



# *Planning of Biomass Gasification Projects*

## *International Training Programme on Bio Energy*

Presented by

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# *Overview*

- *Our Company Profile*
- *Our Resources*
- *Solutions Offered - Systems & Services*
- *End Use Applications*
- *Project Sizing & Siting*
- *Statutory Clearances*
- *Administrative & Legal Approvals*
- *Financial Closure*
- *Detailed Project Report*



# *Company Profile*

- Our Vision is to be significant contributors in a sustainable biomass economy, as providers of systems, service solutions and as innovators of downstream value added products.
- Our Mission is to provide the most cost-effective and user friendly solutions, systems, services and products conforming to internationally accepted quality specifications, within budget and agreed time schedules.



# Resources

- Technology partnership with CGPL, Indian Institute of Science,
- Internationally acknowledged as the group with the best pedigree in terms of large capacity, operating hours and reliability of performance
- The 2004-2005 FICCI Annual award conferred by the Prime Minister on IISc for co-operative initiative in research in Science & Technology
- State of the art knowledge, technical resources and equipment at IISc ensure that the latest technical advances are passed on to the field
- Company incorporated in the Millennium Year and having Modern Manufacturing facility at Chennai to manufacture to Third Party inspection
- Qualified and experienced professionals at all stages of project implementation from design through procurement, inspection, manufacture, installation, commissioning, training and service after sales
- Large Pool of Experienced Professionals and Trained Manpower on the permanent rolls of the Company
- Established linkages with other companies for specialised equipment and services



# *Solutions Offered - Systems*

- Turn-key modular Thermal Systems from 50,000 kCal/hr to 5 Million kCal/hr capacity
- Turn-key Modular Power Systems from 20 kWe to 2 MWe capacity
- Larger capacity Combined Cycle Plants using Gasification & Steam Turbine/ORC modes resulting in lower costs from higher cycle efficiencies
- Customised solutions to meet Client needs for Combined Heat, Power & Refrigeration
- Components & Spares for installed systems



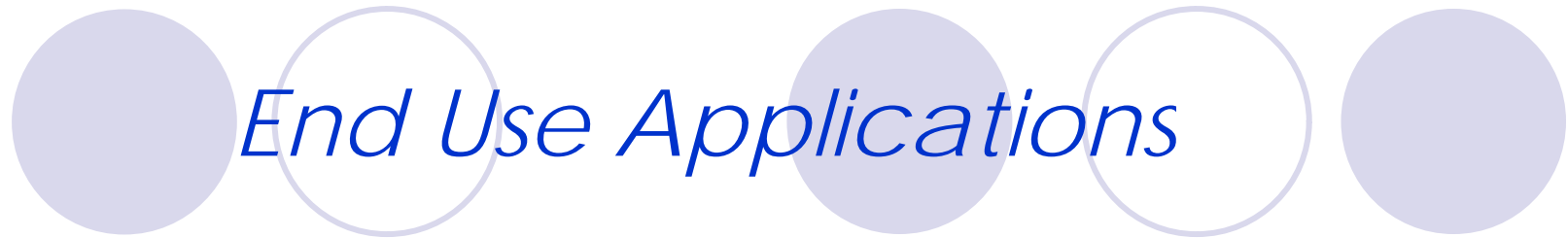
# *Solutions Offered - Services*

- **Turn-key Technical Services for Project Implementation**
  - Project Reports & Biomass Assessment Studies
  - Project site location, water and grid availability
  - Techno-commercial services for subsidies and financial closure
  - Techno-commercial services for letting and permitting, PPA & statutory approvals
  - Detailed Engineering of complete Power Plant including civil, structural, electrical (LT & HT) work
  - Supervision of erection, testing and commissioning of power plants



# *Solutions Offered - Services*

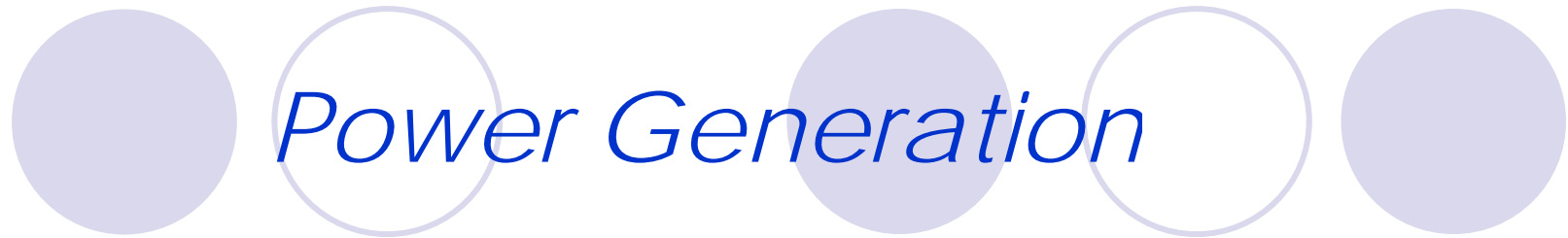
- Complete EPC services for sourcing, tendering, bid evaluation, techno-commercial negotiations, inspection and quality management of offsite equipment
- Managerial assistance for recruiting and training of technical manpower and staff
- **Operation & Maintenance Contracts at Client's site**
- **Annual Maintenance Contracts for installed systems**
- **Project execution on BOO and BOOT basis**



# *End Use Applications*

- Power Generation
- Thermal Applications
- Combined Heat & Power
- Combined Cycle Operation
- Trigeneration





# *Power Generation*

- Retrofit to existing generators in the dual fuel mode
- Total replacement of grid power in existing industries in dual fuel or gas modes
- Sale of power to Utility as base-load station
- Sale of power to Third Parties by wheeling and banking with the Utility/local grid
- Power for remote rural electrification and village energy security



# *Thermal Applications*

- Product drying at 50°C - 800°C for salt manufacture, oil refining, chemicals manufacture food processing, textiles, tea and other heat labile products
- Hot water/steam cooking at 80-120°C
- Heat Treatment Furnaces at 120-1000°C
- Non-ferrous melting at 600-900°C
- Thermal energy for Forging units up to 1100°C
- Ceramic industry upto a maximum of 1050°C
- Thermic fluid heating/ boiler service at 180-450°C
- Vapour Absorption Chilling for Space Cooling, Process Chilling directly or with hot water/steam at 80°C - 200°C



# *Combined Heat & Power*

- Depending on generator size, about 25% - 39% of the energy in the biomass is converted into electricity, the rest is dissipated as heat and sound.
- Thermal energy of 1600-2400 kW of heat/MW of electricity generation is available in the flue gas and engine cooling loop which can be utilised for process heat directly, indirectly or with waste heat boilers or for Vapour Absorption Chilling



## *Combined Cycle Operation*

- Higher capacities above 3 MW of power generation can be configured for Combined Cycle operation
- The plant will generate electricity using gasifiers and gas engine generators/Dual Fuel Generators
- Thermal energy in the flue gas is then used to produce steam with waste heat boilers or organic vapour in an Organic Rankine Cycle
- This steam/Vapour can be used in a Closed Loop Bottoming Cycle in turbines for generating additional power at zero fuel cost and marginal investment additions



# *Tri-generation*

- Industries requiring electricity, steam and cooling such as food processing and cold storages find the concept of tri-generation very attractive.
- After generating power in the combined cycle, the exhaust steam derived from the flue gas of the generator is used to achieve cooling by Vapour Absorption further improving the cycle efficiency
- Each MW Power Plant can generate up to 300 TR of chilling both from the engine jacket with hot water and from the hot flue gas directly.
- Our Plant utilises this concept by using the engine cooling water/exhaust heat for VAC to meet gasifier process needs



# *Project Sizing & Siting*

- Plant Capacity finalised based on
  - End use Application
  - Client need as to capacity
- Project site finalised based on
  - Client Need as to location
  - Grid connectivity
  - Grid availability
  - Biomass availability
  - Biomass cost



# *Statutory Clearances*

- Registration of Industrial Project
  - Small Scale
  - Medium Scale
- Registration of Factory
- Foreign Investment
  - Foreign Investment Promotion Board approval
  - Central Bank Approval
- Import Clearances
  - Capital Goods Clearance
  - Sanction for release of Foreign Exchange for import

# *Statutory Clearances (Contd.)*

- Financial/Technical Collaboration
  - Approval/Registration of financial/Technical Collaboration
- Capital Issues
  - Approval of IPO in the case of listed companies
  - Preparation for IPO such as Prospectus, investor meets roadshows, press conferences
- Power Generation
  - Licence to generate/ distribute power from Regulatory Authority
  - Grid connectivity from local utility



# *Statutory Clearances (Contd.)*

- Municipal/Local Health Clearance
- Environmental Board Approvals
  - Consent to Build
  - Consent to operate
- Water
  - State govt. irrigation dept approval for water use/ bore well
- Social Security Registration
  - Personnel Insurance
  - Provident Fund



# *Legal & Administrative Approvals*

## ● Land

- Title Deed
- Non-encumbrance certificate
- Agreement to sale of land
- Land conversion agricultural to non-agricultural
- Standard land rate as per local authority
- Soil testing for bearing capacity

## ● Building

- Building Plan clearance and approval from Town/Local Planning Authority
- Approval from Structural Engineers for integrity of civil structures
- Standard rate of construction from local authority

# *Legal & Administrative Approvals (Contd.)*

## ● Power

- Power purchase agreement with private buyer/local utility
- Evacuation scheme approval from local utility for grid interfacing
- Electricity Inspectorate approval of drawings and installation for plant internal electrical layout and protection scheme
- Sanction for temporary construction power
- Sanction for start-up power from local utility

# *Legal & Administrative Approvals (Contd.)*

- Biomass Assessment & Fuel Supply Arrangement
  - Area under cultivation of short rotation target biomass such as Eucalyptus, Casuarina, Prosopis, Acacia within 50 km radius of Plant
  - Generation and utilisation of industrial by-product such as coconut shell, ground nut husk, rice husk, coffee husk, cashew nut shell etc. within 50 km radius of Plant
  - Generation and utilisation of agricultural by-product such as coconut husk, coconut fronds, palm fronds, within 50 km radius of Plant
  - Present Alternative use of target biomass and their price
  - Study of Seasonal price fluctuations of target biomass
  - Contract Farming Agreement with share croppers
  - Long term supply contracts with wholesale dealers/ brokers within 50 km radius of Plant



# *Financial Closure*

- Appointment of Project Consultant/EPC Agency
  - Assessment of capabilities
  - Client feedback
  - Order finalisation
- Preparation of Detailed plant layout drawings
- Financial Closure
  - Arrangement of equity for the project
  - Arrangement of collateral security for Bank/Financial Institution
  - Quotations for Civil and Structural Work
  - Quotations for Main Plant & Machinery and off site equipment
  - Preparation of Detailed Project Report
  - Negotiations of terms & Sanction of Term & Working Capital Loan



## *Financial Closure (Contd.)*

- Insurance during transit and project construction
- Subsidies/Incentives
  - Capital subsidy from Power Ministry for rural electrification projects
  - Capital/interest subsidy for biomass gasifiers
  - CDM/JI Carbon Credit application and approval from Nodal Agency
  - Excise exemptions
  - VAT exemptions



# *Detailed Project Report*

- Title Page
  - Project Title
  - Client's details
  - Project site location
  - Consultant details
- Table of Contents
- Executive Summary
  - Prologue & Brief project details
  - Technology & Project Management
  - Power Purchase/ESCO Agreement
  - Funding
  - Status
  - Summary



# *Detailed Project Report (Contd.)*

- **Project in Detail**
  - Introduction
  - Technical highlights such as end use application, installed capacity, total projected generation and & Financial highlights
  - Innovative Features such as specific fuel consumption, replacement of fossil fuels, unit production cost, short gestation, feedstock, conversion efficiency, waste heat recovery, by-products, sustainable re-use of water etc.
- **Product & By-product Characteristics**
  - Classification
  - Physical & Chemical Properties
  - Safety & Storage
  - Specifications, Standards & Test Procedures
- **Product & By-product Applications**
  - End use of power/thermal energy
  - End use of by-products





# *Detailed Project Report (Contd.)*

- **Market Survey**
  - Survey of Power/Thermal Energy scene in the country/state
  - Assessment of Demand Supply Gap in Capacity & unit generation
  - By-Product Industry Status
  - Import Export Details
  - Price Details
  - Assessment Of Demand
  - Export Market
  - Projected Demand Supply Scenario
  - Government Policies
  
- **Manufacturing Process Details of product and by-products**
  - Introduction
  - History Of Developments
  - Process Description

## *Detailed Project Report (Contd.)*

- Project Siting
  - Siting details
  - Advantages of chosen site
  - Location Incentives
- Project Execution Plan
  - Engineering, Procurement & Construction
  - Civil Work
  - Main Plant & Machinery & Off sites
  - Evacuation/Grid interfacing
  - Project Execution Schedule
- Plant Configuration
  - Details of auxiliary equipment
  - Main Plant and Machinery
  - Utilities such as Water, Steam, Dry air & Parasitic Consumption



## *Detailed Project Report (Contd.)*

- **Fuel**

- Target Biomass
- Biomass Assessment Study
- Fuel Linkage
- Biomass Bank

- **Environmental Initiatives**

- Details of solid, liquid and gaseous effluents
- Effluent Characteristics
- Standards and norms prescribed by Environmental Boards
- Comparison with International Standards
- Disposal Scheme



# *Detailed Project Report (Contd.)*

- Project Funding
  - Total Project Cost Assessment
  - Equity
  - Long Term Loan
  - Subsidies/Incentives
- Financial Tables
  - Assumptions
  - Project Cost & Means of Finance
  - Profitability Estimates
  - Working Capital Projections
  - Depreciation Schedule
  - Term Loan Repayment Schedule
  - Profitability Projections for 10 years
  - Taxation Schedule
  - Fund Flow Statements
  - Proforma Balance Sheets
  - Financial Ratios
  - Investment Indicators
  - Sensitivity Analysis



## *Detailed Project Report (Contd.)*

- **Maps**

- Village/Industrial Area Map
- Index Plan
- Site Plan
- Plant Civil Layout

- **Drawings**

- Schematic Diagram
- Block Diagram
- Process Flow Sheet
- Detailed Equipment Layout
- Piping Layouts & Isometrics
- Internal Electrical Layout & Evacuation Scheme