EXECUTIVE SUMMARY

1. BACKGROUND

The use of fossil fuels for transport and other economic activities is constrained due to economic and environmental concerns in the East Asian region. In addition, increased energy demand in developing economies of this region may result in problems of energy security. If energy demand in East Asia is not met urgently, it may severely affect the development of the region. These and similar other factors have forced policy makers in developing countries to use alternative sources of energy such as non-conventional or renewable sources. Among various sources of renewable energy, the development of bioenergy, in the form of biodiesel, bioethanol, biopower, etc., has emerged as an important option. Different forms of bioenergy are being produced and used in various countries with predominance of bioethanol and biodiesel. For example, in Brazil, USA, Sweden, Australia, Thailand, and India bioethanol is blended with gasoline, in the range of 5-20%, and used as transport fuel.

If managed properly, development and use of bioenergy may accrue several benefits in East Asia both on environmental and socio-economic fronts. A judicious selection of bioenergy would help in reducing greenhouse gases (GHGs) emissions. Further, biomass is mostly produced by local farmers, and increased demand for it may improve their employment and income. Increased income may contribute to the improvement of their quality of life. On the other hand, accelerated use of bioenergy could have several negative impacts and aggravate problems of shortage of water, food, fodder, land, etc. in the region. Some biomass resources are utilised as food,

fodder or for other domestic activities in developing economies. Increased demand of biomass for energy generation may cause an imbalance and prices of food crops such as sugar, corn, wheat, etc. may rise, affecting economically weaker sections of the society in the East Asian region.

This project investigates various aspects of “Sustainable Biomass Utilisation in East Asia.” An elaborate research was conducted by a multi-disciplinary working group (WG), consisting of the Economic Research Institute for ASEAN and East Asia (ERIA) experts in energy, environment, social-sciences and economics, within the East Asian region. The WG highlighted the crucial issues and suggested some necessary steps for achieving a sustainable development of biomass utilisation in the region.

2. CONCEPT

The UN World Commission on Environment and Development (WCED) report “Our Common Future”, published in 1987, defines sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

The triple bottom line approach, focusing on "People, Planet, Profit," is based upon economic, environmental and social criteria. To ascertain the sustainability of bioenergy development, these aspects are necessary and must be considered to overcome or minimise the problems cited above.

In view of the above, the WG, through elaborate research and group discussions over six months, produced this report titled “Sustainable Biomass Utilisation Vision in East Asia”, which is essentially based upon the above criteria.

2.1. Economic aspects

Beneficial biomass utilisation in East Asia is expected to generate extra income, through value addition, for local stakeholders including farmers, labourers, energy producers and local/national governments. It may contribute to economic gains for East Asian countries, by reducing imports of fossil fuels, and less dependence on imported fuels may also enhance energy security in the region. However, for maximising economic benefits, energy production potential of each biomass resource should be evaluated and appropriate technologies should be used for energy production. To ascertain this, some case studies have been conducted in the region, which performed economic impact assessment of bioenergy, in terms of value addition at each stage, such as job creation, tax revenue generation, and foreign trade.

2.2. Social aspects

Development of biofuels may have several socio-economic implications in East Asian countries. Positive social impacts of bioenergy are increased employment and income in rural areas, and hence, reduction in income disparity among rural riches and poor and in urban and rural areas; higher income may contribute to better health prospects for all, particularly, for women and children; better life style, etc. Negative impacts could be increased pressure on natural resources such as water, land and forests. Also, biofuel crops may compete with other food and fodder crops and reduce their supplies resulting in higher food prices. The case studies on social issues were

aimed at preliminary estimation of disparity of income in the region and its reduction due to bioenergy development. The case studies were based upon relevant indices developed by international organisations but further investigations are needed for reliable and accurate estimations of social impacts.

2.3. Environmental aspects

Along with the interest to utilise biomass for energy production, there exists a myriad of interconnected environmental factors that has to be taken into account. The merits of any biomass energy production should be assessed along with some crucial sustainable indicators and environmental concerns including: deforestation / land use, water management, fertilizers and pesticides, carbon footprint and energy inputs. If large amounts of energy and resources are consumed during the production of biomass and biofuels, the entire system's energy balance will tend to result in energy losses instead of gains. The same logic holds for GHGs; low or zero carbon biofules can only be achievable with proper conditions in place (elaborated in Chapter 4). The lifecycle carbon-footprint and energy equilibrium of such a system has to be considered carefully.

3. RESULTS

3.1. Economic aspects

Biomass utilisation for energy benefits local and regional economic development through job creation in rural areas on continued basis, foreign exchange saving from reduced oil imports, development of alternative markets for biomass products, and generation of tax revenue for governments.

Based on review of literature, the case studies on economic aspects of bioenergy can be classified into three types, namely, microlevel studies (to calculate the economics of bioenergy from the perspective of an individual economic agent); sector-wide studies (to assess the aggregate response of the entire sector to a policy usually taken from the policymaker's perspective); and input-output (I-O) model studies (to describe the complete economic impacts of industrial activity applying a general equilibrium analysis). While microlevel studies were found to dominate in developing countries in Asia, I-O studies are more common in developed countries such as Japan, the United States and the EU. Most of the studies that were taken into consideration enumerated the positive effects of biomass energy policies to local income, taxes, and rural employment. There is a need for developing I-O models for developing countries, which would be able to assess such effects in Asian economies.

The review assessed the role of biomass in developing economies in East Asia by evaluating the past, current, and future trends of biomass utilisation. Economic impact assessment for East Asian countries is based on GDP, employment, energy security, and foreign exchange savings. Employment generation was found to be a common benefit from biomass-based industries especially in the services sector. In terms of the macroeconomic indicator, i.e. GDP, a generally positive trend with increase in bioenergy share was observed. Net fossil fuel importing economies not only could save fuel dollars but also would be able to diversify their energy resources giving them long term energy security.

Some estimations of benefits from biomass production and its conversion into energy were made through a case study of the Philippines, which assessed economic

impacts at a micro level. The study assessed the economic impacts in terms of value addition, job creation, tax revenue generation, and foreign exchange savings and earnings. The overall economic impact of the biomass-based industries was found to be significant not only at the provincial or regional level within the country but also to the national economy as a whole. The potential economic benefits of biomass energy are extensive. This study has revealed a generally positive trend in the macroeconomic indicator (GDP) with increase of biomass energy share. In addition, a number of employment opportunities can be achieved from the industry.

3.2. Social aspects

East Asian country governments are giving lot of impetus for the promotion of bioenergy and biofuels. In most of the countries a blending rate for biofuels has been proposed in the range of 5-10% in the short term with a long term target of 20%. As the demand for biofuels increases, production of biomass has to be increased, proportionately. Large scale cultivation of biofuel crops such as Jatropha, Coconut, Oil Palm, Sugarcane, etc. in East Asian countries is expected to generate millions of jobs in the farm sector and rural areas. With the help of a case study of India, it is revealed that to achieve 20% blending targets for biodiesel, Indian government hopes to increase Jatropha plantation up to 11.2 million hectares by 2011-12, with a job creation potential of about 311 man-days per hectare per year. Similarly, in case of ethanol, blending targets of 5-20%, by increasing sugarcane production, has a potential of creating jobs of 183 man-days per hectare per year. In addition, employment opportunities will be created in other stages of biofuel development chain.

Marginal income increase due to employment in bioenergy programmes showed positive impact on other parameters of social development and overall improvement in living standards of people in the region. Among the negative impacts of bioenergy, "food versus fuel debate" may be the most crucial issue for East Asian Countries. For long-term sustainability of biofuel programmes and to reduce their negative impacts, use of waste lands for growing biomass, use of agro-residue for bioenergy, use of non-edible oil for biodiesel and, depending upon the fluctuation in domestic sugar demand, use of both molasses and sugarcane juice for ethanol production could be the right strategies.

3.3. Environmental aspects

Along with the decreased use of fossil fuels, biomass is expected to contribute to mitigating climate change by reducing GHG emissions. However, this environmental advantage can be realized only if sustainable practices are in place. The most important step is to prevent the clearance of large tropical forests for the sake of growing biomass. Also it is necessary to avoid the overdose of artificial fertilizers that will result in nitrous oxide emissions, another greenhouse gas. It should be ensured that the harvesting rates of the biomass resources are not higher than the growing capacity of the agricultural land producing it. Sustainable agricultural land management will help to promote the carbon neutral (or in some cases carbon negative) effects of bioenergy.

The WG asserts a conservative approach to biomass utilisation for energy production. A useful measurement is the carbon footprint of the system, where the entire biomass-to-bioenergy production chain should be considered, including any

additional energy and resources spent to grow, produce, and in some cases, transport the biomass feedstock by rail or roads.

By analysing the carbon footprint or by taking into consideration the entire life cycle of biofuel and assessing the GHG emissions from "field to fuel", a more accurate account of GHG emissions i.e. net reduction or increase, may be revealed.

3.4. Sustainability Indicators

The current impetus in the utilisation of biomass for materials and energy has generated a serious debate vis-à-vis its impact on food security. Also, from a life cycle perspective, the advantages of biomass utilisation for climate change mitigation are not as clear as were thought earlier. Hence, it is imperative to assess the sustainability of biomass utilisation. To this end, indicators addressing ecological, economic and social sustainability need to be developed. A suite of such indicators has been proposed as an attempt to quantify the ecological viability, social desirability and economic feasibility of biomass systems. Ecological indicators include thermodynamic metrics based on mass and energy balances and environmental metrics comprising carbon footprint, eutrophication, land use and biodiversity. Economic indicators incorporate income generation and energy security. The lack of quantifiable indicators for social sustainability was evident pointing to a need for further research in this important area.

4. POLICY RECOMMENDATIONS

Biomass production and utilisation for energy involve complex issues that may have significant implications on the economies within the East Asia region.

Sustainable utilisation of biomass should consider economic, environmental and social aspects. Based on the current findings of the WG, and the accepted benefit of biomass as a source of renewable energy that will reduce the rate of depletion of fossil fuels, following recommendations have been proposed for the 'Sustainable Biomass Utilisation Vision in East Asia.'

(1) Addressing Macro and Micro Levels Needs to Reap Maximum Economic Benefits

The economic impact of biomass utilisation should be considered from both macro-level and micro-level perspectives. This takes into account the economic benefit at national level, and its financial sustainability within the local economy. Regulations and subsidies are only short-term advantages, and therefore, the policies that will distribute the economic benefits to each stakeholder along the value-added chain of biomass energy, and also encourage growth of its supporting industries are favourable approaches.

(2) Enhancing Positive and Mitigating Negative Environmental Impacts

Agriculture activities are dominant contributors to the environmental impacts of biomass utilisation. Policies and strategies should be framed to enhance the positive impacts and minimise the negative impacts. The entire life cycle of the process should be considered to identify environmental hot spots or activities that result in the most extensive damage from a particular impact. The action plan to minimise negative impact should be prioritised according to the extent of damage of the hot spot on the environment.

(3) Realising Direct and Indirect Societal Benefits or Returns

Societal impacts include direct monetary benefits as in job creation and indirect monetary benefits in the form of better health and increased literacy and gender equality, etc. Societal benefits vary with their role in the value chain and this variation should be considered in policy framing. Policies must be developed to ensure that food security is not threatened at the expense of energy security and should be designed in such a way that they benefit all strata of the society.

(4) Developing Sustainability Indicators to Enhance the Decision Making Process

Sustainable development indicators should address ecological, economic and social sustainability. Currently, there is no single indicator to integrate all three aspects and a suitable indicator for the same is yet to be developed. However, every indicator need not to be applied in the decision making process. Harmonisation of indicators at the regional level, development of indicators that can integrate all three aspects and indicators that can address complex issues such as energy security should be actively pursued.

(5) Using Appropriate Tools to Generate Quantifiable and Verifiable Life Cycle Information

Appropriate evaluation tools or techniques will enable the generation of quantifiable information and data for use by the indicators. Life Cycle Assessment (LCA) is an established tool that can provide life cycle footprints for critical environmental impact categories. The use of LCA will also ensure those negative

impacts are not passed from one environmental compartment to another, from one time frame to another, or from one region to another.

(6) Considering Country-Specific Needs and Available Biomass Resources

Depending on the country's experience and needs, the driving force to propagate the biomass energy industry can be economic, environmental or social factors, or a combination of these factors. Careful assessment should be conducted to ensure that the decisions and actions are in accordance with the priorities of the country.

(7) Promoting Regional and International Cooperation

Within the East Asian region as well as at international level, each country should pay due attention to the policies and approaches that are adopted by other Countries. Collaboration between bioenergy producing and bioenergy consuming countries in East Asia, including technology exchange, capacity building and appropriate pricing, should be given priority for sustainable biomass utilisation.