



Off-Grid Renewable Energy Systems: Technologies, Advantages, Challenges



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Agenda

- ✓ **Problem Statement**
- ✓ **Current Solution and its issues**
- ✓ **Renewable Energy Solutions available**
- ✓ **Analysis of each option**
- ✓ **About Biomass Gasification**
 - ✓ **Technology**
 - ✓ **Benefits - Social & Environmental**
 - ✓ **Modes of Generation**
- ✓ **Issues and way forward**
- ✓ **Experience so far**
- ✓ **About Ankur Scientific**
- ✓ **Photographs**

Problem Statement

- ✓ No / Bad Energy Access in rural areas.
- ✓ No / Limited Rural Development due to lack of Modern Energy systems.
- ✓ Lack of Employment Opportunities.
- ✓ Migration to Urban areas leading to infrastructural stress.



Solution?



OFF-GRID, Decentralized
Renewable Energy Systems for
Cheap, Sustainable power to all.

RE Solution?

- ✓ Solution should be –
 - ✓ Simple
 - ✓ Sustainable
 - ✓ Scalable
- ✓ Sustainable from the point of view of
 - ✓ Individual and Community involvement
 - ✓ Environment
 - ✓ Health & Safety

Current Electricity Options for Rural Areas

Diesel based gensets



Diesel based Power Generation

Pros

1. Proven technology
2. Reliable technology
3. Large companies operating in the space
4. Good After Sales service

Cons

1. Very high cost of power – around US\$ 0.25 per kW-hr
2. Environmentally unfriendly technology
3. Fossil fuel based

Available Renewable Energy Options

- | | |
|-----------------------------|-------------------------------|
| 1. Solar Photovoltaics | Bio Energy Options |
| 2. Wind Electric Generators | ✓ Biogas |
| 3. Mini Hydro Power Plants | ✓ Bio Diesel |
| | ✓ Biomass Combustion |
| 4. Bio Energy → | ✓ Biomass Gasification |



Solar PV based Power Generation

Pros

1. Proven technology
2. Reliable technology
3. Environmentally Friendly technology
4. No external fuel required
5. Roof top and Home lighting systems big potential

Cons

1. High Capex
2. High cost of power – around US \$ 0.20/kW-hr
3. Power on demand requires batteries
4. Very site and season dependent



Wind based Power Generation

Pros

1. Proven technology
2. Reliable technology
3. Environmentally Friendly technology
4. No external fuel required

Cons

1. High Capex
2. Power on demand not possible/ requires batteries (environmental issue)
3. Very site and season dependent



Micro Hydro based Power Generation

Pros

1. Proven technology
2. Reliable technology
3. Environmentally Friendly technology
4. No external fuel required

Cons

1. High Capex
2. Power on demand not possible
3. Very site and season dependent

Bio Fuel Options



Bio Diesel based Power Generation

- ✓ Bio Diesel is still not widely available.
- ✓ Cost of Bio Diesel production is quite high.
- ✓ Engine generators proven on Bio Diesel are expensive and not easily available.

Biogas based Power Generation

- ✓ High Capex – about US \$ 3 mil + / MWe.
- ✓ Require a lot of space.
- ✓ Waste stream from these plants not easy to handle.
- ✓ Biomass for Biogas more difficult to find for stand alone applications.

Combustion based Power Generation

- ✓ Not relevant at the level we are looking at.
- ✓ Combustion systems are offered above the 1 MWe level, but start making sense only above the 5 MWe level (in terms of efficiencies).

Biomass Gasification Technology

- ✓ One of the best options of Off-Grid RE.
- ✓ Most relevant at the level we are looking at.
- ✓ Wide range of power generation systems available right from 10-kWe to 2-Mwe levels.
- ✓ Can use different available Biomass / waste that are available in the specific rural areas.



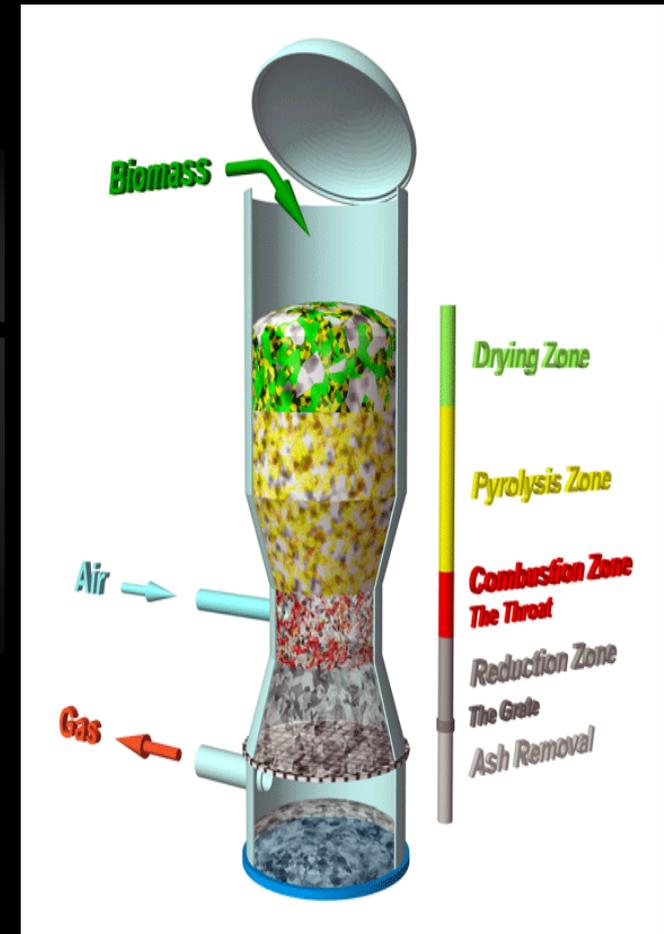
Biomass that can be used...

Rice husk (as is basis & no need to briquette)	Agri-residues like Cotton / Soyabean / Mustard stalks, Corn Cobs	Shells of Arecanut, Almond, Cashewnut, Groundnut, Coconut
Waste Wood, Wood chips, Plywood & Saw mill wastes	Branches & Twigs	Bamboo pieces & Pine needles
Sugarcane bagasse & Sugarcane trash (briquetted)	Wild bushes and weeds like Prosopis Juliflora, Lantana, Invader Bush etc.	Greening of waste lands though production of sturdy Energy species.

What is Gasification?

Gasification is conversion of various biomasses to a combustible gas called Producer Gas.

This gas can then be burnt in Engine Gensets to produce electricity or can be used for process heat applications.



The By-Product?



Benefits apart from Cheap Power on Demand

Social Benefit

- ✓ Wealth from Waste.
- ✓ Large-Scale **Employment** Generation.
- ✓ Great boost to **Rural Entrepreneurship**.
- ✓ Positive Impact on **migration to urban areas**.
- ✓ Unlike other technologies, 70-80% of the revenue returns to the local economy).

Environmental Benefit

- ✓ The energy is clean and green.
- ✓ Reduces CO2 emissions, thus reducing Global Warming

Modes of Power Generation

1. Dual Fuel Mode (Fuel = Diesel + Biomass)

- ✓ Uses a Diesel engine genset (usually available, saving CAPEX).
- ✓ Thereby saving upto 70% of Diesel and its cost.
- ✓ Ideal for Telecom Towers for replacement of huge diesel they use. we

2. 100% Gas Mode (Fuel = Only Biomass)

- ✓ Uses a Producer Gas engine genset.
- ✓ Need 1.3 kgs of woody biomass / 2 kgs of rice husk to generate 1 kW-hr.

Issues and way forward

- ✓ Off Grid RE projects have two phases ...

Phase-I (Pre-setup)

1. Policies
2. Financing
3. Approvals
4. Technology, Investment & Infrastructure

Phase-II (Post-setup)

1. Biomass Logistics
2. Long term Operations and Maintenance
3. Disposal of Wastes
4. Collection of Revenues.

Experience so far

Phase-I - Challenges and Barriers

✓ Policy initiatives

- ✓ Need to make projects bankable through policies like Subsidies, higher tariffs for power sale, GBI, Tax benefits.

✓ Financing

- ✓ FI's / Banks - overly cautious towards funding decentralized projects
- ✓ Need to enhance affordability through Long-term low-interest rates on loans

Experience so far

Phase-I - Challenges and Barriers

✓ Approvals

- ✓ Currently long and multiple approvals
- ✓ Need Single window and fast approvals
- ✓ Setting up of Centre-states co-ordination committee which can push for fast approvals.

✓ Technology – Options, Pros & Cons discussed earlier

Thus Phase-I is easier as it is more or less under Government control & could be managed.

Experience so far

Phase-I I - Challenges and Barriers

✓ Biomass Logistics

- ✓ Ideal to make it a lucrative business for some local Entrepreneur – will define success or failure.

✓ Long Term O&M

- ✓ Electricity use may be limited initially leading to low PLFs.
- ✓ Thus initially the project may need much higher working capital.
- ✓ Regular O&M – a model for that is still not all there. But a cluster approach a must.
- ✓ Collection of revenues – smart metering etc. need to be considered.



About Ankur Scientific

Founded in 1986 by Dr. B.C.Jain, an internationally acclaimed technocrat.

Since its inception, Ankur Scientific has been in the **forefront of research and developmental activities** in the area of non-conventional energy sources.

Have **exported this indigenously developed technology** to more than 25 Countries across the Globe. The company now has installations in USA, Chile, Brazil, Guatemala, Colombia, Italy, Germany, Russia, Australia, New Zealand, Sri Lanka, Myanmar, Cambodia, Vietnam, Malaysia, Indonesia, Ukraine, Slovenia, Latvia, Poland etc.

1.2 MWe, Grid connected Power Plant using Agri-Residues as Biomass



500-kWe Power Plant in California



500-kWe Power Plant commissioned in Slovenia



500-kWe Power Plant commissioned in Thailand



700-kWe Power Plant using rice husk in Cambodia



Rice husk based 350 kWe, Dual Fuel Power Plant in India



250-kWe Power Plant for Captive Use



Systems for Village / Rural Electrification





Thank You

