



**BIOMASS
ENERGY.coop**

Your route to a greener more efficient future.

Biomass Energy Coop business plan

Three years to 2018

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multibio
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Biomass Energy Coop is the trading name of Biomass Energy Technologies Ltd, a Community Benefit Society, registered with the Financial Conduct Authority no. 31523R




CONTENTS

1 EXECUTIVE SUMMARY

2 THE VISION FOR BIOMASS ENERGY COOP (BEC)

- Mission statement
- The story so far
- Vision for the next three years

3 MULTIBIO – OUR UNIQUE BIOMASS SOLUTION

- Global and environmental context
- The multi-fuel opportunity
- Our revolutionary technology

4 MARKET AND CUSTOMERS

- Customer sectors
- National presence

5 MARKETING AND SALES

- The customer proposition
- Products and services
- **Multibio** brand and rights
- Competition
- Promotion and sales strategy
- Fuel experimentation showroom

6 MANAGEMENT AND PEOPLE

- Board of Directors
- Staffing

7 OPERATIONS AND LOGISTICS

- Routes to market
- Premises
- Relationship with the manufacturer

8 FINANCE AND FUNDING

- Trading performance
- Investment and sources of funding
- Cashflow forecast

9 MAKING IT HAPPEN

10 UNCERTAINTY AND RISK

APPENDICES

- A. MARKET OPPORTUNITY: FUELS AND COMMERCIAL UTILISATION
- B. EMISSIONS LEGISLATION EXPLAINED
- C. PREPARING FOR A WORLD WITHOUT RHI



1. Executive summary

This plan proposes to establish a high value biomass boiler brand within the UK market that will not only thrive during the current 'incentive led' period but will outlast it too, emerging thereafter as the major brand in a growing biomass sector.

Biomass Energy Coop (BEC) is a Community Benefit Society, founded in 2012 originally as a worker cooperative. As a social enterprise, our mission is to drive forward technological advances that will benefit the community as a whole.

We are already established as a respected installer and wholesaler of biomass systems in NW England. Turnover increased tenfold in our second year to £341K, mainly due to a programme of installations. In 2014-15 we re-configured to concentrate on waste solutions with our **Multibio** range.

The Multibio opportunity

Over the last 18 months we have been working to develop a new opportunity for the business, after acquiring the sole UK rights for a game-changing addition to the market: **Multibio**, a range of European biomass boilers with revolutionary multi-fuel capabilities.

These boilers are made by a Czech company, Petrojet. This range of medium to large sized biomass boilers have significant benefits over their competition. Principally that in addition to standard wood pellets they can burn a range of lower grade wood materials and other non-wood biomass particularly waste streams from agriculture and industry.

We will generate revenue from the sales and installations of these boiler systems initially in non-domestic settings such as retail, offices, community buildings, industrial units, leisure and wider manufacturing. In addition there will be an opportunity to realise sales of ancillary biomass hardware and small pelletisers (which enable fuel production to be local to fuel use).

National coverage will be achieved through regional sales and maintenance centres and a strong internet presence. There is almost no competition for a multifuel biomass boiler that can be installed and earn RHI.

Customers and fuels

To date we have supplied and installed complete boilers and systems for customers as diverse as golf clubs, churches, hotels pubs, clubs, farms, wood yards and apartment blocks. Sustainability and adaptability are key factors: our biomass systems will enable people to switch from fuel to fuel according to availability and price considerations.

Our typical customer will be attracted by the generous subsidies available and able to utilise local waste streams as a source of heat through our boiler, thereby saving money and transport costs whilst reducing landfill and increasing energy security.

Examples of innovative applications for fuel use are:

- **Cereal and straw:** e.g. creating a localised rural fuel network for community and civic buildings and farms
- **Paper and cardboard:** e.g. creating a means of turning paper and cardboard waste into heat at festivals and large events
- **Coffee:** e.g. generating heat from coffee shop waste
- **Miscanthus:** e.g. a city council growing miscanthus on their brown field sites to fuel a chain of boilers for their buildings
- **Low grade wood:** e.g. creating a means of cheaper heating for community buildings in a free boiler scheme
- **Wood waste and finings from forests, agriculture and homes:** e.g. creating a means of heating a wood drying kiln
- **Olive kernel:** e.g. generating heating in food establishments, such as firing a biomass pizza oven.



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We have received numerous expressions of interest from large operators (such as brewers, coffee producers, farming combines, bedding manufacturers, councils and stables) who are all eager to work with us in the future once certification for their particular waste stream has been attained.

Board of Directors

Over the last year we have strengthened our Board and have the skills, knowledge experience and commitment to make our growth plan a reality. They will provide good governance: strategic direction, oversee the operations and ensure compliance with legal and contractual obligations. A number of board members work in an executive capacity and form the operational management team. Elections of board members take place annually at the Society's AGM.

Finance and funding

We have prepared a budget for the three years of our business plan. This includes the revenue and costs for our sales projections as well as the start-up capital requirements. The budget is based upon our trading experience over the last year and the energy industry knowledge and experience of our Directors. By Year 3 revenue is budgeted to grow to £4.7 million with a net profit of around £590,000.

The investment requirement to scale up is £275,000 to cover testing costs, new premises and equipment and working capital to fund growth. The funding will be raised in two share offers:

- **Pioneer share offer.** We seek first stage funding from Pioneer investors of £100,000 to cover testing costs to prove that our range of products can meet Clean Air Act legislation on a variety of fuels. The offer will be launched in November 2015. We would be unable to proceed with the business growth without this funding.

- **Community shares.** When our boiler range is approved after testing we will be ready to take the business forward. We will seek second stage funding of £175,000 in 2016 from Community share investors to meet the funding requirement to fund our capital investment and working capital.

We have a monthly cashflow forecast for the next three years and it is positive in every month. Monthly cashflow is lowest in February 2016 (£16,544) when we are paying for testing costs which will be funded by our Pioneer share offer.



2. The vision for Biomass Energy Coop

Biomass Energy Coop (BEC) is a Community Benefit Society, founded in 2012 originally as a worker cooperative. It has already established itself as a respected installer and wholesaler of biomass systems in NW England.

As a social enterprise, our mission is to drive forward technological advances that will benefit the community as a whole.

Mission statement

We will provide biomass energy solutions that promote the sustainable use of waste products for heat and micro-power generation.

We will be a viable trading business that ensures all those engaged are enhanced in their abilities and fairly recompensed for their efforts.

We will apply the benefits of our innovations and enterprise to promote the localised provision of energy solutions that in turn create skilled employment, promote low carbon economies and engender community cohesion.

The story so far

Biomass Energy Coop is the trading name of Biomass Energy Technologies Ltd which is a registered Community Benefit Society initially founded in 2012 as a worker cooperative with four members. We have successfully established ourselves as a Hetas registered, experienced biomass system installer with a host of satisfied customers in non-domestic buildings.

Turnover increased tenfold in its second year to £341K. This was mainly due to a programme of installations. In 2014-15 we re-configured to concentrate on waste solutions with our **Multibio** range.

Our work to promote multi-fuel biomass boilers includes the production a range of printed educative materials, a quality web presence (website, 129 Facebook and 1185 twitter followers), our regular contributions to community events and work with academia and industrial partners working on waste valorisation.

Over the last 18 months we have been working to develop a new opportunity for the business, after acquiring the sole UK rights for a game-changing addition to the market: **Multibio**, a range of European biomass boilers with revolutionary multi-fuel capabilities. These boilers will enable us to explore waste-as-fuel solutions.

Over the last 5 years in the UK and Europe there has been a number of initial tests, trial installations of **Multibio** boilers. Through this process they have proved to be exceptionally robust, easy to operate, repair, maintain and have all the technological capability of their competition, being fully automated and remotely monitored. However, and most significantly for the UK majority urban market, they have the potential to be exempt for multiple fuels under the Clean Air Act legislation and be eligible for the Renewable Heat Incentive (RHI) grant scheme. This clearing of environmental legislation for the use of biomass fuels other than wood is the industry's Holy Grail and would make **Multibio** a game-changing addition to the market.

Vision for the next three years

We plan to bring **Multibio** biomass boilers to the UK market. These boilers are made by a Czech company, Petrojet. This range of medium to large sized biomass boilers have significant benefits over their competition. Principally that in addition to standard wood pellets they can burn a range of lower grade wood materials and other non-wood biomass particularly waste streams from agriculture and industry.



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Revenue will be generated from the sales and installations of these boiler systems initially in non-domestic settings such as retail, offices, community buildings, industrial units, leisure and wider manufacturing. In addition there will be an opportunity to realise sales of ancillary biomass hardware and small pelletisers (which enable fuel production to be local to fuel use). National coverage will be achieved through regional sales and maintenance centres and a strong internet presence.

Buoyant demand for this range of **Multibio** boilers will be created as a result of the following:

- The capability of providing to manufacturers and retailers the opportunity of reducing/eliminating some of their waste streams, disposal fees and carbon footprint.
- They create the opportunity to supply a biomass system to compete with natural grid gas.
- They provide an opportunity to create lower carbon heat solutions using waste that is available locally.
- They offer the ability to switch between fuel sources as and when supply requires this.
- They offer a safeguard from being 'locked into' likely wood price inflation, such inflation being caused by the majority installations being with boilers that can only handle high grade virgin wood pellets.
- They provide the opportunity for the development of local energy networks where the fuel used is available nearby thus reducing transport costs and enhancing community cohesion.

Over the next three years we wish to establish BEC as a financially sustainable business recognised as a technological leader in the biomass fuel sector. By Year 3 we wish to be selling over 120 boilers and systems nationally, generating £4.7m revenue and employing circa 14 people.

3. Multibio – our unique biomass solution

Global and environmental context

The UK's 2002 ratification of the UN's Kyoto protocol and the subsequent Cancún agreements in 2010 commits us to reduce carbon emissions as a response to global warming. Initiatives to increase solar power, carbon trading, recycling and education campaigns to reduce consumption have seen the UK government's green agenda develop significantly. The non-domestic RHI started in 2012 and created £860m of subsidies for buildings taking on renewable heat technologies (predominantly biomass boilers).

The RHI programme, whilst currently reducing in its generosity, still offers attractive returns and savings against fossil fuels and aims to kick start the green heat revolution in a similar way that its solar and hydro feed-in tariffs did for renewable electricity generation.



The UK is bound by International agreement to reduce its carbon emissions.



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Additionally and away from the green agenda, the declining North Sea gas stocks, electricity generation shortfalls, controversy over fracking and the dominance of Russia in the European gas supply chain have made the UK government keen to find alternatives to achieve energy security and sustainability.

The above factors along with the increase in solar PV and wind farms would indicate that the renewable energy sector is becoming a key constituent of the UK economy and that there will continue to be a steady increase in the take up and development of green technologies.

The multi-fuel opportunity

Once you attempt to burn biomass other than wood you encounter two problems:

Firstly as ash waste in non woody biomass (cereal residues, paper etc.) tends to be much greater and more volatile it creates the problem of ash 'clinker' clogging up and fusing to the internal boiler mechanisms. Secondly moisture levels, the fuels' chemical constituency and the reactions released following the combustion can all cause emissions that fail the legislative criteria designed to protect air quality.

These factors are the principal reason why wood, being dry and creating small amounts of ash has been the staple of biomass technology thus far. These combustion challenges create a need for innovations in boiler technology in both their burning chambers and exhaust mechanisms to enable the utilisation of other fuel sources. In Northern Europe where wood is plentiful and import supply chains well developed there appears to be no economic motivation for the big boiler makers to consider alternatives. The RHI subsidy scheme and its equivalents elsewhere in the EU have consolidated this position as wood biomass technology is so financially attractive it has negated the need to look for alternatives.

However with the continual decrease in RHI subsidies, along with the increasing waste disposal costs as well and the drive for a low carbon economy, a method of using waste materials as fuel stocks is becoming ever more attractive.

Our revolutionary technology

With the **Multibio** system, fuel combustion takes place within an innovative rotating cylindrical hearth which turns the burning matter around within the cylinder, pushing it along the tube until it falls into the ash can below (as the pictures below illustrate).

This revolutionary chamber provides at least three innovations and advantages over other biomass hearths. Firstly it provides a means of treating and ejecting high levels of ash waste, secondly it eliminates the capacity of the ash to fuse and bind to the mechanism, finally its jet-like design enables greater flexibility and control of the flow of oxygen and fuel into the burning chamber thus making the combustion process exceptionally efficient compared with many of its competitors.

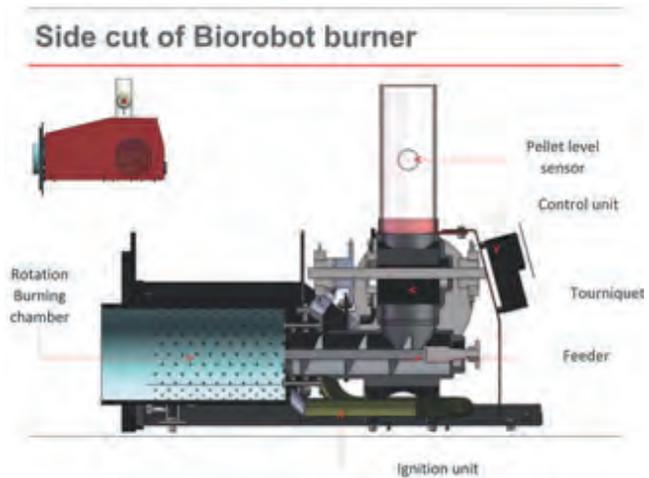
In addition to the immediate advantages of its cylindrical burning chamber the **Multibio** system combines this with a cyclonic exhaust system. And whilst such exhaust technology is available on other biomass boilers the combination of this with a rotary grate operating/burning horizontally within the boiler housing (rather than vertically as in most other boilers) enables the boiler to reduce further the amount of particulates emitted into the flue system.

This whole innovative and sophisticated burning process serves to reduce particulates and elements in the emissions to levels sufficient to clear legislative barriers even for the most 'difficult' fuels. This capability has been tested many times in Europe and beyond with reports available with recorded emissions and tolerances on a range of controlled cereal and wood products.





A **Multibio** burner unit in the testing workshop burning wheat straw showing ejected clinker deposits. Side profile diagram of the burner unit.



A robust and reliable proposition. This boiler technology is now more than 10 years old and has seen at least 3 significant upgrades. It is robust and has been designed to cope in both harsh agricultural and industrial conditions as well as within modern plant rooms. Many of its components - other than the combustion cylinder - are off the shelf manufactures from industrial giants such as Siemens.

The real innovative technology; the burner units have been fitted to other boiler housings of other manufacturers across Europe thus indicating the simplicity, quality and flexibility of the engineering.

This flexibility is achieved because the burner is fixed to the boiler by means of 4 screws and is on castors. This simple fitting system will also enables a less complex repair process and offers immediate solutions to engineers by enabling them to replace the whole burner unit, returning the faulty model for repair off-site, thus reducing down time and engineer cost.

This gives **Multibio** a further competitive edge as many other biomass boilers are completely disabled in the event of a failure of a single component.



“This boiler is able to do what no other boiler has achieved.”

Bengt-Erik Lofgren CEO, AF Ab, Biomass testing laboratory in Sweden speaking at Nextgen Expo, Stoneleigh, 7 October 2015.



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4. Markets and customers

Customer sectors

We have identified (and have experience in) many potential market sectors, including:

- **Buildings off the gas-grid:** In certain regions of the UK the dependence on LPG and heating oil is very high. These fuels are much more expensive than gas.
- **Care homes and hospices:** These sites have a high heat and hot water requirement all year round.
- **Hotels and guest houses:** Like care homes, they have high energy requirements.
- **Leisure facilities and clubs:** Often off grid or high users of heat (especially in the case of swimming pools).
- **Public buildings, office blocks and apartments:** These are usually managed or planned by specialists such as architects, surveyors and property agents and are easy to identify and market to.
- **Farms and orchards:** This industry generate large quantities of woody and biomass waste and possesses the inclination and co-operative experience to work together to create solutions.
- **Stables:** Could potentially dry and use their own shavings, manure and straw to create heat for themselves. We have already received interest from a company working on a trial with the Scottish Government for this waste.
- **Industrial and manufacturing:** In particular those businesses handling organic produce such as wood, paper, cardboard, food or requiring steaming or drying heat; they will have very high refuse and energy bills, both of which could be turned into income through fuel production and RHI.

Typical customer. To date we have supplied and installed complete boilers and systems to customers as diverse as golf clubs, churches, hotels pubs, clubs, farms, wood yards and apartment blocks.

Our typical customer can be characterised by having been attracted by the generous subsidies available. We expect that our typical customer in the future will be one where they will be able to utilize local waste streams as a source of heat through our boiler, thereby saving money and transport costs whilst reducing landfill and increasing energy security.

National presence

We intend to use the existing national co-operative network to develop a countrywide presence and build up a network of partners across the different regions. These offices will handle installations, parts and maintenance, local sales strategies and promotion. BEC's projects director Angela Davies previously held a national position in the development of co-operatives which will lead in this work. We already have expressions of interest from potential regional partners on the South East, Oxford and the West, West Midlands, North East and Cumbria.

BEC has developed a commission-only sales agreement for use with free-lance agents. This will be adapted to enable use within regional offices. We would aim that each of these would be co-operatives and have their own local means of raising investment capital to drive growth. BEC will provide the marketing and technical support to enable each of these to develop their own local markets. It is not expected that the regional partners will have exclusive rights in territories as it is envisaged that a great deal of sales will be internet driven from HQ.



5. Marketing and sales

The customer proposition

Our customer proposition is built upon our innovative technology, our experience and competence and availability of fuel supply.

Innovative technology: We bring a range of innovative biomass boilers to the UK market. These have significant benefits over their competition - principally that, in addition to standard wood pellets, they can burn a range of lower grade wood materials and other non-wood biomass, particularly waste streams from agriculture and industry. Sustainability and adaptability are key factors: our biomass systems will enable people to switch from fuel to fuel according to availability and price considerations.

Taken together these points represent a strong proposition for our customers. Examples of innovative applications for fuel use are:

- **Cereal and straw:** e.g. creating a localised rural fuel network for community and civic buildings and farms.
- **Paper and cardboard:** e.g. creating a means of turning paper and cardboard waste into heat at festivals and large events
- **Coffee:** e.g. generating heat from coffee shop waste
- **Miscanthus:** An excellent low maintenance, high energy crop that has an annual yield, low moisture content at harvest and an ability to thrive on poor quality and brownfield land. A source of heat for civic buildings using surplus public land outside the food chain.
- **Low grade wood:** e.g. creating a means of cheaper heating for community buildings in a free boiler scheme
- **Wood waste and finings from forests, agriculture and homes:** e.g. creating a means of heating a wood drying kiln

- **Olive Kernel:** e.g. generating heating in food establishments, such as firing a biomass pizza oven.

We are also developing ideas with several universities, including Lancaster, York and Milan, working on valorising waste streams and at a later stage we intend to test other likely fuels against the **Multibio** range such as:

- Rice husk pellets
- Fruit stones
- Brewery mash
- Nut waste.

There is more information about these fuel sources in the Appendices.

Experience and competence: The fact that we have already been trading for 4 years as a HETAS qualified and registered biomass installer should engender customer confidence in respect to our offering of the **Multibio** range. We have installed systems in golf clubs, hotels, churches, community buildings and apartments. We have many satisfied customers from both commercial and voluntary sector bodies as well as local co-ops and member-led organisations.

We also can and do complete all the associated civil, electrical and mechanical works which can be required to facilitate biomass installations, this includes slab/brick work, electrical work, plumbing, heating and roofing. We are also conversant and experienced in planning applications and contract law.

Furthermore, we maintain ongoing relationships with all our install customers via our regular service and maintenance visits.

Availability of fuel supply: Potential **Multibio** customers will want to be assured that not only will the technology be able to burn a wide variety of fuels that are available in sufficient quantity and that there are established supply chains in existence for it to be consistently delivered to them.



Over the last 3 years in developing this project we have established and cemented relationships with a variety of 'alternative' fuel suppliers around the country. Pelletised product made from straw and other residue is already a well-developed market as is utilised in animal feed and bedding. These companies have large scale production and distribution networks and access to huge quantities of oat waste, husks and cereal straw. In addition we have experience of importing olive kernel; another well-developed worldwide market (see for yourself at www.alibaba.com) and importantly the contacts to transport and deliver such to end users. Our contacts also have (crucially for RHI), registration with and working knowledge of Ofgem's Biomass Supplier List.

Products and services

BEC developed and owns the **Multibio** trading name for the boiler range, which are manufactured by Petrojet, a Czech engineering company. Petrojet has succeeded in developing a sales and installation capability with a host of national partners and rights owners across Europe, like ourselves. Currently sales of the **Multibio** boilers are being made in Sweden, Finland and of course Czech Republic.

All five machines in our range have achieved the European standard; they cover all sizes from 30kw to 600kw:

- 30kw - suitable for a home;
- 50 kw - suitable for a pub or village hall
- 100 kW - suitable for a block of apartments or sports hall;
- 205 kW - suitable for a small factory or a primary school;
- 600 kW - suitable for an industrial application like a large factory.

We have already taken the 50kW model through successful testing for multiple fuels in the UK, i.e. wood and olive pit, under the UK's Clean Air Act legislation, and the Renewable Heat Incentive (RHI) grant scheme. This is highly significant for the major UK urban market, and so we intend to see the entire **Multibio** range tested and certified. This clearing of environmental legislation for the use of biomass fuels other than wood is the industry's Holy Grail.

Over the last 5 years in the UK and Europe there has been a number of initial tests and trial installations of **Multibio** boilers. Throughout this process they have proved to be exceptionally robust, easy to operate, repair, maintain and have all the technological capability of their competition, being fully automated and remotely monitored.

In addition to the boilers themselves there is the opportunity to sell other ancillary equipment for boiler systems from tanks valves and delivery conveyance to pelletisers, kilns and storage pods.

We will sell two product offerings for each boiler size:

- **Boiler only.** Sales direct to clients or through installation providers.
- **Complete system in a pod.** A complete 'energy centre' with boiler, heat storage and fuel supply sold direct to clients.

We have projected sales for both offerings across the range with national coverage growing over the period of the plan. Sales are projected to increase from 23 units in Year 1 to 122 units in Year 3.

Pricing strategy. In simple terms for a fully automated biomass boiler system there are two distinct 'bands': the high end (mainly Austrian) brands such as ETA, Hertz and Froling and lower down there are other continental (Eastern and Southern European) brands. We have experience of these differences as we have fitted other brands of biomass boilers in the above categories.

We intend to place **Multibio** pricing at around 75% of the price of the equivalent size of the high end Austrian boilers. We will also have two price levels: A full List price and a Wholesale price list.



Multibio brand and rights

The **Multibio** brand name was developed by Ricky Davies and Chris O'Connor, who are founding directors of BEC. The UK **Multibio** trademark and domains are to be owned by the community benefit society, which will allow the **Multibio** brand name to be used by Petrojet in other territories for as long as BEC holds the sole rights in the British Isles.

Competition

Given the RHI stimulus, the collapse of Solar FIT incentives and the confusion of the Green Deal, a large number of companies have moved into biomass.

Other than our own **Multibio** 49, there isn't a multi-fuel biomass boiler that can be operated in a smoke free zone and earn RHI. However, there are some biomass boilers on the market that state they can utilise fuels such as Miscanthus, straw and olive kernel (outside smoke free zones) and we have experience of installing some of these brands of boilers.

What potential competitor brands lack compared to **Multibio** is the flexibility to burn lots of fuels and any inclination to get them through the clean air legislation. This is for a couple of reasons, firstly those that claim ability to burn cereal are unlikely to gain Clean Air Act (CAA) clearance as they are more agricultural and appeal more to rural areas/farms etc. where CAA does not apply. Secondly in respect to those with the capability of utilising more 'woody' fuels such as olive and Miscanthus, most biomass boiler makers are continental (German, Austria and Italian) and the extra investment required to clear UK only emissions legislation for such fuels does not appear to be of interest to them, UK biomass being such a small part of their overall market.

This position may change when the current RHI biomass subsidy finishes. At that point the market may require further stimulation in order to bring biomass heat costs down in order to go head to head with natural gas (which at present is around 20% cheaper).

Other factors which may awaken competition and develop multi-fuel further could come from supply concerns or cost increases of imported wood pellet which is the predominant UK source.

Multibio's launch and success in creating new possibilities and markets will inevitably awaken interest from competitors. We are confident that we have a head start both in terms of the technology and legislative credentials. This head start will create an opportunity for **Multibio** to become a major player in this emerging market.

Away from the 'biomass' and looking at the competition from natural gas and other fossil fuels it is the case that once the RHI subsidy finishes it will become significantly harder to sell 'wood only' biomass against grid fed gas on a cost basis alone. This is because the install cost, space required and pellet prices are all more expensive than natural gas.

Our business proposition is that by utilising waste or local fuel sources, **Multibio** boilers will be able to compete against natural gas. We intend and expect to develop fuels that will create heat at around 3-3.5p per kWh and even less than that when the fuel supply is local and comes free at source. Equally we expect that natural gas prices will increase from their current (low) levels. Furthermore, inflation in the cost of road fuel and waste disposal will also make local/waste heat generation more competitive.

Finally, there are ongoing concerns over the security of our gas and energy supplies given global and political factors and the possibility of shortfalls in the UK's energy generation capability. These factors will make systems that can utilise local waste streams of many different varieties and sources much more attractive.



Promotion and sales strategy

There are many networking, promotional and educational opportunities that can provide a targeted 'soft sell' campaign when we are ready to alert the markets:

- Academic forums that enable us to contact the bigger industrial players
- Trade associations
- Farmer's associations
- Conferences dealing with waste management, renewable energy agriculture and food industries
- Environmental campaign groups
- Community energy activities
- The co-operative sector
- Local government enterprise initiatives
- Chambers of Commerce
- Political parties

Furthermore we expect demand to be stimulated when we invite waste producers to bring samples to be for 'hands on' testing at our head office facility.

Our budget includes provision for the following core marketing activity with the budget increasing over time to £23,060 in Year 3:

Advertising	£8,000
Exhibitions and events	£12,000
Website and SEO	£3,060

Sales strategy. Sales will be built in the following key ways:

- A strong internet presence making use of 'pay per click' and SEO within a quality website
- Regional sales centres and fuel experimentation show room facility (with local campaigns and networking)
- Install networks using independent existing boiler install companies who are trained and equipped to sell, fit, service and repair the **Multibio** range

- **Sales managers:** over time and as we expand our presence nationwide, regional sales managers will be recruited. These managers will be responsible for the management of the relationships in their territory including showroom/test centres, installers, commission based sales agents, after sales service and maintenance

- Individual sales agents who specialise in market sectors – via www.agentbase.co.uk equipped with strong materials and incentivised by generous commission structures

- Press campaign coordinated by a specialist agency (targeting specialist green energy, surveying and building publications). To see our social media check out twitter @ BiomassCoop and Facebook (biomass energy co-operative) to see what BECL do already.

- Public speaking, networking and a www.biomass.guru blog of all our research and opinion (we own this site)

Fuel experimentation showroom

A major component of both the search for new suitable fuels and our marketing campaign will be the establishment of a test facility.

This facility, to be based in Manchester, will have a **Multibio** 49 biomass boiler system, a spare burner, drying, shredding and pelletising equipment, example conveyance systems and an emissions reader. It will enable manufacturers and farmers to bring their potential fuels to see if they will burn in a **Multibio** boiler.

The facility will perform a crucial role in **Multibio's** development. We know from experience that people, especially engineers and academics, like to see working examples. The equipment will enable us to establish if a fuel should be put forward for certification (much cheaper than trial and error when paying expensive test lab fees by the day). Furthermore it will enable us to educate and raise awareness of the potential of multi-fuel biomass and promote **Multibio** as a solution. We will be able to generate RHI from this facility which will reduce our standing costs.



6. Management and people

We are already trading successfully and have worked out the operational arrangements and management structure we need to succeed.

BEC is a community benefit society, registered with the FCA. It is a membership organisation and part of the purpose of this share offer is to widen the membership and participation by the community.



Ricky Davies, Managing Director

As co-founder of BEC, Ricky has extensive knowledge and experience of emissions legislation, multifuel experimentation and technical testing of biomass boilers and their ancillary components. Ricky has worked for 25 years as Operational Director in some of the Catholic Church's largest businesses, and has a working knowledge of business management, social enterprise and charity law.

As MD, Ricky is responsible for overseeing all other roles and the execution of the business plan. Ricky will also manage marketing, bid writing and will fulfil the Finance Director role until filled.

Executive Directors

Board of Directors

Over the last year we have strengthened our Board and have the skills, knowledge experience and commitment to make our growth plan a reality. They will provide good governance: strategic direction, oversee the operations and ensure compliance with legal and contractual obligations. A number of board members work in an executive capacity and form the operational management team. Elections of board members take place annually at the Society's AGM. Our founding directors are:



Chris O'Connor, Technical Director

Our other Co-founder Chris is a fully qualified HETAS heating engineer. He previously operated his family construction company. He oversees all the biomass installation projects and is conversant with planning and contract law. Along with Ricky, Chris has extensive knowledge and experience of emissions legislation, multifuel experimentation and technical testing of biomass boilers and their ancillary components.

As Technical Director, Chris is responsible for the installation programme, to develop install capacity and manage relationships with suppliers. He will also research and introduce improvements to current components, products and ancillary equipment.





Daniel Price, Business Development Director

Dan has a wide-ranging process engineering background and has most recently worked for a multinational pharmaceutical manufacturer as one of their Engineering Specialists. Dan offers both technical expertise and the industry knowledge needed to succeed in biofuels. Dan is also a councillor at Warrington Borough Council.

As Business Development Director, Dan is responsible for the development of policy including relationships and strategic partnerships with government, local authorities and the community energy sector. He will also manage the sales teams, marketing initiatives, website and internet presence.



Angela Davies, Projects Director

Angela has a sound understanding of the co-operative sector. As a manager in The Co-operative Group, she developed The Co-operative Enterprise Hub which supported the growth of co-ops and social investment projects.

As Projects Director, Angela is responsible for the management of projects within the business plan including the community education programme; work with LEPs on chosen fuels; expansion and set up of new offices and centres.





Non-Executive Directors



Nick Crofts

Nick is currently the President of the Members Council for the Cooperative Group, the UK's largest cooperative. Nick has been actively involved in the coop movement for over 10 years, and is also an elected councillor for Knotty Ash on Liverpool City Council.



Phillip Neary

Phillip is Business Development Manager at Balfour Beatty Engineering Services. As an industry technician he has extensive expertise in winning contracts and developing business opportunities.



Nigel Blandford

Nigel is an independent biomass consultant dealing with industrial application of biomass for heat and power. He was previously responsible for The North West Development Agency's Biomass project which investigated the possibilities of alternative fuels including those from waste streams.



Pauline Morgan

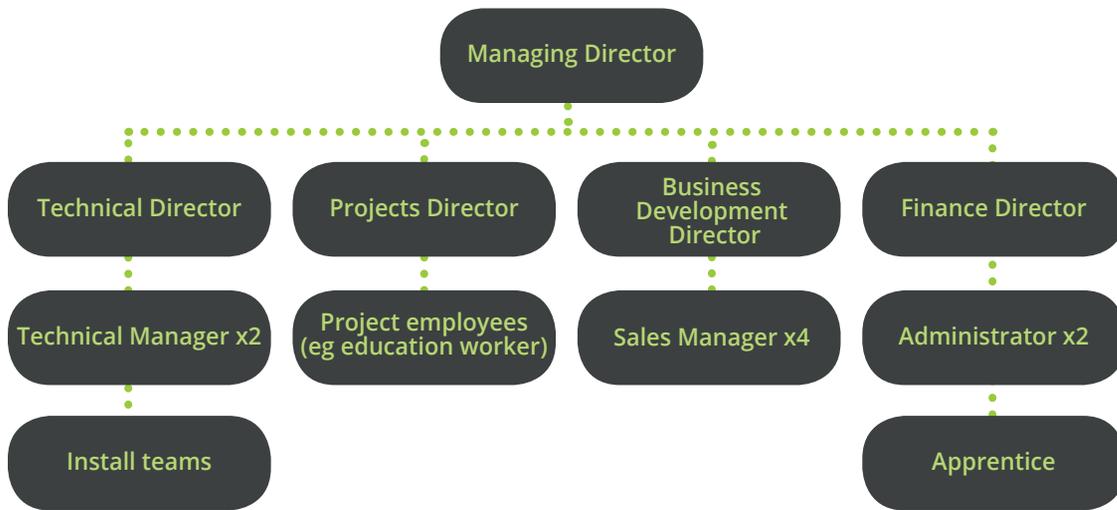
Pauline is Head of Faculty Finance and Director of Operations for the National Graphene Institute. She brings her excellent business operational skills to the Board.



Staffing

In addition to the Executive directors we will recruit staff to drive sales, run customer installation projects and provide back office support. By Year 3 the team will increase to circa 14 people with the addition of Sales managers, Technical managers and administrators. We will have external HR advisor support as required.

The team structure will be:



7. Operations and logistics

Routes to market

Our supply of boilers and ancillary components will come from manufacturers and either be delivered direct to site for install (as is common practice) or into our storage for use in our prefabricated pods or as stock and spares. As such we will provide our products to their end point of use through one of two chains:

Manufacturer > BEC > end user (i.e. website sales and regional BEC led sales)

Manufacturer > BEC > Independent authorised installer > end user

As described previously our two tier pricing policy of a list price and lower wholesale price enables us to maintain our target margin as rights owners whilst providing the opportunity for margin to be made by others involved in the supply. The budget allows for the cost of vehicles and processes necessary for the movement, delivery and positioning of this heavy equipment.

Premises

We will move into premises in the Manchester area with the space we require to install demonstration equipment and a headquarters for the staff team. We will need 5,000 sq² indoor space for a display area, storage and offices as well as yard space to turn and park vehicles. Our initial investigations have led us to conclude that such properties are widely available.

Relationship with the manufacturer

Petrojet is a small engineering company. Their experience matches our own and the many dealings we have had together along with the inevitable strains of small, developing businesses has helped us build up a close working relationship. Most of our board has visited them in the Czech Republic and they in turn have visited the UK for trade shows and planning visits. We have also developed good links with the Czech Embassy who have provided subsidies to enable us to participate and be on a stand at the major trade events such as the Next Gen Expo (www.nextgenexpo.co.uk) saving us thousands and raising our profile in the industry.

Furthermore BEC's control of the **Multibio** brand name presents us with some security and peace of mind when developing the range further and investing in the testing processes. A bigger player would not easily be able to gazump us.

Future prospects with the brand and our relationship may enable us to expand our territory or look to local manufacture under licence. Once this plan is underway and we start to generate increased sales we are confident of negotiating improved supply costs.



8. Finance and funding

We have prepared a budget for the three years of our business plan. This includes the revenue and costs for our sales projections as well as the start-up capital requirements for testing, new premises and equipment and funding of growth.

The budget is based upon our trading experience over the last year selling and installing our products and the energy industry knowledge and experience of our Directors. Our assumptions about the factors affecting financial performance such as customer numbers, sales value and overheads will form Key Performance Indicators (KPIs) and we will use these to monitor progress.

Trading performance

In summary the financial figures are as follows:

Profit and Loss	Year 1 (2016)	Year 2 (2017)	Year 3 (2018)
Income	£1,062k	£3,521k	£4,642k
– Revenue from sales	£23k	£71k	£127k
– RHI Tariff			
Total income	£1,085k	£3,592k	£4,769k
Direct costs	£775k	£2,570k	£3,389k
Overheads and depreciation	£323k	£632k	£788k
Net Profit	- £13k	£389k	£592k

Our largest cost element is the purchase of boiler and other equipment from our supplier in the Czech Republic. We have price agreements in place and have made assumptions about the exchange rate for the £ versus Euro.

We have assumed an interest cost in the P&L equivalent to an average return of 3% annually for our community share investors.

Investment and sources of funding

We have identified the investment funding required and sources of funding in Year 1 to make our plan happen. The breakdown is as follows:

Investment requirement	Year 1
Testing of boiler range	£100,000
Premises refurbishment and fit-out	£9,200
Energy equipment and installation	£75,000
Vehicle purchase and fitting	£53,400
Working capital	£37,400
Total	£275,000
Source of funds	
Pioneer share offer (October launch)	£100,000
Total	£275,000



Investment in Year 2 (vehicles £40,000) and Year 3 (vehicles £20,000) will be funded from cashflow.

Pioneer share offer. We seek first stage funding from Pioneer investors of £100,000. This will raise sufficient funds to cover testing costs to prove that our range of products can meet Clean Air Act legislation on a variety of fuels hitherto not used in the UK. This is essential to allow us to take the product range to the wider market.

The offer will be launched in November and funding will be in place by January 2016. We would be unable to proceed with the business growth without this funding.

Community shares. When our boiler range is approved after testing we will be ready to take the business forward. We will seek second stage funding from Community share investors to meet the funding requirement to fund our capital investment and working capital as we establish regional teams of installers (ideally as cooperatives), develop our fuel networks and expand the markets for our range. The offer will be launched in February and we have assumed that the funding will be in place by end of March 2016.

Cashflow forecast

We have a monthly cashflow forecast for the next three years and it is positive in every month. Monthly cashflow is lowest in February 2016 (£16,544) when we are paying for testing costs which will be funded by our Pioneer share offer.

We have an existing loan with Cooperative and Community Finance/ICOF for £108,000, repayable over six years. This funded the purchase of boiler systems for client installation projects. The repayment and interest costs are included in the budget projections.

The Pioneer shares and Community shares are withdrawable. We have assumed that no capital repayments will be made to shareholders over the three year period of the plan. However, we are budgeting to build a reserve to provide for this in the future.

9. Making it happen

We have an action plan and team in place to deliver the testing programme and achieve the sales growth in this business plan. The indicative schedule for the main elements of the activity plan are as follows:

Activity	When
Launch Pioneer share offer	November 2015
Pioneer share offer closes	December 2015
Testing project	January - February 2016
Community share offer	March 2016
Community share offer closes	April 2016
Move into new premises	Summer 2016



10. Uncertainty and risk

We have identified areas where there is risk and determined the right response to each and these have been incorporated into our business planning. The main risks identified are:

What could go wrong	What we will do about it
Pioneer share offer does not raise sufficient funds	We have a scaled down plan to test less fuels and less boilers thus still proving concept. We will use three fuels (oat, coffee and miscanthus) and two boilers (50kW and 205kW) this will cost circa £40,000.
Testing project takes longer than expected	The testing process does not take longer than three months if the funding is available and there are numerous testing houses across the EU. The testing will be completed in priority order.
Boilers do not meet the legal requirements and fail testing	We already know that coffee, cereal and Miscanthus can burn within the required parameters (previous scientific papers prove this) the pioneer offer is to test the fuels and boilers to UK standards.
Community share offer does not raise sufficient funds	We scale down but seek collaboration with three bodies to make progress on fuels: 1. Local LEP's to develop Miscanthus growing/burning (Liverpool have already stated their interest) 2. A major coffee roaster (Lavazza) have indicated an interest to work with us on coffee. 3. Grant funders have already indicated their support for this work.
Customer uptake is slower than expected	We will seek to get finance and offer free schemes involving waste-conversion-fuelling.
Changes to legal and regulatory framework for energy	Emission standards and legislation is already very high and would be unlikely to change. This business plan sets out proposals which require no subsidies or grant aid to be a success.
Unable to recruit key sales and other staff	We have an attractive sales model involving the recruitment of commission based sales staff (freelance agents). We already operate in this way and would revert to this model if full time sales managers prove difficult to recruit/retain/manage/afford.
Over-dependence on small group of founding Directors	The team as current have the skill set and capability to see through the business plan. Any expansion in volume or scope will necessitate recruitment of new executives which we intend to do. The M+E industry in general is a well established sector which we are confident of being able to recruit from.
Over-reliance on a single boiler manufacturer	To negate this risk: 1. We can consider manufacturing under licence in the UK 2. Manufacture our own boiler body and just source the burner unit from CZ (other EU companies already do this) 3. We have identified another boiler company from Italy (we have installed 5 of their systems) and have a good relationship with the Irish distributor and the company in Italy. This boiler can burn woody biomass (olive, wood and oat husks). 4. In respect to Multibio , the CZ is tied to BEC in a much stronger way as we own the brand name Multibio . We have given them permission to use this on condition that we remain the sole UK and Irish distributor of their product.
Supplies from Czech Republic are disrupted	See above
Currency exchange rate volatility for £ versus Euro	Currency volatility can be both a positive and a negative factor. In our case we can consider both the Euro rate and that of CZ krona before purchasing. The worst case scenario is a weak pound versus both a strong Euro and a strong krona which, whilst unlikely it would cause us to look at UK manufacturing.



Appendix A

Market opportunity: fuels and commercial utilisation

Given that both the amount of possible fuels that can be used in a **Multibio** boiler and the amount of possible sitings and applications are almost endless, we have spent time looking at the best possible fuel sources and their most marketable application.

Fuels

We first sought to identify 6 - 8 fuels (in addition to virgin A grade wood pellet) that would be the best to get the range tested for in order to clear EN 303-5 and UK smoke control legislation. We have done this using our own knowledge of previous testing processes (here and in Europe), biomass installations and consulting academics, European partners and waste producers/handlers. The criteria we used in order to determine the best fuels to consider from a longer list was as follows:

- Had to have the best chance of clearing emissions testing
- Was readily available in sufficient quantities to be a viable long term fuel solution
- Was from a renewable, sustainable source
- Represented a carbon saving against UK wood pellet use
- Provided a potential energy value in excess of 3500kwh per Tonne
- Was a waste product that could not be fed into the food chain
- Was able to be pelletised or granulated to a consistent shape less than 6mm diameter

Utilisation

Once we had chosen the best potential fuels we sought to identify some specific commercial applications for the use of these fuels in a **Multibio** appliance. These applications aim to demonstrate the value of the machines in respect to their multi-fuel capability, their potential to provide a solution to reduce waste treatment costs and finally their commercial viability.

In this appendix we provide more information about the commercial application and annual heating cost comparison for six potential fuels for our **Multibio** range:

1. Cereal and straw pellets
2. Paper and cardboard
3. Coffee
4. Miscanthus
5. Low grade wood pellets
6. Wood waste and finings
7. Olive kernel

We also summarise our interest in other potential fuels:

- Rice husk pellets
- Fruit stones
- Brewery mash
- Nut waste



Potential Multibio fuel 1: Cereal and Straw pellets

Oil Seed Rape (OSR), Wheat and Oat account for over 2.5m Hectares of UK arable land use annually. The straw and husk waste of this crop is of value as a potential biomass fuel as it is plentiful, it's a genuine waste product, can be easily pelletised and has a sufficient energy value of up to 4400 kwh per Tonne. Attached is a study proposal on the potential for OSR as a biomass fuel which provides further technical information.

http://www.harper-adams.ac.uk/postgraduate/files/uploaded/PR_034_Oilseed_Rape_straw_as_a_biomass_source.pdf

Rape straw pellets have proved their potential as a biomass fuel in rural areas (ie outside smoke control zones) within a small range of specially made biomass boilers. Most of these employ technologies or combustion hearths that prove unable to clear urban emission standards.

The challenges of using cereal waste as a biomass fuel centre on the higher ash content (7% compared to <1% in wood and that the chemical content create issues of acidity within the boiler and heavier emissions.

Multibio boilers have the potential to overcome these obstacles. In May 2012 tests on the **Multibio** boiler were completed with Rape straw by ÄFAB bioenergy consultants in Sweden. The report is available on biomassenergy.coop. The conclusions of note from this report which indicate the potential of cereal waste to clear emissions testing within a **Multibio** boiler are summed up by its author Bengt-Erik Lofgren as follows:

"The unit shows that it is indeed possible to construct technology that can handle difficult agrofuels also in a power range suitable for farming and small properties... Our conclusion after testing is that the Petrojet Biorobot 30 is an excellent way to burn all types of pelletised fuels. Of course, it works just fine on wood pellets. But the burner has the unique ability to fire difficult fuels with extremely good result."

Straw pellets: Example of a market application **Creating a localised rural fuel network for community and civic buildings and farms**

In rural communities in east England where cereal crops are most abundant there is the potential to create within a town or borough a network of boilers all set up to utilise cereal waste pellets sourced from local harvest. The machinery to pelletise the crop would be portable (in containers) and be commonly owned by a co-operative, thus providing the facility for each farmer to convert their crop on their own site.

This model would create local, affordable sustainable heating for community buildings, care homes, district heating projects, farms and industrial units. It would create a viable business, employment and significantly reduce fossil fuel use there. Finally it would provide the means to enhance local co-operation and community integration.



Potential Multibio fuel 2: Paper and cardboard

A simple internet search of paper pellets reveals the wide extent to which both the technology and understanding of the process exists. The problem with pelletising paper and cardboard is as follows:

It is dry and dusty, it has a high ash content (similar to cereal waste), can often be difficult to shred (cardboard) and it usually contains impurities print, glue and coverings that can influence both its emissions and ability to be pelletised.

That said paper remains a potential biomass fuel but probably not on its own. The purpose of getting it through emissions legislation on its own is because firstly, it is likely to be sometimes mixed in with other wastes and should be proved 'safe' to eliminate sorting costs before pelletising and secondly, its potential as a stabiliser or means of controlling combustion or moisture content when mixed with another stock to create a more suitable hybrid fuel. Its calorific value is at least as good as cereal waste and around that of wood.

Paper pellets: Example of a market application **Creating a means of turning paper and cardboard waste into heat at festivals and large events**

The UK's festival industry is booming. Combined with the national coverage of fairs, rallies, country shows and carnivals and it is clearly a substantial economic sector. The refuse creation from these events is enormous given the amount of food and drink consumed from disposable crockery and cutlery.

The business solution created by **Multibio** here would be to place portable biomass boiler system in a shipping container (a proven process) and place it alongside another cabin in which there is the means to shred and pelletise the used crockery, cutlery and packaging alongside some supplementary biomass stock such as cereal waste, coffee grounds or sawdust to make pellets to feed straight into the boiler. The heat could be used to heat portable buildings or provide hot water for showers or other hygiene requirements on the site. Most music festivals are being pressed to create less waste and have less environmental impact. Most have banned the use of polystyrene and synthetic catering equipment in favour of wood and paper (Glastonbury started this in 2011).

'We would spend up to £30,000 taking the waste away' Gareth Cooper, co-founder of Festival no.6.

Guardian 9 July 2015



Potential Multibio fuel 3: Coffee

There are 17,000 coffee shops in the UK. This is expected to grow to over 20,000 within 3 years. Each of these shops produce coffee waste in the form of spent coffee grounds. It is estimated that London alone produces 200,000 Tonnes of waste coffee every year.

The potential for using coffee ground as biomass is not new. The big players such as Nestle already utilise their waste grounds at their plants in large incinerators to create heat for ongoing production. A 2013 start-up company in London 'bio-bean' has gained lots of awards and funding and execution of the idea of recycling coffee waste into both biomass and biodiesel (the waste grounds contain 20% oil). Their key obstacle will be that the currently likely destination of their coffee biomass will be to power stations which are not likely to want to spend anything like what it could be sold at as an alternative to wood pellet or Gas heat, thus creating a severe downward pressure on collection costs. Utilisation of this waste locally would be **Multibio's** key advantage.

Furthermore it has been proved that coffee can be utilised as a biomass fuel in smaller appliances. A 2012 research project detailed below reports that whilst spent coffee could not be used super efficiently in a typical wood pellet boiler, it had emissions close to that of wood when mixed 50:50 with sawdust. It concluded that spent coffee was a 'promising alternative fuel'. Given this research, the fact that we have a dedicated multi-fuel boiler, the high urbanised volumes of waste coffee, its chemical composition (high energy and cellulose and low volatiles) and its lack of other uses there is confidence that this could be an exceptionally attractive and viable fuel.

Coffee Ground pellets: Example of a market application Creating a means of heating coffee shops with their own waste

Research already completed by Lancaster University and our partners have concluded that it is possible to reduce the moisture level of waste coffee grounds (WCG) sufficiently at normal room temperatures and that this process is just as efficient as artificial/forced dehydration. Once dry enough the WCG can be easily pelletised (it contains large amounts of lignin; nature's glue).

A large coffee shop will produce 30kg of WCG per day. Accounting for c25% of this being water and oil to be removed, this provides an annual yield of c10 Tonne of grounds (under 1 wheelie bin/week). Such waste would cost at least £5 a week to dispose of but would generate c40,000 kwh of heat in a 30kw **Multibio** boiler, enough to keep its customers warm and with enough hot water for a full year. Additionally the 200 litres of biodiesel produced from this harvest would fuel both 24 round trips of 20 miles to collect the waste and provide the energy required in electric to make the pellets with some to spare. (ie 180 Litres yield less 60L at 8 mpl for the 24 journeys and 130L energy (120kw/T) for 10T of pellet production).



Potential Multibio fuel 4: Miscanthus

Miscanthus is an established and well-known energy crop. To date, it is mostly used in large scale incineration schemes rather than the small and medium sized application proposed by ourselves.

The principle benefits are:

- That it can utilise brown field non-food land
- That it has an annual harvest
- That it has a high energy yield comparable to wood and
- That the land used does not need ploughing prior to each new crop.

Its main disadvantage is that it doesn't pelletise easily however it can be shredded to suitable dimensions.

Miscanthus: Example of market utilisation

We have already received an enquiry from a city council who wish to grow enough crop on their brown field sites to fuel a chain of boilers for their buildings. They have land already identified and just need a boiler that has the proven capability to burn Miscanthus safely and cheaply.



Potential Multibio fuel 5: Low grade wood pellets

There are 3 grades of wood pellet under the EN 14169-2 (known as the ENplus norm); A1, A2 and B. Most biomass boilers can only utilise A1 grade virgin wood pellet.

Multibio boilers are different as they can effectively burn all standards (as they're able to deal with the higher ash content of inferior pellets). However as B standard pellets can contain waste recovered wood it is often unlikely to be permitted under RHI unless declared in the application. A2 pellets are over 20% cheaper than A1 virgin pellets which provides **Multibio** with a distinct marketing opportunity especially where budgets are tight and the building is not connected to the gas grid.

Low grade wood pellets: Example of a market application **Creating a means of cheaper heating for a community building in a free boiler scheme**

The following is an example of a BEC project that was completed in the last 3 months and was financed by the Industrial Common Ownership Finance (ICOF); a Co-operative Funder.

A church, house and social club in Chester England needed a new boiler system to replace the old irreparable one. BEC entered into a 'heat supply agreement' (HSCO) with the church management to provide a new system and all the heat required for the next 20 years (ie. the lifetime of the RHI grant). The boiler installed was a **Multibio** 200kw and the job cost was £65,000.

The RHi income annually will be £12,000 (indexed to RPI and payable for 20yrs). The building pays for its own fuel which being low grade wood pellet works out less than grid gas.

In this example the building gains a new boiler system for free and reduces its heating costs and BEC receive an attractive return for 20 years. The RHI income covers the loan repayment £65,000 plus interest and maintenance costs. The boiler is handed over after 20 years.

This type of contract would be even more attractive on both sides when replacing heating previously using oil, LPG or electricity.



Potential Multibio fuel 6: Wood waste and finings from forest, agriculture and homes

Multibio boilers have a potential application within the work of arbourculturists, parkland management contracts, forestry operations and wastes from vineries, olive groves and orchards.

The collection and disposal costs of fines, scrub and branches is significant and its conversion into pellet impractical given sorting costs and difficulties in pelletising. A **Multibio** boiler would be able to take on this waste in shredded form in a more efficient way than an incinerator given their respective technological, operational and capital costs.

Woody domestic waste and forestry/orchard finings:

Example of a market application

Creating a means of heating a wood drying kiln

The popularity of domestic wood burning stoves has increased considerably in the UK in recent years. In 2013 180,000 stoves were installed and there are well over a million in the UK now (The Stove Industry Alliance) The National Association of Chimney Sweeps says business has increased 40 per cent over the past couple of years as a result of this increase.

This has created a strong demand for firewood. This stock typically takes around a year to dry (season). This process can be accelerated to within a week with a drying kiln. In 2014 BEC installed a biomass boiler at the site of Greater Manchester Tree Station Limited (another co-op) to power their kiln and help them increase their log production to 'fuel' their increased demand. This has been a great success and has increased production and sales.

A **Multibio** boiler utilising the scrap ends of the wood waste process in order to create heat for a kiln to dry logs and fire wood would be exceptionally efficient and profitable.



Potential Multibio fuel 7: Olive kernel

This material, sourced around the Mediterranean, is a dry granulated woody waste that is already widely utilised as a biomass fuel in many other countries. It is already a biomass fuel and has a well-established supply chain. It has significant advantages over virgin wood pellets practically, economically and environmentally:

- It is produced in Europe and North Africa and is a waste product of olive production. The pits are granulated and release much of their moisture within the production process and so require no further energy or treatment (such as shredding, drying or pelletising) to become a biomass fuel.
- In respect to transportation, as most UK wood pellets come from North America, importing olive pit biomass would actually represent a carbon saving in terms of transport costs over using wood pellet.
- From a carbon counting point of view olive is an ideal biomass fuel compared to even UK pellets because it comes ready to use straight from production. The cost of shredding, drying and pelletising wood can be as much as 25% of the energy yield of the fuel when burnt. This is a distinct advantage in respect to olive pit which more than outweighs the transport costs from southern Europe (94g per Tonne CO₂ for transport, sea and road for 2500km and 194kg per Tonne for pellet production)
- There are distinct practical benefits with olive kernel biomass too, kernels do not dust or disintegrate through production, transportation, delivery or final journey into the biomass boiler. This makes them the best biomass fuel we have found so far in terms of performance and maintenance. By way of illustration BEC have been installing biomass boilers since 2011 and can report that over 90% of faults and maintenance works within boilers are caused by fuel delivery and disintegration on the actual site. Olive kernels would eliminate this almost entirely.

- It is very similar in composition to hardwood and therefore has the same calorific value.

Olive kernel: Example of a market application **Heating a coffee shop delicatessen including firing a biomass pizza oven**

Olives are associated with fine foods and Mediterranean dining. The novelty of using olive pits to provide heating for customers can be an attractive selling point for a deli, café or restaurant specialising in such offerings.

BEC is currently working in Lancashire with an existing customer to install a biomass boiler as a centrepiece to a large café/restaurant in his new venture (also including a leisure centre and hotel). This client has specifically requested that the biomass plant room be fitted with large windows so that customers and visitors can see it operating.

As olive biomass is granular it can be gravity fed into a **Multibio** boiler thus eliminating the need for too much conveyance equipment immediately around the boiler. Such a set up with a transparent hopper feeding into the boiler would make for an interesting feature in an Italian deli or bistro.

A 49kw **Multibio** boiler fed on olives would cost £30,000 and generate £2,660 in RHI annually for 20 years, replacing a £2,481 gas bill and saving 13.2 Tonnes of CO₂ every year.



Other potential fuels

This is the current position of our work to locate other possible fuels for testing with **Multibio**:

Rice Husk pellets: These are an already traded biomass commodity imported into the UK for use in power stations. Again, as with olive kernels imported biomass may at first hand seem like being expensive in terms of CO2 cost however given that wood pellet is mostly imported from North America and is not a waste product, other imported wastes like rice should be considered more closely as alternatives to fossil fuels.

Fruit stones: Apricots and Plums are grown in abundance all over northern Europe. In addition we import huge quantities into our food chain. The stones and pits of these fruits being hemi cellulose and lignin mainly would be ideal biomass fuels as they don't need to be pelletised and cannot be put back into the food chain.

Brewery mash: we are currently working with both Lancaster and York and Milan Universities in order to develop ideas on valorising waste streams with **Multibio** boilers. They appreciate the potential of our boilers specifically in respect to being able to test quickly and economically different waste feedstock's potential as fuel. York has asked if we are interested in testing brewery mash as a potential fuel. This is exciting to us not just for application on an industrial scale but locally – in view of the popularity and increase in local 'craft' brewing.

Nut waste: Peanuts are a significant food commodity in the UK. BEC has links with a major UK peanut importer and packer and as such understands the current market conditions and waste considerations. The principle waste in peanuts is their red skin which is being increasingly blanched within the UK causing a potential waste stream. Furthermore there is the potential to utilise other shells as and when they are abundant including walnut, almond, pistachios and coconut.



Petrojet burners in use at a test centre to examine the capability of different potential fuels



Annual heating cost comparisons for fuels and potential fuels

Illustration 1: 200kw boiler for a Block of 12 flats or an office and large retail showroom or a 3 floor offices or a large golf club or a Church, house and community centre or a large farmhouse and grain drying facility.

	Pellets £ p/Tonne	Kwh p/ Tonne	£ p/ Kwh	Heat pa (120,000kw)	£ Replace/ New boiler	RHI £		
(Sept 15)	20 yr. cost							
0% % RPI	20 yr. cost no RHI							
Natural gas	N/a	N/a	£0.041	£9,020	£25,000	£0	£205,400	£205,400
Heating oil	N/a	N/a	£0.055	£12,100	£35,000	£0	£277,000	£277,000
Liquid Petrol Gas	N/a	N/a	£0.065	£14,300	£35,000	£0	£321,000	£321,000
Electricity	N/a	N/a	£0.115	£25,300	£25,000	£0	£531,000	£531,000
A1 grade biomass	£230	4800	£0.048	£10,542	£65,000	£12,100	£33,833	£275,833
A2 grade biomass	£170	4700	£0.036	£7,957	£65,000	£12,100	-£17,851	£224,149
Straw pellet/Miscanthus	£150	4500	£0.033	£7,333	£65,000	£12,100	-£30,333	£211,667
Olive pit	£150	4800	£0.031	£6,875	£65,000	£12,100	-£39,500	£202,500
Coffee grounds	£140	4800	£0.029	£6,417	£65,000	£12,100	-£48,667	£193,333
Free raw material	£40	4400	£0.009	£2,000	£70,000	£12,100	-£132,000	£110,000

Illustration 2: 100kw boiler system feeding an office and small showroom or a row of 4 shops or a typical golf clubhouse or a community centre.

	Pellets £ p/Tonne	Kwh p/ Tonne	£ p/ Kwh	Heat pa (120,000kw)	£ Replace/ New boiler	RHI £		
(Sept 15)	20 yr. cost							
0% % RPI	20 yr. cost no RHI							
Natural gas	N/a	N/a	£0.041	£4,920	£20,000	£0	£118,400	£118,400
Heating oil	N/a	N/a	£0.055	£6,600	£30,000	£0	£162,000	£162,000
Liquid Petrol Gas	N/a	N/a	£0.065	£7,800	£30,000	£0	£186,000	£186,000
Electricity	N/a	N/a	£0.115	£13,800	£13,000	£0	£289,000	£289,000
A1 grade biomass	£230	4800	£0.048	£5,750	£40,000	£5,280	£49,400	£155,000
A2 grade biomass	£170	4700	£0.036	£4,340	£40,000	£5,280	£21,209	£126,809
Straw pellet/Miscanthus	£150	4500	£0.033	£4,000	£40,000	£5,280	£14,400	£120,000
Olive pit	£150	4800	£0.031	£3,750	£40,000	£5,280	£9,400	£115,000
Coffee grounds	£140	4800	£0.029	£3,500	£40,000	£5,280	£4,400	£110,000
Free raw material	£40	4400	£0.009	£1,091	£45,000	£5,280	-£38,782	£66,818



Illustration 3: 30kw boiler system feeding a large home (domestic RHI)

	Pellets £ p/Tonne	Kwh p/ Tonne	£ p/ Kwh	Heat pa (120,000kw)	£ Replace/ New boiler	RHI £		
(Sept 15)	7 yr.cost							
0% % RPI	7 yr. cost no RHI							
Natural gas	N/a	N/a	£0.041	£1,640	£5,000	£0	£16,480	£16,480
Heating oil	N/a	N/a	£0.055	£2,200	£15,000	£0	£30,400	£30,400
Liquid Petrol Gas	N/a	N/a	£0.065	£2,600	£15,000	£0	£33,200	£33,200
Electricity	N/a	N/a	£0.115	£4,600	£5,000	£0	£37,200	£37,200
A1 grade biomass	£230	4800	£0.048	£1,917	£13,000	£2,856	£6,425	£26,417
A2 grade biomass	£170	4700	£0.036	£1,447	£13,000	£2,856	£3,136	£23,128
Straw pellet/miscanthuss	£150	4500	£0.033	£1,333	£13,000	£2,856	£2,341	£22,333
Olive pit	£150	4800	£0.031	£1,250	£13,000	£2,856	£1,758	£21,750
Coffee grounds	£140	4800	£0.029	£1,167	£13,000	£2,856	£1,175	£21,167
Free raw material	£40	4400	£0.009	£364	£17,000	£2,856	-£447	£19,545

Conclusions and notes from the above tables of comparisons

1. In terms of pure economics it is only the RHI subsidy that makes biomass attractive against grid-gas.
2. Biomass will provide cheaper heat against oil, LPG or electricity with or without RHI
3. Biomass using waste is more attractive economically than either A grade wood biomass or fossil fuels.
4. The best **Multibio** opportunities, now and post RHI, will be 'off gas grid' users who have access to local waste that can be converted into fuels.
5. This table was constructed at a time when fossil fuel prices were at a 5 year low
6. Biomass install cost are likely to lower against conventional fossil fuel installs as supply chains develop



Appendix B

Emissions legislation explained

The testing and legislation required to bring a boiler to market comes in 3 forms. Firstly if you want to introduce a safe, legal boiler into the UK, the fundamental safety and capability tests are covered by the European Union norm EN303 - 5 (2012). However if you want to fit the boiler in a smoke control zone (usually the urban areas throughout the UK) then the boiler needs to be listed as an exempt appliance under the 1993 smoke control act. Finally if you want the system to qualify for RHI then you will need an emissions certificate showing that the boiler can safely burn the fuels you have specified within your application.

The appendix to The Smoke Control Act contains a list of solid fuel boilers, incinerators and stoves that have satisfied the emissions and air quality requirements for the UK's urban areas (smoke control zones). The section detailing the biomass boilers in this appendix runs to 51 A4 pages.

The extent of this list is illustrative in two ways; firstly it reveals the large amount of the competition in, and size of, the market. Secondly it reveals how little competition there is for multi-fuel biomass in the majority of the UK. In this list there are only two biomass boilers that can burn anything other than wood. Firstly there is the 'Farm' range, a heavy agricultural technology that can only burn cereal straw bales and secondly our own **Multibio** 49kw that can burn both wood and olive kernel. We completed this testing and application as an initial 'proof of concept' in 2013 and now have 5 of these boilers installed in the UK.

There is now a full range of multi-fuel **Multibio** boilers available, all tested to EN 303-5 2012. However, given the latter two of the requirements detailed in the paragraph above, further testing is required to bring the full range of boilers to the UK market. Such testing takes place in lab conditions and is expensive (around £45,00 for fuel 1 and £18,00 for each subsequent fuel when tested together) In addition there is the final 1993 act application fee of £12,50

per boiler (reductions when submitting a range) and the cost of transport and fuel and accommodation to get the boiler to the test base and stay with it over 2-3 days.

There is a cheaper way and that is to have the boilers tested in Czech Republic to the standards required by the UK government. BEC has the experience of testing and bringing the EP49 to market in 2011. It cost us £16,000 in the UK to do this. This solution is therefore much more economically viable.

In summary the work and costs involved in the testing and application process required to bring the full **Multibio** range of 7 appliances 7 potential fuels each requires a significant change of gear in respect to investment and business organisation, hence this plan. However once this has been achieved we will be in possession of a ground-breaking technology which will give BEC a real competitive and marketing edge, opening up markets (such as waste producers and agri-business) that other boiler sellers cannot even touch.



Appendix C

Preparing for a world without RHI

The non-domestic RHI scheme will eventually run itself out. It has already digressed sharply and is now (Sept 2015) at a point where new installations will receive 50% of the tariff set when the scheme was introduced in 2011. And whilst it is still generous enough to be an incentive it is prudent to look forward to the possible market conditions that will be present after the scheme ends. We think there will be major structural change in the market and three things will happen;

1. Take-up of biomass will fall off dramatically and the number of contractors will reduce (just like has happened with solar PV) leaving behind lots of installations needing maintenance, repair and ongoing solutions.
2. Wood pellet fuel prices and suppliers will stabilise in line with the current levels of demand. The likely result being that prices will be pegged to RHI indexation thus precipitating upward only increases.
3. Future biomass system sales will be restricted to those installations that enable people to make savings on their fuel bills i.e. those off the gas-grid who missed the dash to biomass or with large heat requirements. And those who make purchasing decisions based on ethical factors and carbon reduction targets. This is a significant reduction in market opportunity for wood based biomass suppliers especially given the likely onward and upward price of A class virgin wood pellet.

Multibio will by this time, intends to have a well-known, established range of boilers and heaters that can burn a variety of locally sourced fuel stuffs. At that point and especially if we see increases in both fossil fuel and wood prices the **Multibio** range will be a particularly attractive proposition.

