Memo: **Report on BUS ticket no. C15**
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Scenario-to-strategy. A scenario analysis for new biomass and bioenergy opportunities with Brazilian partners (Quick-scan[2])

Problem definition:
Brazil is one of the most important players in the field of biomass and biofuels and has long experience with conversion of biomass into biofuels, in particular ethanol. In 2004, the cabinet of president Lula decided to give a impulse to the production and export of biofuels. The Netherlands and its hinterland are considered as very important partners (by Brazil). The Netherlands has historically strong positions in agribusiness and energy (oil refining & natural gas production). Given its strong research base and strategic location (deep sea harbour and EU markets) new business opportunities arise for the Netherlands in transport and processing of biomass/biofuels from Brazil for production of electricity, transportation fuels and chemicals. The position of the Netherlands in this international value chain should be determined in the short term. The objective of the initiators is to let Dutch and Brazilian players (stakeholders from private and public sector and civil society) jointly determine their positions in this future value chain. By means of a "scenario-to-strategy cycle" alternative strategic scenario's can be developed, which serve as contextual frameworks for the analysis of feasibility and sustainability of several business cases. In this process research institutes (LEI, A&F, EMBRAPA, etc) and commercial organisations (port or Rotterdam and Santos, Petrobras, Shell, Vopak, etc.) will develop a common visions of the future and (alliance) strategies. It is necessary to describe the "scenario to strategy" and relevant background information.

1. Rationale and question

Questions
Describe the "scenario-to-strategy" method for the case of Biomass and biofuel export from Brazil to Europe by means of the port of Rotterdam and indicate what will be necessary for the execution and what the expected results will be.

2. Approach

This quick-scan gives a short description of the biomass and biofuel situation in Brazil with a strong emphasis on ethanol and opportunities for export. A description is given of the scenario to strategy approach to determine and realize sustainable business concepts for the commercial conversion of biomass (sourced from Brazil) into bio-fuels (i.e. ethanol and bio-diesel) for consumer markets in Europe. This is followed by a short description of the factors that will have to be considered in biomass and biofuel export scenario's from Brazil to Europe.

3. Description of the Brazil and its biomass and biofuel potential and ambitions

Characterisation of Brazil and its biomass and bioenergy potential
Brazil is the fifth largest country in the world with a population of 170 million people and a GDP of 450 Billion $US (2002). The total land area amounts to 850 million ha (200x the Netherlands) of which 375 million ha can be used for agricultural production. Total agricultural area is 50 million ha of which 5 million ha is sugar cane.

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Characterising Brazilian ethanol:
An excellent description of the development of the Brazil ethanol programme since 1975 is given by Koizumi (2003):
"The government of Brazil inaugurated the national ethanol programme (PROALCOOL) in 1975. The major target of the programme was to reduce its oil import bill because, in the mid-1970s, Brazil was strongly dependent on imported oil. An important direct effect of the programme was the creation of a huge domestic demand for its sugarcane market. The creation of PROALCOOL provides the much needed cures to its sugar producers who are frequently faced with problems due to excess sugar production and huge fluctuations in its price. With the second oil-shock in 1979, the government decided to enlarge the programme by providing enhanced supports to the large-scale hydrated ethanol producers to supply the neat and cheaper prices fuel. Two institutes played vital roles in implementing the national ethanol program. The Institute of Sugar and Alcohol (IAA) controlled sugar and ethanol production and exports through implementing a production quota and fixed purchasing price of ethanol. Petrobas, being a monopolistic state oil company, controlled domestic ethanol sales and distribution. The government set the sugarcane price to independent growers. A wide range of governmental investment support programmes were implemented in the 1980s. The national ethanol production capacity expanded to produce over 16 billion litres of ethanol per year.

Despite this achievement, the programme has faced criticism since the middle of the 1980s. Changes in the macro economic conditions were the first source of criticism. The 1982 the Brazilian debt crisis dried up the sources of finance, followed by the declining international oil prices that started from 1986. Inadequate ethanol supply and demand management raised serious market disruptions in the early 1990s and resulted in losing consumer credibility in ethanol fuel. The production of ethanol powered cars has been declining since then. Now only 1 percent of cars are ethanol powered. To forestall that trend, the government set the anhydrous ethanol blend to gasoline between 20 and 25 percent of the product, with a variation of plus or minus 1 percent as a means of balancing the relationship between supply and demand of sugar and ethanol. The government took radical programme reforms over the 1997-1999 period. In 1997, the price of hydrated ethanol was liberalized, followed by the 1999 price liberalization decision of anhydrous ethanol and the abolition of the distribution monopoly given to Petrobas, and the reduction in the subsidies to the ethanol blend gasoline producers. Currently, there are no restrictions on ethanol production, the only tool that is left to the government is setting the anhydrous blend ratio to gasoline. The actual percentage of the blend ratio is determined by the Ministry of Agriculture, as a means of balancing the relationship between supply and demand of sugar and ethanol. A blend ratio of 26 percent is set as the legal maximum blend ratio level. As of April 2003, the blend ratio was set at 20 percent and it will be increased back to 25 percent from July 2003."

Brazil ethanol facts

Production:
Brazil has 5 million ha of sugarcane plantations. Most plantations and mills are located in the province of Sao Paulo (see figure 2). Sugar cane is produced in 6 year cycles in which 3 harvests takes place. Sugar cane is processed in some 320 mills. Some 1 million people are employed in the ethanol business. Most mills produce both ethanol and sugar giving higher overall efficiency and a high degree of flexibility to optimise production depending on ethanol and sugar prices. This also leads to a direct link between the oil, ethanol and sugar price. The volume of ethanol production in Brazil has increased steadily to 12 million tonne in 2003 (48% of world production) (figure 1), by 2015 some 23 million tonnes of ethanol are expected to be produced.

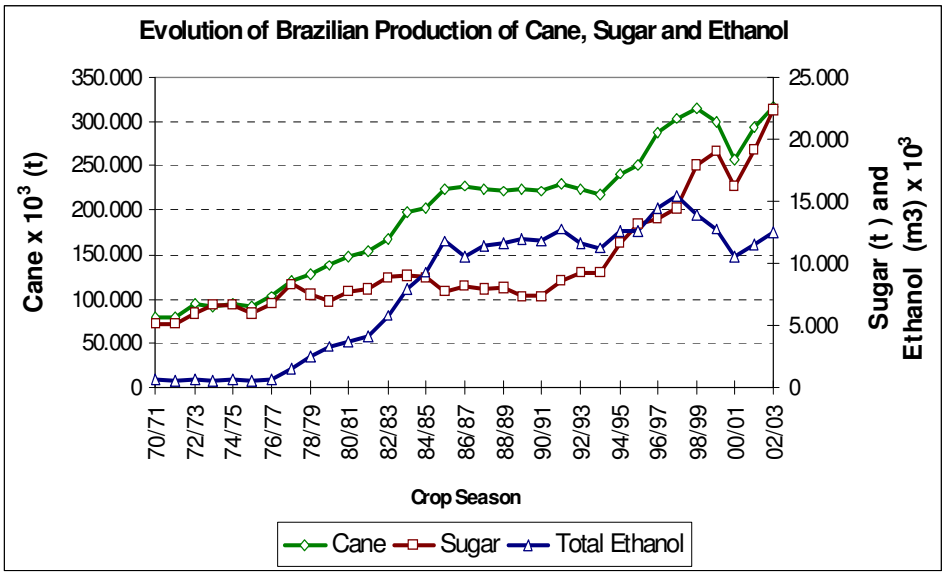

Figure 1. *Development of sugar cane, sugar and ethanol production in Brazil (Figuerut, 2004)*

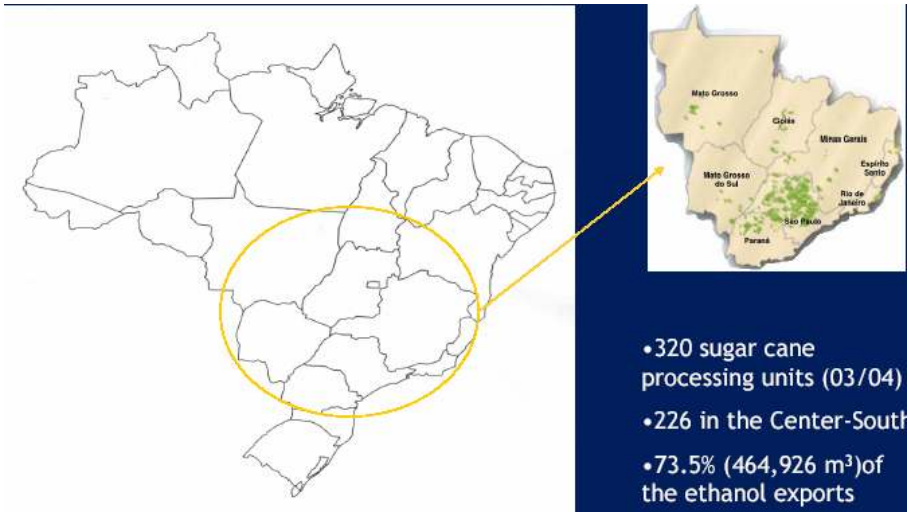

Figure 2. *Main sugarcane growing area and processing mill are located in the south central region with Sao Paulo being the largest producer.*

Ethanol production cost in Brazil has decreased dramatically over the last 30 years making Brazilian sugarcane ethanol competitive with gasoline at oil process of below 30$ per barrel (Corrêa Carvalho, 2005). With current 60$ per barrel ethanol has become very attractive.

Table 1
Costs of biofuels

Biofuel	Cost at filling station (€2004/1000 L)			
	Feedstock	Low	Best estimate	High
(a) Costs of biofuels produced using current technology				
	Sugar crops	875	1265	1855
	Starch crops	809	1173	1572
	Lignocellulosic crops	1148	1448	2435
	Lignocellulosic residues	1052	1316	2232
	Brazilian sugarcane	117	294	351
Biodiesel				
	Oil seeds	755	945	1092
	Used oil/fat	354	454	545
(b) Costs of biofuels produced using future technology				
	Sugar crops	671	954	1432
	Starch crops	653	963	1287
	Lignocellulosic crops	699	884	1469
	Lignocellulosic residues	638	802	1358
	Brazilian sugarcane			
Biodiesel				
	Oil seeds	753	888	1068
	Used oil/fat	317	395	504

Figure 3. Biofuels cost estimates according to Ryan et al., 2005.

The main ethanol export harbours are Santos (near Sao Paulo). Logistics for exporting ethanol can be one of the bottlenecks for development of ethanol exports in the coming years.

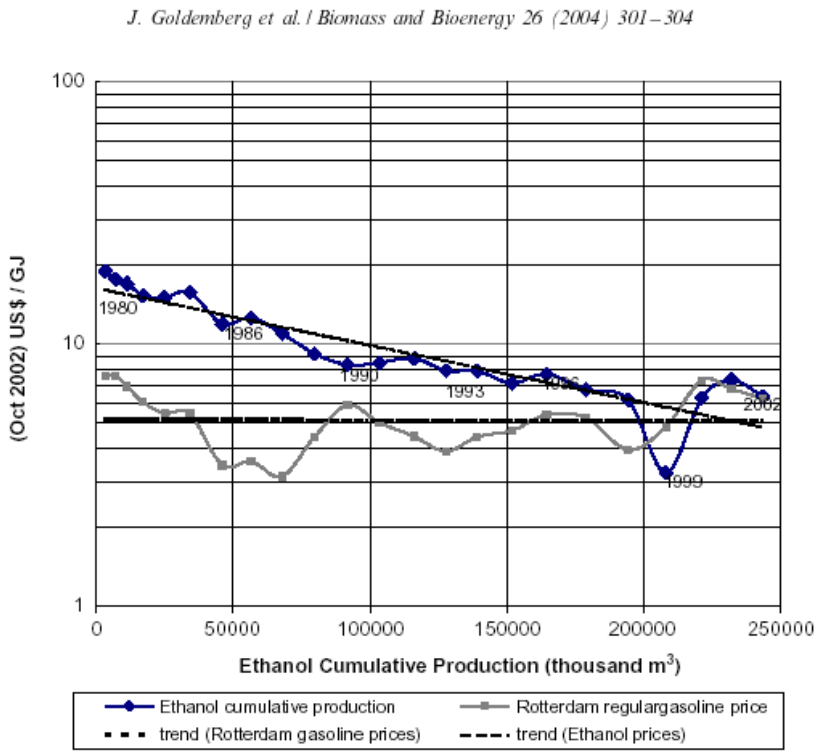

Figure 4. *Brazilian ethanol and gasoline prices are converging.*

Local ethanol market
Ethanol is used as anhydrous ethanol in mixed in to gasoline at 20 to 26 % (E20 – E26) or hydrous ethanol is used in 100% ethanol vehicles (E95). Some 3 million cars run on E95 which is 23% of the national fleet. In recent years flexible fuel cars are being introduced making it possible to run on a wider range of ethanol to gasoline mixes.

Biofuel policies and ambitions
In the recent year Brazil has made public its ambitions to become an exporter of ethanol and biodiesel. The long list of trade talks in which export of biofuels from Brazil is an issue illustrates the trend. The USA will send a trade mission focused on renewable energy technology this year. Japan has discussed importing ethanol for fuel and is expected to import Brazilian fuel ethanol. China is expected to become an importer of ethanol and even Venezuela is importing fuel ethanol from Brazil. The Netherlands Trade Minster van Gennip will visit Brazil with a delegation. In this last mission a visit to a sugar/ethanol mill is planned.

Biodiesel is not yet well developed in Brazil but it is expected to increase very fast. Contacts exist with Germany to develop biodiesel further. President Lula recently opened the first biodiesel plant. A number of crops are potential sources for biodiesel including soya, Ricinus (Mamona), Palm oil, etc.

Lignocellulose
Brazil should also be an efficient producer of (lignocellulose) feedstock for second generation biofuels (lignocellulose ethanol and Fisher Tropsh diesel). Sugar cane bagasse is used for energy production for mill operations, greatly contributing to the CO2 efficiency of the sugar cane to ethanol process. With increased efficiency electricity can be exported to the grid, a potential that can be increased substantially (UNICA, 2004). With the banning of leaf straw burning before harvest this material will also become available for utilization. The exploitation of bagasse and leaf straw is just starting to be explored and ambitions to make better use of this material are clear Apart from sugar cane residues other (lignocellulose) residues are available as illustrated in figure 5.

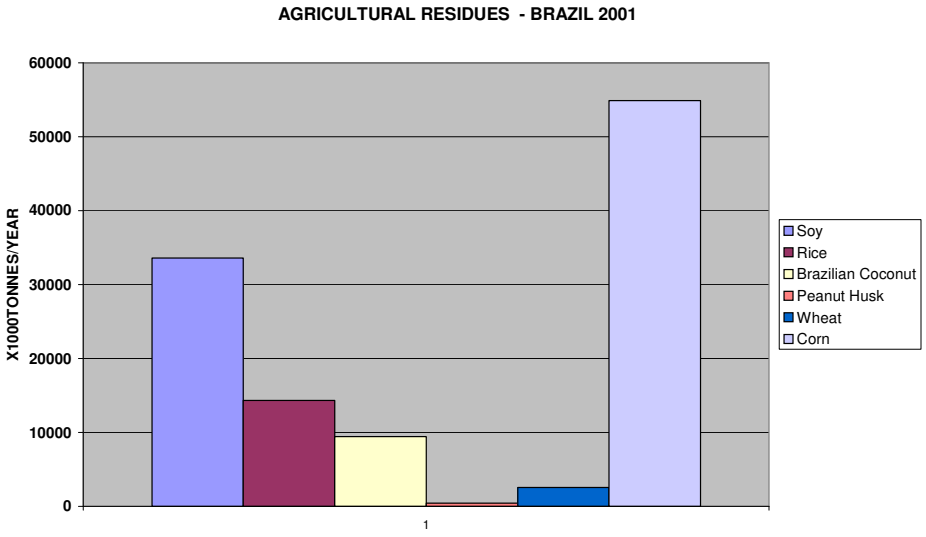

***Figure 5**. Agricultural residues are a hardly exploited energy source in Brazil. (Moreira, 200?).*

4. Scenario to strategy approach

Purpose:
Rationale for using the scenario-to-strategy methodology is the aim to have knowledge institutions (universities, think tanks etc) and business organizations (producers, service providers, investors, banks etc) work together (as strategic partners) in order to jointly determine and realize sustainable business

concepts for the commercial conversion of biomass (sourced from Brazil) into biomass-based fuels (ethanol or bio-diesel) for consumer markets in Europe.

For this purpose the project will provide two separate deliverables:
- a set of alternative contextual scenarios and
- specific business strategies (or strategic options) that can operate under each of the scenarios.

The scenarios will serve to provide alternative cause & effect models based on a range of pre-identified key-uncertainties that will determine future business environments i.e. contextual environments that business organizations cannot effectively influence or control but will affect their businesses. Scenarios therefore are models for plausible future business environments. In the case of biomass-fuels, they may assess Production prices (global sugar and oil prices as well as regional demand & supply for ethanol or bio-diesel), Transportation costs (charges for road, rail, shipping or pipeline movement of bio-mass in Brazil), Harbour costs (port charges in Brazil, Rotterdam and duty free EU havens like Curacao), Ocean freight charges (shipping), Transaction costs (set by cultural, institutional and regulatory differences), Geo-political constraints for outsourcing (set by EU's common agricultural policy, WTO policies, Mercosur-EU negotiations etc.
The joint development of alternative scenarios by knowledge and business organizations (in series of workshops) is a learning process that will enable participants to better understand the consequences of critical uncertainties and inter-dependencies. This will allow them to more successfully select preferred strategic options.
As Scenarios are expressions of 'common ground'; they are excellent tools to communicate joint visions and complex realities to a wide range of stakeholders.

In the second phase, the scenarios are used to determine sustainable business strategies. The scenarios, which were developed as realistic alternative models for future business environments, help in this phase to test strategies for robustness and desirability.
For this purpose, a coalition of selected (private and public) business organizations (from Brazil, the Netherlands and other countries) will be formed to investigate effective ways to operate and coordinate biomass chains and clusters in future. Value chain concepts (from sourcing to markets) will help to analyse and coordinate the activities of all individual business organizations (notably SME's) that will participate. Value-adding steps can be identified in biomass sourcing, transportation, storage, treatment, certification, distribution, marketing etc.
The better business partners understand their roles and value-adding activities in each phase of the biomass chain, the more qualitative, cost-effective and competitive the overall biomass chain will become. An integrated strategic approach, supported by all partners will help to realize this objective.

Organisations involved in one / both project phases:
Knowledge institutions: WUR, Embrapa, consultancies, and others.
Business organizations: Agricultural producers, Energy companies (Petrobras, Shell), shipping lines, Port authorities (Port of Rotterdam, Port of Santos,), terminal & storage companies (Vopak), automotive industries (Daimler Chrysler, Volkswagen), Choren industries, etc.
NGOs?

5. Opportunities and key factors for scenarios

Decisions will have to be made on the boundaries of the scenario's:
- Time horizon: until 2012
- Technology development: For example; when will the second generation biofuels make an impact?

Factors that may be considered as key inputs for the scenario's include:
- WTO developments (see outcome of the Mecosur /EU negotiations)
- CAP reform in the EU
- Reforms of the EU sugar system

- The importance of biodiversity effects for potential biofuel customers
- Technology development, particularly second generation biofuels.
- Importance of food energy competition
- Competition between potential customers Japan, China, USA and Europe
- Competition between potential suppliers Brazil, Argentina, Colombia, Thailand, etc.
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It may be interesting to make use of simulation models for sugar and ethanol markets (Koisumi, 2003).

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