



Competence Platform on Energy Crop and Agroforestry Systems - Africa

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Competence Platform on Energy Crop and Agroforestry Systems - Africa - COMPETE -

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The objective of this Competence Platform on Energy Crop and Agroforestry Systems - Africa (COMPETE) is to stimulate sustainable bioenergy implementation in Africa. COMPETE will establish a platform for policy dialogue and capacity building in the major multi- and bi-lateral funding organisations and key stakeholders throughout the bioenergy provision and supply chains.

A comprehensive, multi-disciplinary, assessment of current land use, energy demand and technology innovation focused on Africa, will be carried out to identify pathways for the sustainable provision of bioenergy, which will:

- ◆ improve the quality of life and create alternative means of income for rural populations in Africa;
- ◆ aid the preservation of the critical functions of arid and semi-arid regions in Africa as intact ecosystems;
- ◆ enhance the equitable exchange of knowledge between EU and developing countries.

L'objectif de cette Plateforme de Compétence dans les cultures énergétiques et dans les systèmes Agroforestier en Afrique (COMPETE) est de stimuler le développement durable en Afrique. COMPETE établira une plateforme pour le dialogue de politiques, capable de construire dans une mesure majeure multi- et bilatéral les organisations qui gèrent fonds et les acteurs clé sur les approvisionnements bioénergétiques et de ces filières.

Une évaluation comprehensive, multi disciplinaire, de la présente utilisation de la terre, de la demande énergétique et d'innovation technologique centré sur l'Afrique, seront développés en identifiant des liaisons possibles pour le approvisionnement durable de bioénergies qui:

- ◆ amélioreront la qualité de vie et qui créeront des alternatives de revenus pour les populations rurales en Afrique;
- ◆ aideront à la préservation des fonctions fragiles des écosystèmes des zones arides et semi-arides de l'Afrique en écosystèmes intacts;
- ◆ rendront possible l'échange paritaire de la connaissance entre la EU et les pays en voie de développement.

COMPETE will deliver a matrix of multi-disciplinary and cross-sectoral work-packages, each led by globally recognised scientists and implementers, to:

- ♦ provide an evaluation of current and future potential for the **sustainable provision of bioenergy** in Africa in comparison with existing land use patterns and technologies.
- ♦ facilitate **South-South technology and information exchange** capitalising the world-leading RD&D in bioenergy in the key countries Brazil, Mexico, India, China and Thailand
- ♦ develop **innovative tools for the provision of financing** for national bioenergy programmes and local bioenergy projects, including: carbon credits, bilateral and multi-lateral funding instruments, and the role of international trade
- ♦ develop **practical, targeted and efficient policy mechanisms** for the development of bioenergy systems that enhance local value-added, assist local communities and address gender inequalities

The COMPETE partnership comprises 20 European and 23 non-European partners - 11 partners from 7 African countries, 3 regional African policy and financing bodies (African Development Bank; Food, Agriculture and Natural Resources Policy Analysis Network of Southern Africa; UEMOA - Biomass Energy Regional Program), 9 partners from Latin America and Asia - and the Food and Agriculture Organisation of the United Nations (FAO).

The COMPETE project duration will be from January 2007 until December 2009.

For more information on the COMPETE project, please consult the website www.compete-bioafrica.net.

The COMPETE project is co-funded by the European Commission in the 6th Framework Programme - Specific Measures in Support of International Cooperation (INCO-CT-2006-032448).



COMPETE mettra à disposition une matrice multi disciplinaire et des divers secteurs organisés en groupes de travail composés de scientifiques mondialement reconnus afin de permettre de:

- ♦ *donner un état de l'art présent et future du potentiel pour l'**approvisionnement durable de bioénergie** en Afrique en comparant les modèles actuels d'utilisation de la terre et des technologies;*
- ♦ *simplifier l'**échange d'informations et de technologies entre les pays du Sud** pour capitaliser les meilleurs programmes mondiaux de Recherche et Technologie des bioénergies dans les pays clé: Brésil, Mexique, Inde, Chine et Thaïlande;*
- ♦ *développer des **programmes innovateurs pour la gestion de financements** de programmes bioénergétiques internationaux et locaux, incluant le Crédit Carbone, les instruments financiers multi-latéral et bi-latéral et le rôle du commerce international;*
- ♦ *développement **pratique d'efficent programmes politiques** pour le développement des systèmes bioénergétiques qui visent à la création d'une valeur ajoutée locale, que assistent les communautés locales et traitent aux inégalités de genre.*

Le partenariat du projet COMPETE est composée de 20 pays européens, 23 non européens, 11 partenaires de 7 différents pays d'Afrique, 3 organismes africains de financement et politiques (African Development Bank; Food, Agriculture and Natural Resources Policy Analysis Network of Southern Africa; UEMOA - Biomass Energy Regional Program), 9 partenaires de l'Amérique du Sud et Asie, et la FAO (Food and Agriculture Organisation of the United Nations).

Le projet COMPETE se déroulera de Janvier 2007 à Décembre 2009.

Pour plus d'infos sur le projet COMPETE veuillez consultez le site: www.compete-bioafrica.net.

Le projet COMPETE est co-financé par la Commission Européenne dans le 6th Framework Programme - Mesures Spécifiques de support à la Coopération Internationale (INCO-CT-2006-032448).

Liquid Biofuels: an Engine for Sustainable Development

West African Initiative for Promoting Liquid Biofuels

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During year 2006, UEMOA through its Biomass Energy Regional Programme (PRBE) organised a feasibility study outlining the market opportunities, supply chain and the technological and economical benefits for promoting liquid biofuels in 8 West African countries.

Main findings of the study

From a regional point of view, the agricultural production potential for the ethanol sector is very consistent with (i) the humid areas of Ivory Coast, Guinea Bissau, Benin and Togo where rain fed sugar cane, cassava and cashew tree are cultivated and (ii) the geographical zones around the Niger, Senegal and Gambia rivers with intensive irrigation of sugar cane and rain fed oils seeds such as cotton, jatropha and ricin. A co-operation with sub-regional organisations charged with the development of these Sahel zones would enable setting projects in motion. It involves OMVS (which includes Senegal, Mali, Mauritania and Guinea Conakry), OMVG (which includes Senegal Gambia, Guinea Conakry and Guinea-Bissau) the Niger River Office in Mali where more than 1.5 million hectares for biofuels production is possible.

The preliminary options for each country are the following:

- ♦ **Benin** - the most suitable raw material for the production of ethanol is cassava. With an average production of 2.8 million tonnes of cassava per annum, Benin could produce 20,000 m³ of ethanol by using just 5% of its annual harvests (no competition with food supply needs).
- ♦ **Burkina Faso** - sugar cane seems to be the most accessible raw material for the production of ethanol at present, based on new cultivations. If the 5,000 ha owned by SOSUCO were used for this purpose, one can reasonably estimate the production of ethanol at 20,000 m³ per annum. Another potential source is sweet sorghum if the plantation envisaged in the Sourou Valley becomes a reality. As for biofuels, SN CITEC (Dagris Group) plans to build a factory in the short term with a production capacity of 10,000 tonnes per annum based on cottonseed.

Pendant l'année 2006, UEMOA dans le Programme Régional Biomasse Energie (PRBE) a organisé une étude de faisabilité décrivant les opportunités des marchés, de la chaîne d'approvisionnements et des avancées technologiques et économiques pour favoriser les biocarburants dans 8 pays de l'Afrique occidentale.

Résultats principaux de l'étude

D'un point de vue régional, la production potentielle du secteur de l'éthanol en agriculture est consistante avec (i) les zones humides de la Côte d'Ivoire, de la Guinée Bissau, Bénin et Togo où la pluie alimente la Canne à Sucre, Manioc et Anacardier et (ii) les zones géographiques autour du fleuve Niger, Sénégal et Gambie avec l'irrigation intensive de la Canne à Sucre et l'apport de la pluie pour les graines oléagineuses telles que le Coton, la Jatropha et le Ricin. La coopération avec les organismes sub-régional chargés du développement de cette zone du Sahel permettra d'exécuter des projets dans ce secteur. Le projet implique OMVS (incluant le Sénégal, le Mali, la Mauritanie et la Guinée Conakry), OMVG (incluant le Sénégal, Gambie, Guinée Conakry et Guinée-Bissau) et l'office du fleuve Niger au Mali où il y a plus de 1,5 millions d'hectares disponibles pour la production de biocarburants.

Les options préliminaires pour chaque pays sont les suivantes:

- ♦ **Bénin** - la matière première plus appropriée pour la production de l'éthanol est la Manioc. Avec une production de 2.8 millions de tonnes de manioc par an, le Bénin serait capable de produire 20,000 m³ d'éthanol en employant juste le 5% de ses récoltes annuelles (sans compétition avec les besoins alimentaires).
- ♦ **Burkina Faso** - la canne à sucre (basée sur de nouvelles cultures) actuellement semble être la matière première la plus accessible pour la production de l'éthanol. Si les 5.000 ha possédés par SOSUCO étaient employés avec ce but, on peut raisonnablement estimer la production d'éthanol à 20,000 m³ par an. Une autre source potentielle est le Sorghum *Saccharatum* toujours si la plantation envisagée à la Vallée de Sourou devient une réalité. Quant aux biocarburants, le SN CITEC (groupe Dagris) projette de construire dans peu de temps une usine avec une capacité de production de 10.000 tonnes par an à partir de les graines du coton.

- ◆ **Côte d'Ivoire** - the country has a large potential to produce ethanol as a result of extensive availability of cheap molasses, enabling the profitable production of ethanol, gel fuel and/or biofuel. The potential is 19,000 m³/yr. Production costs are estimated at 121, 165 and 122 FCFA/l for ethanol, gel fuel and biofuel respectively (1 Euro is 655 FCFA).
- ◆ **Guinea-Bissau** - the cashew tree apple currently seems to be the most suitable raw material to use for the production of ethanol. The annual production is estimated at 400-600 thousand tonnes, of which only 30% are employed for the production of juice, wine and spirits. If the remaining 70% could be used to produce ethanol, the ethanol production potential would be approximately 8,400 - 12,600 m³/yr.
- ◆ **Mali** - the real production potential depends mainly on the new sugar mill in Markala. The envisaged output of 170,000 tonnes of sugar per annum will result in an availability of 61,000 tonnes of molasses per annum, which can be converted into 18,000 m³ of ethanol.
- ◆ **Niger** - the ethanol production potential is very low in Niger due to the absence of sugar cane production and low precipitation. However, there is particular interest to produce biodiesel from jatropha oil. Initial calculations based on cost estimates indicate that biodiesel could compete with (fossil) diesel.
- ◆ **Senegal** - the ethanol production potential in Senegal is considerable. The Senegalese Sugar Company (CSS) produces roughly 35,000 tonnes of molasses with a high sugar content per annum, which they plan to convert into 2,500 m³ of industrial ethanol (96%) and 10,000 tonnes (12,500 m³) of anhydrous ethanol for use as biofuel. As for biofuels several project promoters were identified; including 30,000 hectare of sugar cane and 20,000 hectare of jatropha.
- ◆ **Togo** - In spite of the presence of a small sugar industry, the immediate potential for the production of ethanol is low unless new sugar cane plantations are developed. The private sector has particular interest to produce jatropha oil as a source for biodiesel. Initial calculations based on cost estimates of the various production factors indicate that biodiesel could compete (5% lower prices) with fossil diesel.
- ◆ **Côte d'Ivoire** - le pays a un grand potentiel de production d'éthanol en raison de la ample disponibilité de mélasse à bon marché, permettant ainsi de produire profitablement de l'éthanol, carburant gélifié et/ou biocarburant. Le potentiel est de 19.000 m³/an. Les coûts de production sont estimés à 121, 165 et 122 FCFA pour litre d'éthanol, respectivement carburant gélifié et biocarburant (1 Euro est égal à 655 FCFA).
- ◆ **Guinée-Bissau** -la pomme de l'anacardier semble actuellement être la matière première la plus appropriée à pour la production de l'éthanol. La production annuelle estimée est à 400-600 mille tonnes, seulement 30% actuellement est utilisé pour la production de jus, de vin et de spiritueux. Le restant (70%) pourrait être employé pour la production de l'éthanol, son potentiel serait approximativement 8.400-12.600 m³/an.
- ◆ **Mali** - le réel potentiel de production dépend principalement du nouveau Moulin à sucre dans Markala. Le rendement prévus de 170.000 tonnes de sucre par an aura en conséquence une disponibilité de 61.000 tonnes de mélasse par an, qui peuvent être converties en 18.000 m³ d'éthanol.
- ◆ **Niger** - le potentiel de production de l'éthanol est très bas au Niger, car la canne à sucre est absente. Cependant, il y a un intérêt particulier pour la production de biodiesel à partir de l'huile de la Jatropha. Les calculs initiaux basés sur des estimations des coûts indiquent que le biodiesel pourrait concurrencer avec le diesel traditionnel (fossile).
- ◆ **Sénégal** - le potentiel de production d'éthanol au Sénégal est considérable. La Sugar Company Sénégalaise (CSS) produit approximativement 35.000 tonnes par an de mélasse avec un contenu élevé en sucre. Ils projettent de convertir en 2.500 m³ de éthanol industriel (96%) et en 10.000 tonnes (12.500 m³) d'éthanol anhydre pour l'utiliser comme biocarburants. Quant aux biocarburants plusieurs promoteurs de projets ont été identifiés pour 30.000 hectares de canne à sucre et pour 20.000 hectares de jatropha.
- ◆ **Togo** - Malgré la présence d'une petite industrie de sucre, le potentiel immédiatement disponible pour la production de l'éthanol est bas, à moins que, de nouvelles plantations de canne à sucre soient développées. Le secteur privé a l'intérêt de produire l'huile de Jatropha comme source pour la production de biodiesel. Les calculs initiaux basés sur des estimations des coûts des divers facteurs de production, indiquent que le biodiesel pourrait concurrencer (prix inférieurs de 5%) avec le diesel traditionnel fossile.

Competitiveness

With the exception of Benin and Guinea-Bissau the local production of anhydrous ethanol can compete with gasoline. Feasibility in Benin suffers especially from illegal import of hydrocarbons from Nigeria while production costs in Guinea-Bissau are high due to high raw material costs and low capacity utilisation as a result of the limited seasonal availability of cashew apple. In these countries, modest support measures (for example tax exemptions) could render the production of anhydrous ethanol viable.

On the other hand the production of anhydrous ethanol as fuel substitute for imported hydrocarbons should be especially stimulated in Ivory Coast (-50%), Senegal (-48%), Mali (-34%), Burkina Faso (-17%). These countries with important resources can save on the import of hydrocarbons, especially by developing local resources.

Regarding the production of biodiesel in Niger and Togo, preliminary calculations indicate that this fuel can compete with (fossil) diesel. Biodiesel production costs are 5 to 11% less than those of diesel. These costs are highly sensitive to the price of jatropha seeds.

The table on the next page summarises opportunities that are considered a " programme d'urgence " for short-term implementation.

Actions forward

The principal recommendation is to continue the development of a biofuel sector in the UEMOA region. The potential to produce anhydrous ethanol and/or biodiesel starting from local raw materials is existing and promising in all the Member States. However, a strong will to reform the hydrocarbons sector and to take inciting measures enabling investments is necessary.

Compétitivité

Excepté le Bénin et la Guinée-Bissau la production locale de l'éthanol anhydre peut concurrencer avec l'essence. La faisabilité au Bénin souffre en particulier de l'importation illégale des hydrocarbures de la Nigeria, tandis que en Guinée-Bissau les coûts de la production sont élevés ; coûts élevés de la matière première et basse capacité d'utilisation en raison de la disponibilité limité à la saison de récolte de la pomme de l'Anacardier. Dans ces pays, les modestes mesures de soutien (par exemple l'exonération d'impôt) pourraient rendre la production de l'éthanol anhydre viable.

D'une autre part, la production de l'éthanol anhydre comme produit de remplacement de carburant pour les hydrocarbures importés, devrait être particulièrement stimulée en Côte d'Ivoire (-50%), Sénégal (-48%), Mali (-34%), Burkina Faso (-17%). Ces pays avec des ressources importantes peuvent réduire les importations des hydrocarbures, en particulier développant les ressources locales.

Vis à vis de la production le biodiesel au Niger et au Togo les calculs préliminaires indiquent que ce carburant peut concurrencer avec le diesel (fossile). Les coûts de la production de Biodiesel sont de 5 à 11% inférieurs de ceux du diesel. Ces coûts sont extrêmement sensibles au prix des graines de la Jatropha.

Le tableau ci-dessous récapitule les opportunités qu'on envisage dans un " programme d'urgence " pour une exécution à court terme.

Actions à prévoir

La recommandation principale est de continuer le développement du secteur des biocarburants dans les régions de l'UEMOA. Le potentiel de production de l'éthanol et/ou du biodiesel anhydres à partir des matières premières locales existe et est encourageant pour tous les états membres. Cependant, il est nécessaire une volonté forte pour réformer le secteur des hydrocarbures et la prise de mesures de stimulation en vers les investissements.



Potential projects in the UEMOA countries

Country	Type project / potential	Scale of units	Investment	Remarks
Benin	20 000 m ³ /yr ethanol based on cassava	1 000 - 10 000 m ³ /yr	FCFA 337 Mio (small cut) FCFA 2.6 Mld (large cut)	Biofuel is 11% more expensive than gasoline
Burkina Faso	20 000 m ³ /yr ethanol based on sugarcane	20 000 m ³ /yr	FCFA 5.3 Mld	Biofuel is 17% less expensive than gasoline
Ivory Coast	19 000 m ³ /yr ethanol based on molasses	10 000 - 5 000 - 4 000 m ³ /yr	FCFA 2.1 Mld FCFA 1.2 Mld FCFA 966 Mio	Biofuel is 50% less expensive than gasoline
Guinea-Bissau	~10 000 m ³ /yr ethanol based on cashew tree apples	1 000 m ³ /yr	FCFA 652 Mio	Biofuel is 2% more expensive than gasoline
Mali	18 000 m ³ /yr ethanol based on molasses	18 000 m ³ /yr	FCFA 4.8 Mld	Biofuel is 34% less expensive than gasoline
Niger	Biodiesel based on jatropha	10 000 m ³ /yr	FCFA 500 Mio (factory) FCFA 3.5 Mld (plantation)	Biodiesel is 11% less expensive than diesel
Senegal	15 000 m ³ /yr ethanol based on molasses	15 000 m ³ /yr	FCFA 3.2 Mld	Biofuel is 48% less expensive than gasoline
Togo	Biodiesel based on jatropha	10 000 m ³ /yr	FCFA 500 Mio (factory) FCFA 3.5 Mld (plantation)	Biodiesel is 5% less expensive than diesel
Total General	Ethanol (93 000 m³/yr) and biodiesel (20 000 m³/yr)	Ethanol: 1 000 - 20 000 m³/yr; Biodiesel: 10 000 m³/yr	Ethanol: FCFA 23.2 Mld (EUR 35,4 Mio) Biodiesel: FCFA 8.0 Mld (EUR 12.2 Mio)	Substitution of 57,100 m³ of gasoline and 19,000 m³ of gasoil. Forex savings FCFA 20.6 Mld (EUR 31.4 Mio)



Biofuel Assurance and Certificate systems Preparing for sustainable market development

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The increasing interest worldwide in biofuels has been giving rise to a variety of concerns. These include the sustainability of production and use, increasing demand in particular areas (Europe and USA), the possibilities for producing feedstocks and fuels in developing countries, trading schemes, and their overall contribution to tackling climate change, among others. In Europe, transport is responsible for an estimated 21% of all greenhouse gas emissions (European Commission, 2006). The EU Directive on biofuels² is the European Union's commitment to the use of bioethanol, biodiesel and other renewable fuels for transport.

The Biofuels Directive is part of the EU's response to the need to comply with the Kyoto Protocol and concerns over energy security, where indicative targets were set to 2010 (Directive 2003/30/EC). The Directive outlined how the introduction of biofuels into the European transport sector should conform to technical standards as well as stating that they should be produced in a sustainable way. The World Wildlife Foundation and the European Environmental Bureau have stressed the need for a certification system for biofuels, particularly given the growing demand (EEB, 2005; WWF, 2006). According to the WWF, a system of eco-certification of all biofuels in Europe is needed not only for the fuels and feedstocks produced within the region but also for those which are imported (WWF, 2006).

The European Commission (DGAgri, 2007) stated that it will require 18 Mha of agricultural land to meet the demand using first generation biofuels to supply the Biofuels Directive's target of 5.75% of the transport sector's energy by 2010. Thus, as a result of internal land constraints, in order to achieve the Directive's target, it will be necessary to have a mixture of imported and locally derived biofuels. This imported increment is expected to come mainly from sugar cane, soy bean/oil, palm oil, rape seed/oil, wood products and other biofuel.

Other reasons for allowing imports, are mainly economic and include crop yield efficiency, the price of land, labour and feedstocks, were reported by the IEA (2004) as affecting biofuel production costs in the U.S. and EU, making them higher than probable exporting countries, such as Brazil. To meet their targets, developed countries will have to consider importing biofuels as well as promoting research for cellulose-based biofuels production.

L'intérêt global et croissant pour les biocarburants a provoqué des préoccupations de différents types. Celles-ci incluent la production et son utilisation durables, l'augmentation de la demande dans des zones particulières (Europe et USA), la possibilité de produire les matières premières (feedstocks) et les carburants dans les pays en voie de développement, des schémas de marchés, leur contribution globale eu égard aux changements du climat, pour n'en citer que quelques-unes. En Europe environ 21% des émissions totales de gaz serre est produit par le secteur du transport (European Commission, 2006). La directive de la UE en matière de biocarburants² engage l'Union Européenne à l'utilisation du bioéthanol, du biodiesel et d'autres carburants renouvelables dans le secteur du transport.

La Directive sur les Biocarburants de la UE répond en partie à la nécessité de se conformer au protocole de Kyoto et concerne également la sécurité énergétique dont les objectifs ont été fixés à l'an 2010 (Directive 2003/30/EC). La Directive décrit comment introduire les biocarburants dans le secteur des transports européen, comment se conformer aux normes techniques et comment les produire durablement. La Worldlife Foundation et le European Environmental Bureau ont souligné la nécessité, vue la demande particulièrement croissante, d'un système d'homologation pour les biocarburants (EEB, 2005 ; WWF, 2006).

Selon le WWF, un système d'éco-certification de tous les biocarburants est nécessaire en Europe, pour les carburants et les matières premières produites in loco et également pour ceux/celles qui sont importés (WWF, 2006).

La Commission de l'UE pour l'agriculture (DGAgri, 2007) a déclaré qu'elle nécessitera de 18 Mha de surface agricole pour satisfaire la demande d'utilisation de biocarburants de première génération, et ce dans le but d'atteindre l'objectif de la Directive sur les Biocarburants qui prévoit que le secteur du transport devrait absorber 5.75% d'énergie d'ici l'année 2010. En raison des limites d'utilisation de la terre en EU et afin de réaliser les objectifs de la Directive, il sera nécessaire d'avoir un mélange de biocarburants comprenant ceux produits au sein de l'Union et ceux importés. On s'attend à ce que les importations dérivent principalement de la canne à sucre, de l'huile de soja, de l'huile de palmier, de l'huile de colza, du bois et d'autres biocarburants.

Importing biofuels from developing countries will not only allow developed nations to diversify their energy mix and meet environmental requirements, but could also create new economic opportunities for rural, agricultural areas, allowing low-income countries to become vital producers and exporters of a valuable new good.

For biofuels to be deemed environmentally compatible, it is necessary to demonstrate that they are produced on an environmentally sustainable basis, and that they contribute positively to climate change mitigation (COM, 2006). This would require a certification system that goes beyond simply ensuring that biofuels have been made from raw materials whose cultivation meets minimum environmental standards, to a wider system that indicates the greenhouse gas and security of supply impacts of each type of biofuel including social impacts, e.g. a meta standard (a meta-standard is a basic but ample standard system built upon existing available assurance schemes that works through a cross-compliance involving the development of "Supplementary Checks" to address any gaps in existing schemes - ECCM, 2006).

The Summary of Responses provided in the Review of EU Biofuels Directive- Public Consultation Exercise (Londo et al, 2006), reported that certification of the full biofuels value chain would be better than on feedstock production only. Nevertheless, the costs and administrative burdens associated with full-chain certification could make it far too difficult to develop an agreed methodology and implementation. There are some initiatives currently ongoing in the UK through the Renewable Transport Fuel Obligation (RTFO), the Netherlands and Germany working on a certification system to ensure sustainable production and use of biofuels. Other applicable environmental standards have already been reviewed by the ECCM (ECCM, 2006), Junginger (2006) and Lewandowski & Faaij (2006).

From the available standards, particular attention should be paid to the indicators related to water, soil fertility and crop management, which are very similar in most agricultural assurance schemes. In the case of the forest schemes, the indicators for forest production, environmental indicators and conservation are also similar. For both previous schemes, carbon conservation is essential if the commitment to reduce greenhouse gas emissions and tackle climate change is to be taken seriously. The implementation of social indicators is also essential as demonstrated by the efforts of the Roundtable for Sustainable Palm Oil Production (RSPO, 2005). New initiatives for other crops are also working on developing indicators and standards such as the Roundtable on Responsible Soy (RTSR) and the new Roundtable on Sustainable Biofuels (RTSB).

Il y a d'autres raisons pour lesquelles on devrait importer (conformément au rapport de l'IEA, 2004), avant tout pour des raisons d'ordre économique, et qui incluent principalement le rendement à la récolte, le prix de la terre, du travail et des matières d'approvisionnement de base (feedstocks), car ces raisons affectent les coûts de production des biocarburants aux États-Unis et en UE : pour résoudre ces problèmes, il serait opportun d'augmenter les importations en faisant produire les matières premières par des pays pouvant probablement exporter, comme par exemple le Brésil. Pour atteindre leurs objectifs, les pays développés devraient à la fois prendre en compte la possibilité d'importer les biocarburants et de promouvoir la recherche sur la production de biocarburants obtenus à partir de la cellulose.

L'importation des biocarburants des pays en voie de développement permettrait ainsi non seulement aux nations développées de diversifier leur mélange d'énergie et de satisfaire les conditions environnementales, mais encore de créer de nouvelles possibilités économiques pour les zones rurales et agricoles, permettant aux pays qui ont de faibles revenus de devenir producteurs et exportateurs d'un produit de valeur.

Pour pouvoir considérer les biocarburants compatibles du point de vue environnemental, il est nécessaire de prouver qu'ils ont été produits conformément au principe d'environnement durable et qu'ils contribuent positivement à la réduction du changement du climat (COM, 2006). Ceci exigerait un système d'homologation qui dépasse le simple fait que les biocarburants ont été obtenus à partir de matières premières produites selon des normes qui garantissent une attention environnementale minimum, mais devrait consister en un système plus ample qui indique les gaz serre produits et la sécurité des impacts de l'approvisionnement pour chaque type de biocarburants, par exemple un méta-standard (un méta-standard est un système de normes standard de base bien qu'élargi construit sur des schémas existants d'assurance disponibles qui travaille par le biais d'une conformité croisée impliquant le développement de " Contrôles supplémentaires " pour prendre en compte tout écart dans les schémas existant - ECCM, 2006).

Le résumé des réponses fournies dans la revue de la EU, Biofuels Directive-Public Consultation Exercise (Londo et al, 2006) signale que la certification de la valeur de la chaîne complète de production des biocarburants serait meilleure que celle basée uniquement sur la matière de base (feedstock). Néanmoins, les coûts et les fardeaux administratifs liés à la certification de la chaîne pourraient rendre le développement d'une méthodologie non seulement partagée mais encore mise en œuvre bien trop difficile. Il existe actuellement plusieurs initiatives en cours, notamment au Royaume-Uni par le biais du Renewable Transport Fuel Obligation (RTFO), en Hollande et en Allemagne

The World Trade Organisation (WTO) does not currently have a specific position on biofuels, however, a recent report by the International Policy Council in collaboration with the Renewable Energy and International Law (2006) investigated how WTO rules could potentially be applied to biofuels. The authors speculate how the WTO might view biofuels standards using three different scenarios:

- ◆ addressing the environmental impact of biofuels in the country of import;
- ◆ looking to the net effects of a particular fuel on carbon emissions throughout its entire life-cycle;
- ◆ going beyond carbon emissions to promote sustainable agriculture in the country producing the feedstock for the biofuel.

These three scenarios, and the possible WTO interpretations of each, highlight the need to draft and enforce standards that are equally applied to domestic and imported goods. Ideally, regulations for imported feedstocks or biofuels should be as rigorous as those for production in the EU. Strict enforcement for imported biofuels may not be politically feasible. Nonetheless, acceptable protocols are required given the scrutiny that will be given to the environmental sustainability of imported biofuels.

Development of an international biofuels market might be viewed as a multi-fold task to provide energy security, reduce GHG emissions, protect the environment, and generate economic growth in rural areas and developing nations. A comprehensive standard or certificate system is considered necessary to ensure a sustainable production while promoting trade and not imposing barriers. If biofuels are defined properly within in the scope of international trade law, and standards are developed incrementally, and revised and refined as the state of knowledge advances, a global biofuels market has the potential to succeed in all above areas.

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2 Currently under review



qui travaillent sur un système d'homologation pour assurer la production et l'utilisation durable des biocarburants. D'autres normes environnementales applicables ont été déjà passées en revue par le ECCM (ECCM, 2006), Junginger (2006) et Lewandoski & Faaij (2006).

A partir de normes disponibles que l'on retrouve très semblables dans la plupart des divers plans/schémas d'assurance, une attention particulière devrait être prêté aux indicateurs liés à l'eau, à la fertilité du sol et à la gestion de la récolte. Pour la forêt, les indicateurs de la production, environnementaux et conservatifs sont également semblables. Pour les deux schémas précédents la conservation du carbone est essentielle notamment si les engagements sont ceux de réduire les émissions des gaz serre et essayer sérieusement de maîtriser les changements du climat. L'implémentation des indicateurs sociaux est également essentielle, comme ceci a été démontré par les efforts de différentes tables rondes. Celle portant sur la production durable de l'huile de palme (RSPO, 2005) ; celles portant de l'avant de nouvelles initiatives pour d'autres cultures comme sur le soja responsable (RTSR) et sur les biocarburants durables (RTSB) qui sont en train de travailler pour développer des indicateurs et des normes.

L'organisation du commerce mondial (WTO) n'as pas pris une position précise sur les biocarburants, cependant, un rapport récent de l'International Policy Council en collaboration avec le Renewable Energy et l'International Law (2006) à étudié comment les règles du WTO pourraient être potentiellement appliquées aux biocarburants. Les auteurs se penchent sur le comment la WTO pourrait formuler des normes en envisageant trois scénarios différents:

- ◆ *envisageant les impacts environnementaux des biocarburants dans le pays importateur;*
- ◆ *envisageant les effets nets d'un carburant spécifique sur ses émissions en carbone pendant la durée entière de son cycle de vie;*
- ◆ *en surmontant les émissions de carbone pour favoriser l'agriculture durable dans les pays qui produisent la matière de base pour la production des biocarburants.*

Ces trois scénarios et l'interprétation possible de la WTO de chacun d'eux, accentuent la nécessité de rédiger et d'imposer des normes qui sont également appliquées aux marchandises de l'Union européenne et celles importées. Idéalement, les normes qui règlent les biocarburants et la matière de base importées devraient être aussi rigoureuses que celles pour la production en EU. De telles applications aussi strictes pour les biocarburants importés pourraient ne pas être politiquement faisables.



Néanmoins, des protocoles acceptables sont nécessaires vu le contrôle auquel sera soumis la durabilité environnementale des biocarburants importés.

Le développement d'un marché international des biocarburants pourrait être envisagé comme une mission multi objectifs pour assurer la sécurité énergétique, la réduction des émissions de gaz serre, la protection de l'environnement et pour générer la croissance économique des zones rurales et des pays en voie de développement. Des normes d'ensemble ou système de certification est considéré comme nécessaire pour assurer une production durable tout en favorisant le commerce sans imposer des barrières. Si les biocarburants sont définis de façon adéquate dans le cadre de la portée de la loi du commerce international, et si les normes sont développées de façon conséquente, mises à jour et améliorées au fur et à mesure de l'état d'avancement des connaissances, un marché global des biocarburants aura la possibilité de réussir dans tous les secteurs susdits.

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2 Actuellement à l'étude

References - Bibliographie

COM (2006): Report from the Commission to the Council on the review of the energy crops scheme. - COM (2006) 500 final 2006/0172(CNS). Brussels, 22.9.2006. Brussels.

DG Agri 2007. The role of the European Commission in the development of sustainable biofuels. Waterfront Conference. Developing Biofuels Sustainably: Can it be done? 17 April 2007. London.

EC Directive 2003/30/EC of the European Parliament and of the Council on the promotion of the use of biofuels or other renewable fuels for transport (2003) L 123/42. Official Journal of the European Union, Brussels.

ECCM (2006): Environmental Standards for Biofuels. - Report commissioned by the LowCVP. <http://www.lowcvp.org.uk/assets/reports/Final%20LCVP%20Environmental%20Standards%20Report.doc>.

ECOFYS (2007) Sustainability reporting within the RTFO. -Presentation. Commissioned by the UK Department of Transport

EEB (2005) EEB position on biomass and biofuels: the need for well defined sustainability criteria [Online]. Available from: <http://www.eeb.org/activities/agriculture/EEB-position-on-bioenergy-191205.pdf> [Accessed 28th October 2006].

EUROPEAN COMMISSION. (2006) Review of EU Biofuels Directive: Public Consultation Exercise, April-July 2006. Energy and Transport Directorate-General, European Commission. Brussels.

IEA. (2004) Biofuels for Transport. International Energy Agency (IEA). Paris.

INTERNATIONAL POLICY COUNCIL AND RENEWABLE ENERGY AND INTERNATIONAL LAW. (2006) WTO Disciplines and Biofuels: Opportunities and Constraints in the Creation of a Global Market Place. International Policy Council (IPC). Washington, D.C.

JUNGINGER, M. 2006. Overview of Biomass - related sustainability certification efforts and policy in IEA Bioenergy. Task 40 member countries. Projectgroep duurzame import biomass.

LEWANDOWSKI, I and FAAIJ, A. (2006): Steps towards the development of a certification system for sustainable bio-energy trade. - Biomass and Bioenergy 30 (2006) 83-104

RSPO. 2005. RSPO Principles and Criteria for Sustainable Palm Oil Production. Round Table on Sustainable Palm Oil. Public Release Version 17 October 2005. p. 6.

WWF. (2006) Agriculture. WWF asks for mandatory eco-certification for biofuels. [Online] Available from: http://oanda.org/about_wwf/what-we-do/policy/agriculture_environment/index. [Accessed 15th October 2006].

Partners of the Project



Partner No.1 (Co-ordinator): WIP - Renewable Energies (WIP), Germany

WIP has been active in the fields of land recovery and fight against desertification providing a range of technical expert and non-technical services to both industrial and public sector clients. WIP offers project development, project management, technical supervision and realisation of both large- and small-scale projects, which involve the co-ordination of international consortia. WIP complements its mainstream international technical projects through its conference organisation services in the clean energy and environment sectors.

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Partner No.2: Imperial College of Science, Technology and Medicine (Imperial), United Kingdom

The BioEnergy Group is an integral part of the Centre for Environmental Policy, within Imperial College's Faculty of Life Sciences. Its research focus is on techno-economic, environmental and policy issues related to biomass energy systems applied to the heat, electricity and transport sectors. The group is composed of an inter-disciplinary team of experienced researchers.

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Universiteit Utrecht

Partner No.3: Utrecht University, Department of Science, Technology and Society, Copernicus Institute (RUUTR.STS), The Netherlands

The COPERNICUS Institute for Sustainable Development and Innovation covers the fields of energy research, environmental science, policy studies and innovation management; in addition, it holds some 90 research staff.

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Partner No.4: Stockholm Environment Institute (SEI), Sweden

The Stockholm Environment Institute (SEI) is an independent and non-profit international research institute specialising in sustainable development and environment issues. SEI's mission is to support decision-making and induce change towards sustainable development around the world by providing integrative knowledge that bridges science and policy in the field of environment and development.

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Partner No.5: Austrian Biofuels Institute (ABI), Austria

The ABI is a registered association and works as a private competence centre for liquid biofuels. It is officially appointed by the A.E.A. (Austrian Energy Agency) as the animator and co-ordinator for all Austrian projects related to liquid biofuels within the ALTENER-programme. The ABI is an internationally recognised Biodiesel-competence centre with an experienced Biodiesel and Bioethanol team of 52 experts.

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Partner No.6: Höhere Bundeslehr und Forschungsanstalt für Landwirtschaft, Landtechnik und Lebensmitteltechnologie Francisco Josephinum (FJ BLT), Austria

The BLT has been founded in 1947 and is a public institution belonging to the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management. The BLT is occupied with research and development of biomass energy projects as well as in the whole field of renewable raw materials and industrial crops and products.

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Partner No.7: ETA-Renewable Energies (ETA), Italy

Based in Florence, Italy, ETA - Renewable Energies promotes the utilisation of biomass for energy purposes, carrying out feasibility studies, technical analysis and economic optimisation of the bioenergy chain. ETA promotes industrial cooperation in the bioenergy field and the identification of financial resources through a vast network of international "expertise" of which is part.

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Partner No.8: European Biomass Industry Association (EUBIA)

EUBIA, the European Biomass Industry Association is an international non profit association in Brussels. It groups together market forces, technology providers, and knowledge centres, all of them active in the field of biomass to support the European biomass industries at all levels (promoting the use of biomass as an energy source, developing innovative bioenergy concepts and fostering international co-operation within the bioenergy field.).

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Partner No.9: Practical Action, United Kingdom

Practical Action is a charity registered in the United Kingdom, which works directly in four regions of the developing world, works with poor communities so as to develop appropriate technologies in food production, agro-processing, energy, transport, small enterprise development, shelter, small-scale mining and disaster mitigation.

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Partner No.10: Consiglio Nazionale Ricerche (CNR), Italy

The Institute for Studies of Ecosystems (ISE) was recently established by the merger of some smaller institutes under the general reorganisation plan of CNR. The soil team was originally the Institute for Soil Genesis and Ecology (IGES) and consists of scientists and technicians being experts on soil physics, ecology, bio-geo-chemistry, and microbiology.

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Partner No.11: E+Co. Inc. (E+Co), USA

E+Co is a ten-year old public purpose investment company with offices in Africa, Asia, Europe, Latin America and the United States. Its sole focus is to empower local small and medium sized enterprises that supply modern energy to households, businesses and communities in developing countries. It pioneered and is the leading practitioner of the enterprise-centered model of investing in the small scale, clean energy sector.

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Partner No.13: Institute for Sustainable Solutions and Innovation (ISUSI), Germany

ISUSI is specialized in providing expertise in the fields of sustainable solutions, innovations and technologies. The spectrum of activities ranges from research for possible solutions related to specific problems to eco-evaluation of new technologies, as well as the project management of sustainable innovations' research and development. Their work focuses on renewable energy technologies, solar buildings and ecologically sustainable energy systems.

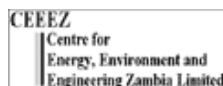
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Partner No.14: AGAMA Energy (Pty) Ltd (AGAMA), South Africa

The AGAMA Group, comprising AGAMA Energy and AGAMA BioEnergy, and with interests in Biofuels Africa and GreenX Energy - provides green energy solutions for Africa, s for strategic focus areas include policy support and capacity building within the region, sustainable energy services consultancy, bioenergy project implementation and modelling, and technical support to national and local authority renewable energy initiatives.

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Partner No.16: Centre for Energy, Environment and Engineering Zambia Limited (CEEEZ), Zambia

The Centre for Energy, Environment and Engineering Zambia Limited (CEEEZ) is a non-governmental organisation, which is independent and non-profit making in its activities. The specific role of CEEEZ is to investigate, analyse and make useful conclusions and policy recommendations on energy, environment and engineering concerns.

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Partner No.17: Environnement et Developpement du Tiers-Monde (ENDA-TM), Senegal

Environment and Development Action in the Third World (ENDA-TM) is an international non-profit organisation based in Dakar, Senegal. Founded in 1972, ENDA is an association of autonomous entities co-ordinated by an Executive Secretariat. Enda collaborates with grassroots groups in search of alternative development models, on the basis of the experience, expectations and objectives of marginalised peoples.

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FANRPAN

Food, Agriculture and Natural Resources Policy Analysis Network

Partner No.19: Food, Agriculture and Natural Resources Policy Analysis Network of Southern Africa (FANRPAN)

The Food, Agriculture and Natural Resources Policy Analysis Network (FANRPAN) was established to enhance the capacity for policy formulation and analysis in the Southern African region.

The policy network is to build on a long term investment and commitment already made in universities, national agricultural research institutes and policy analysis units in Southern Africa. By addressing comprehensive policies and strategies concerning the desperate state of food, agriculture and natural resources in the region, the network's main objective is to resuscitate agriculture.

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Partner No.20: FELISA Company Limited (FELISA), Tanzania

FELISA (Farming for Energy for Better Livelihoods in Southern Africa) is a company newly established in Tanzania aiming at producing and promoting biofuels and more particularly biodiesel in Southern Africa.

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Partner No.21: Mali-Folkecenter (MFC), Mali

Mali-Folkecenter (MFC) is a Malian NGO which represents the Danish Folkecenter for Renewable Energy. Mali-Folkecenter's permanent staff consists of Malians and expatriates including: engineers, socio-economists, socio-environmentalists, a sociologist and technicians. This core team is complemented by contractual staff when additional expertise is necessary.

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Partner No.22: MOI University (MU), Kenya

The Department of Forestry & Wood Science in the School of Natural Resources Management, MOI University, has a wide interdisciplinary and multidisciplinary research and work experience, borrowing from the natural and social sciences, and engineering in aspects of livelihood, socio-economics and ecosystem sustainability along the "resources production-consumption chain" of Arid and Semi-arid Ecosystems.

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TaTEDO is a non-governmental organisation based in Dar es Salaam, Tanzania, with more than 13 years of active involvement in sustainable energy development projects and programmes in rural areas. Its goals are to improve the Tanzanians quality of life by improving sustainable energy services, employment and income, which will generate opportunities and are essential for poverty reduction

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Partner No.25: UEMOA - Biomass Energy Regional Program (PRBE), Burkina Faso

The Biomass Energy Regional Program (PRBE), financed by the DGIS (The Netherlands), has the main mission to develop, in a sustainable approach, Biomass energy in the community area of UEMOA as well as to promote alternative energies while preserving the environment and fighting against poverty.

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Partner No.26: University of KwaZulu-Natal (UKZN), South Africa

The University of KwaZulu-Natal aims to be a truly South African university that reflects the society in which it is situated - not only in terms of race, gender and class - but in terms of how it structures its values and priorities and how it responds to social needs. As an institution of higher learning, it is committed to academic excellence, innovation in research and critical engagement with society. With its vision to be the Premier University

of African Scholarship, the University of KwaZulu-Natal draws inspiration from an African identity and takes seriously its responsibilities to the development of the African continent.

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Partner No.27: University of Cape Town - Energy Research Centre (UCT, ERC), South Africa

ERC (University of Cape Town - Energy Research Centre) is an African-based multi-disciplinary energy research centre, which pursues excellence in technology, policy and sustainable development research, education and capacity building programmes at a local and international level. The research focus areas of the Centre are poverty and development; energy efficiency; modelling; environment and climate change; energy technologies and resources; economics.

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Partner No.28: China Academy of Agricultural Science (CAAS), P.R. China

The Institute of Environment and Sustainable Development in Agriculture (IEDA), the Chinese Academy of Agricultural Sciences (CAAS), established in 1953 (the former Agro-Meteorology Institute), is a national-level agricultural research institution in China with 148 staff members engaged in Agricultural Environment, Natural Resource Management and Sustainable development. It has a firm background on the researches of Climate Change, Agro-Environmental Engineering and Environment Protection, Rural Energy and agroforestry, Dry-land Farming and Water-saving Agriculture, Agricultural Disaster Mitigation close related to the CA action.

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Partner No.29: Centro Nacional de Referencia em Biomassa (CENBIO), Brazil

Founded in 1996, CENBIO is the Brazilian Reference Center on Biomass, with the main mission of implementing the energy generation from biomass through efficient processes. Located at the University of São Paulo/Institute of Electrotechnology and Energy, Brazil; CENBIO works on joint research and development of technological, economic, social, environmental and political studies related to biomass conversion and use, together with National and International groups, in the scientific, technological, industrial and agricultural sectors.

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Partner No.30: Indian Institute of Science (IISC), India

The Centre for Sustainable Technologies (CST) is an interdisciplinary research and development centre within the Indian Institute of Science - Bangalore/India -, promoting sustainable technologies, particularly focused on advancing sustained rural development. Technologies developed at CST are; environmentally sustainable, lower in cost, resource use efficient, and based preferably on local resources.

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Partner No.31: The Energy and Resources Institute (TERI), India

The Energy and Resources Institute (TERI) is an autonomous, not-for-profit research institute, established in 1974. While in the initial period the focus was mainly on documentation and information dissemination activities, research activities in the fields of energy, environment, and sustainable development were initiated towards the end of 1982.

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UNAM is the largest and most important public University in Mexico. It accounts for 50% of total scientific research conducted in the country. Specifically, researchers at the Institute of Ecology and Engineering have been working for more than two decades on the dynamics of biofuel use in the rural sector and its environmental implications.

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Partner No.33: Universidade Estadual de Campinas (UNICAMP), Brazil

The State University of Campinas was established in 1966 as a public university funded by the State of São Paulo. Today, UNICAMP can be considered a fully consolidated university. The University receives undergraduate and graduate students from all over Brazil and also from abroad. The University concentrates 15% of the total scientific production in Brazil and approximately 10% of the graduate courses.

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Partner No.34: Winrock International India (WII), India

Winrock International India (WII) is a not-for-profit, non-governmental organisation with Headquarters in New Delhi. WII's mission is to "develop and implement solutions that balance the need for food, income and environmental quality". WII's thrust areas of work include natural resource management, energy and environment and climate change.

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Partner No.35: Interuniversity Research Centre for Sustainable Development - University of Rome "La Sapienza" (CIRPS), Italy

CIRPS is a Consortium of nine Italian Universities. The University "La Sapienza" of Rome is the leading partner of the Consortium. The mission of CIRPS is the promotion and implementation of activities related to sustainable economic and social development in co-operation with Italian, foreign institutions and international organisations.

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The Department of Sociology and Human Geography (ISS) within the university's Faculty of Social Sciences hosts a group of human geographers who focus on global environmental change and development, with particular focus on climate change. Research is carried out on the vulnerability of human populations in developing countries in the face of climatic changes and how economic globalisation and government policies affect the patterns of vulnerability and the way in which local natural resource are managed to secure livelihoods.

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University of
BRISTOL

Partner No.37: University of Bristol (UNIVBRIS), United Kingdom

The University of Bristol is a major research university and one of the most prestigious in the UK. It is a dynamic international community dedicated to learning, research and enterprise. The Department of Earth Sciences at Bristol is one of the most prominent Earth Science institutions in the UK, having been graded 5* (the highest possible grade) in all of the UK Research interests range broadly across the Earth sciences from deep Earth processes, volcanology and palaeobiology to icecore physics, isotope geochemistry and Earth system modelling.

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Partner No.38: University of Botswana (UB), Botswana

The Harry Oppenheimer Okavango Research Centre is a new University of Botswana Research institute based in Maun, Ngamiland. The research goal of the Centre is to enhance the understanding of the natural, socio-cultural, political and economic systems of the Okavango River Basin in order to achieve an effective long term planning and management. It does so through research, outreach and research teaching. The centre's main research areas of emphasis are hydrology and water management, ecosystems management, social systems, and tourism and protected areas.

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University of Fort Hare
Together in Excellence

Partner No.39: University of Fort Hare (UFH), South Africa

The Department of Agricultural Economics and Extension is part of the School of Agriculture and Agribusiness. The University is situated in a rural setting and this environment has an influence on the research carried out by the Department. The main interests of the students are also in the field of agricultural development.

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Partner No.40: TWIN, United Kingdom

Established in 1985, Twin is the leading alternative trading company in the UK. Whilst the focus of Twin's operations has evolved over the last 20 years, its principles and approach have remained consistent. Twin's expertise and innovative approach is internationally renowned and acknowledged.

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Internet: <http://www.twin.org.uk>



Partner No.41: Joint Graduate School of Energy and Environment (JGSEE), Thailand

The School operates as a consortium to conduct collaborative research focusing on alternative fuels, renewable energy and energy management, and environmental topics related to energy. The mission of JGSEE is to conduct high quality research through graduate education and provide technical services, with a view to meeting societal needs for the development and deployment of

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Partner No.42: African Development Bank Group (AFDB)

The African Development Bank is the premier financial development institution of Africa, dedicated to combating poverty and improving the lives of people of the continent and engaged in the task of mobilizing resources towards the economic and social progress of its Regional Member Countries. The Bank's mission is to promote economic and social development through loans, equity investments, and technical assistance.

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Partner No.43: Energy for Sustainable Development Ltd. (ESD), United Kingdom

Energy for Sustainable Development Ltd (ESD) is the premier consultant in carbon management. As a UK-based consultancy, ESD is specialised in energy assessment and energy policy, planning, modelling, product development and commercialisation. ESD has developed particular expertise in sustainable energy and forestry at national, regional and local levels.

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Internet: <http://www.esd.co.uk>



Partner No.44: Eco Ltd, United Kingdom

Established in March 2000, Eco is a private consultant firm based in London. Specialized in sustainable energy project financing and project, market, and business development; it aims to empower local communities and organizations.

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Internet: <http://www.ecoharmony.com>



Partner No.45: Chinese Association for Rural Energy Industry (CAREI), P.R. China

The Chinese Association of Rural Energy Industry, CAREI, is a non-governmental organisation of different regions, departments and disciplines for the whole rural energy industry in China. It is a social corporation voluntarily organised by enterprises and institutions of the rural energy industry, after examination and approval by the Ministry of Civil Affairs for registration.

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Internet: <http://www.carei.org.cn>



Partner No.46: Food and Agriculture Organisation of the United Nations (FAO)

The Food and Agriculture Organization of the United Nations (FAO) leads international efforts to defeat hunger. Serving both developed and developing countries, FAO acts as a neutral forum where all nations meet as equals to negotiate agreements and debate policy. The structure is also a source of knowledge and information. They help developing countries and countries in transition modernize and improve agriculture, forestry and fisheries practices and ensure good nutrition for all.

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Partner No.47: Conservation International Foundation (CI), USA

The Conservation International Foundation is a global partnership of research institutions, corporations and environmental groups; with a mission to research, develop and promote voluntary standards for multiple-benefit land-use projects.

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Email: tjanson@conservation.org
Internet: <http://www.conservation.org>



Partner No.48: Foederation Evangelischer Kirchen in Mitteldeutschland (EKMD), Germany

The Federation of Evangelical Churches in Middle Germany (EKMD) has direct links to various congregations in Tanzania and works, as a member church of the Evangelical Church in Germany (EKD), in close co-operation with Mission Societies, Bread for the World and the Evangelical Development Services (EED). The EKMD is further involved in various activities concerning environment protection and combating poverty.

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