

# Eco-industrialism: The Potential for Inclusive Growth with Bio-Plastic Production in Brazil Using Sugarcane Ethanol

Peter Wells, Cardiff University, UK

Clóvis Zapata, IPC-UG - UNDP

# Eco-industrialism

- Eco-industrialism is the physical manifestation of industrial ecology whereby several distinct processes and products inter-connected by material flows that collectively result in reduced waste and higher resource efficiency, usually though not always within a spatially concentrated area.
- waste from one process can become the input for another, and that energy and material use are optimised.

# Eco-industrialism

- Kalundborg Community : the entire complex is premised on the consumption of carbon intensive, non-renewable, fuels.
- Asnaes Power Station, a 1,500-megawatt coal-fired power plant; a large oil refinery operated by Statoil; Novo Nordisk, a maker of pharmaceuticals and enzymes; and Gyproc, a plasterboard manufacturer.

# Eco-industrialism

- Research into eco-industrialism is characterised by the use of methodologies such as Materials Flow Analysis and Life Cycle Analysis, or related techniques that seek to quantify observable processes.
- industrial ecology in general tends not to challenge the business or social status quo, and is therefore often inherently conservative rather than radical in a social sense.

# Eco-industrialism and social impacts

- `green economy` has emerged as a central area of future economic development that directly speaks to the relationship between sustainable pathways and poverty alleviation strategies (UNEP, 2011).
- Renewable energy – energy poverty

# The Brazilian experience with biofuels

- Brazil has a large experience with bio-ethanol and relatively new experience with biodiesel.
- Ethanol programme (proalcool) – 1978
- Biodiesel (PNPB)- 2004
- The Biodiesel Programme has organized the supply chain of biodiesel. Specific instruments have been crafted to foster the small-scale farmers' participation, including fiscal incentives, free distribution of seeds, funding and technical assistance.

# Bio-plastics

- large potential with the enhancement of the 'green economy' agenda.
- The technical feasibility of localized production has been proven by the PLA that has the largest bio refinery that is in Nebraska, USA. The refinery makes use of corn for the production of bio-plastic.
- It gets 60% of corn from a local area (Nebraska and Iowa less than 40 kilometres from the plant).

# Sugarcane ethanol and bio-plastic

- Interest in bio-plastic in general has grown as a result of :
  - 1- increasing petroleum prices;
  - 2- growing legislative pressure to reduce the carbon content of products and services;
  - 3 - Pressure to reduce waste streams to landfill.



# Sugarcane ethanol and bio-plastic

- The potential of Brazilian sugarcane as a plastic feedstock other than ethanol has been recognised. Koller et al., (2010) studied the biodegradable polymer poly-(3-hydroxybutyrate) (PHB) and concluded that embedding of the industrial PHB production into a sugar and ethanol refinery starting from the raw material sugarcane makes it possible to achieve a production price per kilogram PHB that is 4–5 times lower than known for prior PHB production processes.

# Sugarcane ethanol and bio-plastic

- Toyota bio-PET 'Ecological Plastic', derived from sugar cane.
- Polyethylene terephthalate
- - 70 % terephthalic acid / 30% monoethylene glycol,
- Is used to manufacture the lining of the luggage area of the new Lexus CT 200h introduced in 2010, though Toyota also claimed that it planned to introduce a model in which 80 per cent of the interior trim would be manufactured from this material (Wells and Morreau, 2010).

# The Brazilian case study

- São Paulo: 62% of Brazilian production and 26% of global production of ethanol in 2007 and 2008.
- productivity growth: up to three times the output of 2009 expected by about 2010/11 and a growth in exports from 16% of output in 2007/08 to 24% by 2020/21 (Wells and Faro, 2011).
- Capturing a greater share of downstream value would be economically highly significant for Brazil and potentially put the country at the forefront of technological developments in this nascent sector.

# Brasken

- In 2010, the company claimed to be the world leader in the production of bio-polyethylene as it opened a US\$320 million biofuel ethanol plant, which has the capacity to produce 200,000 tonnes of bio-polyethylene.
- It is located in Triunfo, in the south state of Rio Grande do Sul.
- for each ton of green Polyethylene, 2.5 tonnes of CO<sub>2</sub> are captured.

# Brasken

- 1- Environmental issues: A code of conduct for the suppliers of ethanol that include the traditional areas of environmental degradation in the production of ethanol in the south states of Brazil. Green label called “I’m green”.
- 2 - Labour conditions: The company has released clear labour condition that shall be respected in regards to the suppliers. These include, follow international human rights and fair labour rights, labour work conditions, that includes minimum pay for manual cane cutters, decent work conditions regarding rest and housing for migrant workers, security and accident prevention official schemes, free distribution of safety gear and monitoring of their use, provision of safe transportation, decent meals (respecting minimum nutritional and temperature standards).

# Analysis and Conclusions

- Diversification can be an important principle in economic development. Dependence upon commodities makes a country vulnerable.
- Going further downstream into plastics and thence into plastic products would considerably increase the value of the sector and allow companies in Brazil to differentiate themselves on global markets.
- Brazil only contributes to less than 1% of the world total plastic production

# Analysis and conclusions

- Biofuels are a growing market and new technological options in this market have the potential to enhance future options for poverty reduction.
- feasible alternative as household income can be increased with high value added products from biomass, through small-scale local bio-refineries producing bio-energy or other bio-based products in poor marginal and remote areas.



# Analysis and conclusions

- Policies can be designed to foster the development of this market, structuring the supply chain of the product, while guaranteeing inclusive policies.
- Bioplastic
- production can potentially act as a catalyst for rural development, providing renewable energy options in energy deficient rural areas, and greening and restoring degraded environmental areas.