ECONOMICS OF RICE HUSK FUELED COGENERATION POWER SYSTEM FOR A RURAL CLUSTER OF RICE MILLS IN NIGERIA

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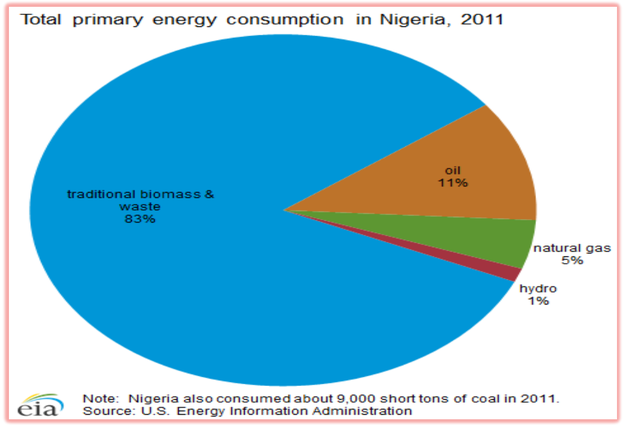
INTRODUCTION

- This study investigates the feasibility of replacement of conventional power system based on fossil fuel with a cogeneration system fuelled with rice husk
- 83% of primary energy consumption in Nigeria is derived from traditional biomass and agro wastes
- Only 10% of rural population have access to modern energy service
- Agro based industries such as rice mills generate substantial biomass (rice husk) but depend on high cost and environmentally unfriendly fossil fuels for their process heating and electrical energy needs



BARRIERS TO BIOMASS CONVERSION

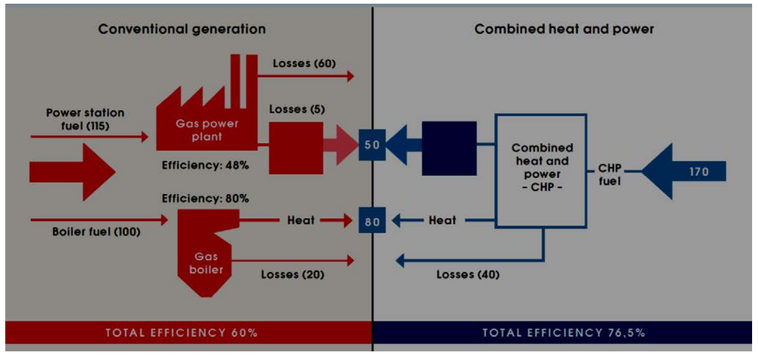
- Low energy content per unit
- High initial capital cost of conversion technology
- Non-modularity of conversion technology

INCENTIVES

- US$180/MWh feed-in-tariff
- Guaranteed power buy back of excess electricity
- Emissions Reduction

METHODOLOGY

- This study proposes combined heat and power system as an efficient means of rice husk utilization for the service of heat and electricity needs of rice mills
- For the cogeneration system to be feasible, it should accumulate enough avoided cost and income from energy sale to overcome the initial cost

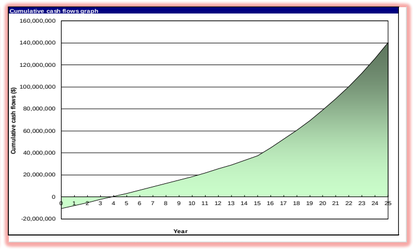


- RETScreen clean energy simulation software was used to estimate energy production and GHG emission reduction as a result of replacement of the conventional system with the cogeneration system
- Discounted cash flow, Monte Carlo simulation and sensitivity analysis

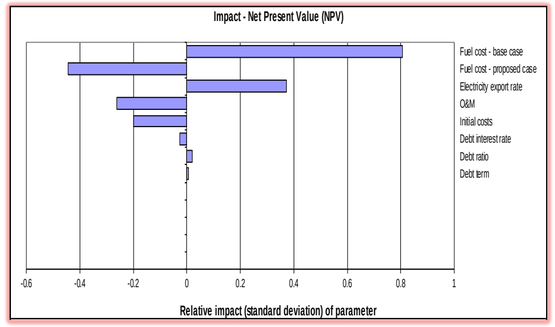
RESULTS

- At 5MW capacity and 65% efficiency, the cogeneration system delivers 17,187 MWh of heat and 7,078MWh of electricity to the rice mills cluster processes and export 36,742MWh of electricity to the grid annually.
- The 5MW capacity has initial capital cost of US$34.8million and annual cost of US$6.2million
- Pay back period of 3.8 years and levelized generation cost of US$0.049KWh
- GHG emission reduction equivalent to taking 3,656 cars and light trucks off the road was achieved.
- At 5% risk level, IRR ranges between 20.8% and 38.4%

Financial viability		
Pre-tax IRR - equity	%	40.0%
Pre-tax IRR - assets	%	14.8%
After-tax IRR - equity	%	28.4%
After-tax IRR - assets	%	10.6%
Simple payback	yr	5.3
Equity payback	yr	3.8
Net Present Value (NPV)	$	42,578,934
Annual life cycle savings	$/yr	3,653,720
Benefit-Cost (B-C) ratio		5.08
Debt service coverage		2.46
GHG reduction cost	$/tCO2	(95)



- Most influential factors include; fuel cost in the conventional case, electricity export rate and cost of handling rice husk



CONCLUSION

- Cogeneration provides cost effective method of rice husk utilization in a rural industrial setting without grid electricity supply
- LGC of US$0.049/KWh is profitable for excess electricity supply to rural isolated grid against the benchmark of US$0.07/KWh
- Guaranteed buy back mechanism was key to profitability
- Removal of artificial caps on the cost of fossil fuels shall encourage more deployment of captive biomass fired cogeneration system
- Introduction of carbon trading/credit shall encourage further deployment

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