

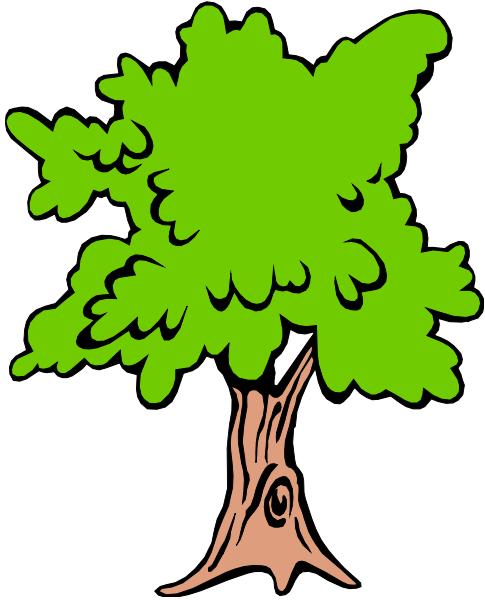
BIOMASS ENERGY SERVICE BASED RURAL ENERGY ENTREPRENEURSHIP: PART II

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Biomass Energy: Conventional & Potentially Renewable



→ Solid → Eg: wood, biomass,
charcoal, briquettes

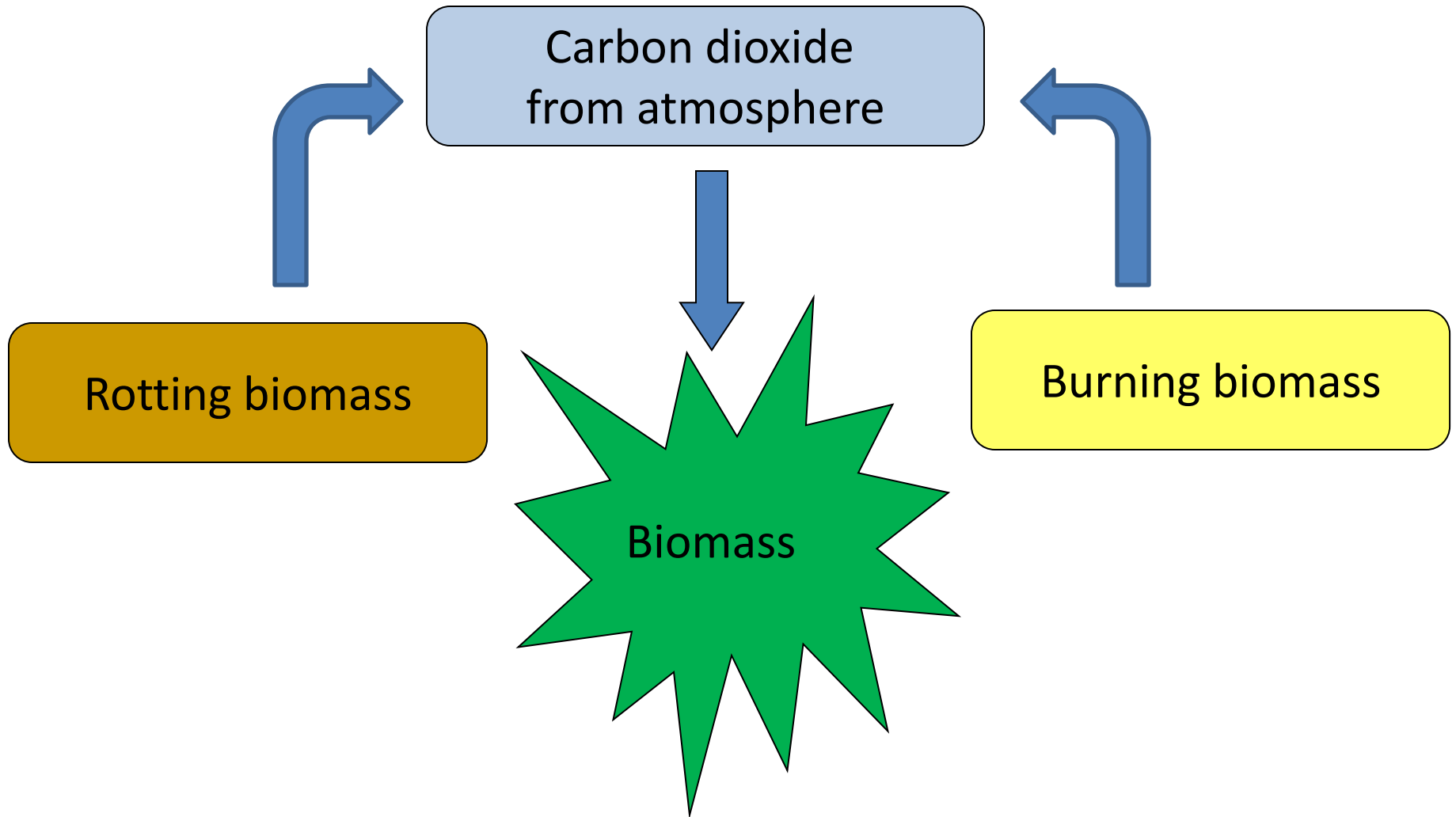
→ Liquid → Eg: alcohol, bio-gasoline

→ Gas → Eg: woodgas, biogas

- Biomass can give 'fuels' equivalent to fossil fuels.
- Fuels represent stored energy that can be converted into heat, electricity, mechanical energy, as and when required.
- Biomass can be a source of substitutes for many other petrochemicals.

Biomass is climate Friendly

Use of biomass as fuel is greenhouse gas neutral, **provided the green cover remains constant.**



Biomass Energy is controversial!



Food Vs Fuel!!

Where is the extra land to grow energy crops???

We cannot maintain forest cover to match growing energy demand!!!



Solar Energy



Agricultural Biomass



Agricultural Produce



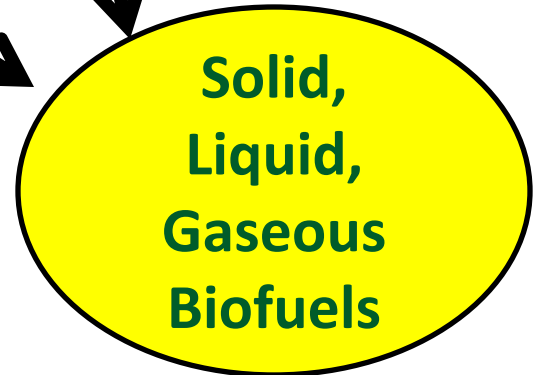
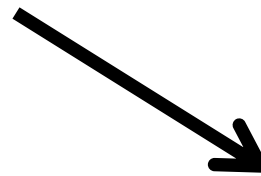
Processing of agricultural produce



Organic Waste



Agricultural Waste



**Solid,
Liquid,
Gaseous
Biofuels**



**Processing
Waste**



Conversion of Waste Biomass into Char

Waste Biomass to 'Charcoal'

- **Local production units for converting waste biomass from forest floor or agriculture into char**
 - Portable charring kilns
 - Hand or motor operated briquetting machine for converting char powder into briquettes
 - Feedstock (for char powder): Leaf litter, dry weeds, dry grass, dry bushes, agriwaste, etc.
 - Feedstock (for charcoal): dead wood, wood waste, bamboo waste, woody agriwaste, etc.



Renewable Charcoal as Cooking Fuel

Charcoal Stove



**Charcoal
Barbeque Grill**



**Samuchit
Steam Cooker**



Charcoal Oven



Biochar as Soil Amendment Agent

- CONTROL
- 4 KGS BIOCHAR COMPOST
- 8 KGS BIOCHAR COMPOST



Biochar Urinals



TAPPING NITROGEN FROM
URINE OF ANIMALS AND
PEOPLE USING BIOCHAR

Other Biochar Applications



BIOCHAR BRICKS, GREEN BUILDINGS

WATERLESS CLEANING



The Charring Process

- Video – Samuchit Trashflasher Kiln Animation



Further Processing of Char

- Dependent on starting material + application
- Loose char powder can be briquetted.



**Mold for Beehive
Briquettes**

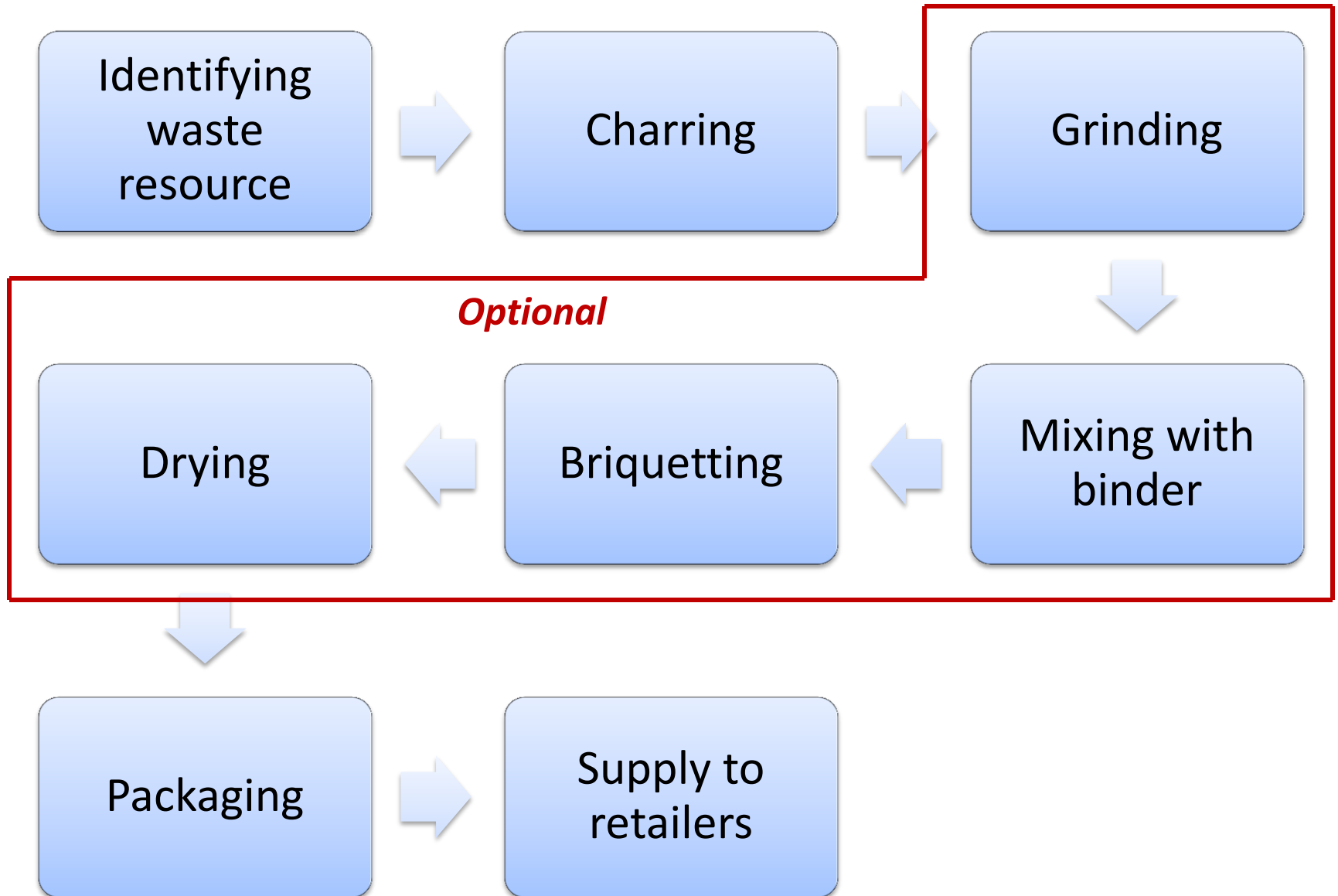


**Hand-operated
Briquetting Machine**

Electricity-operated Briquetting Machine



A Typical Business Process



Economics

Capital Expense

- Charring kilns
- Grinder
- Mixer
- Briquetting machine
- Drying trays
- Transport vehicles
- Working shed
- Land

Recurring Expense

- Fuel for transport, machinery
- electricity
- Binder (waste grain flour)
- Consumables (gloves, masks, etc.)
- Salaries and wages
- Marketing expense

Income Potential

- Minimum for selling char briquettes/charcoal as cooking or industrial fuel
- Low for biochar as soil additive
- High for renewable charcoal or biochar based substitutes for inorganic products

Biogas from 'Green' Organic Waste

Samuchit Household Biogas Plant

Balcony Model:

Size: 0.5 m³ digester, 0.3 m³ gas holder

Capacity: up to 2 kg kitchen waste, daily.

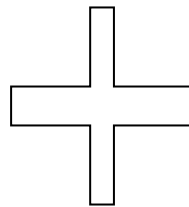
Quantity of gas produced: up to 300 g biogas, capable of replacing 100 g of LPG, daily.

Terrace Model:

Size: 1 m³ digester, 0.75 m³ gas holder

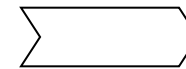
Capacity: up to 5 kg kitchen waste, daily.

Quantity of gas produced: up to 1 kg biogas, capable of replacing 300 g of LPG, daily.



Instructional video

Locally purchased tanks and pipes



Estimated number of household plants in operation across the world: ~ 1 million

Institutional/Commercial Biogas Plant



- **Capacity:** 10 m³ Digester (plastic/masonry tank)
- 7.5 m³ gas holder (plastic tank)
- **Pay back period:** 3-4 years, for commercial LPG replacement
- **Operating cost:** Electricity for Food Pulper, 1 hp
- Labour 2 hr/day (at actual)
- **Gas production:** 2-3 kg LPG eq/day
- **Requirements:**
- Area open to sunlight throughout the day 3 m x 3 m
- Water ~ 100 lit/day (spent slurry can be recycled)
- Feedstock: Food waste, any green plant matter, pulped, up to 50 kg

Operation of Food Waste Biogas Plant

- Video - Samuchit Biogas Working Animation

Biogas based Rural Energy Entrepreneurship

Sale of Biogas Plants

- Installation and user training
- Periodic service and maintenance support
- Cost is high, but installment payment schemes can be designed on the basis of cost saving on other cooking fuels

Leasing Biogas Plants

- Installation on user's premises
- User training
- Period service and maintenance
- The 'rent' should take into account all costs
- Drawback: No control over use
- Drawback: Capital cost is high

Sale of Biogas

- Build a biogas plant on user's premises, but operate it yourself.
- The gas supplied to the kitchen is metered, and charged on a weekly or monthly basis.
- Drawback: Capital investment is high

Challenges of Biogas Technology

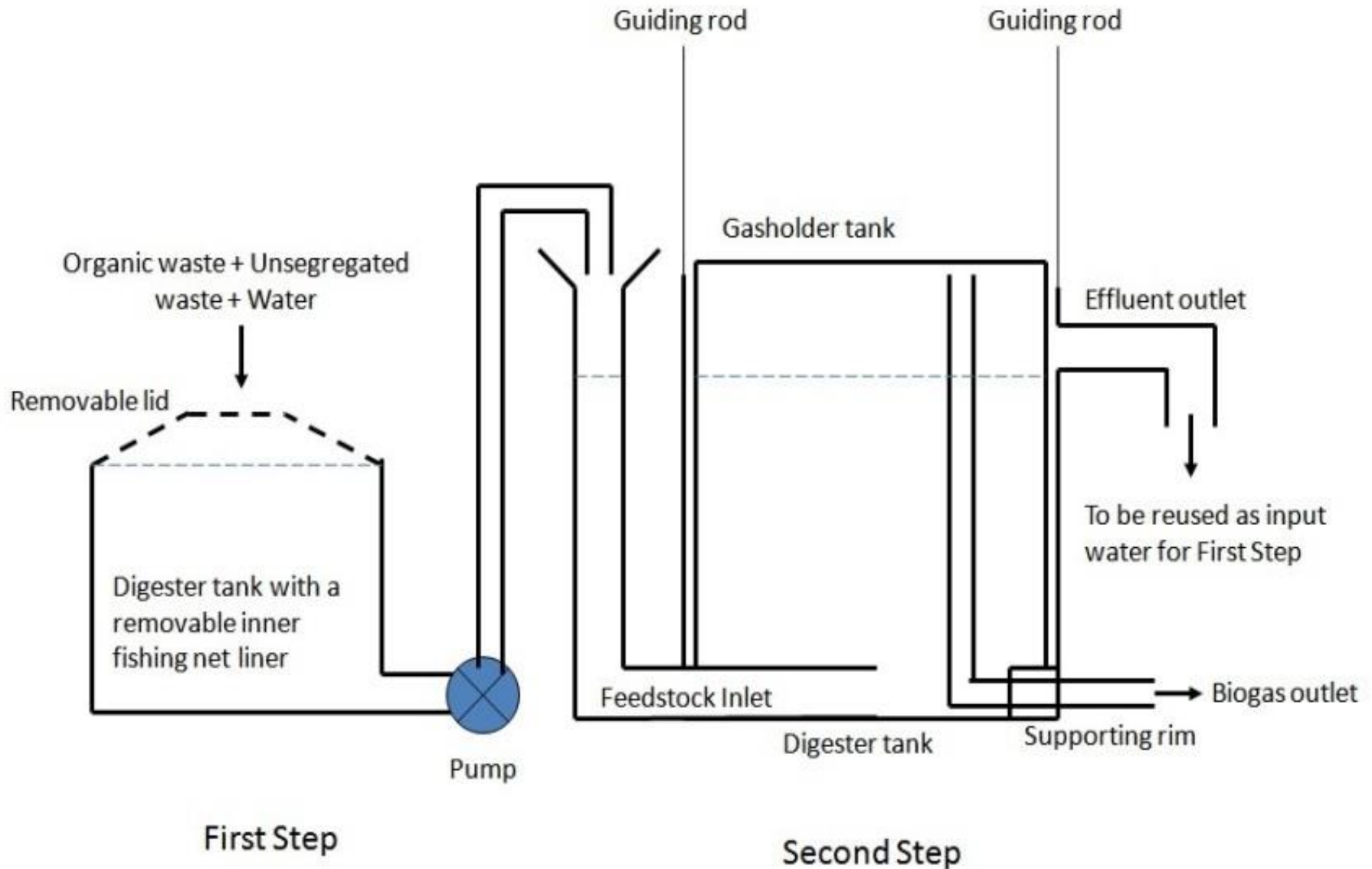
- **At household level**

- Subsidised petroleum based cooking gas (even if it is not accessible)
- Perceived 'hassle' of processing organic waste
- Total substitution of petroleum based gas is not possible using only own household waste
- Biological system, therefore needs the same level of care and attention as a pet
- Service and maintenance support is not available

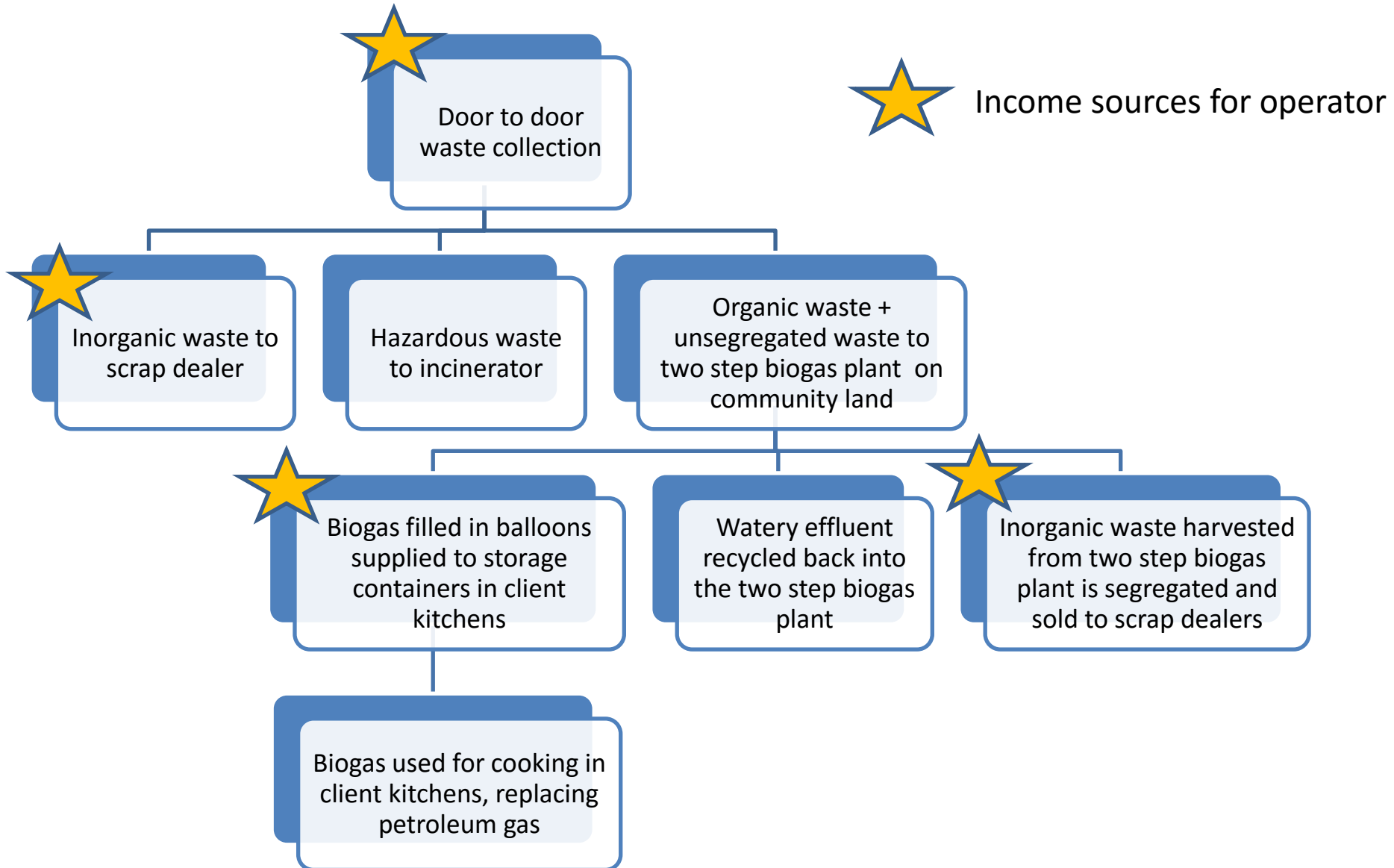
- **At community level**

- Non-segregated garbage received
- Challenging to distribute biogas to households
- Waste to biogas to electricity is more expensive than grid power

Two Step Biogas System



Rural Enterprise based on Two Step Biogas System



Economics

Capital Expense

- Two step biogas plant
- Vehicles for door-to-door waste collection
- Rubber balloons for use as biogas transporting media
- Tanks and stoves at customer sites
- Incinerator to deal with hazardous waste

Recurring Expense

- Salaries and wages
- Fuel cost for vehicles
- Sundry repair, maintenance etc.

Income Potential

- Waste management service fee from the village council/community
- Price received for recyclable inorganic waste sold to scrap dealers
- Price received for the biogas from the end user customers

Conclusion

- View biomass as ‘a natural storage of solar energy’.
- Find innovative ways of fulfilling some of the energy services required for day to day life using waste biomass from other biomass cultivation/harvesting/processing activities.
- Identify energy service needs of the target customers.
- **There is tremendous potential for rural energy enterprises based on locally available biomass resources and targeted at real service needs of the rural customers.**

Thank you

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