

# Wetland Biomass Options Project

Somerset Levels and Moors

**A community energy model for the utilisation of wetland biomass for the generation of energy and improvement of landscapes for the benefit of biodiversity.**

Business Plan - Draft

February 2016



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## 1. Executive Summary

The RSPB has been considering an initiative to utilise wetland biomass, primarily resulting from conservation management works, and comprising mostly common reed and soft rush. The idea is to make operations more efficient and effective, thereby improving habitats for biodiversity, whilst also reducing waste, serving the local communities and reaching out to new supporters. This idea is being considered in the landscape area of the Somerset Levels and Moors in southwest England, but can then be refined as necessary for implementation in other wetland landscapes across the UK.

It is proposed that the scheme could be achieved by creating a new limited company to purchase and run a medium sized anaerobic digester (AD) and by using the heat and power generated to run a separate plant operated by a local community group producing fuel briquettes. To accommodate different ownership options and income distribution between stakeholders, this project would potentially involve the creation of two separate companies: one running the AD plant and one manufacturing briquettes.

The scale of both operations would need to be carefully matched so that the feedstock available is maximised and the AD plant operated without reliance on purposely grown or imported energy crops such as maize.

Technical viability and financial projections were concluded under DECC and DEFRA funded RSPB research projects and the findings are integrated into this business plan. A summary of the findings are appended.

To reduce potential reputational risk the new limited company would own the AD scheme initially, and once the model is proven, it would be possible to encourage community ownership of the process. In due course it is intended to recoup the cost by transferring the assets and business to the local community once the model is tested and risk fully quantified. To ensure this is achieved successfully, community engagement at the outset needs to be handled sensitively. As Community Power Ltd is experienced in community ownership they will work with the stakeholders through the process. It is likely that the new company would borrow the money to invest in the new AD business; however, the intention is that the briquette business will be financed through the equity provided by shareholders as it will be a cooperative based business.



As a general business model the new company will need to make a strategic decision on long term ownership of the scheme. It will need to consider whether it wishes to retain ownership to maximise income in the long term; sell the business to recoup capital; maximise community engagement, enabling them to become financially involved to make nature central to the local economy, thus sharing benefits more widely, or to promote a hybrid model which generates significant income and gives local people a stake.

Prospects for the UK economy are uncertain and the form of community energy scheme envisaged is seen as a haven for local investment; fostering greater community engagement through mutual financial benefit and greater energy security. This scheme will bolster local prosperity; improve understanding of wetland conservation and wildlife, together with the issues associated with habitat management, the importance of the Somerset Levels and Moors for biodiversity, and serve as a catalyst for energy saving measures in the community.

The proposed AD aspect of the project will cost between £1.5m-£1.7m. The revenue projection is based on HM Government sponsored Feed-in Tariff payments (FiTs), Renewable Heat Incentive payments (RHI) and a potential harvesting service. All income streams are projected to rise ahead of cost and so revenue and profit should increase annually.

Public subscription has become much more common over the last three years and there is already evidence that shares will sell well enough to support the proposed later divestment. The new company will have the option of retaining a percentage of the equity in this business, if it wishes. A well connected local group called 'Re-imagining the Levels' are interested in setting up the community ownership vehicle for the briquette manufacturer and have allocated a monetary contribution to do so in due course. The briquette business will be financed through the subscription of community shareholders.

Borrowings of between £1.5m-£1.7m will be needed for the AD scheme. This facility will help to pay for the construction; the new company will have the option to continue to run the business or to sell all or part of the equity to repay the debt and/or to support a series of similar projects in other landscape areas. The loan will be serviced so far as possible from the revenue generated through the scheme. It is the intention that no part of the loan will be called on for any speculative phase and funds will only be sought once all consents, statutory or otherwise, are in place, which will reduce any speculative risk.



## 2. Business Overview

### Introduction

The RSPB has been considering an initiative to utilise wetland biomass, primarily resulting from conservation management works, and comprising mostly common reed and soft rush. The idea is to make operations more efficient and effective, thereby improving habitats for biodiversity, whilst also reducing waste, serving the local communities and reaching out to new supporters. This idea is being considered in the landscape area of the Somerset Levels and Moors in southwest England, but then refined as necessary for implementation in other wetland landscapes across the UK.

### RSPB

The RSPB is the largest wildlife conservation charity in Europe with over a million members. Working with a wide range of partners to deliver wildlife conservation, they manage more than 200 nature reserves for the benefit of wildlife and people across the UK. Internationally, the RSPB works through a global partnership of like-minded conservation organisations called BirdLife International

Habitat management on many nature reserves, and within the landscapes that they are located, generates unwanted biomass as a by-product. This material can significantly limit the quality and extent of the management that can be undertaken for both the benefit of biodiversity and the wider landscape area. These operations, together with the disposal of the resultant biomass, can incur a significant financial cost to organisations and land managers. Consequently, continuing to manage nature reserves and landscape areas in this way is not sustainable and an economically viable and ecologically sound solution is being sort.

So far the RSPB has been involved in the development and trial of a series of 'conservation biomass to bioenergy' approaches looking to convert this surplus material into bioenergy products.<sup>1</sup> Developing on from this they have been exploring different scenarios to see which could form a profitable business model to help the RSPB to pay for more, and better conservation work.

Converting biomass into bioenergy offers the potential to create a financially sustainable approach to the management of nature reserves and the wider landscapes in which they sit. Working with neighbours (e.g. local farmers) and partners (i.e. other land managers who face similar challenges, e.g.

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<sup>1</sup> DECC funded Wetland Biomass to Bioenergy Project (and other parallel initiatives, e.g. heathland trials)



Natural England) would provide the opportunity for reserve operations to be streamlined through the utilisation of more cost-effective management techniques, enabling more and better quality habitat management. In addition it would create the environment to work within those landscapes and widen the influence and impact of conservation work. Offering biomass to bioenergy as a solution to other land managers could facilitate biodiversity conservation on a larger, landscape scale.

The establishment of biomass to bioenergy community energy schemes is one option developed through the RSPB's Energy for Nature project.<sup>2</sup> This option looks at the potential contribution to the funding of nature reserve operations and at the same time provides an opportunity to raise the profile and credibility of organisations such as the RSPB. It would also widen the relevance of nature conservation areas to the communities within which nature reserves are located. For neighbours and partners it could offer the opportunity for diversification and help land management become more resilient and equipped to deal with future landscape challenges, such as those resulting from climate change.

### **Community Power Ltd (CPL)**

CPL was formed in 2012 to develop community owned renewable energy projects by directors who were already involved in similar businesses. CPL designed and built the £1.1 million community solar project just north of the village of Wedmore in Somerset. Wedmore lies on a ridge of hills spanning the Somerset Levels within four miles of the proposed project site.

Wedmore Community Power Co-operative Ltd was the second largest development of this kind in the UK when built and gained national recognition, not just for the scale of the project, but for the highly innovative procurement and funding models employed. From identifying the project through to its development, installation and commissioning CPL delivered on time and within budget.

Also within the Somerset Levels area, CPL directors sponsored the installation of solar power on the community owned Red Brick Building paying for this through a members' bond sale, and have recently completed a commission from a Somerset Wildlife Trust trustee exploring options for the Trust sponsoring new community owned Somerset solar farms.

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<sup>2</sup> DEFRA funded PES pilot project 2014/15



Today CPL is working on a £5 million community owned solar farm sited on redundant dockland in South Wales, and helping with preliminary advice to support a community group based in The Gower who want to build a c. £25 million community benefit society based on a renewable energy portfolio.

## **Current position**

The forming of a new company to establish the AD scheme will allow the creation of a separate tradable entity. CPL usually has a stake in the investment, though that is normally because the client requires bridging finance or risk capital. In this case the new company will be probably be a completely separate entity with support from CPL. The new company structure will be determined after fuller discussion of these proposals with backers and stakeholders. Different ownership models are also possible, perhaps involving investment in equity instead of or as well as loans.

## **Ownership options**

### **1. Single organisation/new company long term ownership**

In this scenario the organisation investment risk is rewarded with a long term, unrestricted income stream, as well as solving the biomass arisings problem.

Although this would deliver the maximum financial benefit for the single organisation/new company, there are also associated reputational risks that may compromise good existing relationships with local stakeholders, e.g.:

- a. This may prevent the single organisation/new company securing the site needed for the location of the scheme when the plant is located on land that is not under the organisation/new company's ownership/tenure.
- b. The scheme would not be considered as a community project which could alienate members of the community by excluding their involvement.
- c. This scenario does not encourage local stakeholders to remain engaged, which may negatively affect their willingness to supply feedstock and consequently limit scheme success.

### **2. Single organisation/new company long term AD ownership, community benefit society briquette manufacture ownership**



As in scenario 1 the single organisation/new company's investment risk in AD is rewarded with a long term, unrestricted income stream, as well as solving the biomass arisings problem. However, the same risks outlined above would apply.

In addition this scenario presents other benefits both for the organisation/new company and the local community in which the scheme is based, e.g.:

- a. The briquette business is handled by a Community Benefit Society (CBS) who would be responsible for financing the set-up of the business through stakeholders, rather than the organisation/new company. This provides opportunities for community involvement and investment.
- b. The organisation/new company would receive some income from shares in the CBS (should they wish to invest); however, separate ownership would enable a percentage of profits from the CBS to be reinvested within the local area.

### **3. Organisation/new company short term AD ownership, community benefit society briquette manufacture ownership**

The organisation/new company makes the initial investment in the AD plant but then sells the business to the community after a few years, recouping capital and reducing debt, as well as solving the biomass arisings problem. The two points highlighted in scenario 2 apply and there would be additional benefits for both the organisation/new company and the local community in which the scheme is based, e.g:

- a. The organisation/new company facilitates and supports income generation within the local community.
- b. The scheme helps rural communities to diversify, grow resilience and brings benefits to the local economy.
- c. The relevance of the local conservation organisations and nature reserves, as well as nature conservation, to the local community is increased.
- d. Develops the partnerships and working with stakeholders that is central to the development of the scheme.



- e. Finance for the briquette manufacture business is raised through shareholders rather than a loan via the organisation/new company.

#### 4. Shared ownership

Some equity is retained by organisation/new company, some sold to the community.

- a. All benefits are shared between the organisation/new company and the local community.
- b. The scheme benefits from shared expertise.
- c. A complete community project which builds a positive narrative around the organisation/new company, the organisation's work, and nature.
- d. Develops the partnerships and working with stakeholders that is central to the development of the scheme.
- e. The significance of the conservation organisations, local nature reserves and nature conservation is increased within the local community.

It is likely that with the wider roll out of the community energy model a number of the above options will be applicable to different landscape areas. However, in the trial area of the Somerset Levels and Moors options 3 and 4 are recommended. This is due to long standing relationships that have been developed over a long period of time prior to and during the development of this community energy proposal. Members of the local communities of the Avalon Marshes have played a significant part in the development of ideas and approaches throughout the RSPB's previous work on wetland biomass to bioenergy in Somerset, and recognising this commitment is important in progressing the project in the future in this area.

#### Competitive advantage

The project is based on the Somerset Levels and Moors region of southwest England. It specifically focuses on the landscape of the Avalon Marshes in the northern area of the region, which is an important wetland landscape for wildlife and has a strong local heritage linking people with the land, predominantly through farming and peat extraction.

The RSPB is a major local land manager so they have good knowledge of the local area which allows considerable vertical integration in the proposed model. The imperative to manage wetlands for wildlife, and the desire to broaden support for the organisation are unusual imperatives and ones that



make this project relatively safe from competitive risk. This project is designed to achieve financial savings for land management in the area, but is at a scale that would not appeal to many commercial developers. The goal is not to make as much money as possible and so the medium sized local AD model is not likely to face competition.

The desire to avoid any purpose grown feedstock for the AD plant should render the plant immune from competition risk on the supply side, and prevent incentives for promoting inappropriate land management practices being created.<sup>3</sup>

Predominant use of surplus biomass from the nature reserves and adjoining farmland should give greater control of input cost than normal. It is specifically proposed that the new company owned AD business will coordinate the specialist harvesting operation and charge the land managers for clearing and managing their biomass. The value of this service needs to be carefully worked out as the harvesting contractor can be expensive; however, if the service harvests reserve reedbeds efficiently, and renders marginal farmland suitable for grazing by reducing rush cover, it may be possible to subsidise the development and operation of the scheme through this service. Depending on how this is managed there may be scope to encourage the expansion of reedbeds supported by the utilisation of harvested biomass as a feedstock (as long as conservation objectives were adhered to), and renting marginal land adjoining the reserves. Incorporating both energy conversion technologies (combustion and AD) will provide the flexibility of approach needed to deal with the diverse range of wetland biomass, whose condition can be affected by seasonal variances and site conditions, which can then have an impact on feedstock quality.

The sale of briquettes will need to compete with sale of timber logs and alternative briquettes already available, therefore prices will need to be tested. The environmental benefits of this product and the link with the community that will own the briquette manufacture and distribution system will be an advantage. The ecological nature of the product will provide a 'nature friendly' status which, through certification, could attract a premium price. The local provenance will add credibility to the product and provides an attractive narrative which clearly connects the consumer to the wildlife and habitats they are protecting through purchasing the product.

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<sup>3</sup> AD plants can use a wide variety of feedstocks but the reliance on maize as a primary feedstock in many AD plants has led to large increases in plantings, which are not always to benefit of biodiversity. In Germany, 800,000 hectares of maize are grown for AD feedstock, and 34,000 hectares (19.6%) of the 173,000 hectares of maize grown in England in 2015 were planted for AD feedstock, an increase from the 2014 figure of 16.9%.



CPL and two of the CPL directors are based in Wedmore, and have strong local networks that make consultation and engagement with the landowners and community more productive. They also have strong links with relevant local organisations such as Green Wedmore and the Re-imagining the Levels group, which could assist with community liaison. Green Wedmore currently has in the region of 125 members. The objective of the group is to co-ordinate, explore and encourage sustainable living and its application in practical terms to Wedmore and the surrounding Somerset villages. Re-imagining the Levels is a new group which was set up within the last 12 months following a local workshop to explore ideas that support and sustain viable communities on the Somerset Levels. The Group aims to achieve these ends by working with local charities and groups. The RSPB have similar, but complimentary, links within the area. Being local is particularly important while testing concepts, but will be less so when this model is employed in other wetland landscapes.

## **Growth plan**

The challenges presented by dealing with conservation biomass from the management of wetlands is common to other landscape areas in the UK and the model tested here will be adaptable and transferable to other communities within those landscapes. It may also be transferable to suit alternative biomass types, such as that harvested from heathland and dry grassland areas.



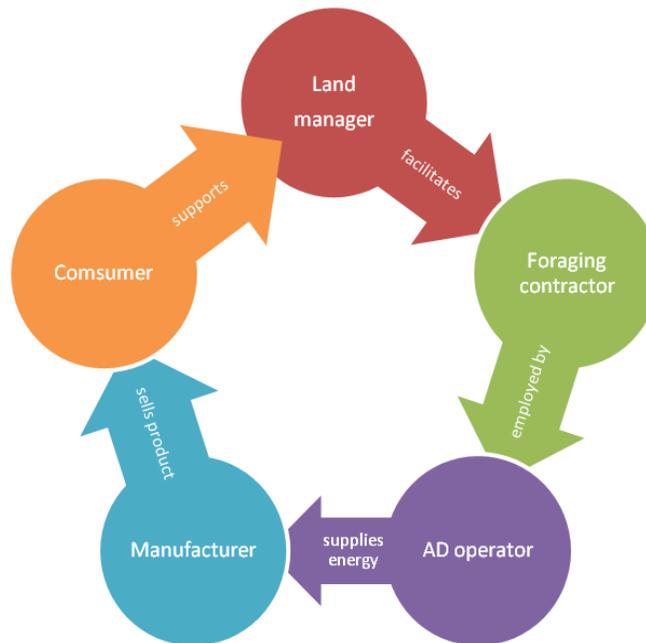
### 3. Business Strategy

Once the necessary consultations and approvals have been gained, the focus will be on the liaison with technology providers, the creation of the new company, setting up of leases, completing a detailed project design, undertaking community engagement and gaining the consents and permissions needed, such as planning permission through the Local Authority and for the operation of an AD unit from the Environment Agency. Once these activities have been undertaken the building of the power system can then commence. It is likely to take two months to achieve planning permission and it may take six more months to procure, build and commission the system. During procurement there will be considerable local interest which we will exploit to sell shares in the briquette business.

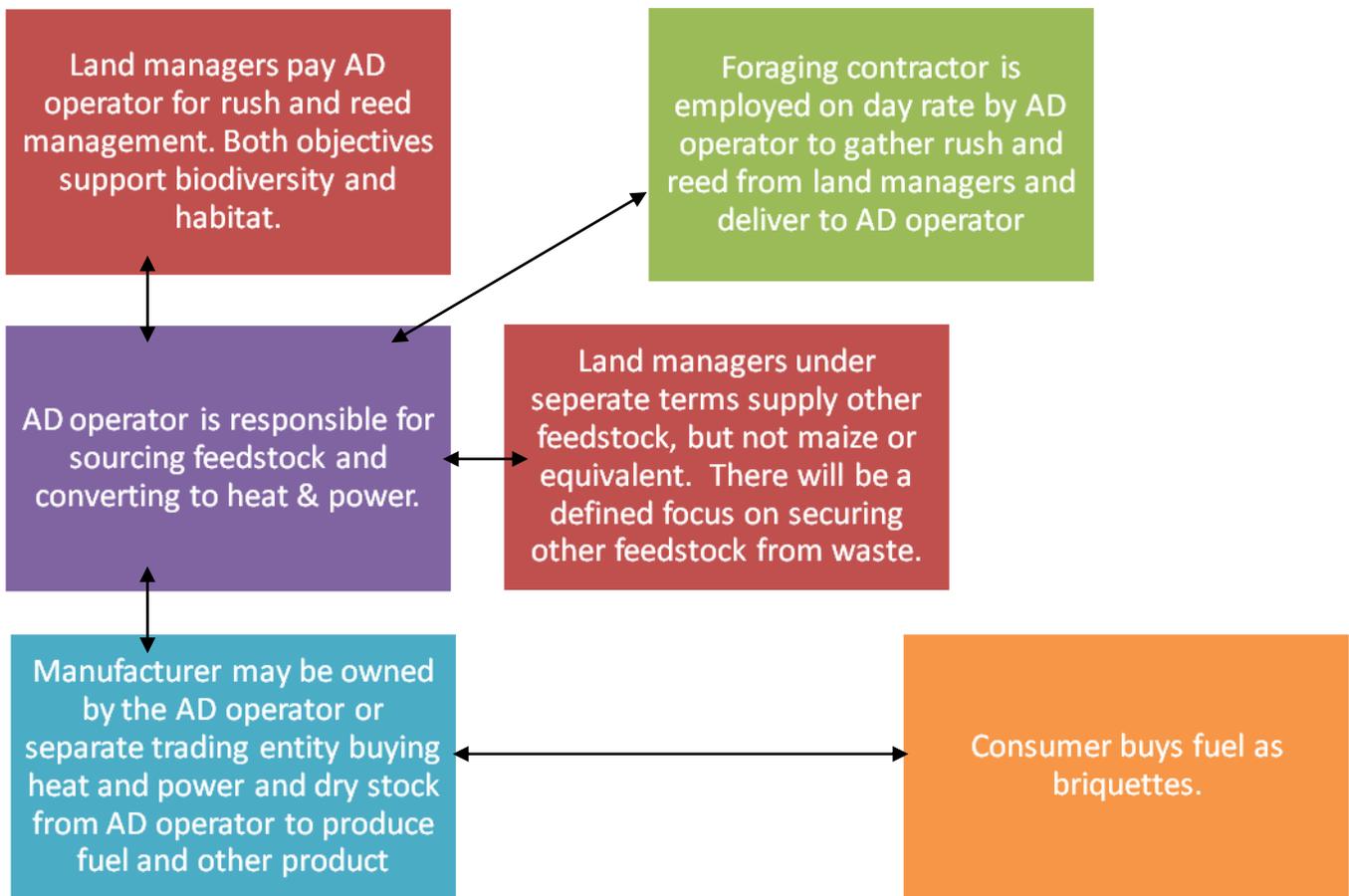
To take advantage of Government supported incentives it would be highly desirable to complete the pilot project by the end of 2016. Subsequent projects may need to work in different incentive regimes, but as there could be considerable advantage in testing the pilot for some years and Government policy is fluid there may be advantage in leaving the next scheme until 2018.

#### Approach

Five critical stakeholders and how they relate to each other in the business model have been identified and are illustrated below.



The new company will sit in the circle as the AD operator. The circle shows how mutual support flows, but this is different to how it is visualised that the contracts would need to work. This is demonstrated in the following diagram. The black arrows show how contracts might operate between stakeholders and how the AD operator controls the process. The contracts would be as long term as possible, mutually supportive and allow for strict minimum obligations, perhaps with profit share if higher outputs boost revenue.



Although this illustration does not show who owns which aspect, it does demonstrate the critical position of the AD operator. The RSPB for example, may have a stake as land manager, AD operator, manufacturer and consumer, but there are other land managers and consumers, and the harvesting contractor may be more cost effectively distinct. The AD operator and manufacturer will have to share a site with sufficient space for development.

The briquette manufacture will be funded locally by a new community benefit society (CBS) or traditional co-operative as broad local participation would improve prospects of fuel sales and create new links between the community and both the nature conservation organisations and local landowners. This would suggest that the AD plant and briquette manufacturing plant are separately owned, although this is not necessarily the case as the new CBS could own a licence to operate from the AD site. Linking good local use of the heat and electricity generated to sustainable local production is important, especially if the surplus heat can be utilised to dry the feedstocks for combustion. Surplus electricity will be sold to the grid.

Harvesting common reed and soft rush in an efficient and environmentally sensitive way is a service to everyone, but particularly to the landowner who will reduce costs and achieve environmental objectives. It is therefore assumed that the landowner should be prepared to pay for that service at a sum at or marginally below what that management currently costs. As a result the landowner may be tempted to set aside more land for ecological objectives. The landowners would be charged a rate per tonne for removed material or a rate per hectare for managing a given area of land, and the harvesting contractor will be paid a rate per day for its removal and delivery to the AD site. The process will have to be carefully managed in order to optimise viability of the AD plant.

It is envisaged that using the scenario of the landowners paying for a harvesting service, the nature conservation organisations, as landowners, would also pay the same harvesting rate/tonne, under the assumption that profit would return to the organisations who had bought into the scheme, later through dividends and capital appreciation. Offering a harvesting service will ensure that the operation is undertaken according to best environmental management practices and as such will directly serve to enhance land for biodiversity both on nature reserves and in the wider landscape. This may also help to justify proceeding with management on some areas even if borderline in revenue terms or perceived as costly in management time.



As outlined in the RSPB's Energy for Nature report<sup>4</sup> a central coordinator with an understanding of wetland management, contracts and the bioenergy conversion processes is essential to operate the AD system. The coordinator will be employed by the new owned company and based on site. They will manage the physical feeding of the unit and work with the AD supplier based support mechanism for the technical operation. The coordinator may usefully and cost effectively also run the briquette business under terms that see their cost reimbursed by the community owners of that business. As the AD plant needs attendance all year there would need to be an assistant able to step in and look after matters when the coordinator is absent; it may be the case that a separate manufacturer looks after the AD plant when the manager is absent, and vice versa. Further work will include careful consideration of how best to organise management and caretaking but there are likely to be at least two employees, with at least one employed by each business.

Harvesting would normally be most cost effectively achieved by contractors, but terms would have to be reviewed and terms might be expensive as the machinery is specialised.

### **Strategic risk issues**

Formal lease options are a risk until concluded, but the local landowners are supportive and careful dialogue and fair terms will help to reduce this risk. The landowner may also seek the opportunity for a stake in the new company.

Obtaining the necessary consents and permissions is a risk; however, CPL have experience in these matters and will reduce this risk by enlisting maximum community support, emphasising the positive in planning terms and engaging openly with the planning authority and other statutory agencies.

After the development stage, when the risk of the scheme has been reduced, it is intended that the AD plant will be sold to the community owned briquette manufacturer which will simplify the management structure. This will be delayed until the AD model has been fully tested under the control of the new company and risks fully quantified. The potential sale will be prescribed as an option with a formula for agreeing sale terms. There is some risk that the community will not be able to raise the funds to exercise the option in the future and then the company will need to decide whether to retain the AD operating company, sell it to another stakeholder or sell it to a commercial operator.

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<sup>4</sup> [Energy for Nature project report](#)



The costs (pre-construction) relating to leases and planning approval are relatively small and identified in the cash flow projections. There are a number of contracts to devise and legal costs will reflect this, but agreeing heads of terms before instructing solicitors will minimise cost. The risk of the community being unable to purchase the plant is linked to the overall viability of the project and will be mitigated by careful management of the pilot.

There are further risks around government support (FiTs and RHI payments), the regular supply of feedstocks, which can be managed through good relationships and robust planning, and potential income, both volumes and price, which will be affected by the wider market.

### Core values

The RSPB is committed to delivering work that benefits both wildlife and people. Nature is crucial for people's quality of life and the planet's life support systems, and the organisation is committed to saving nature for the benefit of all. The RSPB believes that this cannot be achieved alone and strives to work in partnership with other organisations and local communities to achieve their vision of a *world richer in nature*.

Inspiring people about the wonder of nature is key to the RSPB's mission, and they have a wealth of experience in working with local communities on a diverse array of different projects. The RSPB feels that conservation biomass to bioenergy is a great new initiative that can provide a direct link, and foster a personal connection, between communities and their local wildlife, sites and the landscape, and also highlights how that landscape is benefiting them. The RSPB has worked for many years in the Somerset Levels and Moors and feels that this is a key area where the organisation can come together with the local community to deliver benefits to the local wildlife and people.

The organisation is committed to reducing the impacts of their conservation operations on climate change, and leading by example to demonstrate how this can be achieved by others. The RSPB deems conservation biomass to bioenergy to be a great initiative for working with partners to help achieve our own carbon reduction goals whilst supporting local communities to become less reliant on fossil fuels.

The CPL directors have an established track record of dealing with communities and hold the interests of the community and environment. The directors will continue to profit from these endeavours as the sector will only develop so long as the sector and the businesses are profitable. There is no place for excessive profits in this sector, but CPL believe it is right and proper that as much power capacity as



possible is held locally and that means CPL need to dedicate the same resources and effort to the task as any other commercial venture.

CPL do not favour removing farmland from production and prefer that farmers continue to use pasture on the Somerset Levels for grazing in order to manage grassland habitats and make the best of land that does not lend itself to arable use. CPL would discourage strongly any reliance on maize as feed for the AD plant, as local maize production, whilst increasingly common, would normally be considered environmentally damaging both on the Levels and the upland catchment areas.



## 4. Marketing

### SWOT and critical success factors

The whole project; AD plant and briquette manufacture considered together.

Strengths	Weaknesses	Opportunities	Threats
Local	Complex ownership	Developing new models for placing nature conservation at the heart of communities and for generating income	Obtaining consents and permissions needed
Close engagement	Reliance on goodwill and desire for the project to succeed	Local power and reduction on the reliance on fossil fuels	Stakeholder relations
Progress to date	Challenges of managing wetland areas	Local prosperity bolstered	Reduction in Government incentives – FiTs and RHI payment levels
Benefits biodiversity, does not effect food production	Utilisation of unconventional feedstocks	Sensitive development	Reputation risk to the stakeholders if the scheme fails
Complete energy system with flexibility to take different biomass types	New area for the stakeholders to work in	Facilitates increased management to enhance areas for biodiversity	Feedstocks do not perform as expected.
Pools expertise and increases likelihood of scheme success, through drawing on expertise from within the community	Will require feedstocks to be stored on site to ensure continuity of supply – this will require space and storage facilities	Opportunity to re-engage and reconnect local communities with their local natural environment	Sales income - volume and price
Helps deal with continuity of feedstock supply and offers the ability to cope with unforeseen events which prevent harvesting in any one year.			

Vertical integration will help to reduce risk associated with mixed ownership and any breakdown of stakeholder relations. It is therefore felt to be very desirable that the RSPB takes a lead and continues



a major involvement in the main part of the scheme until any adverse issues are resolved and other stakeholders have confidence in the process.

It is intended that the community owned briquette manufacturer takes over the AD plant and runs the whole process, but that will only occur if the scheme is successful. The briquette manufacturer may need to relocate and find alternative power and dry stock if the AD business should fail completely.

For the scheme to succeed in the short term, a degree of goodwill and co-operation, particularly between the land managers, scheme coordinator and manufacturer, will be required. Contracts will be established that are manifestly fair, but length of term will be important to ensure security of feedstock supply.

The AD Scheme.

<b>Strengths</b>	<b>Weaknesses</b>	<b>Opportunities</b>	<b>Threats</b>
Tested concepts	Management cost	Developing new model	Obtaining consents and permissions needed
Proven technology	High capital set up costs	Local power	Adverse local reaction
Using waste material and so facilitates land management	Some wetland feedstocks may be untested	Local prosperity bolstered	Energy costs
Sensitive approach	New area for the stakeholders to work in	Sensitive development	Changes to Government incentives– FiTs and RHI payment levels
		Opportunity to re-engage and reconnect local communities with their local natural environment	Reputation risk to stakeholders if the scheme fails

As a standalone entity the use of AD to process vegetative material is proven technology and the utilisation of harvested soft rush and common reed as a feedstock has been researched and tested. One of the most difficult challenges is setting the size of the AD plant to optimise the use of wetland biomass and achieve a sufficient return to cover management costs.



The community owned briquette manufacture.

Strengths	Weaknesses	Opportunities	Threats
Community engagement	Management cost	Developing new model	Obtaining consents and permissions needed.
Limited availability of firewood	An untested community energy approach	Local power	Reputation risk to stakeholders if the scheme fails
Using waste material and so facilitates land management	Some wetland feedstocks may be untested	Local prosperity bolstered	Sales income - volume and price
Production of a high calorific value dry combustion fuel	Briquette production can be time consuming	Provides potential for diversification with rural communities	
Sensitive approach	New area for the stakeholders to work in	Sensitive development	
		Opportunity to re-engage and reconnect local communities with their local natural environment	

The market for briquettes will need to be reviewed as the business plan is developed, but is likely to be subject to competition. The price of briquettes will probably correspond to the price of bagged logs, and so long as the price is seen to be fair there ought to be a strong demand for supply from the community shareholders.

This is not likely to be a hugely profitable endeavour. The members subscribing for shares in the community owned business are likely to be attracted to the ethical and environmental benefits; and also to the opportunity to secure a fuel source over which they will exercise some measure of control. Financial modelling will be needed before any estimate of projected financial returns can be made in the share offer document.

There may be other profitable uses for the heat, electricity and waste material derived from the AD plant that could bolster the community owned business, such as the sale of digestate as a fertiliser for local farms.



## Market research

1. There are two closely allied aspects of market research relating to the community ownership. Efforts will be directed at establishing demand for public subscription for the community owned briquette business, and that will be combined with enquiry into demand for briquettes and the value of product.

Through CPL's experience, fundraising through share subscription is much more productive when there is confidence in the prospect of completing the project, and when risk is manageable and defined. CPL developed this into a model they call **Parallel Development**, in which the project and the Community Benefit Society or Co-operative are developed simultaneously rather than in series. This has been found to be much more efficient and effective in previously run initiatives.

The parallel development model has been tested and found to be very successful, but is not thought suitable for the AD business which will need to be tested and tuned to meet the conservation objectives before being transferred to community ownership as a going concern. In that sense the AD business is tested in the real market before sale, but at this preliminary stage research is required to test the procurement of feedstock with land managers and in that respect the following work is needed:

2. Would land managers pay to have reed and rush biomass gathered and removed from their land, and if so how much would they pay?
3. How much biomass feedstock could be gathered on those terms?
4. What is the optimum balance between harvesting terms and feedstock supply that optimises RSPB objectives while achieving a viable business? This may not be the same thing as maximising profit.

This is a new industry, subject to constant change and as such it is necessary to constantly develop new themes. There is no scope to sit back and let a proven business model run its course, as that course will typically be very short. It is necessary always to lead with new ideas, but pointless to do so without understanding where public aspirations lie and so that is a common thread throughout the market research required.



It would be interesting to test the appeal of this project within the RSPB membership, although funding from RSPB members may not be required until later when the AD plant is sold to the community. At this point it will need to be established whether:

5. Would RSPB supporters respond favourably to the RSPB engaging in this endeavour?
6. Would they invest in the AD plant when sold to the community?

### **Distribution channels**

The intention is that the briquette manufacturer will use as much surplus heat as possible, and electricity as required, from the AD plant. Some of the heat will be utilised to satisfy the parasitic load of the AD plant, and most of the electricity will be connected via the local electricity grid and sold to an electricity supply company. Further uses for the surplus heat may need to be found to maximise the income generated through incentives as the tariff per kWh of heat can only be claimed on the amount of heat utilised, rather than the amount generated.

CPL directors are involved in a new local group called Re-imagining the Levels. This group has a wide reach in the areas due to benefit from this project. CPL has canvassed the views of the group and they are very interested in supporting the community owned briquette manufacturer, in terms of funding the formation and launch of the community group. It is seen that the Re-imagining the Levels group will help sell shares and sell briquettes.

### **Strategic alliances**

Stakeholders will all mutually benefit and the market research will determine whether they are sufficiently interested to support the project. These strategic alliances will then be formalised under contract. These contracts will be as long in duration as possible to secure the viability of the plant, without deterring participation of land managers. Contracts will be drafted to secure terms that are essential to support the business.

1. There will be a contract between the AD business and the various land managers setting out terms for harvesting wetland biomass. This contract will be drafted to allow a limited range of options so terms can be adapted to suit different land management requirements. Conservation site management plans are typically five years in duration and the harvesting contracts will be



2. negotiated with a five year term and based on harvesting a given area. Farmland contracts may need to be shorter as farm management practices typically change more quickly; this could be an advantage as it will allow adjustment in the supply to take place without effecting the management of conservation sites. Farmland contracts may be reviewed and renewed annually.
3. There will be a single contract with a harvesting contractor.
4. There will be a lease between the AD business and landlord, and probably a sub-lease allowing the briquette manufacturer to use part of the same site.
5. There will be a single contract between the AD business and briquette manufacturer that may include terms supporting the transfer of the AD business to the community at a future date. There may be a service contract facilitating optimum co-operation between the two connected businesses, transfer of input stock and sharing of staff.
6. There may be informal and relatively short term agreements with other waste vegetation suppliers to bolster or diversify the AD diet, although the priority is to maximise use of wetland biomass and the plant will be sized accordingly.
7. There will be a power purchase agreement between the AD business and their electricity supply company. These can be relatively long in term, perhaps five years in duration.
8. Terms between the briquette supplier and its customers will not be fixed; allowing customers to purchase fuel as required. It is therefore essential that the fuel is competitively priced. Many of the customers will be shareholders in the manufacturing business and that may entitle them to favourable terms.

The application to the Financial Conduct Authority (FCA) when setting up the community owned company will be based on standard rules and sponsored by the author of those rules. That strategic partner is not yet selected and will depend on the rules that best serve the purposes of the briquette manufacturer.

## **E-commerce and technology**

The briquette manufacture will have a website from the outset to support the community subscription, marketing and sales. There is no need for the AD operator to do the same, but they will be strongly featured on the community website and that can carry links to all stakeholders' activity and media feeds, where appropriate.



## **Tactical promotion plan**

The two closest settlements are Wedmore and Glastonbury/Street, and both have community owned solar photo-voltaic (PV) assets developed by CPL and its directors. Many of the people who supported those schemes will want to support this project. Announcements through the network of stakeholders and the Re-imagining the Levels group will provide excellent links to attract interest from potential new stakeholders. The opportunity will be open to everyone; membership will be expanded considerably when the AD plant is transferred to community ownership and so those disappointed at the outset may invest later.

## **Marketing budget**

Local marketing will involve more time than advertising cost. There will be cost associated with website designs, production of flyers and the share offer document which should not exceed £5,000.

Market research may have similar cost, but as the two exercises may be combined the total cost should not exceed an estimated figure of £10,000.

## **Financing options**

The new company may borrow the money necessary to pay for the new AD business. This loan will pay for the construction. The loan or facility may be maintained/extended by the company to support a series of similar projects. The loan will be serviced so far as possible from the revenue generated through the scheme. It is the intention that no part of the loan will be called on for any speculative phase and funds will only be sought once all consents, statutory or otherwise, are in place this will reduce an speculative risk.

The briquette business will be financed through the subscription of shareholders. Until very recently there was a substantial tax advantage attached to share purchase using the Enterprise Investment Scheme (EIS). However, that incentive is no longer available, therefore it may be preferable to raise some of the capital by borrowing any outstanding balance from the shareholders or other interested investors through the issue of bonds. The appetite for shares should be sufficient without the need for any debt finance, but this will be tested as part of market research.



### **Credibility and risk reduction**

The RSPB is a widely known and trusted charity, and has a strategy for risk management. CPL has an established track record in solar-PV and community projects. CPL has an honest and open approach and will promptly deal with queries and questions. They have the background and credibility necessary to support the development, but will need to enlist technical help from suppliers of the specialist plant before putting together a credible and effective share offer.



## 5. The Energy Conversion Processes

### Anaerobic Digestion

Anaerobic digestion (AD) is the digestion of material in anaerobic conditions to produce biogas, which is then harvested and either cleaned and directly fed into the gas grid or converted through a combined heat and power plant to produce electricity and heat. AD can be used for processing green (vegetative) material, high in moisture content, ideally freshly harvested or if stored, stored as silage in the absence of oxygen. This process deals with green biomass well, and so is well suited to dealing with the soft rush found on nature reserves and farmland. However, the process can struggle with woodier material of high lignin content, such as common reed, and so briquetting this material is a more suitable option.

### Briquetting

Briquetting is a process in which material is compacted under great pressure in a contained die / former to produce a product for combustion. The resulting briquettes can be used to replace logs, in a domestic environment, in log burners or open fires. Briquetting can be achieved in three ways and the choice of technique is particularly important in relation to the characteristics of the biomass being processed. As it is able to process more woody material well, it provides a complimentary energy conversion process to the AD.

### Feedstock supply

For any schemes looking at the conversion of biomass into energy, continuity of feedstock supply is one of the most important elements. An essential component of this is the identification of potential harvesting areas within an acceptable distance of the project, to ensure the scheme is as economically viable and as carbon efficient as possible. From the work already undertaken with stakeholders on the Somerset Levels and Moors a number of sites have been highlighted which currently produce unutilised material. Land managers of these sites have demonstrated a desire to find a solution to this problem and have expressed support for schemes that could put this material to a beneficial use.

It is proposed that the material needed for the two schemes identified would be produced from a variety of sites, in a number of different ownerships. These areas will produce a range of material types, with the most common being soft rush, common reed and poor quality grass. The two conversion operations proposed will provide the flexibility needed to deal with the variety of materials



available. Harvesting biomass at different times of year can provide marked differences in its characteristics and its suitability for the conversion processes. The need to harvest at the appropriate time for species and habitat conservation will essentially determine the nature of the biomass and its make-up.

Having an approach that can deal with different biomass characteristics, including variable moisture content, will enable conversion into energy to be both economical and carbon efficient. Understanding the potential and limits of the two conversion technologies and their relationship to the types of biomass harvested off conservation sites and the time of year of the harvest will be essential for the operation of an efficient system. This will be the role of the coordinator. In broad terms the green material, of higher moisture content will be used for the AD operation and the drier, woody material for briquette manufacture.

The tables in Appendix 2 show potential feedstock available based on a 10 and 15 mile radius to the possible project location point. These are indicative figures for nature conservation areas where management is currently undertaken with suggested typical yields. Other than the wider Somerset Levels and Moors and the wider Avalon Marshes, numbers presented are based on reserve management plans which in some areas may be constrained by the ability to harvest and the disposal of resultant material. It is therefore likely that more material could be available from some of the wetlands if it were practical and cost effective to remove it.

### **AD operation -250kW and 500kW**

Consistency and continuity of supply are important for anaerobic digesters. Unlike processing through combustion, AD needs a constant supply of material to maintain the activity of the micro-organisms and biogas production. To enable this continuity, materials will need to be cut and stored to provide a supply at times when material cannot be harvested e.g. through the bird breeding season.

The medium scale wet AD systems at 250kW and 500kW identified are specified to take wet material annual amounts of 3,500 tonnes and 7,000 tonnes respectively.



Per annum	250kW	500kW
Quantity of material processed (wet tonnes)	3,500	7,000
Equal to wet area of grassland <sup>5</sup> (ha) <sup>6</sup>	875	1,750
Equal to area of reedbed <sup>7</sup> (ha) <sup>6</sup>	350	700
Production of electricity (kWh-e)	2,000,000 <sup>8</sup>	4,000,000 <sup>8</sup>
Production of surplus heat <sup>9</sup> (kWh-th)	1,300,000 <sup>8</sup>	2,600,000 <sup>8</sup>

## Briquette manufacture

Effective briquette production relies on material being of a moisture content below 20%. This both increases the density at which the briquette can be produced, but most importantly its calorific value and burn rate – providing a higher quality product.

Utilisation of the surplus heat from the AD to dry material for briquette manufacture will produce material of a consistent dry matter which will aid the efficiency of the process. This surplus heat will be used to service a drying floor on which any material above the desired moisture content can be dried.

The auger screw system specified will convert approximately 1,500 tonnes of drier material as identified in Appendix 2. Unlike the AD operation the conversion of material through briquette production can be a little more flexible as it is not serving to support a living system.

<sup>5</sup> Assuming 4 wet tonnes per hectare

<sup>6</sup> See Appendix 2

<sup>7</sup> Assuming 10 wet tonnes per hectare for reed cut in the summer months as a method of control rather than management.

<sup>8</sup> Based on figures from Hallmark’s modular AD, using material which generates 170m<sup>3</sup>/t of gas at 53% methane.

<sup>9</sup> Available after parasitic load subtracted



## 6. Team and Management Structure

### Skills, experience, training and retention

Management of the process and project will be shared between the RSPB and CPL.

#### **Sally Mills – RSPB**

Sally Mills is the Bioenergy Project Manager for the RSPB, and has worked for the RSPB since 1989. Up until November 2012, when she took on her current role, she worked for the reserves department. This enabled her to work on and manage a number of the reserves, including leading on the creation of the very successful wetland reserve at Ham Wall, Meare in the Somerset Levels and Moors.

In her current role, Sally was responsible for running the recent Wetland Biomass to Bioenergy Project with the Department of Energy and Climate Change, through which the RSPB looked at the conversion of biomass resulting from habitat management works into energy. This project involved working with contractors in the development of new innovative harvesting and conversion technologies to tight timescales; liaising with DECC over project delivery and carbon efficiencies and ensuring the experience and knowledge gained from the project are used to maximise their benefit to the organisation and the future delivery of land management and nature conservation.

In conjunction with the DECC work, Sally ran a DEFRA Pilot Payment for Ecosystem Services (PES) Project, which looked at the delivery of the biomass to bioenergy approach as a PES scheme. This work involved working with the RSPB's economists to understand markets and business models, liaising with local and national stakeholders, and the development of a Conservation Biomass Calculator to assist land managers to realise the potential of their land management operations.

Since completing the above projects Sally is now exploring opportunities with local stakeholders to use the knowledge and experience gained through the DECC and DEFRA work to deliver biomass to bioenergy within rural communities nationally.

#### **Dr Lynne Osgathorpe - RSPB**

Lynne Osgathorpe works within the RSPB's Sustainable Development Team within the Policy and Advocacy Department at the RSPB's Headquarters. Lynne is responsible for delivering policy into practice (and vice versa) through her role as the organisation's lead on ecosystem services.



The emphasis of Lynne's work is on delivering conservation projects on the ground, particularly through the use of new and innovative funding streams based on principles of ecosystem services. As such, Lynne is responsible for exploring how the concept of Payments for Ecosystem Services (PES) can be applied to support the RSPB's conservation work, and developing projects based on this idea. Lynne was a key member of the RSPB's Energy for Nature project team supporting Sally Mills, and with responsibility for analysing the stakeholder feedback and developing the models within the final report. She is also a member of the RSPB's national biomass to bioenergy team. Wetland biomass to bioenergy is just one area of ecosystem services that Lynne is currently involved with, and she is exploring other areas in which ecosystem services can be used a mechanism for supporting conservation.

Lynne has a PhD in ecology and agricultural economics, part of which explores the economics of developing PES like schemes in marginal agricultural landscapes, therefore she is well placed to develop the PES aspects of the scheme. With a background in academia and the eNGO sector, Lynne has a wealth of experience in working with a range of different partners, including local authorities, community groups, statutory agencies and land managers, including land managers on the Somerset Levels and Moors.

#### **Robin Mewes BSc Hons MSc FRICS – CPL**

Robin Mewes is a Chartered Surveyor and registered Valuer. He has a BSc in Building Surveying and MSc in the Conservation of Historic Buildings. Robin draws on 25 years experience gained in the property industry to develop opportunities and create value through renewable technology.

Robin has been deeply immersed in the world of solar-PV since mid 2010, forming the company, Rooftop Consulting Ltd at the end of that year to explore innovative funding and procurement.

#### **Vanessa Becker Hughes - CPL**

Vanessa manages several businesses from her home office in Theale, Somerset. The experience she has gained throughout her career working in a variety of industries has allowed her outlook to be both fresh and innovative.

Vanessa initiates many voluntary projects within the local community and has particularly affinity with the environment and people of the Somerset Levels.



### **John Whiten – CPL**

John founded Ethical Solar, an award winning solar power business to reduce a reliance on carbon and further his interest in 'transition' objectives. That business still trades from Grimsby, but the local operations were wound up when the Government cut FiTs and since John has concentrated on community power as a director of CPL.

### **General**

The management team will be motivated by a direct share in the profit derived from a successful venture and by the satisfaction of developing a new model for creating community ownership. Labour employed during the construction phase will be employed under contract for the duration of construction and incentivised by fair terms and proper on site care.

During planning and procurement the team will be retained under terms agreed between the new businesses, CPL and the RSPB. It is anticipated that a fixed charge will apply to allow safer cost modelling, but with a performance bonus if project costs are lower than projected.

The input of the named team will diminish substantially when the plant is operational and day to day responsibility is transferred to an employed coordinator.

### **Advisors**

We have appointed or are in discussion with the following organisations.

#### AD plant supplier

Hallmark Power, UK and/or AWS Ltd UK

#### Drying floor and briquette plant supplier

Drying Floor – Hydroscot Energies, UK

Briquette plant – Asket, Poland and/or AB Systems (UK) Ltd



Lawyer

Not yet appointed.

Accountant

Not yet appointed.

Health and Safety consultants

Not yet appointed.

**Management systems**

Still to be confirmed.



## 7. Financial Budgets and Forecasts – AD Business

### Cost and income data

The tables in this section set out the assumptions of cost and income at the commencement of the business and for the first trading year. The first two indicate costs and income for both the 250 and 500kW AD systems, and include all costs from harvesting to energy production. The annual running of these systems compared to current practice (a cost of £135 per hectare<sup>10</sup>) offer savings of £240.53 and £276.13 respectively per hectare. However to cover capital expenditure and set up costs the financial modelling which follows also includes potential income gained through providing a harvesting service to other landowners. This is illustrated through the application of different rates per hectare, including the current cost paid of £135.

It can be seen from the figures presented that the larger 500kW AD plant would potentially be much more profitable, as the capital expenditure does not rise proportionally to the increase in size. However both models have been presented as the size of plant will be determined after gauging support from local conservation partners and neighbouring partners. The smaller scheme may suit objectives better if the availability of biomass from the local area is limited.

The figures are indicative only and will need to be tested as detailed planning progresses and formal tenders are sought for procurement. The income projections include incentives applying today<sup>11</sup> that may be subject to significant change. The potential income generation from a harvesting service will need to be tested through market research and liaison with local stakeholders.

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<sup>10</sup> Somerset Wildlife Trust, July 2015 cost for material to be cut, baled and removed using conventional agricultural machinery

<sup>11</sup> Jan 2016



<b>250kW Anaerobic Digestion Costs</b>	<b>££</b>
<b>Set Up Costs<sup>12</sup></b>	<b>150,000</b>
<b>Capital Investment Costs</b>	
AD unit required	<b>1,500,000.00</b>
<b>Annual Operating Costs</b>	
Lease of site	6,000.00
Operation resource needed	31,824.00
Digester maintenance costs <sup>13</sup>	45,000.00
CHP maintenance costs <sup>14</sup>	20,000.00
Insurance <sup>15</sup>	15,000.00
Environmental permitting	1,580.00
Administration cost	5,000.00
<b>Total</b>	<b>124,404.00</b>
<b>Annual Processing Costs – Based on use of specialist machinery</b>	
Harvesting rush	59,182.50
Haulage of rush	38,988.37
Storage of rush	21,000.00
<b>Total</b>	<b>119,170.87</b>
<b>Grand total – annual + processing costs</b>	<b>243,574.87</b>
<b>INCOME</b>	
Incentives <sup>16</sup>	331,809.64
Fuel savings <sup>17</sup>	4,100.44
<b>Total annual income</b>	<b>335,910.08</b>
<b>Balance (net income)</b>	<b>92,335.20</b>

<sup>12</sup> Based on 10% of capital costs

<sup>13</sup> Based on 3% of capital costs

<sup>14</sup> Based on 1p per kWh

<sup>15</sup> Based on 1% of capital costs

<sup>16</sup> FiT's tariff 9.12p per kWh generated, 4.85p per kW exported, RHI tariff 4.1p per kWh heat generated and used

<sup>17</sup> Electricity rated at 13p per unit and oil at 5.8p



<b>500kW Anaerobic Digestion Costs</b>	<b>££</b>
<b>Set Up Costs<sup>18</sup></b>	<b>170,000</b>
<b>Capital Investment Costs</b>	
AD unit required	<b>1,700,000.00</b>
<b>Annual Operating Costs</b>	
Lease of site	9,000.00
Operation resource needed	31,824.00
Digester maintenance costs <sup>19</sup>	51,000.00
CHP maintenance costs <sup>20</sup>	40,000.00
Insurance <sup>21</sup>	17,000.00
Environmental permitting	1,580.00
Administration cost	5,000.00
<b>Total</b>	<b>155,404.00</b>
<b>Annual Processing Costs – Based on use of specialist machinery</b>	
Harvesting rush	118,245.00
Haulage of rush	77,976.74
Storage of rush	42,000.00
<b>Total</b>	<b>238,221.74</b>
<b>Grand total – annual + processing costs</b>	<b>393,625.74</b>
<b>INCOME</b>	
Incentives <sup>22</sup>	636,509.64
Fuel savings <sup>23</sup>	4,100.44
<b>Total annual income</b>	<b>640,618.08</b>
<b>Balance (net income)</b>	<b>246,984.33</b>

<sup>18</sup> Based on 10% of capital costs

<sup>19</sup> Based on 3% of capital costs

<sup>20</sup> Based on 1p per kWh

<sup>21</sup> Based on 1% of capital costs

<sup>22</sup> FiT's tariff 8.42p per kWh generated, 4.85p per kW exported, RHI tariff 4.1p per kWh heat generated and used

<sup>23</sup> Electricity rated at 13p per unit and oil at 5.8p



### Preliminary financial model showing cash position

Expressed simply the following table shows how cash accumulates in the business for the **250kW AD system** based on given assumptions and the data set out above. The charge per hectare relates to the amount the AD plant would charge land managers for harvesting and removing biomass from their land. £135 per hectare is currently the typical cost.

Assumptions	Repayment period of 5 years		All inflation set at 2% (on costs and income)		Interest rate 0.05			
250kW	No charge per ha		£70 charge per ha		£100 charge per ha		£135 charge per ha	
Year	Final annual position	Cumulative position	Final annual position	Cumulative position	Final annual position	Cumulative position	Final annual position	Cumulative position
1	-132,664	-132,664	-78,414	-78,414	-55,164	-55,164	-28,039	-28,039
2	-280,817	-413,481	-225,482	-303,896	-201,767	-256,931	-174,100	-202,139
3	-263,934	-677,415	-207,492	-511,388	-183,303	-440,234	-155,082	-357,221
4	-247,012	-924,427	-189,442	-700,830	-164,769	-605,003	-135,983	-493,204
5	-230,053	-1,154,480	-171,331	-872,161	-146,164	-751,167	-116,803	-610,007
6	-213,054	-1,367,533	-153,157	-1,025,318	-127,487	-878,654	-97,539	-707,546
7	103,985	-1,263,548	165,080	-860,238	191,263	-687,391	221,810	-485,736
8	106,065	-1,157,483	168,381	-691,857	195,088	-492,303	226,246	-259,490
9	108,186	-1,049,297	171,749	-520,108	198,990	-293,313	230,771	-28,719
10	110,350	-938,947	175,184	-344,924	202,970	-90,343	235,387	206,668
11	112,557	-826,389	178,688	-166,237	207,029	116,686	240,094	446,762
12	114,808	-711,581	182,261	6,025	211,170	327,856	244,896	691,659
13	117,104	-594,477	185,906	201,931	215,393	543,249	249,794	941,453
14	119,446	-475,030	189,625	391,556	219,701	762,950	254,790	1,196,243
15	121,835	-353,195	193,417	584,973	224,095	987,045	259,886	1,456,129
16	124,272	-228,923	197,285	782,258	228,577	1,215,622	265,084	1,721,212
17	126,758	-102,165	201,231	983,489	233,148	1,448,770	270,385	1,991,598
18	129,293	27,127	205,256	1,188,745	237,811	1,686,581	275,793	2,267,390
19	131,879	159,006	209,361	1,398,106	242,568	1,929,149	281,309	2,548,699
20	134,516	293,522	213,548	1,611,654	247,419	2,176,568	286,935	2,835,634



This table shows how cash accumulates in the business for the **500kW AD system** based on given assumptions and the data set out above. The charge per hectare relates to the amount the AD plant would charge land managers for harvesting and removing biomass from their land. £135 per hectare is currently the typical cost.

Assumptions	Repayment period of 5 years		All inflation set at 2% (on costs and income)				Interest rate 0.05	
500kW	No charge per ha		£70 charge per ha		£100 charge per ha		£135 charge per ha	
Year	Final annual position	Cumulative position	Final annual position	Cumulative position	Final annual position	Cumulative position	Final annual position	Cumulative position
1	-8,007	-8,007	89,993	89,993	131,993	131,993	180,993	180,993
2	-173,067	-181,074	-73,107	16,886	-30,267	101,726	19,713	200,706
3	-151,028	-332,103	-49,069	-32,183	-5,372	96,353	45,607	246,313
4	-128,889	-460,992	-24,891	-57,074	19,680	116,033	71,679	317,992
5	-106,647	-567,639	-568	-57,643	44,894	160,927	97,933	415,925
6	-84,300	-651,938	23,900	-33,742	70,272	231,199	124,372	540,297
7	278,154	-373,784	388,518	354,776	435,817	667,016	490,999	1,031,296
8	283,717	-90,067	396,289	751,064	444,533	1,111,549	500,819	1,532,114
9	289,392	199,325	404,214	1,155,279	453,424	1,564,973	510,835	2,042,950
10	295,179	494,504	412,299	1,567,577	462,492	2,027,465	521,052	2,564,002
11	301,083	795,588	420,545	1,988,122	471,742	2,499,208	531,473	3,095,475
12	307,105	1,102,692	428,955	2,417,077	481,177	2,980,385	542,102	3,637,577
13	313,247	1,415,939	437,535	2,854,612	490,801	3,471,186	552,945	4,190,522
14	319,512	1,735,451	446,285	3,300,897	500,617	3,971,802	564,003	4,754,525
15	325,902	2,061,353	455,211	3,756,108	510,629	4,482,431	575,284	5,329,809
16	332,420	2,393,773	464,315	4,220,423	520,842	5,003,273	586,789	5,916,598
17	339,068	2,732,841	473,601	4,694,024	531,258	5,534,531	598,525	6,515,123
18	345,850	3,078,691	483,073	5,177,098	541,884	6,076,415	610,495	7,125,618
19	352,767	3,431,458	492,735	5,669,833	552,721	6,629,136	622,705	7,748,324
20	359,822	3,791,280	502,590	6,172,422	563,776	7,192,912	635,159	8,383,483



## 8. Financial Budgets and Forecasts – Briquette Business

### Cost and income data

These tables set out the assumptions of cost and income at the commencement of the briquette business and for the first trading year. The first indicates the full range of costs from harvesting to energy production. The second displays potential income generation through briquette sales at different rates per tonne. The mid range income is broadly in line with the cost of supplied logs, but logs are not normally sold by weight, but rather by ‘load’ which is a rather less reliable measure. A premium product, consistent and with good providence ought to sell at a premium price, but until market testing is concluded it is too soon to say which of the price options below is most realistic.

The annual running of this system compared to current practice for harvesting poor grassland areas (a cost of £135 per hectare<sup>24</sup>) cannot offer savings per hectare. However for the management of reedbed areas large savings per hectare can potentially be made (dependent on current methods employed) when compared to current practice.

To cover capital expenditure and set up costs the financial modelling undertaken at an assumed sales rate of £150 a tonne also includes potential income gained through providing a harvesting service of reedbed areas to other land owners. This is illustrated through the application of different rates per hectare, which are less than currently paid.

The figures are indicative only and will need to be tested as detailed planning progresses and formal tenders are sought for procurement. The potential income generation from a harvesting service will need to be tested through market research and liaison with local stakeholders.

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<sup>24</sup> Somerset Wildlife Trust, July 2015 cost for material to be cut, baled and removed using conventional agricultural machinery



<b>Briquette production costs</b>	<b>££</b>
<b>Set Up Costs</b>	<b>40,000</b>
<b>Capital Investment Costs</b>	
Briquetter	150,000.00
Drying floor	40,000.00
<b>Total capital costs</b>	<b>190,000.00</b>
<b>Annual Operating Costs</b>	
Lease of site	9,000.00
Operation resource needed	31,824.00
Insurance <sup>25</sup>	1,499.00
Administration cost	5,000.00
<b>Total</b>	<b>47,323.00</b>
<b>Annual Processing Costs</b>	
Harvesting	76,628.31
Haulage	17,875.04
Storage	9,982.00
Briquette production costs	41,972.00
<b>Total</b>	<b>146,457.36</b>
<b>Grand total – annual + processing costs</b>	<b>193,780.36</b>

#### Potential income from Briquette sales

<b>Income from Briquette sales</b>	<b>£130 per tonne</b>	<b>£150 per tonne</b>	<b>£180 per tonne</b>
Total annual income	194,870.00	224,850.00	269,820.00
Annual + processing costs	193,780.36	193,780.36	193,780.36
<b>Balance (net income)</b>	<b>1,089.64</b>	<b>31,069.64</b>	<b>76,039.64</b>

<sup>25</sup> Based on £1 per tonne



### Preliminary financial model showing cash position

Expressed simply the following table shows how cash accumulates in the business selling briquettes at **£150 per tonne** based on given assumptions and the data set out above. The charge per hectare relates to the amount the briquetting operation would charge land managers for harvesting and removing **reed biomass** from their land.

Assumptions	Repayment period of 10 years		All inflation set at 2% (on costs and income)		Interest rate 0.05			
Year	No charge per ha		£500 charge per ha		£750 charge per ha		£1000 charge per ha	
	Final annual position	Cumulative position	Final annual position	Cumulative position	Final annual position	Cumulative position	Final annual position	Cumulative position
1	-18,430	-18,430	14,070	14,070	30,320	30,320	46,570	46,570
2	3,191	-15,239	36,341	50,411	52,916	83,236	69,491	116,061
3	4,775	-10,463	38,588	89,000	55,495	138,731	72,401	188,463
4	6,372	-4,092	40,861	129,861	58,106	196,837	75,350	263,813
5	7,981	3,890	43,160	173,021	60,750	257,586	78,339	342,152
6	9,604	13,493	45,486	218,507	63,428	321,014	81,369	423,521
7	11,240	24,733	47,840	266,347	66,140	387,154	84,440	507,962
8	12,890	37,623	50,222	316,569	68,888	456,043	87,554	595,516
9	14,553	52,176	52,632	369,202	71,672	527,714	90,711	686,227
10	16,232	68,408	55,072	424,274	74,492	602,207	93,913	780,140
11	17,924	86,332	57,541	481,815	77,350	679,557	97,159	877,298
12	38,632	124,964	79,041	560,857	99,246	778,803	119,451	996,749
13	39,404	164,368	80,622	641,479	101,231	880,034	121,840	1,118,589
14	40,192	204,560	82,235	723,713	103,256	983,290	124,277	1,242,866
15	40,996	245,556	83,879	807,593	105,321	1,088,611	126,762	1,369,629
16	41,816	287,373	85,557	893,149	107,427	1,196,038	129,298	1,498,926
17	42,652	330,025	87,268	980,417	109,576	1,305,614	131,884	1,630,810
18	43,506	373,531	89,013	1,069,431	111,767	1,417,381	134,521	1,765,331
19	44,376	417,906	90,794	1,160,224	114,003	1,531,383	137,212	1,902,542
20	45,263	463,169	92,609	1,252,834	116,283	1,647,666	139,956	2,042,498



### Application of shareholder funds

The above table assumes early capital payment so the projection can be compared with that of the AD system, but in practice community shareholders will mostly remain invested and capital repayment is more likely to occur in later years. There is also scope to offer benefit in kind to member shareholders and the interest payments may be suspended initially and less overall than those necessary in the AD model. In practice, therefore, the unfavourable cash flow shown above can be avoided under the community ownership model.



## 9. Appendices

### Appendix 1

## Energy for Nature Project Summary

### Background

Energy for Nature evolved from the DECC Wetland Biomass to Bioenergy Competition<sup>26</sup> which looked at ways in which to harvest biomass<sup>27</sup> from wetland nature reserves and convert the material into viable bioenergy products. The management of wetland habitats generates large quantities of surplus biomass which is costly to remove, and limits the quality and extent of the habitat management the RSPB can carry out for wildlife. By converting the material into saleable bioenergy products the cost of management may be reduced or offset. The DECC project provided a wealth of valuable information about the practical end-to-end processes necessary to achieve this but did not consider the economics, markets or business opportunities that 'conservation biomass to bioenergy' could afford the RSPB and other land managers. Energy for Nature addressed this knowledge gap.

### What is Energy for Nature?

Energy for Nature was one of several projects funded through the third round of Defra's Payments for Ecosystem Services (PES)<sup>28</sup> Pilot Scheme between 2014/2015. The project aimed to develop a PES based model that links biomass producers, through intermediaries and markets, to the buyers of bioenergy products, and therefore create a sustainable funding stream to support essential conservation work whilst providing a reliable, and ecologically sustainable, source of energy to local communities.

### What did the project aim to achieve?

The project ran from May 2014 to April 2015 and focused on the Somerset Levels and Moors in southwest England. This was one of the locations for the DECC research and is an important wetland area for the RSPB and other organisations (e.g. Natural England, Somerset Wildlife Trust, etc.) due to its significance for wildlife.

Through the project we worked with local stakeholders to:

- Determine the extent of the biomass problem in the area.
- Establish what level of interest there was for developing a PES scheme.
- Determine which bioenergy products stakeholders were most interested in.
- Determine who all the actors in a scheme would be and their associated role.

<sup>26</sup> [Wetland Biomass to Bioenergy Competition](#).

<sup>27</sup> Unutilised vegetation produced as a by product from habitat management

<sup>28</sup> Payment for Ecosystem Services (PES): A form of market based instrument used to help deliver the provision of ecosystem services over and above what would be delivered in the absence of a payment. It is based on the idea of the 'beneficiary pays principle', whereby the ecosystem service user (i.e. the beneficiary) pays the service provider to secure the continuation of its supply. Schemes can be varied, operate across a range of spatial scales and involve a variety of stakeholders who are linked together in a variety of different ways. For a full definition see the [Defra PES Best Practice Guide](#) (2013)



- Identify possible barriers and challenges to scheme development and implementation.

The data gathered through the stakeholder engagement process was then used to assess the opportunities for developing a scheme based on PES principles and to develop two potential models for delivery.

Economic and market analyses were also carried out and suggestions for possible business models developed based on the results.

### What were the results?

- Energy for Nature can provide a viable solution to the biomass challenge faced by land managers.
- Implementing Energy for Nature in the project area has the potential to convert the costs of managing vegetation from c. £70,000/year to harvest and remove via contractors into bioenergy products worth £150,000 as wholesale loose biomass, or over £5 million if converted into biochar and sold retail.
- The results show that creating a profitable business is achievable, particularly through the conversion into heat and power via anaerobic digestion (AD). However, the extent to which this will be the case will be heavily dependent on the volumes and types of biomass available.
- Two delivery models were developed based around PES principles: Land Manager Model and Community Model.
- Bioenergy (fuel) is the primary service being delivered with biodiversity as a co-benefit through the funding of habitat management.
- The Land Manager Model is driven by the need of land managers to address their biomass challenges and improve land management for wildlife. The model is most similar to a traditional PES scheme with payments moving directly between buyers of the bioenergy product (e.g. local community) and sellers of the biomass (e.g. RSPB).
- The Community Model is driven by the desire of local communities to reduce their dependence on fossil fuels and diversify rural economies. The model is based on actors subscribing to a cooperative grouping (e.g. community benefit society, land trust, etc.) and receiving payments as a share of profits generated from the sale of bioenergy products.
- Whether the driver is land management or community development Energy for Nature has the potential to increase the opportunities for delivering biodiversity at the landscape scale, whilst helping to promote a low carbon, more sustainable economy through providing communities with greener, locally sourced alternatives to fossil fuels.

### What's happening now?

The RSPB is using the research in Energy for Nature to explore how conservation biomass to bioenergy can be implemented on the ground. Work is continuing in the Somerset Levels and Moors case study area to:

- Develop and trial the Land Manager Model, including identifying the administrative structures required to implement on-the-ground to ensure successful delivery.
- Identify key areas in the region where the conversion of conservation biomass into bioenergy could be rolled out for the benefit of nature and people.



- Develop the Community Model, identifying business structures and opportunities to work with local stakeholders to trial in the area.

**Where can I find more information?**

The full report has been published by Defra and can be accessed online at: [Energy for Nature project report](#)

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## Wetland Biomass to Bioenergy Project Summary

### Background

The Wetland Biomass to Bioenergy Competition was born out of the Department of Energy and Climate Change's (DECC) **UK Bio-energy Strategy** (April 2012). This strategy identified the need to source new feedstocks for bioenergy, which sat within the limits outlined in DECC's sustainability criteria. This specifically states feedstock production must not pose a threat to food security, in the UK or internationally, or present risks to biodiversity and ecosystems.

### What did the project aim to achieve?

Funded by DECC, the **Wetland Biomass to Bioenergy Competition** aimed to demonstrate the untapped potential of using existing biomass produced on wetland nature reserves generated from habitat management, as a new energy feedstock. It was designed to encourage business and academia to develop a solution for the end-to-end delivery. To design, build and procure the technology needed to create and deliver the complete process from harvesting through to energy production from wetland biomass in an energy efficient way.

Biomass generated from **conservation management** can be a challenge for many land managers, often limiting the management work undertaken or compromising what can be achieved, and in some instances resulting in the need for sites to have sacrificial areas, where the material is left to rot down.

The competition was delivered in **three phases**; Phase 1 commenced January 2013 and concluded March 2013. Phase 2 ran between May 2013 and March 2014, with Phase 3 from April 2014 to March 2015 concluding the project.

The project was undertaken in **three geographical wetland areas** which were selected based on habitat diversity, scale and complexity, they were:

- The Somerset Levels and Moors.
- The Broads, Fens and Suffolk coast.
- Northern and Eastern Scotland.

Within each of these areas there were consortiums of conservation land managers who provided the sites and biomass needed for the trials and demonstrations undertaken throughout Phase 2 and Phase 3.

### What were the results?

Initially **14 applications** were submitted for Phase 1 of the project, a large percentage of these were consortiums of applicants, with expertise from academia to engineering. From the 14, seven were selected to proceed to the feasibility stage and were provided with funding to undertake this work. From these seven, three applicants were chosen to receive funding for Phase 2. During this phase, the competition element was



removed by DECC and the same three applicants continued through to complete the project to the end of March 2015.

The **three successful applicants**, [AB Systems \(UK\) Ltd](#), [AMW-IBERS](#) and Natural Synergies Ltd employed a diverse range of approaches that have now provided land managers with a portfolio of techniques for the conversion of conservation biomass into bioenergy. These include specialist harvesters, drying and storage systems, together with energy conversion processes such as pyrolysis, anaerobic digestion and combustion.

**Harvesting** material off wetland sites in a suitable condition is essential in its utilisation; through the project new specialist tracked harvesters capable of dealing with challenging wet conditions, were developed. The large 300hp Pisten Bully equipped with a precision chop forager was both effective and efficient for the removal of thick vegetation in large areas with good access and ground not considered as exceptionally sensitive. In comparison the design of the smaller 120hp Softrak operating a double chop forager, was more manoeuvrable, with a lighter footprint, but with a slower work rate.

Once cut, **haulage** of the material off site was either achieved via the harvesters' collection bins or through adapted tracked haulage vehicles and the newly developed sledge cableway system. This cableway could transport 1,000kg of biomass up to a distance of 1,000m with a footprint of 0.2 psi when hauled over wetland areas, significantly reducing the impact of vehicle movements on sensitive ground.

**Storage** of the cut material was dealt with through conventional means such as wrapped bales and silaging using existing farm structures for wet materials, or via the AgBag system which was capable of storing biomass in both dry and wet condition. To reduce the moisture content of the biomass to be used for combustion, **drying** was undertaken in two ways: through the use of a pyrolysis kiln, which dried small amounts of material quickly and through the AgBag system using perforated pipes and solar panels, bringing the potential to dry larger volumes over a longer period - this is still to be trialled.

A **pyrolysis** kiln was developed as part of the project to produce biochar, (in addition to drying) which was successfully achieved using rush, reed and scrub. This process proved excellent for reducing the volume of materials (conversion rate of 3 to 1 for reed), whilst increasing their energy density, producing a high calorific value additive which was mixed with other materials during the briquetting process.

Both small and medium scale **anaerobic digestion** were trialled during the project, each with satisfactory results. The small scale 7kW system utilised liquid produced from the screw-pressing of wetland biomass, this provided the energy needed to power processing the remaining solid fraction into briquettes at a feed rate of 500 litres a day. The pilot medium scale system explored cell disruption techniques to process whole crop foraged material and achieved a biogas composition of between 54 to 56% bio-methane. Further trials and investment are needed to progress this system beyond pilot stage and to the desired 150kW scale, with significant changes needed on the design of the feed mechanism.

**Combustion** of the wetland materials was achieved successfully through the production of briquettes, with emissions results displaying that each of the wetland biomass briquettes performed satisfactorily to be burned as an alternative to pine. Although briquette composition, density and production efficiency would benefit from



further trials. Loose material and briquette wafers were trialled in a biomass boiler and performed effectively, however further emissions testing is needed to achieve RHI accreditation.

The efficiency of each process was monitored and **life cycle analysis** revealed the following results:

Participant	Energy Conversion Technology	Greenhouse gas savings (MJ/a)	Biomass Energy Efficiency (MJ/a)
AB Systems	Briquette production	89.8%	65.0%
AMW-IBERS	Briquette production	84.1%	68.7%
Natural Synergies	Anaerobic Digestion	73.4%	58.9%

### What's happening now?

**Next steps** are to progress the areas already mentioned and to identify opportunities to utilise this range of techniques on the ground, to both maximise conservation management whilst providing a new bioenergy feedstock. Exploration in to the application of knowledge and experience into other habitats has also been initiated, with heathland as the next priority.

The project has illustrated that this approach has immense potential and could range from small scale briquette production on a site by site basis to replace fossil fuels, up to operating at a landscape scale to deliver a complete community energy system. The options are now being explored further using the mechanisms identified in the Energy for Nature project which looked to develop a PES based model for delivery<sup>29</sup>. Through this project, linked with the DECC research it has been demonstrated that the idea of 'conservation biomass to bioenergy' can form a sustainable means of financing essential management of key habitats for biodiversity whilst providing an environmentally sound alternative energy feedstock.

Thanks must go to the many organisations who allowed their sites to be used as guinea pigs and biomass donators without which the project wouldn't have been possible. They also showed much appreciated patience when trials didn't always go to plan!!

### Where can I find more information?

The applicants' reports have been published by DECC and can be accessed online at [Wetland Biomass to Bioenergy Competition](#).

### Contact:

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<sup>29</sup> [Energy for Nature project report](#)



**Appendix 2.** Potential feedstock available within a **10 mile radius** of the potential project site

Site	Management responsibility	Habitat type	Current desirable annual harvest ha	Dry tonnes per/ha	Wet tonnes per/ha	Total dry tonnes	Total wet tonnes	Combustion	AD	Time of harvest
Ham Wall	RSPB	Reedbed	5	7	0	35	0	35	0	Nov - Jan
			2	0	5	0	10	0	10	July - Oct
			10	0	10	0	100	0	100	Sept - Feb
Shapwick Heath	Natural England	Reedbed	6	7	0	42	0	42	0	Aug - Oct
		Reedbed	5	7	0	35	0	35	0	Aug - Dec
		Grassland	3	3	0	9	0	9	0	July - Oct
Westhay Moor / Heath	Somerset Wildlife Trust	Reedbed	3	7	0	21	0	21	0	Nov - Jan
		Fen	12	0	2.5	0	30	0	30	July - Oct
		Grassland	40	3	0	120	0	120	0	July - Oct
Chilton Moor	Somerset Wildlife Trust	Wet grassland - hay	2	3	0	6	0	6	0	July - Oct
		Wet grassland - rush	17	0	4.9	0	83.3	0	83.3	July - Oct
Burtle Moor	Somerset Wildlife Trust	Wet grassland - rush	15	0	4.9	0	73.5	0	73.5	July - Oct



<b>Catcott Lows</b>	Somerset Wildlife Trust	Wet grassland - rush	55	0	4.9	0	269.5	0	269.5	July - Oct
		Wet grassland - hay	40	3	0	120	0	120	0	July - Oct
		Fen	10	0	2.5	0	25	0	25	July - Oct
<b>Tealham &amp; Tadham</b>	Somerset Wildlife Trust	Wet grassland - rush	60	0	4.9	0	294	0	294	July - Oct
<b>Greylake</b>	RSPB	Wet grassland - rush	60	0	4.9	0	294	0	294	July - Oct
<b>Wider Somerset Levels</b>	Mixed	Wet grassland - hay	250	3	0	750	0	750	0	July - Oct
<b>Wider Somerset Moors</b>	Mixed	Wet grassland - rush	425	0	5	0	2082.5	0	2082.5	July - Oct
<b>Wider Avalon Marshes</b>	Mixed	Reedbed	52	7	0	364	0	364	0	Nov - Jan
<b>Totals</b>			<b>1072</b>			<b>1502</b>		<b>1502</b>	<b>3,261.8</b>	



Potential feedstock available within a **15 mile radius** of the potential project site

Site	Management responsibility	Habitat type	Current desirable annual harvest ha	Dry tonnes per ha	Wet tonnes per ha	Total dry tonnes	Total wet tonnes	Combustion	AD	Time of harvest
Ham Wall	RSPB	Reedbed	5	7	0	35	0	35	0	Nov to Jan
			2	0	5	0	10	0	10	July to Oct
			10	0	10	0	100	0	100	Sept to Feb
Shapwick Heath	Natural England	Reedbed	6	7	0	42	0	42	0	Aug to Oct
		Reedbed	5	7	0	35	0	35	0	Aug to Dec
		Grassland	3	3	0	9	0	9	0	July to Oct
Westhay Moor / Heath	Somerset Wildlife Trust	Reedbed	3	7	0	21	0	21	0	Nov to Jan
		Fen	12	0	2.5	0	30	0	30	July to Oct
		Grassland	40	3	0	120	0	120	0	July to Oct
Chilton Moor	Somerset Wildlife Trust	Wet grassland - hay	2	3	0	6	0	6	0	July to Oct
		Wet grassland - rush	17	0	4.9	0	83.3	0	83.3	July to Oct
Burtle Moor	Somerset Wildlife Trust	Wet grassland - rush	15	0	4.9	0	73.5	0	73.5	July to Oct
Catcott Lows	Somerset Wildlife	Wet grassland - rush	55	0	4.9	0	269.5	0	269.5	July to Oct



	Trust	Wet grassland - hay	40	3	0	120	0	120	0	July to Oct
		Fen	10	0	2.5	0	25	0	25	July to Oct
<b>Tealham &amp; Tadham</b>	Somerset Wildlife Trust	Wet grassland - rush	60	0	4.9	0	294	0	294	July to Oct
<b>Greylake</b>	RSPB	Wet grassland - rush	60	0	4.9	0	294	0	294	July to Oct
<b>West Sedgemoor</b>	RSPB	Wet grassland - hay	250	3	0	750	0	750	0	July to Oct
		Wet grassland - rush	200	0	4.9	0	980	0	980	July to Oct
<b>Wider Somerset Levels</b>	Mixed	Wet grassland - hay	500	3	0	1500	0	1500	0	July to Oct
<b>Wider Somerset Moors</b>	Mixed	Wet grassland - rush	4,500	0	5	0	22050	0	22050	July to Oct
<b>Wider Avalon Marshes</b>	Mixed	Reedbed	52	7	0	364	0	364	0	Nov to Jan
<b>Totals</b>			<b>5847</b>			<b>3002</b>		<b>3,002</b>	<b>24,209.3</b>	



