

Renewable & Energy Efficient Technologies (REET)

Information Manual



INDEX

RENEWABLE ENERGY (RE) / ENERGY EFFICIENCY (EE) OPTIONS FOR:

RURAL ELECTRIFICATION		
1	SOLAR HOME-LIGHTING KIT	3
2	SOLAR STREET LIGHTS	4
3	SOLAR WIND HYBRIDS	5
4	MICRO-HYDRO POWER	6
5	SOLAR POWER GRID	7
DOMESTIC		
6	BIOGAS PLANT	8
7	SOLAR LAMPS	9
8	SOLAR COOKER	10
9	BIO-BRIQUETTE	11
AGRICULTURE		
10	SOLAR DRYER	12
11	SOLAR PUMP	13
12	ZERO ENERGY COOLING CHAMBER	14
13	GREENHOUSE	15
14	WIND TURBINES POWERED WATER PUMPS	16
TOURISM / INSTITUTIONAL		
15	SOLAR WATER HEATER	17
16	TROMBEWALL	18
17	SOLAR POWERED PORTABLE MOBILE CHARGERS	19
EMERGING TECHNOLOGIES		
18	SOLAR SPACE HEATING	20
19	SOLAR REFRIGERATION	20
20	GEOTHERMAL HEAT PUMPS	20

1) SOLAR HOME-LIGHTING KIT

The Solar Home Lighting Systems harnesses the power of the Sun to provide reliable, cost effective domestic electricity solutions.



TECHNOLOGY / FUNCTIONING				CATEGORY	
The components of the solar lighting system includes solar panels, charge controller, solar battery and lighting system (lamps & fans)				RE	
INSTALLATION & MAINTANENCE					
The Solar Module is installed on roof leaving it exposed to sunlight. The charge controller & battery are kept indoors. This system requires low ongoing maintenance. The Solar Panel needs to be cleaned on regular intervals.					
UTILITY	APPLICATION	COST/ UNIT	DURABILITY	ESTIMATED USAGE	
Households	Bulbs / Fans / Portable TV sets (DC) / Mobile Charging	Rs.4,280/- (approx.)	Min 20 Years (Approx.)	32 hours with 1 lamp, 15 hours with 2 lamps, and 8 hours with 2 lamps and 1 radio	
BENEFITS			ECONOMIC BENEFITS		
<ol style="list-style-type: none"> 1. Location flexibility 2. Automatic operation 3. High reliability and long lifetime 4. Non-Polluting and Environmentally benign 5. Better standard of living with better lighting system for the functioning of facilities like primary schools, health centre, community centre, trade centre, library, and connectivity 6. Scalable 			<ol style="list-style-type: none"> 1. No utility bills 2. Fast and simple installation 3. ZERO fuel cost 4. Little recurring cost 5. Longer life of 20 years or more 6. Negligible maintenance 		
SUBSIDIES/ASSISTANCE FROM GOVT.			AGENCIES INVOLVED		
<p>Capital subsidy is limited to 40% of the total benchmark cost for SPV system with battery upto 300 Wp. Further, capital subsidy is limited to 30% of the benchmark cost for SPV.</p> <p>Capital subsidy of 90% of the benchmark cost, would be available for special category states (e.g. J&K, Himachal Pradesh, Uttarakhand, etc.). However, for funding solar thermal systems in these areas, the subsidy is limited to 60% for all categories of beneficiaries.</p>			MNRE / NABARD		

2) SOLAR STREET LIGHTS

Solar street lights are raised light sources which are powered by solar panels mounted on a street lighting structure.



TECHNOLOGY / FUNCTIONING				CATEGORY
The solar panels charge a rechargeable battery during the day, which powers a CFL or LED lamp during the night.				RE
INSTALLATION & MAINTANENCE				
The base foundation must be parallel to an even surface. Street lighting systems require ongoing maintenance and the batteries have to be replaced from time to time.				
UTILITY	APPLICATION	COST/UNIT	DURABILITY	ESTIMATED USAGE
Outdoor street	LED, CFL, LPSV lamps	Rs.23,000 (12W) to Rs. 30,000 (20W)	Pole: up to 25 years, Battery: 5 - 7 years (max)	10 hours (Approx.)
SOCIAL BENEFITS		ECONOMIC BENEFITS		
<ol style="list-style-type: none"> Individual parts of solar system can be easily transported to remote areas. It is a non polluting source of electricity Since external wires are eliminated, risk of accident is minimised It reduces the usage of non-renewable energy Increases security as streets are lit up during the night 		<ol style="list-style-type: none"> Minimised operation costs Very low maintenance compared to conventional street lights 		
SUBSIDIES/ASSISTANCE FROM GOVT.		AGENCIES INVOLVED		
<p>The Central Financial Assistance (CFA) of 30% would be given for the projects/systems set up on open tender basis by SNA/SECI/PSUs/FI/ Government organizations or 30% of benchmark cost, whichever is lower.</p> <p>Capital subsidy of upto 60% of the benchmark cost would be available for special category states, (J&K, Himachal Pradesh, etc.)</p>		MNRE/NABARD		

3) SOLAR WIND HYBRIDS

Solar Wind hybrids use solar panels and small wind turbines to generate electricity. They work in small capacities in the range of 1 kW to 10 kW for the solar panel and the wind turbine combined system.



TECHNOLOGY / FUNCTIONING				CATEGORY
The solar panel and the wind turbine work in tandem to charge a battery via a controller. In a typical hybrid system the battery is first charged by the Solar, then by Wind and if necessary, by grid.				RE
INSTALLATION & MAINTANENCE				
To allow smooth flow of air and avoid turbulent flow to the turbine rotor, turbines should be placed at a distance twice or more times the height of any man made structure. The basic maintenance includes: supplying fuel, lubricants and other liquids, washing and cleaning, replacement of technical fluids (oil, sewage, etc.), control (diagnosis) of the basic component parts of the system.				
UTILITY	APPLICATION	COST/UNIT	DURABILITY	GENERATION CAPACITY
Household/ Rural Offices/ Small Hotels	Electricity for cell phone recipient stations, farm houses, guesthouses, hospitals, hotels, remote and rural village electrification, and street lighting	Rs. 2,50,000/kW	Wind turbine with 15 years . Solar module with 25 years .	600W SWHS produces 4 kWh/day . 3.5 kWh SWHS produces 28 kWh/day
BENEFITS		ECONOMIC BENEFITS		
<ol style="list-style-type: none"> 1. Easy to operate, service and maintain 2. One of the most eco-friendly and clean source of power 3. Increases public safety and aids in providing a safe working environment in areas where main power is risky 4. Enhanced neighbourhood security 5. Easy to charge 		<ol style="list-style-type: none"> 1. No pollution and no recurring fuel costs, highly reliable and consistent power supply 2. Long life span for SPV modules & modular design 3. Very few moving parts- negligible maintenance required 		
SUBSIDIES/ASSISTANCE FROM GOVT.		AGENCIES INVOLVED		
Rs. 1,50,000/kW for Government, Public, Charitable, R&D, Academic and other non profit making organizations and Rs. 1,00,000/kW for other beneficiaries not covered above		IREDA		

4) MICRO-HYDRO POWER

Micro hydro plant is a smaller hydroelectric power plant that typically produces up to 100 kW of electricity using the natural flow of water. Micro hydroelectric power is different from typical hydroelectric power because it doesn't attempt to significantly interfere with the flow of the river.



TECHNOLOGY / FUNCTIONING				CATEGORY
<p>Micro hydro systems do not need to dam rivers, but instead divert a stream of water that flows downhill through a pipeline dropping into the turbine that generates the electricity. This can also be stored in batteries and transported to where villagers may need it most.</p>				RE
INSTALLATION & MAINTANENCE				
<p>In order to operate micro hydropower plants in good condition for long period, waterway facilities, electric equipment, transmission and distribution line should be maintained adequately. Operators must try to observe even a small trouble and prevent accident of facilities. For the purpose, daily patrol and periodic inspection are essential and recording and keeping of those data are also important.</p>				
UTILITY	APPLICATION	COST/ UNIT	DURABILITY	ESTIMATED CAPACITY
Home / Farm / Village	Lighting and communications for homes, medical clinics, schools, and other facilities	Rs 8-10 Lacs for 10 kW plant (approx.)	25 Years - Turbine	A 100 kW plant has the potential to power approx. 4-7 rural villages depending on size of the village
ENVIRONMENTAL BENEFITS		ECONOMIC BENEFITS		
<ol style="list-style-type: none"> 1. Little to no harmful effects on the environment. 2. Utilises the natural flow of water 		<ol style="list-style-type: none"> 1. No reservoir required 2. Maintenance fees are relatively small in comparison to other technologies. 		
SUBSIDIES/ASSISTANCE FROM GOVT.		AGENCIES INVOLVED		
NA		NA		

5) SOLAR POWER GRID

A grid-connected PV system consists of solar panels, one or several inverters, a power conditioning unit and grid connection equipment that is connected to the utility (power) grid.



TECHNOLOGY / FUNCTIONING				CATEGORY
Residential, grid-connected rooftop systems which have a capacity less than 10 kilowatts can meet the load of most consumers. They can feed excess power to the grid where it is consumed by other users.				RE
INSTALLATION & MAINTANENCE				
Before installation, a solar site survey is required to ensure, enough sun on collector to make it worthwhile, locate roof rafters or trusses, plan system layout and mark the joists on roof with chalk, Six feet between mounting feet. Requires minimal maintenance.				
UTILITY	APPLICATION	COST/UNIT	DURABILITY	ESTIMATED USAGE
Households / Commercial	Rural electrification, Solar lamps and lighting, Agricultural support, Solar water heaters, etc.	Rs. 1.1 to Rs 1.3 lacs (1 KWp rooftop) (approx). Rs. 1.5 lacs to 1.7 Lacs (1 KWp off-grid system) (approx)	20 years (approx)	Highly variable depending on number of panels.
BENEFITS		ECONOMIC BENEFITS		
<ol style="list-style-type: none"> Grid-connected PV systems are comparatively easier to install as they do not require a battery system Effective utilization of generated power because there are no storage losses involved 		A grid-connected photovoltaic power system will reduce the power bill as it is possible to sell surplus electricity produced to the local electricity supplier.		
SUBSIDIES/ASSISTANCE FROM GOVT.		AGENCIES INVOLVED		
Ministry of New and Renewable Energy provides 70% subsidy on the installation cost of a solar photovoltaic power plant in North-East states and 30% subsidy in other regions.		MNRE		

6) BIOGAS PLANT

Biogas typically refers to a mixture of different gases produced by the breakdown of organic matter in the absence of oxygen.



TECHNOLOGY / FUNCTIONING				CATEGORY
<p>The main part of a biogas system is a large tank (digester). Inside this tank, bacteria convert organic waste into methane gas through the process of anaerobic digestion. Tank is fed with household by-products such as market waste, kitchen waste, and manure from livestock.</p>				EE
INSTALLATION & MAINTANENCE				
<p>Digester moulding, is very easy and can be prepared by an experienced technician. The digester is made of concrete and bricks. Biogas can be explosive when mixed one part biogas to 8-20 parts air. When the tank is open for cleaning or repair work is being done open flames, sparks, and smoking should be avoided. If someone enters a biogas digester they should always have someone with them in case they stop breathing due to low oxygen intake.</p>				
UTILITY	APPLICATION	COST/ UNIT	DURABILITY	ESTIMATED GENERATION CAPACITY
Household / Rural electrification	Cooking, lighting, and other similar energy needs	Rs. 40 lakh (for 20-kW plant)	15 years (approx)	25 m ³ to 85 m ³ has a output generation capacity of 3 - 20 kW
SOCIAL BENEFITS		ECONOMIC BENEFITS		
<ol style="list-style-type: none"> 1. Produces high-quality fertiliser 2. Saving time for collecting firewood 3. It improves sanitation in villages and semi-urban areas by linking sanitary toilets with biogas plants. 		<ol style="list-style-type: none"> 1. Saves cost as compared to the use of kerosene or LPG for cooking 2. Digested slurry from biogas plants is used as enriched bio-manure to supplement the use of chemical fertilizers 		
SUBSIDIES/ASSISTANCE FROM GOVT.			AGENCIES INVOLVED	
<ol style="list-style-type: none"> 1. Subsidy for setting up of Biogas Plants under National Biogas and Manure Management Programme: Jammu & Kashmir, Himachal Pradesh, Uttrakhand - Rs 7,000 (1 Cubic Metre) and 11,000 2- 6 Cubic Metre 2. SC & ST Categories of NE Region States - Rs 15,000 (1 Cubic Metre), 17,000 (2- 6 Cubic Metre) 3. Additional subsidy (CFA) for toilet linked Biogas Plants (in Rs. per plant): Rs 1,200/- 4. The Ministry of New and Renewable Energy (MNRE) has provided a subsidy of Rs. 8 lakh at a rate of Rs. 40,000 a KW 			MNRE	

7) SOLAR LAMPS

A solar lamp is a light fixture composed of an LED/CFL lamp for lighting, a photovoltaic (PV) solar panel, and a rechargeable battery.



TECHNOLOGY / FUNCTIONING				CATEGORY
Solar lamps recharge during the day and automatically turn on at dusk and remain illuminated overnight, depending on how much sunlight they receive during the day. Indoor solar lamps may or may not store power.				RE
INSTALLATION & MAINTANENCE				
The solar panel needs to be kept clean and dirt free at all times for optimal efficiency.				
UTILITY	APPLICATION	COST/UNIT	DURABILITY	ESTIMATED USAGE
Indoor / Outdoor	Lighting	Starting - Rs. 300 (600 mAh)	10 + years (with LED)	6-8 hours
SOCIAL BENEFITS		ECONOMIC BENEFITS		
<ol style="list-style-type: none"> 1. Reduces risk of fire from kerosene lamps 2. Saves Energy 3. Reduces air pollution 4. Offsets greenhouse gases 5. Eco-Friendly; especially in rural areas 6. According to studies, there has been 75% increase in child study time, and 94% owners feel safe and healthier 		<ol style="list-style-type: none"> 1. Reduced maintenance 2. Saves cost 3. In rural areas, a 25% increase in household income has been observed (due to ability to work at night) 		
SUBSIDIES/ASSISTANCE FROM GOVT.		AGENCIES INVOLVED		
The MNRE provides subsidies @ Rs. 81/Wp to offset the capital cost of the project; 30% of the product cost (Maximum). In Special Category States - 60% of the product cost (Maximum)		MNRE		

8) SOLAR COOKER

A solar cooker is a device which uses the energy of direct sunlight to heat, cook or pasteurise food items or liquids.



TECHNOLOGY / FUNCTIONING				CATEGORY
A solar cooker converts the sunlight to heat energy, which essentially cooks the food.				RE
INSTALLATION & MAINTANENCE				
Solar cooker should be placed in the open and sheltered place. Take good care of surface materials and the glass, because they can be easily damaged or broken. If the glass is dirty, wash it to help the sun's rays pass freely through it. Taking good care of the cooker increases its lifetime and increases its efficiency.				
UTILITY	APPLICATION	COST/ UNIT	DURABILITY	ESTIMATED USAGE / CAPACITY
Large Households / Community	Cooking (Grill meats, stir-fry vegetables, make soup, bake bread, and boil water in minutes)	Rs. 1000 to Rs. 5000 (approx)	10 years (approx)	15 - 50 people at once depending on the diameter of dish
SOCIAL BENEFITS			ECONOMIC BENEFIT	
<ol style="list-style-type: none"> 1. It cooks food without using any fuel 2. Any type of cooking may evaporate grease, oil, and other material into the air, hence there may be less cleanup 3. It does not require constant attendance while cooking 4. Since food cooks slowly, it becomes more nutritious 5. The fibers in the cereal remain intact 6. It can also be used as a oven for baking 			Does not require any fuel and saves cost, reducing environmental damage.	
SUBSIDIES/ASSISTANCE FROM GOVT.			AGENCIES INVOLVED	
30% of the product cost (Maximum). In un-electrified rural areas, subsidy for solar thermal power plants will be 60% in all category of states.			MNRE	

9) BIO-BRIQUETTE

Biomass briquettes are a biofuel substitute to coal and charcoal. Biogas comprises of 60-65% methane, 35-40 % carbon dioxide, 0.5 - 1% hydrogen sulphide and rest of water vapour.



TECHNOLOGY / FUNCTIONING				CATEGORY
<p>Briquetting of residues takes place with the application of pressure, heat and binding agent on the loose materials to produce the briquettes. Equipments required: Charring Drum, Briquetting die and Extruding machine. The raw materials for biomass briquetting can be, agricultural residues, invasive plants, and/or waste from bio-product industries. Briquettes produced from briquetting of biomass are fairly good substitute for coal, lignite, firewood and offer numerous advantages.</p>				EE
INSTALLATION & MAINTANENCE				
The briquettes should be protected from water and it is ideal to store them under a shed.				
UTILITY	APPLICATION	COST/UNIT	DURABILITY	ESTIMATED CAPACITY
Households / Industrial	Cooking, heating, barbecuing, agro-industries, and food processing	Rs. 15,000 - 25,000 for Briquetting and Grinding machine both (Approx)	10-15 years (Approx)	Generates 350-400 briquettes per hour of same size and shape
SOCIAL BENEFIT		ECONOMIC BENEFIT		
<ol style="list-style-type: none"> Indoor air pollution is minimised The process solves the residual disposal problem The process assists the reduction of fuel wood and deforestation 		<ol style="list-style-type: none"> Reduces consumption and dependency on fuel wood High density fuels are easy to handle, transport and store 		
SUBSIDIES/ASSISTANCE FROM GOVT.		AGENCIES INVOLVED		
A subsidy of 35% on the cost of the plant is provided by the Government. 80% depreciation on Capital cost in the First year itself. 100% income tax free for the First five years. No Requirement of NOC from State pollution Boards		MNRE		

10) SOLAR DRYER

Solar dryers are devices that use solar energy to dry substances, especially food.



TECHNOLOGY / FUNCTIONING				CATEGORY
<p>There are two general types of solar dryers: Direct and indirect; Direct solar dryers expose the substance to be dehydrated to direct sunlight. In indirect solar dryers, the black surface heats incoming air, rather than directly heating the substance to be dried.</p>				RE
INSTALLATION & MAINTANENCE				
<p>The solar food dryer can be constructed making use of locally available materials. Since the entire casing is made of wood and the cover is glass, the major construction works is carpentry works. Trays can be taken out for cleaning easily.</p>				
UTILITY	APPLICATI ON	COST/UNIT	DURABILITY	ESTIMATED CAPACITY
Households / Agriculture / Industrial	Agriculture crop drying, Food processing industries, Dairy industries, and Textile industries	Solar cabinet dryer Rs.5,000; Green house crop dryer Rs. 2,000; Reverse absorber cabinet dryer Rs. 8,000; Conventional active solar dryer Rs. 15,000; Hybrid PVT integrated greenhouse dryer Rs. 43,000; Hybrid PVT solar dryer Rs. 39,000	Solar cabinet dryer- 5 years; Green house crop dryer- 5 years; Reverse absorber cabinet dryer- 5 years; Conventional active solar dryer- 5 years; Hybrid PVT integrated greenhouse dryer- 35 years; and Hybrid PVT solar dryer- 30 years	Temperatures can reach upto 78°C and upto 76% of moisture can be reduced, as per study* * http:// www.ripublication.c om/ijeem_spl/ ijeemv4n4_12.pdf
SOCIAL BENEFIT			ECONOMIC BENEFIT	
<ol style="list-style-type: none"> 1. An environment friendly energy source 2. Reduces drying time due to effective utilization of solar energy 3. Maintains the quality of the food products and acts as an ideal substitute for fossil fuel based dryers 			<ol style="list-style-type: none"> 1. Can be constructed from locally available materials at a relatively low capital cost 2. There are no fuel costs 3. Can be useful in areas where fuel or electricity are expensive 4. They may be useful as a means of heating air for artificial dryers to reduce fuel costs 	
SUBSIDIES/ASSISTANCE FROM GOVT.			AGENCIES INVOLVED	
<p>Capital subsidy of Rs.2,400/- per sq.mtr for the installation of Flat Plate Collector based Solar air heating system for various drying applications.</p>			MNRE	

11) SOLAR PUMP

A solar-powered pump runs on electricity generated by solar panels or the thermal energy available from collected sunlight.



TECHNOLOGY / FUNCTIONING				CATEGORY
Surface pumps sit above ground and move water through pipes. There are also submersible solar water pumps. These units are installed underground, but the solar panels are connected above ground. Submersible pumps are used to move water from inside wells to the surface.				RE
INSTALLATION & MAINTANENCE				
Before installing the pump measure the depth of the well (bore hole) and static water level. Do keep the pump under water at all times when operating (incase of a submersible pump). Make sure the pump has adequate water around it during pumping.				
UTILITY	APPLICATION	COST/UNIT	DURABILITY	ESTIMATED CAPACITY
Agriculture	Village water supply, Livestock watering, Water supply to remote homes / agriculture, and Micro-Irrigation.	1 HP, 1000W PV Solar Pump - Rs 1.9 Lacs (Approx.) 3 HP Solar Pump - Rs 4.2 Lacs (Approx.)	Upto 25 years (approx .)	Shallow Well (Surface) Solar Pumping System - 900 Wp panels with 1 HP motor - 90,000 litres per day
	Solar Deep well (submersible) Pumping System - 1200 Wp panels - 42,000 Litres per day			
SOCIAL BENEFIT		ECONOMIC BENEFIT		
<ol style="list-style-type: none"> 1. Long operating life 2. Highly reliable and durable 3. Easy to operate and maintain 4. Eco-friendly 5. Contributes to sustainability especially as it is relatively simple and could be delivered by locally trained installers 		<ol style="list-style-type: none"> 1. No conventional grid electricity is required 2. No fuel cost 3. Minimises energy bills and dependency on fossil fuel 		
SUBSIDIES/ASSISTANCE FROM GOVT.		AGENCIES INVOLVED		
<p>DC Pumps <2 HP pump - Rs 57,600 2 HP - 5 HP - Rs 54,000</p> <p>AC Pumps <2 HP pump - Rs 50,400 2 HP - 5 HP - Rs 43,200</p> <p>5 HP to 10 HP - Rs 194,00/-</p>		MNRE		

12) ZERO ENERGY COOLING CHAMBER

An on-farm rural oriented storage structure which operates on the principle of evaporative cooling. Cool chambers can reduce temperature by 10-15C and maintain high humidity of about 95% that can increase shelf life and retain quality of horticultural produce.



TECHNOLOGY / FUNCTIONING				CATEGORY
<p>The chamber is an above-ground double-walled structure made up of bricks. The cavity of the double is filled with riverbed sand. The lid is made by using dry grass/straw on a bamboo frame. The rise in relative humidity (90% or more) and fall in temperature (10–15°C) from the ambient condition could be achieved by watering the chamber twice a day.</p>				EE
INSTALLATION & MAINTANENCE				
<p>Select an-upland having a nearby source of water supply. Drench the chamber with water. Soak the fine river bed sand with water. Water twice daily (morning and evening) to achieve desired temperature and relative humidity. Cover crates with thin polyethylene sheet. Cool chamber should be reinstalled once in 3 years with new bricks.</p>				
UTILITY	APPLICATION	COST/UNIT	DURABILITY	ESTIMATED CAPACITY
Households	Short term storage of fresh vegetables, fruits and flowers; Growing of white button mushroom; Ripening of tomato and banana; Plant propagation; and Storage of processed fruit products	Rs. 4000.00	The cool chamber should be reinstalled once in 3 years with new bricks utilizing the old bricks for other purposes.	100 Kg Capacity Chamber
SOCIAL BENEFIT		ECONOMIC BENEFIT		
<ol style="list-style-type: none"> Most effective during drying season Can retain the freshness of the fruits and vegetables for a short period Can be constructed by an unskilled person as no mechanical or electrical energy is needed Environment friendly storage system with no pollution 		<ol style="list-style-type: none"> Cool chambers can be constructed easily any where with inexpensive locally available materials like bricks, sand, bamboo, khaskhas/straw, gunny bags with a source of water Small farmers can easily construct these chambers nearer to their houses or storage passage to store a few days after harvest before sending to the market, thus reduces transportation costs Reduces losses and thus pays for itself in a short time. 		
SUBSIDIES/ASSISTANCE FROM GOVT.		AGENCIES INVOLVED		
NA		NA		

13) GREENHOUSE

Greenhouse is a glass building in which plants that need protection from cold weather are grown.



TECHNOLOGY / FUNCTIONING				CATEGORY
<p>A greenhouse is a structural building with different types of covering materials; that heats up as incoming visible sunshine is absorbed inside the structure. Air warmed by the heat from warmed interior surfaces is retained in the building by the roof and wall.</p>				RE
INSTALLATION & MAINTANENCE				
<p>Choose a south facing area. All structures should be to the north of the greenhouse. Install roll-up shades inside the greenhouse to protect plants from summer sun when necessary. Regularly check and maintain all heating system components, especially before the winter. Check for and fill any gaps in the greenhouse exterior. Install roof vents at the ridge line of the greenhouse's ceiling and roof. Wash down tables and benches with soapy water to remove dirt.</p>				
UTILITY	APPLICATION	COST/UNIT	DURABILITY	ESTIMATED PRODUCTIVITY
Farming / Agriculture / Households	Growing vegetables, plants and fruits	Rs.500 to Rs. 2000.00 / m ²	5-12 years (approx.)	Rs 4000-6800/- per harvest and Rs 12,000-20,400/- per year through a greenhouse of 35 sq. m. adopting two-storey cultivation model
SOCIAL BENEFITS		ECONOMIC BENEFITS		
<ol style="list-style-type: none"> Reliability of crop increases under greenhouse cultivation Disease-free and genetically superior transplants can be produced continuously Provides fresh vegetables all year It saves crop from cold winters, from heat in summers and from rain in monsoon seasons 		<ol style="list-style-type: none"> Off-season production of vegetable and fruit crops Water requirement of crops very limited and easy to control Drastic reduction in wastage of fertilisers and pesticides Higher value and higher quality crops can be grown. 		
SUBSIDIES/ASSISTANCE FROM GOVT.		AGENCIES INVOLVED		
<p>50% subsidy is provided to the farmers for greenhouse construction, planting material, and other items related to harvest management and marketing; The second scheme is run by the state government where 80% subsidy is provided to the farmers for greenhouse construction and irrigation purpose.</p>		<p>NABARD, APEDA, NHB Subsidy Consultation, Green House / Poly House Subsidy, Tissue Culture Lab Subsidy, NHM Subsidy Consultation, MOFPI Subsidy Consultants, Horticulture Plantation Subsidy.</p>		

14) WIND TURBINE POWERED WATER PUMPS

Water pumping with wind energy is a type of off-grid system with strong relevance to livestock producers. Water is pumped out of the ground directly with help from a small windmill.



TECHNOLOGY / FUNCTIONING				CATEGORY
<p>Wind energy can be used by both mechanical and electric water pumps. Turbine subsystems include: a rotor, or blades, which convert the wind's energy into rotational shaft energy, a nacelle containing a drive train, usually including a gearbox and a generator; a tower, to support the rotor and drive train; and electronic equipment such as controls, electrical cables, ground support equipment, and interconnection equipment.</p>				RE
INSTALLATION & MAINTANENCE				
<p>The design of any water pumping system, is based upon the quantity and timing of the water required and the depth from which the water must be extracted. The location of the water well, the wind resource, and a direct comparison to solar power cost and efficiency are the most important considerations. Systems typically do not involve batteries to store energy, thus they don't require significant maintenance.</p>				
UTILITY	APPLICATION	COST/UNIT	DURABILITY	ESTIMATED USAGE / CAPACITY
Households / Farming	Rural and Industrial	Gear type Water Pumping Windmill Rs. 80,000; Auroville type Windmills Rs. 1,50,000; Wind Solar Hybrid Systems Rs. 2,50,000/kW	10- 25 years (approx)	3 blades of 10 ft each, at 10 m/s wind speed can draw 180 litre of water / minute from 40 ft depth.
SOCIAL BENEFIT		ECONOMIC BENEFIT		
Help uninterruptible power supplies ride through extended utility outages		<ol style="list-style-type: none"> 1. Lower electricity bills by 50%–90% 2. Helps to avoid the high costs of having utility power lines extended to a remote location 		
SUBSIDIES/ASSISTANCE FROM GOVT.		AGENCIES INVOLVED		
The capital subsidy to Rs. 1.00 Lakh per Kw		MNRE		

15) SOLAR WATER HEATER

A Solar Water Heater is a system in which the sun's heat is gathered by a solar collector that provides hot water for bathing, washing, cleaning, etc. using solar energy.



TECHNOLOGY / FUNCTIONING				CATEGORY
Solar water heating systems use solar panels (sometimes called collectors) to collect heat from the sun which is then used to heat up the water stored in a hot water cylinder. A boiler is then used to further back up the heat from the water to reach the desired temperature				RE
INSTALLATION & MAINTANENCE				
The best time to install the heat pipes and vacuum tubes is in the morning or in the evening or the time when the sunlight is weak. Dusty or soiled collectors will perform poorly. Periodic cleaning may be necessary in dry, dusty climates. Make sure the valve is not stuck open or closed. Timely, verify that distribution pumps or blowers (fans) are operating.				
UTILITY	APPLICA TION	COST/UNIT	DURABILITY	ESTIMATED OUTPUT
Households / Tourism / Agriculture / Industrial	Water Heating	Rs.15000- 20,000 for a 100 litres capacity system and Rs.110-150 per installed litre for higher capacity systems (approx.)	15-20 years	Around 60°C – 80°C temperature can be attained
SOCIAL BENEFITS		ECONOMIC BENEFIT		
A SWH of 100 litres capacity can prevent emission of 1.5 tonnes of carbon dioxide per year, It works throughout the year		<ol style="list-style-type: none"> 1. Fuel Savings - A 100 litres capacity SWH saves 1,500 units of electricity annually 2. Payback period is 3-4 years when electricity is replaced & 5-6 years when coal is replaced 		
SUBSIDIES/ASSISTANCE FROM GOVT.				AGENCIES INVOLVED
<ul style="list-style-type: none"> • General category states: 30% capital subsidy or loan at 5% interest on 80% of the benchmark cost. • Special category states for domestic & non commercial categories (not availing accelerated depreciation): 60% capital subsidy or loan at 5% interest on 80% of the benchmark cost. • Special category states for commercial users category (availing accelerated depreciation): 30% capital subsidy or loan at 5% interest on 80% of the benchmark cost. • Benchmark Cost : ETC based systems : Rs. 10,000/ sq. m. FPC based systems : Rs. 11,000/ sq. m. • ETC based system - Rs. 4500 per 100 lpd system in General category states & Rs. 9,000 in special category states or 30%/ 60% of benchmark cost whichever is less. • FPC based system - Rs. 6600 per 100 lpd system in General category states & Rs. 13,200 in special category states or 30%/ 60% of benchmark cost whichever is less. 				MNRE

16) TROMBE WALL

A Trombe wall is a passive solar building technique where a wall is built on the winter sun side of a building with an external layer of glass and a high heat capacity internal layer separated by a layer of air.



TECHNOLOGY / FUNCTIONING				CATEGORY
<p>Conducts heat from their solar hot side to their interior cooler side, where the heat then radiates to the house. A typical Trombe wall consists of a 20 - 40cm (8" - 16") thick masonry wall painted a dark, heat-absorbing colour and faced with a single or double layer of glass. The glass is placed between 2 - 15 cm (1" - 6") away from the masonry wall to create a small airspace. Heat from sunlight passing through the glass is absorbed by the dark surface, stored in the wall, and conducted slowly inward through the masonry.</p>				EE
INSTALLATION & MAINTANENCE				
<p>It is most effective if installed facing south, A typical Trombe wall consists of an 8- to 16-inch thick masonry wall coated with a dark, heat-absorbing material and faced with a single or double layer of glass. No maintenance required</p>				
UTILITY	APPLICATION	COST/UNIT	DURABILITY	ESTIMATED PRODUCTIVITY
Households	Heating Ladakhi houses	Rs 40,000 - 50,000 (approx.)	50 Years +	For a 40cm (16") thick Trombe wall, heat will take about 8 to 10 hours to reach the interior of the building.
SOCIAL BENEFITS		ECONOMIC BENEFITS		
<p>Relatively easy to incorporate into building structure as an internal or external wall. Materials (masonry, concrete) are relatively inexpensive. Eutectic salt incorporation preferable where available</p>		<ol style="list-style-type: none"> 1. No moving parts and essentially no maintenance 2. Can reduce heating bills by large amounts 		
SUBSIDIES/ASSISTANCE FROM GOVT.		AGENCIES INVOLVED		
NA		NA		

17) SOLAR POWERED PORTABLE MOBILE CHARGERS



TECHNOLOGY / FUNCTIONING				CATEGORY	
Solar cell phone chargers use small solar panels to charge cell phone batteries. They are an alternative to conventional electrical cell phone chargers and in some cases can be plugged into an electrical outlet.				RE	
INSTALLATION & MAINTANENCE					
A series of solar cells are installed in a stationary location (i.e. rooftops of homes, base-station locations on the ground etc.) and can be connected to a battery bank to store energy for off-peak usage. It should be kept clean and dry at all times.					
UTILITY	APPLICATION	COST/UNIT	DURABILITY	ESTIMATED USAGE	
Households	Mobile Charging	Rs. 1000 to Rs. 3000 (approx)	10 + years (approx.)	3W/hr panel can charge a mobile in 2-3 Hours	
SOCIAL BENEFIT			ECONOMIC BENEFIT		
<ol style="list-style-type: none"> 1. Easy to use 2. Battery life is more as high voltages are not developed 3. Mobiles can be kept charged even during extreme winters when electricity may be cut off 			Reduced electricity bills		
SUBSIDIES/ASSISTANCE FROM GOVT.			AGENCIES INVOLVED		
NA			NA		

18) SOLAR SPACE HEATING

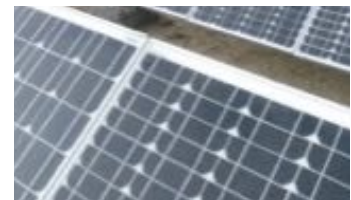
Solar Thermal Space Heating systems capture the sun's energy to supplement the existing heating system for a home or commercial building. The heating system intensifies the sun's power to heat water or air that is then used to heat the house/building.



CATEGORY	BENEFITS
RE	<ol style="list-style-type: none"> 1. Constructed using non corrosive materials, hence, has a longer system life cycle 2. No major wear and tear 3. Pay-back period is shorter some products less than 2 years 4. Possible to control the required temperature to improve the product quality

19) SOLAR POWERED REFRIGERATORS

Solar refrigerator on electricity provided by solar energy, this can keep perishable goods such as meat, dairy and vaccines at their appropriate temperature to avoid spoilage.



CATEGORY	BENEFITS
RE	<ol style="list-style-type: none"> 1. Environmentally friendly and helps to prevent global warming 2. It also helps to improves indoor air quality 3. It is safe and shock proof 4. Durable & Scalable 5. Works best for areas where electricity is scarce 6. Easy to install 7. Adequate protections for load and battery

20) GEOTHERMAL HEAT PUMPS

A geothermal heat pump or ground source heat pump is a central heating and/or cooling system that transfers heat to or from the ground.



CATEGORY	SOCIAL BENEFITS	ECONOMIC BENEFITS
RE	<ol style="list-style-type: none"> 1. No pollution 2. No need for auxiliary heating 3. No outdoor equipment required 4. It can be installed in both new and retrofit situations 5. It is much quieter than other cooling systems as there is no noisy outdoor compressor or fan 6. Geothermal energy is available 24 hours a day, 365 days a year 	<ol style="list-style-type: none"> 1. Reduces air conditioning bills by 40-60% 2. Low Energy and demand costs 3. Low maintenance costs 4. High efficiency and stable capacity 5. Saves money as energy can be extracted without burning fossil fuels such as coal, gas, or oil