Biomass Gasification
An Introduction

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Agenda

- About Ankur Scientific
- Biomass as a Fuel
- What is Gasification? Why Gasification?
- Ankur Gasifiers
  - Range of Applications
  - Schematics
  - Environmental Aspects
- Actual Case Studies
  - Thermal Applications
  - Power Generation
- Opportunities

About Ankur Scientific

Founded by Dr.B.C.Jain In 1986

Located in Vadodara

12 National Associates
4 Regional Offices

8 International Associates

110 Employees
Extensive Mfg. Facilities
GoI recognised R&D

World wide leader In Small & Medium scale Gasifiers

Senior Management
Well known Nationally & Internationally for expertise In Gasifier Technology

Installed more than 700 gasifiers worldwide

Systems supplied in 2004

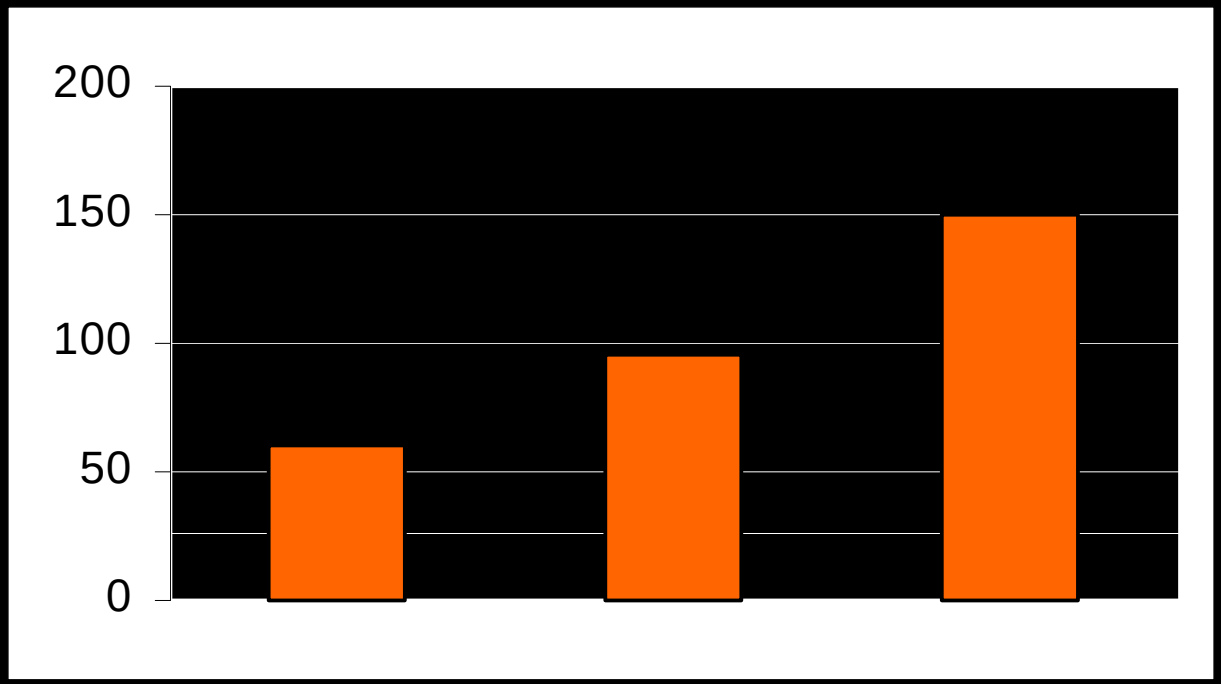
- Systems supplied: 110
- Exports: 15
- 72 systems for power generation; rest for thermal applications
- 40 units for industry
- 69 small rating systems for rural decentralized power
- 66 systems using Wood as feedstock

Systems supplied in 2005

- Systems supplied: 105
- Exports: 15
- 80 systems of above 100 kWe for power generation
- 95 units for industry
- 10 Large (120 kWe and above) 100% Producer Gas Power Plants based on wood as the feedstock.
- 65 systems using Wood as feedstock

Biomass Gasification - Business

- Ankur Scientific turnover from Gasifiers
  (past 3 years - 2003 - 2005)



Turnover in Million Rupees

Biomass as a Fuel

- Age-old and most widely used fuel source - *Annual consumption was estimated to be of the order of 20 million tonnes a few years ago*
- A Cheap, abundantly available fuel
- A very Clean fuel
  - Biomass has no Sulphur content
  - Short CO_2 fixation cycle
- Renewable

Why Biomass Gasification?

Biomass → Producer Gas

Gasification

- Highly Efficient Process
- Can be applied over a range of output ratings (few to hundreds of kWs)
- Can be used for thermal applications & electricity generation
- Low initial investment and cost of power production

Producer Gas

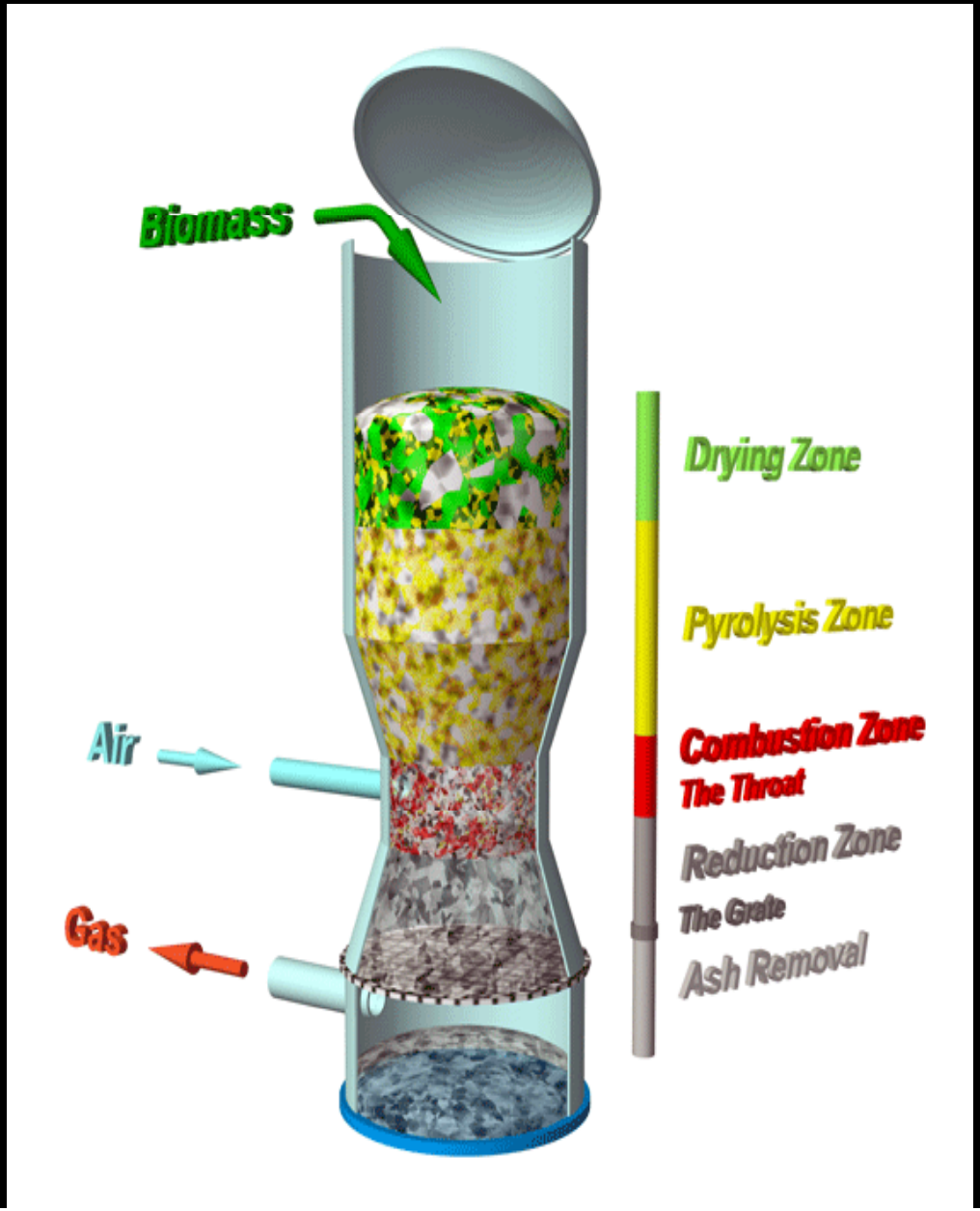
- Allows better process control and convenience
- Cleaner combustion in connected equipment
- Elimination of all pollution related to Biomass use

What is Gasification?

Basic Process Chemistry

- Conversion of solid fuels into combustible gas mixture called producer gas ($CO + H_2 + CH_4$)
- Involves partial combustion of biomass
- Four distinct process in the gasifier viz.
  - Drying
  - Pyrolysis
  - Combustion
  - Reduction

Gasification – Basic Process Chemistry Schematic



Producer Gas Properties

Particulars	Rice Husk as biomass	Woody Biomass
CO	15-20%	15-20%
H_2	10-15%	15-20%
CH_4	Upto 4%	Upto 3%
N_2	45-55%	45-50%
CO_2	8-12%	8-12%
Gas C.V. in kcal/Nm^3	Above 1050	Above 1100
Gas generated in Nm^3/kg of biomass	2	2.5

‘Ankur’ Gasifiers

What we Offer

The WBG Series:
Fuel : Woody Biomass

The FBG Series:
Fuel : Fines *(Rice Husk)*

The Combo Series:
Fuel : Both of the above

‘Ankur’ Gasifiers– Product Range

WBG Series –

- 5 kWe to 1500 kWe.
- Uses wood, corncob, coconut shells, bamboo pieces as the fuel.
- Thermal output 12500 - 3750000 kCal/hr.

FBG Series –

- 40 kWe to 500 kWe.

'Ankur' Gasifiers– Product Range *(contd.)*

FBG Series *(contd.)* –

- Uses rice husk, mustard stalk, coconut stalk etc. as fuel.
- Thermal output 100000 - 1250000 kCal/hr

COMBO Series –

- 40 kWe to 500 kWe.
- Multi Fuel capability (woody as well as fines)
- Thermal output 100000 - 1250000 kCal/hr

Applications

Power Generation

Dual Fuel mode:

About 70% energy comes from Biomass and the rest from liquid fuels.

0.9 kg of wood or 1.4 kg of rice husk & 90 cc of diesel/kW-hr

100% Producer Gas:

Systems based totally on Producer Gas. The fuel cost of power generation is very low.

1.3 kg of wood/kW-hr

Thermal Applications

Flame temperature of 1200^{o}C.

Applications requiring up to 1000^{o}C can be totally on Producer Gas.

Higher temperatures through Dual fuelling.

4 kg of wood or 6 kg of rice husk to replace a liter of liquid fuel

Range of Applications

Power Generation

- Irrigation Pumping
- Village Electrification
- Captive Power *(Industries)*
- Grid-fed Power from Energy Plantations on Wastelands
- Simultaneous Charcoal and Power Production

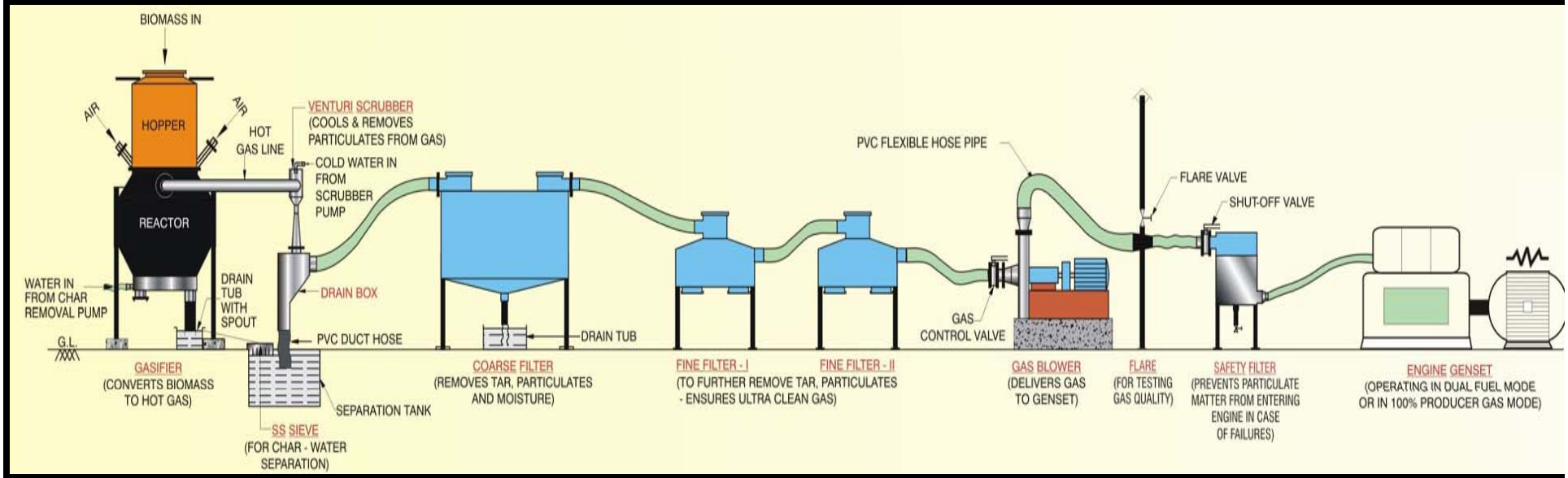
Thermal Applications

- Hot Air Generators
- Dryers
- Boilers
- Thermic Fluid Heaters
- Ovens
- Furnaces & Kilns

Ankur Scientific Energy Technologies Pvt. Ltd.

"ANKUR" BIOMASS GASIFIER SYSTEM

SCHEMATIC (POWER GENERATION MODE)



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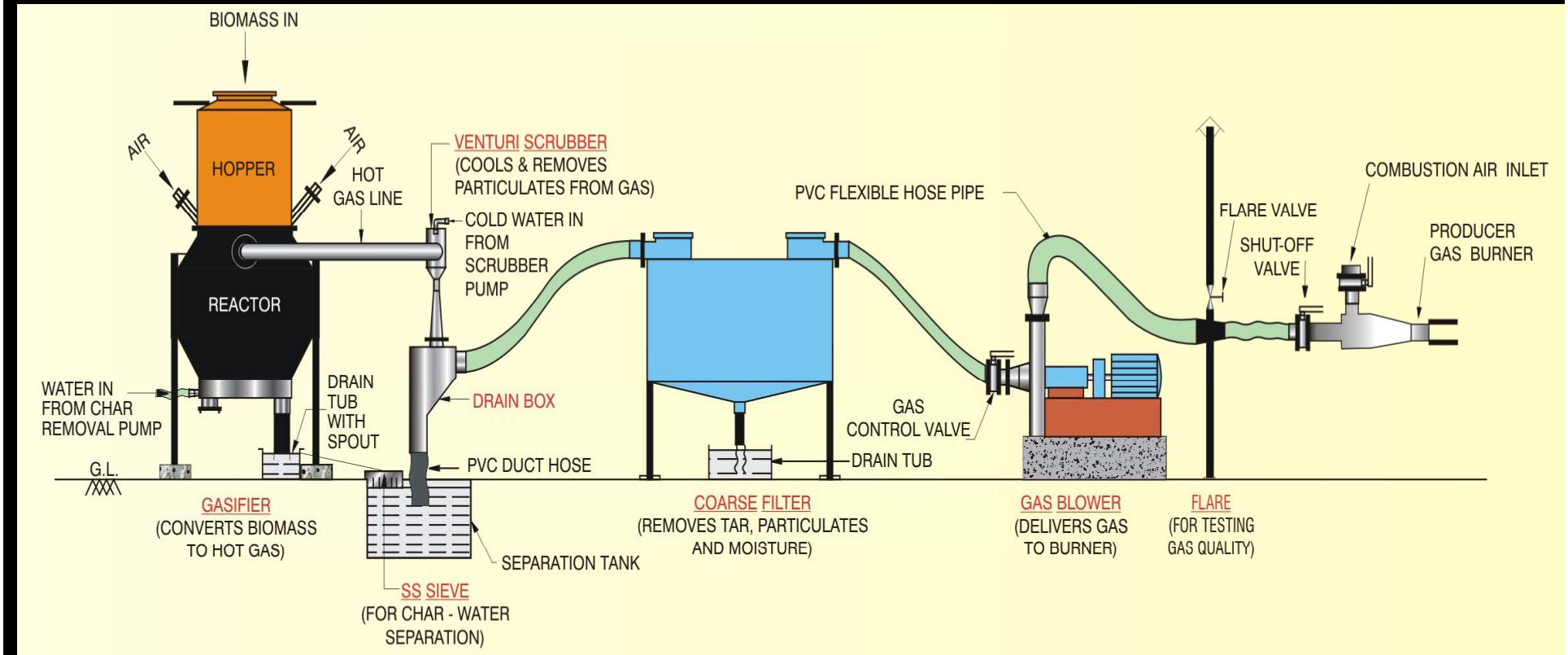
"ANKUR" BIOMASS GASIFIER SYSTEM

SCHEMATICS (THERMAL MODE)



SCRUBBED GAS MODE

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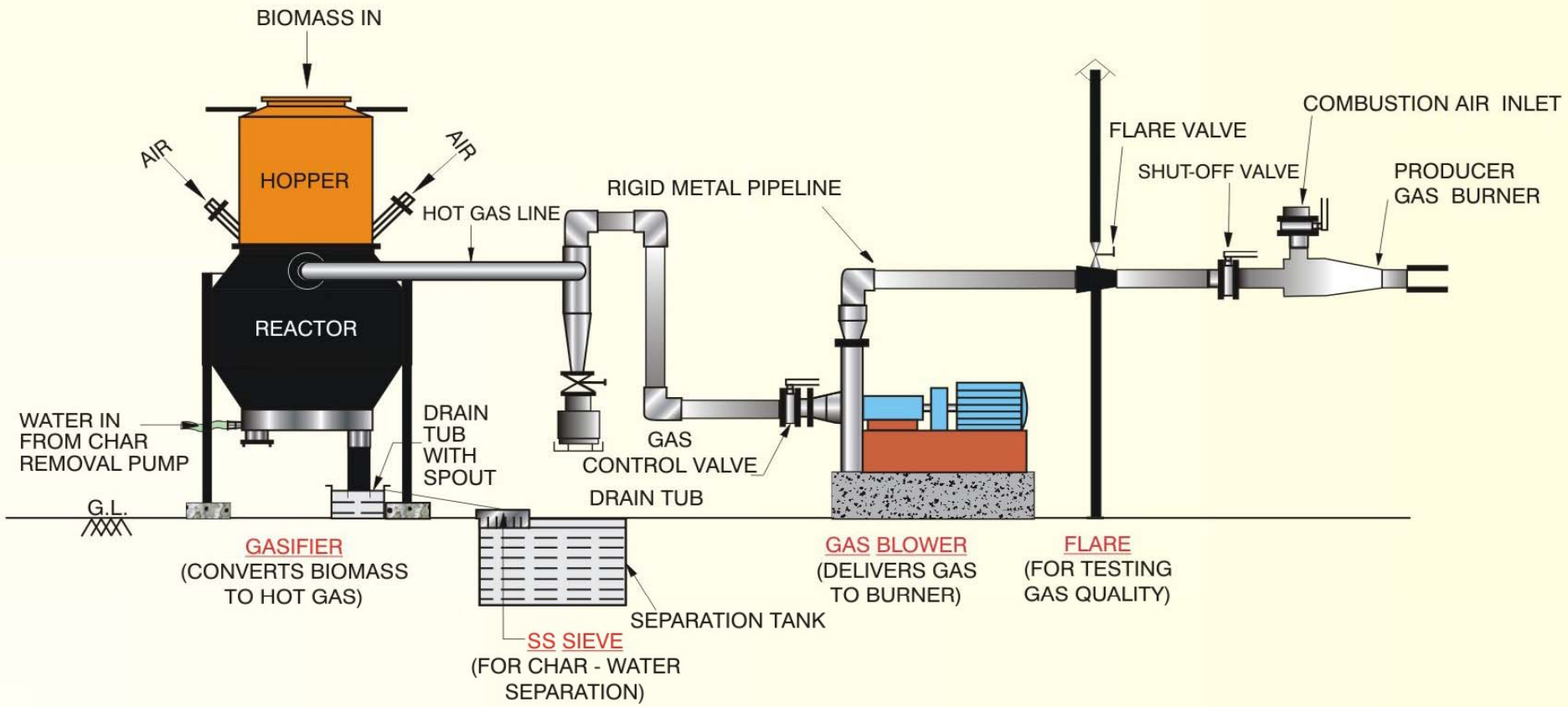
"ANKUR" BIOMASS GASIFIER SYSTEM

SCHEMATICS (THERMAL MODE)



HOT GAS MODE

Environmental Aspects

Water	Used in re-circulation mode with zero discharge. Occasional ph adjustment and simple treatment may be needed.
Air	Gasifier does not release gas to the atmosphere. Combustion in user equipments (connected to gasifier) is much cleaner compared to liquid fuels.

Environmental Aspects *(contd.)*

Solid Waste

Charcoal can be sold as fuel.
Biological ash can be returned to the soil.

Noise

In case of major user equipment i.e. genset, noise level is lower than with 100% liquid fuels.

Biomass materials contain negligible Sulphur

Emission Levels with Producer Gas

Gas	Permissible limits as per CPCB norms	Emission Observed
CO	1.2 g/MJ	0.4 – 0.6 g/MJ
NO_X	2.2 g/ MJ	0.7 g/MJ
Hydro carbons	0.3 g/MJ	0.005 g/MJ
Particulate matter	0.2 g/MJ	0.005 g/MJ

'ANKUR' BIOMASS GASIFIERS INSTALLED IN THERMAL MODE FOR INDUSTRIAL APPLICATIONS

CO_2 Production

Highlights

- LDO Savings: 250kL/year
- Payback Period: 8 months
- Increase in production capacity by about 25%
- Gas is free from Sulphur,
  - No SO2 scrubber needed. Thus lower operating cost
  - Improved purity of CO2 & better market realization

Gasifier Model: WBG-150

M/s Mahabhadra Industrial Gases, Por. (Since 1994)

Annealing of Steel Tubes

Highlights

- FO Savings: 90kL/year
- Payback Period: 12 months
- Only oil burner replaced by gas burner. No other modification on the furnace
- Very clean operation as against large amounts of black smoke generated with furnace oil

Gasifier Model: WBG-60
(Hot Gas Mode)

M/s Patson Industries, Por.

Case Study

WBG-200 installed in Feb'04 at M/s Lloyd Insulations,Pithampur.
Provides thermal energy to furnace and hot air generator.

1.	Prior to Installation of Gasifier	
	LDO Consumption	37 liter/hour
	Fuel Costs/hr	Rs 647.50 /hour
2.	With Gasifier	
	LDO Consumption	NIL
	Wood Consumption	148 kg/hr (max)
	Fuel Cost/hr	Rs 222/hour
3.	Overall Savings	
	LDO Savings	37 liter/hr
	Monetary Savings	Rs 425.50 /hour
	Capital Investment	Rs 11.90 lacs
	Payback Period	5 Months

Granule Drying

- Khaitan
  - One of the leading chemical manufacturers in the country
  - WBG-500 is replacing 110 liters of FO per hour
  - Payback in less than 8 months
  - Recently installed `Ankur' WBG-850 gasifier
  - Placed third order for WBG-700 just received

Calcination Kiln

- Calchem
  - One of the leading Calcium Carbonate manufacturers in the country
  - WBG-850 (in Hot Gas Mode) is replacing 350 kgs of coal per hour
  - The company had also applied for Carbon Credits and has been able get a buyer for

    6 Euros per tonne

'ANKUR' BIOMASS GASIFIERS INSTALLED IN DUAL FUEL POWER GENERATION MODE

Captive Power for Rice Mill

Highlights

- 70-75% diesel replacement obtained using rice husk as feedstock.
- Diesel Savings : 22 liters/hr
- Payback Period : 6 months
- Trouble-free operation since June, 2001
- Engine performance assessed by KOEL, the Original Equipment Mfr.

Gasifier Model: FBG-120

Sree Gopal Rice Mills, West Bengal.

FBG Series – Partial List

- Maa Rice Mill, Memari, Burdwan – FBG-100
- LNC Rice Mill and Sabita Rice Mill, Burdwan – FBG-300
- M/s Jai Baba Bakreshwar Rice Mill, Birbhum – FBG-200
- Sree Brijuka Agro Products Pvt. Ltd., Burdwan – FBG-350

'ANKUR' BIOMASS GASIFIERS INSTALLED IN 100% PRODUCER GAS POWER GENERATION MODE

Power Pack for Chlorate Industry

Highlights

- First installation of 200kWe *(GAS-200)* in India
- Low start–up power
- Specific fuel consumption less than 1.3 kg/kWhr
- Low cost of power has enabled the company to restart the production which was stopped 4 years ago due to increased electricity cost

System Package : GAS-200

M/s Valli Chlorate,
Kovilpatti

Power Pack for Lanka Transformers

Highlights

- First installation of GAS-40
- Low start – up power
- Specific fuel consumption: less than 1.3 kg/kWhr
- Very low cost of power generation

System Package : GAS-40

M/s Lanka Transformer Ltd.,
Sri Lanka

Other Installations

- Agrocel, Dhordo, Bhuj – GAS-180
- Muni Seva Ashram, Goraj – 1 X GAS-40
- Periyar Maniammai College for Women, Thanjavur – 1 X GAS-200
- Adi Chunchinagiri Medical College – GAS-250
- Mercury Chlorate – GAS-320
- Meghaplast – GAS-250
- Sringeri Mutt – GAS-120

‘ANKUR’ BIOMASS GASIFIERS INSTALLED IN POWER GENERATION MODE FOR VILLAGE ELECTRIFICATION

Island Electrification

Highlights

- Caters to about 800 households
- Six hours operation daily, now increased to 16 hours
- No disruption to date (since 1997)
- Tremendous boost to education, economic opportunities and social/cultural activities
- Another project installed at Chhotomollahkhali Island

Gasifier Model: 5 X WBG-100

Gosaba Island, Sunderbans
(100 Km from Kolkata)

Based on the unqualified success of the first two projects, not only additional projects have been planned but there is also a policy decision to electrify the entire Sunderbans area using Solar P.V. and Biomass Gasifiers.

Installed capacity is already much higher through Gasifiers and much larger number of customers are being served at a much lower cost.

Other Installations

- Gasifier Power Plant at Kumarikanan, Purulia - 2 X WBG-50
- Gasifier Power Plant at Khetricherra - 4 X WBG-250
- Gasifier Power Plant at Mamit - 2 X WBG-100

A large number of other projects currently under installation in Arunachal, Nagaland, Meghalaya

'ANKUR' BIOMASS GASIFIERS INSTALLED IN POWER GENERATION MODE (SMALL RATING SYSTEMS)

Power Pack for Coconut Plantation

Highlights

- First installation of GAS-4 100% Producer Gas system
- Start–up through battery
- Specific fuel consumption: less than 1.3 kg/kWhr
- Visited by thousands of people from all over

Gasifier Model: GAS-4

Dr Ray Wijewardene's Coconut Plantation, Sri Lanka

Power Pack for Village Irrigation

Highlights

- First installation of GAS-9 100% Producer Gas system
- Start-up through battery
- Specific fuel consumption: less than 1.3 kg/kWhr
- Operated by Womens' Self Help Group
- Has become a catalyst for economic growth in the village

Gasifier Model: 1 X GAS-9

Odanduthurai, Coimbatore

Other Installations

- The President, Melthattaparai Panchayat – 1 X GAS-4
- The District Forest Officer, Hosur Division – 1 X GAS-4
- The District Forest Officer, Salem Division – 1 X GAS-9
- The President, Nellithurai Panchayat – 1 X GAS-9
- The President, Semmipalayam Panchayat – 1 X GAS-9
- The President, Chikkaram Panchayat – 1 X GAS-9
- Project Officer, DRDA, Saram Village – 1 X GAS-9

EXPORTS

Uganda

- Two orders received from Finlays, UK
  - Muzizi Factory – GAS-250
  - Ankole Factory – WBG-200 in Ultra Clean Gas Mode

- Muzizi Factory
  - Complete co-generation system being offered – Heat recovery from Engine Exhaust, Engine Jacket and After Cooler.
  - Synchronization panel to synchronize the GAS-250 system with existing 250 KVA genset.

From top left to right – Exhaust Cooler, Remote Radiator, Gasifier, Engine Genset modified to operate on Producer Gas

EERC - USA

- The whole gasifier system is mounted on a trailer
- The gasifier is coupled to three turbines of 30 kW

Export Installations

- GAS-60 CAEMA S.r.l., Italy
- GAS-120 Mr..Broer, Germany
- WBG-200 Finlays Group, Sri Lanka
- GAS-22, UNIDO, Plant installed in Sri Lanka
- 2 X 240 kWe Dual Fuel,
  Flex Technology,Russia
- 1 x 40 kWe dual fuel power,
  Forestry Tasmania, Australia

Export Installations

- GAS-9 CAEMA S.r.l., Italy
- GAS-9 SME, Cambodia
- GAS-9 UTA, Cambodia
- GAS-103 NERDC, Sri Lanka (ordered by UNIDO,Austria)
- GAS-11, Flex Technology,Russia

Possible Monetary & Fiscal Incentives

- Purchase Obligations with reasonable purchase price for electricity produced.
- Investment assistance of 20-30%.
- Enhanced Depreciation.
- Exemption from certain taxes & duties – for the equipment as well the energy/ electricity generated by the equipment.

Thank You for Your Attention !

Questions?

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