ILO climate change and employment

.

Case study no. 1

Brazil and biofuels

February 2008

Introduction

Increasing developments in how best to address climate change – through mitigation and adaptation have in some cases led to aggressive market responses, none more so than in the rapid growth of the global biofuels industry. Analysts forecast that the global annual biofuel capacity will double to 25 billion gallons over the next five years and could reach 80 billion gallons by 2020 (Riese, 2007).

This recent boom in biofuel production is generating vigorous debate on social, economic and environmental grounds. This case study will examine the impact of climate change on livelihoods and employment, by looking at Brazil's rapidly growing biofuel industry and its impact on agriculture and poverty reduction.

Biofuels

Global production of biofuels reached 20 million tons of oil equivalents (Mtoe) in 2005, representing about 1% of total road transport fuel energy consumption (International Energy Agency, 2007). Brazil and the United States together account for 90% (GTZ *et al*., 2006) of global supply. Ethanol production is increasing rapidly in many parts of the world due to higher oil prices, climate change, government incentives, increasing availability of flex fuel cars, and mandates on fuel blending.

Biofuels are liquid, solid or gas fuels derived from biomass, either from recently living organisms or from their metabolic waste. Biomass refers to organic matter made from plants and animals. (For an explanation of first- and second generation biofuels see Box 1.)

Brazil's ethanol experience

Brazil's economy and land mass dominate Latin America. Brazil is among the ten largest economies in the world, the third largest user of energy, and the largest producer of the biofuel ethanol.

Two years after the 1973 Oil Crisis, Brazil launched the 'PróAlcool' ethanol[1] programme, and it remains to date the largest commercial initiative of biofuel production for transport in the world (WWF, 2007a). Since 1975, Brazil has saved some US$ 100 billion in foreign exchange while also reportedly boosting rural incomes, improving air quality, and reducing greenhouse gas emissions.

Nearly half of Brazil's sugarcane crop is destined for ethanol production each year, accounting for 40 percent of domestic transportation fuel use (WRI, 2005). In 2005 (latest figures), Brazil produced a total of 16.82 billion litres of ethanol, while its sugarcane production for 2005-06 stood at 423 million metric tons. Forecasted growth of ethanol production in Brazil (2007-2010) is likely to attain Compound Annual Growth Rate (CAGR) of 8.48% (www.marketresearch.com).

Brazil's ethanol sector

Brazil has about five million hectares under sugar cane, a fifth of its total land under cultivation. In Brazil, it is estimated that there are around 60,000 crop suppliers (e.g., farmers and farmer co-operatives) supplying over 400 industrial processing plants producing ethanol (e.g., bioreactors and distilleries) with a further 50 such units under construction (Mathews, 2006).

In July 2007, President Luiz Inácio Lula da Silva told an EU-sponsored international conference that his country's use of biofuels had reduced its dependence on fossil fuels by 40% and created six million jobs while cutting deforestation by a half (www.guardian.co.uk).

Climate change, along with diversity and security of energy supply, remain the primary driving forces for Brazil's biofuel industry. However, many other social, economic and environmental challenges remain:

- *Social challenges* – Sugar cane expansion for ethanol production may further reduce access to land and drive up food prices in the context of an already existing highly unequal income distribution – where 50 million Brazilians live below the poverty line. In addition, human rights and labour organisations believe that between 25,000 to 40,000 people could be working in conditions akin to slavery in Brazil's ethanol sector (BBC, 2007).

[1] Ethanol or bioethanol is an alcohol derived from sugar or starch crops (e.g., sugar cane, sugar beet or corn) by fermentation. Ethanol can be used either in neat form in specially designed engines or blended with petroleum fuel.

- *Economic challenges* – After achieving economic success with ethanol, the Brazilian government is moving into biodiesel production but import duties both to the US and EU along with non-tariff barriers to trade (e.g., lack of international biofuel standards and certification) will need to be overcome.

- *Environmental challenges* – Given that Brazil is the steward of the world's largest remnant tropical rainforest and of almost 14% of world's freshwater, there are concerns that ethanol-driven agricultural expansion will accelerate deforestation in the Brazilian Amazon, increase soil erosion, damage river ecosystems from excessive water use for irrigation, and reduce access to land for rural farmers. These environmental challenges strongly tie into more social challenges for subsistence farmers.

Carbon footprints, agriculture and poverty reduction

Three particularly critical issues that surround Brazil's biofuel industry are:

- The carbon footprint of biofuel production,
- Its impact on agricultural workers,
- The food versus fuel debate.

All of these issues have implications for employment, enterprise development, and re-skilling workers.

Carbon footprint of biofuel production

Different biofuel feedstocks have different greenhouse gas emissions; as do different biofuel production technologies. When crops grow, they absorb carbon dioxide from the atmosphere, thus negating any greenhouse gas emissions that result from burning biofuels. However, planting, fertilising, harvesting and transporting a biofuel crop requires machinery that utilise fossil fuels, as do the fermentation, distillation and transportation processes. All together, the energy required to generate one gallon of corn-based ethanol is equal to about 60-75 percent of the energy produced (NRDC, 2006). As a result, GHG emissions are only reduced by 15-40 percent relative to oil on a per gallon basis (GTZ et al., 2006).

By contrast, biodiesel and sugar-based ethanol such as produced in Brazil, yield higher net energy gains than corn ethanol, decreasing greenhouse gas emissions by 45-75 percent and 40-90 percent

respectively (reference). Biodiesel GHG nitrous oxide emissions are much higher than initially calculated.

However, decisions to increase biofuel use to levels that have measurable impacts on greenhouse gas concentrations must be carefully weighed against the environmental costs of production as agriculture is a leading driver of deforestation (Clay, 2004), soil erosion and water pollution (reference) which can exacerbate rural poverty and contribute to climate change as is described in the next section on the impacts on agricultural workers in Brazil.

Impacts of biofuels on Brazil's agricultural sector

In March 2007, Brazil and the USA announced a new alliance to promote the use of ethanol. Effectively, the US Administration wants to multiply national consumption of ethanol sevenfold in just 10 years. In the joint press conference, Brazil's President Lula emphasised the social aspects of the new alliance. The new cooperation with the US, he said, will create the conditions to "convince the world that everyone can change the energy blend," by generating "a global market for biofuels" that will "democratise access to energy," create jobs and reduce poverty in developing countries" (IPS, 2007). Although we want to believe this assertion, there is a danger that biofuels are not the panacea to poverty alleviation in Brazil or elsewhere as some would have us believe. Why is this?

Researchers at the UK-based Overseas Development Institute (ODI) argue that biofuels could help to reduce poverty in the developing world, through increased employment, wider economic growth multipliers and energy price effects. However, this potential is described as 'fragile', and is reduced where feedstock production tends to be large scale, or causes pressure on limited agricultural resources including capital investment, land, water, and the net cost of food for the poor (www.odi.org).

With regards to the potential for poverty reduction or exacerbation, biofuels rely on many of the same policy, regulatory or investment shortcomings that impede agriculture as a route to poverty reduction. Since many of these shortcomings require policy improvements at a country level rather than a global one, they argue for a country-by-country analysis of the potential poverty impacts of biofuels. This would consider, among other things, land administration systems, market coordination and prioritising investment in biodiesel, as this 'generates more labour, has lower transportation costs and uses simpler technology' (reference). But biodiesel production as illustrated above has varying GHG gains according to feedstock and processing technologies.

Martin Prowse *et al*., writing in an ODI blog "Millennium Development Goals, agriculture and climate change" noted that "If climate change impacts are greater and sooner than previous models have suggested, it may only be a matter of two or three decades before it becomes much harder for agricultural growth and poverty reduction to be achieved using the approaches currently available. If this is the case it is a clear reason to double and redouble efforts at stimulating small holder driven rural growth processes and poverty reduction immediately." The blog concerns sub-Saharan Africa but the warning is relevant to the situation in Brazil.

In March 2007, WWF took three UK Members of Parliament to Brazil to investigate what climate change means to this emerging economy. "The MPs found contrasting views on the future for the sugar sector. The industry sees opportunity for growth into new parts of Brazil, with a growth in jobs and expansion of market opportunities from biofuels. The NGOs are concerned for environmental impacts of the sector and the need to carefully manage expansion, plus the welfare of sugar workers who are mainly from the poor North East region of Brazil. The MPs themselves want to investigate the potential for Brazilian biofuel to push out the competition in Europe from biofuels produced in the UK (WWF, 2007b).

Food security and biofuels

Climate change will disproportionately affect developing countries and vulnerable populations least able to cope with the changes. The UN Intergovernmental Panel on Climate Change (IPCC) notes that "Agricultural yields are expected to drop in most tropical and sub-tropical regions."

Critics of biofuels highlight the potential environmental and social costs of biofuels, including the possible consequences of increased food prices on the global poor. To the extent that biofuel production will compete with food production for land and water resources, it will drive up the price or limiting the quantity of food produced and it will alter international trade in agriculture products accordingly. As noted earlier, the US and EU have proposed major initiatives to expand biofuel use in the past couple of years. But even before these programs were fully realized, expansion of the industry has revealed what analysts have long understood — there would be food security and environmental consequences.

The potential appetite of the world's 800 million car owners is vast. It took 13% of the US corn harvest in 2005 to displace less than 3% of fuel

needs (RFA, 2007). As the fuel market increasingly competes with food and livestock feed markets over the same crops, the prices of food commodities -- from bread to poultry to cooking oil -- are expected to rise, which could have serious consequences for the over 800 million people worldwide facing chronic hunger. Confirming these fears, corn prices doubled last year, causing social unrest in Mexico where corn tortillas are a dietary staple (BBC News, 2007).

On the other hand, biofuel production can boost incomes in rural areas, where three-quarters of the world's poor reside, which may increase their ability to secure food supplies. The extent to which higher crop prices will hurt or help poor people in developing countries will likely vary from region to region. Deeper analysis is needed to understand the global and local impacts of expanded biofuels demand.

Can Brazil hang onto its ethanol success story?

Some key issues that Brazil will need to address if its ethanol success story is to be a success follow:

- *Support sustainable biofuel management certification* - Support the development of a global independent voluntary third party accredited certification system for biofuels to reduce negative social, economic and environmental impacts of biofuel production. (Note standards already exist for forestry and marine resources and standards are in development for palm oil, soy and sugarcane.)

- *Potential benefit from increased employment opportunities in forest and fibre producing sectors* – There may be increased employment opportunities when the technology for second generation lingo-cellulosic biofuels production comes on-line.

- *Food and energy policy overlap* - Biofuels are pushing the boundaries of traditional industries: If the world were to dramatically ratchet up biofuel production and consumption as suggested by current pledges and plans in the USA and EU, it will be asking development policy and regulatory frameworks traditionally concerned with food and fibre production to enter the complex arena of global energy policy.

Box 1 – First and Second Generation Biofuels

First generation biofuels

First generation biofuels refer to fuel derived from feedstocks harvested for their sugar, starch and/or oil content, which can be converted using methods including: hydrolysis, fermentation and pressing, and esterification technologies. At present, in OECD countries, most ethanol is produced from starchy crops such as corn, wheat, and barley. In tropical countries, like Brazil, ethanol is made primarily made from sugar cane.

Second generation biofuels

Second generation biofuels refer to fuel produced from lingo-cellulosic biomass such as herbaceous and woody perennials, through hydrolysis/fermentation, gasification or pyrolysis technologies. At present there is no large-scale industrial production of biofuels from cellulosic biomass, but research is being carried out in USA, Canada, Germany, Sweden, China, and Brazil.

References

BBC (2007) 'Slave' labourers freed in Brazil. www.bbc.co.uk

Clay, J. W. (2004) *World Agriculture and the Environment. A Commodity by Commodity Guide to Impacts and Practices*. Island Press. Washington DC.

GTZ, WorldWatch, and FNR (2006) *Biofuels for Transportation – Global Potential and Implications for Sustainable Agriculture and Energy in the 21st Century*. Summary Report.

International Energy Agency (2007) *Renewables in Global Energy Supply*. An IEA Fact sheet January 2007. www.iea.org

IPS (2007) Ethanol Deal Represents Convergency of Multiple Interests. Inter Press Service News Agency. www.wbcsd.org

Mathews, J. (2006) *A biofuels manifesto: Why biofuels industry creation should be 'priority number one' for the World Bank and for developing countries*. Macquarie Graduate School of Management, Macquarie University (unpublished) www.gsm.mq.edu.au

Monbiot, G. (2006) *Heat – How to Stop the Planet Burning*. Penguin Books Limited, London. UK

Natural Resources Defence Council (2006) Ethanol Energy: Energy Well Spent – A Survey of Studies Published Since 1990. Natural Resources Defence Council (NRDC) www.nrdc.org

Prowse, M., Peskett, L., and Braunholtz, T. (2007) Climate Change: Endangering the MDGs? *in* Climate Change and Development: Threat and opportunity? Tropical Issues – Climate Change ODI Annual Report 2007. London, UK

RFA (2007) Ethanol Facts – Agriculture. Renewable Fuels Association. http://www.ethanolrfa.org/resource/facts/agriculture/

Riese, J. (2007) Beyond the Hype: Global Growth in the Biofuels Industry (speech) McKinsey & Co addressing the World Congress on Industrial Biotechnology and Bioprocessing.

WRI (2005) March 2007 Monthly Update Global Biofuel Trends. http://earthtrends.wri.org/updates/node/180

WWF (2007a) *Climate Solutions: The WWF Vision for 2050*. WWF International. Gland, Switzerland.

WWF (2007b) Forest, Fish & Carbon Credits. WWF UK, Godalming, United Kingdom. www.wwf.org.uk/core/about/mp_brazil.asp

Related links

Biofuel Review www.biofuelreview.com

OverSeas Development Institute www.odi.org.uk

PróAlcool - Programa Brasileiro de Álcool www.biodieselbr.com/proalcool

World Resources Institute http://earthtrends.wri.org

World Wide Fund for Nature (WWF) www.panda.org