Biomass and SD: Ethanol in Brazil, a single case (André S. Pereira and Emilio L. La Rovere)

1. Public subsidies, now phased out, were fundamental to the Ethanol Program in Brazil. But such public effort would be in vain if the subsidized sector hadn't invested in R&D looking for productivity growth and technical progress, which have been verified in sugarcane crops, in sugarcane processing and in ethanol fired and flex fuel cars manufacturing.

2. High level oil prices, energy security concerns and the global GHG emissions reduction efforts have been pushing domestic production and exports.

3. According to government scenarios, ethanol production in Brazil is expected to grow from 18 billion litters to reach 67 billion liters in 2030, of which 12 billion liters would be exported. To make it in a sustainable way is a non-negligible challenge.

4. Kojima & Johnson (2005) show that gasoline/anhydrous ethanol blend are heavier taxed than hydrous ethanol in Brazil. This taxing policy is a very good example of how government may act if he wants to have some influence on ethanol demand levels in Brazil. The question is to know if the current policy of taxing gasoline/anhydrous ethanol blend heavier than hydrous ethanol would be enough to foster demand or if this policy would have to be deepened in order to do so.

5. A technological breakthrough in ethanol production would be using the cellulose contained in the bagasse as an input. This may double or triple ethanol productivity per hectare, and also reduce land needs in a high production scenario. (For instance, the main ethanol production equipment manufacturer in Brazil claims that after twenty years of development, the flash acid hydrolysis is now able to deliver 109 to 180 liters of additional ethanol per ton of bagasse, at competitive costs, based upon results obtained at its 5,000 liters/day demonstration plant, yet to be scaled-up to 50,000 liters/day. This may nearly double ethanol output per hectare, supplying additional up to 5,600 liters/ha/year on the top of current 6,800 liters/ha.year yield (Fairbanks, 2003). This new market for bagasse would also favor an optimization of energy use at the distilleries, allowing for maximizing bagasse surplus after meeting the heat and power process needs.

6. Pre-harvest burnings are still a problem for local air pollution next to sugar cane fields, but the practice has been progressively banned in São Paulo State, where 60 % of the production is located. This allows for a more efficient use of the sugar cane biomass (the straw and the bagasse).

7. Bagasse is already a very important energy source in its own right, used for generating heat and electricity. The increase of energy efficiency in this process may add almost 100 TWh/year to the system, considering present levels of sugar cane production, and this only with bagasse. If 20% of the straw is also used (most of the straw should be left in the field for agronomic reasons), this extra supply might reach 140 TWh/year.

8. In Brazil, not only ethanol production tends to increase. Biodiesel has also a great potential to be developed. As for the ethanol case, at the beginning, public policies and investments are necessary and desirable to foster investments and futures economies of scale, productivity gains and to improve its contribution to sustainable development. The Biodiesel National Program intends to fill this gap, learning from the ethanol program experience. However, much has to be done yet in further detailing its guidelines to reach a consistent regulatory framework.

9. There is also scope for a potential synergy between biodiesel and ethanol programs. According to Dedini, building a biodiesel transestherification unit integrated to an ethanol distillery may reduce investment costs by 20% to 25% (Olivério, 2005).

10. Ethanol fuel in Brazil contributes to energy matrix diversification. Moreover, it also contributes to improve reliability of internal energy supply, to reduce balance of payments problems related to fossil fuel

imports, to foster sustainable long term energy supply, to promote regional social development and to reduce local pollution and GHG emissions.

11. Even though those positive externalities are evident in the Brazilian case, they are very difficult to be quantified. If so, these externalities might foster even faster biofuels development.

12. Biofuels development represents a major opportunity to rethink rural development and to promote a new rural development cycle, especially in Brazil due to its natural advantages, which include the largest biodiversity in the world, the largest land area still free to agricultural use and several different climates and excellent hydro resources (Sachs, 2004).

13. Biofuels are only a part of biomass use. Biomass can be used to produce not only biofuels but also food, fibres, plastics, construction materials, industrial feedstock and pharmaceuticals. Several developing countries can foster their development on the condition of exploring their biodiversity. Biotechnology should be used both to enhance biomass output and to widen the spectrum of its by-products. In this way, such countries "may engage ahead of industrial countries into a genuinely sustainable and fairly labour intensive development pattern, on the condition of respecting the rules for an ecologically sound management of forests, land and water" (Sachs, 2004).

14. On the long run, it is important to conduct a strategic social and environmental assessment of sugarcane production expansion, with an appropriate zoning, in order to ensure biofuels development sustainability. Air, soil and water pollution, soil erosion, impact on food prices and in land use, especially deforestation; energy balances; LCA and well-to-wheels analysis for GHG emissions reductions estimates and social conditions of manual workers are the questions at stake.

15. Sugar cane ethanol in Brazil is unique case. The energy and GHG balances are definitely very favorable due to some local factors, such as agricultural practices, including low fossil fuel use; a high yield of the culture per hectare; a high yield of fuel per unit of feedstock processed; and a large use of sugarcane biomass to replace fossil energy in the ethanol processing. Therefore, the positive conclusions of sugar cane ethanol in Brazil might be not applicable to other biofuels.

16. It is worth therefore quoting IPCC 4AR WGIII SPM "Biofuels might play an important role in addressing GHG emissions in the transport sector, depending on their production pathway"

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