Confederation of Indian Industry

Case Study Booklet on

Renewable Energy

Volume-II

Disclaimer

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Message from Chairman

It is indeed heartening to witness how Indian industry is in the forefront in transforming imminent climate change challenges into vibrant opportunities by adopting clean energy technologies.

Understanding this imperative, CII-Godrej GBC through its Renewable Energy Council has embarked on a journey for rapid adoption of Green Power in the Country.

As part of the Council's initiative, we are launching the second volume of 'Case Study Booklet on Renewable Energy'.

This booklet contains some of the best projects implemented across the country covering major sectors and includes their latest operational experience, technology, financial viability and benefits achieved. We would like to thank all the organisations for sharing their data & inputs.

The case studies are innovative and have immense replication potential in meeting the energy requirements of Indian industry. We hope this booklet will add great value to your organisation.

This is an ongoing effort and in days to come, CII-Godrej GBC would compile more case study booklets, which we believe will further catalyze Project Costs in renewable energy sector.

Regards

Ramesh Kymal
Chairman
Renewable Energy Council

Contents

Acknowledgements

‘Renewable Energy Case Study Booklet Volume - II’ has been made possible through the efforts of various stakeholders in Renewable Energy sector. The Council would like to thank the following industry members who have enormously contributed to the development of the case study booklet.

- I-Max, Hyderabad
- YesSV Solar, Hyderabad
- Turbo Energy Pvt. Ltd., Chennai
- Auroville Community, Pondicherry
- Clique Solar, Mumbai
- Mahanand Dairy Unit, Latur
- Mahindra Vehicle Manufacturing Limited, Pune
- TTK Prestige, Coimbatore
- SunBest System, Theni
- AMR Dal Mill, Theni
- Suzlon, Pune
- Synefra Infrastructure Pvt. Ltd., Pune
- DESI Power, Bangalore
- Wipro Technologies, Bangalore
- NERD Society, Coimbatore
- Prakruti Renewable Power Pvt. Ltd., Bangalore

India's Renewable Energy Trends

Renewable Energy Trends and Market Potential in India

The Indian economy has experienced unprecedented economic growth over the last decade. Today, India is the ninth largest economy in the world, driven by a GDP growth of 8.7% (MOSPI 2013) in the last 5 years. This high order of sustained economic growth is placing enormous demand on its energy resources. A vital part of the solution would be to promote renewable energy technologies in a big way.

India's energy basket has a mix of all the resources available including coal, natural gas, oil, hydro, nuclear and renewables. As on date, the total installed capacity of renewable energy in the country is 28,000 MW (MNRE 2013), representing 12.20% in the total installed capacity of power. The installed capacity of renewable energy has grown at CAGR of 23% over FY07-FY12. India ranks tenth among the G20 for renewable energy installations and fifth amongst the wind-energy-producing countries of the world after USA, China, Germany and Spain.

The total potential for renewable power generation in the country as on 31.03.12 is estimated at 90,000 MW, out of which 49,000 MW is wind, 15,500 MW is small hydro power and 23,500 MW is bio-power (MOSPI 2013, MNRE). CWET estimates the wind power alone has the potential of over 1,02,000 MW at 80m hub height of turbine. Lawrence Berkley National Laboratory (LBNL) estimates that the potential is over 300 to 400 GW.

India has set an ambitious target of achieving 30,000 MW of installed renewable energy capacity during the 12th Five Year Plan (2012-2017) which would witness a estimated investment of Rs. 3.2 lakh crore into the sector and would represent 16 to 17 percent of the total installed capacity in the country (Twelfth Five Year Plan, Vol 1, Planning Commission).

Following table shows the total installed capacities of various renewable energy sources in India.

Renewable Energy Source	**Target for 2012-13 (MW)**	**Installed Capacity (MW)**
Grid interactive power		
Wind Power	2500	19051
Small Hydro Power	350	3632
Biomass Power	105	1264
Bagasse Cogeneration	350	2337
Waste to Power	20	96
Solar Power (SPV)	800	1686
Total	**4125**	**28078**

Off-grid captive power

Waste to energy	20	115
Biomass(non-bagasse) Cogeneration	60	471
Biomass gasifiers – Rural and Industrial	11.5	158
Aero-Genrators/Hybrid systems	0.5	2
SPV Systems (>1kW)	30	124
Water mills/micro hydel	2	10
Total	**124**	**880**

Table: Total installed capacity of Renewable Energy in India

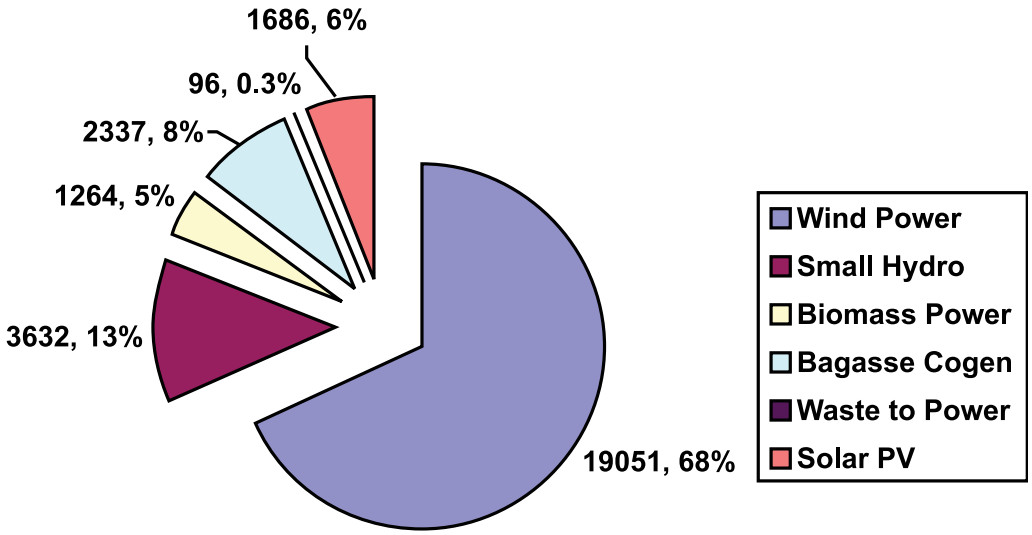


Chart: Percentage of various RE technologies in total installed capacity

Highlights of Renewable Energy sector in 2012

- Generation Based Incentive (GBI) has been re-introduced for Wind power sector
- Draft Off-shore Wind Power Policy announced
- The Government has set a target of 15000 MW of wind power to be installed during 12th Plan period
- Several states have announced their Solar Policy including Tamil Nadu, Andhra Pradesh, Kerala, Punjab, Uttar Pradesh
- Several states have announced their Roof-top Solar Policy including Tamil Nadu, Kerala, Chhattisgarh, Karnataka, Maharashtra, Gujarat, Haryana, Rajasthan

- Domestic Content Requirement for Solar modules and cells in Phase II of NSM for developing Indian Solar manufacturing industry
- Allocation of funds from the National Clean Energy Fund (NCEF) to IREDA to facilitate low costs financing to renewable energy projects
- Tamil Nadu, Karnataka, Uttarakhand, Nagaland and Meghalaya are the top 5 states in RPO compliance for 2012
- CERC extends validity period of REC to 730 days
- IEX witnessed the highest REC trading of 2012 in December with a total trading volume of 1,75,252 REC s, including non-solar and solar
- Demand for Indian REC plunged 41 percent in November 2012 from the previous month as the regulators failed to enforce RPO
- Gujarat is leading the country in total installed capacity of Solar power at 952 MW (as on Jan 2013)
- Godawari Green Energy Limited (GGEL) (EPC: Lauren CCL, US) commissioned the first utility-scale CSP project in India under NSM with an installed capacity of 50 MW in Rajasthan

Renewable Energy Investment

Indian renewable energy programme is primarily driven by private sector. It offers significant investment and business opportunities.

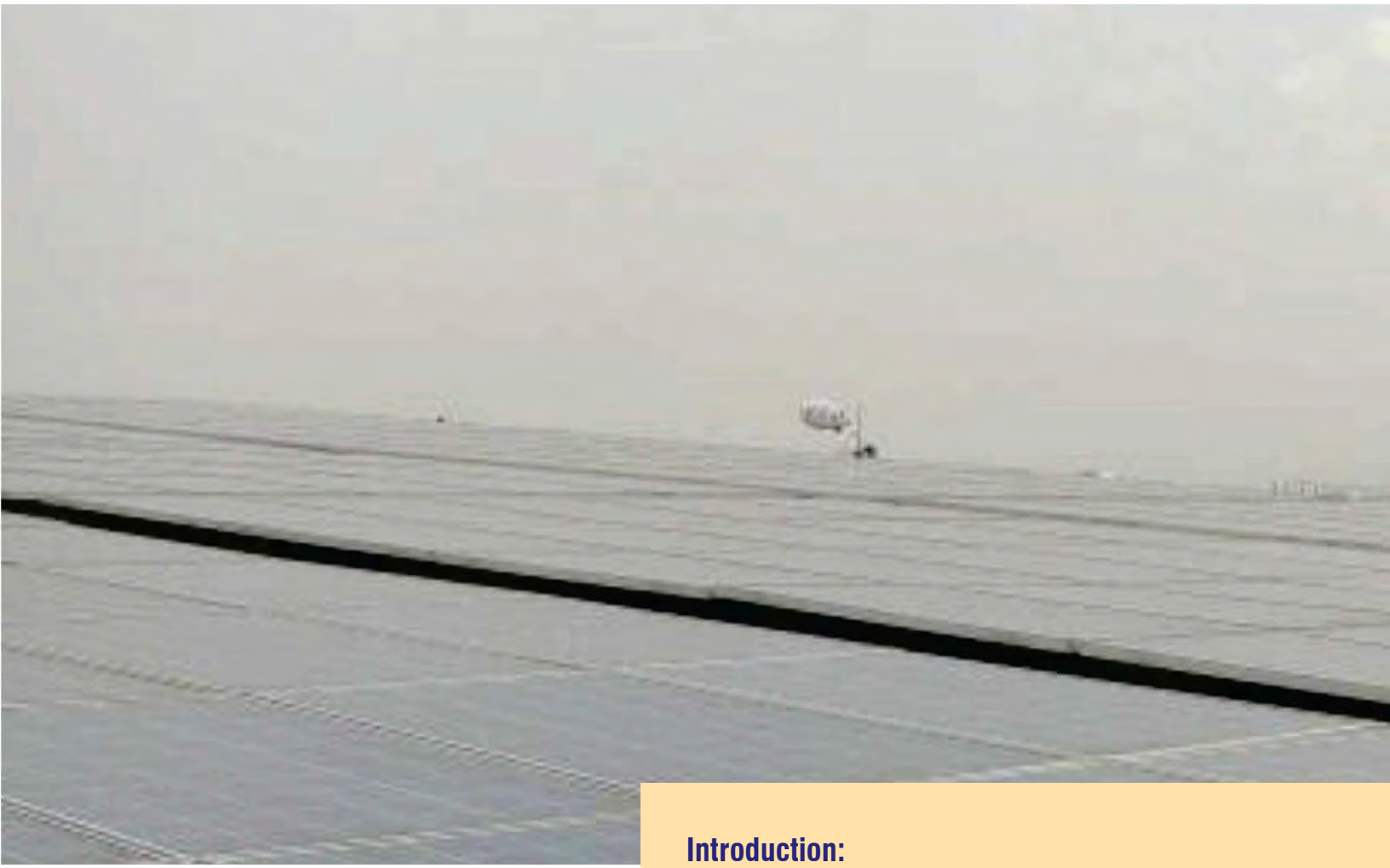
Indian renewable energy sector witnessed investment of over INR 63,000 crore in 2011. In order to double the installed capacity of renewable energy, the 12th Five Year Plan has approved an outlay of INR. 33,000 crore to MNRE. A Gross Budgetary Support (GBS) of INR 1521 crore has been provided to MNRE during 2013-14.

Foreign direct investment (FDI) inflows from renewable energy companies during the period April 2000 to February 2013 stood at US$ 2,518.31 million, according to Department of Industrial Policy and Promotion (DIPP), Govt. of India.

With an increasingly favorable Regulatory and Policy environment along with a growing number of enterprising entrepreneurs and project developers, India is ranked fourth on E&Y Renewable Attractiveness Index (Second on the Solar Index).

Solar Photo-voltaic
Technologies

Solar Rooftop at I-Max, Hyderabad



Introduction:

Prasad's Multiplex (I-Max) in Hyderabad has become India's first theatre to install a 100 kWp solar photo-voltaic power generation system on its rooftop to meet part of its energy requirements. The system was inaugurated in May 2011.

Project Description:

The 100 kW rooftop solar PV system has been designed and installed by Yes SV Solar, Hyderabad, PV panels were supplied by Solar Semiconductor, Hyderabad and inverters were supplied by SMA, Germany. This is a web based remote monitoring system. The entire implementation was done in 4 months covering 9,000 Sq.ft of rooftop space.

The system has 30 arrays with 440 panels connected in series and parallel. Polycrystalline cells are used in the Solar PV system and the panels are fixed at an angle of 14 degrees to horizontal. The life of the system is 25 years and the degradation factor is 0.5 % per annum. The system will generate 400 – 450 units/day. The system is directly connected to grid and has no battery back up. The total consumption of the building is around 16,000 – 17,000 units/day and the solar PV system caters to 4 % of the total energy demand.

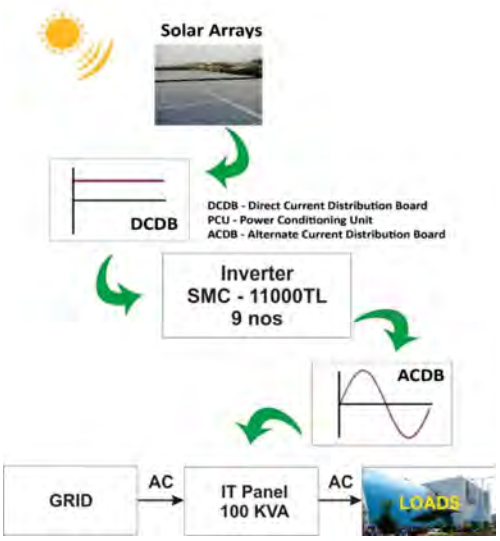
Solar panels mounted at the roof of I-Max Theater

Anemometer to record wind speed

String inverters installed under the panels

Technical Specifications:

Total Installed Capacity	100 kW
Technology	Poly Crystalline
Type of system	Stand alone SPV
Total system efficiency	80 %
Year of installation	April, 2011
Installed area	9000 Sq. ft.
Monitoring & Status indication	Web based remote monitoring system
Energy generation	1,50,000 KWh/year



Financials:

Sl. No	Objectives	INR
1	Total project cost	23 million
2	Central Financial Assistance (CFA) (30 % from MNRE)	6.9 million
3	Incentives (Accelerated Depreciation & Tax Benefits)	5.31 million
4	Actual Project Cost (Project cost – (CFA+Incentives))	10.7 million
5	Total energy cost saved	1.15 million / year
6	Payback Period	8 – 10 years

Benefits:

- The solar plant generates an average 400 – 450 kWh per day, supplying green power for lighting and running the water pumps.
- The amount of Carbon Emission Reduction is 108 Tons every year
- The total energy cost saved is INR 1.15 Million per annum

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Solar Thermal
Technologies

Solar thermal energy for air-conditioning systems at Turbo Energy Ltd., (TEL), Chennai

Introduction

Turbo Energy Limited (TEL) is a part of TVS group of companies located at Paiyanur which is 52 km from Chennai. TEL is a leading supplier of turbochargers to many automobile manufacturers in India. The company has undertaken various green initiatives and their administrative office is a LEED Platinum rated green building. The company has a sprawling campus with an area of 50 acres and 400 employees.

TEL has an air conditioning load of 130 TR (Tons of Refrigeration) for its administrative block with 24000 ft^2 area in the Paiyanur campus. The company came up with an innovative idea of adopting renewable energy (Solar) for air-conditioning. Vapor Absorption Machine (VAM) provides cooling similar to centralized air-conditioning systems and requires heat instead of electricity as input. Solar thermal energy can be used to run VAM by using solar thermal Concentrators.

The system is generating hot water through Scheffler Parabolic dish and Solar Parabolic Concentrator to operate VAM of capacity 90 TR and of 40 TR respectively. The Scheffler Parabolic Dish was installed in 2008 and the Solar Parabolic Concentrator was installed in 2011.

Scheffler Parabolic dish - 90 TR

Solar Parabolic Concentrator - 40 TR

Scheffler Parabolic Dish

There are 60 Scheffler Parabolic dishes installed in a total area of 960 m^2 to capture the heat energy in the sun. The overall system assembly consists of the concentrator dish, receivers, tracking system, and supporting structure with an automatic dual axis tracking mechanism for improved efficiency.

Scheffler Parabolic dishes generating heat at 140 °C

The Parabolic dish generates pressurized hot water at a temperature of 140 °C and this is fed into a vapour absorption chiller which generates chilled water used for air-conditioning the building. With carbon-dioxide control instrumentation, fresh air intake is optimized to reduce A/C load and control Indoor Environmental Quality. The solar parabolic dish produces 90 TR to meet the air-conditioning load of the building. The system has an efficiency of 45-60% and was supplied & installed by Thermax, Pune.

Technical Specifications:

Scheffler solar dish	Description
No of dishes	60
Size of dish	16 m^2
Total area of the reflector	960 m^2
Hot water generation temperature	140 ^oC
Application	Air-conditioning
Electrical output	450 units / 24 hrs

Financials:

Project Cost	INR 12.5 million
Subsidy by MNRE	INR 3500/m^2 & AD benefit up to 80% in the First Year.
Payback Period	7 - 9 years
Savings	INR 1.0 - 1.3 million / annum

Benefits:

- Annual electricity savings of 154 MWh
- Carbon Emission reduction is about 150 tonnes per annum.

Solar Parabolic Concentrator

To cater to the increased load of air-conditioning system, TEL has installed two more systems of ARUN 160 which is a double axis tracking, Fresnel parabolic concentrator of 40 TR capacity.

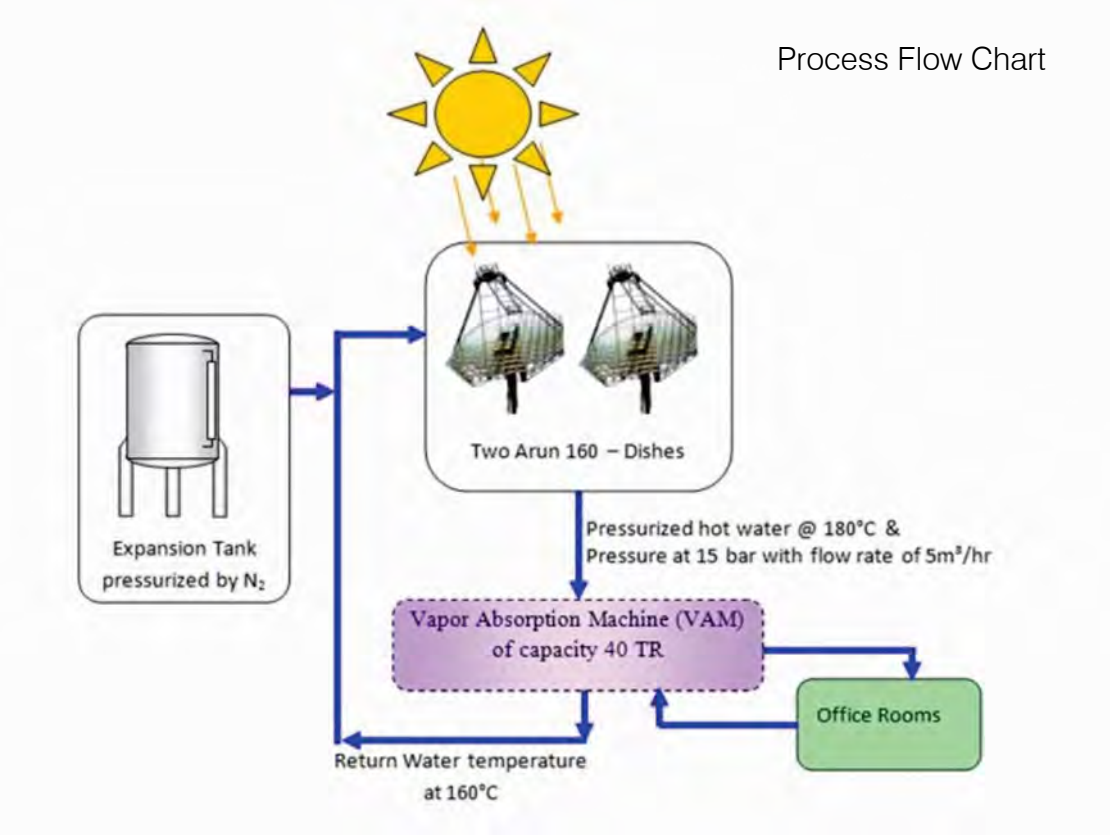
Solar Parabolic Concentrator generating heat at 180 °C

The aperture area of the each dish is 169 sq. m which always faces the sun with cavity absorber at point focus. The dishes generate 5 m^3/hr of pressurized hot water at 180°C for the vapor absorption machine (VAM). The return temperature of the hot water is 160 °C. The water is circulated, using centrifugal type circulating pump, through the Arun dishes. The dishes are arranged in parallel configuration; therefore a single pump is sufficient for the water circulation through both dishes.

The system is kept pressurized at 15 bar to avoid steam formation in the circuit by using nitrogen pressurization. The nitrogen cylinders are connected to the expansion tank in the circuit, for this purpose. The average heat output from the two dishes is about 1,00,000 kcal/hr which is sufficient to operate the vapor absorption machine.

Technical Specifications:

Operating parameters	System specifications
Water flow rate to dish = 5000 L/hr	No. of Dishes: 2
Pump inlet pressure = 12 bar	Technology: ARUN 160
Pump discharge pressure = 15 bar	Area of concentrator: 169 sq. m. / dish
Hot water outlet temperature from the system = 180 °C.	Capacity: 80-100 kWth per dish
Chilled water outlet - VAM = 8 °C.	Heat generation capacity: 115 X 106 Kcal/day
Chilled water inlet - VAM = 12 d	Average solar radiation: 0.8 KW/m^2



Financials:

Project Cost	INR 7.5 million
Subsidy	INR 2.02 million + AD benefit up to 80% in the First Year.
Payback Period	5 - 8 years
Savings	INR 1.0 - 1.3 million / annum

Benefits:

- Electricity savings of around 300 - 350 MWh/yr.
- GHG reduction is around 130 tonnes per annum.

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Solar Kitchen-Auroville, Pondicherry

Introduction:

Auroville Community which came into existence in 1968 has today grown into a community consisting of more than 90 settlements inhabited by 1700 people from 35 countries. The residents are engaged in a wide range of activities, including research into Cashless Economy, Organic Farming and Renewable Energy.

Solar Parabolic Concentrator installed on top of Kitchen

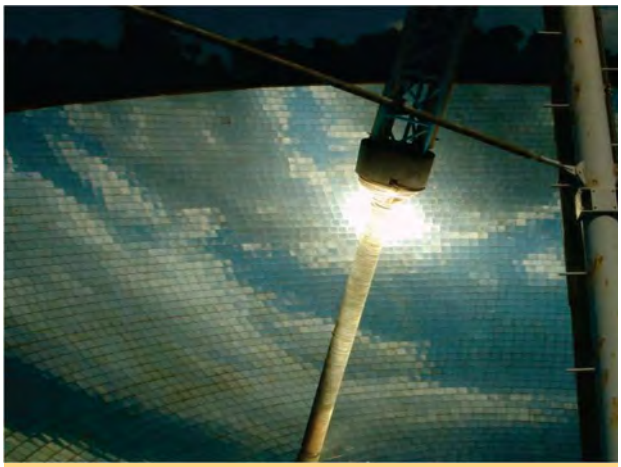
Solar kitchen:

The Auroville community has a kitchen which serves food for around 1000 people / day using a solar-diesel hybrid system. Mr. Gilles Gluigou is the Principal Project Investigator for the Solar Parabolic Concentrator system which is designed to meet the steam requirements of the kitchen. The Solar Parabolic Concentrator was installed in the year 2001 under a 100 % grant by MNRE as a research project and is in operation on a daily basis since February 2005. The solar parabolic concentrator type steam cooking system is able to provide steam for preparing 1000 meals every day and the condensate is being utilized for keeping the cooked food warm and laundry service. The Solar Parabolic Concentrator system meets 35 % of the kitchen's steam requirements and the rest is met by the diesel-fired boiler. The entire system is completely automated. However, unlike the solar photovoltaic system, the performance of Solar parabolic concentrator drops drastically sometimes to half of its peak value during cloudy weather conditions. Therefore, the system is hybridized with a conventional diesel fired boiler to surmount the problem of temperature fluctuations.

Project Description:

The solar concentrator with a 15 m. diameter is mounted on the first floor of the building, at 12 degree angle to the horizontal and at an elevation of 7 m above the ground. The concentrator is equipped with 11000 mirrors covering 175m^2 of aperture area. It reflects and concentrates the rays of sun onto a heat receiver which is positioned at the focal point of the concentrator. The heat receiver consists of copper coils through which cold water flows. The concentrator is supported by a wall built with pre-fabricated ferro-cement blocks arranged in such a configuration to form a perfect spherical structure. A tilted fixed mast supports a moving receiver which can rotate in all directions.

Solar Parabolic Concentrator with south orientation



Solar bowl during peak operating time

The system is equipped with a 4-point electronic controller and a double axis tracking system. The electronic controller ensures automatic tracking of the whole system with a built-in arrangement for making adjustments according to seasonal variations and movement of the sun.

The cold water pumped through the copper coils of the heat receiver is heated to a temperature of 150°C, which goes up to 360 °C during peak period. This steam is then piped down to the boiler room from where it is routed to the kitchen.

The steam requirement of the kitchen is 300 kg/ hr. at 3 bar pressure. The peak steam production from the solar concentrator has been measured at noon to be 83 kg/hr. In terms of heat generation the peak output of solar concentrator at noon is 75 kW_{th}.

Technical Specifications:

Solar Parabolic Concentrator	Description
No. of Mirrors	11000
Aperture area	175 m^2
Steam generation at peak hour	83kg/hr
Temperature	150 °C
Heat generation potential	75 kW th
Diesel Savings	15000 litres / year
Annual cost savings	INR 0.75 million
Application	Cooking

Financials:

The research project is 100 % funded by Ministry of New and Renewable Energy (MNRE) to the Auroville community and the total cost of the system is INR 2.0 million.

Benefits:

- Saving of 15000 liters of diesel / annum
- The total energy cost savings of about INR 0.75 million per year.

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Solar Concentrator for Milk Pasteurisation at Mahanand Dairy Unit, Latur

Introduction:

According to Ministry of Petroleum and Natural Gas, GoI, nearly 42 % of refined crude is used for process heat applications in Indian industry. These include boiler feed water heating, steam generation, solvent extraction & distillation, food processing and other industrial processes. One of the sectors where fuel-oil heating is used extensively is the Dairy industry.

There are around 700 milk processing plants in the dairy sector which requires thermal energy for processing and this thermal energy can be partially or fully met through solar concentrator systems.

Solar Parabolic Concentrator installed at Mahanand Dairy Unit top of Kitchen

Mahanand Dairy Unit:

Mahanand Dairy unit located in Latur, Maharashtra is processing about 20,000 to 25,000 liters of milk per day. Following are some of the activities which consume thermal energy in the plant:

- Pasteurization
- Milk Chilling
- Cleaning in Place(CIP)
- Can and Crate washing
- Sterilization

To save on expensive furnace oil, Mahanand dairy unit has installed a solar thermal concentrator for their thermal energy requirements. ARUN–160 Dish Concentrator was installed in 2006 with technical support from IIT Mumbai and financial support from MNRE as an R&D project. The project helps in generating hot water for processing 20,000 to 25,000 litres of milk per day.

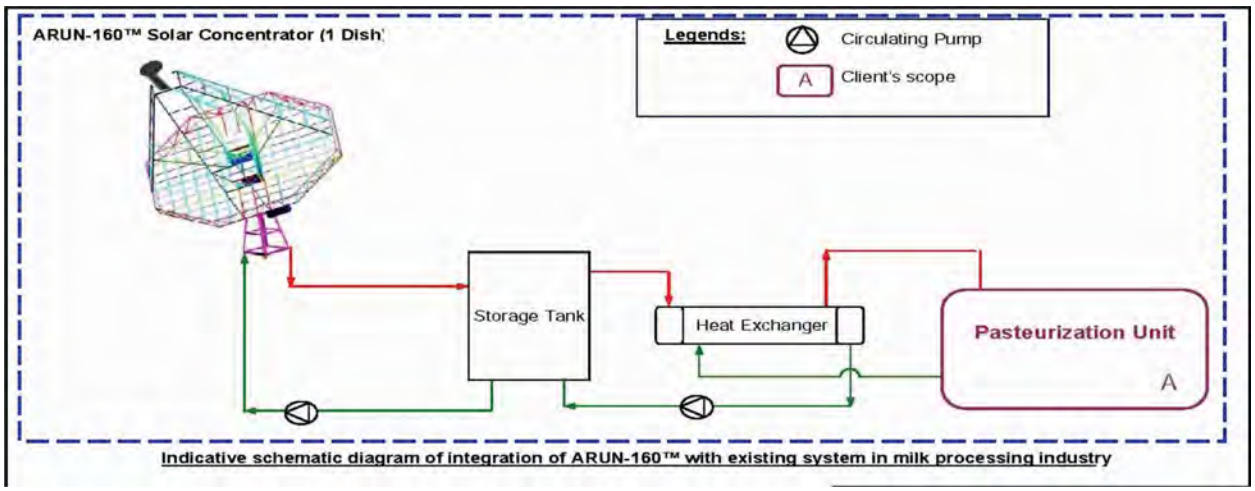
Project Description:

The solar parabolic concentrator has a collector area of 169 m^2 and is equipped with a double axis tracking system for hot water generation at a temperature of 80-90 °C. The system uses a Fresnel Paraboloid Solar Reflector with reflector facets fixed on to a tracking surface.

Milk Pasteurisation Unit

ARUN 160 Dish in a sunny day

An insulated pressurized water storage tank has been provided for storage of thermal energy. Pressurized water was selected as the medium of heat transfer and storage as it has high specific heat, free from fire hazards, zero possibility of accelerated oxidization, compatibility with food products and low operational cost. This system toltally replaces the furnace oil that was earlier used for heating requirement of milk pasteuraization.



Indicative schematic diagram of integration of ARUN-160™ with existing system in milk processing industry

Technology Specifications:

Parameter	Units
Technology	ARUN 160 dish
Collector Area	169 m^2
Heat Delivery (Annual Average)	80 – 100 kW Th
Temperature	80 °C – 90 °C
Efficiency (%)	60 - 65 %
Application	Pasteurization, CIP, Can & crate washing

Financials:

Project Cost	INR 3.7 million (after deducting subsidy, includes civil, transportation, integration)
Subsidy from MNRE	INR 1.01 million
O&M cost	INR 0.1 million per annum
Cost Savings	INR 1.0 million
Payback Period	3.6 years

Benefits:

- Furnace oil saved / annum is 18000 - 20000 litres.
- Carbon emission reduction of about 60 – 70 tonnes / year

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Solar Thermal Energy for cleaning engine components at Mahindra Vehicle Manufacturers Ltd., Pune

Introduction:

Automobile industry is one of the major industries in India having large energy requirements in the form of both thermal and electrical energy. Vehicle manufacturing includes many processes that require thermal energy in the low or medium temperature range (60 – 150˚C).

ARUN 160 dish installed at MVML, Pune

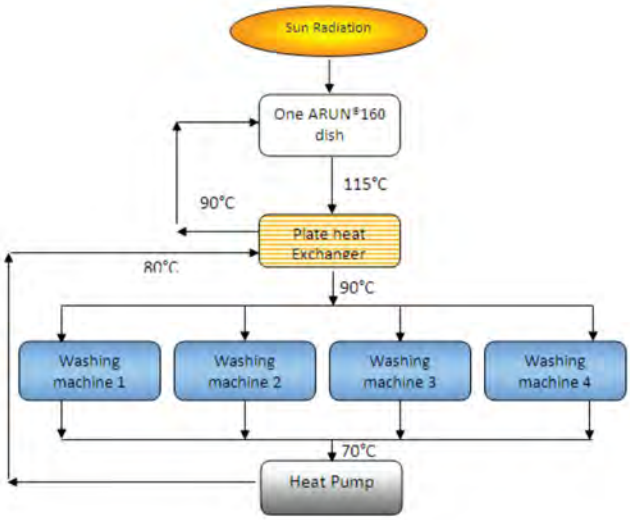
Mahindra Vehicle Manufacturers Ltd. (MVML) was set up in 2007 as a Greenfield facility at Chakan, near Pune, Maharashtra.

Project Description:

ARUN 160 dish is an indigenously developed Fresnel Paraboloid Solar Concentrator for generating hot water. The innovative dish design and the automatic two-axis tracking system help to deliver the optimal thermal energy output per m^2 of collector area. MVML, Pune has installed ARUN 160 dish in October 2010 to meet the hot water requirements for cleaning engine components.

The dishes have been installed at a height of 8 meters so that the area beneath the dish can be used as Test Track for vehicles. The dish generates pressurized water at 120˚C which is used for cleaning engine components.

Process flow chart



Technical Specifications:

Objectives	Units
Technology	ARUN 160 dish
Collector Area	169m^2
Heat Delivery (Annual Average)	80 – 100 kW_{th}
Temperature	120 °C
Efficiency (%)	60 - 65 %
Application	Washing/ Degreasing ofautomobile components

Financials:

Project Cost	INR 3.7 million (after deducting subsidy, includes civil, transportation, integration)
Subsidy from MNRE	INR 1.01 million
O&M cost	INR 0.1 million per annum
Cost Savings	1.0 million
Payback Period	3.6 years

Benefits

- GHG reduction of about 60 – 70 tonnes / year
- Amount of Energy / Diesel Saved every year is 18,000 - 20,000 litres / year

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Solar Thermal Energy for cooling requirement - Mahindra Vehicle Manufacturers Ltd., Pune

Introduction:

Introduction: VAM utilizes thermal energy either through waste heat recovery or fired heating systems for generating chilled water. The latest trend is to generate hot water through solar thermal system, substituting fired heating systems. MVML was earlier using LPG fired heating system for VAM, but has now installed solar thermal system for partially replacing the LPG firing for generating hot water.

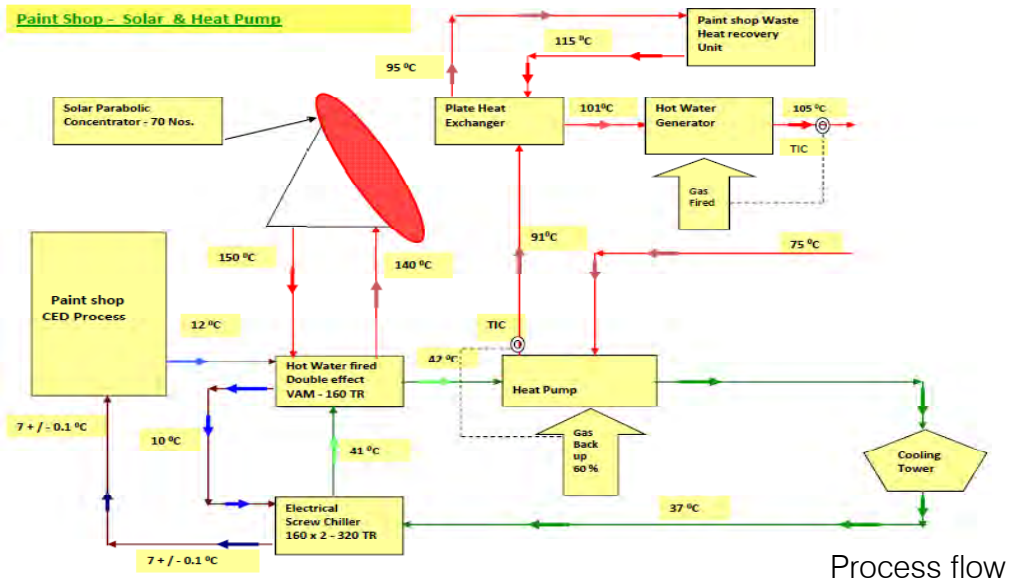
Project Description:

A cluster of 70 Scheffler solar dishes SolPac-D160 (Thermax) generates hot water to be used in VAM to cool the paint used for electro-deposition painting on the vehicle bodies. The system helps to reduce the consumption of LPG in the paint shop.

The system has an efficiency of 45-60% and was supplied & installed by Thermax. When heat from the solar dishes is not adequate at evenings and during off-season to meet the hot water requirement of the chiller, LPG firing is used. The hot water generated from the Solar dish is also used in LPG vaporizers.

SolPac-D160 (Thermax) installed at MVML, Pune

Scheffler solar dish	Description
Technology	SolPac-D160 (Thermax)
No of reflectors	70
Size of reflector	16 m^2
Total area of the reflector	1120 m^2
System Efficiency	45 - 60%
Temperature Range	100 - 150 ^oC
Application	Process cooling for the paint shop



Process flow chart

Financials:

Project Cost	INR 80 million (Excluding subsidy)
Subsidy	INR 3.9 million @ the rate of 3500/m^2 & AD up to 80% of project cost in the First Year.
Payback Period	5 years

Benefits:

- Scheffler solar dishes helps in saving 1476 tonnes of LPG for Mahindra

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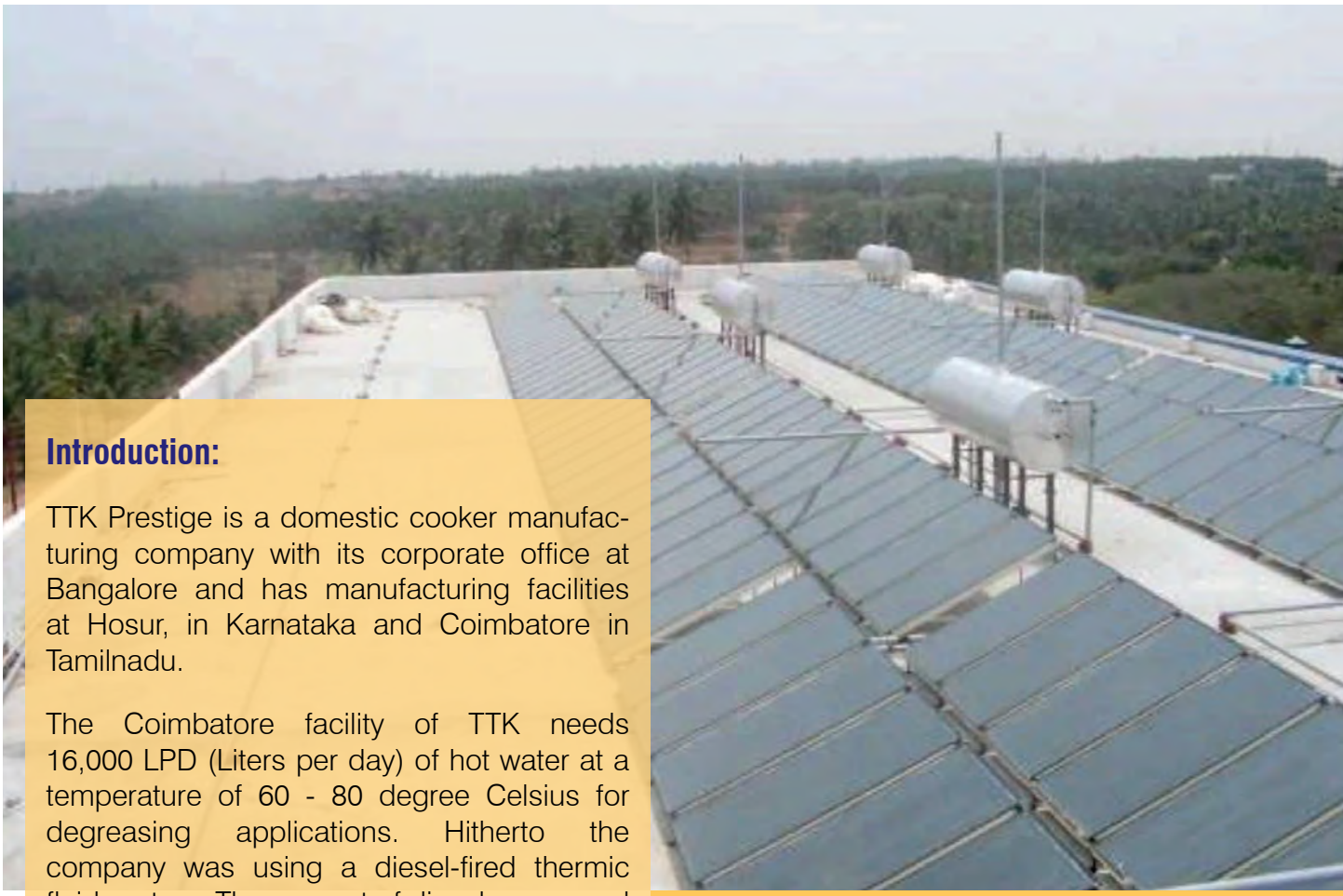
Solar Water Heaters for process cleaning at TTK Prestige, Coimbatore



Solar Water Heaters installed in the roof of TTK

Introduction:

TTK Prestige is a domestic cooker manufacturing company with its corporate office at Bangalore and has manufacturing facilities at Hosur, in Karnataka and Coimbatore in Tamilnadu.

The Coimbatore facility of TTK needs 16,000 LPD (Liters per day) of hot water at a temperature of 60 - 80 degree Celsius for degreasing applications. Hitherto the company was using a diesel-fired thermic fluid system. The amount of diesel consumed per day to run the thermic fluid heater is around 80 - 100 litres per day. To bring down operating costs the company decided to install solar water heaters at the plant site to generate hot water and use it for degreasing application.

Coimbatore has 300 sunny days and enough solar radiation to meet the company's heat requirements.

Flat plate SWH with the hot water tank

Project Description:

TTK has installed Solar Water Heaters in 2012 with technical support from PEN (Planters Energy Network) based out of Theni. The total installed capacity of the system is 16,000 litres per day. Each Solar hot water tank of 2,000 litre capacity is connected to a 24 flat plate solar water heater. The hot water is used to de-grease the manufactured cooker vessels.

Water Bath - cleaning the vessels

Sensors in the water bath

Insulated Solar Water Tank and pipelines

The system is capable of completely replacing the diesel fired thermic fluid heater on a sunny day. Each 2,000 litre tank is now fitted with 3 X 3 kW electrical heaters as a back up.

Technical Specifications:

Installed capacity (Litres)	16000
Installed Collector area (sq. m)	384
Supplier	PEN Industry
Technology	Flat Plate Collector
Number of Solar water heaters	192 panels
Power generation or Steam generation /day (kilo calories)	1.25
Efficiency (%)	30-50
Temperature of Hot water / Steam generated	70-75 °C
No. of operational days/ year	300
Monitoring & Status Indication	PLC panel with timer and temp. indicator
Electrical heater capacity in each tank (kW)	9

Investment:

Total Investment	5.0 million
Subsidy availed from MNRE	1.26 million
Payback Period	2yrs

Benefits:

The industry is completely able to replace diesel during sunny days.

- The quantity of diesel savings is about 75 to 100 litres/day
- Savings in diesel costs is about INR 1.2 - 1.5 million per annum.
- GHG reduction is about 65 tonnes per annum.

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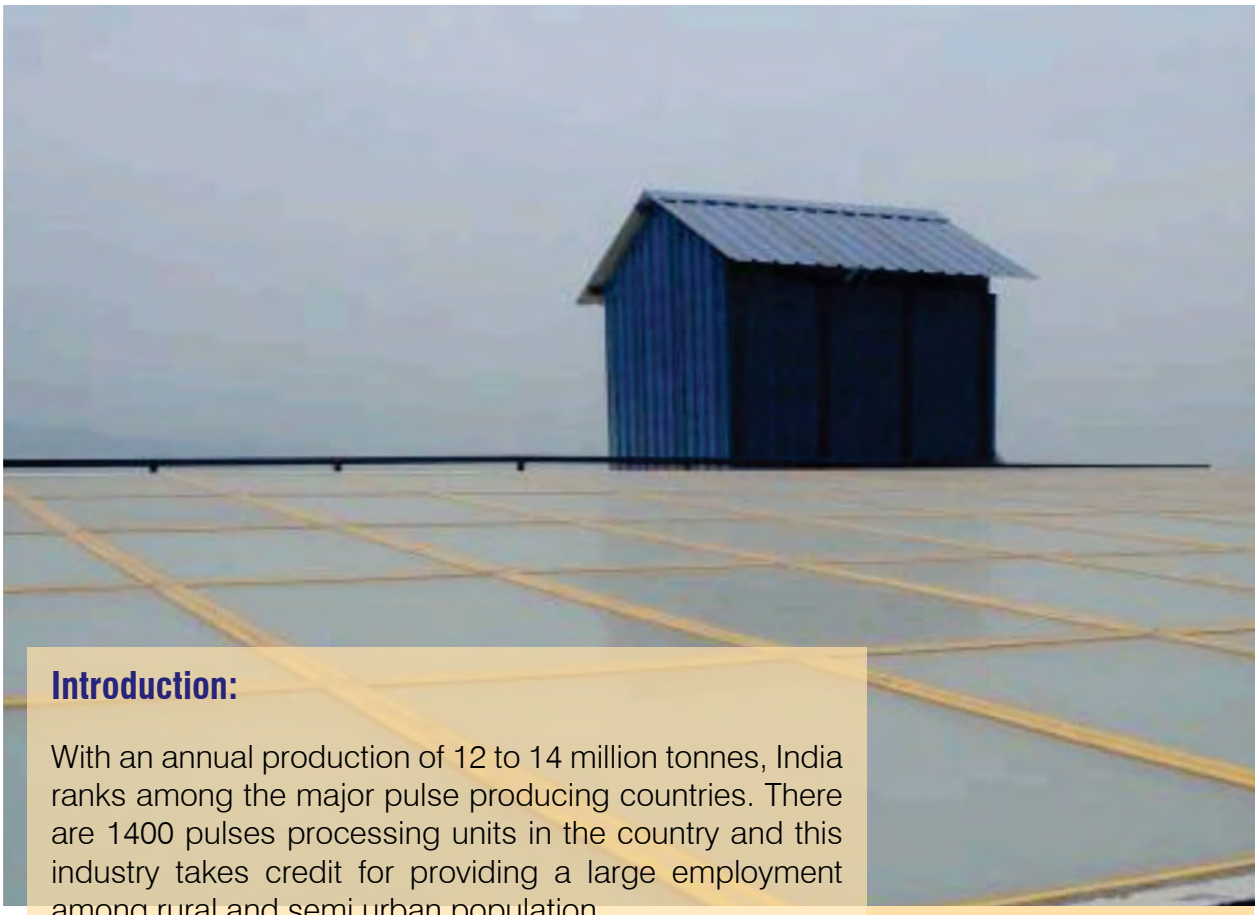
Solar air heating for drying requirement in food processing industry, Theni



Solar air heating system installed in AMR Dal Mill

Introduction:

With an annual production of 12 to 14 million tonnes, India ranks among the major pulse producing countries. There are 1400 pulses processing units in the country and this industry takes credit for providing a large employment among rural and semi urban population.

Since the last decade, dal processing units are shifting from open sun drying to fossil fuel fired dryers due to constraints in space availability. This has created an additional burden on the energy sector. Recently innovative solar air heating systems have been developed to reduce consumption of diesel.

AMR Dal Mill is located in the south western part of Tamilnadu where huge farming lands cultivated Dal. This mill processes 20 tonnes of Urad dal per day where solar air heating system has been installed successfully.

Project Description:

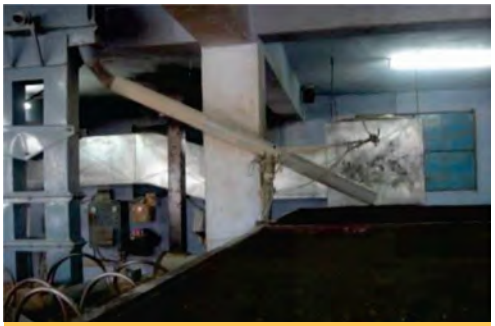
The AMR Dal Mill located in Theni enjoys more than 300 sunny days in a year. Prior to the installation of solar collector, AMR Dal mill used to spend around INR 5000 per day to run the diesel-fired heater for hot air production.

To save on diesel, the solar flat plate collector was installed in 2012 at AMR Dal Mill covering an area of 230 m^2.

Dal processing involves the following steps:

- Sieving machines are used to clean the external impurities in the pulses.
- The pulses are sprinkled with vegetable oil.
- Then they are heated in a trough which can hold around 5 tonnes of pulses.
- Hot air is generated by burning diesel and the blower drives the hot air into the trough. A temperature of 60 to 65°C is maintained for duration of 75 – 90 minutes in the trough.
- The dal mill processes typically 4 to 5 batches per day and consumes around 60 to 90 litres of diesel every day for generating heat.
- After the pulses are heated, water is sprinkled on them to separate the skin from the kernel.

The solar flat plate collector consists of a tempered glass at the top, and a black color coated special aluminum absorber kept in a box which is insulated at the sides and bottom to prevent heat loss. The insulation material used is rockwool and thermocol. The atmospheric air is drawn into the solar collector and made to pass through the chambers in a zig zag motion, to increase the air temperature by the absorber. A 5 HP power blower is used to deliver the hot air from the solar flat plate collector to the open trough through the metal duct which is insulated.



Dal processed in the open trough

Openings for sucking air

Dampers for heat regulation

Temperature sensors on the duct

A damper is used for temperature control in the duct and in the trough. Temperature sensors monitor the temperature inside the duct. The damper closes when a higher heat output is required and opens automatically when low heat output is enough. On a normal sunny day the collector delivers hot air at 65 °C – 75 °C. The maximum hot air temperature achieved through the solar flat plate collector is 110 °C in the month of May. On a rainy day and at night times the diesel-fired boiler is used as a backup. The unit operator could switch from solar heating to conventional heating by flicking a single way switch. The life of the flat plate solar collector is 15 years and has been installed by SunBest systems.

Technical Specifications:

Installed capacity of Dal Processing unit (T / day)	20
Installed solar collector panel area (m^2)	230
Heat generation /day (m^3)	9000
Make/Brand	Sun Best
Solar Technology	Flat Plate Collector
Efficiency (%)	30 to 40
Maximum heat generated by the Solar Air Heater	Avg: 75 – 80 °C & Maximum 110 °C
No. of operational days/ year	300
Monitoring & Status Indication	Temperature sensors for heat regulation through actuators dampers
Insulation Material	Rockwool and thermocole

Financials:

Cost of Flat plate solar air heaters	INR 1.84 million
Total Project Cost	INR 1.93 million
Subsidies availed from MNRE	INR 0.55 million
Payback Period	2 years

Benefits:

The Dal mill was completely able to replace diesel during sunny days and save energy costs.

- Savings in diesel about 60 to 90 litres/ day
- Cost savings by replacing diesel is about INR 1.0 - 1.2 million per annum.
- GHG reduction is about 60 tonnes per annum

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Wind Energy
Technologies

Hybrid Renewable Energy systems for meeting building energy demand

Introduction:

Suzlon One Earth is the global head quarters of Suzlon group situated in Hadapsar, Pune and is surrounded by large townships and IT parks. The Suzlon campus consists of an office space and a global learning academy with a plot area of 45392 m^2 and built up area of 75825 m^2 with a capacity comprising of 2300 employees.

LEED Platinum rated Green Building:

Suzlon One Earth is one of the greenest campuses in India and is Platinum rated by the Indian Green Building Council (IGBC) under LEED - NC (Leadership in Energy & Environment Design - New Construction). The project was executed and completed in October, 2009 by Synefra Engineering and Construction Ltd.,

Green Features:

Solar Water Heating System: The campus has a solar water heating system of capacity 10,000 litres per day which saves more 0.14 million units of electricity annually

Zero Waste site: The waste generated is recycled using an organic waste converter and used as manure

Alternative Fuel Vehicles: Suzlon one earth promotes the use of electric vehicles by providing charging points for E-vehicles

Storm & Rain water Management system: Channels all rain water received into a controlled flow thereby enhancing the water table, preventing soil erosion

Solar water heaters installed at Suzlon

Project Description:

Aerial view of Renewable Energy Systems installed at Suzlon

The total energy consumed by 'Suzlon one earth' in last year is approximately 5.48 Million units. 'Suzlon one earth' is 100 percent powered by a combination of on-site and off-site renewable energy sources. In this, 6 percent of the total energy consumption comes from 18 on-site hybrid wind turbines, Solar PV panels and Bi-PV systems (Building Integrated Photo-voltaic) and remaining is from off-site wind turbines.

The power generated using on-site renewable energy is used for external and parking lights and to run the indoor A/C and communication server. The total on-site renewable energy system installed capacity is 155 kW and the table shows the numbers.

Windmills	4.75 kW	18 numbers	85.50 kW
Solar PV	230 W	243 numbers	55.89 kW
Solar Bi-PV	105 W	128 numbers	13.44 kW
Total			**154.83 kW**

On-site wind mills: Suzlon has 18 small windmills installed around its campus by Unitron Energy Systems Pvt. Ltd. The wind mill is of capacity 4.75 kW each which occupies an installed area of 4 sq.ft and the hub height of windmill is 24 metre and the weight is 99 kg. The power generated from the wind turbines at 4.5 m/s is 28,500 kWh and at 4.9 m/s is 39,000 kWh per annum.

Technical Specifications:

No. of blades	3
Rotor diameter	5.24 m
Swept area	21.4 sq. m
Hub height	24 m
Nominal output	4.57 kW / windmill
Rated wind speed	9 m/s
Cut in wind speed	2.7 m/s
Cut-out wind speed	2.7 m/s
Nominal Wind Speed	11 m/s
Plant Load Factor	17 %

The power generated from the 18 small wind turbine is about 30,000 - 40,000 units every year.The total cost of installing of 18 small windmills is INR 3.6 million (@ the rate of INR 0.2 million each). The O&M (Operation and Maintenance) cost for the 18 small windmills is about INR 0.2 million / annum

Off-site windmills: Suzlon is making an attempt to offset the environmental impact of energy consumed by the facility, since the Off-site green power produced is more than 50% of the project's energy consumption. The windmills are installed in Satara region of Maharashtra. The wind power generated from off-site are wheeled and used to meet the demand in Suzlon administrative office.

56 kW Solar PV system

Rooftop Solar Photo-voltaic: The capacity of rooftop Solar PV system is 55.89 kW (230 W x 243 panels) and the cells are of multi-crystalline technology with an efficiency of 14.5 %. The rooftop Solar PV system was installed by Titan Energy System, the Inverter and EPC is done by Unitron and O&M is taken care by Synefra. The power generated from the rooftop PV system is about 67,000 units per year.

Bi-PV: The installed capacity of Bi-PV system was 13.44 kW (105 W x 128 panels) and the system was installed by SunTechnics Energy Systems Pvt. Ltd, and O&M is done by Synefra. The total installed area is 2148 sq.ft with a poly-crystalline technology. The solar panel efficiency is 10.5 % and the Bi-PV system efficiency is 92 %. The total number of cells in each panel is 30 with 8 arrays in the system. The power generated from the Bi-PV system is about 16,000 units per year.

13.5 kW Bi-PV systems integrated with the roof

Storage: The power generated from the onsite renewables is stored in the 384 batteries of capacity of 1150 Ah each and the life cycle of battery is 4 - 7 years. The back up is made for duration of 12 hours.

Benefits:

- The amount of energy saved through on-site and off-site renewable energy systems is 4.382 million units.
- 100 % External & Parking Lighting and for Communication Server and Electric Car Charging points
- The amount of Carbon Emission Reduction is 6,000 tonnes every year

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Biomass & Biogas
Technologies

SPEED - Biomass Gasifier at Bara, Bihar

Introduction

SPEED is a rural energy access initiative which strives to create a positive impact on the lives of poor and vulnerable populations by providing clean energy to rural communities, thereby improving the quality of life and enhancing livelihood security. The programme aims to have a profound impact on the economic development and job creation in the targeted regions.

The objective of SPEED is to provide affordable green energy and clean fuels to rural Indian population using locally available renewable energy sources with mobile towers serving as anchor loads.

SPEED project is implemented by CII-Sohrabji Godrej Green Business Centre, TARA - Development Alternatives, cKinetics, Desi Power, Sambodhi, Pradan and SAIS with active involvement of Central and State Governments. The Rockefeller Foundation, USA is supporting this programme.

Stakeholder engagement under SPEED

CII Godrej GBC aims to build an enabling environment for the SPEED programme to establish and scale up rural energy services across India. CII, being a leading Industry Association in the country, is uniquely positioned to link and engage all the key stakeholders to establish and scale up the programme rapidly. Key stakeholders include Energy Service Companies (ESCO s), Telecom tower companies, Technology manufacturers, suppliers and service providers, financial institutions, Rural community and Government agencies.

CII formed a high-level Advisory Group which would steer, lend vision to the project and guide the team in effective implementation. The Advisory group is lead by Mr. Jamshyd Godrej, Chairman, CII Godrej GBC & CMD, Godrej & Boyce Manufacturing Co. Ltd and includes senior members from industry, finance and Government. The Renewable Energy Council of CII Godrej GBC lead by Mr. Ramesh Kymal, Chairman and Managing Director, Gamesa Wind Turbines Pvt. Ltd., is lending its full-fledged support to the SPEED initiative.

Under the SPEED programme, a biomass power plant was set up at Bara village in Bihar in 2012 by DESI Power. Bara is a 300 household village in Araria district of Bihar situated at the foothills of Himalayas. The village has a population of around 3000. Like several other villages in Bihar, grid has not reached Bara village. In spite of being blessed with extremely fertile land and ample water availability to grow three crops, the farmers were constrained by the total absence of infrastructure like roads, power which are crucial for overall development. Due to lack of grid power, the villagers were forced to irrigate the fields using diesel pump sets which are proving to be a heavy economic burden on the farmer.

Kerosene based lighting at Bara village

Diesel fired irrigation pumpsets

Kerosene lamps are used for lighting the households in the village and average expenditure on kerosene per household comes to INR 150-200. Few telecom towers in the village are also running totally on diesel with all its attendant problems.

DESI Power which is a rural power producer based in Bangalore come forward to electrify the Bara village using a biomass gasifier power plant.

Biomass Gasifier

Biomass Power Plant

Micro Enterprises, Mobile Towers and Lighting

DESI Power has set up a Biomass power project in Bara village in 2012 to harness electricity from biomass. The 32 kW down draft Gasifier produces 100-120 kWh of energy per day. The gasifier runs on locally available feed stocks such as Ipomea, Dhaincha, Corn Cobs and waste wood available in and around the village. The gasifier consumes around 1.40 kg of feed stock to generate one kWh of energy.

The gasifier currently operates 5-6 hrs/day supplying power to the village. Major part of the power generated goes for energizing the village micro-enterprises such as chura mill, oil expeller, rice huller and irrigation pump sets. The plant is also supplying power to a few telecom towers.

Technical specifications

The village also has few telecom towers which is run by diesel is now running on biomass based power.

Total Installed Capacity	32 kW
Technology	Biomass Gasifier
Type of system	Down draft
Manufacturer	Ankur Scientific
Gasifier Rating	50 kg/hr
Engine Rating	32 PG kWe
Biomass feedstock	Ipomea, Dhaincha, Corn Cob, Jungle Wood
Calorific Value	3600 kCal/kg
Power generation	100-120 kWh per day
Feedstock consumed / day	150 kg
Operational Hours and Days	5-6 hrs / day, 330 days / year

Financials:

Project Cost	INR 3.2 million
Subsidy by MNRE	0.48 million
Savings through Kerosene	INR 0.55 million / annum
Income from power generation	INR 0.18 million / annum

Benefits:

The plant is creating new jobs in the village. Better irrigation facilities are resulting in higher farm income and better quality of life. There is considerable improvement in education opportunities as children are able to study in the night due to better quality lighting and women work on handicrafts.

The benefits from the power plant can be summarized as follows:

- Improvement in quality of life as households are illuminated with electricity
- Earning capacity has increased due to regular power supply to micro enterprises.
- The project helped in skill up-gradation & employment generation in the village.
- Increase in farm productivity due to timely supply of irrigation water for fields
- Telecom tower players are able to save money spent on diesel.

On the whole, around 50 people have benefited directly and indirectly due to this project.

Community Mobilization at Bara Village

Electrified rural households

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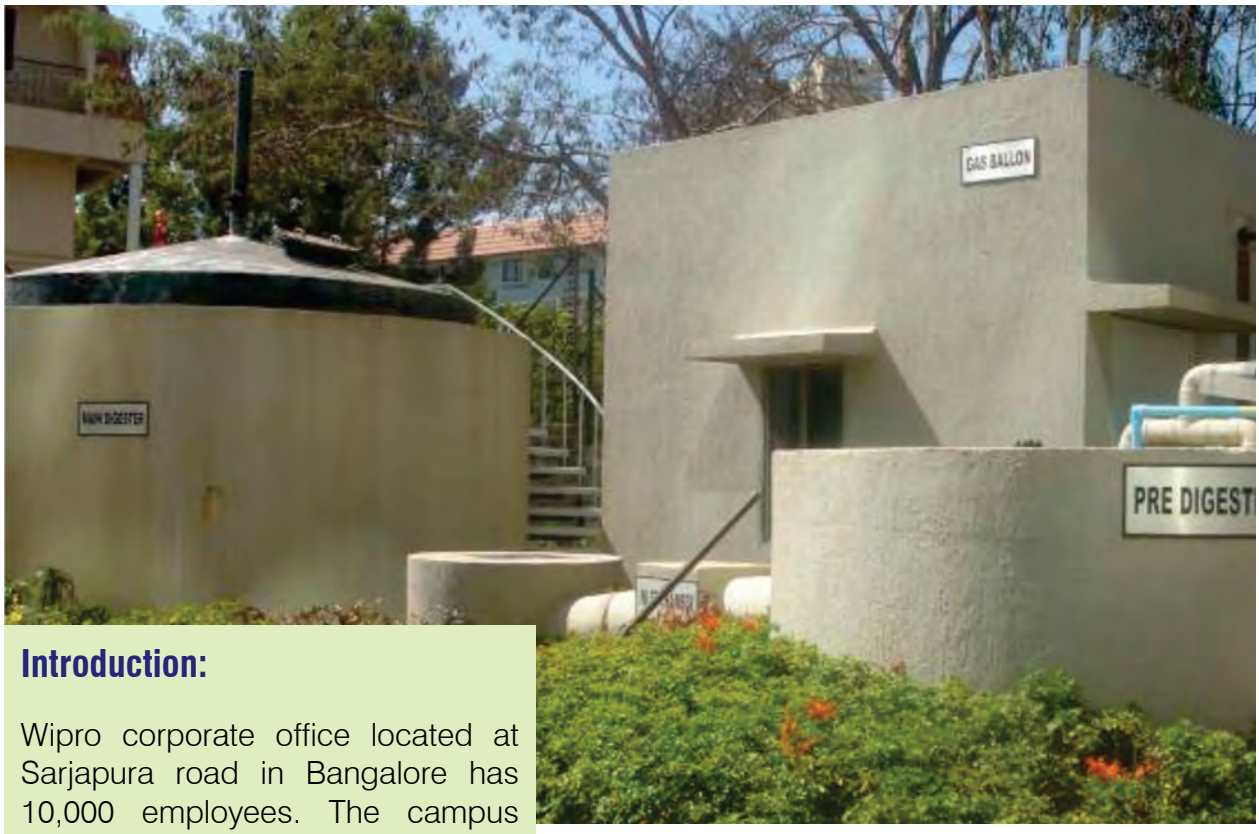
Biogas from Canteen Waste at Wipro, Bangalore



Introduction:

Wipro corporate office located at Sarjapura road in Bangalore has 10,000 employees. The campus has a huge canteen to cater to employees. Prior to the installation of Biogas digester, the canteen used LPG gas to cook food. Food wastage in the canteen was estimated at 600 - 1000 kg / day, which is substantial. Considering that there is significant amount of waste generated in the campus and having faced difficulties in transporting and disposing waste, Wipro thought of an innovative idea of generating Biogas from the food waste.

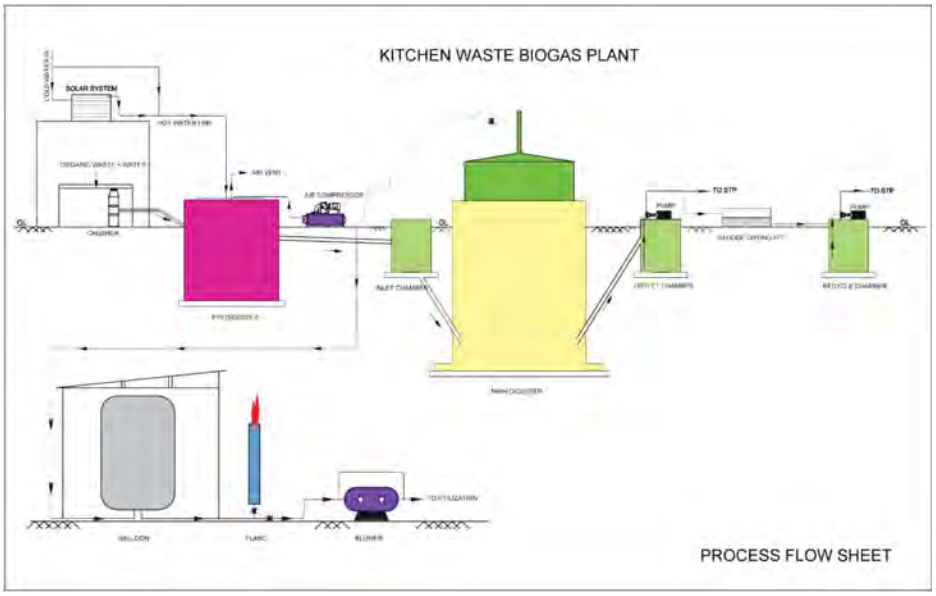
A 50 m^3 Biogas digester was installed in the Sarjapura campus in 2010 with technical support from the Nuclear Agriculture and Bio-technology Division (NA&BD) of BARC (Bhabha Atomic Research Centre). BARC developed Nisargaruna technology' which offers a "Zero effluent" method for management of solid waste. This system not only helped in safe disposal of waste and minimized transportation cost but also partly replaced the LPG gas used for cooking in the canteen.

Project Description:

The 50 m^3 Biogas digester plant is designed to handle a capacity of 1000 Kg of waste per day. The area occupied by the biogas digester is 15 x 15 m. The process starts with segregation of waste and then turning it into a slurry form in a mixer. The aerobic digestion of the slurry is carried out in a pre-digester tank using hemophilic bacteria treated with hot water at 50 °C temperature. This is followed by an anaerobic digestion by methanogenic bacterial consortium in the main digester tank. The biogas (mainly methane) is tapped from the floating head of the main digester tank and the residual slurry is sent to manure pits where the nutrient-rich water from manure separates out. This water can be recycled for gardening purposes.

Hot water and gas pipelines to the Pre-digester

The plant can generate around 3 cylinders (14.3 kg/cylinder) of biogas and around 80 - 100 kg of high quality organic manure which can be used as an excellent soil conditioner/ fertilizer. The gas can cook 1000 - 1500 meals per day or alternatively can generate electricity of 32 MWh per annum.



60 % of gas generated in the Wipro biogas digester is stored in the dome while the remaining 40 % of gas is stored in the balloon of capacity 15 m^3. The balloon is made up of neoprene rubber. The system also comprises of a 100 litre solar hot water system to meet the hot water requirement duringthethermophilic reactionin the pre-digester unit. The plant provides a higher methane yield of 60 - 70 % and gross calorific value of 4500 - 6000 kcal/ m^3.

Inlet Chamber from the Pre-digeste

Gas Balloon unit of 15 m^3 capacity

Organic manure pit

Technical Specifications:

Biodegradable waste from canteen	1.0 TPD
Biogas Digester Capacity	50 m^3
Type of waste	Food / kitchen waste
Technology	(Nisargaruna) BARC
Gross Calorific value of Biogas	4,500 - 6,000 kcal/ m^3
Installed area	15 * 15 m
Retention Time	3 days - Aerobic, 25 days - Anaerobic
Biogas Generation	80 m^3 / day
Electricity Generation Potential	30,000 - 35,000 kWh / annum
LPG cylinder replacement	3 LPG cylinders / day

Financials:

Project Cost	INR 1.4 – 1.6 million for 80 m^3 plant
Subsidy	INR 4,000 – 8,000 / m^3
Payback Period	3 years
Savings on LPG	INR 0.3 - 0.5 million / annum

Benefits:

- The gas produced is used by 4 burners to cook food continuously for 5 hours in the canteen that helps in saving 3 LPG cylinders per day.
- Produces Manure of 80 - 100 kg/day with about 3% nitrogen and 1.5% phosphate content.
- GHG reduction of about 50 - 65 tonnes / annum
- Waste disposal is done in a scientific manner
- Reduces Energy cost for treatment

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Biogas power for Thalingi village, Tamilnadu

Introduction:

Thalingi village is located in the Amaravathi Forest Division, Udumalpet Taluk, Tirupur District, Tamilnadu. The tribal habitat has no transport facility and the nearby road is 6 Km away. The village is un-electrified as the hilly terrain made it impossible for grid infrastructure to reach. The village was also spending INR 1020/- per day on the kerosene for home lighting and to meet their energy requirements. The tribal people used to walk 12 km up and down once in a week to get this kerosene which is a huge burden. Also the village is located in the forest cover, where there is a high chance for getting attacked by wild animals. Hence to create access to energy NERD Society of Coimbatore has installed a 100 m^3 biogas plant.

Horses carrying construction materials for the biogas digester

Project Description:

The village which comes under the Tiger reserve forest cover has 102 households and 450 cattle. Taking advantage of the huge cattle population a 100 m3 biogas plant was installed and commissioned in December 2009 which helps in meeting the energy requirements of the rural village.

There are two biogas digesters (35 m^3 and 65 m3) totaling to 100 m^3 and Fixed Dome Biogas technology is used. The approximate quantity of cattle dung (feedstock for biogas digester) available is 1.5 tonnes which is used partly for generation of electricity and the rest is used for cooking purposes. The calorific value of the cow dung is 2500 kCal/kg and that of biogas is 4800 kCal/m^3.

65 and 35 m^3 biogas digester

Gas Engine for m^3 biogas digester

Scrubber for purification of gas

The gas generated from the biogas digester is fed into a H_2S scrubber for purification and then supplied to a generator. A 15 kVA generator is used for generating electricity. The amount of power generated from the 100 m^3 biogas plant is 60 units / day. The electricity generated would meet the entire lighting needs of the village. The plant operates for 4 hours a day and 300 days in a year.

NERD Society of Coimbatore has also taken the lead to train a few villagers on the Operation and Maintenance aspects of Biogas plant at Tamilnadu Agricultural University. This has helped in skill development and capacity building for over 36 people in the village.

Community Mobilization at Thalingi Village

Technical Specifications:

Installed Capacity	100 m^3
Technology	Fixed Dome Biogas Plant.
Calorific value of cow dung and Biogas	C.V of cow dung = 2500 kCal/kg
C.V of Biogas = 4800 kCal/m^3	
Biomass feed stock	Cow dung
Feed stock consumed / day	1500 kg/d
Gas engine and capacity	12 kW generator, running with 100% biogas
Power Generation	60 units / day

Financials:

Project Cost	INR 1.2 million for 100 m^3 plant
Subsidy	INR 0.2 million
Payback Period	8 years
Savings through kerosene	INR 0.1 million / annum
Income from power generation	INR 0.09 million / annum

Benefits:

The project has following benefits;

- Access to modern amenities such as TV s, Grinders and Mixers for the village people
- Improvement in children's education as they can study in evening and night
- Around 450 people have been benefitted directly and indirectly through this initiative.
- Skill up-gradation & Employment generation for 36 people in the village.
- The amount of carbon emission reduction achieved is 21 Tonnes per annum

Dish Antenna installed in a tribal home at Thalingi village

Biogas power lighting a home in the un-electrified village

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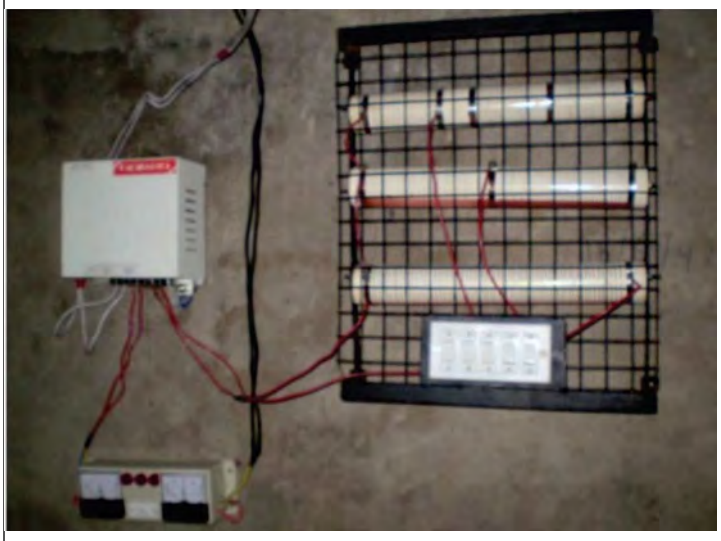
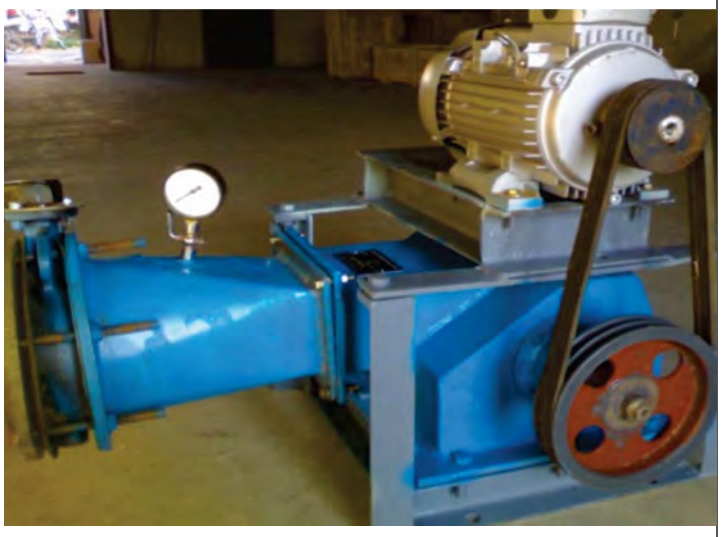
Pico-hydro
Technologies





3 kW Pico-hydro in Jodpal Hamlet, Karnataka

Background:

Access to energy is critical for economic development and poverty alleviation, as it promotes localized economic development through creation of livelihood opportunities beyond daylight hours, in addition to better health & education opportunities. Societal development cannot be achieved without access to reliable and affordable energy.

Jodpal village is an un-electrified tribal hamlet located near Madikeri, in the western part of Karnataka. People were using kerosene for lighting at a typical expense of INR 3,600 - 4,500 / annum per household. This is not only costly for the villagers but also poses health problems for children due to the fumes released by the kerosene lanterns.

The 3 kW Pico-hydro project was installed and commissioned in 2011 by Prakruti Renewable Power Pvt. Ltd. Similar systems have been installed in more than 600 un-electrified villages in Kerala, Maharashtra, Tamilnadu and Himachal Pradesh.

The site receives water from Thala-Cauvery which is a perennial stream originating from the Kodagu hills. Continuous water availability has ensured the success of this Pico-hydro project. The power generated is enough to meet the lighting and small commercial activities of the village.

Project Description:

The 3 kW power generation unit comprises of three essential components viz. the turbine, the generator and the electronic load controller. The water which flows from the stream is stored in a masonry tank at a head of 30 metre. This water flows down to the power generating unit by gravity through a nozzle and runs the turbine thus generating the electricity. The discharge rate of water is 7-8 litres/second from the tank and is measured using a pressure gauge attached to the discharge pipe. There is a gate valve at the end of the pen stock to control the flow of water to the unit. The type of turbine used is Micro-pelton with single jet and direct coupling mechanism. The generator is a three phase induction motor. The power generated is controlled using an Electronic Load Controller (ELC).

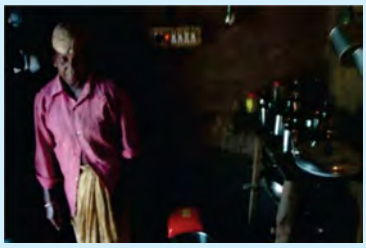
The system is designed to run 24 x 7 round the year based on the availability of water in the tank. The 3 kW system generates 24 units of AC power which is enough to meet the lighting needs of the village.

Technical Specifications:

Total Installed Capacity	3 kW
Head Height	30 M
Discharge rate	7-8 L/sec
Type of Generator	3 phase-induction motor
Type of Turbine	Micro pelton
Operational hours & days	24 & 365
Energy Generation	24 units / day
Monitoring & Status indication	Electronic Load Controller

Financials:

Project Cost	0.16 million per kW system
Subsidy	INR 0.11 million / kW
Payback Period	2 - 3 years
Savings through Kerosene	INR 0.1 million / annum



Modern amenities such as Grinder, Mixy, TV and Dish antenna installed in a tribal home located at an un-electrified zone in Karnataka.

Benefits:

The power generated from the Pico-hydro system caters to a population of more than 50 people in the tribal hamlet and provides the following benefits:

- Access to modern amenities such as TV s, Grinders and Mixers.
- Improvement in indoor air quality and consequent health benefits.
- Savings of INR 300 - 500 per month on kerosene for each family in the village.
- Creation on employment opportunities.
- Improvement in educational opportunities for children

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Renewable Energy Projects in CII - Sohrabji Godrej Green Business Centre

Supported By: Rockefeller Foundation

Partners: TARA, CII, dkinetics, Desi Power, Urja Pradan, Sambodhi Knowledge for change, SAIS

Smart Power for Environmentally Sound Economic Development

SPEED

The SPEED program aims to create a positive impact on the lives of poor rural communities in India through delivery of more affordable, reliable and clean energy services. This is expected to enhance the livelihood security and improve overall quality of life.

Confederation of Indian Industry

SPEED

In India, 42,000 villages are either un-electrified or de-elctrified and over 400 million people do not have access to electricity. This lack of access is a major inhibitor to achieving equitable growth and building resilience of poor and vulnerable communities.

Decentralized power production using renewable energy (RE) technology with assured demand, and parallel creation of a conducive environment for investment in sustainable rural electrification is the only holistic and realistic solution for village communities to secure their household and community energy needs within a reasonable timeframe.

By creating a first of its kind multi-dimensional, multi-partner program to attract private investment and mainstream sources of finance, the Rockefeller Foundation supported SPEED program seeks to harness the potential of smart business models to deliver electricity through decentralized renewable energy based power plants. The bulk of the power generated would cater to village lighting & entrepreneurial needs, and the rest of the power will be used to run mobile towers in the area.

On the basis of intensive research, analysis and practical action, SPEED has been designed to capitalize on the energy demand of the 320,000 telecom towers located in India which consume over 2 billion liters of diesel annually, second only to the Indian Railways. As the anchor load, this potential for usage of "green power" can play a crucial role in the viability of decentralized renewable energy based power projects and their eventual replication at scale.

Objectives of SPEED

- Integrate the demand for rural electrification with the growing energy needs of cell tower operators; thereby creating an opportunity for decentralized renewable energy solutions.
- Create a positive impact on the socio-economic development of rural communities and the environment as well
- Reduce the costs of mobile tower industry and demonstrate that Green makes good business sense.

Scope

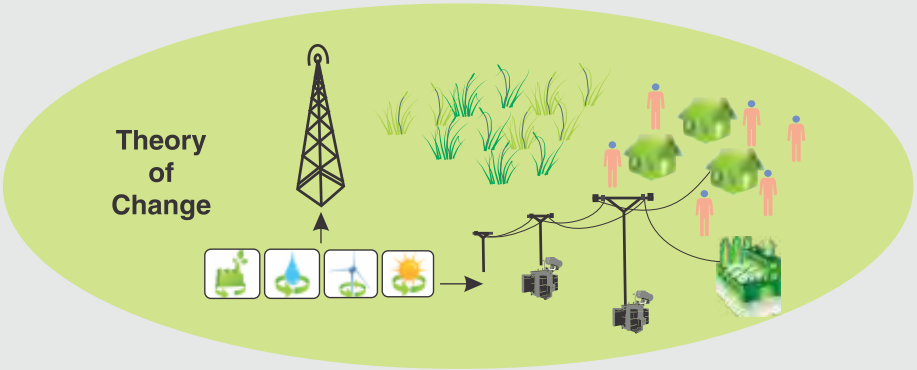
SPEED aims to create an ecosystem of key stakeholders to support the spread of scalable and sustainable business models, engage critical industry players, create financing models and promote favorable policies thus catalyzing socio-economic development and also reducing GHG emissions.

Business opportunity

SPEED will create an attractive business opportunity to all the stakeholders who wish to explore the latent market potential of rural India and thus play a key role in nation building.

Some of the key stakeholders who could significantly benefit from the project include:

- Rural Community & Enterprise
- Energy Service Companies (ESCO s)
- Telecom Tower Companies
- Technology manufacturers, suppliers and service providers
- Financial Institutions
- Government Agencies



Rural Community & Enterprise

Rural community would be key stakeholder and the major beneficiary.

As the project consolidates, access and availability to clean energy will become a reality and will accelerate socio-economic growth in rural communities. This will facilitate the development & progress of micro-enterprises, strengthening social infrastructure - schools, hospitals, computer centres, etc.

This project is expected to result in enhanced quality of life, improved healthcare facilities and enhanced livelihoods.

Smart Power for Environmentally Sound Economic Development

Energy Service Company (ESCO)

ESCO companies are the heart of the programme. They are one of the key stakeholders who will play an important role in setting up energy service companies in un-electrified and under-electrified regions of rural India. They have the unique advantage of entering an untapped rural market, which has a huge potential for de-centralized and distributed technologies.

ESCO s will have the following benefits in the project:

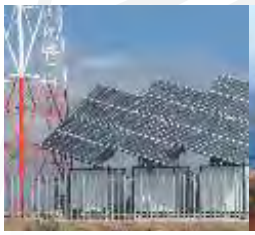
- Quick & easy startup of operations as the ecosystem and community development would be in place
- Opportunity to demonstrate viable rural energy business models and scale up rapidly across the country
- Support for load development in the village
- Policy facilitation support
- Support for capacity building of staff

Telecom Tower Companies

Telecom players have a pivotal role to play in this project. SPEED offers them access to clean energy to run their towers, thus providing them an opportunity to expand their network operation to remote rural areas.

Telecom tower companies can avail the following benefits:

- Reduced OPEX due to lower diesel consumption
- Reduced carbon footprint
- Security against escalating fuel costs
- Tax incentives
- CDM benefits



Technology Companies

Technology companies will provide the required hardware and know-how to set up the rural power plants and distribution network to enable energy access through renewable energy sources.

Technology companies can avail the following benefits:

- Opening up of new business opportunities
- Gateway into rural business

Financial Institutions

Significant business opportunity exists for financial Institutions under SPEED. The programme will provide them a unique platform to further enhance their portfolio in rural energy business investments which has a high potential for growth.

Financial Institutions can avail the following benefits:

- New business opportunity in the decentralized RE sector in rural areas
- Significant opportunities for Impact Investors across the globe that are seeking to invest in initiatives that create financial, social and environmental benefits
- Opportunity to establish special investment vehicles managed by suitable financial intermediaries who can identify, review and manage SPEED ecosystem investments

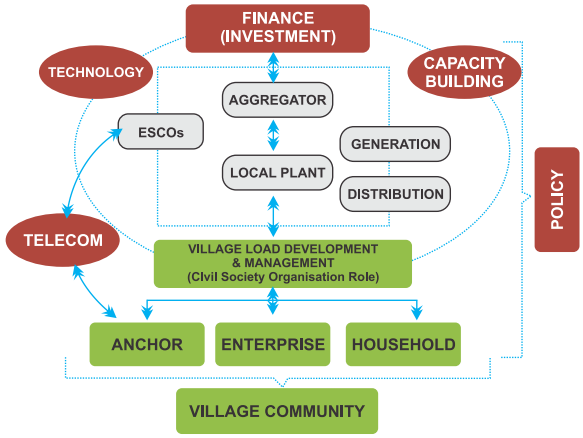
Government Agencies

Government is a key stakeholder for SPEED. This programme can facilitate Government, Nodal Agencies and other related departments to accelerate promoting the use of renewable energy sources and rural electrification.

Government can avail the following benefits:

- Engage private enterprises to leverage Government Polices and attract private capital, thereby creating a multiplier effect for Government capital
- Demonstrate a successful model of Public- Private-Community Partnership (PPCP) in promoting renewable energy technologies
- Facilitate India emerge as one of the global leaders in promoting renewable energy sources for sustained energy access and enhanced livelihoods for rural communities

SPEED FRAMEWORK



Clusters under development:

So far, the clusters that have been developed across the following 5 states in India:

- Bihar
- Jharkhand
- Chattisgarh
- Madhya Pradesh
- Uttar Pradesh

By 2014, SPEED will:

- Create an "ecosystem" of key stakeholders to support the spread of scalable and sustainable business models, engage critical industry players, creation of financing models and promotion of favorable policies
- At the local level, implement pilot projects in 50 villages that will demonstrate sustainability of the model and create conditions for its scaling up to 1000 villages thereafter

SPEED Partners

- CII – Sohrabji Godrej Green Business Centre
- cKinetics
- D.E.S.I. Power
- Professional Assistance for Development Action (PRADAN)
- Sambodhi Research & Communications
- Technology and Action for Rural Advancement (TARA)
- The Paul H. Nitze School of Advanced International Studies

About Us:

The Confederation of Indian Industry (CII) works to create and sustain an environment conducive to the growth of industry in India, partnering industry and government alike through advisory and consultative processes.

CII is a non-government, not-for-profit, industry led and industry managed organisation, playing a proactive role in India's development process. Founded over 117 years ago, it is India's premier business association, with a direct membership of over 7000 organisations from the private as well as public sectors, including SMEs and MNCs, and an indirect membership of over 90,000 companies from around 400 national and regional sectoral associations.

CII - Sohrabji Godrej Green Business Centre (CII - Godrej GBC) is one of the 10 Centres of Excellences of the Confederation of Indian Industry (CII).

CII-Sohrabji Godrej Green Business Centre offers advisory services to the industry in the areas of Green buildings, energy efficiency, water management, environmental management, renewable energy, Green business incubation and climate change activities.

The Centre sensitises key stakeholders to embrace Green practices and facilitates market transformation, paving way for India to become one of the global leaders in Green businesses by 2015.

For more information, please contact:

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Confederation of Indian Industry

WORLD RESOURCES INSTITUTE

Green Power Market Development Group - India

Green power for a sustainable energy future

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WORLD RESOURCES INSTITUTE

Green Power Market Development Group is a partnership between Confederation of Indian Industry (CII) and World Resources Institute (WRI) that works with large commercial and industrial energy consumers in India to rapidly scale up the use of renewable energy in the overall energy consumption. The group will promote this goal by sharing best practices and collaborating with government, technology providers and financiers to develop a stronger business case for diversifying the energy mix with clean energy.

CII, WRI and corporate members will work closely together to identify, evaluate, and pursue renewable energy opportunities. The group will be convened initially in Bangalore, Karnataka and will focus its activities in the surrounding region. The success would be replicated in other states and regions across India.

- The group will engage in conversation with renewable energy project developers, electricity suppliers, and policy makers around new / innovative purchasing strategies, new / innovative technologies, policy barriers and potential solutions to barriers
- The group will identify barriers to clean energy solutions, and public policies that help overcome challenges to corporate use of renewable energy. The group will interact with decision makers in regulatory bodies and government agencies to discuss these concerns and solutions.
- The Group will meet at least thrice annually to learn and share from CII, WRI, other participants and guest experts about renewable energy markets, technologies, products, economics, incentives and providers
- In Partnership with CII, WRI, and other members, companies will have an opportunity to evaluate and pursue renewable energy projects between Group meetings
- Partners will share "on-the-ground" renewable energy procurement experiences, strategies, innovative financing approaches, and lessons learned. Members will be covered by a mutual non-disclosure agreement.
- Member Companies will have the opportunity to aggregate partner demand to capture purchasing economies of scale
- Member Companies will be able to share analytical tools for evaluating financial and environmental parameters of green power projects
- Individual members can use shared knowledge and experiences to develop internal business cases for green power

Confederation of Indian Industry

WORLD RESOURCES INSTITUTE

How do members derive value from the group?

Once an organization joins the group, it would enjoy many benefits that the partnership can offer, including:

- Accelerated learning about green power markets, technologies and products
- Opportunities to aggregate purchases and collaborate with peers to scale approaches that reduce costs
- Access to network of corporate energy and environment managers experienced at pursuing green power opportunities
- Technical assistance in evaluating green power projects
- Lessons learned and innovative strategies shared by member companies
- Timely information about green power products, suppliers and incentives
- Information about new green power projects
- Public recognition for green power purchases and investments
- Access to global best practices and network
- Brand image and reputation

About us

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The Confederation of Indian Industry (CII) works to create and sustain an environment conducive to the growth of industry in India, partnering industry and government alike through advisory and consultative processes.

CII - Sohrabji Godrej Green Business Centre (CII Godrej GBC) is one of the 10 Centres of Excellence of CII which offers advisory services to the industry in the areas of Green buildings, Renewable Energy, Energy Efficiency, Water Management, Environmental Management, Green Business Incubation and Climate Change activities.

To facilitate private investments in Renewable Energy sector, CII Godrej GBC has formed an exclusive Council on Renewable Energy. The Council with the support of all stakeholders conducts Feasibility Studies, Demonstration Projects, Training Programs, Green Power Conference & Exposition and Investor Meets.

WORLD RESOURCES INSTITUTE

The World Resources Institute is an environmental think tank that goes beyond research to create practical ways to protect the Earth and improve people's lives. Our mission is to move human society to live in ways that protect Earth's environment for current and future generations.

The Green Power Market Development Group – India

Green Power Market Development Group – India is an industry-led initiative to scale up Indian green energy market by devising innovative approaches that rapidly increase the share of renewable energy in the overall energy consumption of commercial and industrial establishments. This will be accomplished by addressing the policy and market barriers that currently impede the growth of renewable energy sector. GPMDG will closely work with Government and other relevant institutions to help member companies set and achieve their renewable energy goals.

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