CARENSA-cane resources network for southern Africa

AIMS AND ACHIEVEMENTS

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CONSORTIUM

- SEI- Stockholm Environment Int.
- ICL- Imperial College London
- UM- University of Mauritius
- UND- University of Natal
- AUA- Agric. Univ. Athens
- BUN- Biomass Energy Network
- CEEEZ- Centre for Energy, Envi (Zam)
- ISO- Inter. Sugar Organization
- FAO,
- WII- Winrock International India
- CENBIO-UNICAMP, Brasil
MAIN OBJECTIVES

• assess the role of sugarcane in bio-energy production
• Promotion of sustainable development
• Potential for improving global competitiveness (S. Africa)
• Provide a comprehensive synthesis and comparative evaluation of cane resources
SPECIFIC OBJECTIVES

• **Agriculture** (agronomic, harvesting…)
• **Industry** (sugar/fibre resources, agro-industrial processes)
• **Markets** (assess policies, regulations, economic incentives)
• **Impacts** (socio-economic, environmental)
• **Integration** (sustainable development, risks, competitiveness, international comparisons, industrial perspectives)
Methodology Cont…

• Evaluating the potential for SADC’s sugar industry for BioEnergy production:

  – Use modelling / scenarios as tools to assess the potential for:

1. Ethanol production
2. Electricity (and heat) production
   – integral Cogen (CHP)
3. Impacts on local/regional sugar production/consumption
CARENSA Scenario Methodology

• Use the existing situation to develop projections based on Global state-of-the-art to emerging technologies

• Global
  – Brazil to EtOH
  – India recent Cogen coupled with elec. Deregulation
  – Mauritius- Cogen in small island situation

• Africa
  – Malawi EtOH fuel blends
  – Zimbabwe EtOH fuel blends (not since 1991) plus some cogen
  – Emergence of ‘Gel-fuel’
SOME KEY ELEMENTS FOR SUCCESS

• Policy commitment
• A regulatory framework (e.g. fiscal)
• Availability of feedstock at low cost
• Land availability (if large programmes)
• Willingness to open domestic market to competition (ethanol imports)
• Production capacity (e.g. industrial ethanol, ETBE)
SUGARCANE

- Produced in more than 100 countries
- Very resilient crop
- Few alternatives in cane prod. Countries
- Very efficient crop
- Accumulated experience over many years
- Large amount of commercial by-products
- Energy self-sufficiency
- Molasses, majority from cane
SOUTH AFRICA

- Cassava .......... 3 B/l
- Sugarcane ....... 500 M/l
- Cane bagasse ... 250 M/l
- Molasses .......... 100 M/l
- Maize .............. 1B/l
- Sorghum (straw) 150 M/l
- Wheat (straw) ... 200 M/l

(WEC 2003 Energy Survey)
FEEDSTOCK & TECH ISSUES

• MAIN CHALLENGES:
  – Increase productivity
  – Reduce costs e.g. today c.60% of feedstock
  – Conversion technology is not the problem
  – Competition from synthetic fuels
  – Poor R&D funding
  – Fragmentation, short term R&D
  – Lack of cooperation
  – Lack of innovativeness
FEEDSTOCK TECH, CONT...

• Greater commitment from the private sector
• More industrial participation
• Greater attention to environmental issues
• Greater use of by-products
• Explore new markets/possibilities aggressively.
  – Hydrolysis of bagasse + co-firing
  – Ethanol from sugarcane leaves
FEEDSTOCK- POLICY

• Growing demand mostly from Asia
• International trade increasing
• Increase international competition
• Importing countries (China, EU, USA, Canada, Japan..) more demanding
• Key driver: cost competitiveness
• Governments policy
• International policy reforms (WTO)
• New opportunities (ethanol, sugar demand)
• Challenges: sweeteners, corn, synthetic fuels…
SYNTHETIC VS BIOFUELS

- Synthetic fuels will become increasingly important (alcohols, diesel and gasoline)
- They will not go away
- South Africa has been producing them for many years (oil, coal and natural gas)
  - 40% of total supply
  - New plants are coming on stream in USA, Malaysia
  - This has major implications for biofuels
SYNETHETIC VS BIO, CONT..

- R&D on synthetic fuels (oil, coal + n. gas) is gathering pace
- Fossil fuels are abundant, particularly coal
- The quality of synthetic fuels is high
- These fuels quality is improving and will develop, eventually, into even higher and cleaner fuels
FOSSIL FUELS

- Fossil fuels are abundant. Time-span for:
  - OIL (25 yr reserves; 70yr resources)
  - N. GAS (70yr reserves; 130yr resources)
  - COAL far more
- Other RE, will increase their contribution
- WE DRIVE ON INDUSTRIALLY MANUFACTURED FUELS. THE TECH IS CONSTANTLY IMPROVING UNDER CONSTANT SOCIO-ECONOMIC PRESSURES
South Africa is a major manufacturer of synthetic fuels. It is phasing out leaded gasoline (Dec/06). Currently, unleaded represents 30%. The main alternatives are:

- Continue use of MMT (manganese organo-metallic compound)
- MTBE
- Alcohols (bio or synthetic)
• About 40% of gasoline is synthetic (oil, gas and coal)
• MAJOR PRODUCERS:
  – SASOL, 175,000t/y (from oil, coal and gas)
  – Plants in Sasolburg & Secunda
  – Approx. 43 Mt of coal converted into liquid fuels (39.3 M bb/y) and chemicals
• + 1.2 M bbl/yr of residual fuel
• PETROSA Mossgas)  
  – 22,500 bbl/d from natural gas  
    • 67% petrol  
    • 32% diesel  
    • 2% others  
  – 24,000 bbl/d of alcohols (Graboski)
SOUTH AFRICA, CONT...

- Coal reserves are 175 Gt
- Coal provides 45% of the country’s energy
- Synthetic ethanol could provide most of the needs to replace lead
  - Current production 6,200 bbl/d (c.360 Mt/yr – 284Mt) Needed: 18,000 bbl/d
  - More profitable to export it as high value chemical alcohol (ethyl acetate)
SOUTH AFRICA, CONT…

• THE BIOETHANOL ALTERNATIVE
  • South has the potential to produce large quantities of ethanol (5.2 B/I)
  • Approx. 12,500 bbl/d (725 Ml/yr) will be needed to replace lead + (minimum)
  • Costs estimated at $300M (Grabosky, 2003)
THE FFVs/FLEX-FUEL

• Idea from the USA Alternative Fuels Act of 1988
• 1992 GM introduced the Flex-Fuel vehicles in the USA;
• Currently over 1.5 million vehicles in USA
• Many improvements since then
• The FFVs-Fuel-flex is an “intelligent engine”
FFVs, CONT..

- A Software Flex Fuel Sensor (SFS) allows engines to run equally efficient on standards gasoline/ethanol blends in any proportion
- Considerable fuel flexibility (producers & end users)
- Fuel efficiency
- More environmentally friendly
- Similar costs (in Brazil c.R$950+ gasoline)
FLEX-FUEL, CONT…

- Important advances in Brazil
- Hybrid compromise of gasoline-ethanol vehicle (compression ratio 11; USA same as gasoline)
- Can use hydrated ethanol (7.4% water v/v)
  - Changes in gasoline (no separation)
- Brazil experience with the ethanol fuel car
- Same fiscal incentives
- Export potential
- TRI-FUELS e.g. ethanol +gasoline + n. gas
CONCLUDING ....

• Demand for ethanol fuel will increase
• Few feedstocks are economic. Viable
• Sugarcane the most promising
• Synthetic fuels (coal & natural gas) will increase
• The ICE remains best alternative (2020)
• FFVs-Flex-fuel- opens new possibilities (fuel flexibility, economic. & environment)
MORE DATA/ ANALYSIS ....
- Feedstock costs
- Cost implication various molasses
- Governmental energy policies

SOUTH AFRICA
- energy policy toward RE
- policy toward synthetic fuels (costs, …)
- LEAD substitution
- ethanol fuel plan (biofuels)
- Potential role of FLEX-FUEL

EMISSIONS/CARBON TRADINGS
• Substantial resources exist for supplying bioenergy services and markets for bioenergy in southern Africa but in South Africa in particular
• If significant fractions of BioEnergy are required from the sugar industry over the next 30 years incentives are required very soon.
  – Early adoption will make meeting longer-term targets less difficult.
• The cost implications of reduced transmission costs by adopting cogen should be recognised by policy makers
• The sugar industry represents a key actor in the early development of biomass systems
• Strategic development of single purpose and poly-generation technologies (pathways) needs to be encouraged.
• Innovation will play a key role in the successful development of BioEnergy from Sugarcane
• Persistence
  – long term strategies and stability are essential for private investment