



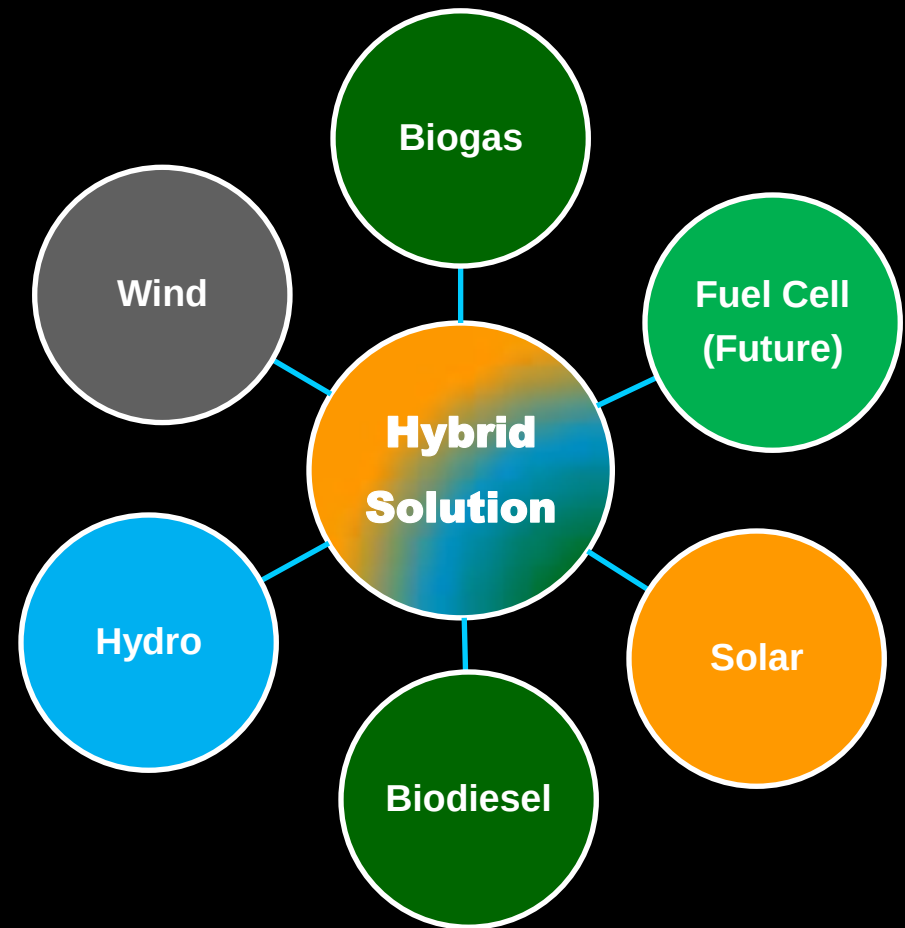
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# Green Energy Solutions

**Kirloskar Integrated Technologies Ltd. (KITL)  
(Confidential)**

# Vision 2020

*Provide sustainable turnkey solutions best suitable for the location, using natural resources ... one or more in combination...*



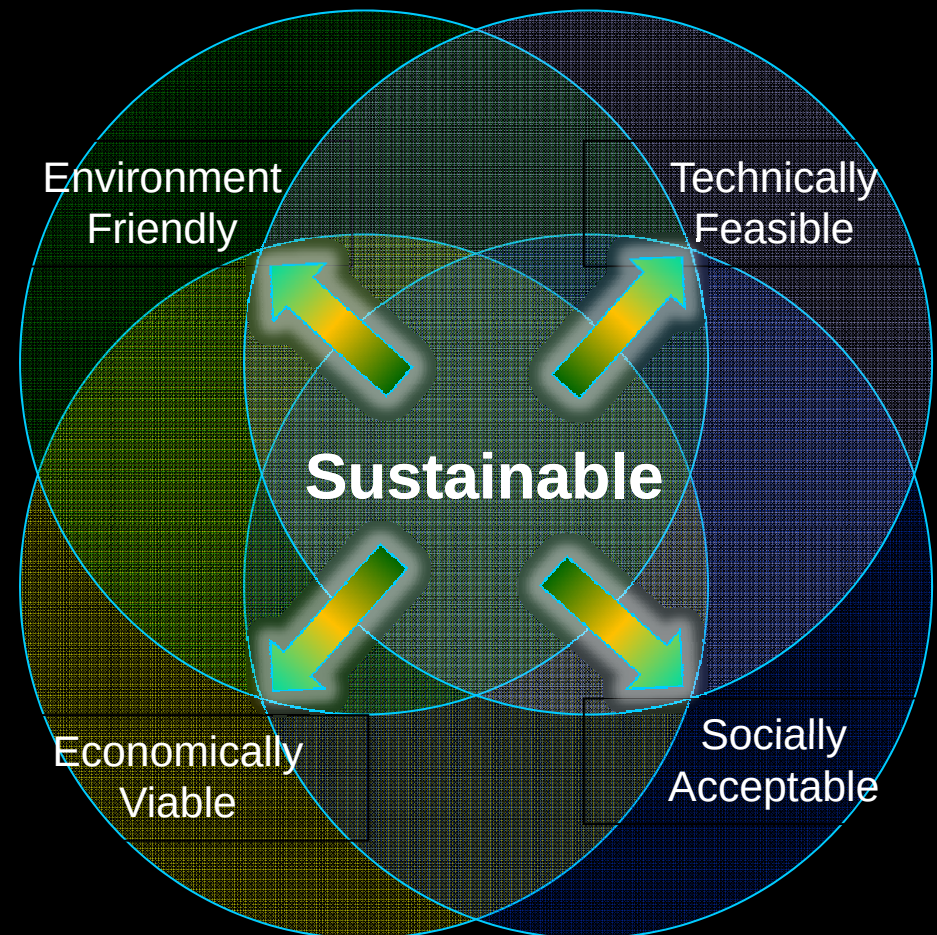
*"Basket of technologies" → a solution for*

# Sustainable Energy Solutions



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- Solutions that meet the needs of the present generation without compromising the ability of future generations to meet their needs
- Solutions achieved through “**GREEN TECHNOLOGIES**” – by harvesting renewable energy
- Local Energy Resource that is “perennial” or “infinite”



*Waste → Wealth → Replicable solutions*

# Research & Development

- DSIR certified R&D facility
- Highly qualified, passionate and motivated team
- 15 patents filed so far and more being filed in Bioenergy, T&M & Solar
- R&D focus:
  - Testing biogas potential for substrates in laboratory for designing a solution
  - Research on biogas process for various substrates to increase biogas potential
  - Research and development for reducing retention time
  - Designing and testing processes and equipment at pilot levels
- R&D facilities:
  - Well equipped lab for testing any type of substrate
  - Advance equipment like Gas Chromatography for gas analysis
  - Pilot digesters from 1 m<sup>3</sup> ~ 50 m<sup>3</sup> (total capacity: @ 300 m<sup>3</sup>)
  - Pilot scale gas cleaning equipment for H<sub>2</sub>S and CO<sub>2</sub> from the biogas
  - PESO approved Bio-CNG set-up including storage of cascades
- Tie-up with Educational Institutes for process and equipment development



*Our solutions are backed by intensive*

*R&D efforts*

# Focus Biogas Substrates

- Hotel waste (*food and other biodegradable*)
- Agro waste (*Paddy Straw, Wheat Straw, maize, sorghum, etc.*)
- Food processing waste (*fruit & vegetable*)
- Animal waste (*cow dung & poultry droppings*)
- Agro industry waste (*starch, oilcakes, etc.*)
- Energy Crops (*elephant grass, Napier grass, etc.*)
- Sugar Industry (*press mud*)

*We handle a large variety of organic was*

# Sanjeevani: A KITL Biogas Product

- A 2 m<sup>3</sup> per day readymade biogas plant
- Can provide biogas and light
- Feed: Cow dung @ 40 kg/day OR food waste @ 20 kg/day
- Fuel for cooking → replaces LPG, kerosene and wood
- Eco-friendly, Smokeless cooking system

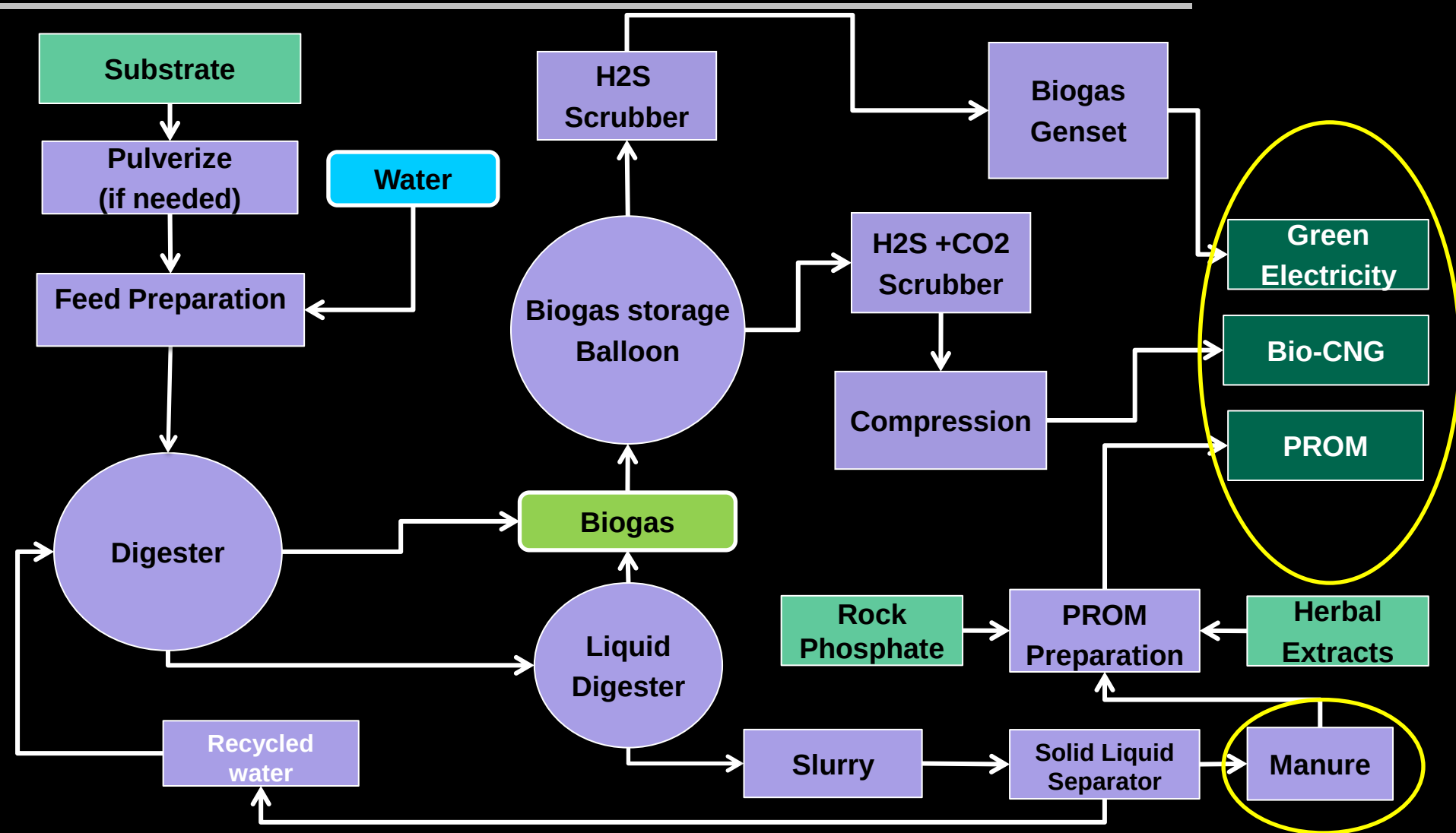


***Home energy for Rural / Waste management***



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# Process Flow





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# TURNKEY SOLUTION: KITCHEN / FOOD WASTE

# Concerns about Kitchen / Food Waste

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- ✓ Forms close to 50% of Municipal waste
- ✓ Should not be disposed off in open as it decomposes, smells, forms leachates, contaminates water and air
- ✓ Almost in all Municipal set-ups it has created social issues (no one wants it dumped / processed near own establishment)
- ✓ It often gets mixed with other hazardous waste if not segregated at source
- ✓ Pollution Control Board wants it disposed as per Municipal Solid Wastes (Management and Handling) Rules, 2000 (MSW 2000); gives acceptable limits for most common pollutants
- ✓ Anaerobic digestion is one of the best options

# Anaerobic Digestion of Kitchen / Food Waste

- ✓ Anaerobic Digestion (AD) of the waste creates stable compost (manure) and biogas ( $\text{CH}_4 + \text{CO}_2 + \text{Moisture} + \text{Traces}$ )
- ✓ At  $\text{CH}_4$  increasing beyond ~ 45%, becomes flammable → fuel
- ✓ Fuel can be used for electricity generation or heating, it can replace wood, coal, CNG, petrol, diesel, LPG etc.
- ✓ Plants can be of different sizes: Domestic waste disposal at about 20 kg per day to over 100 TPD (gas from 2 ~ over 8,000  $\text{m}^3$  / d)
- ✓ In limited quantities, one could mix dung or other pulverized biodegradable waste
- ✓ Output solids are acceptable as “organic manure” and could be further converted to value added fertilizers
- ✓ Liquid output COD ~ 8,000, BOD ~ 5,000 → to be further put through ETP to bring COD < 250 and BOD < 50 (**Can be used as Liquid Manure**)

# Advantages of AD for Kitchen / Food Waste

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- ✓ Waste disposal can generate energy and / or fuel
- ✓ **The process is net energy positive**
- ✓ Can work in tandem with STP sludge digester and make the STP energy self sufficient
- ✓ Excess gas can be converted to bio-CNG to replace fuels
- ✓ Could give net saving for Municipalities
- ✓ Every m<sup>3</sup> of biogas will also produce about half kg manure



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# Kitchen / Food Waste: Ready Reckoner

| Kitchen Waste (ton/day) | Biogas per Day (m <sup>3</sup> ) | Electrical Power (kWh) | Bio-CNG (ton/day) | Manure (kg/day) |
|-------------------------|----------------------------------|------------------------|-------------------|-----------------|
| 5.0                     | 400                              | 350                    | 0.15              | 110             |
| 10.0                    | 800                              | 800                    | 0.30              | 230             |
| 20.0                    | 1,600                            | 1,920                  | 0.61              | 450             |
| 40.0                    | 3,200                            | 3,840                  | 1.22              | 900             |
| 50.0                    | 4,000                            | 5,600                  | 1.52              | 1,130           |
| 80.0                    | 6,400                            | 8,960                  | 2.44              | 1,800           |
| 100.0                   | 8,000                            | 12,800                 | 3.05              | 2,250           |

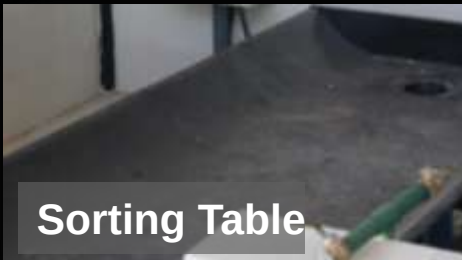
# PMC Dhanori Plant



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# PMC Dhanori Plant



Sorting Table



Main Digester 400 m3



Biogas Storage Balloons



Flare

Waste Heat Recovery Unit



100% Biogas Genset 40 kW



H<sub>2</sub>S Scrubber



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# Thank You

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