FEASIBILITY STUDY FOR ETHANOL PRODUCTION

WASHINGTON, MAY 29TH 2007
Learning curve

Cost

Production

Ethanol - Production and Cost Production

Fonte: Elaboração D. L. Gazzoni
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## PHASE A

**Pre-analysis**
- Agriculture Analysis
- General infrastructure analysis
- Potential Feasibility Report

## PHASE B

### Technical Feasibility and Economic Study by Region:

- **Step 1**: Agriculture Analysis
- **Step 2**: Industrial Analysis
- **Step 3**: Environmental, Legal and Social Analysis
- **Step 4**: Technical-Economic Analysis (agriculture, industrial and investment costs)
- **Step 5**: Consolidation of Study
Objective: Identify potential regions for ethanol production in the selected countries.
**Objective:** Obtain information that characterizes agricultural aptitude for the production of sugarcane.

**Parameters:**
- Water balance
- Water resources
- Maximum, minimum and average temperatures
- Terrain in the regions
- Making maps and agricultural zoning
- Soil aptitude
- Available agricultural area

**Survey of country’s technological level:**
- Agriculture machines and implements
- Varieties
- Fertilizing/Inputs
2. General Infrastructure

Parameters:

- Logistics – flow and storage of ethanol production:
  - Highway
  - Railroad
  - Waterway

- Energy matrix – energy sources

- Labor availability

- Study of local plants, when they exist
3. Potential Feasibility Report

Data certification

- Visit to research entities, government secretaries and other institutions that enable checking of information obtained in Phase A.

- Gathering of evidence at the site.

- Elaboration of the Report
Certification and Evaluation – gathering evidence

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PHASE B

Objective: Elaboration of the Technical-Economic Feasibility Report for the selected regions
**Methodology**

**STEP 1**
Agriculture Analysis
- Agriculture aptitude
- Agriculture planning
- Logistics
- Financial

**STEP 2**
Industrial Analysis
- Industrial Planning
  - Energy balance
  - Co-generation
  - Infrastructure
  - Logistics
  - Financial

**STEP 3**
Legal Analysis Environmental and Social
- Environmental aspects
- Tax issues
- Legal aspects
- Labor relations
- Legislation for contracting International Services

**STEP 4**
Technical Analysis Economics
- Production costs:
  - Agricultural
  - Industrial
  - Investments

**STEP 5**
Consolidation of the Study
- Consolidation of Previous Steps
- Technical-Economic Feasibility Report
STEP 1: Agriculture Analysis

Objective: Evaluate aspects that refer to agriculture production.
Agriculture Aptitude

Broadening of studies for regions selected in Phase A:

- Study of rainfall history;
- Water balance of regions;
- Soil characterization;
- Study of region’s topography and mechanization feasibility.
Agriculture Aptitude

Study of rainfall history:
✓ Study of historical records on rainfall for a specific region.

Water balance:
✓ Study of water entry and exit from soil using meteorological variables (EPT, CAD, ARM, altitude etc).

Soil aptitude:
✓ The conventional classification system is used based on crossing of information:
  • Geological formation;
  • Potential fertility;
  • Potential drainage and etc..
Agriculture Aptitude

Temperatures – maximum, average and minimum:
✓ Meteorological variable used in the region’s weather balance and crop needs.

Topography and mechanization feasibility:
✓ Study of the potential region’s terrain to define if it is appropriate for a mechanized production system.
Agricultural Planning

- Recommendation of appropriate varieties.
- Estimate of initial area needed to multiply saplings.
- Estimate of areas appropriate for sugarcane production.
- Definition of planting systems.
- Definition of a production model.
- Creation of a cooperative model for providing services.
- Study of agricultural machines and implements.
Recommendation of Brazilian varieties of sugarcane based on analogies, where there is a similarity between environments and where the qualities have been tested and proven for that environment and specific situation.

Estimate of initial area needed for the multiplication of saplings.
- Area for construction of nursery for self-supply of saplings.

Estimate of areas appropriate for sugarcane production
- Quantify planting areas according to information raised.
Agriculture Planning

Definition of planting system:

 ✓ Recommend the best system, considering the area’s support capacity, labor availability, cost/benefit, among other variables.
 ✓ Recommend the adoption of crop rotation in sugarcane renewal areas.

Definition of a production model that best guarantees income distribution in the chain (Distributivism Production System)

 ✓ Leasing of lands;
 ✓ Farmer/Plant Partnership;
 ✓ Sugarcane supply.

Land Ownership (public or private)
Creation of a cooperative model for providing service that optimizes production costs and makes the small producer feasible:

- Sapling production
- Technical assistance
- Implements, harvesters, tractors
- Mechanical workshop, etc
- Storeroom

Study of agricultural machines and implements:

- Dimension the fleet according to production estimates.
LOGISTICS STUDY – SUPPLY OF RAW MATERIAL

Study of sugarcane supply

- Study of local logistics infrastructure (Side and local roads);

- Study of possible routes, modes, distances covered and freight cost estimates for sugarcane placed in the plant:

- Sugarcane harvest maps and competition for raw material (range of competitive action).
Financial

Estimate for investments, costs and operational expenses:

- Planting areas (production cost estimate).
- Agricultural machines and implements.
- Operational infrastructure.
PHASE 2: Industrial Analysis

Objective: Study and analyze all necessary items for executing an industrial project.
Industrial Analysis

Industrial Planning

- Estimate of project numbers x available appropriate areas.
- List of main equipment.
- Identification of installation needs.
- Preliminary list of electrical charges.
- Co-generation of electric energy with sugarcane bagasse.
- Basic information on water supply, effluent treatment and discharges.
- Production and grinding projections.
- Size of workforce.
- Logistics for ethanol production flow.
- Investment estimates for all the project’s industrial phases.
- Taking advantage of sub-products.
Industrial Analysis

List of main equipment:
✓ Ethanol Production – Distillery.

Identification of need for installations:
✓ Basic project – process, electric and utilities.

Balance: Water, Mass and Thermal:
✓ Entry, consumption and exit.

Preliminary list of electric charges:
✓ Voltage and charge specifications.
Co-generation of electric energy with sugarcane bagasse:

- Generation of energy.

Basic information on water supply, effluent treatment and discharges.
Industrial Analysis

Production and grinding projection:
✓ Tons/year

Size of workforce:
✓ Distillery Employees - industrial

Logistics for ethanol production flow:
✓ Study of possible routes, modes, distances covered and estimates of ethanol freight costs

Estimate of investments in the project’s industrial phase:
✓ Physical-financial timetable

Taking advantage of sub-products.
✓ Distribution of vinasse for fertilizer.
PHASE 3: Legal, Environmental and Social Analysis

Objective: Analyze the legal, environmental and social aspects involved in ethanol production.
Legal, Environmental and Social Analysis

Environmental aspects
- Study of local, state and federal legislation regarding agricultural management, industrial installation and waste treatment.
- Identification of investment needs aimed at adapting to current legislation.

Tax issues
- Analysis of federal, state and municipal taxes.
- Analysis of fiscal benefits.

Legal aspects
- Contract issues for sugarcane supply.
- Industry and agricultural regulatory norms.
- Legislation that regulates biofuel use (mandatory regulation).
- Land legislation
Legal, Environmental and Social Analysis

Analysis of labor relations
✓ Analysis of contracting mechanisms.
✓ Analysis of labor norms.

Analysis of Legislation for Contracting International Services
PHASE 4: Technical- Economic Analysis

Objective: Estimate costs, expenses and investments
Technical-Economic Analysis

Agriculture Production Cost
✓ Inputs;
✓ Mechanized and manual operations;
✓ Acquisition of saplings;
✓ Operational and administrative;
✓ Freight;
✓ Others

Industrial Production Cost
✓ Inputs;
✓ Equipment;
✓ Operational and administrative;
✓ Industrial infrastructure
✓ Others

Needed investments, considering:
✓ Agriculture production;
✓ Industrial production;
✓ Environmental, legal and social aspects;

Carbon credit incentives
✓ Estimate of bonus from commercialization of carbon credits.
PHASE 5: Consolidation of Technical-Economic Feasibility Report

Objective: Consolidate the information obtained in the previous phases and elaborate the Technical-Economic Feasibility Report.
Consolidation of the Technical-Economic Feasibility Report

- Market analysis.
- Agricultural Planning.
- Industrial Planning.
- Environmental, Legal and Social Analysis.
- Technical-Economic Analysis.
ENERGY CLUSTERS

Ethanol

Wood

Biodiesel

FULL BUSINESS POTENTIAL
AGROENERGY CLUSTERS
Territorial occupation for each crop

- **Forest Eucalyptus sp.**
  - 12,250 ha

- **Soybean**
  - Rotation: 5,000 ha

- **Sugarcane**
  - Total: 30,000 ha
**AGROENERGY CLUSTERS**

**Sugarcane**
Energetic balance : 8,06
- Ethanol - Biofuel
- Bagasse – Electricity generation.
- Vinasse – Fertilizer.

**Soybean**
Energetic balance : 3,0
- Oil – Biofuel.
- Meal – Animal feed.
- Glycerin – Electricity generation.

**Eucalyptus sp.**
Energetic balance : > 20
- Biomass (Pellets) – Heat generation.
- Wood
  - Firewood – Heat generation.
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