Electricity and Fuel from Sugar Cane in SADC Region

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South Africa IRP2010 Stakeholder Plenary Session 7 June 2010

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Perspective

- Potential substantial supplier of renewable electricity
- Established regional company offering regional solution
- Private sector – JSE listed company

Summary

- Renewable electricity and fuel from agriculture
  – co-energy from sugar cane
  - Option currently not included
  - Substantial - similar in size to coal, nuclear, hydro and renewable energy
  - Compiled New Supply Input Parameter Information Sheet
- Preliminary feedback on key parameters
  - Detailed feedback in written submission

Sugar Cane Plant: Sugar and Energy

Sugar cane photosynthetic efficiency of 1-3.3%

Sugar Industry

Energy Industry

30 % Cane tops & leaves
-
No incentive to harvest
-
left in field

70 % Cane harvested

All values dry matter per ton cane harvested

180 kg dry biomass

150 kg dry biomass (bagasse)

40 kg molasses sugar

120 kg sucrose

Molasses

Sugar

34%

34%

8%

24%

Electricity 100 – 300 kWh/ton

Ethanol 85 l

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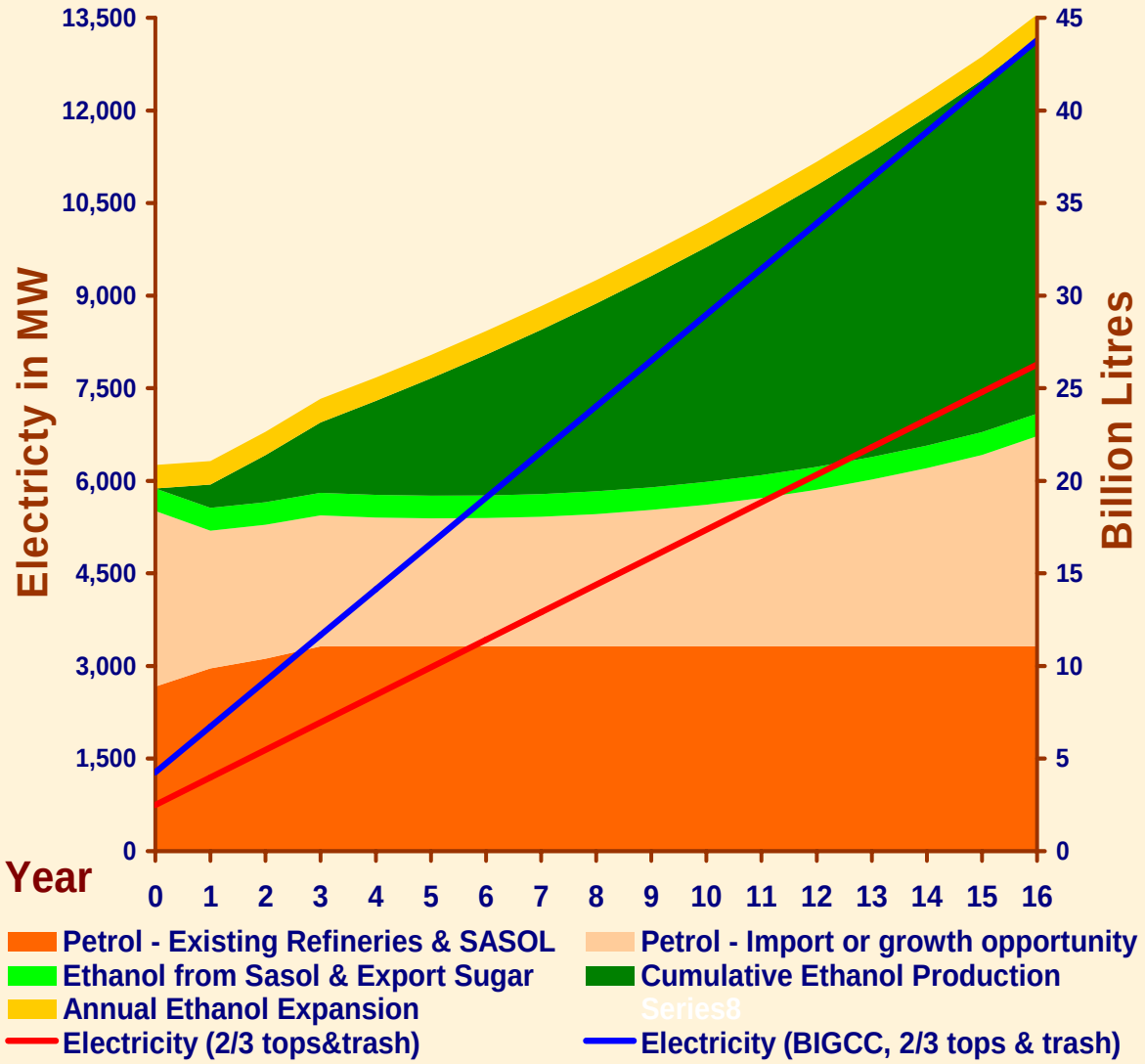
next 15 to 25 years by 2025 to 2035		Sugar Cane - Region (SADC)				Additional Capacity required by SA	
		Sugar	Energy Supply		Total		
			Electricity (Export)	Ethanol E50		Target	%
Electricity	1000 MW	1 - 2	7.5 - 12.5		8.5 - 14.5	40[1]	20% - 35%
Petrol	Billion liter per annum	0.5		20	20	20[2]	100%
Liquid Fuel	Billion liter per annum					40[2]	50%
CO_2 Emission Reduction	Million ton CO_2 per annum	5 - 10	40 - 70	20 - 60	65 - 140	360[3]	20% - 40%

1) ESKOM demand scenarios
2) Assumed 50% split between petrol and diesel
3) 2025 target: 42 % of 'business as usual' scenario 850 million ton CO2 pa based on SA commitment to UNFCCC and LMTS scenarios

SADC has similar cane energy potential as Brazil



- Combine competitive advantages of SADC
  - 2% – 4% of SADC cropland required
  - Water suitable – rain and irrigation
  - Market - Economies of scale
    - SA 70% of SADC fuel
    - SA 80% of SADC electricity
  - Equivalent to 13 SA sugar industries
- Electricity generation
  - 7 500 MW (tops and trash)
  - 12 500 MW (BIGCC)
  - Annual increase in supply - 500 to 1 200 MW

  Medupi power station = 4800 MW
- 20 billion litres of ethanol
  - 10% of Angola Oil Industry
- 15 years to achieve E50 – Brazil 2010 at E60
  - Fuel growth 5% pa - all future petrol demand
  - Blend E20-25 – anhydrous ethanol
  - Flex Fuel Vehicle E85 – hydrous ethanol
  - No light diesel vehicles
- >1 million new jobs
  - 5 million indirect employment
- Meets 20 to 40% of UNFCCC CO_2 reduction commitment by South Africa
- Rateable investment reduces cost over time
  - fleet procurement - IPAP
  - learning curve principle
  - 6 to 7 estates and plants each year
- $ 20 - 25 billion annual turnover

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Electricity Potential from existing Sugar Cane

All in MW	TH	SA Sugar Industry	SADC Sugar Industry
Generation for own use	160	130	440
Export Electricity (2/3 of tops and trash)			SADC[1] Mainland
Conventional Technology	300	440	750
BIGCC[2]	530	700	1 300

- Re-design
  - Sugar plant energy efficiency
  - Combined heat and power plant
- Investment
- Fair value for sugar cane (raw material)

1 Excluding Mauritius and Madagascar
2 BIGCC – Biomass Integrated Gasification Combined Cycle

Why Bioenergy from Sugar Cane?

- **Efficient generation of jobs**
  - Every two hectare creates one job
- **Develops agriculture and rural economy in SADC**
  - Reduces migration and cost of urban renewal
- **Develops manufacturing and services, especially SA**
- **Sustainable**
  - Climate - 70 to 100% lower carbon footprint
  - Renewable - scarce oil is used once
- **Improves energy security**
  - Distributed over many plants and countries
  - Both base and peak load electricity supply capacity
- **Improves food security**
- **Improves fiscal aspects of economies sustainably**

General feedback and concepts

- Consistent methodology and treatment across all supply options
  - Extent - from “inception to decommissioning”
- Clear separation of commercially conflicting interests
- Establish financially strong purchaser and market
- Energy Mix and “decision to invest” based on all known costs and impacts – internal and external
- Externality Parameters to date limited
  - ‘Multi-criteria decision making’ to be linked to parameters
- Limited input sheets and limited parameters
  - Full input to planning model to be made available
  - EPRI Report - link to parameters ? - supply options ?
- All supply options including raw materials to be defined
  - Parameters for each supply for all externalities and outputs to be defined

Key Parameter Feedback (1)

- **S3 - Discount Rate**
  - Project and Parameter Risks not included but need to be defined
  - Project and Parameter Risks either part of discount rate or addressed separately
  - Consistent with commercial private sector requirements
- **S8 - Imports**
  - MOU conditionality does not apply to any other supply options
  - MOU conditionality effectively eliminates future regional imports - unacceptable
- **S9 - Lifecycle cost**
  - Must include all known internal and external costs
  - Consider extent and probability of fleet strategy
- **S10 – Generating Plant Location**
  - Need to account for regional or SADC approach
- **S11 – Generation Mix**
  - Requires earlier inclusion of more RE including electricity from sugar cane
- **S12 – Funding & Financing**
  - Restructuring as proposed by IPAP2 critical

Key Parameter Feedback (2)

- **Ex1 - Climate Change**
  - Set targets based on best available data and policy
  - LMTS and UNFCCC commitments
- **Ex2 – Carbon Tax**
  - Final Carbon Tax same order as abatement cost estimates
  - Final Carbon Tax less than adaptation or cost of impact of fossil fuel
  - Final Carbon Tax to be included in Lifecycle Cost and Energy Mix Analysis
  - No comment on actual Carbon Tax implementation
- **Ex4 – Distribution Infrastructure**
  - Ensure sufficient distribution from supply across SADC to end-user
  - Equitable access by suppliers
  - Flexible and reliable market (off-take) for electricity at defined tariffs

Suggested additional parameters (1)

Parameter	Type	Comment
Coal Power Station	Supply	• include coal • link to externalities
Nuclear	Supply	• include uranium • link to externalities

Domestic Heating and Cooking	Demand	• replace wood and charcoal in rural areas
		• options could be combinations of:
		  • Solar
		  • Ethanol (gel)
		  • Paraffin
		  • Gas
		  • Electricity

Supply Options on Externalities	Output	• matrix between supply (inputs) and externalities (outputs)
Multi Criteria Decision Making - Evaluation	Output	• Combine financial and non-financial parameters • Overall rating (e.g. balanced score card)

Suggested additional parameters (2)

Parameter	Type	Comment
Employment	Ext	• Project phase • Operational phase • Employment efficiency - capital and operations
Water (Effluent)	Ext	• Effluent discharge • decommissioning of mines
Health	Ext	• Atmospheric regulations and impacts • Domestic use impacts
Fleet Strategy	Ext	• Extent and probability of local supply
Rural Development	Ext	• Migration between countries • Cost and impact of rural to urban migration
Regional Development	Ext	• Combine competitive advantages • Strengthening of region • Macro-economic benefits to SA and region
Macro-Economic	Ext	• Balance of payments • Growth multiplication

Thank you