USING GIS FOR MAPPING AND QUANTIFYING EXISTING AND POTENTIAL FEEDSTOCK AREAS FOR BIOETHANOL PRODUCTION

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Presentation Outline

• Bioethanol Production: An overview

• Sugarcane as feedstock for ethanol production-availability

• GIS on feedstock management and planning

• Potential GIS initiatives in process industries

• Environmental & Social Perspectives
Bioethanol Production: An Overview

- Bioethanol – is a light alcohol produced by fermenting carbohydrates, such as starch or sugar and is mixed to gasoline up to 10% blend
- Benefits:
  - Clean fuel
  - Boosts octane level help the car run smoothly
  - Biodegradable and has few harmful effect with the environment
- ≈20.7 M liters produced in the Philippines = 0.032% (65, 621.21 M liters) of the total world’s production
Policy Support from the Government

- Republic Act 9637 – Biofuels Act of 2006
  - Mandates the blending of 1% biodiesel in PetroDiesel and 5% of bioethanol in gasoline for the first 4 years.
# Feedstock for Ethanol Production within The Philippines

<table>
<thead>
<tr>
<th>FEEDSTOCK</th>
<th>MT/HA</th>
<th>Li/MT</th>
<th>Croppings</th>
<th>Li/Ha/Yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugarcane</td>
<td>65</td>
<td>70</td>
<td>1</td>
<td>4,550</td>
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<tr>
<td>Cassava</td>
<td>8</td>
<td>180</td>
<td>1</td>
<td>1,440</td>
</tr>
<tr>
<td>Sweet Sorghum</td>
<td>50</td>
<td>50</td>
<td>2</td>
<td>5,000</td>
</tr>
<tr>
<td>- Stalk</td>
<td>3</td>
<td>375</td>
<td>2</td>
<td>2,250</td>
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<tr>
<td>- Grain</td>
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</table>

Source: Bureau of Agricultural Research, Department of Agriculture (www.bar.gov.ph)
SCBI: 1st Integrated Bioethanol and Co-generation Power Plant

- Situated in San Carlos City, Negros Occidental
- Requires 450,000 tonnes of cane spread over 10 months
BIOETHANOL PRODUCTION PROCESS FLOW

1. **SUGAR CANE** to MILL:
   - Juice
   - Bagasse
   - Biogas

2. **MILL**:
   - Juice to SYRUP HOUSE
   - Bagasse to BOILER

3. **SYRUP HOUSE**:
   - Syrup
   - Mud press

4. **CO2 PLANT**:
   - CO2 gas

5. **BOILER**:
   - Steam
   - Biogas
   - Bagasse

6. **FERMENTATION**:
   - Mash
   - Syrup
   - Biogas

7. **RECIRCULATED WATER**

8. **WASTEWATER TREATMENT**
   - Wastewater
   - Recycled water
   - Electricity

9. **POWERHOUSE**
   - Electricity
   - Fuel alcohol

10. **DISTILLATION**
    - Fuel alcohol
    - Electricity
    - Recycled water

11. **COMPOST**

12. **IRRIGATION WATER**

*Source: San Carlos Bioenergy, Inc*
Project Goals

- determination of the exact area planted with sugarcane
- establishing of a computer-supported geographic-based database management system for sugarcane farms
- providing management information to sugar industry stakeholders
Overview of Methodology

1. Data Collection
   - GPS Survey
   - Key Informant Interviews

2. GIS Data-Building and Validation

3. Spatial Analysis

4. Production of Maps
GIS on Feedstock Management & Planning

- District wide validation & mapping of sugarcane areas
  - Assess total available cane & allocation for ethanol production
  - Helps in the assessment & determination of the size of bioethanol facility
GIS on Feedstock Management & Planning

- District wide validation & mapping of sugarcane areas
  - Determines suitable sources based on distance to the plant
  - Assess areas that are productive and areas that would need assistance in increasing productivity level
CURRENT CANE HARVEST PRACTICE

• Excessive supply during dry months

• Deficit supply during wet months
  
  ▫ Need to: REPROGRAM/RESCHEDULEING of farm operations from planting, ratooning, cultivation and other farm practices with the choice of appropriate variety

CROP SURVEY 2008-2009
GIS on Feedstock Management & Planning

- **Determine market competition**
  - Assist in market strategies & Pricing
- **Instrumental in logistic planning**
  - Determine farm distance to the plant and assess road types
  - Determine truck requirements per area
SCBI Farm Information Database

**FARM INFORMATION SYSTEM**

- ≈ 10,000 hectares planted with sugarcane or 2.51% of the country’s total sugarcane plantation
- ≈ 467 total number of planters - surveyed
- ≈ 650,000 Mtons – cane yield or 3% of the country’s total cane production

**GEOGRAPHIC INFORMATION SYSTEM**

**PLANTER’S PROFILE**

<table>
<thead>
<tr>
<th>Hectares</th>
<th>Total Area (ha)</th>
<th>Location of Farm</th>
<th>Projected Yield (ton)</th>
<th>Variety</th>
<th>Classification</th>
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</thead>
<tbody>
<tr>
<td>Ben al</td>
<td>4.00</td>
<td>BAGBONBON, SAN CARLOS CITY</td>
<td>140.00</td>
<td>Phil B8-39</td>
<td>R3</td>
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<td></td>
<td>TOTAL AREA</td>
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<td>TOTAL YIELD</td>
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<table>
<thead>
<tr>
<th>Date of Harvest</th>
<th>Hectares</th>
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<th>Projected Yield (ton)</th>
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<tbody>
<tr>
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<td>TOTAL YIELD</td>
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<tbody>
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<td>175.00</td>
<td>Phil B8-13, Phil B8-39</td>
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<tr>
<td></td>
<td>TOTAL AREA</td>
<td>5.00</td>
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<td>TOTAL YIELD</td>
<td>175.00</td>
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<td>BAGBONBON, SAN CARLOS CITY</td>
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<td>TOTAL YIELD</td>
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GIS on Farm Planning & Operations
Gamboa Multi-purpose Farm-Workers Cooperative

VARIETY DISTRIBUTION
GIS on Farm Planning & Operations

• Annual record of variety planted and its performance

• Assess productivity level of each field

• Records amount of fertilizer application and water level intake, in the case of irrigated fields
Potential GIS initiatives in Process Industries

- Raw Material Inventory
- Design Mass Balances
- Optimization of Equipment and Plant capacity
- Production Schedules
Conclusions

• Bioethanol is:
  ▫ supported by the Philippine Government policy
  ▫ Clean and environmental friendly
  ▫ Reducing pollution but not the global warming

• GIS is:
  ▫ Helpful in bioethanol production monitoring through its ability of:
    • Recording the variety and area planted
    • Assessing the productivity per field
    • Elaborating scenarios for the future
Perspectives for discussion
Environment / Social Impact / Sustainability

• Environment:
  ▫ Increasing the monocrop planted area for biofuel will reduce the biodiversity
  ▫ The coming 2d generations of biofuel production will reduce the organic materials returned to the soils
    • decreasing soil quality
    • increasing soil erosion
• Social impact :
  ▫ Biofuel production is challenging the food security policy by increasing land pressure
  ▫ Biofuel production might lead to a major change in the coming future feeding mode

• Sustainability :
  ▫ Biofuel/agrifuel is a good economic fuel alternative ...for the mid term only
  ▫ 3rd generation agrifuel is promising
OR THIS WAY? IT'S UP TO YOU.

DO YOU WANT IT THIS WAY?