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CDM Opportunities in Southern Africa, and the Role of Bio-Energy in Contributing to a Sustainable Regional Energy Mitigation Scenario

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BACKGROUND (1)

- Following the Marrakech Accord which approved general rules and procedures for CDM to take effect, and possible ratification after the WSSD conference in Johannesburg in the next week, it is essential that the role of bio-energy is assessed in contributing to sustainable Southern Africa Region energy mitigation scenario.
- For the region to arrive at such a scenario, it is natural that the present status quo, baseline in supply in the region, and its projection into the future are considered

BACKGROUND (2)

- Having done so, it is essential that driving forces which will influence the envisaged sustainable mitigation scenario are considered.
- The above should then be followed by assessing the potential of bio-energy contributing to this scenario, in terms of its range, resource use and technological options available.

BASELINE (1)

- Southern Africa's energy supply is based on power sector collaboration – the Southern African Power Pool (SAPP).
- SAPP was created in 1995 through an inter-utility memorandum of Understanding among 10 of the SADC utilities including Congo DR.

BASELINE (2)

❑ Aims of SAPP:

- To increase regional security of supply
- To smoothen load curves
- To engender economies of scale in the supply base
- To increase revenue for exporting countries by opening up a ready market
- To share power to meet national shortfalls and to off set temporary deficits in the medium term, and in the long term to adopt and implement power sharing as an operational strategy aimed at maximising financial and environmental benefits.

1995 STATUS QUO & BASELINE ENERGY CAPACITY

Country	Available Capacity (MW)	Peak Demand (mw)	Sources & Shares													
			Hydro MW	%	Coal MW	%	Diesel/ G.Turbine MW	%	Natural Gas MW	%	Wind MW	%	Biomass MW	%	Other & Nuclear	
Angola	326.0	180	200.8	61.6			125.2	38.4								
Botswana	172	205			172	100										
Congo DR	2560.8	600	2522.39	98.5			12.8	0.5	25.61	1.0						
Lesotho	4.9	80	3.3	67.4			1.6	32.6								
Malawi	243.7	150	219.1	89.9			24.6	10.1								
Mozambique	2075		2075.0	100												
Namibia	387	277	240	62.0	120	31.0	27.0	7.0								
South Africa	35, 951	25, 133	107.9	0.2	330.4	92									2804.2	7.8
Swaziland	50	117.5	40.0	80.0												
Tanzania	525	71.4	375	71.4			10									
Zambia	1750.5	1300	1670	95.0			150									
Zimbabwe	1722		516.6	30	120	7.0	80.5	4.7								
TOTAL	**45, 767**		7970	17.4		75.5	431.7	1.0	25.61	0.5					2804.2	5.6

Source: Climate Change cooperation in Southern Africa 1998

SADC PROJECTED ENERGY PEAK DEMAND/SUPPLY (GJ) (1)

Assumptions:

- Electric growth rates

	2015-2020	2020-2050
South Africa	2.0%	1.5%
Rest	3.5%	2.5%

- The projected energy supply has been arrived at taking into account national utility plans and also experts' assessment on the energy natural resource potential of each SADC country

SADC PROJECTED ENERGY PEAK DEMAND/SUPPLY (GJ) (2)

	1995		2030		2050	
~~Demand~~	~~45.8~~		~~73.5~~		~~101.70~~	
Supply	**GJ**	**%**	**GJ**	**%**	**GJ**	**%**
(i) Coal	34.5	75.5			76, 294.65	60.3
(ii) Hydro	7.97	17.4			41, 247.15	32.6
(iii) Diesel/ Gas turbines	0.43	1.0			253.05	0.2
(iv) Natural Gas/CBM	0.025	0.5			759.15	0.6
(v) Wind	-				607.32	0.48
(vi) Biomass	-					
(vii) Other/nuclear	2.804	5.6			1897.88	1.5
TOTAL	**45.8**				**126, 525**	

Source: Climate Change Cooperation in Southern Africa and Expert Assessment

PROJECTED GENERATING CAPACITY IN SOUTHERN AFRICA BY COUNTRY BY 2050

Country	Capacity (MW)	Predominant Source
Angola	4013	Hydro
Botswana	187	Coal/imports
Congo DR	14, 676	Hydro
Lesotho	211	Imports
Malawi	678	Hydro
Mozambique	8234	Hydro
Namibia	894	Imports
South Africa	77, 171	Coal
Swaziland	109	Imports
Tanzania	5749	Coal/Natural Gas/Imports
Zambia	5759	Hydro
Zimbabwe	8844	Coal/hydro/imports
TOTAL	**126, 525**	

Source: Climate Change Cooperation in Southern Africa and Expert Assessment

SUSTAINABLE MITIGATION SCENARIO WHICH TAKES ACCOUNT OF THE ROLE OF BIO-ENERGY (1)

- **DRIVING FORCES**
  - **Security of supply**
  - **Industrial competitiveness**
  - **Poverty reduction/sustainable development**

SUSTAINABLE MITIGATION SCENARIO WHICH TAKES ACCOUNT OF THE ROLE OF BIO-ENERGY (2)

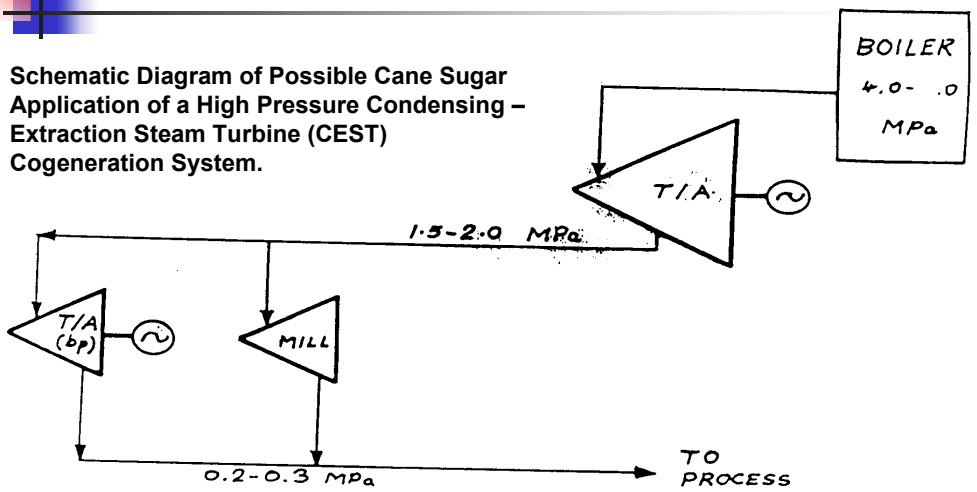
- Currently Southern Africa produces 50.0 Million tonnes of sugarcane
- Once produced has a potential of 15.0 million tonnes of bagasse depending on the nature of the technology used
- Bagasse can have a significant contribution to share of bio-energy

SUSTAINABLE MITIGATION SCENARIO WHICH TAKES ACCOUNT OF THE ROLE OF BIO-ENERGY (3)

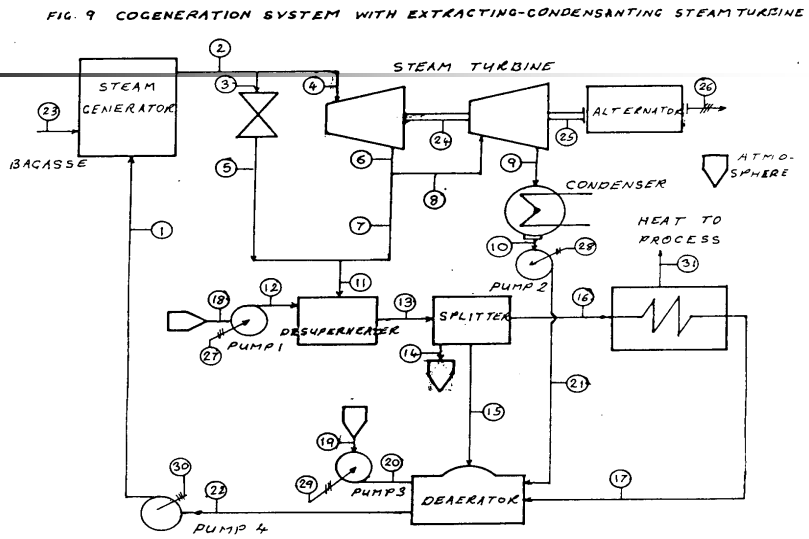
- In the Sustainable Mitigation Scenario, the technology for this purpose include:
  - Traditional boilers – low pressure
  - Improved combustion in traditional boiler
  - CEST (Condensing Extraction Steam Turbines)
  - BIG/CC (Biomass Integrated Gasifier Combined Cycle)

EXAMPLE OF CEST (1)

Schematic Diagram of Possible Cane Sugar Application of a High Pressure Condensing – Extraction Steam Turbine (CEST) Cogeneration System.

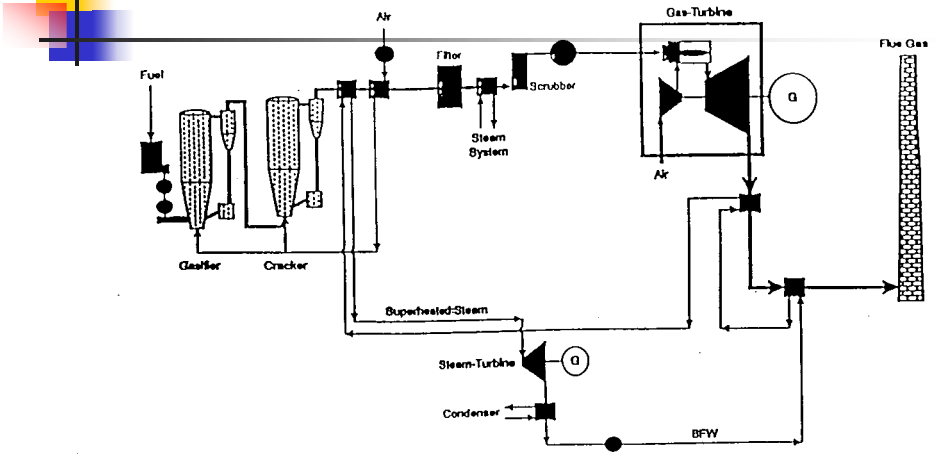


EXAMPLE OF CEST (2)



Cogeneration System with Extracting – Condensing Steam Turbine.

EXAMPLE OF BIG/CC



Combined Cycle with Integrated Atmospheric Gasifier

ESTIMATED SURPLUS ELECTRICTY GENERATION FROM SADC SUGARCANE FACTORIES BASED ON CURRENT & PROJECTED BAGASSE AVAILABILITY (1)

Year	Bagasse Resource (millions)	Traditional Boilers (MW)	Traditional Boilers with Improved Combustion* (MW)	CEST (MW)	BIG/CC (MW)
2000	50.0	Negligible	750	1500	3000
2020	80	Negligible	1250	2500	5000
2030	100	Negligible	1500	3200	6500
2050	180	Negligible	2600	5500	11000

**Also involves optimisation of steam generation and utilisation*

Source: *Study on Luena Sugarcane Resources and Mauritius Experience*

SURPLUS ELECTRICTY GENERATION FROM SADC SUGARCANE FACTORIES BASED ON CURRENT AND PROJECTED BAGASSE AVAILABILITY (2)

- Other agricultural wastes in the region such as maize cobs, groundnut shells have good potential
- For example in Zambia where data is available, the following potential exists.

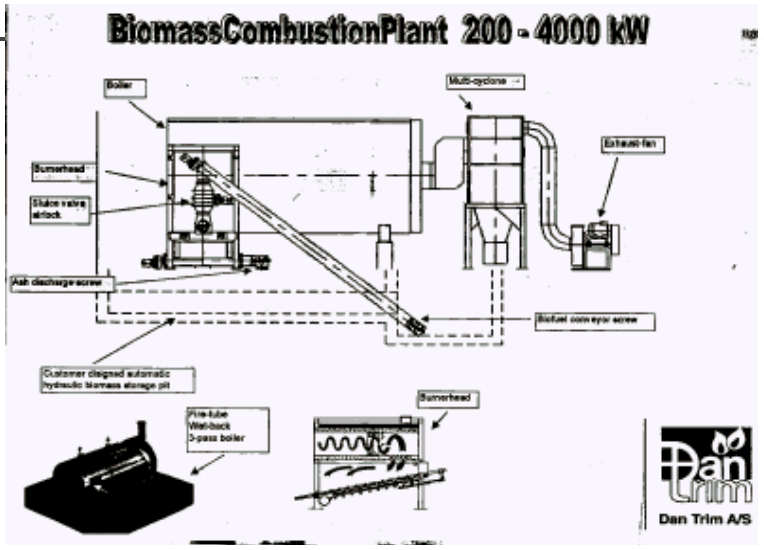
AVAILABLE AND ECONOMIC ENERGY POTENTIAL FROM OTHER AGRICULTURAL PRODUCTS (ZAMBIA) (1)

Crop	Average Yield (tonnes)	Residue Ratio	Available Potential (tonnes)	Available Potential (MJ million)	Economic Energy Potential (MW)
Maize Cobs	1, 000, 000	0.3	300, 000	5.61	10
Ground-nut shells	50, 000	0.3	15, 000	0.23	0.5
Millet Straw	50, 000	1.2	60, 000	0.9	1.2
Cotton stalks	60, 000	3.0	180, 000	3.29	4.5

AVAILABLE AND ECONOMIC ENERGY POTENTIAL FROM OTHER AGRICULTURAL PRODUCTS (ZAMBIA) (2)

- Such raw material base can be used in decentralised situations and particularly suitable for rural areas where the national grid does not reach.
- Use of such material will result in provision of electricity in such areas required for income generating activities.
- The technology can be either gasification systems or advanced combustion systems based on internal steam engines

Use of Waste in Advanced Combustion Equipment



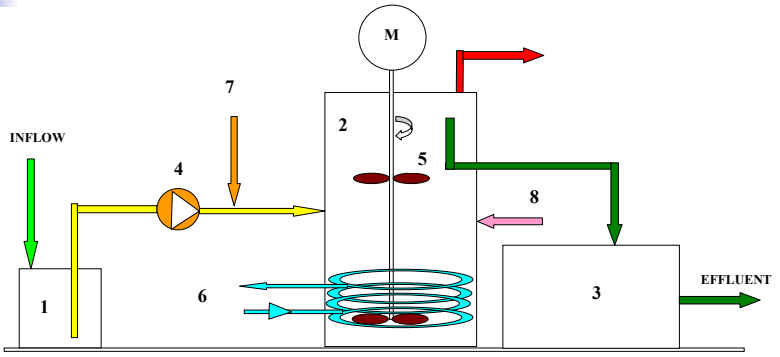
Technology Characteristics Summary

Technology	Output (electricity), kW	Capital Cost Per kW (US$)
Biomass Gasification	5 – 500	900 – 3, 000
Advanced combustion system	30 – 1, 500	1, 000 – 3, 500
CEST	0-50, 000	900 – 3, 000
BIG/CC	0-60, 000	900 – 3, 000

Industrial Waste

- **Most industries in the SADC region, particularly food & beverage, leather & textiles industries, and sewerage companies have large quantities of industrial waste which currently is untapped**
- **The wastes above can be used to produce biogas (methane). The gas which is generated from bio-methanation process, and burnt in advanced combustion and/or co-generation systems to generate steam for either process use or electricity generation on site.**
- **Application of such technologies will go a long way in improving industrial competitiveness through reduction of energy costs by using on-site generated fuel or electricity.**

Generation of Biogas From Waste Water For Use In Boilers



1Pre-treatment
2Entec-CSTR Digester
3Effluent Buffer
4Feed Pump

5Low Speed Mixer
6Heating Tubes
7Nutrient addition
8Ph Adjustment

CONCLUDING REMARKS (1)

- From the aforesaid, it is clear that sustainable mitigation scenarios do exist which can go along way in developing CDM projects through the CDM financing mechanism
- Project finance required for implementation can be made available through:
  - Advanced sale of carbon credits to contribute to project finance
  - Improved revenue streams (IRR and NPV) through sale of remaining carbon credits

CONCLUDING REMARKS (2)

- In view of the level of economic development in most parts of Southern Africa, one of the barriers for CDM investors from the North is the size of CDM projects
- However, it is pleasing to note that the Conference of Parties through the Marrakech Accord have specifically addressed this hand-cap through CDM prompt start by allowing project with up to
  - 15MW
  - 15, 000 tonnes of $CO_{2\ eq}$ per annum

CONCLUDING REMARKS (3)

- Further the World Bank is proposing a Community Development Fund to provide carbon finance to small scale projects in small countries and poorer, rural areas of development countries
- Other countries are interested
  - CERUPT
  - Finnish CDM
  - Swedish CDM