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BIOENERGY POLICY, MARKETS AND TRADE AND FOOD SECURITY

TECHNICAL BACKGROUND DOCUMENT

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BIOENERGY POLICY, MARKETS AND TRADE AND FOOD SECURITY

Introduction

This report synthesizes the main points made by Expert Group 5, on ‘Bioenergy policy, markets and trade and food security’, and Expert Group 6, on ‘Global perspectives on fuel and food security’, which met jointly from 18-20 February, 2008 at FAO headquarters in Rome. The report focuses on the state-of-the-art, specifically:

- The knowledge base: the longer perspective, knowledge gaps, information needs.
- Impacts on food security: availability, access, utilization, stability.
- Possible technical and policy response: regional, national, international.
- Main findings and recommendations: short, medium and long-term.
- Priority criteria for policy decisions.

The knowledge base

The Global Perspective to 2050

Two of the main drivers of trends in demand for food, feed, fibre and fuel are income and population growth. These projections indicate that population numbers in developed countries have already peaked and food demand has more or less reached the saturation point. However, in developing countries rising incomes, continuing population growth and increasing rates of urbanization mean that more and more people are becoming net consumers of food and fibre products, and have more intense energy demands.

Although growth in demand for cereals is projected to slow, the rise in per-capita incomes that is foreseen in many parts of the developing world will translate into rapidly growing demand for animal protein, especially pigmeat and poultry, with consequent increase in demand for feed. This in turn implies increasing demand for agricultural land and water, although less than if a large part of the demand growth were for beef, with its very high feed requirement compared to pigs and poultry. Overall, FAO forecasts a further slow-down in the demand for agricultural resources to support food production in the period to 2050, even considering the shift toward more animal protein in the diet, resulting in a decline in the growth rate for world agricultural food production from 1.6 percent per year in the period 2000-2015 to 0.8 percent per year in the period 2030-2050.

Even with a slow-down in the growth of food demand and further improvements in yields, FAO anticipates the need for an additional 200 million hectares of land to be brought under cultivation by 2050 - an increase of 14 percent compared with 2006. However, despite the fact that some parts of the world are facing limits on the availability of agricultural water and land, in the absence of climate change, increases in demand for water and land are not projected to be a major factor in determining world market prices for food.

Current projections to 2030 suggest that globally the share of food spending in average household expenditure will continue to decline. This result follows from two fundamental trends. On the one hand, as incomes rise, proportionately less expenditure will be allocated to food and food services. On the other, and importantly, agricultural commodity prices have exhibited a long-term trend decline in real terms for many decades, due mainly to rapid technological progress in agriculture which lowered unit costs of production, and to a slowdown in demand growth.

However, against this long term global perspective for agriculture and food, recent developments appear to be showing signs that the new challenges of increased demand generated by first generation biofuel production are changing markets. Agricultural commodity prices rose sharply in 2006 and 2007. The surge in prices has been led primarily grains, but prices of other commodities, with the exception of sugar, have also increased significantly. Moreover, high international prices for food crops such as grains continue to ripple through the food value/supply chain, contributing to a rise in retail prices of such basic foods as bread or pasta, meat and milk. According to FAO the global food price index rose by 9 percent in 2006 and by 23 percent in 2007. This has triggered a widespread and commonly shared concern about food price inflation, a fear which is fuelling debates about the future direction of agricultural commodity prices in exporting as well as importing countries, be they rich or poor. There is mounting evidence to suggest that the long term decline in real prices of agricultural commodities has shifted to a new paradigm in which agricultural prices have a strong link to energy prices, not only via input costs, but determined by a competitive food versus fuel price linkage. Much depends on the future of international energy markets, role of bioenergy, and the policies of governments.

The International Energy Agency considers that on the basis of fossil fuel availabilities, growing energy demand requirements and current policies, the world is facing an unsustainable energy future. In 2004, total energy demand for all uses was 460 exajoules, with about half consumed in OECD countries and the other half in non-OECD countries. Projections to 2030 suggest that demand will increase to around 690 exajoules, of which 40 percent will be consumed in OECD countries and 60 percent in non-OECD countries. Biofuels currently fill only a tiny fraction of this demand, but preliminary FAO analyses suggest that over the medium-term they could supply a greater share, without reducing capacity to meet projected demand for food and other agricultural commodities. These analyses assume that a much greater variety of feedstocks will become commercially viable than at present.

Climate change could put upward pressure on both food and fuel prices through its influence on the pricing of agricultural water and land. Also, the attribution of market value to environmental services to mitigate climate change has the potential to cause significant changes in relative prices for different food items, and an overall increase in the cost of an average food basket for the consumer, with accompanying increases in price volatility.

Food and fuel security to 2050

Food security has always been dependent on the performance of the agricultural sector, both because it is the sector that supplies both food and the main source of livelihood for over one-third of the world’s population. In the future, the performance of the sector may also matter for fuel security as well.

Although under current assumptions, the projections foresee an improved food security situation at the global level, not all countries are projected to achieve food consumption levels consonant with requirements for good nutrition. In fact, in a number of low-income countries in Asia and Africa, where rates of under-nourishment and population growth rates are currently high, prospects for rapid economic growth are poor and adverse impacts from climate change are projected, the food security situation may worsen. With increasing urbanization, and with the percent of rural household income coming increasingly from off-farm activities, rural communities may experience a re-orientation of production systems and out-migration of youth and aging of their population. Although agriculture will continue to be the backbone of the rural economy, sources of growth will change towards increased dependence on remittances, new opportunities for agro-tourism and other environmental services, and integration across communities and cultures through travel and communication. These trends will increase the economic options available to many currently vulnerable rural people and help lift some out of poverty and food insecurity. For others, however, climate change will increase their vulnerability to market-driven shocks and shortages arising because of increased weather variability and higher incidence of extreme weather events.

The growing role of biofuels in the food security equation

Investments in biofuels have grown rapidly since 2000, accelerating especially in OECD countries and Brazil since 2003, when oil prices began to climb above $25/barrel to surpass $100/barrel in early 2008. Between 2001 and 2007, world production of ethanol tripled from 18.5 billion litres to almost 60 billion litres, while biodiesel rose from 1 billion litres to 9 billion litres, almost ten-fold. Steenblik (2007) estimated U.S. corn-based ethanol production at roughly 18 billion litres in 2006 followed by Brazil at 17 billion litres of ethanol from sugar cane, and the EU at 1.6 billion litres. Biodiesel, the other major biofuel, is produced mainly in the EU, with 4.8 billion litres of production in 2006, compared with 850 million litres in the U.S.[1] World production of ethanol and biodiesel in 2006 was 51 billion litres and 6.5 billion litres, respectively. A growing list of developing countries are beginning to invest in feedstocks for the production of ethanol and biodiesel and are watching both the progress and pitfalls of the "big three": Brazil, the EU and U.S.

These developments are set against a background of rapid changes in the rural sectors of developing countries driven by urbanization, trade integration and a reversal of secular declines in world grain and oilseed prices. These prices have risen rapidly since 2005 due to growing demands from countries such as India and China, production shocks in several major exporting countries, declining stocks, the diversion of food stocks to biofuel use, and other factors. Rising food and feed prices have been a boon to surplus producers of these commodities. But the combined effect of rising oil and food prices has stressed many developing economies and poor households, because most of the 82 FAO low-income food-deficit countries are also net oil importers (Runge and Senauer, 2007).

Biofuel policies are playing a major role

Governments in many countries have initiated or updated existing policies to encourage biofuels, sparked mainly by rapidly rising energy prices. Policy objectives include agricultural and rural development, enhancing domestic fuel security, and addressing concerns for climate change. However policy development is increasingly facing pressure concerning the impact of these policies on food security and their environmental impact particularly on net greenhouse gas (GHG) emissions, land-use changes, water depletion and other environmental issues.

The outlook for food, agriculture and energy suggests that the substantial sums spent in OECD countries to subsidize the biofuels sector are encouraging rapid investments that are consuming a growing share of feedgrains, oilseeds and other crops. In the U.S., once a reliable supplier of exported grain and oilseeds for food, biofuels are projected to consume more than 30 percent of record maize harvests in 2007 and as much as 50 percent or more by 2015 even as export demand remains strong, driving prices farther upward. In the EU, ethanol and biodiesel are projected to

[1] Ethanol from maize is processed from dried grain to produce denatured alcohol dried distillers feed grains with solubles (DDGS) and CO_2. Sugar cane-based ethanol converts juice from cane to ethanol and CO_2 , using cane residues to heat and distill the ethanol in a process that is half the cost per litre or less than corn-based fuel. Biodiesel fuels involve different technologies which convert oils or fats from soybeans, rapeseed, sunflowers, oil palm or rendered grease into additives that can be blended with petroleum diesel. These oils are reacted with methanol and potassium chloride to separate the glycerine molecules, which can be sold separately for use in soap or cosmetics.

increase oilseed, maize and wheat usage from negligible levels in 2004 to roughly 21, 17 and 5 million tonnes, respectively, in 2016 (OECD-FAO, 2007).

Government supports underpinning the biofuels industry have grown rapidly; it is fair to say that until oil prices began rising rapidly after 2004, biofuels would have been unprofitable without these subsidies, which in 2006 totalled more than 11 billion dollars in the OECD countries (de Gorter and Just, 2008; Steenblik, 2007). This support has expanded since 2005, notwithstanding the rise in oil prices to over $100/barrel. The U.S. leads this list, with over 6 billion U.S. dollars in annual support, followed by the EU with about 4.8 billion U.S. dollars. Brazil has also based its sugar cane-based industry on a variety of direct and indirect subsidies, which have declined in recent years.

Five main policy instruments support the biofuels industry, apart from the crop price supports that encourage production of feedstocks. The first of these are mandates (sometimes described as "renewable fuels standards"). In the U.S., 2007 energy legislation raised mandated production of biofuels to 36 billion gallons by 2022. The EU set targets for biofuels at 2 percent of liquid motor fuel demand in 2005, and at 5.75 percent by 2010, accompanied by mandatory blending requirements in nine Member States. As a prelude to new mandatory requirements, in January 2007 the European Commission announced new pollution standards for motor fuels based on developing methods to measure the carbon-output of different fuels and certification of life-cycle carbon emissions, in recognition of growing concerns over the GHG implications of the biofuels industry.

The second main set of instruments is direct biofuel production subsidies, which also raise feedstock prices. In the U.S., blenders are paid a 51 cent-per-gallon "blender's credit" for ethanol, and a $1.00 credit for plant-based biodiesel. These are topped off by additional volumetric credits in many U.S. states. The EU pays subsidies to turn surplus low-grade wine into alcohol fuel as part of its "crisis distillation" policy.

The third main policy instrument is a tariff on imported biofuel to protect domestic production from competition, such as the 54 cent-per-gallon U.S. tariff on imported ethanol markets. The U.S. thus now converts over 30 percent of its feed maize, in which it has a distinct comparative advantage, to ethanol, which the 54 cent-per-gallon tariff demonstrates has a clear comparative disadvantage against competitors. The EU's tariff on denatured ethyl alcohol adds 50 percent to the cost of imported ethanol.

Fourth are subsidies for the distribution, storage and transport of biofuels. Ethanol requires distribution, transport and storage to be separate from petroleum fuels because it contains water and is corrosive to petroleum facilities. In order to encourage the construction of biofuels facilities, the U.S. applies a 30 percent "fuel property tax credit" for installing E-85 facilities. It also subsidizes flexible fuel vehicles by exempting them from fuel-economy (CAFE) standards.

A final set of subsidies to the industry involves public grants to support R&D into better conversion technologies, notably "2nd generation" cellulosic biofuels. The U.S. Department of Energy has paid six "pilot" cellulosic plants a total of 385 million dollars to subsidize cellulosic ethanol, a measure of its current lack of competitiveness. It is important to note that despite the 21 billion gallon U.S. cellulosic mandate (part of the 36 billion gallon mandate for 2022), no cellulosic ethanol has yet been produced in the U.S. on competitive commercial terms. And unless production of U.S. ethanol shifts significantly away from the U.S. Cornbelt, the incentive to grow and supply any feedstock but maize (now priced at highs in excess of $6.00/bushel) will be limited.

The combined effect of these subsidies, especially in the U.S. and EU, together with the rapid increases in the price of oil (for which biofuels are a substitute) has been to encourage further expansion of ethanol and biodiesel production capacity. The result: ethanol producers can pay higher and higher prices for feedstocks, illustrated by the near-record early 2008 levels of maize, soybean and wheat prices. While these prices may return to their secular trend levels at some point (if yield increases and hectares opened to new plantings occur) projections suggest they may go 30-50 percent higher in the short-run, even assuming normal weather and yields.

In developing countries, meanwhile, the ability to pay comparable subsidies to biofuels does not exist. Still, many developing countries, such as Angola, Malaysia and Thailand are encouraging ethanol and biodiesel production (from sugar cane, oil palm, sugar and cassava). Many more are considering how they can be part of the biofuels boom, and if the employment and rural development opportunities are worth land conversion to supply feedstocks and produce biofuels.

Assessment of the impact of biofuels

Careful assessment of these trends has given rise to criticisms from economists, ecologists, and NGO's who point to gaps in our state of knowledge and call for additional analysis of biofuels' effects. In making assessments of these impacts, it is important to disentangle the impact of biofuel development as driven by the current and prospective economics surrounding investments in both first and second generation biofuels, from the impact of biofuel policies themselves, which have been undertaken to affect this development.

The economics surrounding biofuel development are complex, from agricultural producers, to processor/biofuel producers, to distributors and consumers, where profit or cost minimization rules work to signal resource allocation and consumption, subject to different technological situations and infrastructures that are very different by country, and which are changing significantly over time. Higher oil/energy prices are a fundamental trigger that, depending on local economics may create incentives for biofuel production from various feedstocks, using required resources in competition with other demands. The consequences for local economies or for international markets depend on many economic factors that also include industrial organization, depend critically on local resources and contexts, including market size and trade. The environmental impacts are not fixed but vary according to economic conditions and technologies. Full assessment of these is required for policy development that is oriented to achieving objectives for biofuel development.

There are three main impact areas:

- Economic distortions and unintended consequences of policies.
- Food prices and food security in poor households, especially in food-importing developing countries.
- Environmental and ecological impacts on land-use, air and water quality, water quantity, and global GHG emissions related to climate change.

Economic Distortions of Biofuels Subsidies

As one set of subsidies for biofuels has been layered on pre-existing ones, and as national subsidies have been joined by state and sub-national supports, their effects are often complex and contradictory. For example, the U.S. credit of 51 cents-per-gallon is often argued to be offset by the 54 cent-per-gallon tariff (largely by ethanol producers themselves, who suggest, erroneously, a sort of budget neutrality). The mandates provided under 2005 and 2007 legislation were laid on top of the blender's credit and tariff. It is clear that without at least some of these subsidies, ethanol production in the U.S. would not have been viable. But their combined effects, including the U.S. 36 billion gallon mandate by 2022, have encouraged new construction of ethanol plants. These may be thought less risky than is in fact the case, especially as rising maize prices (the feedstock of 95 percent of U.S. plants) also raises primary input costs (as well as the cost of soybeans, the indirect feedstock for soy-biodiesel). Even with mandates and blenders credits, rising feedstock prices, combined with logistical problems in delivery of ethanol due to lack of infrastructure, created gluts and declining ethanol prices in 2007.

A recent analysis by de Gorter and Just (2008) illustrates the substantial losses in welfare resulting from the combined effect of blender's credits and mandates, and argues that the ironic result is to subsidize U.S. gasoline consumption, exactly the opposite of ethanol's purported intent of reducing reliance on petroleum fuels. Results from global models that include commodity markets and biofuel production linked to feedstock demand, point to the sizable impact of policies on biofuel production, commodity production, trade and prices on both the global and national contexts. While quantitatively, OECD policies show the greatest impact, in particular those of the United States and European Union, the growth of production subsidies/tax incentives, consumption mandates and border policies in a myriad of countries is creating a cumulative impact and leading to a global policy error in which prices of resources and outputs are not priced appropriately for their efficient use.

Biofuels policies, reliant on both high domestic subsidies and border protection through tariffs, also contradict the goals of the Doha Round to reduce domestic subsidies and expand market access to developing countries. In this respect, they mirror the most distorting aspects of domestic support and border measures practiced in the farm sector, and discourage developing countries from investing in biofuels as an export-promotion strategy. Biofuels are not now classified consistently in the harmonized classification system, and policies may be considered under varying texts of WTO, including those respecting agricultural goods, industrial goods, and possibly environmental goods.

Food Prices and Food Security in Poor Households

The rapid increase in grain and oilseed prices due to biofuels expansion represents a shock to food prices worldwide. In the OECD countries, the effect has been felt especially in relation to animal agriculture – the beef, pork, poultry, eggs and milk resulting from maize and soybean-derived feeds. In the U.S., the consumer price index for food calculated by USDA increased in 2007 by 4 percent, the highest annual increase since 1990, and is projected to rise in 2008 by another 3.0-4.0 percent. The index of meat prices rose in 2006-2007 by 3.3 percent, poultry by 5.2 percent, eggs 29.2 percent, and dairy products by 7.4 percent. Price effects were also felt in the processed food sector, where maize, wheat and soybean-derived products are prominent. Food manufacturers including canned and frozen vegetable producers have also felt the transmission effects of these food price shocks. As farmland was diverted from other crops to grow maize (U.S. maize acres expanded by 20 percent in 2007, mainly drawing land away from soybeans and land conservation programs such as the CRP), vegetable processing firms raised the premiums paid to contract growers to keep them from turning to maize. These cost increases will eventually appear in prices for canned and frozen vegetables.

Worldwide, maize prices rose 54 percent from 2004-2006, wheat prices 34 percent, soybean oil prices 71 percent and sugar prices 75 percent. In 2006-2007, this rate of increase accelerated, according to USDA (2008, p. 2), "due to continued demand for biofuels and drought in major producing countries." Maize prices rose 28 percent and wheat prices by 35 percent. In rich countries such as the U.S., these shifts fell most heavily on the poorest, who consumed disproportionate shares of processed foods and spent a higher percentage of disposable income on food in general. But it is in poor countries that the price increases posed direct threats to disposable income and food security. There, the run up in food prices (which the OECD in its ten-year outlook of 2006-2015 identified as a fundamental structural shift) the boom had a double-edge. For those producers of maize, soybeans, wheat or cassava that have surpluses to sell, higher prices offered new hope and opportunity. But for the nearly one-billion of the world's poor who are chronically food-insecure, they foretold deepening poverty and hunger (see Runge, et al., 2003). These are poor farmers in countries such as Bangladesh who can barely support a household on a subsistence basis, and who have little if any surplus production. They are also poor slum-dwellers in Lagos, Calcutta, Manila or Mexico City who produce no food at all. They are net-consumers of food, not producers, who spend as much as 90 percent of their meager household incomes just to eat.

Environmental and Ecological Impacts

Perhaps the most salient set of issues of biofuels policy relate to their local, national and global impacts on the natural environment. At the local level, water shortages due to the huge volumes necessary to process grains or sugar into ethanol are not uncommon, and are amplified if these crops are irrigated. Growing corn to produce ethanol, according to a recent study by the U.S. National Academy of Sciences (2007), consumes 200 times more water than the water used to process corn into ethanol, which involves about 4 litres of water per litre of ethanol, compared with 1.5 litres of water per litre of gasoline. Local complaints over odors and particulate pollution are also prevalent.

In well-watered areas, such as the Corn Belt of the Upper Midwest U.S., another more serious problem may arise. Maize plantings, which expanded by nearly 20 percent in 2007 in response to ethanol demands, required extensive fertilization, adding to nitrogen (N) and phosphorus (P) loadings that run off into lakes and streams and eventually enter the Mississippi watershed. This runoff is aggravated by systems of subterranean tiles and drains (98 percent of Iowa's arable fields are tiled) which accelerates field drainage into ditches and local watersheds (Petrolia, 2005). As a result, loadings of N and P into the Mississippi, and hence the Gulf of Mexico, encourage algae growth and eutrophication, starving the Gulf of oxygen needed by aquatic life and enlarging the hypoxic "Dead Zone." Using data from the U.S. Geological Service, which keeps track of the Dead Zone, scientists predicted in 2007 that it would expand in 2007-2008 to 22,127 km2 – 25 percent higher than the year before and its largest extent since measurements began in 1985 (Turner and Rabalais, 2007).

While Brazil reports ample water supplies for its ethanol industry, and sufficient suitable land to allow continued expansion of cane, land use pressures elsewhere appear less neutral. In general, sugarcane production in most areas does not rely on irrigation, and the most competitive sugar producing regions have ample water supplies. In a recent evaluation of forest cover and land use, Righaleto and Spracklen (2007) note that to substitute ethanol and biodiesel for petrol and diesel by 10 percent in the U.S. would require 43 percent of current U.S. cropland for biofuel feedstocks (whether 1st or 2nd generation), the EU would need to commit 38 percent of its cropland base. Otherwise, new lands will need to be brought into cultivation, drawn disproportionately from those more vulnerable to environmental damages.

Two recent studies focused on the question of carbon loadings and GHG emissions due to land use shifts resulting from biofuels. Fargione, et al. (2008) argue that if land is converted from rainforests, peatlands, savannas or grasslands to produce biofuels, it will immediately incur a "carbon debt." Calculating the savings on greenhouse gas emissions from biofuels compared to fossil fuels, the authors calculate the time in years necessary to repay this debt. In the case of maize for ethanol, this time is 93 years (48 years if grown on "abandoned" cropland); for soybean biodiesel from rainforest it is 319 years; for palm oil biodiesel 423 years on peatland rainforest. In light of the urgency of actions to confront global warming, this long "payback" to biofuels is disappointing, suggesting that other measures would be far more effective in facing GHG challenges.

Searchinger, et al. (2008) examine how land-use changes for biofuels feedstocks may displace crops previously grown to new areas which then require further land use conversions. Using a worldwide agricultural model to estimate emissions from these land use changes, they estimate that corn-based ethanol nearly doubles greenhouse emissions over 30 years, and increases greenhouse gases for 167 years. (These impacts would be reduced to the extent that crop yield growth accelerates in response to higher commodity prices—rather than growing at trend rates as assumed in their analysis.) Biofuels from switchgrass, if grown on U.S. corn lands, would increase greenhouse emissions by 50 percent.

A third study emphasizes the links from the heavy applications of nitrogen needed to grow expanded feedstocks of maize and rapeseed (Crutzen, et al., 2007). The nitrogen necessary to grow corn and rapeseed releases N2O into the atmosphere, a greenhouse gas 296 times more damaging than CO2, and contributes more to global warming than biofuels save through fossil fuel reductions, making them net greenhouse gas negative. These results do not even include the fossil fuels used on farms or for fertilizer and pesticide production.

Models of climate change reinforce a need to continue analysis of the impacts of biofuels to determine whether certain feedstocks are negative, neutral or positive in their effects on GHG emissions. They conclude that conventional feedstocks perform inadequately for environmental criteria, especially if cultivation leads to conversion of grassland or forests. Models clearly point to the conclusion that the use of cellulosic feedstocks in second generation biofuels can achieve positive or neutral effects, underscoring the need to move rapidly in this direction.

Whither Food Security?

With respect to food security, there is reason for concern over the current effects of biofuels. The high food prices of 2006 increased the food import bill of the developing countries by 10 percent over 2005. But by the end of 2007, the annual rate of increase was estimated at 28 percent. Some countries stand out for their vulnerability to price increases. Work by IFPRI (2007) shows that in rural Ethiopia the share of food expenditures in was 70 percent in 1999 and the share of energy was 10 percent. Corresponding shares for Bangladesh were 66 percent and 9 percent, and for Tajikistan 71 and 5 percent respectively. Scenario analysis to 2020 suggests that real commodity prices could increase 25-60% under a large expansion of biofuel production, and calorie availability would be significantly affected in many already undernourished countries.

Other research shows similar findings. The Economic Research Service of USDA Food Security Assessment model of 70 low-income countries estimates the "food gap": the "amount of food needed to raise consumption of all income groups to the nutritional requirement of roughly 2,100 calories per person" (USDA, 2008, p. 4). A baseline scenario of the food gap in 2016 assumed a 1 percent annual food price increase from 2007-2016, resulting in a food gap of 25.2 million tons by 2016. But if the estimated 28 percent grain price increase actually occurring in 2007 is used, followed by an assumed return to 1 percent annual increases thereafter, the shock raises the food gap by 8 percent *in one year* to 27.2 million tons. When broken down by region, Latin America and the Caribbean experience a 24 percent increase, while Asia's increase is 9 percent and Sub-

Saharan Africa's is 6 percent. Certain countries, such as Guatemala, Honduras and Peru, see food gap increases of more than 20 percent.

The consequences of such a shock are also noteworthy in relation to available food aid. Even given the unrealistic assumption that a 28 percent food price increase in 2007 will be followed by a return to 1 percent increases from 2008-2016, the quantity of food aid donations, which averaged 7.5 million tons a year from 2004-2006, falls to 5 million tons by 2016 with constant spending, covering only 17 percent of the projected food gap, compared with 25 percent coverage in 2006. To maintain the 2006 level of food aid at 8 million tons, food aid budgets will need to rise by 35 percent over the next decade (USDA, 2008, p. 6).

However, despite the foregoing, biofuel development does not have to be adverse for economic welfare and food security, especially if production is allowed to find its natural competitive equilibrium, in which government policies are more efficiently aligned to objectives, and do not distort resource allocation. There can be also positive effects of biofuel development, depending on specific circumstances. Biofuels are a new driver for investment in agriculture, the sector on which most of the rural food insecure depend for their livelihoods. Biofuels can increase value added to agricultural land, offer new market opportunities and boost demand for labour. Solid fuels could help the rural poor as cleaner sources of energy than current sources, helping to improve health. These need to be assessed carefully, and more than just at the aggregate level.

If as many experts predict, 2nd generation biofuels come on stream during the next decade or two, this may create new livelihood opportunities and improve food security for many currently vulnerable people living on degraded lands where lignocellulosic feedstocks could eventually be produced. Such a development would also constitute a good option for mitigating and adapting to climate change on these lands, since the introduction of woody vegetation would sequester carbon, improve the water retention capacity of the soil and reduce erosion.

Even without 2nd generation biofuels, the mix of feedstocks and biofuels in use is likely to change over the medium-term. For example, FAO projects that traditional sources of biofuel will decline in importance as opportunity costs for labor increase and rural people can no longer afford the time to collect fuel wood or burn charcoal. At some point rising prices for oil will make methane (biogas) competitive and eventually, butanol is likely to replace ethanol for mixture with gasoline as a transport fuel.

Diversification of biomass feedstocks, including greater use of agricultural and municipal wastes as well as of a greater variety of biofuel crops and woody vegetation as these become economically attractive, may contribute to fuel security at all levels - an increasing concern for many countries in the face of tightening crude oil markets.

Possible technical and policy responses: national, regional, international

Technical responses are necessary to the foregoing impacts of biofuels on:

- Economic distortions and unintended consequences.
- Food prices and food security.
- Environmental and ecological impacts, including GHG emissions.

The first issue, economic distortions and unintended consequences, requires detailed technical analysis of known and thus far unknown and unstudied interactions between policy instruments. Both de Gorter and Just (2007, 2008) and Steenblik (2007) have pointed to some of the unintended consequences of “subsidy stacking”. FAO and governments should undertake technical reviews respecting food security, “subsidy stacking” and the environmental impacts of biofuels expansion. Especially where assessments are global or transboundary in nature, multilateral review by FAO/OECD, WTO and other groups such as UNEP may be appropriate. It is fundamental that biofuel policies be reviewed with respect to their classification at WTO, in order to provide guidance and discipline for policy development in a manner that limits transborder policy spillovers, and enables a rational development of the global biofuel industry.

The second issue, prices and food security requires further analysis by FAO/OECD and member governments of threats to food security posed by run-ups in commodities prices, especially in countries most vulnerable to grain price increases and in most need of food aid to alleviate the food gap—including analysis of the impact of price increases on employment and incomes.

The third area, environmental and ecological impacts, requires technical assessments at all levels – regional, national and international. At the subnational level, monitoring of water resource quantity and quality, including groundwater depletion and surface water pollution from nitrogen and phosphorus loadings, will be critical, as will be analysis of the impact of price increases on production practices and crop yields. At the national and international level, ocean pollution (such as the Dead Zone in the Gulf of Mississippi) must also be monitored. Finally, the GHG emissions resulting from biofuels require full life-cycle assessments of land and forest clearing, alternative feedstocks, and the use of fossil fuels and fertilizers to grow them.

These reviews and assessments do not require the creation of a separate multilateral entity. FAO/OECD are well placed to undertake these under their current authority. However, it would be useful for FAO/OECD to develop some type of globally-based information and data clearinghouse on biofuels and the issues and challenges they pose.

Main findings and recommendations

The main findings and recommendation of this technical report are stated below.

- Rapid increases in biofuel production have important implications for global food security and climate change.
- These developments are set against rapid changes in the rural sectors of developing countries driven by urbanization, trade integration and reversals in secular declines in world grain and oilseed prices.
- Most of the world’s food insecure countries are also net oil importers, caught between rising petroleum and food prices.
- Rapid increases in biofuels production are supported both by escalating oil prices (for which biofuels are a substitute) and by expanding subsidies and mandates.
- Biofuels are also subject to border protections, distribution, storage and transport subsidies, and sponsored R&D into conversion technologies for cellulosic or “2nd generation” biofuels. Biofuel trade is not classified consistently in the harmonized system, and this is required if future WTO discussion on appropriate disciplines for biofuel tariffs and subsidies are to be discussed.
- Many developing countries, who cannot afford subsidies, are considering how they can benefit from the biofuels boom, and if the employment and rural development opportunities are worth land conversion to supply feedstocks and produce biofuels.
- These trends have given rise to criticisms from economists, ecologists and NGOs, who point to gaps in our state of knowledge and call for additional analysis of biofuel’s effects in three main impact areas: (1)) economic distortions and

unintended consequences of OECD subsidies; (2) food prices and food security in poor households, especially in food-importing developing countries; (3) environmental and ecological impacts on land-use, air and water quality, water quantity and global GHG emissions related to climate change.

- Technical responses to these issues are necessary and require further analysis by FAO/OECD and member governments in all three impact areas, including a matrix evaluating costs and environmental impacts of various biofuel feedstocks in different countries and agro-ecological subzones.
- Policy responses are also urgently needed, in which the technical responses noted above inform policy reforms built around a set of principles and criteria described in the conclusion of this report.
- There is no need for a separate multilateral entity on biofuels; FAO/OECD are well-placed to provide guidance to governments. However, they might develop a globally-based information and data clearinghouse on biofuels.

Policy criteria for policy decisions

In developing policies for the biofuels sector, the following principles can be helpful guideposts:

- Make policies more market-oriented and outward looking;
- Incorporate the full environmental impacts of trends, including air, land and water pollution, land use changes, and atmospheric CO_2 and N_2O loadings;
- Initiate growth-enabling policies to promote R&D with the objective of improving economic and physical efficiencies of feedstock production and biofuel conversion processes
- Protect the poor and food-insecure as a priority, with attention both to food availability and oil import-dependency.

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