Biomass, Rural Energy and the Environment

Global multi-stakeholder networks linking knowledge and policy in support of sustainable development

POSITION PAPER

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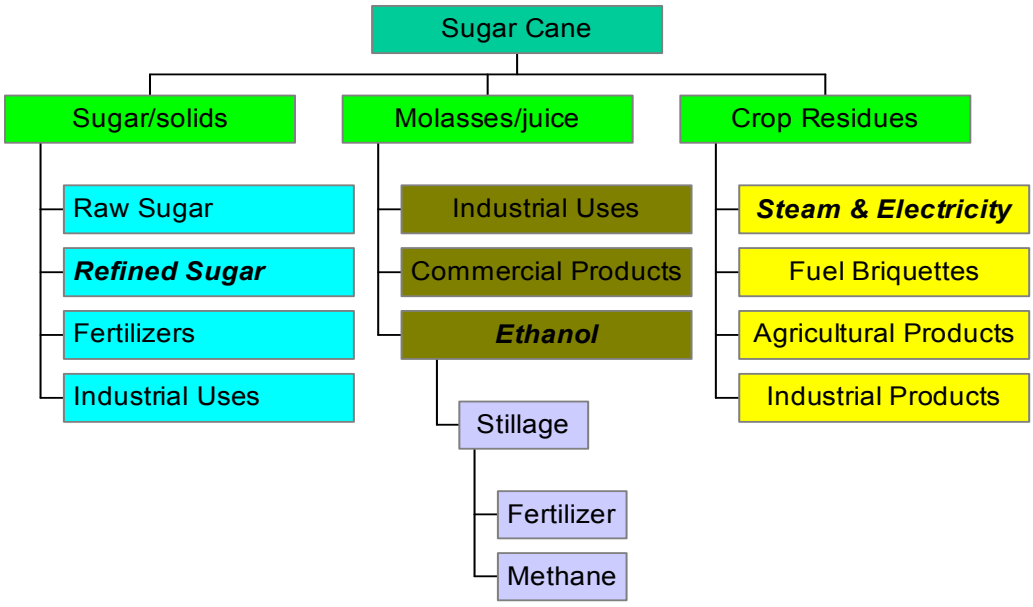
CARENSA – Cane Resources Network for Southern Africa

THE CANE RESOURCE

The sugarcane plant is one of the world's most cost-effective and diversified renewable resources, offering many alternatives for production of food, feed, fibre, and energy. Owing to climatic factors, sugarcane is found predominantly in the developing world and as such represents a valuable tool in the simultaneous search for sustainable energy sources and new development alternatives.

Sugarcane resources support a variety of uses and products in the energy, industrial, and agricultural sectors, based on different resource streams: sugars, molasses/juice, and crop residues (see figure below). Co-generated electricity and ethanol are the most important cane co-products in commercial terms, but there are many others as well.



The sugar industry has faced increasing competitive pressures in recent years, due to such factors as saturated demand in industrialised countries, competition from other sweeteners, and low and/or fluctuating sugar prices. These difficulties have increased economic incentives for sugar producers to diversify their product portfolio by investing in renewable energy applications. Diversification of sugar companies into renewable energy has been slowed by institutional barriers and by continued price supports for sugar production around the world. New markets can emerge through public-private cooperation in modernising the cane resource base.

SOUTHERN AFRICA

The current cane resource base in southern Africa countries is over 50 million tonnes of cane per year. The installation of modern cogeneration systems could translate this cane resource into over 600 GWh of electricity. If this cane were used as a direct feedstock for ethanol production, it could result in 4 billion litres of ethanol. Furthermore, a variety of other products could be developed, with production levels tailored to the different markets that emerge. Although not large by world standards, these amounts are large by African standards, and they represent a significant expansion of the domestic resource base. With additional efficiency measures at sugar factories, ethanol distilleries, and other sectors or components, the contribution could be much higher.

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PROJECT OBJECTIVES

The Cane Resources Network for Southern Africa (CARENSA) will critically assess the role of bio-energy from sugarcane in promoting sustainable development and improving global competitiveness in the region of southern Africa. The main objective of CARENSA is a comprehensive synthesis and comparative evaluation of the utilisation of cane resources in the region, including organisational and institutional dimensions as well as technical features and socio-economic and environmental impacts. Specific objectives of the network include:

- Compare current and potential levels of cane resource utilisation in southern Africa
- Develop benchmarks for system inputs, production levels and overall performance
- Promote multi-purpose production strategies to enhance regional competitiveness
- Capacity-building and technology transfer for the SADC region
- Promote south-south co-operation with key producing countries outside the region
- Characterise policy and regulatory environment and identify incentive schemes
- Compare socio-economic and environmental impacts for co-product scenarios
- Identify implementation strategies and sources of support, particularly via CDM
- Evaluate alternative co-product strategies with financial and sustainability criteria
- Provide a regional and global forum for discussion and information exchange

WORK PLAN

The network brings together five institutional or thematic phases that are critical to the goal of harnessing cane resources for sustainable development in southern Africa, and the project components have been designed around these five phases (see the figure below).

(1) ***Agriculture:*** agronomic and harvesting practices for cane and optimising of the biomass resource.
(2) ***Industry:*** the sugar and fibre resource streams and the agro-industrial processes and technologies that separate and exploit these resource streams.
(3) ***Markets:*** articulation of product demand and formation of markets through sound policies, regulations, and economic incentives that promote efficient implementation and market strategies.
(4) ***Impacts:*** socio-economic and environmental impacts across different strategies so as to insure that local and regional benefits are properly incorporated into decision-making frameworks.
(5) ***Integration:*** including sustainable development, risk, competitiveness, international comparisons and industry perspectives, associated with the diverse elements and linkages of the network.

The main forms of interaction, communication, and information dissemination in the network include:

- ***Project Meetings***
- ***Scientific Exchanges and Study Visits***
- ***Workshops***
- ***Continuously updated website***
- ***Electronic newsletter***
- ***Participation in International Conferences***

The thematic network was launched in Fall 2001 and will continue until 2005. Publications resulting from the project are expected to include five thematic reports, three workshop proceedings, conference papers, journal articles, and a book.

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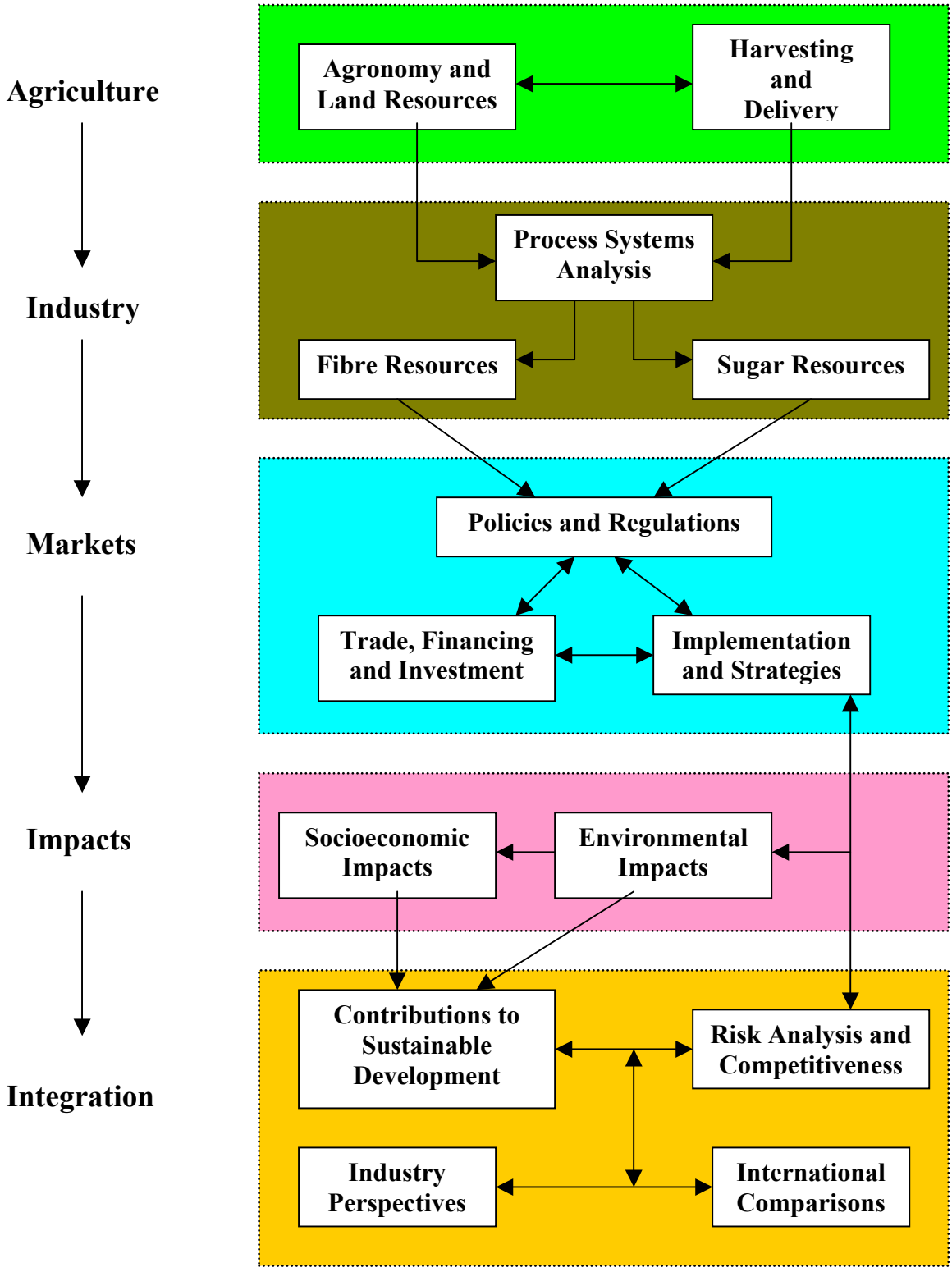
CANE RESOURCES: FROM FIELD TO MARKET AND BEYOND



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FUNDING AND IMPLEMENTATION

The European Commission's Directorate General for Research supports the thematic network in the amount of 500.000 EURO. The Stockholm Environment Institute (SEI) serves as Scientific and Administrative Coordinator for the Network. The project team was designed to place the key issues in their proper regional and global context, while also promoting north-south and south-south cooperation on cane resource development. There are four European organisations, four African organisations, three international or regional organisations, and two organisations based outside of Africa in the world's two largest cane-producing countries (Brazil and India), as listed below:

1) SEI, Stockholm Environment Institute
2) KCL, King's College, Life Sciences Division, London, UK
3) UM, University of Mauritius, Chemical and Sugar Eng. Dept.
4) UND, University of Natal, Durban, South Africa
5) AUA, Agricultural University of Athens, Greece
6) CIRPS, Interuniversity Research Centre on Sustainable Development, Italy
7) BUN, Biomass Users Network, Zimbabwe
8) CEEEZ, Centre for Energy, Environment, and Engineering, Zambia
9) ISO, International Sugar Organisation
10) FAO, Food and Agricultural Organisation (FAO), United Nations
11) WII, Winrock International India
12) CENBIO, National Reference Centre for Biomass, Brazil
13) SADC, Southern African Development Community

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SPARKNET: THE KNOWLEDGE NETWORK ON ENERGY FOR LOW-INCOME HOUSEHOLDS IN SOUTHERN AND EAST AFRICA: SOME KEY ISSUES

Smail Khennas*: Sparknet co-ordinator

The world economy is still characterised by an unequal production, distribution and consumption of wealth between the North and the South. In developing countries, poor people do not even have access to basic services such as clean water, shelter, improved fuels for cooking and space heating. Poor people are also experiencing severe food supply shortages and poor health cover. This economic marginalisation is exacerbated by a lack of political power which contributes to the vicious circle of poverty.

The challenge is how poor people, in a context of acute poverty, can gain access to better energy services and improve their livelihoods.

Basic energy services

The sustainable supply of improved and affordable energy services for meeting **household energy** basic needs is the first priority of poor people. It is also of vital importance in the reduction of poverty. Poor people spend up to a third of their income on energy, mostly for cooking.

Almost half the world's population still rely on biomass fuel – i.e. wood, charcoal, animal dung or crop wastes – and coal, for their everyday household energy needs. Although accurate data is scarce, estimates suggest that wood provides around 15% of the energy needs in developing countries, and as much as 75% in tropical Africa. In more than 30 countries, wood provides more than 70% of the energy needs, and in 13 countries it is over 90% (World Energy Council 1999). Over the last 25 years, the trend in global biofuel use has changed little, and in some parts of the world where poverty and the prices of alternative fuels such as kerosene and bottled gas have increased, the use of biomass has increased (WHO 1997).

With development, there is generally a transition up the so-called 'energy-ladder' (see figure) to fuels which are progressively more efficient, cleaner, convenient and expensive. It is important to emphasize that households typically use a combination of fuels – for example, wood for cooking and heating, kerosene for lighting, and perhaps charcoal for making hot drinks. Thus, there is not a simple linear progression up this ladder, but it is nevertheless the case that households will tend to carry out more tasks with more modern fuels as their socio-economic circumstances improve. However, the problem remains that almost half of the world's population relies predominantly on fuels at the lower end of this energy ladder, and, for many, the prospect of moving up the ladder in the short term appears limited.

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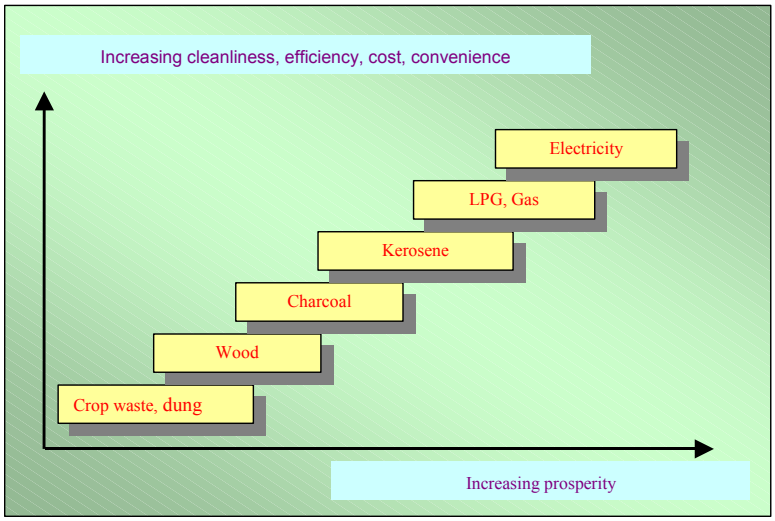

Figure : The 'Energy Ladder'

Social, economic and environmental recognition of the biomass dimension

It seems that on the micro economic level where women and young girls collect firewood, usually "free" of charge, the tremendous amount of effort and time is not adequately recognized. But also where firewood and charcoal are purchased – mainly through the informal sector – prices do not reflect production costs but merely the costs for harvesting and transport. However, in urban households costs for buying fuel wood represent a significant share of their low income. Recent studies in Africa assessed that for many households the required energy supply is almost as expensive as the basic food supply (Habermehl, 1994).

Also the macro economic costs of fuel wood scarcity are not fully recognised: e.g. the fact that women´s work force is not available for productive activities (agriculture, small scale business) and reproductive activities (education, child care, family nutrition), if they spend so much time on fuel wood collection. Data of environmental costs for over utilisation of forest resources are mostly not well known and hardly considered.

Poverty and indoor air pollution

Poverty remains a very important, probably the most important, determinant of health, underlying all other issues discussed so far – and this is clearly demonstrated by the close inter-relationship between household energy, poverty and health. Reliance on simple biomass fuels holds back development because it impairs health and restricts opportunities for education and income generation.

In these poor rural and urban homes, biomass fuels and coal are typically burnt in open fires or poorly functioning stoves, often indoors, with inadequate ventilation for the smoke. This leads to very high levels of pollution in the homes where especially women and young children are exposed on a daily basis.

Indoor air pollution is the clearest and most direct physical health risk, and there is now fairly consistent evidence that biomass smoke exposure increases the risk of a range of common and serious diseases of both children and adults (Bruce et al, 2000). Chief among these is childhood acute lower respiratory infections (ALRI), particularly pneumonia (Smith et al, 2000). There is also evidence, mainly from China, that exposure to coal smoke in the home markedly increases the risk of lung cancer, particularly for women.

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In recent years, new evidence has emerged which suggests that indoor air pollution (IAP) in developing countries may also increase the risk of other important child and adult health problems, such as low birth weight, perinatal mortality (stillbirths and deaths in the first week of life), asthma, and middle ear infection in children, tuberculosis, nasopharyngeal and laryngeal cancer, and cataract in adults (Bruce et al, 2000).

Household energy and gender

Household energy is usually equated with cooking. In households where there are adult men and women, the gendered division of labour generally allocates to women the responsibility for household energy provision related to their spheres of influence in the household, in particular activities centred around the kitchen. However, men become involved in places where fuel has to be collected from long distances, fuel is purchased or there are social restrictions on women leaving their homes.

Energy use in rural areas differs significantly from that in urban areas. In the former, there is a particularly heavy reliance of households on biomass as an energy carrier for process heat. In addition, there is a lack of access to reliable supplies of modern energy forms at affordable prices. Biomass is obtained at zero direct monetary cost, although there are time and environmental costs. Biomass production is integrated into local land-use management systems which balance ecological sustainability with the provision of a range of goods.

To increase biomass supply therefore requires an integrated approach to providing solutions. Access to the production system is restricted by rules and regulations that govern the local management of common property resources. It is not a system which responds well to the supply driven, market orientated policies of increased fuel production. Control of, and access to, this system have a distinct gender dimension. In any society, women have different access to and control over resources than men which influences their ability to adopt strategies to respond to changes in their circumstances. For example, increased time to collect biomass for household needs could be addressed by planting trees for fuel, however, women do not usually own land and where they have access to land, they may not have control over what is planted.

Household energy and income generation

The informal sector provides employment for many women men and children at household level. This is especially true for women, for whom income generation is particularly important. It is estimated that between 30 and 60 % of all micro enterprises in Latin America and the Caribbean are owned and operated by women. Lessons from various female led enterprises world-wide, show that many are performing relatively well in competitive markets. Much of this employment is at household level such as food for sale, fuel supply provision, ceramic stove production and installation etc.

Women-headed enterprises are frequently located in the home. These “cottage industries” tend to be concentrated in a relatively narrow range of activities, with disproportionately low rates of return compared to what men earn: beer brewing, knitting, dress making, crocheting, palm oil processing, soap making, hairdressing, metal working, pottery making, basket weaving, cane work, spinning and textile production and retail trading. Cottage industries play an important role by providing a significant range of products and services for the local market. Despite the low financial returns, women’s enterprises provide important sources of household income, even in male-headed households. One of the advantages for women working from home is that it allows them the opportunity for combining business activities with other domestic responsibilities.

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Developing financing mechanisms

The up-front capital is a key constraint which could be to a large extent overcome, if from the outset it is addressed taking into consideration the resources (human, financial, technical, managerial etc.) of the communities. Even though alternative energy options, particularly from renewable, could be more cost effective over the long run, the up-front capital is a key barrier to the entry for poor people. Subsidies cover only part of the costs and cannot be sustainable within a long term strategy. The development of improved energy services will require leverage funds from many sources. Appropriate financing and subsidies can give low income communities, households or entrepreneurs the ability to afford to invest in new energy technologies. Achieving this aim will require a sustained effort by the international community, as well as new local partnerships involving NGOs and private sector.

Conclusion:

- Addressing household energy issues offers opportunities for time and labour saving, income generation, health improvements and social empowerment.
- The lack of improved energy services combined with very low efficiency and over-use of biomass have an adverse impact on bio-diversity, health and on the overall quality of life of poor people.
- There is an increase understanding that poor people's livelihood is likely to depend upon a mix of natural resources, social capital than a single source of income. This thinking implies the understanding of the relationships between the various sectors as well as the impact of policies, institutions and processes.
- A marked change in policy on household energy is required to improve this situation in short to medium term for the majority of rural poor in many countries.

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LAMNET – A Global Network on Bioenergy

LAMNET constitutes a transnational forum for the promotion of the sustainable use of bioenergy.

The activities of LAMNET include the analysis of existing energy policy frameworks, the assessment of energy demand and biomass resources, the analysis of available bioenergy technologies and systems as well as the development and implementation of policy options.

LAMNET focuses on the promotion of small- and medium-scale decentralised bioenergy systems and the large-scale implementation of bioethanol production as well as the generation of heat and electricity based on sugar cane and other biomass resources.

LAMNET consists of 49 institutions and organisations located in 23 countries within Europe, Latin America, Africa and Asia.

The efficient dissemination of the LAMNET activities is realised through the publication of a periodical newsletter and the establishment of a project web site (www.bioenergy-lamnet.org). Additionally, several workshops and seminars are being organised with participation of members of the Thematic Network and interested persons or organisations from Latin America and other European and non-European countries.

➢ Sustainable Energy – A Burning Issue

Energy is fundamental to our well-being. Our lives depend on access to an affordable, sustainable energy supply. Yet most people take energy for granted, at least in developed countries. We only become concerned when there is a power cut or the price of petrol goes up. Driven by industrialisation and economic development, global energy use has grown 20-fold over the past century. The majority of this increase has been in the use of fossil fuels. In contrast, over 2 billion people in the developing world still do not have access to commercial energy or grid-based electricity. Energy is vital to their development but if they follow our example the environmental consequences could be very serious.

The EU has taken some first steps to promoting sustainable energy through setting quantitative policy targets, energy labelling, energy standards, voluntary agreements, research and development and energy taxation, but more are required to break the link between growth and increased energy use.

➢ Global Impact

The EU cannot develop sustainable energy strategies in isolation, given the global impact of increasing energy production. Fossil fuels cannot sustainably meet the needs of the developing world for another century. The World Summit in Johannesburg provides an opportunity for the EU to initiate a partnership with the developing countries to increase the provision of affordable and sustainable energy services, in particular renewables.

Biomass will need to be better utilised than at present and managed in a sustainable matter in order to provide energy for people living in rural communities to have a more healthy and enjoyable quality of life. This will take time, effort, investment and political will to achieve. However, as is clearly stated in the IPCC Third Assessment Report (2001), biomass has a major part to play in determining the future of the planet and its people.

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➢ Characteristics of Biomass and Bioenergy

The extremely varied nature of biomass and the many routes possible for converting the biomass resources to bioenergy make this whole topic a complex subject. For other renewable energy sources, such as wind, solar and hydro, the energy conversion technology employed is the key component. **For biomass it is the whole system that is important**:

- The nature of biomass and its greenhouse gas mitigation potential
- The range of diverse biomass resources, including wastes
- The processing and delivery of these resources to the energy conversion plant
- The thermochemical conversion of dry biomass fuels
- The biochemical conversion of wet biomass fuels

Biomass can be transformed into both **heat and electricity** simultaneously through cogeneration, into **transport fuels** and even into petrochemical substitutes. At the smaller domestic and village community scale, biomass also has good potential as fuel for micro-turbines and fuel cells. A range of **socio-economic benefits (e.g. employment opportunities)** will also result, particularly at the smaller scale. There seems little doubt that biomass will provide an increasing share of the global primary energy supply, and that in the future new and more efficient bioenergy technologies will continue to be developed.

➢ Overcoming Barriers to the Implementation of Bioenergy

Many bioenergy projects are technically feasible today, but investments do not proceed because other forms of energy are more cost competitive. High cost is the most significant barrier to achieving an increased uptake of biomass.

The removal of barriers to implementation is a challenge for developers and policy makers in order to increase the sustainable use of bioenergy systems. Faster uptake could be made by offering a number of incentives:

Economic Instruments

- **Carbon taxes** imposed on a society in order to increase the costs of fossil fuels, making biomass more competitive since, being carbon neutral, it would be exempt.
- **Climate change levies** on electricity sales, having the potential both to provide revenue and to create awareness if the revenue were used to encourage the use of biomass and other renewable projects.
- **Carbon trading** offering additional value to bioenergy projects in terms of measurable carbon offset.
- **Long-term feed in tariffs** in order to stimulate the renewable energy market
- **Grants and subsidies** offered by governments
- **Increased depreciation rates** on plant and equipment for tax purposes
- **Reduced excise taxes** to the use of fuels with a biofuel component

Non-economic Instruments

- **Targets set by governments for new renewables**
- **Green electricity markets** enabling retailers to trade the renewable energy certificates after generation. The green certificate value can be capped by imposing a penalty for not meeting the green electricity targets.
- **Education and access to information** about the problem of GHG emissions in order to create greater awareness and encourage companies, communities and individuals to be prepared to act

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➢ Strategy for International Cooperation

At the UN Earth Summit in Rio in 1992, the participating countries agreed on a global partnership, with the ambitious strategy to remedy the environmental problems facing our world and come to sustainable development.

For the World Summit on Sustainable Development in Johannesburg in 2002 the EU focuses its activity on **four strategic objectives**:

- Increased global equity and effective partnership for sustainable development
- Better integration and coherence at international level
- Adoption of environment and development targets
- More effective action at national level and international monitoring

Financial and technical assistance for the developing countries is a crucial issue. Any new undertakings given in Johannesburg must include the financial resources to implement them and in South Africa, getting business on board will be a major opportunity.

➢ Towards a Partnership for Action

In the field of bioenergy, the **cooperation between the EU and developing countries** should concentrate on the following topics in order to guarantee the successful implementation of bioenergy projects:

- *Identification of typical local needs and biomass resources*
- *Identification of commercial and reliable technologies*
- *Assessment of the potential of know-how and technology transfer and joint-ventures*
- *Identification of opportunities for project financing*
- *Implementation of bioenergy cooperation projects*

Thereby, it is essential to focus on **reliable and commercial bioenergy technologies** which contribute to an enhanced living standard for people living in rural areas, such as:

- *efficient solid biomass cooking stoves (low emission)*
- *heating solid biomass stoves for cold areas*
- *refrigeration/biomass system for food preserving or cooling*
- *biogas plants (wastes)*
- *charcoal production from agro-forestry residues*
- *small capacity decentralised cogeneration systems (0,1 –1 MWe)*
- *small bioethanol unit (for sugar-starch crop)*
- *small "food-feed-bioenergy" complexes for villages*
- *bioethanol cooking stoves (GPL substitution)*
- *water purification and disinfecting*

Promoting bioenergy technology through the instruments set forth in this position paper will contribute to the achievement of the goals of a fair and more sustainable development around the globe.

Political commitment and appropriate policies are an essential pre-requisite for a significant increase of the renewables' share of the global energy supply and should complement the efforts in improving the technological and economical capabilities of renewable energy sources.

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