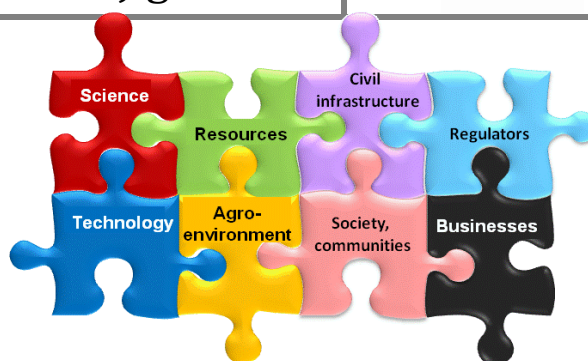


## Biofuels Putting together the Green Jigsaw



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

### Background

**The history of biofuel technology adoption** reveals a repeating pattern of government subsidies and government mandates since the 1860s to promote biofuel use. The aim in general has been to create jobs in the agricultural sector and to decrease reliance on fossil fuels, and government interventions have taken place depending on the price and availability of fossil fuels. In recent times the IPCC Climate Change report (2007) has impressed the need for CO<sub>2</sub> mitigation measures, and biofuel technologies have now been argued as able to play a role in reducing CO<sub>2</sub> emissions.

Climate change mitigation by reducing CO<sub>2</sub> emissions in the atmosphere has a global context, and is evidenced by the 191 states that have signed and ratified the Kyoto Protocol. In turn, biofuel adoption strategies – subsidies and mandates - now come under a similar global spotlight. However there is a commensurate widespread debate as to where society's agricultural outputs should be best directed i.e. food, feed or fuel? This debate is highly relevant in the context of global population growth.

Moreover, the availability and discovery of new seams of fossil fuel continues to place fossil fuel as a cheaper alternative to non-fossil fuel and this suggests that the use of fossil fuels might continue unabated, as in the past, unless Society as a whole acts to pay for the environmental benefits of implementing non-fossil technologies. This adds further impetus to understanding what the costs are to Society, and how the implementation of non-fossil bioenergy technologies might affect local communities.

**Tools to assess the value to society of a given bioenergy technology** are not well developed. For example, life-cycle analysis (LCA) was introduced only in the late 1980s as a technique for compiling an inventory of material inputs and environmental releases associated with the production, use and disposal of a given product or service. Applied to biofuels, serious differences have started to emerge between different assessments, largely due to the definition of the system boundary; indirect emissions and Indirect Land Use Change; the definition of the fossil fuel baseline, and different methodologies. Unfortunately the different results have been used to support or damn adoption of a bioenergy technology.

The environmental impact of a given biofuel must be considered in the technological and geographical context in which the system performs and this in turn, implies that assessments need to be conducted case by case, in a given local, not global context.

**Evolutionary Innovation Systems Analysis (EISA)**, offers a way of assessing the merits of a given biofuel technology to local communities. EISA involves assessment over a given time frame to deduce the nature and role of two so-called 'change motors':

- (a) Human controversy i.e. how have stakeholders attempted to safeguard their interests in processes of debate, coalition formation, power play and conflict?
- (b) Evolution selection amongst a range of options because they simply 'work better'. EISA complements the idea of Innovation Platforms which seek to integrate stakeholder partnerships and activities to generate, compile and transfer knowledge in order to support the successful adoption of, in this case, biofuel technologies, for impact.

## Aim.

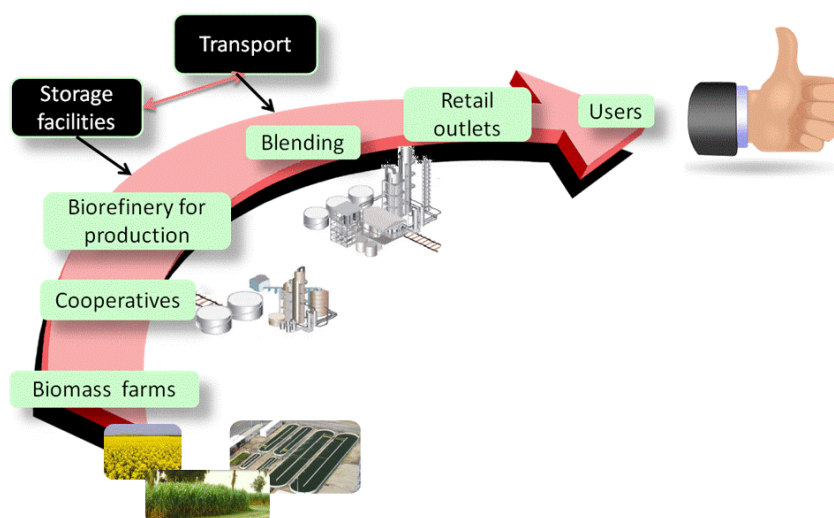
The aim of the investigation is to interrogate case studies that have been aimed at either supporting or adopting biofuel technologies or the biofuel supply chain in order to assess:

1. Impact on jobs, women in society, wealth creation
2. Impact on agricultural practice
3. Contribution of stakeholders (government, local authorities, regulators, other) in the biofuel supply chain.

The context of the investigation is: biofuel supply chains (see Fig 1) in both Africa (Ghana, Namibia and South Africa) and Europe (Italy and the UK).

Fig 1

## Biofuel Supply Chain



## Interrogation methods

1. Case studies should be interrogated deeply using a variety of tools:
  - Publicly available literature i.e. Internet, company literature, public databases
  - Contact with stakeholders by for example, email, telephone, one-to-one interviews, interrogation of stakeholder groups at a workshop.

## Questions

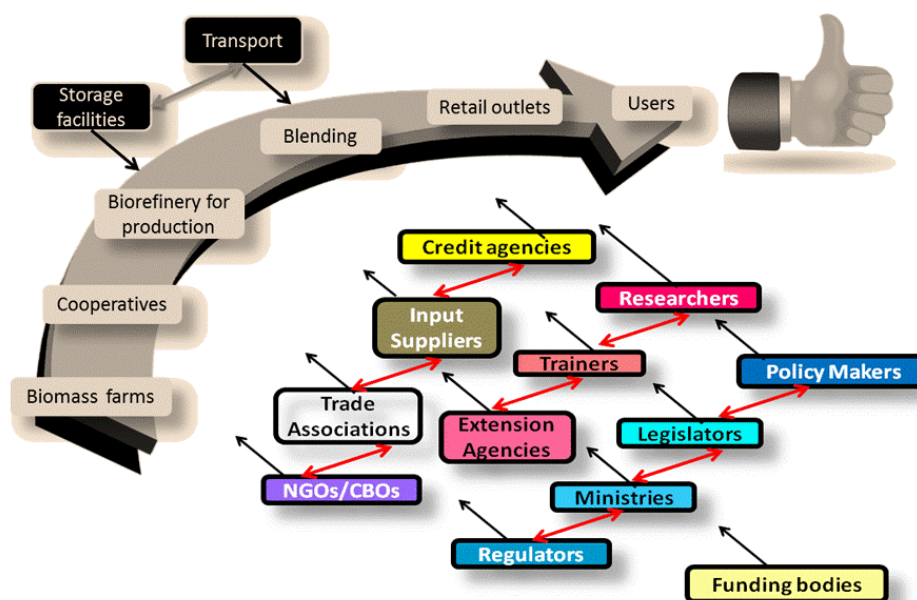
2. Questions for which answers are sought are shown in appendix 2 and should be adapted to suit a given stakeholder.
3. Wherever possible, interviews with stakeholders should be recorded by video or tape-recorder, with their permission.

## Stakeholders

4. In order to understand the identity of stakeholders, case studies should aim to contextualise the whole biofuel supply chain *first*, as broken down in Fig. 1 i.e.
  - 1) **Biomass farms** – stakeholders involved in the cultivation of the biomass/feedstock in the agricultural sector, or collection of biowaste
  - 2) **Biomass transportation**– stakeholders involved in transporting biomass from biomass farms to biofuel refineries

- 3) **Co-operatives** - stakeholders involved in managing the storage of biomass before processing, if this step occurs
- 4) **Biorefineries** - stakeholders involved in the production of the energy carrier/biofuel in a conversion plant
- 5) **Blending operations** (where this occurs): - stakeholders involved in blending with fossil fuel
- 6) **Product distribution** - stakeholders involved in transportation to deliver the final biofuel product from biofuel refinery to consumer.
- 7) **Stakeholders involved in the strategic and operational planning** of the whole supply chain to achieve maximum efficiency.
- 8) **Other stakeholders that have contributed to development of components of the biofuel supply chain** (see fig. 2). These might include
  - Agencies supporting the implementation of biofuel policies in the region including policy makers, legislators, ministries, regulators
  - Financiers including venture capitalists, grant agencies etc
  - Trainers
  - Trade associations etc

Fig. 2

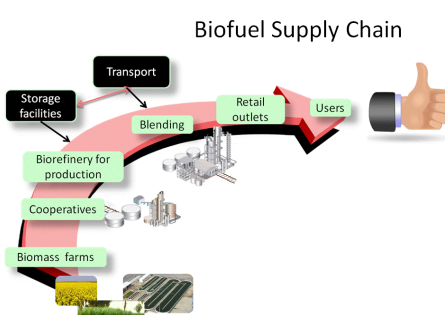


## Data and reporting

5. The data should be analysed and summarised according to the template supplied in appendix 1 and forwarded together with any transcripts / video / audio recorded outputs to Prof PJ Harvey. The information will be further analysed and integrated to understand the impacts of Energy policies in Developing countries by a team comprising
  - ACP Partners
  - Oxfam – Ruth Kelly for the European Commission
  - Durham Energy Institute
6. The final outcomes will be reported back to students and supervisors.
7. Students that submit the best report will be invited to the forthcoming ACP meeting in Brussels in September 2012. The criteria will be
  - a. Extent and thoroughness of interrogation of the case study, and
  - b. Organisation, analysis and summary of the case study.

## Appendix 1

### Reporting Template

Case Study title	
Name of reporter	
Contact details	
Time period of interrogation	
Methods used in interrogation	
Stakeholders interviewed- title, position in organisation	
Any permissions / restrictions on use of information	
 <p><b>Biofuel Supply Chain</b></p>	<p><b>The Biofuel/energy supply chain</b>  <i>With reference to fig 1, give an overview of the full biofuel supply chain that the case study forms a part, both as it exists now and/or as is planned. Include details of</i></p> <ol style="list-style-type: none"> <li>Biomass feedstock – locations of biomass farms,</li> <li>transportation methods to ship biomass to processing units;</li> <li>key technologies used in biorefineries / blending operations;</li> <li>Retail outlets and users, including any international export markets involved.</li> </ol>
<p><b>The case study.</b> Give a brief overview of the case study, its size of operation, the business model, when it was initiated and by whom, and how long it was/has been operational for. Indicate the sources of funding, any written or contractual agreements with suppliers of either equipment supplies, or of biomass sources as relevant.</p>	
<p><b>Drivers.</b> Describe any external drivers that were important for initiating the case study and for its forward progression eg government mandates, subsidies, tax exemptions, legislation, local pressure groups. Analyse the data to highlight the enabling and constraining factors. Describe how these may have influenced the way in which the project has developed.                  Describe any relevant technology drivers for example, was established technology adopted, was local or internationally-led technology adopted?                  Indicate knowledge and attitudes to the concept of an environmental footprint</p>	
<p><b>Support.</b> Describe any support (or lack of support) from Investment Promotion Agencies, export promotion agencies, trade associations, government agencies etc that has had an impact on the sustainability of the case study. Include here any impact that this may have had on the way the business plan evolved.</p>	
<p><b>Jobs.</b> Describe the case study expectations in terms of jobs planned/created, and how far these expectations have been met from initial position. Include details of the percentage of jobs that required training, and percentage of jobs and nature of these jobs given to women. Describe whether the mix of paid and unpaid activities changed after the project began</p>	
<p><b>Business targets and wealth creation.</b> Describe the case study expectations in terms of business targets and wealth creation, and how far these expectations have been met from initial position</p>	
<p><b>Training.</b> Describe how knowledge of the processes involved was gained and then communicated to employees, and whether expert opinions were sought.</p>	
<p><b>Local community stakeholder groups.</b>                  Describe the stakeholder groups that the case study engaged with, the order of engagement and whether the stakeholder groups changed with time, and if so, explain why.                  Describe the methods used to engage with stakeholders and the representatives chosen, for example whether women were actively involved, whether communities were represented by their tribal chief, or by democratically elected leaders etc.                  Describe how frequently case study operatives engaged with community stakeholders.</p>	

*Explain whether there were any conflicts along the way, describe what they were and how they were resolved if at all.*

*Describe the perceptions of surrounding communities about what the project would bring and what perceptions the stakeholders had over their rights and whether this coincided with current legislation. Describe whether there were any notable unintended consequences, for example, whether women's access to land water and fuel and household access was affected, and whether long-term income increases were enough to compensate all households for reduced access to land and increased prices*

### Impact on agricultural practice

*Describe whether the availability and type of food on local markets changed after the project began and whether there was any impact on localised supply of or demand for food and fuel and if there were any credibly attributable impacts on prices*

*Describe whether there were any changes in land use as a result of e.g. new biomass farms being established.*

Future growth plans and recommendations. *Describe what the future growth plans of case study are, if any, and what the perceived opportunities and threats might be for future growth.*

## Appendix 2

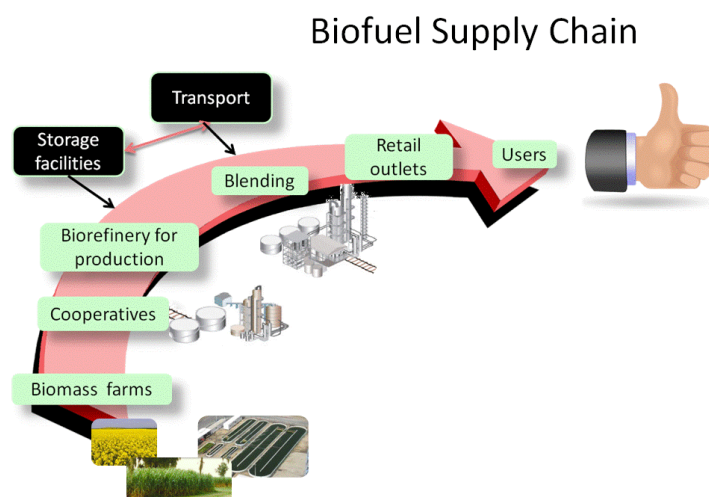
### Questionnaire – for adaptation depending on the stakeholder groups interviewed.

For all of the questions try to tease out as much additional information as you can. Ask "why"?

1. Date of Interview:	
1.1 Interviewer's name:	
1.2 Respondent's name:	
1.3 Position within organisation	
1.4 Position/role within a Biofuel Supply chain	
1.5 Name of enterprise / project	
1.6 Location, country	

## 2 Biofuel Supply chain overview

*(This question could be sent in advance of an interview to primary stakeholder group)*



2.1 In your supply chain, what biomass feedstocks are used?

2.2 From where are they sourced – how far away to storage units or biorefineries?

2.3 How are biomass feedstocks transported from farm to storage unit or refinery? Are they first dried before transportation?

2.4 What are the main technologies used in your supply chain to process biomass eg anaerobic digestion / pyrolysis / oil esterification? What scale?

2.5 Where are the retail outlets / end-users? In the region, in-country, and/or international export?

## 3 Case study overview

3.1 How involved are you in the day-to-day running of the technology/business?

3.2 How would you classify your business model? *Tick which category(s) apply:*

<input type="checkbox"/>	Creator (buys raw materials or components from suppliers and then transforms or assembles them to create a product sold to buyers)
<input type="checkbox"/>	Distributor (buys a product and resells it to someone else).
<input type="checkbox"/>	Landlord (sells the right to use, but not own, an asset for a specified period of time)
<input type="checkbox"/>	Broker (facilitates sales by matching potential buyers and sellers)

3.3 What type(s) of asset are involved? *Tick which category(s) apply:*

<input type="checkbox"/>	Financial e.g. entrepreneur, financial broker
<input type="checkbox"/>	Physical e.g. manufacturer, retailer/wholesaler, physical broker
<input type="checkbox"/>	Intangible e.g. inventor, IP trader, IP broker
<input type="checkbox"/>	Human e.g. contractor
<input type="checkbox"/>	Other (please describe)

3.4 When was your business created?

3.5 Why was your business created?

3.6 How was the project financed? Give approx. % in one or more *multiple boxes; if 'other' please specify.*

<input type="checkbox"/>	Private investment	<input type="checkbox"/>	Grant from NGO	<input type="checkbox"/>	Grant from government	<input type="checkbox"/>	Other <i>please specify:</i>
--------------------------	--------------------	--------------------------	----------------	--------------------------	-----------------------	--------------------------	------------------------------

3.7 Was funding easy to obtain? *(Tick one box)*

<input type="checkbox"/>	1. Very difficult	<input type="checkbox"/>	2. Somewhat difficult	<input type="checkbox"/>	3. Neither difficult or easy	<input type="checkbox"/>	4. Somewhat easy	<input type="checkbox"/>	5. Very easy
--------------------------	-------------------	--------------------------	-----------------------	--------------------------	------------------------------	--------------------------	------------------	--------------------------	--------------

3.8 Please provide reasons/give details for your answer – e.g. what enabled or stopped you getting the funding you sought.

3.9 Please could you give an estimate of the size of the operation in terms of any/all of the following:

- annual turnover,
- investment money,
- number of beneficiaries,
- volume/weight of feedstock per year

3.6a Were there written or contractual agreements with suppliers of e.g. equipment, or of biomass sources? YES / NO

3.6b If yes, with whom, and what type of agreement?

## 4 External drivers

4.1 Which of the following external drivers were important for *initiating* your business?

(Tick one or more)

- Government mandate   
  Government subsidy   
  Tax exemption   
  Local pressure group   
  Other (please specify)

4.2 Which of the following external drivers were important for *forward progression* of your business?

(Tick one or more)

- Government mandate   
  Government subsidy   
  Tax exemption   
  Local pressure group   
  Other (please specify)

4.3 Did you adopt established technology? YES / NO

Please give details

### Environmental Footprint

4.4 Do you have knowledge of your environmental footprint (tick one or more of the following boxes)

1. Carbon footprint   
  2. Energy footprint   
  3. Water footprint   
  4. Water pollution footprint   
  5. Agricultural land footprint?

4.5 How important is knowledge of your environmental footprint to your business?

- Very   
  Somewhat   
  Not at all   
  Other:

4.6 Please explain the reasons for your answer

## 5 Support

5.1 Have you had support from any of the following:

- Investment Promotion Agency   
  Export Promotion Agency   
  Trade Associations   
  Government agencies   
  Other (please indicate)

5.2 Please list the organisations that have provided you with support

5.3 How important has support been to the sustainability of your business?

- Very   
  Somewhat   
  Not at all   
  Other:

5.4 Has support had an impact on the way your business plan has evolved? YES / NO

## 6 Jobs

6.1 How many jobs were anticipated to result from this project?

6.2 How many jobs have been (or were) created so far?

Long term/permanent jobs:

Short term/casual jobs:

6.3 What was the mix of paid and unpaid activities at the start of the project?

Unpaid activities:	Paid activities:
--------------------	------------------

6.4 What was the mix of paid and unpaid activities now?

Unpaid activities:	Paid activities:
--------------------	------------------





--

### 9.3 What methods did you use to engage with these groups?

	Group meeting	Personal visit	Letter	Email	Telephone	Mailshot
Agricultural land owners						
Democratically-elected leaders						
Tribal chief						
Women's groups -specify which						
Other relevant community groups – specify						
Local Traders						
Service providers						
Policy makers						
Regulators						

*Examples of these methods might be a good documentary source for the report*

### 9.4 How frequently did you engage with the stakeholder groups?

	1 per week	1 per fortnight	1 per 3-month	1 per 6-month	1 per year
Agricultural land owners					
Democratically-elected leaders					
Tribal chief					
Women's groups -specify which					
Other relevant community groups – specify					
Local Traders					
Service providers					
Policy makers					
Regulators					

### 9.5 Have the stakeholder groups changed with time? YES / NO If yes, which group(s) and how?

Stakeholder	Change

### 9.6 Were there any conflicts or issues with local community stakeholders? YES / NO If yes, please describe these conflicts/issues and how they were resolved, if at all:

Conflict / issue	Solution

### 9.7 What were the perceptions of local community stakeholders about what the project would bring e.g. jobs, education, wealth etc?

## **10 Impact on agricultural practice and livelihoods**

10.1 Did the availability of food on local markets change after the project began? YES / NO  
If yes, describe how?

10.2 Did the type of food on local markets change after the project began? YES / NO  
If yes, describe how?

10.3 Were there any impacts on the prices of food in local markets? YES / NO  
If yes, please give details

10.4 Were there any changes in land use? YES / NO  
If yes, please give details

10.5 How did the project impact (positively or negatively) on livelihoods of surrounding communities?  
Please give examples

10.6 How did the project impact (positively or negatively) on women's time burdens?

10.7 How did the project impact (positively or negatively) on household incomes?

## **11 Recommendations**

11.1 If you were to do this project again, what would you do differently, if anything, and why?