Concept note

Governing the risks and opportunities of bioenergy

Risks and opportunities of significantly increasing the production of biomass energy for heat, electricity and transport fuel

International risk governance council

Preface

IRGC is an independent organisation whose purpose is to help the understanding and management of emerging global risks that have impacts on human health and safety, the environment, the economy and society at large. IRGC's work includes developing concepts of risk governance, anticipating major risk issues and providing risk governance policy recommendations for key decision makers.

Every IRGC project commences with the writing of a "concept note" to describe the particular risk issue being addressed. This is the objective of the following document, which is not intended to be a complete and in-depth description of the current status of bioenergy development and of the associated debate but, rather, merely provides a brief summary of bioenergy and of its possible risks and presents a preliminary identification of risk governance deficits. The document thus seeks to inform and guide any future work by the IRGC on the subject.

Starting in September 2007 the IRGC, under the leadership of Jeffrey McNeely, Chief Scientist of IUCN - The World Conservation Union - is convening an Advisory Board, composed of eminent international experts in bioenergy with a wide range of backgrounds and expertise. The Advisory Board will develop risk governance guidelines and policy options for the production and trade of biomass for all modern applications, including biofuels and bioenergy for heat and electricity.

More information on the project can be obtained from Marie-Valentine Florin, at IRGC marie.florin@irgc.org

Introduction

The development of biomass energy (bioenergy) has become increasingly attractive to governments around the world as an alternative to traditional fossil fuels (such as oil, gas and coal). The International Energy Agency expects global biofuel production to quadruple over the next 20 years, ultimately accounting for about 10% of the world's transport fuel. At face value, bioenergy appears to offer several advantages: lower CO2 emissions, an alternative source of renewable energy, enhancement of energy security by lowering dependence on unstable foreign suppliers of fossil fuel, and economic benefits to biomass producers, among others. Several governments have recently passed legislation mandating or promoting rapid increases in the proportion of bioenergy in their overall energy mix. The ensuing rush to meet this growing demand has begun to reveal environmental, economic and social risks associated with bioenergy development. Serious questions have arisen regarding the carbon neutrality and the sustainability of biomass feedstock production and processing, and about its potential adverse impacts on biodiversity, water supply and quality, food supplies, and the livelihoods of the poor. Diversifying the range of energy options makes sense, but the negative impacts of some of the early bioenergy projects have the potential to adversely affect the whole market.

This pattern of events may represent a failure of good risk governance practice.

The purpose of this note is threefold: to briefly evaluate the risk governance issues surrounding bioenergy; to draw the attention of policy makers to the potential secondary risks of an excessive development of biomass energy supply (particularly of biofuel); and to introduce an initiative of IRGC to contribute to the current bioenergy governance debate.

Content

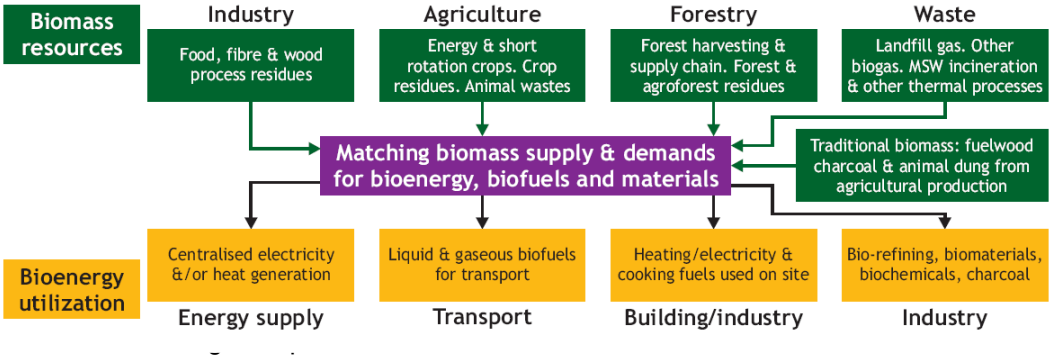
1. Background/Definitions

Biomass collectively describes all organic non-fossil material. It comprises the mass of all biological organisms, dead or alive, excluding biomass that has been transformed by geological processes into substances such as coal, petroleum, or natural gas. It includes municipal and agricultural waste derived from biological sources. **Bioenergy technologies use these resources to produce heat, electricity or fuels.**

This note focuses on the following uses of "renewable" biomass[1] for energy:

- Biomass for heat or electricity production via conversion processes such as combustion, thermochemical or biological conversion for power in industrial or small-scale applications.
- 1st generation biofuel derived from sugar crops, grains or seeds (sugar cane, maize, rapeseed, potatoes, wheat, soybean, etc.). Bioethanol currently accounts for more than 94% of global biofuel production, with the majority coming from sugar cane.
- 2nd generation biofuels produced from lignocellulosic feedstocks such as low-input high-diversity grassland, agricultural wastes, woody crops (poplar and willow plantations, wood residues, etc.) and from emerging genetically engineered or bred plants ("energy designed crops") for development on “energy plantations”. The technologies behind most second-generation biofuels are still in their early development stage, but some have already reached the pilot-testing stage. In one experiment, researchers were able to convert *Miscanthus* grass into ethanol at a rate of 24,000 litres per hectare. Some experts believe that cellulose-based ethanol could replace at least a third of the petrol used in the United States today. Another alternative derives from breeding cellulosic plants that are more amenable to the conversion process, and scientists in several parts of the world are working on a genetically modified poplar tree whose cellulose is easier to convert into sugars (typically through reducing lignin content).

Figure 1: The Biomass Resource Chain



Source: IEA 2007

[1] See UNFCCC definition of renewable biomass : http://cdm.unfccc.int/EB/023/eb23_repan18.pdf

2. Increasing Market Demand for Biomass Energy

Biomass, primarily wood, was the main source of energy for humankind for thousands of years. But, with the development of more convenient and efficient fuels - especially oil and coal - over the past two centuries, it now represents only about 14% of the world's primary energy supply.[2] Nonetheless, it still accounts for a higher percentage of total energy use than any other renewable form of energy, and governments are giving it renewed and increasing attention.

This new interest reflects the concerns of governments about the cost, reliability and security of their imports of fossil resources. Governments are also increasingly concerned about global climate change and are looking for opportunities to reduce net carbon emissions both from the energy and transport sectors, as well as from agriculture and forestry. Bioenergy is uniquely positioned at the centre of all of these concerns.

While the market for bioenergy (and biofuels in particular) is increasing, production is still predominantly for domestic consumption. This focus on domestic development is due to bioenergy often being viewed politically not only as a vital contributor to energy security and independence, but also as an opportunity for rural employment and development.

"The biofuel industry is dominated not by market forces but by politics and the interest of a few large companies." (Foreign Affairs, May/June 2007).

Nevertheless, various forms of bioenergy are increasingly being traded, often in preferential bilateral agreements. Overall, the sustainability aspect of bioenergy is regarded by many as an issue that can only be addressed once international trade of bioenergy achieves sufficiently large volumes. The argument is that sustainability standards will gain traction once strong import-export relationships form between a large number of producers and consumers.

[2] There are strong regional differences: developed countries meet around 3% of their overall energy needs from biomass, while Africa's share ranges from 70-90%.

3. Advantages of developing biomass energy for heat, electricity and fuel

Proponents of biomass energy highlight advantages that address many growing political, environmental and economic concerns:

- Reducing net carbon emissions. Bioenergy is theoretically carbon neutral since carbon emitted during combustion is reabsorbed by crops grown for bioenergy, resulting in a closed carbon cycle.
  In practice, every form of bioenergy results in some net emissions from agriculture, processing and transport. However, emission figures vary widely; analysis of the Brazilian sugar cane ethanol industry has demonstrated that ethanol produced from sugar cane in Brazil has a substantially lower net CO2 impact in comparison to traditional corn-derived ethanol, and both are improvements over normal petroleum use.
- Enhancing energy independence and security by diversifying energy sources and utilizing local sources, thereby reducing energy imports.
- Achieving other national energy policy goals, such as:
  - maintaining the energy supply at a predictable price,
  - meeting increased needs.
- Developing economic opportunities for biomass producers in the agricultural and forestry sectors, especially in developing countries. For example, mobile phone companies in Nigeria and India have established pilot schemes to expand their mobile networks by using bioenergy as a cheap and green way to provide power to their networks in rural areas. The intention is to encourage poor rural communities to produce energy from organic matter and sell it to the mobile phone companies to provide power for the base stations that receive and transmit wireless signals. The schemes are being sponsored by the mobile phone company Sony-Ericsson and the GSM Association Development Fund.
- Providing rural employment. In Brazil, the production of sugar cane-based bioethanol employs around one million workers. In Canada, nearly 1,000 jobs have been secured in Fort Frances, Ontario, after a newsprint company approved plans to build a biomass energy generator at its pulp and paper mill. Wood waste from its operations and sawmill, along with material gathered from forest companies operating in the region, will be used to generate steam and 45.5 MW of electricity for the mill. The company, Abitibi-Consolidated, is considering expanding this approach to its other mills elsewhere in Canada.
- Reducing waste that would otherwise require disposal at increasingly high economic and environmental costs. The US military is supporting the development of new plastics that can easily be converted into biodiesel, thereby both reducing the cost of disposing of packaging waste and making more fuel available in remote areas at lower cost. Civilian applications are likely to follow.

4. Present regulation and governance context

Several countries, including the US, the EU Member States and Brazil, have adopted policies to increase the usage of transportation biofuels in their existing energy mix. Biofuel production and use are heavily subsidized throughout the world, including the EU and the US, because they are currently more expensive to produce than conventional fossil fuels. Some examples of biofuel-supporting policies include:

- The 2003 European Union Biofuels Directive, which is now under review.[3] The EU policy provides a strong incentive to develop biofuels. The EU hopes to produce a quarter of its transportation fuels from biomass by 2030. It has established a goal of 5.75% biofuels in the transport fuel mix by 2010, which would require a five-fold increase in production within the EU if produced domestically. Rapeseed is the primary source of European biofuel, but is not particularly productive and is unlikely by itself to reach the EU target. The solution is likely to involve importing biofuels from other countries, primarily in the tropics. Experience has shown that these countries do not have the regulatory and governance frameworks to ensure that supplies are grown in a sustainable manner that does not have negative impacts on biodiversity. Indonesia and Malaysia are already major suppliers, especially of palm oil, at the expense of replacing biodiversity-rich tropical forests.
  The European Common Agricultural Policy encourages energy crop cultivation in two ways: farmers are not allowed to use set-aside land for growing food crops, but can use it for industrial or energy crops. They also receive subsidies when they produce biofuel feedstock on agricultural land (but not on set-aside land).
- The US programme on alternative fuels. Under the US Energy Policy Act of 2005, the US aims to replace 30% of its transportation fuel with biofuel by 2030.[4]
- By 2020 Sweden plans to be the first country worldwide to no longer use oil to generate electricity. Local energy production from waste and biomass plays a key role in this vision, and a demonstration facility has already been established. Sweden offers tax incentives and state funding to stimulate new technologies and systems.
- Brazil is a leader in the development of biofuel, and more agricultural land is being allocated for biomass production. Brazil and the US are building a new partnership to expand the use of ethanol and other biofuels throughout Latin America and the Caribbean in an effort to increase energy security and create rural jobs for poorer nations. The partnership is in the interest of both countries. Brazil would like to export more ethanol and ethanol related technologies and encourage other regional nations do the same, thus turning ethanol into a tradable commodity. The US would benefit from the repeal of its current domestic tariff on Brazilian ethanol of $0.54 per litre that currently discourages its entry to the US, especially since increased use of ethanol has become a

[3] European Directive on biofuels + report on the progress made in the use of biofuels and other renewable fuels (Jan 2007) + "An Energy Policy for Europe" (Jan 2007)

[4] "One half of that goal can be met by corn ethanol, says Brian Davison, director of bio processing research and development centre at Oak Ridge National Laboratory… The House's (2007) budget requests $150 million for biomass research and the Senate's (2007) budget $213 million, up $94 million from 2006"… in Nature, Vol 444, 30 November 2006.

long-term goal for the Bush Administration. However, the US farm lobby is likely to continue to support the tariff, in order to protect their market share; ethanol production in the US already receives a substantial subsidy.

5. Risks related to uncontrolled increase in biomass energy demand and supply

Indonesia is embarking on an ambitious bioenergy programme which has already attracted more than US$ 17 billion in foreign and domestic investment, as well as considerable criticism from conservationists worried about the country's forests. The government says that energy crops could hold the answer to Indonesia's concerns about energy security, employment, poverty, the environment and local unrest. However, drainage of vast peatland areas for deforestation for oil palm plantations leads to huge emissions of carbon dioxide as drained peat decomposes very rapidly (the decomposing peatland can release 70 to 100 tonnes of CO2 per hectare per year and result in emissions 10 times higher than if coal was used instead of biofuel). As a result, these biofuels may be more polluting than fossil fuels.[5] [6]

Early enthusiasm for the benefits of biomass energy production and their subsequent promotion by governments around the world have given way to concerns about the unintended consequences of a sudden, large-scale shift to biofuels.[7] [8] These include environmental, social, and economic risks.

Environmental risks

- The whole life cycle, from planting to production to consumption, needs to be included in an environmental assessment of biomass used for energy production, also taking into account other issues such as pollution, land use, biodiversity, and water.[9] It is crucial to investigate all processes involved in the use of bioenergy systems on a full fuel-cycle basis with the aim of establishing overall greenhouse gas (GHG) balances. Among other points this implies: comparison of GHG emissions from various biomass production processes in agriculture and forestry and from biomass conversion; selection of appropriate national strategies for GHG mitigation; comparison of bioenergy and fossil energy systems in terms of GHG balance; and evaluation of the tradeoffs between strategies of maximised carbon absorption (reafforestation, forest protection) and maximised fossil fuel substitution with biofuels or other forms of renewable energy.[10]

[5] AFP 17 February 2007, WBCSD "biofuel to power Indonesia's anti-poverty drive".
[6] To the point that researchers from Wetlands International and Delft Hydraulics estimate Indonesia is now the world's third-leading producer of greenhouse gases. IHT 30 January 2007.
[7] Rosenthal, E. 2007 « Scientists take another look at biofuels », International Herald Tribune Tuesday January 30, 2007.
[8] “Le grand bluff des biocarburants” Que Choisir 444, Janvier 2007.
[9] "If you make biofuels properly, you will reduce greenhouse emissions, but that depends very much on the types of plants and how they are grown and processed. You can end up with a 90% reduction compared to fossil fuels, or to a 20% increase. It is important to take a life cycle view". Peder Jensen, European Environment Agency, Copenhagen.
[10] http://www.ieabioenergy.com/Task.aspx?id=38

- The carbon benefits of biomass energy are uncertain, as in the case of ethanol produced from corn (maize). "Studies that compare the energy that goes into making ethanol – expended during the harvesting, fertilizing and transporting of the corn to refineries, and then refining it – with the energy that is released when it is burned routinely show that the net gain is at best small. The American Coalition for Ethanol says that ethanol contains twice the amount of energy that is used to market it; critics see no net gain whatsoever… Only sugar cane grown in the tropics puts enough energy into its easily purified products to make bio ethanol obviously attractive".[11]
- The agricultural and forestry sectors (as suppliers of biomass) are already affected and will be under pressure to increase their production in order to meet the increased demand for biomass products for energy. Planting monocultures is inherently risky, as pests and diseases are far more likely to spread quickly in monocultures than in poly-cultures. When large numbers of people become dependent on a single species, they risk becoming vulnerable to changing conditions (ecological, sociological and economic). Furthermore, as the market value of bioenergy crops increases, farmers are tempted to apply increasingly intensive husbandry to the crop, reaching the ecological limits of the species. Crops being grown at these ecological limits are particularly subject to perturbation. This expansion also has the side effect of pushing the "agricultural frontier" further into lands that may not be suitable for crop production in the long term, leading to land degradation.
- These risks are related to overexploitation and soil erosion of certain land areas and types. In Indonesia and Malaysia, for example, conversion of mature rainforest to oil palm has led to the loss of over 10 million hectares of productive and biologically-rich forests. In Brazilian sugar cane cultivation, widespread soil erosion is a damaging side-effect, with losses of up to 30 tonnes of topsoil per hectare per year. The risks related to unbalanced land management are underestimated, as the multiple values of old-growth forests and wild cerrado cleared for biofuel plantations are discounted.
- In some Brazilian states, the smoke pollution produced by the burning twice a year of sugar cane fields before manual harvesting continues to be a major problem. This leads to further acidification of the poor tropical soils and high particulate concentration in the atmosphere. Farmers are reluctant to replace cheap manual labour with more expensive mechanized harvesting that does not require burning the sugar cane before harvest. The smoke from fires used to clear forests in Borneo causes health problems in Singapore and peninsular Malaysia.
- Other environmental risks include:
  - Risks linked to water scarcity (expected to increase in some areas as the biomass energy production process is water-intensive).
  - Risks related to excessive or inappropriate use of fertilizers and pesticides.
  - Risks to aquatic ecosystems from nutrient overloading; and
  - Risks of loss of biodiversity and increases in invasive species.[12]

[11] Nature, Vol 444, 30 November 2006

[12] Ragu, S. et al. 2006. Adding biofuels to the invasive species fire? Science 313: 1742

In conclusion, biomass produced by unsustainable feedstock cultivation practices poses the risk of not producing the positive impact expected. This may be even truer when the other parts of the value chain (bioenergy carrier production, transport and final use) are included in the assessment.

Social Risks

The bioenergy industry generates jobs in the producing countries. This is particularly significant in countries like Brazil, Malaysia and Indonesia which have developed large-scale biofuel industries. However, the working conditions for manual harvesters are often substandard. Other social risks include:

- The possible shift away from food production towards biomass production resulting in potential increased competition for agricultural land in developing countries and consequent concern about adequacy of food supplies. Reduced US exports of corn to Mexico have already led to increases in the price of tortillas, a decline in the value of the peso, and food riots. In Italy, the price of pasta is expected to increase by 20% in the short term due to the competition for cereals with the biofuel industry [Daily Newspaper *La Republica*, 20 July 2007].
- Imbalances between developed and developing countries can lead to geopolitical risks.
- Dependence on biofuel production can lead to societal impacts on traditional cultures and sustainable agricultural practices.
- Consumers are currently positive but poor management of the development of biofuels could lead to a consumer backlash that reduces demand for biofuels.

Economic Risks

- Competition for food products, wood fibre and products in the forestry sector is expected to drive prices upwards, with impacts on the food as well as the paper and wood industries.
- Perverse effects of subsidies for a source of energy that should be competitive to avoid economic bias; Germany has even added a tax to biodiesel, perversely adding a disincentive to the mix.
- International trade can be distorted through country-specific subsidies and tariffs.
- The bioenergy sector is still in its infancy. Much under-informed capital has flowed into the sector recently, leading to talk of a 'bubble' that could burst. Although billions of Euros have been flowing into the bioenergy sector in recent years, the returns on investment have to date been highly uncertain. For instance, although the New Energy Global Innovation Index (NEX), which tracks the world largest and cleanest clean energy stocks, recorded a yearly 30% compound increase over the past 4 years, 40% of the NEX constituents were not profitable in 2006.
- Although their enormous potential is recognized, the economic viability of emerging bioenergy technologies remains uncertain (due to factors such as fossil energy price, oil reserves, stability of supporting regulation, etc.). The economic potential of specific technologies is difficult to assess, complicated by the rapid innovation rate in many of them. Hundreds of bioenergy technologies are being developed throughout the

world and not all will manage to access the market. Moreover, success factors can often prove intangible and may not always reflect the intrinsic technological or economic value of innovation. Technology that appears economic today might not be competitive tomorrow as successful newcomers might soon replace today's sustainable energy companies. In this regard one thinks in particular of the potential impacts of second generation biofuels on markets.

- Bottlenecks preventing lean technology deployment are key issues in the clean energy sectors. The building of bioethanol filling stations in the USA is too slow to cope with the rate of increase of bioethanol production. Furthermore, the production of high-ethanol fuel blends is about to out-pace the production of automobiles capable of using this fuel.

6. Conclusions and recommendations

Society needs more efficient, sustainable and certified technologies and practices for bioenergy

Proposals for the expansion of biofuel production should be carefully evaluated, to avoid environmental and social problems that may outweigh long-term economic gains. However, "second generation" biofuels may provide answers to some of the sustainability issues mentioned above. Research into dedicated energy crops is, in particular, raising interest from producers as well as from environmentalists concerned about the related risks to biodiversity and of reliance of weak economies on a single crop.

The enthusiasm for biofuels should not overshadow other technologies involving biomass energy, which include:

- Thermochemical conversion: combustion and gasification of biomass for power and for clean synthesis gas production; combustion for industrial and small-scale application; etc.
- Biological conversion: fermentation and enzymatic processes; methane from garbage disposal and animal wastes; etc.
- Biophotochemical conversion: biological hydrogen production from algae.

Some of the doubts raised about the actual net gain from biofuel production on greenhouse gas emissions are addressed when biomass is used for producing heat or electricity to support part of the production process of timber, paper, chemicals, and others.

Biomass tends to have lower energy density as compared to fossil resources, making it more suited for processing close to where it is produced. This supports the argument for multiple small bio-energy facilities rather than a few large, centralized ones. Such systems also reduce the risk of linked infrastructures that may be vulnerable to external effects. [13]

[13] White Paper on "Managing and Reducing the Social Vulnerabilities of Couples Critical Infrastructures", IRGC, 2006

However, this may contradict the economic need for larger plants as economies of scale often prove significant.

Advocates believe that perennial and deep-rooted energy crops, such as prairie grasses and fast-growing trees, reduce run-off, use fewer fertilizers and pesticides, increase water infiltration and retention, support higher levels of biodiversity and wildlife habitat, and enhance soil carbon sequestration. Using diverse feed stocks, including organic waste, could also reduce pressure on current agricultural lands and provide a market for materials that are now of negligible value or that even involve a cost for disposal. But such optimal solutions need careful management, suggesting that a certification scheme may be necessary and appropriate.

Policy-makers in governments and the private sector need a better analysis of needs, risks, opportunities and energy efficiency, to facilitate a better assessment of trade-offs between:

- biomass for biofuels (mostly to replace fossil fuel for transport)
- biomass directly used for electricity or heat
- biomass for food (both for direct consumption and for animal feeds)
- biomass for local conservation
- biomass for national or international markets
- bioenergy produced from waste or from plants

Such an analysis will need to consider country- and region-specific contexts. For example, both the opportunities and risks will be different in an advanced economy with a mostly urban population as compared to a developing economy whose population is mostly agrarian. Other important geographic variables include climate, soil productivity and available water resources.

A need for improved governance practices

One of the intentions of this note is to draw attention to the potential secondary effects of an excessive development of biomass energy supply. At the multilateral level, no specific forum is currently available for discussions on how to address the trade in biofuels.[14] In some countries, a deficit in appropriate political governance may increase the risks mentioned above (short-term interests, weak governance and inappropriate incentives).

The production of biomass-related energy is not yet a sector where the governance deficit is perceived as critical by the major policy makers, who are preoccupied with reducing their dependency on imported oil. The improved risk governance of biomass energy will enable better decision-making from governments and the private sector.

[14] However, the UNCTAD BioFuels Initiative is designed to play this role in the future. It is conceived to offer a facilitating hub for programmes already underway in a number of institutions. http://r0.unctad.org/ghg/projects/Biofuels%20flyer.pdf

The private sector is improving its understanding of the inextricable links between business and ecosystems. Corporations rely on ecosystem services - biomass production being one of these - and damaged ecosystems will no longer be able to provide industry with the services it requires. As in other sectors, trade-offs will have to be made to maintain the sustainable use of natural resources. The collaboration between Boeing, General Electric, and Virgin Airways to develop a biofuel suitable for aviation, or the partnership between DuPont and BP towards production of biobutanol, are promising initiatives, among many others.

On the policy side, developments have been moving so fast that regulations and legislation are lagging behind biomass action plans that promote dynamic and aggressive biomass production. For example, the northeast US is using biodiesel to contribute to its heating oil needs, with a target of displacing 5% of its petroleum consumption in five years. The new blended fuels are known as "bio-heat". A risk is that the regulatory framework might not be in place to enable such fuels to be used. Current State law in New York, for example, prohibits licensed oil burner technicians from working on any heating system not operating on standardized heating oil. Technical definitions of heating oil would preclude the technicians from working on "bio-heat". National and international policies need to be updated, to take into account the opportunities and risks mentioned in this note: security of supply, globalisation of biomass, international biofuels trade, externalities assessment, etc.

Sustainability criteria will need to be defined and agreed upon; certification, international standards and environmental management systems for biomass production will need to be put in place, etc. Criteria should include, among others: greenhouse gas balance, biodiversity, environment, competition with food / local energy supply / medicines / construction material, economic prosperity, wellbeing of workers and local communities.[15]

Under the Clean Development Mechanism (CDM) of the Kyoto Protocol, international industrial policies, regulations and financial mechanisms will have to be defined to promote and control sound environmental and socio-economic practices. The post-Kyoto negotiations are already being influenced by bioenergy considerations, though they will not enter into force until 2012.

At this stage, we may conclude that improved risk governance requires:

- Voluntary measures for governance of biomass services by the relevant industries.
- A global governance framework for biomass energy to take into account the distinct needs of different countries, both developed and developing.
- Regulatory frameworks at national and international levels.
- Continuing research to address identified and emerging risks.

[15] http://www.ieabioenergy.com/DocSet.aspx?id=5331&ret=dss
IEA Bioenergy workshop, 4-6 June 2006: Availability of Biomass Resources, Certification/Sustainability Criteria and Land-use and Bioenergy in the Kyoto and post-Kyoto Framework

IRGC project work on biomass energy in general and biofuels in particular

IRGC has developed a comprehensive framework for analysing, understanding, managing and communicating global, systemic risks.[16] IRGC is undertaking work to apply this framework to the broadly defined risk issue described in this note in order to provide recommendations to policy makers on options for appropriate biomass energy policies, regulations and practices.

The objective of IRGC's bioenergy project is to develop risk governance guidelines for the production and trade of biomass energy. Under the supervision of Jeffrey McNeely, IUCN, and involving other members of IRGC's Scientific and Technical Council, the project will focus on an appraisal of the basic technical, economic, and social issues involved in biomass production, their risks and benefits, the strengths and limitations of the current regulatory and risk governance context, the status of work underway by both the private sector (for example, BP and Shell) and international organizations (UNFCCC, the Convention on Biological Diversity, the World Trade Organization, UNCTAD, the Food and Agricultural Organization, International Energy Agency, the International Biofuels Forum of the UN, and others), and the opportunities for IRGC to contribute to improving the process.

The project will bring together experts from various relevant disciplines including agriculture, biomass energy technology, trade, environment, regulation and policymaking in workshops focused on developing initial recommendations for further research and for improving risk governance of the development of biomass energy in the future.

The challenge is to ensure that the use of biofuels and bioenergy to solve one problem does not lead to the creation of several others (leakage effect). Much depends on the way that bioenergy is developed, including a focus on who are expected to be the major beneficiaries.

Energy from biomass has the potential to make significant contributions to solving some of the world's energy issues and to providing benefits to the rural poor. Improved use of waste, better technologies, sustainable husbandry techniques and, when appropriate, dedicated energy crops are some of the options that improved governance guidelines will highlight.

[16] IRGC White Paper Nr 1: Risk Governance – Towards an Integrative Approach

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