

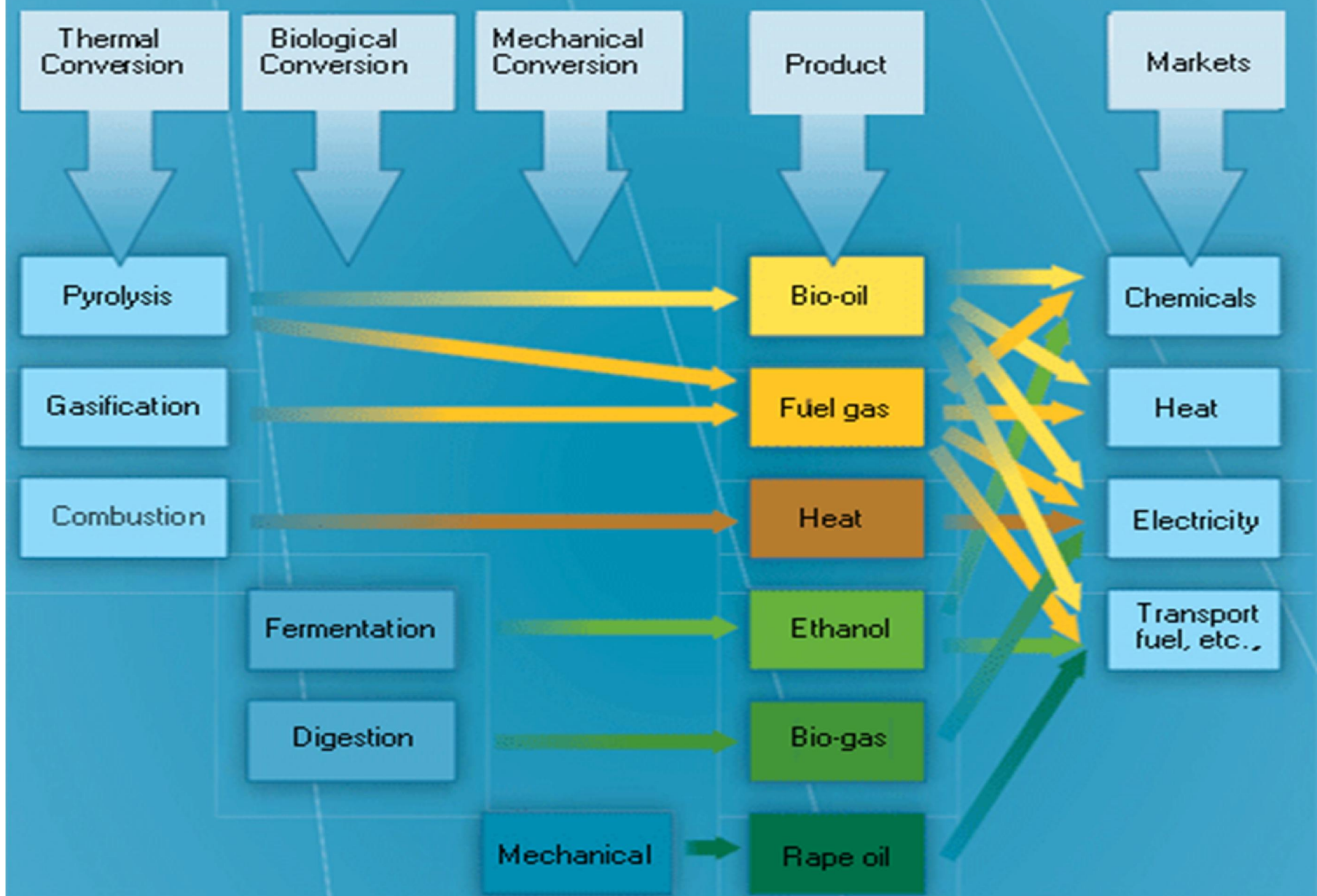
Poly generation using Biomass gasification



4th February 2013



Biomass conversion pathways



Biomass Gasification is the process of conversion of *solid* biomass to *gaseous* form by partial pyrolysis, oxidation and reduction under sub-stoichiometric conditions.





Composition of Producer gas

H_2 (18-20%)

CO (18-20%)

CH_4 (<3%)

CO_2 (8-10%) and balance

N_2



Producer gas
can be used for :

Thermal Applications

Power Generation and/or

Combination of Heat and Power

Thermal Applications



To replace Diesel/FO/HFO/LPG in:

Kilns

Dryers

Furnaces

Boilers & Thermal Heaters

Thermal Applications



Typically used in melting Iron,
Steel and Lead

Thermal Applications

Heat treatment furnace, Crumb rubber preparation, Biscuit Furnace, Tea drying and fluidized bed driers





Hot water and process steam generators

e.g. in the chemical or pharmaceutical industry, paper industry, industrial cleaning, and farming.



Asphalt production

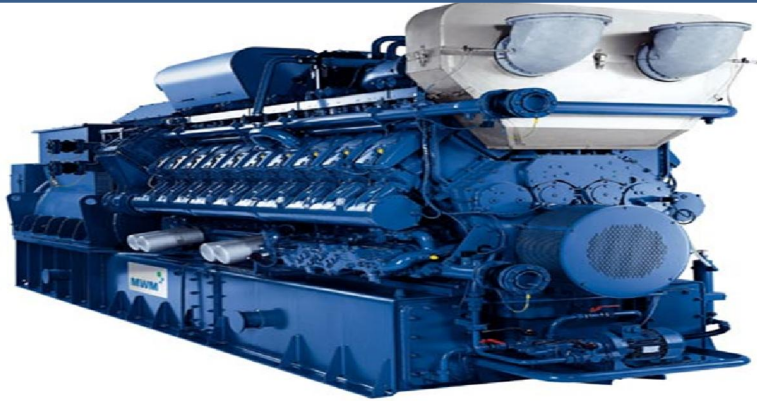
for drying and heating the aggregates.



Drying processes

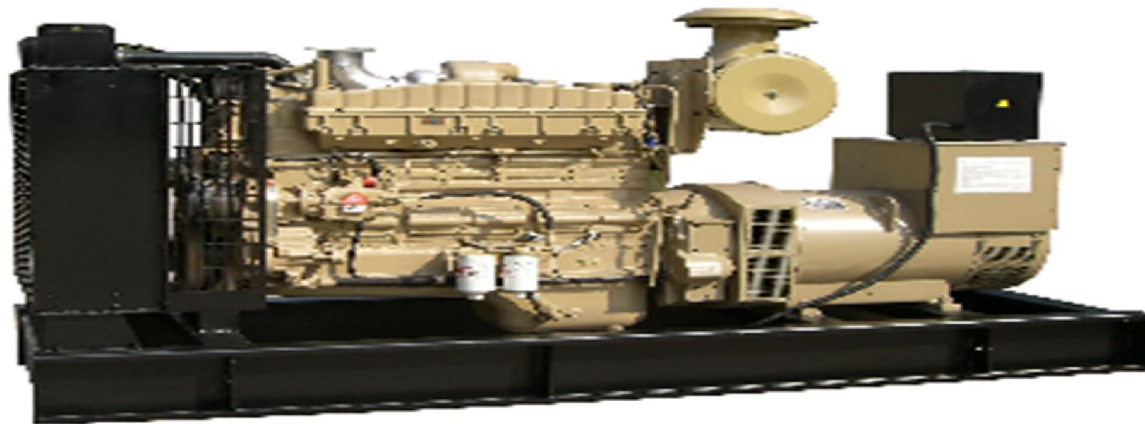
e.g. in ore processing, mineral processing, sludge drying, biomass drying, and foodstuff drying.

Power



Producer gas can be used in 100% Gas Engines
and/or modified Diesel Engines in dual fuel mode

(80% Producer Gas : 20% Diesel)





Combination of
Heat and Power

Energy in engine exhaust gas and engine jacket
water can be recovered for heating or chilling
application

for applications in

Jelita
Cold Storage





Air conditioning
Malls/Multiplex



Local power generation

on industrial estates and in residential areas with a poor supply situation.

Biomass Gasifier based power plants can be built from 25 kW to 3 MW.



BIOMASS ENERGY BASED RURAL ELECTRIFICATION

B.HOSAHALLI, TUMKUR Dist.

Sponsored by. 1. MIN. OF RURAL DEVELOPMENT.

2. MIN. OF NON CONVENTIONAL ENERGY SOURCES.

3. RAJIV GANDHI FOUNDATION.

Implemented by. ASTRA & KSCST, I.I.S., BANGALORE - 12



BIOCHAR

Byproduct is
Biochar that
guarantees
output by 20%
and best soil
sequestration
product

Case Study



PROJECT CONCEPT

- Tamilnadu is a power starved State
- Plant designed to meet the energy needs of
 - Mall
 - Multiplex
 - Hotel
 - Convention hall
- Land acquired for energy plantation to ensure fuel linkage

Location

- The project is located in the bustling Industrial town of Tirupur boasting of a turnover of 3 billion US \$ per annum of Hosiery products.
- Velan Hotels Limited in Tirpur is a 4 star rated hotel and one of the oldest and patronised hotel.
- Velan Hotels is located in a 20 acre plot which houses a hotel, 2 convention halls a Mall and a Multiplex. The power plant is located within the same premises

Energy Consumption Profile

Electricity	Annual consumption kWh
Mall (12 hrs operation per day)	3,600,000
Multiplex (12 hrs operation per day)	1,400,000
Hotel	1,700,000
Convention Hall	300,000
Plant Auxiliary consumption	2,500,000
Grid feed	10,000,000
Total	19,500,000
Air conditioning	Tons Refrigeration (TR)
Peak	1200
Average	800

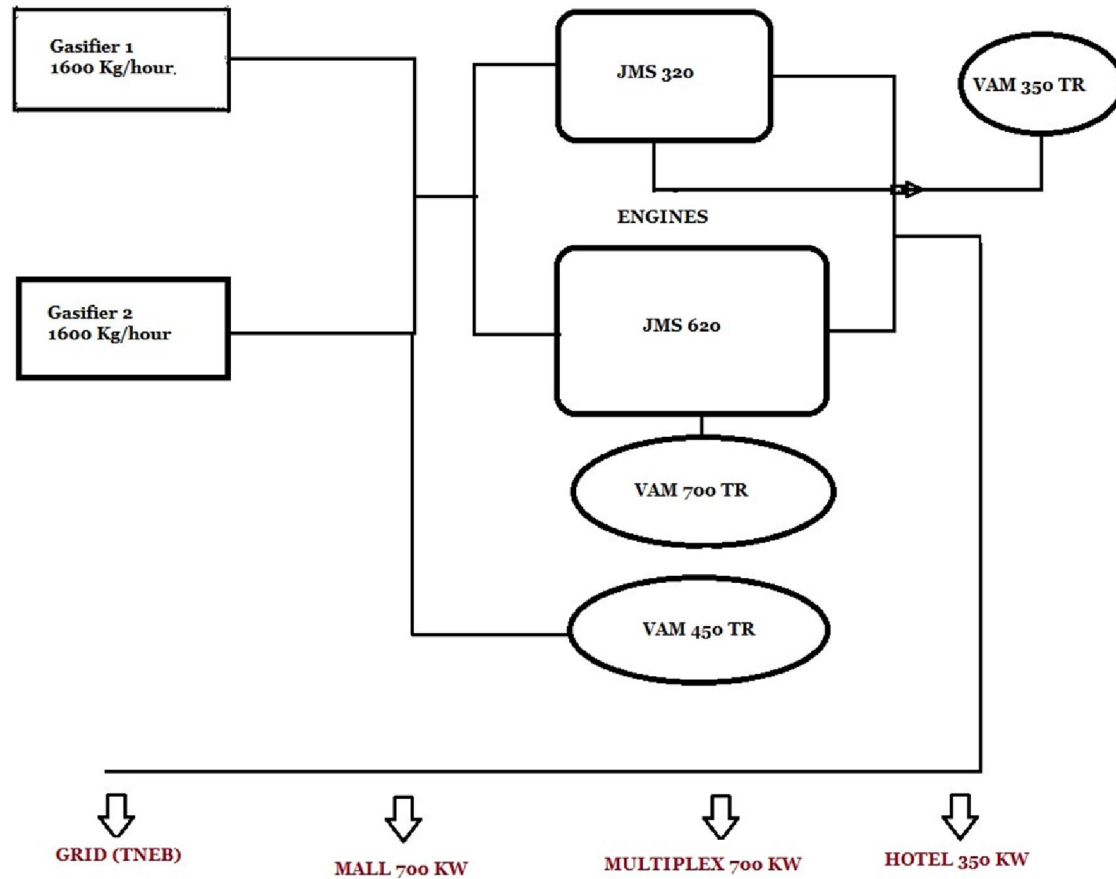
WASTE HEAT RECOVERY DATA

Waste heat data from engines	JMS 320	JMS 620	
Electrical output	766	1976	kW
Exhaust gas temperature	456	456	Deg .C
Exhaust gas mass flow rate (wet)	4863	14399	kg/hr
Exhaust gas total energy available	632	1890	kW
Surface heat and unaccounted heat	101	205	kW
Energy removed by jacket water	268	417	kW
VAM recovery from waste heat	205	595	TR

PLANT CAPACITY

Plant sizing		
Gasifier	kg/hr	$1600 \times 2 = 3200$
Engine	kW	$766 + 1956 = 2722$
VAMs	TR	$350 + 700 + 450 = 1500$
Plant operating hours		7250
Plant load factor		82.5%
Specific fuel consumption kg /kWh		1.00

Plant Configuration



PROJECT COST

Project cost	Rs.
Land	90,000,000
Building	22,000,000
Power plant machinery	170,000,000
Absorption Chillers VAMs	30,000,000
Miscellaneous fixed Assets	6,000,000
Preliminary and preoperative expenses	13,000,000
Total	331,000,000
Cost per kW	122,600
Cost per kW without land	89,260
Cost per kW without VAM	78,148
Subsidy	20,000,000
Cost per kW after subsidy	70,740

FISCAL BENEFITS

- Capital subsidy of Rs. 10,000,000/
MW
- Accelerated Depreciation Allowance
- Tax break of 50% for 5 years and 30%
for the next 5 years

Plant Operating Parameters

		Rs
Specific fuel consumption	kg./kWh	1.00
Cost of wood	Rs./kg	4.50
Input feed cost		4.50
O and M cost for gasifier		0.45
O and M cost for engine		0.95
Total cost		5.80

SPECIFIC FUEL CONSUMPTION

Average engine efficiency (Electrical)	37%
Input energy per kWh out put	2.70
Equivalent gas input @ 1150 kcal/Nm ³	2.02
Average biomass input @2.5Nm ³ /kg	0.81

Revenue Projections

Electricity generated	19,500	MWH
Captive consumption	9,500	MWH
Grid feed	10,000	MWH
TNEB tariff - Commercial use	9,800	Rs./MWH
Notional cost at current tariff rate	93.1	Rs.million
Rate of sale to third parties	7,000	Rs./MWH
Revenue from third party sale	70	Rs.million
Gross revenue	163.1	Rs.million
Cost of Air conditioning power saved	25	Rs.million
Cost of Generation	5,800	Rs./MWH
Annual generation cost	113.1	Rs.million
Net revenue from operation	75	Rs.million

Profit projections

Net revenue from operation	75	Rs.million
Average interest cost (loan 200 million@ 7% /annum	14	Rs.million
Profit from operation	61	Rs.million
Sale of REC @ Rs. 1500/MWH	15	Rs.million
Net Profit	76	Rs.million
Net Profit / Equity	0.57	
Net Profit/ Project cost	0.23	

Gasifier Arrangement



Gas cooling and scrubbing system



Cooling tower bank



Gas Engine



Is there enough Biomass?

PRODUCTION OF 2nd Generation

Wheat as Intercrop

Sorghum as Intercrop

By Order

Average Growth Rate (t/ha/year)

Year	Wheat	Sorghum	Other	Total
1990	100	0	0	100
2000	150	50	0	200
2010	200	100	0	300
2020	250	150	0	400

BIOENERGY
(INTERCROPPED WITH)
FOOD & CASH CROPS

Pie Chart Data:

Source	Percentage
Forest Residues	33%
Other Residues	22%
Corn Stalks	18%
Heavy Manufacturing	15%
Timber Residues	12%

BIOENERGY
(NON FOOD SOURCES OF BIOFUEL FEED STOCK)

Type of Crops and biomass residue available/ 1 Kg of Crop

Crop Name	Residue Name	Amount (in Kg)		Crop Name	Residue Name	Amount (in Kg)
Areca Nut	Husk	0.80		Maize	Cobs	0.30
Arhar	Hut	0.30			Stalks	2.00
	Stalks	2.50		Masoor	Stalks	1.80
Avare	Stalks	1.10		Meshta	Leaves	0.05
Bajra	Cobs	0.33				Stalks
	Husk	0.30		Mong	Husk	0.15
	Stalks	2.00				Stalks
Banana	Residue	3.00		Mustard	Stalks	1.80
Barley	Stalks	1.30		Niger Seeds	Stalks	1.28
Cardamom	Stalks	0.64		Onion	Stalks	0.05
Coconut	Husk & Pith	0.53		Paddy	Husk	0.20
	Shell	0.22				Stalks
Coffee	Husk	0.50				Straw
Coriander	Stalks	1.15		Paes and Beans	Stalks	0.50
Cotton	Boll Shell	1.10		Potato	Leaves	0.76
	Husk	1.10				Stalks
Cow Gram	Stalks	1.10		Pulses	Stalks	1.30
Cumin Seed	Stalks	1.55		Ragi	Straw	1.30
Dry Ginger	Stalks	0.05		Red Gram	Stalks	1.10
Garlic	Sheath	0.25		Small Millets	Stalks	1.20
	Stalks	0.25		Soya Bean	Stalks	1.70
Green Gram	Stalks	1.10		Sugarcane	Baggasse	0.33
Ground Nut	Shell	0.30				Top & leaves
		Stalks	2.00		Tapioca	Stalks
Guar	Stalks	2.00		Turmeric	Stalks	0.30
Horse Gram	Stalks	1.30		Urad	Husk	0.20
Jower	Cobs	0.50				Stalks
	Husk	0.20		Wheat	Pod	0.30
	Stalks	1.70				Stalks
Kodo Millets	Stalks	1.16		Dried Chilly	Stalks	1.50
Linseed	Stalks	1.47		Oil Seeds	Stalks	2.00

Ideal species of trees for Energy Plantations

Species	Spacing (in Mtr)	Trees/ Acre	yield / tree (in Kgs)	Yield / Acre (tons)
Melia Dubia (Malai vembu)	1.5 x 1.5	1,799	104	187
Paulownia fortunei	3 x 1.5	900	80	72
Paulownia trifoliata	2 x 2	1,012	70	71
Casuarina junghuhniana (Savukku)	1 x 1	4,049	30	121
Eucalyptus camaldulensis	1.5 x 1.5	1,799	25	45
Eucalyptus tereticornis	1.5 x 1.5	1,799	12	21
Prosopis juliflora (Velikathan)	1.2 x 1	3,374	17	57
Elephant Grass	Bush	Bush	..	40



Agri waste

Corn /Wheat straw,
Sugar cane trash,
fronds, Cotton stalks,
Rice/ Coffee husk,
wood chips, sawdust,
fronds, Groundnut
shell...anything.!

A value addition of Industrial Biomass residues



BRIQUETTING OF SMALL BRANCHES AND LEAVES



Different grades of Briquettes



A Note on our company

- Provides total turnkey solutions in renewable, green and clean energy integrating various technologies – Gasification, Pyrolysis, Combustion, Bio-methanation and Solar Thermal CSP with Parabolic Troughs.
- Support in **Energy Plantations** to ensure fuel linkage at viable prices over the life of the plant.
- **Acclaim** over the last decade and more of operation in the "Green Power" sector has more than 50,000 hours experience in Biomass Gasifier Plants. Acclaim today offers sustainable solutions for industries to replace fossil fuels (Diesel/Furnace Oil/LPG) in Thermal applications and Power Generation.
- **Acclaim** integrates a variety of technology options to offer best fit solutions using Biomass and have implemented projects pan India from TN to J&K.





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