

7. Policy challenges

Liquid biofuels for transport have been the subject of considerable debate concerning their potential to contribute to climate-change mitigation and energy security, while also helping to promote development in rural areas. However, as some of the initial assumptions concerning biofuels have come under closer scrutiny, it has become increasingly clear that biofuels also raise a series of critical questions concerning their economic, environmental and social impacts. Biofuels present both opportunities and risks from an environmental and social perspective. Developing socially and environmentally sustainable biofuel production that exploits the opportunities, while managing or minimizing the risks, will depend crucially on the policies pursued *vis-à-vis* the sector.

The preceding chapters have reviewed the role of biofuels – both actual and potential – and the main challenges and issues involved in their development from economic, environmental, poverty and food-security perspectives. A series of the most critical questions surrounding biofuels have been addressed and an attempt made to provide answers based on the evidence available to date. This chapter tries to spell out what are the implications for the design of appropriate policies for the sector.

Questions addressed by the report

The key questions addressed by the report and the answers provided can be summarized as follows.

■ *Do biofuels threaten food security?*

For poor net buyers of food staples in both urban and rural areas, higher food prices resulting in part from increased biofuel demand will pose an immediate threat to their food security. Even if biofuels are only one of several sources of the recent sharp increases in food prices, expanded biofuel production can still continue to exert upward pressure on food prices for considerable time

to come. The immediate impact of high food prices on the poor can be mitigated through appropriately designed and targeted safety nets that support access to food. At the same time, it is important to allow rising prices to feed through to farmers so as to trigger a possible supply response. Imposing price controls and export bans, as many countries have done in 2008 in efforts to protect consumers from high prices, prevents markets from adjusting and, while providing an apparent short-term relief, may actually prolong and deepen the food-security crisis. If markets are allowed to function and price signals are effectively transmitted to producers, higher prices will provide an incentive for increased production and increased employment, which may alleviate food-security concerns over the longer term.

■ *Can biofuels help promote agricultural development?*

Although higher prices for agricultural commodities constitute an immediate threat to food security for poor consumers worldwide, in the longer run they represent an opportunity for agricultural development. This opportunity can be realized only when and where the agriculture sector has the capacity to respond to the price incentives and poor farmers, in particular, are able to participate in the supply response. Expanding demand for biofuels may reverse the long-term decline in real agricultural commodity prices that, for decades, has discouraged public and private investment in agriculture and rural areas in many developing countries. These countries may be able to use this opportunity to revitalize their agriculture sectors, but, as for agriculture in general, their ability to do this will depend on investments in infrastructure, institutions and technology, among other factors. Promoting access to productive resources, particularly by smallholders and marginalized groups such as women and minorities, will strongly improve the likelihood that agriculture can serve as an engine of growth and poverty reduction. Opportunities would also be

expanded by the removal of subsidies and trade barriers that benefit producers in OECD countries at the expense of producers in developing countries.

■ **Can biofuels help reduce greenhouse gas emissions?**

Some biofuels may, under certain conditions, help reduce greenhouse gas emissions. In practice, however, the global effects of an expansion of biofuel production will depend crucially on where and how the feedstocks are produced. Land-use change resulting from increased feedstock production is a key determining factor. For many locations, emissions from land-use change – whether direct or indirect – are likely to exceed, or at least offset, much of the greenhouse gas savings obtained by using biofuels for transport. Moreover, even when biofuels are effective in reducing greenhouse gas emissions, they may not be the most cost-effective way of achieving this objective compared with other options. Good agricultural practices and increased yields can help mitigate some of the negative greenhouse gas effects arising from land-use change, and technological developments and improvements in infrastructure, leading to increased yields per hectare, can contribute to a more favourable outcome. Second-generation technologies, in particular, may improve the greenhouse gas balance of biofuel production significantly.

■ **Do biofuels threaten land, water and biodiversity?**

As for any form of agriculture, expanded biofuel production may threaten land and water resources as well as biodiversity, and appropriate policy measures are required to minimize possible negative effects. The impacts will vary across feedstocks and locations and will depend on cultivation practices and whether new land is converted for production of biofuel feedstocks or other crops are displaced by biofuels. Expanded demand for agricultural commodities will exacerbate pressures on the natural resource base, especially if the demand is met through area expansion. On the other hand, the use of perennial feedstocks on marginal or degraded lands may offer promise for sustainable biofuel production, but the

economic viability of such options may be a constraint at least in the short run.

■ **Can biofuels help achieve energy security?**

Liquid biofuels based on agricultural crops can only be expected to make a limited contribution to global supply of transport fuels and a yet smaller contribution to total energy supplies. Because agricultural markets are small relative to energy markets, expanding biofuel production quickly bids up the price of agricultural feedstocks and makes them uncompetitive against petroleum-based fuels. However, countries with a large natural-resource base that can produce feedstocks competitively and process them efficiently may be able to develop an economically viable biofuel sector. Unforeseen changes in energy markets could also change the economic viability of biofuels. Technological innovation – including the development of second-generation biofuels based on cellulosic feedstocks – may expand the potential and the range of countries where biofuels could make a significant contribution to energy security. However, it is not clear when second-generation technologies may become commercially viable. When they do, first- and second-generation fuels are likely to continue to coexist; the bulk of biofuel supply will be provided by first-generation biofuels, based on sugar, starchy and oil crops at least for a decade.

■ **A framework for better biofuel policies**

Liquid biofuels for transport have been actively promoted, especially by some OECD countries, through a series of policies providing incentives and support for their production and use. Such policies have been largely driven by national and domestic agendas. A strong driver has been the desire to support farmers and rural communities. They have also been based on assumptions about the positive contribution of biofuels to energy security and climate-change mitigation that are increasingly being challenged. The unintended consequences, especially in terms of market and food-security impacts, have frequently been overlooked. It is increasingly recognized

that a more consistent set of policies and approaches towards biofuels is needed, based on a clearer understanding of their implications that are now emerging.

Policies must be aimed at grasping the potential opportunities offered by biofuels, while carefully managing the indisputable risks they also present. They must be consistent with policies in other related areas and based on clear and sound policy principles if they are to be effective. Unfortunately, these policies must also be formulated in a situation of considerable uncertainty.

Uncertainties, opportunities and risks

Policy-making for biofuels has to take into account the high degree of uncertainty still surrounding the potential and future role of liquid biofuels in global energy supplies. This uncertainty is underscored by the considerable variation in estimates of the potential for bioenergy supply in the medium-to-long term presented in various recent studies. However, in general, the studies suggest that land requirements would be too large to allow liquid biofuels to displace fossil fuels on a large scale. The development of biofuels must be seen as part of a long-term process of moving towards a world that is less reliant on fossil fuels, in which biofuels represent one of several renewable energy sources. However, even if the contribution of biofuels to global energy supply remains small, it may still imply a considerable impact on agriculture and food security.

Foremost among the factors contributing to uncertainty are future trends in fossil fuel prices, which will determine the economic viability of liquid biofuels. In the medium-to-long term, technology developments in the field of biofuels may alter the underlying equations determining their profitability. Such developments may be in the areas of feedstock production technologies (e.g. agronomic developments) and conversion technologies. Moving towards second-generation biofuels based on lignocellulosic feedstocks may significantly change the prospects for, and characteristics of, biofuel development and expand its potential. Technology and policy developments in other areas of renewable energy and in the field of energy conservation will also have an impact,

as will overall developments in global and national energy policies and in policies addressing climate-change mitigation.

Biofuels have been seen as offering opportunities both from an economic and social and from an environmental and natural resource perspective. However, also these dimensions are surrounded by considerable uncertainty, and their actual magnitude is not clear. The socio-economic opportunities derive from an increase in demand for farm output, which could boost rural incomes and stimulate rural development. From the environmental and natural resource perspective, there have been expectations that biofuels may, under appropriate conditions, contribute to reducing greenhouse gas emissions. Other expected benefits have included reductions in emissions of regulated air pollutants from combustion engines and the potential for biomass feedstocks to contribute to restoring degraded lands.

Greater attention is now being paid to the risks involved in biofuel development. The risks, which have been documented by this report, are both socio-economic and environmental. The socio-economic risks are largely associated with the negative implications on poor and vulnerable net food buyers of higher food prices resulting from increased demand for agricultural commodities. The increased competition for resources – land and water – may also pose threats to poor unempowered rural dwellers who lack tenure security, with women often among the most vulnerable. From the environmental perspective, it is becoming clear that greenhouse gas emission reductions are far from a guaranteed outcome of substituting biofuels for fossil fuels. The impact depends on how biofuels are produced – both in terms of how crops are grown and of how conversion takes place – as well as on how they are brought to the market. The global impact is more likely to be negative if large tracts of additional land are brought under agricultural cultivation.

Policy coherence

Biofuel developments are shaped by several different policy domains – agriculture, energy, transport, environment and trade – often without clear coordination

and coherence among the policies pursued in each. Only if the role of biofuels is considered in relation to each of these policy domains can it be ensured that they play the appropriate role in reaching the various policy objectives.

For example, biofuels currently rely on many of the same agricultural commodities that are destined for food use. Their feedstocks compete with conventional agriculture for land and other productive resources; food and agriculture policy is therefore central to biofuel policy development. At the same time, biofuels are only one among many possible sources of renewable energy, a field where technological innovation is moving rapidly; therefore biofuel policy must be considered within the wider context of energy policy. Similarly, biofuels only constitute one option for reducing greenhouse gas emissions, and so must be evaluated against alternative mitigation strategies. Choices in the field of transport policies also crucially affect the demand for liquid biofuels. Finally, trade policies can support or hinder the development of environmentally sustainable biofuels. If trade barriers prevent the most efficient and most sustainable geographic pattern of biofuel production and trade, they may undermine the environmental objectives of biofuels.

Policy principles

Five guiding principles are proposed for effective policy approaches to biofuels.

- Biofuel policies must be protective of the poor and food-insecure. Priority should be given to the problems posed by higher food prices for the food-importing countries, especially among the least-developed countries, and the poor and vulnerable net food buyers in rural and urban areas. Potential opportunities to improve food security and the rural economy offered by biofuel developments should be exploited.
- They should be growth-enabling, both by improving economic and technical efficiency and by ensuring that developing countries can participate in future market opportunities. Policies should therefore promote research and development, thereby enhancing the efficiency, as well as environmental

sustainability, of feedstock production and biofuel conversion processes. Similarly, they should create an enabling environment to support a broad-based supply response to biofuel demand in developing countries, allowing poor farmers the possibility of reaping the benefits.

- Biofuel policies should be environmentally sustainable. They should strive to ensure that biofuels make a strong positive contribution to reducing greenhouse gas emissions, protect land and water resources from depletion and environmental damage and prevent excessive new loadings of pollutants.
- They should be outward-looking and market-oriented so as to reduce existing distortions in biofuel and agricultural markets and avoid introducing new ones. They should also be based on a consideration of unintended consequences that may go beyond national borders.
- Policies should be developed with appropriate international coordination to ensure that the international system supports environmental sustainability goals as well as social goals for agricultural development and poverty and hunger reduction.

Areas for policy action

The following section reviews some of the main policy issues to be addressed in order to ensure the environmentally and socially sustainable development of the biofuels sector. Some of the issues raised are specific to biofuels. Others are well-known issues that relate to sustainable agricultural development and food security in general, but that are gaining increased importance by the emergence of biofuels as a new source of demand for agricultural commodities.

Protecting the poor and food-insecure

As has been emphasized, biofuel policies are not the only reason behind the recent increase in commodity prices. Nevertheless, growing demand for biofuels has certainly contributed to the upward pressure on agricultural and food prices and could continue to do so for some time to come,

even if and when some of the other factors underlying the current high prices subside. The magnitude of the effect is uncertain and will depend on the pace of development of the sector and on the policies relating to biofuel development pursued in both developed and developing countries. However, there is a clear need to address the negative food-security implications for net food-importing developing countries (especially the least-developed countries) and poor net food-buying households, even beyond the current emergency situation of widespread and severe threats to food security.

An important step forward would be for countries to refrain from pursuing and adopting policies that put a premium on and promote demand for biofuel feedstocks to the detriment of food supplies, as is the case for the current widely applied mandates and subsidies supporting biofuel production and consumption.

Safety nets are required to protect poor and vulnerable net food buyers from nutritional deprivation and reductions in their real purchasing power. In the immediate context of rapidly rising food prices, protecting the most vulnerable may require direct food distribution, targeted food subsidies and cash transfers, and nutritional programmes such as school feeding. Import and generalized subsidies may also be required. In the short-to-medium run, social protection programmes must be established, or expanded and strengthened. Well-organized and targeted social protection systems are potentially capable of providing direct support to the neediest at a substantially lower cost than that of more broad-based actions; this, in turn, makes them more sustainable.

In the medium-to-long run, the impact of higher food prices could be mitigated by a supply response from the agriculture sector. Such a response would require effective transmission of prices to the farmgate. Effective price transmission is dependent both on policy and on the existence of adequate institutional and physical infrastructure to support effective markets. Policy interventions to control prices or disrupt trade flows, while providing an apparent immediate relief, may be counterproductive in the longer run, because

they interfere with price incentives to producers. Investment in infrastructure for storage and transportation is also crucial for the effective functioning of markets.

Taking advantage of opportunities for agricultural and rural development

While representing an immediate threat to the food security of poor and vulnerable net food buyers, higher prices for agricultural commodities induced by growing demand for biofuels can present long-term opportunities for agricultural and rural development, income generation and employment. They can constitute an important element in the effort to re-launch agriculture by providing incentives to the private sector to invest and produce. However, higher prices alone will not generate broad-based agricultural development; investments in productivity increases in developing countries will be an indispensable complement. Productivity increases will require significant and sustained improvements in long-neglected areas such as research, extension, and agricultural and general infrastructure, along with credit and risk-management instruments – all of which must complement improved price incentives.

Efforts need to focus particularly on enabling poor rural producers – those who are least able to respond to changing market signals – to expand their production and marketed supply. Agricultural research must address the needs of such poor producers, many of whom farm in increasingly marginal areas. It is also crucial to enhance their access to agricultural services, including extension, and financial services, and to strengthen their capacity to take advantage of these services. No less fundamental is securing their access to natural resources such as land and water and fostering their participation in non-agricultural sources of income, including payment schemes for environmental services. Land-policy issues are critical, especially the need to ensure that the land rights of vulnerable and disadvantaged communities are respected. Support to poor rural households is needed, to help them strengthen their livelihoods in conditions of ever greater climatic uncertainty, and allow them to benefit from new approaches to managing weather and other risks, including new forms of insurance.

Ensuring environmental sustainability

It must be ensured that further expansion of biofuel production will provide a positive contribution to climate-change mitigation. For this purpose, there is a critical need for an improved understanding of the effects of biofuels on land-use change, which is the source of the most significant effects on greenhouse gas emissions. Other negative environmental impacts must also be assessed and minimized. Harmonized approaches to life-cycle analysis, greenhouse gas balances and criteria for sustainable production should be developed in order to ensure consistency in approach.

Support to biofuels has generated an artificially rapid growth in biofuel production. Reducing the rate of expansion by eliminating subsidies and mandates for biofuel production and consumption will help improve environmental sustainability, as it will allow time for improved technologies and yield increases to become effective and thus ease the pressure for expansion of cultivated areas. Research and development, as well as investing in productivity increases, may help reduce the stress on the natural resource base caused by expanded biofuel production. Indeed, improved technologies, both in feedstock production and conversion to biofuels, will be crucial for ensuring long-term sustainability of biofuel production.

Sustainability criteria and relative certification can help ensure environmental sustainability, although they cannot directly address the effects of land-use change resulting from an increased scale of production. However, criteria must be carefully assessed; they must apply only to global public goods and must be designed so as to avoid creating additional trade barriers and imposing undue constraints on the development potential of developing countries. The issue of possible differential treatment of biofuel feedstocks and agricultural products in general must be addressed and clarified. There is no intrinsic justification for treating the two differently – nor may a distinction be feasible in practice.

As for any type of agricultural production, promotion of good agricultural practices may constitute a practical approach to reducing the negative effects, in terms of climate change and other environmental impacts, of expanded biofuel production. Payments for

environmental services provided by feedstock producers through sustainable production are also an instrument that can be used in conjunction with sustainability criteria to encourage sustainable production. Initially, the promotion of good practices could be combined with capacity building for the countries in greatest need. In time, more stringent standards and certification systems could be gradually introduced.

Reviewing existing biofuel policies

OECD countries, in particular, have been providing significant levels of support to the biofuel sector, without which most of their biofuel production is unlikely to have been economically viable given existing technologies and recent relative prices of commodity feedstocks and crude oil. The main policy objectives, apart from support to farm incomes, have been climate-change mitigation and energy security. The policies adopted have focused on mandates and significant subsidies to production and consumption of liquid biofuels. Trade protection measures, such as tariffs, have limited market access for potential developing-country producers of biofuels, to the detriment of an efficient international pattern of production and resource allocation. Such support and protection have been added to the already extremely high levels of subsidies and protection to the agriculture sector that have characterized agricultural policies in most OECD countries for decades and have exacerbated the market-distorting effects of these policies.

There is an urgent need to review these biofuel policies in the light of emerging knowledge about biofuels and their implications. Such a review should be based on an assessment of their effectiveness in reaching their objectives and of their costs. The evidence discussed in this report indicates that the policies pursued have not been effective in achieving energy security and climate-change mitigation. Indeed, in terms of energy security, biofuels will be able to contribute only a small portion of global energy supply. The assumed mitigation of greenhouse gas emissions is also not certain; it appears that rapid expansion of biofuel production may increase rather than reduce emissions, especially where large-scale land-use change is involved. The policies pursued

have been costly to the OECD countries, and the costs may escalate as production levels expand. Based on current knowledge, the arguments seem weak for maintaining some of the current policies such as blending mandates, subsidies to production and consumption, and trade barriers for biofuels. Expenditures on biofuels would be much better directed towards research and development – both for agriculture in general and biofuels more specifically – aimed at improving economic and technical efficiency, and sustainability, rather than towards subsidies linked to production and consumption. Moving towards second-generation biofuels, in particular, would appear to hold significant promise.

Political economy considerations also speak against the subsidies for biofuels. Even where subsidies could be justified (e.g. based on infant industry arguments) and are intended to be only temporary, experience (e.g. earlier agricultural policies) shows that subsidies are extremely difficult to eliminate once they have become entrenched.

Policy coherence is also a critical issue. Biofuels are only one among many sources of renewable energy and only represent one among a range of alternative strategies for greenhouse gas mitigation. With regard to energy security, it is important to ensure equal conditions for different sources and suppliers of renewable energy, at the national and international levels, and to avoid promoting biofuels over other sources. In the case of greenhouse gas mitigation, carbon taxes and tradable permits constitute mechanisms that place a cost or price on carbon and thereby stimulate the most efficient carbon-reduction response, which may involve energy conservation, biofuels and other technologies.

Abolishing the current mandates and subsidies linked to production and consumption would bring other benefits or minimize some of the negative implications of biofuels. Subsidies and mandates have created an artificially rapid growth in biofuel production, exacerbating some of its negative effects. This policy-induced rapid growth has placed significant upward pressure on food prices and is one of the factors (although perhaps not the most important one) contributing to the recent rapid increase. It is also intensifying the

pressures on the natural resource base through its effects on land-use change. As emphasized above, more gradual development of the sector would ease the upward pressure on prices and reduce the stress on natural resources, as technologies could be developed and disseminated, allowing a larger share of the demand to be met through sustainable yield increases rather than area expansion.

Enhancing international system support to sustainable biofuel development

International trade rules and national trade policies for agriculture and biofuels should be made more conducive to an efficient and equitable international allocation of resources. The current combination of subsidies, mandates and trade barriers does not serve this purpose. Biofuel trade policies should enhance opportunities for agricultural producers and biofuel processors in developing countries, in line with their comparative advantage, by eliminating existing trade barriers. This will contribute to a more efficient pattern of biofuel production at the international level.

There is a need for an appropriate international forum in which sustainability criteria can be debated and agreed so as to ensure that they achieve their intended environmental objectives without creating unnecessary barriers to developing-country suppliers. It is also important to ensure that sustainability criteria and related certification schemes are not introduced unilaterally and do not constitute an additional barrier to trade. To the extent that sustainability criteria are established, the international community has an obligation to provide assistance in capacity building to developing countries.

The international donor community, likewise, has a clear responsibility to support developing countries in addressing the immediate threats to their food security, resulting from higher food prices, by contributing resources for the necessary measures to assist and protect the most vulnerable and negatively affected countries and population groups.

International donors must also recognize the opportunities arising from biofuel development and redouble their support to agricultural development. Many of the

opportunities and challenges associated with biofuels are the same as those already experienced with agricultural expansion and intensification. However, the expansion of biofuels and the ensuing price increases for agricultural products increase the returns on agricultural investments and strengthen the case for enhanced development assistance aimed especially at the agriculture sector.

Conclusions

Production and consumption of biofuels have increased dramatically in the past few years, driven largely by policies aimed at enhancing energy security, reducing greenhouse gas

emissions and supporting agricultural development. This rapid growth has in many ways outpaced our understanding of the potential impacts on food security and the environment. As our recognition of emerging impacts grows, the need arises to put biofuel policies on a more solid base. The challenge we face is that of reducing the risks posed by biofuels while at the same time ensuring that the opportunities they present are shared more widely. There is an urgent need to review existing biofuel policies in an international context in order to protect the poor and food-insecure and to promote broad-based rural and agricultural development while ensuring environmental sustainability.

Views from civil society

Agrofuels or food sovereignty?

From the International Planning Committee for Food Sovereignty (IPC)

www.foodsovereignty.org

The current massive wave of investment in energy production based on the cultivation and industrial processing of crops like maize, soy, palm oil, sugar cane, canola, etc., will not solve the climate crisis nor the energy crisis. It will bring disastrous social and environmental consequences. It is already one of the causes behind the current food crisis. It creates a new and very serious threat to food production by small farmers and to the attainment of food sovereignty for the world population.

It is claimed that agrofuels will help fight climate change. In reality, the opposite is true. The new extensive monoculture plantations for the production of agrofuels are increasing greenhouse gases through deforestation, drainage of wetlands, and dismantling of communal lands. There is simply not enough land in the world to generate all the fuel necessary for an industrial society whose needs for transport of people and goods are continually increasing. The promise of agrofuels creates the illusion that we can continue to consume energy at an ever-growing rate. The only answer to the threat of climate change is to reduce energy use worldwide, and to redirect international trade towards local markets.

To address climate change, we don't need agrofuel plantations to produce fuel energy. Instead, we need to turn the industrial food system upside down. We need policies and strategies to reduce the consumption of energy and to prevent waste. Such policies and strategies already exist and are being fought for. In agriculture and food production, they mean orienting production towards local rather than international markets; they mean adopting strategies to keep people on the land, rather than throwing them off; they mean supporting sustained and sustainable approaches for bringing biodiversity back into agriculture; they mean diversifying agricultural production systems, using and expanding on local knowledge; and they mean putting local communities back in the driving seat of rural development. Or put simply: it means a resolute move towards food sovereignty!

We demand:

- The end of corporate-driven, monoculture-based production of agrofuels. As a first step, a five-year international moratorium on the production, trade and consumption of industrial agrofuels has to be immediately declared.
- An in-depth evaluation of the social and environment costs of the agrofuel boom and of profits made by transnational corporations in the processing and trade of the raw materials.
- The promotion and development of small-scale production and local consumption models and the rejection of consumerism.
- Explicit support from governments and institutions to the sustainable peasant-based model of food production and distribution, with its minimal use of energy, its capacity to create jobs, to respect cultural and biological diversity and its positive effect on global warming (fertile soils are the best way to capture CO₂).
- The reorientation of agricultural policies towards sustainable rural communities and livelihoods based on food sovereignty and genuine agrarian reform.

Biofuels: a new opportunity for family agriculture

From the International Federation of Agricultural Producers (IFAP)

www.ifap.org

The production of food and feed remains paramount for the farmers of IFAP; however, biofuels represent a new market opportunity, help diversify risk and promote rural development. Biofuels are the best option currently available to bring down greenhouse gas emissions from the transport sector and thus to help mitigate climate change. With oil prices currently at record levels, biofuels also support fuel security.

Recently, biofuels have been blamed for soaring food prices. There are many factors behind the rise in food prices, including supply shortages due to poor weather conditions, and changes in eating habits which are generating strong demand. The proportion of agricultural land given over to producing biofuels in the world is very small: 1 percent in Brazil, 1 percent in Europe, 4 percent in the United States of America, and so biofuel production is a marginal factor in the rise in food prices.

The misconceptions about biofuels are important to overcome for a farming community that has long suffered from low incomes. Bioenergy represents a good opportunity to boost rural economies and reduce poverty, provided this production complies with sustainability criteria. Sustainable biofuel production by family farmers is not a threat to food production. It is an opportunity to achieve profitability and to revive rural communities.

Development of biofuels depends on positive public policy frameworks and incentives such as mandatory targets for biofuel use and fiscal incentives that favour biofuels relative to fossil fuels until the industry matures. This is in the public interest when biofuels are produced from local sources since they create employment and wealth in the country. Governments should also provide investment incentives including: income tax credits for small biofuel producers, financing bioenergy plants, increasing farmers' participation through matching grants, and reducing business risk for the adoption of new technologies. Support for research and development, particularly for small-scale technology and enhancing the energy potential of indigenous plants, is crucial.

Biofuels are not a miracle solution, but they offer significant income opportunities for farmers. If farmers are to benefit, careful long-term assessment of economic, environmental and social benefits and costs are required to identify real opportunities aimed at improving producers' incomes. Sound strategies, developed along with the different stakeholders, are needed to capture the potential environmental and economic benefits, including the setting up of a rational land-use policy, appropriate selection of crops and production areas, and protection of rights of farmers. Farmers' organizations need to push for the creation of the right incentive mechanisms that will allow their members to benefit from this new opportunity and generate complementary incomes.

Further research and development are needed in order to avoid competition between food and fuel uses of certain crops and also to get the right signals regarding the development of biofuel production worldwide. Therefore, bridging the knowledge gap on biofuels through information dissemination and capacity building programmes to support farmers in developing ownership of the value chain are of utmost importance.