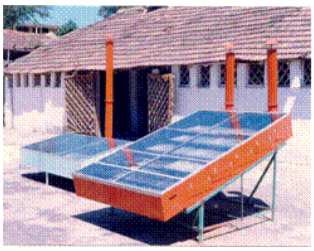
1. SOLAR ENERGY

Step Type Solar Dryer

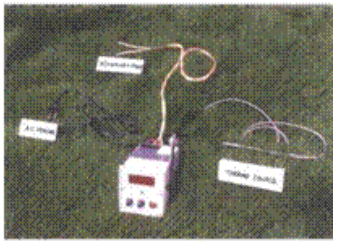



1.Function	Drying of fruits, vegetables and agricultural commodities
2.Specification	
(i) Collector area	2.4 x 1.8 m
(ii) Type and Model	Step type, TNAU
(iii) Number of trays	10 in five steps
(iv) Insulation (Bottom)	Glass wool, 10 cm. thick
(v) Motive power	Natural convection
3. General Information	Step type solar dryer has a collector area of about 4.32 m^2. This multi track step type dryer can hold 10 aluminum trays at a time. The absorber is 20 gauge GI sheet, black painted at the top with bottom insulation. The drier is covered at the top with 2 layers of 3 mm thick plain glass kept at an air gap of 2.5 cm. At the rear side of the collector, two chimneys of 120 cm height are provided. Chimneys are provided with butterfly valves to control the movement of air. Holes provided at the bottom of the collector just below the first step allow the entry of atmospheric air into the dryer
4. Cost of the unit (approx)	Rs.15000/-
5. Cost of operation	Rs.3.75/h.
6. Salient features	(i)Solar drier takes 40 hours for drying 50 kg of papaya leather, while conventional sun drying takes 61 hours. Thus there is a saving of 21 hours which is 35% when compared to conventional drying. (ii)The drier handles 10 kg of cocoon per batch and each batch takes 30-40 minutes for completion of stifling. 80 kg of cocoon per day in 8 batches can be conveniently stifled in a day

Forced Convection Solar Dryer

1. Function	Drying grains, chillies, copra
2. Specification	
(i) Type and Model	Forced convection
(ii) Area of the flat plate	$8m^2$
(iii) Diameter of the bin	178 cm
(iv) Depth	45 cm
3. General Information	The drier has three main components *viz*. flat plate collector, blower and drying bin. The area of the collector is 8 m^2 and is divided into 4 bays each having 2 m x 1 m absorber area. The absorber is made of 20 gauge corrugated GI sheet and is painted with black colour. A plain G.I.sheet placed 5 cm below the absorber plate creates air space for heating. This sheet is insulated at the bottom with glass wool. The absorber is covered at the top with two layers of 3 mm thick plain glass. The unit is placed at 10°C to the horizontal, facing south. The air space is open at the bottom to suck atmospheric air and at the top it is connected to a duct leading to the suction side of the blower. The blower is of 8 m^3/min capacity and run by 3 hp electric motor. The delivery side of the blower is connected to the plenum chamber of a circular grain holding bin.
4. Cost of the unit (approx)	Rs.25000/-
5. Cost of operation	Rs.7.00/h
6. Salient features	Time taken for drying 500 kg paddy from 25% to 12% m.c (w.b.) is 8 h.

Electronic Temperature Controller for Solar Dryer



1.Function	To control the air temperature inside natural convection solar dryer
2.Specification	
(i) Power requirement	Single phase 230 V
(ii) Temperature range	0 - 200^{o}C
(iii) Temperature band width	1^{o}C to 10^{o}C
(iv) Rated load capacity	100 W
(v) Thermo couple	Stem type Fe:K
3. General Information	The unit consisted of a the mister sensor circuit to detect the hot air temperature having a differential amplification unit, a buffer circuit for impedance matching and a controller circuit to actuate an exhaust fan. The controller module is a simple "on - off" device with independent dead band and centre level adjustments with the output driving a relay. When temperature of the air inside the dryer exceeds the set level, the controller switches on the exhaust fan to quickly draw away hot and humid air from the dryer, reducing the stagnation temperature to the desired level. As soon as the temperature is reduced to a predetermined level, it switches off the fan checking further drop in temperature. The dead band provision prevents hunting of the controller and provides a precise band of temperature control.
4. Performance	Accurate control of temperature within the desired range. Energy consumption less than 1 kWh / d
5. Cost of operation	Rs. 3000/-

Solar Tunnel Dryer for Agro Industrial Applications



1.Function	Natural convection walk-in type dryer for bulk drying of agricultural & agro industrial products at moderate air temperature
2.Specification	Semicylindrical shaped tunnel with a base area of 3.75 m x 18 m for capacity of 1 ton per batch for drying of sago and coconut Metallic frame structure of tunnel dryer is covered by UV stabilized semi transparent polythene sheet of200 micron thickness Length of the dryer depends upon type and quantity of the product to be dried per batch. A slope of 10-15o is provided along the length of the tunnel. An exhaust fan at the upper end of the tunnel, and a few chimneys on the top of the tunnel are provided to remove the moist air
3.Design Features	Sago is highly hygroscopic and the drying of roasted sago in open air is labour consuming and costly. Thus sago contains 37 % (w.b) moisture initially and it is to be brought down to 11% (w.b) by drying. This is critical process and it depends on monsoonic vagaries. Hence, it is proposed to integrate small poly cover in tunnel shaped structure for drying agro-industrial product
4. Salient Features	(i) Simple in fabrication and installation (ii) Maximum mean temperature obtained inside the dryer is 57° C while the ambient temperature was 33.5 °C (iii)The drying time for sago drying in solar tunnel dryer is 5 hours with 20% cost saving when compared to open sun (11 hours drying time) method (iv)Payback period is 5.8 years for sago product (v) The savings in drying time using coconut as produce is 16 hours, with 42 % cost saving when compared to open sun drying method. (vi) This tunnel dryer can also be useful for drying of chilles
4. Cost (approx)	Rs 1, 20,000 for standard size (3.75m x 18.0m)

Community Solar Cooker

1. Function	:	Community level cooking of rice, dhal, vegetable and egg
2. Specification		
i. Type and Model	:	Box type
ii. Size of the cooker	:	2.5 x 0.6 x 0.15 m
iii. Reflector material film	:	Metalized polyester
iv. Size of vessels	:	28 cm. dia x 7.5 cm height
v. Number of vessel	:	16 (Aluminium)
3. General Information	:	It has 3 compartments. Each compartment can be opened and closed by the wooden frame having two numbers of 3 mm thick plain glasses. The bottom absorber sheet is painted with black colour. The bottom is insulated with glass wool. The cooker is having a cooking capacity of 8 kg of rice at a time.
4. Cost of the unit (approx)	:	Rs. 6000 /-
5. Cost of operation	:	Rs. 0.75/h
6. Salient features	:	Time taken for cooking 8 kg parboiled rice : 150 min 6 kg parboiled rice + 1 kg red gram + 1kg beetroot : 160 min

Community (Scheffler) Solar Cooker

1. Function	:	To cook food indoor using solar energy within the kitchen itself and can cater to 40 to 50 persons.
2. Specification		
i. Type	:	-
ii. Temperature requirement	:	400° C at focal point
iii. Capacity	:	To cook two meals a day in places where solar insolation is good during most part of the year.
3. General Information	:	The cooker is of parabolic type having primary and secondary reflectors. The parabolic frame of the primary reflector is made of metallic square tubes. Secondary reflector sheet / mirror is so curved in shape that it reflects the incoming rays towards the bottom of the vessel. The stand on which the reflector frame is fixed is made of iron structure suitably painted. The movement of the rotating support on which the frame is fixed is done with the help of automatic tracking device. There is a pendulum clockwork device with provision for seasonal adjustment. In view of high temperature (400° C) at focal point, the cooking rate is significantly faster than that in other types of solar cookers.
4. Cost of the unit (approx)	:	Rs 75 000
5. Salient features	:	Cooking in residential schools, institutions, ashrams, hotels, hostels, industrial canteens hospitals etc. Use of this can save about 35 to 40 LPG cylinders per annum (Rs.12000/year). It can cook almost all traditional dishes including chappathis, poories, dosas etc. To eliminate use of conventional fuel like gas, electricity etc.

Solar Box Type Cooker

1. Function	:	For cooking purposes where sunshine is available in plenty
2. Specification	:	
i. Type	:	Box type
ii. Power requirement	:	
iii. Overall dimensions	:	500 x 500 x 200
iv. Weight (kg)	:	12
v. Capacity	:	Time taken in cooking (min): 35-40
3. General Information	:	The important parts of a solar cooker include the outer box with thermal insulator, inner cooking box or tray, the double glass lid, mirror and cooking containers. The outer box is generally made of G.I. or aluminum sheet or fibre reinforced plastic. The inner cooking box or tray is made from aluminum sheet and coated with black paint to absorb solar radiation and to transfer the heat to the cooking pots. The cooking tray is covered with a double glass lid in which the two glass sheets are spaced at about 20 mm to entrap air which acts a insulator and prevents escape of heat from the inside. The space between the outer box and inner tray including bottom of the tray is packed with insulating material such as glass wool pads to reduce heat losses from the cooker. In addition to the above, the cooker is fitted with a mirror to increase the radiation input on the absorbing space. This radiation is in addition to the radiation entering the box directly and helps to quicken the cooking process by raising the inside temperature of the cooker. The cooking containers (with cover) are generally made of aluminum and painted black on the outer surface so that they also absorb solar radiation directly.
4. Cost of the unit	:	
5. Salient features	:	Conversion efficiency (%) Rice: 45-60, Vegetables : 60-100 A large number of items such as pulses, rice, kheer, khichri, vegetables, meat, fish etc. can be cooked in the solar cooker. The time taken to cook will depend upon the type of food, time of the day and solar intensity.

Steam Cooking (Parabolic Concentrators)

1. Function	:	Cooking in ashrams, temples, gurdwaras, army canteens etc
2. Specification		
i. Type and Model	:	Automatic tracking solar dish concentrators
3. General Information	:	Solar steam cooking system can cook food for several thousand persons at a time. The system uses automatic tracking solar dish concentrators which convert water into high pressure steam and consists of shell type receiver made of mild steel, 35 cm in diameter, connected to two concentrators on either side, which focus sunlight on both sides of the receiver. Several such receivers are connected to a 12" dia header pipe which is half-filled with demineralized water The receivers and the header pipes are insulated to avoid any heat losses. Each receiver is integrated with two pipes of 1 ½" and ½" diameter from inside, which help in thermo-siphonic flow of water from receivers to header and back. When the water gets heated in the receiver, it starts moving up in the header through one pipe and the cold water from the header starts coming into the receiver. The cycle goes on and a high pressure steam is generated in the header pipe after some time.
4. Cost of the unit (approx)	:	
5. Cost of operation	:	
6. Salient features	:	Cost of cooking system for 1000 people is about Rs.80 lakhs. (Special workshop facilities are required at site for installing the system besides back up boiler and cooking utensils.) Saving in fuel cost (furnace oil) would be about Rs.20 lakhs / year. The payback period varies from 3 to 5 years depending upon size of the system.

Solar Lantern

Configuration

SPV lantern is a portable lamp. It consists of SPV module of 10 Wp capacity, rechargeable battery, Compact Fluorescent lamp (CFL) of 5 / 7 W and electronics *(i.e*. inverter and charge controller). When sunlight falls on the SPV module, it is converted into DC electricity, which is stored in a battery and converted into AC electricity by the inverter and used for supplying power to CFL. If charged regularly, it can be used for 4 hours daily.

Potential for use

- Individuals: Remote households, farm operations, emergency (portable) lamp, fly catchers etc.
- Industries: Emergency lamps in factories, offices, canteens, security gates etc.
- SHGs : Lanterns may be provided to vendors on hire (daily) by Self Help Groups or small entrepreneurs.

Cost

A lantern with SPV panel of 10 Wp costs about Rs.3000 (tentative) each.

Solar Water Pumps

1. Function : Drinking water supply for small habitations

2. Specification

Type	Capacity	Water Level Depth (maxi) m	Discharge rate / day (litres)
i) DC Surface	900 Wp - 1 Hp	14	75000
	1800 Wp - 2 Hp	14	140000
ii) AC submersible	1800 Wp - 0.75 Hp	50	50000

3. General Information	:	A solar PV water pumping system consists of a number of solar PV modules connected in series - parallel combination to generate sufficient power to operate a motor pump. The solar PV modules are mounted on a metal frame in a manner that the mounting frame can be turned / tilted to ensure that the modules keep facing the sun throughout the day. The system does not have any storage battery since power generated is used directly then and there. The SPV array converts the solar energy into electricity which is used for running the motor pump set. The pumping system can draw water from the open well / bore well or stream / pond or canal. The normal discharge rates of water for different types of pumps are given above.
4. Cost of the unit (approx)	:	Rs.2.50 lakhs (1 HP)
5. Salient features	:	Drinking water supply for small habitations Horticulture farms, orchards, vineyards, gardens and nurseries Agro forestry and plantations Dairy, poultry and sheep farm Aqua culture, fish farming

Solar PV Street Lights

Configuration

SPV street lighting system is a stand-alone system consisting of 74 W module, rechargeable battery, CFL lamp of 11 W, electronics (inverters & charge controller), a GI or MS pole of 4 m height above ground for mounting the panel, luminaire and battery. When sunlight falls on SPV module, it is converted into DC electricity which is stored in the battery. This in turn is converted as AC electricity by the inverter and used for providing light.

Potential for use

Individuals: Garden / security lights (compound wall)

Industries: Campus / factory lighting approach road, garden lighting, parking areas, security lights, storage yard etc.

Local bodies / Institutions: Street lights, parks, play fields, bus stands, bus shelters, petrol bunks, resorts etc.

SPV street lights are being installed by the local bodies – panchayats, municipal corporations etc. in large numbers by availing subsidy so as to reduce the recurring power consumption charges. Non-profit organizations can also use them for their campuses.

Cost

Tentative cost of solar street lights range from Rs.25,000/- to Rs.35,000/- depending upon period of warranty.

Solar PV Home Lights / Office Lights

Configuration

This is a fixed indoor lighting system and consists of solar PV, module, battery and balance of systems. It is supplied under the following configurations as per specifications of

MNRE: * 1 light * 2 lights * 1 light & 1 fan * 2 lights & 1 fan * 4 lights.

The luminaries used in the above systems comprise compact fluorescent lamp (CFL) of 7 W / 9 W / 11 W capacity which consume less energy but give illumination equivalent to 25 / 40 / 60 W capacity conventional incandescent lamps respectively; The fan is of DC type with less than 20 W rating. One Battery of 12 V, 40 / 75 Ah capacity is also provided with SPV modules of 37 Wp / 74 Wp as required. The system will work for about 4 hours daily, if charged regularly. The capacity and rating of different models are as follows:

Model No	Module Capacity	CFL rating	Fan Capacity	Battery capacity
1	18 W	7 W	---	20 Ah
2	37 W	9 W	---	40 Ah
3	37 W	9 W	20 W	40 Ah
4	74 W	11 W	20 W	75 Ah
5	74 W	11 W	---	75 Ah

Potential for use:

Individuals: Home / office lighting in residential / buildings, farmhouses

Institutions / Industries / Local bodies: Parking areas, porticos, canteens, guest houses, toilets, Office lighting, Group houses, Community centers, corridors, places of worship etc.

Cost

Tentative cost of the systems range from Rs.8,000 for model-1 to Rs.25,000 for model-5.

Solar Water Heating System

Solar water heating system (SWHS) has three main components, namely, Solar Collector, Insulated hot water storage tank and Cold water tank with required insulated hot water pipelines and accessories. In the case of smaller systems (100 - 2000 litres per day), the hot water reaches the user end, by natural (thermo - siphon) circulation for which the storage tank is located above the collectors. In higher capacity systems, a pump may be used for forced circulation of water. A bank of collectors can be arranged in a series – parallel combination to get higher quantity of hot water. A typical 100 litres insulated tank with a 2 m^2 collector area, will supply water at a temperature of 60 - 80°C.

Hot Water Storage Tank and Cold Water Tank & Pipelines

The tanks are generally made of stainless steel to avoid corrosion and are insulated to reduce heat losses. They are also fitted with electrical heater as a backup during monsoon days. The tanks may also be made of G.I. sheets or aluminum. Cold water comes from the over head tank. Hot water from the system is transferred to various utility points through to insulated pipelines. A heat exchanger may be provided when the water is hard.

Usages

Domestic	:	Bathing, Coffee / Tea preparation, Dishwashing etc.
Industrial	:	Pre-heating of boiler feed water, cooking / dishwashing in industrial canteens. washing of milk canes in dairies, sterilization of surgical instruments etc.

Economics (Tentative)

- A 100 lpd domestic solar water heating system (SWHS) can cater to a family of 5 persons and costs about Rs.20000.
- It saves about 1500 units of electricity per annum equivalent to about Rs.5000/- per year.
- A 1000 lpd industrial system would cost about Rs.2.0 lakhs and would have a payback period of 2 years.

Solar cum Biogas Insect Trap

1. Function	:	Control of pests and diseases without addition of chemical pesticides
2. Specification		
i. Frame dimension	:	60 x 60 x 75 cm
ii. PV module	:	7.5 V, 10 W
iii. Battery	:	10 Ah, 6 V
3. General Information	:	The biogas cum solar light trap was developed to monitor the pest infestation in the crop field. A conical funnel of base diameter of 32.5 cm and height 26 cm with a 5 cm diameter hole at the apex was used as the insect trap. A collar was welded at the apex and a clamp was provided for fixing polythene bag or plastic bottle to the collector for collecting the insects. The funnel was painted with yellow, since some insects are seen to be attracted by yellow colour.
4. Cost of the unit	:	Rs. 1000/-
5. Cost of operation	:	Rs. 1.15/day
6. Salient features	:	The gas consumption is 0.1 to 0.15 m^3/h of operation

Solar Distillation Plant

1.	Function	:	Converting salt water into potable water
2.	Specification		
	i. Base	:	Area : 15 m^2 Concrete : 1:5:10 Wearing coat : 1 : 1.5 : 3 7.5 cm thick black coated
	ii. Side walls	:	Brick masonry
	iii. Roof	:	Glass roof on steel truss Thickness of glass : 5 mm
	iv. Distilled water collecting channel	:	Aluminium
	v. Tank	:	Two numbers in brick masonry structure
3.	General Information	:	The unit is a basin type solar distillation plant of masonry construction, with a basin area of 15 m^2 and slope of the glass cover is 15°. The distilled water sliding down the slope of the bottom of the glass cover is collected at the end along the aluminium channels. The channels are fixed with a slope to collect the water at the end where the water drops in to the tank through the end cover and pipe at the bottom.
4.	Cost of the unit (approx)	:	Rs. 28000 for 15 m^2
5.	Cost of operation	:	Rs.6/h
6.	Salient features	:	The still can yield 3 to 4 liters of distilled water per square meter area of the basin in a day.

2. GASIFIERS

Rice Husk Gasifier

1.	Function	:	Thermal applications in small scale industries
2.	Specification		
	i. Rice husk consumption rate		6 – 8 kg/h
	ii. Thermal efficiency	:	55 – 60 %
	iii. Gas yield	:	10 – 12 m^3/h
	iv. Power required for blower	:	0.2 kW
	v. Thermal capacity	:	10,000–15,000 kcal/h
3.	General Information	:	A 4.5 kW downdraft open rice husk gasifier consists of two cylindrical drums of 300 mm and 370 mm diameter, joined with flange at the top and fitted with a grate and a lid at the bottom. A 0.2 kW electrical motor run blower sucks the gas, produced from the plant and supplies to the burner. The gas cooling and cleanup systems were provided in between the reactor and the burner.
4.	Cost of the unit (approx)	:	Rs. 25,000
5.	Cost of operation	:	Rs.30/h
6.	Salient features	:	Thermal applications of rice mills can be suitably met with the thermal efficiency of 55 to 60% Compared to diesel system, about Rs.300/day can be saved

Bagasse Gasifier

1. Function	:	For thermal applications of small and medium scale industries
2. Specification		
i. Rate of consumption of feedstock	:	135 kg/h
ii. Efficiency of the system	:	50%
iii. Holding capacity of system	:	250 kg
iv. Specific gasification rate	:	300 kg/m^2 -h
3. General Information	:	The gasifier has a cylindrical reactor of diameter 0.7 m and height of 2 m. Bagasse consumption is in the range of 105 to 180 kg/h as compared to 60 to 120 kg/h of briquettes. 2 m^3 of gas can be obtained from one kg of fuel. For one batch of gur making, the time of operation is about 2.5 hours.
4. Cost of the unit (approx)	:	Rs.2,50,000/-
5. Cost of operation	:	Rs. 250/h
6. Salient features	:	Producer gas generation of 250 m^3/h, is suitable for boiling of cane juice in gur industries. Saving in fuel is 40 to 50%. Saving in time is 42 to 46%.

TNAU Single Pot Improved Chulha

1.	Function	:	Cooking and water heating
2.	Specification		
	i. Inner wall diameter	:	18 cm
	ii. Outer wall diameter	:	24 cm
	iii. Size of legs	:	5 x 5 cm
	iv. Fuel inlet	:	15.5 x 15 cm
	v. Fuel used	:	Wood, Agrl. Wastes, etc.
3.	General Information	:	The single pot chulha has a double wall with a gap of 2.5 cm. It has a grate at the bottom of the combustion chamber. Legs have been provided in the four corners of the chulha (5 cm height) as the ash can be collected below the grate. The outer wall has two rectangular secondary air openings at the lower portion on both sides for air entry. The inner wall has 1 cm diameter holes which maintain a triangular pitch of approximately 3 cm. The secondary air enters through the rectangular opening in the outer wall, gets heated in the annular chamber and while moving up it passes through the holes in the combustion chamber. The preheated air helps in proper burning of the fuel.
4.	Cost of the unit	:	Rs. 75 /-
5.	Salient features	:	Efficiency : 24 %

TNAU Double Pot Improved Chulha

1.	Function	:	Cooking and water heating
2.	Specification		
	i. Overall dimension	:	55 x 30 x 25 cm
	ii. Fuel inlet	:	15.5 x 15 cm
	iii. Air inlet	:	17 x 1 cm
	iv. Size and no. of legs	:	5x5 cm, 6 nos.
3.	General Information	:	The TNAU double pot portable chulha (chimneyless) is made with two walls. Around the first pot, an annular chamber having a width of 2.5 cm is left and the outer wall is constructed. The outer wall is also extended to cover the second pot in which case the annular chamber width is 3.5 cm, because of the smaller diameter of the second pot hole. Two secondary air inlets are made, one on the outer wall with rectangular shape (17 cm x 1 cm) near the combustion chamber and the other at the bottom of the second pot hole with round shape having a diameter of 5 cm. At the bottom of the first pot hole in the base, a hole of diameter 14 cm is made and a grate (C.I.) is placed over it. For the entry of secondary air to the first pothole, 1 cm dia holes are made with a triangular pitch of 3 cm on the inner side of first pot hole and also on the tunnel projecting into the second pot hole.
4.	Cost of the unit (approx)	:	Rs. 150 /-
5.	Salient features	:	Efficiency - 26%

TNAU Noon Meal Improved Chulha (Community Chulha)

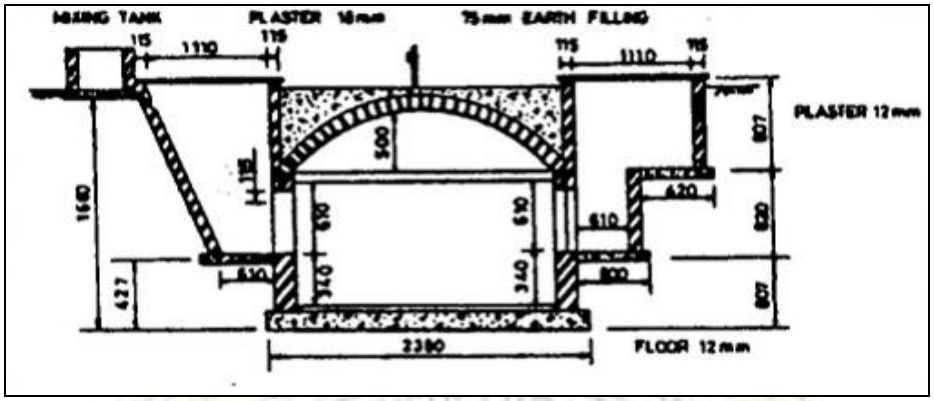
1.	Function	:	For cooking for large mass *i.e*. community level
2.	Specification		
	i. Feed stock	:	Firewood, agricultural wastes etc.
	ii. Fire box mouth size	:	25 x 30 cm
	iii. Fuel consumption	:	5.6 kg/h
3.	General Information	:	This community model (TNAU noon meal chulha) double pot chulhas is made up of local materials such as clay, sand, paddy husk etc. This chulha has two air inlets (6 x 9 cm) on the sides of the fire box mouth for better combustion. Tunnels were provided to pass the flame to the second pot and carry smoke easily into the chimney pipe. The height of the first pot hole is made lower (40 cm) than the second pot hole (48 cm) for the better propagation of flame.
4.	Cost of the unit (approx)	:	Rs. 300/-
5.	Salient features	:	Thermal efficiency : 23 % Fuel saving : 16 % Time saving : 30 %

Wood Based Down Draft Gasifier

1.	Function	:	For converting fuel wood to fuel
2.	Specification		
	Capacity	:	58 kW
3.	General Information	:	Fuel consumption : 20 to 25 kg/h Gas production rate : 50 m^3/h Thermal output : 500000 kcal/h
4.	Cost of the unit (approx)	:	Rs.1,50,000/-
5.	Salient features	:	• Fuel wood can be used as fuel • 40% fuel saving due to higher thermal efficiency • No smoke • Best suited for processing industries with steam • Fulfill the heat energy requirement in rice mills, turmeric and arecanut processing units etc

3. BIOGAS

Janata Type Biogas Plant



1.	Function	:	Household cooking, lighting and running engines
2.	Specification		
	i. Components	:	Digester, and inlet and outlet tanks
	ii. Feed material	:	Cow dung, pig manure, poultry droppings etc.
	iii. Shape of the plant	:	Cylindrical
3.	General Information	:	This is a semi-continuous flow plant for producing biogas from cattle waste in domestic level. This is a fixed dome model. Main feature of janata design is that the digester and gas holder are the parts of a composite unit made of bricks and cement masonry. It requires centering for making the dome shaped roof and, skilled and trained mason is a must for the construction. Based on the requirement and availability of feed material, the size of the plant may be fixed suitably.
4.	Cost of the unit	:	Rs. 10,000 (2 m^3 plant) Rs. 12000 (3 m^3 plant)
5.	Cost of operation	:	Rs. 5/day
6.	Salient features	:	20 - 30% cost saving than KVIC floating drum type plant

Deenabandhu Model Biogas Plant

1.	Function	:	Household cooking, lighting and running engines
2.	Specification		
	i. Components	:	Dome, Digester, Gas storage, Gas Outlet Pipe, Inlet and out let pipe
	ii. Feed material	:	Cow dung, pig manure, poultry droppings etc.
	iii. Shape of the plant	:	Dome model
3.	General Information	:	It is an improved fixed dome model, where form work is used for construction. Due to shell structure the thickness is considerably reduced. The entire plant is built with brick in cement mortar. Unlike janta Biogas plant it does not require any shuttering, thus reducing the cost of construction. The digestor, gas storage chamber and the empty space above the slurry are all provided in the spherical shell. All the slurry displaced out of the gas storage chamber is stored in the outlet displacement chamber as there is no displacement space on the inlet side. The inlet is in the form of a pipe which connects the digester with slurry mixing tank. The hydraulic retention time for this design is 40 days for northern plains of the country. For hilly regions the retention time is about 50 days. A number of plants have been built in village Darapur, P.O. Hardnaganj, Aligarh (U.P.) and Nagercoil in Tamil Nadu.
4.	Cost of the unit	:	-
5.	Cost of operation	:	-
6.	Salient features	:	1- 4 cum capacity in 1 to 2 days duration.

Community Biogas Plant

1.	Function	:	Cooking, lighting and running engines
2.	Specification		
	i. Gas volume	:	35 m^3
	ii. Gas holder height	:	1.0 m
	iii. Inlet/outlet opening	:	2.0 x 1.2 m
	iv. Initial dung required	:	32 to 36 tonnes of cow dung
	v. Daily loading rate	:	800 to 900 kg
	vi. No. of cattle required	:	80 to 90 animals
3.	General Information	:	The community level biogas plant will be constructed in a common place, the feed material will be collected from a group of households and the produced biogas will be distributed to all the beneficiaries. The size and cost of the plant may vary based on the availability of feed material, requirement of biogas and initial investment.
4.	Cost of the unit (approx)	:	Rs. l,50,000/-
5.	Cost of operation	:	Rs. l 00/day
6.	Salient features	:	Rate of biogas production : 1.5 m^3/h No. of hours 5 hp dual fuel engine can run: 14 h Electricity production potential : 40 kWh No. of beneficiaries for cooking gas : 40 - 50 families

Solid-State Biogas Plant

1. Function	:	Anaerobic digestion of cattle dung in solid-state to produce biogas and compost
2. Specifications	:	Plant capacity - 2-3 cu m, Feed inlet - RCC pipe, 30 cm diameter, Feed rate50 kg fresh cattle dung/day ,TSC of the feed upto 17%, Retention period - 75-103 days
3. Design Features	:	-
4. Performance	:	The average gas yield up to 50% higher for the modified plants as compared to the common Janta / Deenbandhu biogas plants, TSC of the digested slurry discharged from the plant is 9.5 - 10.5%. The digested slurry can be transported to fields for use as manure after 2 - 6 days interval
5. Cost (approx)	:	Rs. 12 000/ -
6. Salient Features	:	The fixed dome Janta and Deenbandhu designs modified for digestion of cattle dung in solid-state. The main modifications include feeding through a RCC pipe of 30 cm diameter, enlarge outlet chamber and widened slurry outlet channel

Plug Flow Biogas Plant

1	Function	:	Anaerobic digestion of mixture of cattle dung and green lignocellulosic biomass (weeds, vegetable, residues etc.) to produce biogas and compost
2	Specifications	:	Rated capacity - 1 cu m / day, Material of construction - Brick masonry, Substrate - 3:1 mixture of cattle dung and green chopped agro-residues, TSC of input slurry - around 10%, Feed rate 4.2 - 5.0 kg dm / day, Retention period - 60 days
3	Design Features	:	-
4	Performance	:	Average biogas yield of 0.8 - 0.9 m3 / d for monthly average mean ambient temperature of 24 - 25°C.
5	Cost (approx)	:	Rs. 15 000/- .
6	Salient Features	:	Fixed dome type plant, digester of capsule geometry, low dead space at corners of the digester, smooth plug flow of the mixed substrate with no short circuiting. Suitable for substrate consisting of green crop / vegetable residues, weeds like lantana-camara, ageratum etc and cattle dung.

10 m^3 High Rate Reactor for Cassava Starch Factory Effluents (Sago Effluents)

1. Function	:	For energy production
2. Specification		
i. Type	:	-
ii. Power requirement	:	-
iii. Overall dimensions	:	-
iv. Weight	:	-
v. Capacity	:	10 m^3 / day
Cost of gas production		Rs.35/- / day
3. General Information	:	-
4. Cost of the plant (approx)	:	1.5 lakhs
5. Salient features	:	• Promising technology for energy production • Pollution reduction and ease of operation • High rate reactor for treating 7000 litres of sago effluents per day • Suitable for small and medium scale sago industries • BOD reduction : Upto 80%

4. BIOFUEL

Pilot Plant for the Manufacture of Biodiesel

1.	Function	:	Production of biodiesel from vegetable oils
2.	Specification		
	i. Capacity	:	250 kg oil/day
	ii. Command area required	:	25 ha
	iii. Biodiesel production	:	250 L/day
	iv. Glycerol production	:	55 kg/day
3.	General Information	:	Biodiesel is produced from *Jatropha* oil by converting the triglycerides into methyl esters with a process known as transesterification. The *Jatropha* oil is blended with methyl alcohol and catalyst mixture, which is kept at reaction temperature for specific duration under agitation and sent to the settling tank. The ester is collected and washed to get pure biodiesel. The pilot plant consists of reaction vessel with heating and agitating device, catalyst mixing vessel, settling tanks and washing tank.
4.	Cost of the unit (approx)	:	Rs. 1,50,000
5.	Cost of operation	:	Rs.3/L of diesel (excluding the cost of Jatropha oil)
6.	Salient features	:	About 250 litres of biodiesel can be produced per day from vegetable oils or tree seed oils Glycerol (by-product), can be used further in soap making or in chemical industries

5. WIND MILL

Small Aero Generator (Mini-Wind Mills)

1.	Function	:	To reduce electricity for captive purposes
2.	Specification	:	It consists of smaller capacity wind electric generator (up to 30 kw) a tower, a battery bank with an inverter and electronic control system.
3.	General Information	:	Wind force makes the blade rotate and produce mechanical energy which in turn drives the wind electric generator to produce AC electricity, converted as DC, stored in a battery and used for electrical applications (DC or AC) whenever required to supplement EB supply or to save on diesel. There is an in-built self protection mechanism to reduce power output in severe weather conditions. It can be installed in places where the wind speed is more than 15 kmph. The generators could be installed where wind speed is > 15 kmph. Saves around 2500 kwh per kw per annum depending on wind speed and duration.
4.	Cost of the unit (approx)	:	Rs.2.50 - 3.00 lakhs / kw
5.	Cost of operation	:	-
6.	Salient features	:	-
7.	Manufacturers	:	(i) Auto Spare Industries, 4, Kalathiswaran Koil St, Pondicherry – 605001 (ii) Auroville Energy Products Auroshilpam, Centre for Scientific Research, Auroville, Tamilnadu – 605101

Wind Mill Water Pump

1.	Function	:	To roduce electricity for captive purposes
2.	Specification	:	It consists of smaller capacity wind electric generator, (up to 30 kw) a tower, a battery bank with an inverter and electronic control system.
	Description / Types	Gear	Gearless (AV55)
	Tower Height (m)	10	13.5 to 19.5
	No of blades	18	24
	Blade diameter (m)	3.3	5.6
	Pipe size (inches)	2 to 4	3 to 5
	Wind speed (kmph)	9	18
	Water output (lph)	1000	4000
	Water depth (m)	20	15
3.	General Information	:	The wind force striking at the blades is converted to mechanical energy which in turn is used for operating a pumping rod, as in the case of hand pump, to pump water from open or bore well. It can operate in places where the wind speed is about 18 kmph**.** Gear-type wind mills are also available which can operate at a speed of 9 kmph. Saves around 1500 kWh per annum depending on wind speed and duration.
4.	Cost of the unit (approx)	:	Rs.2.50 - 3.00 lakhs / kw
5.	Cost of operation	:	
6.	Salient features	:	
7	Manufacturers	:	(i) Auto Spare Industries, 4, Kalathiswaran Koil St, Pondicherry – 605001 (ii) Auroville Energy Products Auroshilpam, Centre for Scientific Research, Auroville, Tamilnadu – 605101