

SPRERI'S TECHNOLOGIES

Ready for dissemination



SPRERI

Striving for Excellence

**SARDAR PATEL RENEWABLE
ENERGY RESEARCH INSTITUTE**

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Sardar Patel Renewable Energy Research Institute

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About the Institute

Sardar Patel Renewable Energy Research Institute (SPRERI) is a research and development organization recognized in the country and outside for its contribution to the fields of renewable energy. The legendary founders, Late Dr. H.M. Patel and Late Mr. Nanunhai Amin, established the institute on 27th January 1979. The institute has three research divisions namely Solar Energy Division, Bio-chemical Conversion Division, Thermo-chemical Conversion Division and one Technology Transfer and Extension Division. The institute is recognised as a scientific & industrial research organisation by Department of Scientific and Industrial Research (DSIR), Bureau of Indian Standards (BIS), National Accreditation Board for Testing and Calibration Laboratories (NABL) and empanelled with Tata Institute of Social Sciences (TISS).



Inauguration of the Institute by legendary founders,
Late Dr. H.M. Patel and Late Mr. Nanunhai Amin

Solar Energy Division: focuses on design, development, evolution and refinement of solar energy devices like, dryers air heaters, stills, cookers, water heaters, solar refrigeration system, solar greenhouse, and standalone power generation systems based on solar thermal technologies.

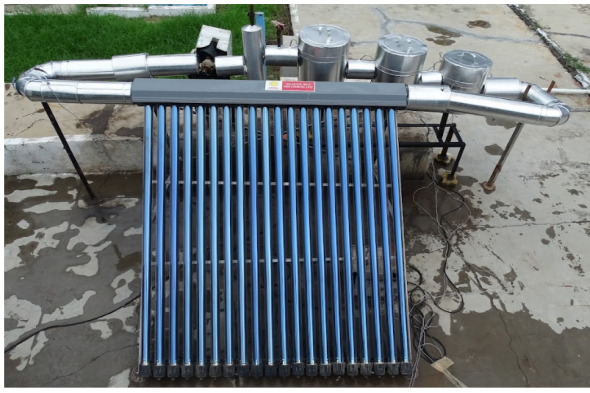
Bio-chemical Conversion Division: studies on anaerobic reaction; development, evaluation and refinement of technology for efficient bio-conversion of solid biomass and agro processing waste into biogas and good quality manure. The division is also working on green hydrogen to support country's hydrogen policy.

Thermo-chemical Conversion Division: is engaged in research and development related to design development and refinement of biomass gasification systems, quality improvement of producer gas and replacement of conventional fuels by producer gas in thermal and power generation systems. The division is also working intensively on bio-oil production technologies, pyrolysis and torrefaction.

Technology Transfer and Extension Division: is engaged in promotion of renewable energy technology through demonstration, training, business meet, and entrepreneurship activities.

Services offered by the Institute: All the divisions are well equipped research facilities and infrastructure to take up consultancy projects to meet the requirements of the industries. We conduct tests as per BIS norms of solar systems, cook stoves and characterization of biofuels. We also facilitate post-graduate and PhD students in their dissertation work.

Solar Passive Tracking Collector based Cooker



Specifications

Parameters	Values
Collector area	3.5 m ²
cooker capacity	3 Nos, 5 litter each
CO ₂ offset	3.2 tonnes/annum
Water boiling capacity	45 Litter
Stagnation temperature	155 °C

Salient Features

- Scalable to desired capacity
- Boiling water temperature: Up to 95oC during entire day operation and is suitable for cooking by boiling.
- Cooking Capacity: 3.2 kg rice, 2.0 kg lentils, and 1.6 kg curry
- Domestic household purpose and community

Solar Dish Cooker with Thermal Storage



Specifications

Parameters	Values
Concentrator diameter	2.5 m
Concentration ratio	277
Tracking Type	Manual
Diameter and weight of receiver	15 cm & 2.7 kg
Fin Type	Concentric rings with vertical fins
CO ₂ offset	0.3 tonnes/annum

Salient Features

- Portable thermal energy storage device
- Indoor and night time cooking
- Domestic household purpose for cooking

Solar Refrigerator with Thermal Backup



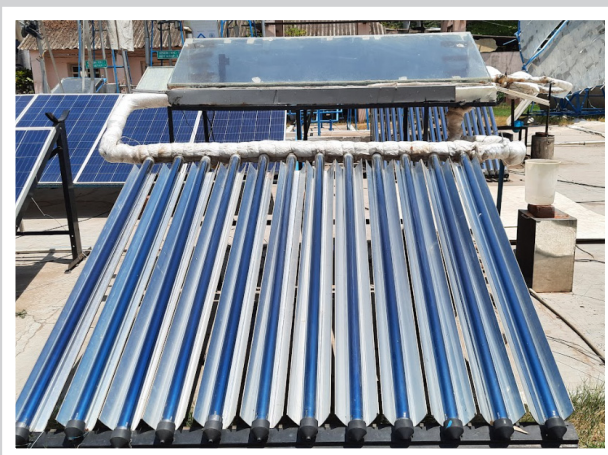
Specifications

Parameters	Values
Chamber capacity	50-100 liter
PV panel capacity	325-500 W
Refrigeration system capacity	130-210 W
Storage temp. range	2-8 °C
CO ₂ offset	0.3 tonnes/annum

Salient Features

- Standalone
- Grid-free
- Suitable to store vaccine, medicines and other perishable in remote location

Solar Assisted Desalination System



Specifications

Parameters	Values
Basin area	4.75 m ²
Distillation capacity	6-10 L/day
Basin MOC	MS
Still cover MOC	Glass
CO ₂ offset	0.33 tonnes/annum

Salient Features

- Suitable for contaminated water resources in rural areas
- Standalone system
- No waste water as compared to RO systems

Solar Dryer with Thermal Storage



Specifications

Parameters	Values
Collector area	12.8 m ²
Storage tank capacity	400 liter
Drying capacity	50-250 kg/batch
CO ₂ offset	Up to 15 tonnes/annum

Salient Features

- 2-3 h extended operation with thermal storage
- Indirect heater of air
- Continuous overnight drying in hybrid mode
- Retain nutrients and colour of the product
- Suitable for drying of various agro-produce and fish etc.

Portable Double-Glazed Solar Dryer



Specifications

Parameters	Values
Collector area	2.15 m ²
Drying temperature	50-70 °C
PV module capacity	40 Wp
Capacity	8-10 kg/batch
CO ₂ offset	1.0 tonnes/annum

Salient Features

- PV-integrated for grid-independent operation
- “Direct contact with the product” for faster drying
- Suitable for domestic households in rural areas for drying of various agro-produce

Standalone PV-integrated Solar Low Tunnel Dryer



Specifications

Parameters	Values
Collector area	7 m ²
PV module capacity	150 Wp
Drying air temperature	50-70 °C
Capacity	20-40 kg/batch
CO ₂ offset	3.2 tonnes/ annum

Salient Features

- Suitable for Aromatic, spices and herbal medicine/pharmaceutical industries and agro products for agroindustries
- Standalone and Low-cost
- Retain nutrients and colour in the dried product

Forced Convection PV Integrated Cabinet Solar Dryer



Specifications

Parameters	Values
Capacity	100 kg/ batch
CO ₂ offset @100kg/ batch	10.3 tonnes/ annum

Salient Features

- Suitable for Agricultural Sector, Food Processing Industry, Small-Scale Enterprises, Developing Countries and Rural Areas
- Scalable to desired capacity
- Grid-independent operation
- Continuous Overnight drying in hybrid mode

Fluidized-bed Gasification System



Specifications

Parameters	Values
Capacity range	10-200 kg/h
Energy generation capacity	Up to 8,00,000 kcal/h
Thermal efficiency	≥ 60 %
Carbon conversion efficiency	≥ 90 %
Energy cost through producer gas	0.6-0.9 ₹/MJ
CO2 offset @ 100 kg/h	350 tonnes/annum

Salient Features

- Fuel flexible system
- Low char yield
- Close-loop operation for zero mass loss
- Automation of systems for quality product & varying heat requirements

Downdraft Gasification System



Specifications

Parameters	Values
Capacity range	50-300 kg/h
Energy generation capacity	Up to 12,00,000 kcal/h
Thermal efficiency	≥ 60%
Carbon conversion efficiency	≥90 %
CO2 offset @ 100 kg/h	300 tonnes/annum

Salient Features

- Suitable for biomass briquettes and woodblocks
- Low char yield
- Automation of systems for fuel supply and gas output
- Suitable for 100 kWe power generation with matching cooling and cleaning systems

Biomass-based Hot Air Generator



Specifications

Parameters	Values
Fuel feed	10-15 kg/h
Air flowrate	3,000 m ³ /h
Hot air temperature	Up to 120 °C
Combustion efficiency	≥ 55 %

Salient Features

- Suitable for briquettes of crop residues and wood blocks
- Indirect heating of air for drying fruits and vegetables
- Low emissions
- Could be integrated with solar drying system for backup

Pyrolysis cum Torrefaction System



Specifications

Parameters	Values
Capacity range	20-100 kg/h
Bio-char yield	27-30 %
Bio-oil yield	30-45 %
Pyro-gas yield	30-40 %

Salient Features

- Fuel flexible system optimized for groundnut shell, cotton stalk, sawdust etc.
- Produces three different phases of the bio-fuels
- System could be operated at different parameters for desired products
- Utilization of pyro-gas (8-10 MJ/kg) for process heat

Fluidized-bed Oxidative Fast Pyrolysis System



Specifications

Parameters	Values
Capacity range	10-100 kg/h
Bio-char yield	10-15 %
Bio-oil yield	30-40 %
Pyro-gas yield	50-55 %
Calorific value of bio-oil	30 MJ/kg

Salient Features

- Fuel flexible
- Primarily used for the production of the bio-oil
- Precise control of fluidizing medium, process temperature and feedstock feeding using control unit

Activated Carbon Production System



Specifications

Parameters	Values
Activated Carbon	5 kg/batch
Mode of activation	Thermal & Chemical
Chemical agents	KOH and H ₃ PO ₄
Surface area	700-800 m ² /g

Salient Features

- Suitable for crop residues
- All processes carried out in single pass by changing process parameters
- Closed loop operation for zero mass loss
- Activated char received at the end of process with minimum material handling

Improved Biomass Cookstoves

Domestic cookstove



Specifications

Parameters	Values
Configuration	Natural draft
Burning Rate	1.5 kg/h
Thermal Efficiency	≥ 26 %
Power Rating	1.7 kW
CO ₂ offset	1.2 tonnes/annum

Salient Features

- Smoke-less operation
- Fuel saving in the range of 18-20%
- Easy to operate
- Controlled burning
- Intermittent ash removal

Community cookstove



Specifications

Parameters	Values
Configuration	Forced draft
Burning Rate	4.8 kg/h
Thermal Efficiency	≥ 31 %
Power Rating	6.8 kW
CO ₂ offset	5.7 tonnes/annum

Bio-Methanation of Industrial Potato Wastewater



Specifications

Parameters	Values
Capacity	1,50,000 L/day
Feed material	Potato industry waste water
Biogas yield	500 m3 per day
Payback period	<1 year

Salient Features

- Anaerobic hybrid reactor in combination of up-flow anaerobic sludge bed reactor and anaerobic filter (UASB+AF) supporting microbial growth as a biofilm on the surface or as flocs in interstitial spaces.
- PNG equivalent: ~335 cu m/d

Bio-Methanation of Dairy Waste Scum



Specifications

Parameters	Values
Capacity	500 kg/day
Feed material	Dairy scum
Biogas yield	13 m ³ /day
Payback period	1.4 years

Salient Features

PNG equivalent: ~10 m³/d

Technology for dairy scum treatment

Bio-Methanation of Dairy Effluent



Specifications

Parameters	Values
Capacity	12000 L/day
Feed material	Dairy Effluent
Biogas yield	45 m ³ /day
Payback period	3 years

Salient Features

- Capacity Scalable
- COD removal up to 80%

Mandi/Kitchen Waste Bio-Methanation Plant

Specifications

Parameters	Values
Capacity	3.5 TPD
Feed material	Kitchen and mandi waste
Output yield	250 m ³ biogas
Payback period	3 years



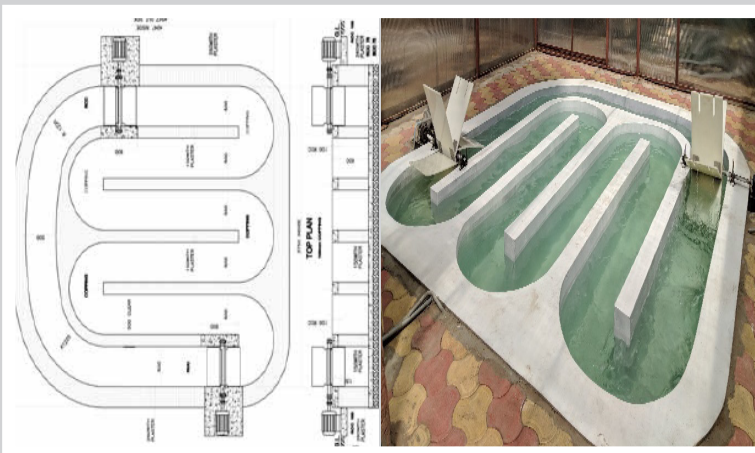
Salient Features

- Odourless
- Methane content up to 64%
- COD removal up to 80%
- Suitable for kitchen and mandi wastes

Bioremediation of Dairy Effluent by Microalgae

Specifications

Parameters	Values
Capacity	6000 L per batch
Feed material	Dairy effluent
Biomass yield	1.5-1.8 g/L
Lipid content	~ 30%
Simple payback period	3 years



Salient Features

- COD removal up to 90%
- Treated water suitable for irrigation
- Suitable for bioremediation of dairy effluent

In-Farm Composting Using Microbial Consortia



Specifications

Parameters	Values
Capacity	1 tonne/ batch
Treatment	Mixed fungus and bacterial culture
Biomass	Rice straw
Compost yield	0.6 tonne
Payback period	3 years

Salient Features

- Capacity scalable
- Decomposition of rice straw in 25 days
- Reduction in volume by 50%

Rice Straw Enzymatic Hydrolysate to Biogas in a Continuous Mode of Operation



Specifications

Parameters	Values
Reactor	Anaerobic jacketed thermophilic reactor
Mode of operation	Continuous
Feed material	Enzymatic hydrolysate of Rice straw
Output	360 L/kg of RS at HRT of 60 h
Calorific values	Produced pellets : 13.2 MJ/kg Extracted lignin : 18.7 MJ/kg

Salient Features

- COD removal rate was 80%.
- Zero-waste approach on anaerobic fermentation of rice straw to bio-methane.
- Methane content upto 73%
- Leftover solids and liquids during the process were used to produce pellets and lignin.



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