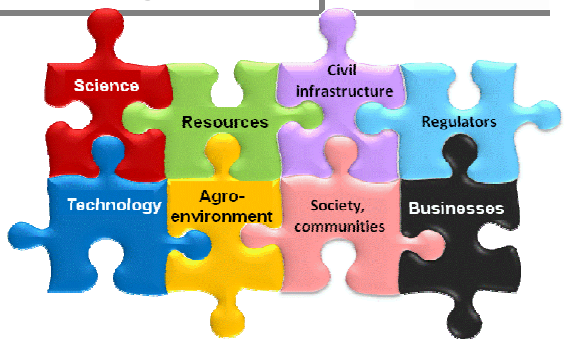
Biofuels Putting together the Green Jigsaw



Project Title:	Capacity Building in South Africa, Namibia and Ghana to Create Sustainable, Bio-oil Supply Chains
Lead	University of Greenwich
Partners	Turner & Townsend (Pty) Ltd, South Africa University of Namibia, Namibia University of Ghana, Ghana Jatropha Africa Ltd, Ghana Goldex 35 (Pty) Ltd, South Africa Consorzio di Ricerca per lo Sviluppo di Sistemi Innovativi Agroambientali (CoRiSSIA), Italy Marine Biological Association, United Kingdom

Reporting Template

Case Study title **British Sugar**

Name of reporter **Katie Thompson**

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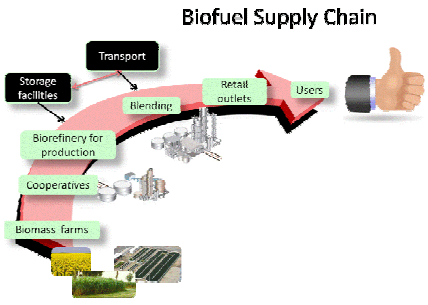
Time period of interrogation **December 2012-March 2013**

Methods used in interrogation **Internet trawling, grey literature search, telephone and email correspondence, telephone interview (5th March 2013) .**

Stakeholders interviewed- title, position in organisation **Paul Lucas, Senior Bio Scientist**

Any permissions / restrictions on use of information **No Negative reporting – seek permission before use**

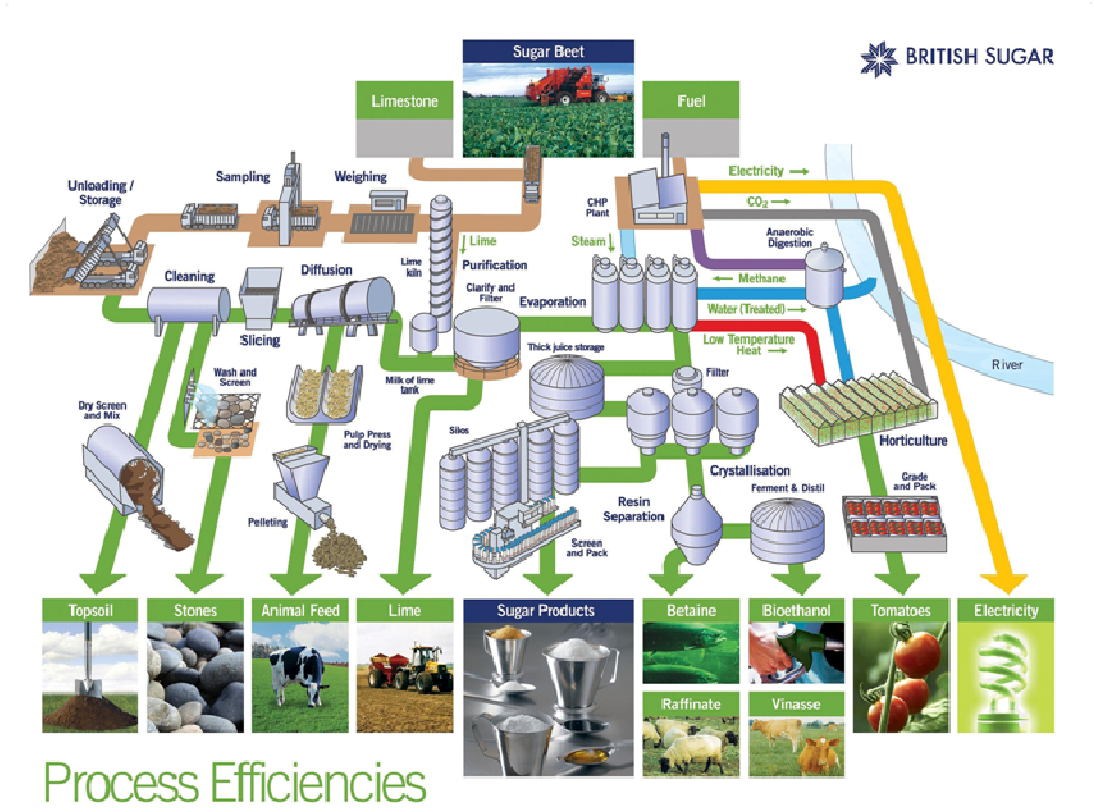
The Biofuel/energy supply chain



- *British Sugar monitors the water source and usage of their growers (primarily within a 50mile radius) of sugar beet, by carrying out a survey annually. They state that presently (2012) less than 5% of the crop receives any irrigation during the growing season due to improved efficiency measures, in order to reduce their growers water footprint. The embedded water within the beet (5.5 million tonnes, based upon the processing of 7.5 million tonnes of sugar beet) is also recovered and utilised for cleaning, heating, cooling and transportation of the plant. Over 60% of their total water usage comes from that extracted from the beet, whilst the remaining is sourced from rivers (27%), bore holes (6%) and town mains (6%).*
- *Fleet transport for British Sugar forms a small part of their sugar's carbon footprint (1%). However, they work in partnership with their hauliers to improve fuel efficiency and reduce any external impacts.*
- *British Sugar works closely with and plays an active role in the wider business community. For example, they are fully committed to comply with the Prompt Payment Code (PPC), to which they are a signatory. Although this is a voluntary code which was developed by the UK government and aided by the Institute of Credit Management (ICM), it seeks to ensure best practice for payment of suppliers, which is essential for SME's (small and medium enterprises). Additionally,*

British Sugar have become a member of the Suppliers Ethical Data Exchange (SEDEX) and submitted an independent audit of their data and activities, in order to aid other companies in enhancing their own sustainable activities.

- *The energy supply chain is exceptionally large given that British Sugar's Wissington plant utilises all its by-products. Therefore, the biofuel supply chain is better explained by visiting;* http://www.britishsugar.co.uk/Products-and-services.aspx Or the figure below



<u>The case study</u>.

British Sugar (an AB Sugar company, owned by international group Associated British Foods plc) is a leading supplier of sugar to the UK market. Recently, the beet sugar industry has celebrated its centenary and British Sugar has been integral to this longstanding success. Although they primarily deal with supplying sugar, the company has a more diverse product portfolio, which includes bioethanol, electricity, tomatoes and animal feed.

British Sugar is an ideal case study for the project given the success they have encountered in their commitment to sustainable development and adoption of biomass and biofuels in their supply chains. .

Given that British Sugar is such a large corporation, this case study concentrates on their Wissington Plant, in Peterborough. This is an ideal case study given that it is the largest sugar beet factory in the world and has a long history. The first factory was placed on the site in 1925 and became part of the British Sugar Corporation (BSC) in 1936. In 1971 a new factory was built on the site at a cost of £10 million. Since this redevelopment, British Sugar has continued to carry out improvements to their processing and the factory alongside the technology becoming available.

Between 1991 and 1994 British Sugar expanded the factory further, focusing on slice and thick juice production, enabling operations of year-round crystal production to take place, rather than just during the beet sugar season. This redevelopment cost £50million, but meant that with the addition of a new Combined Heat and Power (CHP) plant the availability of all year round steam and power presented new opportunities. One of which was the creation of the UK's first bioethanol plant. At the same time the company announced their ambitious plans to reduce the factory energy demand by 20%.

The addition of the CHP plant on the Wissington site has meant that more outputs of each of the processes from the sugar production could therefore become the input for the next, and thus avoid any unnecessary waste. In addition to the extra electricity which is fed back to the grid (as discussed previously) two examples of additional processes taking place as a consequence of the CHP are briefly detailed below, in order that the company can reduce their carbon footprint in addition to making money.

Horticulture

One benefit of the CHP is the horticulture business British Sugar has produced with regards to their tomatoes. Wissington is actually the largest producer of classic round and speciality salad tomatoes. The glasshouse (Cornerways Nursery) covers a total of 18 hectares and produces approximately 140 million tomatoes a year. This is possible due to over 240 miles of heating pipes carrying recovered heat (hot water) from the adjacent factory to maintain optimum temperatures, eliminating the need to burn additional fossil fuel. In addition, the CHP plant provides flue gas, which is a rich source of carbon dioxide, essential for the photosynthesis process and enables the tomatoes to grow quicker, encouraging more production.

Bioethanol Production

As can be seen from the figure above, the extract from the resin separation process, together with other sugar streams, is used in the fermentation/distillation plant to produce 55kt of bioethanol per annum. The extract is mixed with the yeast and fermented in three 1000 m^3 continuous fermenters maintained at 35^{o}C. The yeast is then removed by settlement and recycled back to the fermenter, with the resultant 8% alcohol mash then passing to the distillation process. Here, the alcohol is boiled off from the water in a two-stage distillation process producing concentrated ethanol with only 5% water remaining. In order to remove the water a molecular sieve utilising dehydration technology means that 100% pure ethanol is achieved. The ethanol is then passed to storage where it is denatured, ready to be transported to blenders where it is incorporated into petrol supplies. Finally, the company installed heat recovery systems, involving condensing heat exchangers and falling film tubular evaporators in order to further minimise the energy demanded from this process to ensure that the low carbon footprint required from a sustainable and renewable biofuel is achieved.

Furthermore, British Sugar is able to supply bioethanol with full traceability, including a full life-cycle analysis to demonstrate that the whole process of production, including crop growing, fermentation and distribution, is carried out in a way that provides genuine environmental benefits.

Funding

According to Paul Lucas, the Senior BioScientist of British Sugar, all the funding for all of their projects is internal, but he is unsure as to the exact costing.

Sustainability

British Sugar began production of bioethanol in September 2007 at their Wissington plant, making it the first company to manufacture bioethanol in the UK. Their refinery at Wissington uses sugar beet and produces up to 55,000 tonnes (70 million litres) of bioethanol each year.

All of British Sugar's factories utilise Combined Heat and Power (CHP), which are fuelled from either coal, oil or gas in their water boilers. The steam generated is then used to electrify the factory as well as being reused in the evaporation stages and to heat sugar juice at several points in the refinement process. Their Wissington and Bury St Edmunds factories utilise high performance combined cycle gas turbines which enables them to efficiently generate additional electricity to sell back to supply companies. This results in over 50 MW being exported into the local electrical grid, which they state is enough for a population of 120,000 people. In addition, British Sugar is keen to emphasise how they achieve the best CHP rating under the Government's CHP Quality Assurance (CHPQA) programme.

On their website, British Sugar highlight how they utilise 3 million tonnes of beet a year, which is delivered at an average distance of 28 miles from the factory from 1,200 UK growers. On average their sugar travels 168 miles from beet to bulk delivery at their UK customers. Overall the company are supplied sugar beet from approximately 4,000 growers.

British Sugar recognises their responsibility in respect to the environment. In the last two decades, for example, they have invested approximately £1 billion to improve the utility and transformation of raw materials, as well as investing in new technologies for environmental and energy efficiency. These steps include the recycling of stones for building materials, soil for landscaping, lime for soil conditioning, beet pulp for animal feed and the combustion gases and recovered heat from the running of their Wissington plant contributes to the growth of over 140 million tomatoes annually.

As with many companies seeking to operate sustainably, British Sugar's sites operate using an Integrated Environment Management System (EMS), certified to ISO 14001 to ensure continuous monitoring, environmental performance and improvement. Additionally, British Sugar operates under the UK's Climate Change Agreement Scheme and the EU Emissions Trading Scheme in order to reduce energy consumption and carbon emissions.

In 2008, British Sugar became the first manufacturer to certify their carbon footprint using the new 2050 PAS method. The PAS 2050 method was the world's first method produced to assess the lifecycle greenhouse gas (GHG) emissions of goods and services. It was developed by BSI British Standards and sponsored by the Carbon Trust and the Department for Environment, Food and Rural Affairs. In conjunction with their sister company Silver Spoon, they took part in the pilot process for the initiative, resulting in their home-grown granulated white sugar being assessed to produce 0.6 grams of CO_2 equivalent per gram of product when using the final method. British Sugar highlighted how since 2006 they had managed to reduce the energy required per tonne of sugar by 19% in the UK.

Drivers.

The concept for the bioethanol project was initiated some ten years ago; however, it wasn't until the Renewables Obligation was introduced that it could financially be realised as it enabled a guaranteed income to be secured and a market for the product. The Renewables Obligation was an important driver for the building of their Bioethanol plant and production. However, the main driver (albeit the Renewables Obligation made it economically feasible) was due to their factory efficiency, as highlighted by Paul Lucas in the following excerpt:

> *"the beet sugar process operates on a campaign base normally, so from September through to March the sugar beet is harvested, it comes in to the factory, its processed and sugar then is produced and stored and the tradition is that for the rest of the year the factory then shuts down, maintenance is carried out, everyone goes on holiday and so from March through to September again nothing much happens and then half way through*

> *September all hell breaks loose and all the beet starts arising again. That's not a terribly efficient use of inventory and all the kit that's sitting around doing absolutely nothing. So the key to changing that is to have different operations going on, which would mean that the plant could run all year round, or virtually all year round and so the first change was the introduction of a what we call a 'thick juice operation' that requires, instead of processing beet immediately all the way to sugar or to granulated sugar or whatever, we actually only part process some of it and store it in a thick juice form, i.e. it's been evaporated close to crystallisation, but not actually crystallised. Then it's put in a big tank and we have a number of these tanks and all of them holding something like 45 thousand tonnes and what that means is that you can run the front end of the process fast, but the back end of the process more slowly and more efficiently and then during the none-campaign period you can continue to run the back end of the plant and because you are running it that also means you can do some useful things with energy".*[interview transcript, pg2 38-53]

Support.

When asked what support was integral to the plant and in particular the addition of the CHP and the subsequent bioethanol plant, Paul Lucas explained that the Renewables Obligation was the only integral means of support they required. As the Wissington plant was already in existence, very little was changing and as they were aiming to be more efficient and reduce their reliance upon fossil fuels the project was seen as a positive move by the company. Although Paul himself was unsure how it works in practice he stated that:

> Interviewer: So you said that it was conceived ten years ago, but that the financial conditions weren't correct, was that because the financial backing wasn't available?
> Paul: Yes, it's all to do with the Renewable Obligations...Yeah the RO…
> Interviewer: The ROCs
> Paul: and the requirements for the fuel industry to replace petrol with ethanol. I'm not very good with the details, but we now have I think 5% of all petrol and all diesel is replaced with renewable fuel and obviously there was a government incentive to producing that so that's part of the Renewables Obligation I think.
> Interviewer: So was that financial incentive taken away.
> Paul: Yes, exactly how that financial incentive works in terms of ethanol I am not clear.

Jobs.

The Wissington plant is a large employer for the area with 240 permanent skilled workers and over 300 more employed during the campaign period.

The addition of the bioethanol plant specifically created approximately 10 new jobs as the existing infrastructure for the betaine processing plant provided the support required in terms of office space and administrative aid.

Business targets and wealth creation.

As mentioned previously, the bioethanol plant was an additional means to utilise the heat and power generated from their CHP, the beet processing and various other initiatives were already

in operation. However, upon interviewing Paul Lucas he emphasised how any project, whether environmentally driven or not, has to be economically viable and a means for making money. He further highlighted how a further business plan was to build an anaerobic digester in order to produce a substantial amount of gas for the CHP and therefore save money in terms of the purchasing and reliance upon fossil fuel. This project has been put on hold as the finances are not viable. Paul explains:

> *"The finances don't stack up. So it's not going to happen, from when we started looking at it the price of the feedstock has increased and the price of the gas hasn't gone down, but it has stabilised…"[*pg.5; 166-167]

Paul further emphasised how this project was first suggested in 2007 and was at the point of contracts being signed and contractors in place late last year (2012) before it was put on hold. He highlighted how the company are now much more risk averse and cautious, than they might have been before the financial crash, and other projects running over budget have impeded its creation. He also noted that:

> *Interviewer: "So the fact that it was over budget do you think that's had a knock-on effect for how long it took for…if the project hadn't of gone over budget, the bioethanol plant, do you think the AD plant would have gone ahead sooner?"*
> *Paul: "Possibly. Possibly. We had a couple of projects which ran over budget and Vivergo is another one, which has taken much longer than planned and much more money and that's made us even more risk averse."*

The AD plant is something that Paul envisages for the near future for Wissington.

Training.

British Sugar is passionate about training the future generation. Consequently, they have a highly competitive graduate scheme, internship and apprentice programmes as well as placement opportunities as part of their business philosophy.

Furthermore, all those employed with British Sugar are trained in the necessary components and this is reviewed on an annual basis. Particularly paramount in this respect is safety. The site is registered to OSHAS 18000 and is proud to hold a RoSPA Presidents Award. According to their website both of these accreditations recognise the continuous and ongoing improvement in safety which Wissington has made over many years. The key focus is to never compromise standards and to always train people to know and care about what they do.

Local community stakeholder groups.

Paul explained how they engaged with the local stakeholders and communities as is normal practice when seeking planning permission. However, due to the plant already being in existence, there was very little to oppose. They did receive a little opposition when it was originally going to be a biobutanol plant, but this changed to bioethanol as biobutanol wasn't financially viable. Additionally, some of the negative feedback surrounding Ensus and Vivergo meant that British Sugar has on occasion been subject to the same opinions, but given their full disclosure of their life-cycle assessment, ongoing communication, by means of community forums and through their website, with the local and wider community and sustainable targets, this has often quickly 'blown-over'. For example, the feedstock utilised by Ensus and Vivergo (wheat) meant that beet was also under scrutiny at time as a feedstock for bioethanol production.

Impact on agricultural practice

As noted previously, the plant has had little implications with regards to agricultural practice, British Sugar do monitor their suppliers to ensure that best practice is shared and the best land management and efficiency is being maintained.

Future growth plans and recommendations.

The project did run over as a consequence of the changes to the planning and type of plant being built and as such this, according to Paul, may have had some financial implications for other projects that were/are in the pipeline. One such project was the development of an anaerobic digester, but other reasons (such as gas prices and the cost of the feedstock has increased) has meant this now being on hold, however Paul envisages that this will go ahead at some point in the future.

1. Date of Interview:	**28th February 2013**
1.1 Interviewer's name:	Katie Thompson
1.2 Respondent's name:	Paul Lucas
1.3 Position within organisation	Senior Bio Scientist
1.4 Position/role within a Biofuel Supply chain	
1.5 Name of enterprise / project	British Sugar
1.6 Location, country	Peterborough, England