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 OFBECTIVES

- 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

- 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 cots 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 aggress.
  - 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-ECONIMIC PRESSURES*

SOUTH AFRICA SCENE

- South Africa is a major manufacturers of synthetic fuels
- It 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)

SOUTH AFRICA, CONT..

- 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

SOUTH AFRICA, CONT..

- 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 Ml/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/l)
- 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)

SOUTHERN AFRICA…

- 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