MNRE

SOLAR WATER HEATER CASE STUDIES BOOKLET

INTERNATIONAL COPPER PROMOTION COUNCIL (INDIA)

FOREWORD

The 20 th (Twentieth) Century was considered as the Knowledge Century when many scientific inventions and discoveries took place. We consider the 21 st (Twenty first) Century as the 'Century for Energy' as the requirement of Energy keeps on increasing day by day.

We, in India, are fortunate to get Sunshine for almost 280 days in a year in most parts of the country. The country has an average sun insolation of 4.5 to 6.5 KWh /Sq.m / day. This translates into a technical potential of approximately 45 million Sq.m of Solar Collector area. As on date, (2012) the Solar Water Heater Industry has been able to install up to approximately 6 million Sq.m of Solar Collectors. Solar Water Heater has a maximum conversion rate of the solar irradiance into useful energy.

The Solar Water Heater Industry is geared to achieve the target of 20 million Sq.m of Solar Collectors by 2022 as mandated by JNNSM. The Industry has attracted new entrepreneurs which has strengthened the supply chain. It has made technological advancements in Designing & Manufacturing processes of Solar Water Heating Systems. There is increased availability of trained manpower for installation of such Systems.

There have been consistent efforts from Ministry of New & Renewable Energy (MNRE), Government of India. MNRE has provided BIS Standards for Flat Plate Collectors, Technical Specifications for Evacuated Tube Collectors & guidelines for complete Solar Water Heating Systems. It has also provided guidelines for Raw Materials, Design, Manufacturing, & Installation.

Global Solar Water Heater Market Transformation Project of UNDP / GEF in partnership with MNRE & International Copper Promotion Council (India), ICPCI in India was taken up since 2009. This Project has provided impetus in all directions.

Hence, as a part of this Project ICPCI has commissioned to compile sample cases in the form of a booklet and release the same.

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International Copper Promotion Council (India)

Place : Mumbai
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INTRODUCTION

In this situation, it is our moral duty to not to use any type of conventional fuel and avail Solar Thermal Energy available abundantly from SUN free of cost for Hot Water applications.

It is understood that end users should be informed about some successful installations in various sectors while highlighting application efficacy; advantages; Payback periods etc. This will instill confidence in prospective end users. Moreover, purpose of increasing awareness in use of Solar Water Heaters would be served by show casing successful applications.

Solar Water Heaters are becoming popular & useful for providing Hot Water for bathing purposes. In Domestic Sector, apart from thousands of regular systems (readily & off the shelf available 100 to 500 Litres per day types) tailor made Systems have been installed in high rise buildings with acceptable results.

For Institutional, Commercial & Hospitality sectors Solar Water Heating systems having large capacities (in thousands of Litres per day) have been designed & installed. Similarly, Solar Water Heating Systems have found increasing acceptance in Industrial applications.

Due to increasing costs of Electricity and alternate fuels, the Payback periods for such systems have also fallen to acceptable and comfortable levels.

This booklet consists of compilation of some of the sample stories of Solar Water Heater Installation from various sectors. The objective is to cover as many as sectors & applications as possible.

We acknowledge contributions made by those Manufacturers who provided data for their Case Studies. Special mention is made for Mr.R.S.Sethuraman of M/s Solar Hi Tech Geysers, Bangalore for his valuable inputs.

TECHNOLOGY

Two types of Solar Collectors are used for assembly of Solar Water Heating Systems viz.

1. *Flat Plate Collector, commonly known as FPC*
2. *Evacuated Tube Collector, commonly known as ETC*

Each type of Solar Collector has got its advantages / disadvantages based on

- *Standards / Technical specifications*
- *Application*
- *Quality of water*
- *Ambient temperature & conditions*
- *Temperature of Hot Water available*
- *System Efficiency*
- *Cost*
- *Robustness*

Most commonly available, Flat Plate Collector is of 1 x 2 metre size i.e., 2 square metre Collector area. It is expected to provide approximately 100 (One Hundred) Litres of hot water per day at temperatures up to 80 deg.C.

On the other hand, Evacuate Tube Collectors come in different sizes i.e., collector areas are based on number and sizes of tubes used. Moreover, the systems are made either tube-in-tank – integrated tank – type or manifold & tank type). It is generally available with 1.5 square metre Collector area (depending upon manufacturers).

This basic Collector, either FPC or ETC type, is then assembled with Hot Water Tank, Top & Bottom Header etc. to form a Standard Solar Water Heater System to provide designed quantity of hot water per day at the required temperature.

These systems are then coupled in series or parallel or a combination of both series & parallel to provide higher capacity systems. These Systems are further classified as Thermo siphon & Forced Flow Systems. There are more variations & combinations possible.

These systems are further custom designed to match site requirements.

BRIEF ON SECTORS

A. Non Industrial

The end user of Hot water ***for bathing purposes in Domestic & other sectors*** *does not immediately get attracted to Solar Water Heaters due to various perceived reasons & assumptions including the following:*

- *lack of general awareness*
- *higher initial purchase price*
- *inadequate information on manufacturers*
- *installation, commissioning & after sales service*
- *perceived long payback periods*

Here, ***it may please be appreciated*** *that*

- *Marketing efforts have increased*
- *initial purchase price has become competitive*
- *Very low or no operating costs*
- *Require minimum maintenance*
- *payback periods are around 36 months*
- *Many Municipal Corporations & Local Urban bodies recommend use of Solar Water Heaters*
- *State Nodal Agencies & Renewable Energy Departments offer assistance*
- *Government is providing approx. 30 % subsidy at the time of purchase*

1. Domestic

1.1 Residential / Individual Households

Nearly eighty percent of the existing Solar Water Heating Systems at present are installed in this segment. The several fold increase in installations in this sector is largely due to

- *change in life style of the people particularly in tier 1 cities;*
- *hot water utilization habits of people;*
- *all year weather conditions in some parts of the country;*
- *increasing cost of electricity and other conventional fuels;*
- *availability of 30% Purchase Price subsidy upfront from MNRE;*
- *guidelines from State Nodal Agencies for installations;*
- *Concessions & Mandatory regulations from local urban bodies;*
- *Renewable energy efforts from some State Governments;*
- *Efforts of MNRE in creating increased awareness*

While these installations at present are concentrated in parts of Karnataka & Maharashtra & scattered in other places, these are catching up in other parts of the country too.

This sector is addressed to by most of the manufacturers of Solar Water Heating Systems who are aware of this growing market segment. They are spreading marketing network with efficient Dealers and trained manpower to provide pre sales support and after sales service.

Just to give an idea of the potential in this sector we mention that the number of urban households only in Tier 1 cities is as under :

Household Income (Rs/Year)*	Number of Households*
10-50 lakh	280,000
50 lakh-1 crore	200,000
1-5 crore	120,000-150,000

*(*Data from http://www.indiabiznews.com/?q=node/1285)*

The above statistics make the affordable households 630,000 and taking an average of four members per household 157,500 families. Considering 4 sq.mtrs (200 LPD) per family, this sector itself makes the potential to 0.63 million sq.mtrs. Part of this shall be accommodated in high rise buildings too. Since the 6 major cities are considered in to this classification, one can judge the real potential taking around 54 nos. tier 2 cities and other towns and minor towns.

1.2 High Rise Buildings

As compared to the systems for individual households, the application in this sector needs to address some special issues viz.,

- *heat loss in hot water pipes while reaching apartments from top* –
  This aspect is addressed by i) adapting proper insulation on the pipeline; ii) using circulation pumps intermittently for evacuation of cold water stored in pipe line; & iii) using proper sensors and electronic controls.

- *availability of equitable quantity of hot water to all*
  This aspect is addressed by incorporating suitable solenoid valves, flow measurements and electronic controls for supply of pre designed fixed quantities of hot water to each apartment

- *Guaranteed supply of hot water even during non-sunny days* –
  This aspect is addressed by using back up heating systems in nights during non-sunny days.

- *space shortage for installations on roof*
  This needs special attention during designing stage of the systems

- *architectural & aesthetic challenges*

This can be addressed during building design stage itself by architects and builders while maintaining building by-laws and also by incorporating renewable energy as one of the subjects in the curriculum.

The growth in the requirement of Solar Water Heating Systems in this sector is expected to be astronomical. Though, it would be tough to project estimates in this sector, it is expected that, the requirement in this sector combined with individual households, shall surpass many times the combined estimates of projected requirements of all industrial applications put together (mentioned later in ensuing pages).

1.3 Offices & Commercial Institutions

This sector also has the same difficulty like high rise buildings. In this mainly the focus can be on the educational Institutions which caters for students hostels for schools and colleges. Presently all the residential schools and most of the colleges in India has hostels for students accommodating 1000s of students. All these are required to be provided with hot water facility not only for bathing purposes but also for cooking and washing facilities in canteens. But considering the increase in thrust in this sector by Govt. & private entities, this is also an ever growing one and the requirement of SWH is also immense and can be well compared with the high rise buildings.

Being a multi religion country in additions to this there are several pilgrimage centers where the accommodation is provided to the yathris and devotees by the respective institutions. These centers too have great potential for installing SWH which will be light on the purse of the managements to maintain and to offer a better service to the occupants. Manu such institutions are also capable of raising funds to meet the capital cost of installing the SWH by means of charities and donations.

Also, recently, after the IT revolution, many reputed IT companies are running their own hostels for their employees and their in house training centers.

2. Hospitality

2.1 Hotels & Paying Guest accommodations.

This is one of the biggest and most demanding sectors with respect to Solar Water Heater applications. This sector consumes Electricity & conventional fuel in very large quantities to provide Hot Water. While individually, the Electricity / conventional fuel consumption for providing Hot water may be small as a percentage of the total Energy bill, collectively, taking into consideration, all hotels spread across different star ratings all over the country; it makes a big impact on energy scenario. The impact would be more severe if we include many small and medium hotels which do not fall under any star ratings.

The country, currently has over 200,000 hotel rooms spread across hotel categories and guest-houses while projecting estimated shortfall of over 100,000 rooms (source: FHRAI). The country is witnessing an unprecedented growth in hotel constructions and will be adding almost 114,000 hotel guest rooms to its inventory over the next five years. (source: HVS)

The requirement of Hot water is estimated at 100 Litres per day per double occupancy room. Going by this benchmark, this translates to 0.40 million sq.mtrs of collector area to meet the present needs and 0.22 million sq. mtrs of Collector area to meet the future needs. This includes only the standard/premium hotels. If other category of smaller and budget hotels is also included, requirement of Collector area shall be further increased.

In the changing times, in most of the tier 1 & tier 2 cities, paying guest accommodation facilities have come up for individuals be they students or working people. The accommodation capacity varies from housing 20/30 inmates to 100/150 inmates. Their Hot water needs are also currently addressed by Electricity or conventional fuels. Due to increasing costs, some of these accommodation facilities are turning towards Solar Water Heating Systems and others are expected to follow suit.

Here, the application challenges are a mix of those encountered in individual households and high rise buildings, apart from Hotel specific issues.

2.2 Hospitals

As per National Health Profile 2010, there are 12,760 hospitals having 576,793 beds in the country. 6,795 hospitals are in rural area with 149,690 beds and 3,748 hospitals are in urban area with 399,195 beds. (Rural and Urban bifurcation is not available for the States of Bihar and Jharkhand)

It is estimated (and as per Karnataka Renewable Energy policy) that 100 Litres of Hot water per day per three beds is required. Going by this benchmark the total solar collector area required in this sector alone shall be 0.40 million sq. mtrs.

Also, for hospitals it has become a necessity to provide hostels for nurses and other working staff, which are located either within or outside the hospital premises. So, there would be an additional requirement of Collector area in order to meet the needs of Hot water for such Hostels.

2.3 & Hostels & Commercial

This sector includes Hostels attached to Schools, Colleges, Educational Institutions, Private/Corporate/Government training centres, Religious estates, Defence establishments etc. All these Hostels require Hot water for bathing, house cleaning & laundry purposes apart from cooking and washing applications in canteen/kitchen facilities.

Here, the application challenges are a mix of those encountered in individual households and high rise buildings. The other issues are different from those applicable in Hotels.

B. Industrial Sectors

*The end user of Hot water **for use in different applications in Industrial sectors** does not immediately get attracted to Solar Water Heaters due to various perceived reasons & assumptions mentioned above & also the following:*

- *issues of requisite temperature for required quantity*
- *integration with process equipment*
- *coordination with other sources of hot water*
- *reluctance to wait till payback period is over*

*Here, **it may please be appreciated** that*

- *Payback periods are now attractive*
- *Competitive initial purchase price*
- *Skilled System Integrators are available*
- *Available manufacturers with technical manpower*

We have listed below few sectors in India, where these devices can be successfully installed and the potential areas in each sector. If these potentials are exploited and carried out the saving quantum of conventional energy and fossil fuels shall be huge.

Some of the areas where good number of Solar Water Heating System installations has taken place are:

- *Dairy*
- *Textile processing Industry*
- *Rice Mill*
- *Pharmaceutical*
- *Sea food Industry*
- *Chemical Industry*
- *Auto Component, including Electro plating*
- *Breweries*

Apart from the above there are many other industries, which require hot water, viz., Soaps & Detergent industry; Tyre Industry; Vegetable Oil Mills & Solvent extraction. There are few examples of installations of Solar Water Heating Systems in these industries as well.

We reproduce data from a market assessment study

Market Assessment of SWH systems in Industrial Sector

Collector Area in Sq.Mtrs *

Type of Industry	*FY-2013*	*FY-2017*	*FY-2022*
Dairy	*39520.18*	*100508*	*192505.8*
Paper & Pulp	*10078.72*	*27934.12*	*60098*
Textile Processing	*78929.79*	*226229.7*	*509926.6*
Rice Mill	*11331.81*	*28264.38*	*52769.44*
Pharmaceutical	*102247.5*	*253475.4*	*469474.5*
Sea food Industry	*17751.28*	*44006.11*	*81505.92*
Chemical	*17673.57*	*51735.55*	*120111*
Auto Component & Electroplating	*19515.25*	*80683.44*	*193304*
Breweries	*8124.213*	*23187.97*	*51960.18*
Total	***305172***	***836025***	***1731656***

** Ref:"Final Report of Solar Water Heating Systems in Industrial Sectors" by ABPS Infrastructure Advisory Pvt.Ltd.*

We have also tried to show case studies of some of the installations in respective sectors with all available data.

Conclusion :

In following pages the case studies of several SWH installations are show cased which are self explanatory.

We are confident that these case studies shall be a convincing booster and encourage many potential users of SWH in taking quick decisions to adapt to this matured and proven renewable energy device which is cost effective and have a lowest pay back period. Also increase in number of such installations will not only reduce considerable amount of expenditure, every year during the life time of the device, to the users but also save huge amount to the nation's wealth too by conservation of conventional fuels , reduce the polluting carbon emission and ultimately save the nature for our future generations. We sincerely believe that all the users of hot water and steam shall join hands with our efforts who can also be proud partners in our small efforts to achieve the goal and shall also have their personal satisfaction of their individual contribution to our generations to come.

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LIST OF CASE STUDIES

Case Study No.	SECTOR	USER	Manufacturer	CAPACITY LPD	ANNUAL SAVINGS in INR
RES -1	RESIDENTIAL	A B C Construction, Vijayawada	Emmvee Solar	15,000	10,98,000
RES -2	RESIDENTIAL	Alien Developers, Hyderabad	Emmvee Solar	70,000	51,26,400
RES -3	RESIDENTIAL	ETA Constructions, Bengaluru.	Emmvee Solar	1,00,000	73,24,200
RES -4	RESIDENTIAL	Golgen Tower, Erode	Sudharshan Saur	1,500	73,000
RES -5	RESIDENTIAL	HUDA Housing society, Gurgaon	Inter solar	32,000	18,20,000
RES -6	RESIDENTIAL	Paramount Properties, Pune	Sudharshan Saur	12,500	4,65,000
RES -7	RESIDENTIAL	Renaissance Prk III, Bengaluru	Solar Hitech Geysers	12,000	8,78,000
RES -8	RESIDENTIAL	Karnataka Police Housing, Karnataka	Emmvee Solar	2,00,000	146,50,000
RES-9	RESIDENTIAL	Happy Valley Bldg, Thane	Sun Zone SolarSystems	9,000	6,58,800
RES-10	RESIDENTIAL	Ambavane Associates	Sun Zone SolarSystems	10,500	7,68,600
Hosp-1	Hospital	Fr.Muller, Mangalore	Emmvee Solar	65,000	47,61,000
Hosp-2	Hospital	M S Ramaiah Hospital, Bengaluru	Emmvee Solar	50,500	36,99.000
Hosp-3	Hospital	Palakulath Hospital, Ernakulam	Emmvee Solar	12,000	8,78,000
Hosp-4	Hospital	Yashoda Hospital, Hyderabad	Emmvee Solar	32,500	23,70,000
Hotel 1	HOTEL	Fountain Hotel,Mahabaleswar	Emmvee Solar	30,000	10,98,000
Hotel 2	HOTEL	Hotel City Mark, Gurgaon	Inter solar	6,000	2,75,000
Hotel 3	HOTEL	Hotel Park Premier, Gurgaon	Emmvee Solar	3,000	2,75,000
Hotel 4	HOTEL	Sai Thirumala Constructions, Hyderabad	Emmvee Solar	24,000	17,56,000
Hotel 5	HOTEL	Sri Sai Venkateswara, Tiripathi	Solar Hitech Geysers	4,000	2,93,400
Hotel 6	HOTEL	Hotel Sindu international,	Solar Hitech Geysers	2,000	1,45,800

		Tirupathi			
Inst-1	Guest House	Kaustubham Guest House, Tirumala	Photon Energy	30,000	29,66,000
Inst-2	Hostel	IIT Roorkee	Photon Energy	98,400	97,31,000
Inst-3	Hostel	North Maharashtra University	Sudharshan Saur	18,000	9,40,000
Inst-4	Yathri centre	Ozar Ganapati Sansthan, Pune	Sudharshan Saur	12,000	8,25,000
Inst-5	Hostel	Collecge of Engg. Roorkee	Sudharshan Saur	10,000	5,94,000
Inst-6	Pilgrim centre	Sri Gajanan Maharaj Sansthan, Shegaon	Sudharshan Saur	53,500	36,67,000
Inst-7	Hostel	Vellore Institute of Technology, Chennai	Emmvee Solar	30,000	21,96,000
Inst-8	Hostel	Knowledge City Education P.Ltd.,	Sun Zone SolarSystems	13,125	9,61,200
Indl-1	Industries	Aavin, Tirunelveli	Photon Energy	15,000	19,09,000
Indl-2	Industries	Accenture Services,Chennai & Hyderabad	Emmvee Solar	20,000	14,63,000
Indl-3	Industries	Chelsea Textile, Gurgaon	Inter solar	50,000	20,02,000
Indl-4	Industries	FORD India, Chengalpattu	Sudharshan Saur	20,000	11,32,000
Indl-5	Industries	MILMA Dairy, Palakad.		60,000	39,75,000
Indl-6	Industries	Sona Koyo, Chennai	Solar Hitech Geysers	35,000	11,36,000

SECTOR : NON INDUSTRIAL - RESIDENTIAL

CASE STUDY - RES 1

Name & Address of Client	ABC Construction, Vijayawada. AP
System Capacity	15000 LPD
Type of Collector	FPC
Type of circulation	Thermo siphon
Final Temperature	60^{o}C
Use of Hot water	Hot water for bath rooms
Cost of the Project	NA
Year of Installation	2011
Fuel used before SWH system	Electric Geysers
Total savings per annum	10.98 lakhs
Payback period	
Name of Manufacturer	Emmvee Solar Systems Pvt.Ltd, Bangalore-560024. Email: info@emmvee.in

Economy Calculations:

Details	Value	Units
Inlet Temperature	25	°C
Outlet Temperature	60	°C
Quantity of Water	15000	LPD
Temperature Difference	35	°C
Heat Input required	525000	KCals/Day
Calorific Value of 1 KWH of Electricity	860	KCal
Electricity Consumption per day	610	KWh
Electricity Consumption per annum (300 days)	183000	KWh
Cost of Electricity	6	Rs./KWh
Total Savings per year	1098000	Rs.

Payback Calculation:

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	NA	NA	1098000	
Second Year		0	1098000	
Pay Back Period :				

CASE STUDY - RES 2

Name & Address of Client	Alien Developers, Hyderabad. AP
System Capacity	70000 LPD
Type of Collector	FPC
Type of circulation	Thermo siphon
Final Temperature	60°C
Use of Hot water	Hot water for bath rooms
Cost of the Project	NA
Year of Installation	2008 & 2009
Fuel used before SWH system	Electric Geysers
Total savings per annum	51.26 lakhs
Payback period	
Name of Manufacturer	Emmvee Solar Systems Pvt.Ltd, Bangalore-560024. Email:info@emmvee.in

Economy Calculations:

Details	Value	Units
Inlet Temperature	25	°C
Outlet Temperature	60	°C
Quantity of Water	70000	LPD
Temperature Difference	35	°C
Heat Input required	2450000	KCals/Day
Calorific Value of 1 KWH of Electricity	860	KCal
Electricity Consumption per day	2848	KWh
Electricity Consumption per annum (300 days)	854400	KWh
Cost of Electricity	6	Rs./KWh
Total Savings per year	5126400	Rs.

Payback Calculation:

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	NA	NA	5126400	
Second Year		0	5126400	
Pay Back Period :				

CASE STUDY - RES 3

Name & Address of Client	ETA Constructions, Bengaluru. Karnataka
System Capacity	100000 LPD
Type of Collector	FPC
Type of circulation	Thermo siphon
Final Temperature	60°C
Use of Hot water	Hot water for bath rooms
Cost of the Project	NA
Year of Installation	2009
Fuel used before SWH system	Electric Geysers
Total savings per annum	73.24 lakhs
Payback period	
Name of Manufacturer	Emmvee Solar Systems Pvt.Ltd, Bangalore-560024 Email: info@emmvee.in

Economy Calculations:

Details	Value	Units
Inlet Temperature	25	°C
Outlet Temperature	60	°C
Quantity of Water	100000	LPD
Temperature Difference	35	°C
Heat Input required	3500000	KCals/Day
Calorific Value of 1 KWH of Electricity	860	KCal
Electricity Consumption per day	4069	KWh
Electricity Consumption per annum (300 days)	1220700	KWh

Cost of Electricity	6	Rs./KWh
Total Savings per year	7324200	Rs.

Payback Calculation:

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	NA	NA	7324200	
Second Year		0	7324200	
Pay Back Period :				

CASE STUDY - RES 4

Name & Address of Client	**Golden Tower, Erode, Tamilnadu**
System Capacity	1,500 LPD
Type of Collector	ETC
Type of circulation	Thermo siphon
Final Temperature	60°C
Use of Hot water	Hot water for bath rooms
Cost of the Project	Rs.1.40 lakhs
Year of Installation	2011-12
Fuel used before SWH system	Electric Geysers
Total savings per annum	Rs.0.73 Lakhs
Payback period	**1 year & 11 months**
Name of Manufacturer	Sudharshan saur, Aurangabad office@sudarshansaur.com

Economy Calculations:

Details	Value	Units
Inlet Temperature	25	°C
Outlet Temperature	45	°C
Quantity of Water	1500	LPD
Temperature Difference	20	°C
Heat Input required	30000	KCals/Day
Calorific Value of 1 KWH of Electricity	860	KCal
Electricity Consumption per day	35	KWh
Electricity Consumption per annum (300 days)	11200	KWh
Cost of Electricity	6.5	Rs./KWh
Total Savings per year	72800	Rs.

Payback Calculation:

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	140000	0	72800	67200
Second Year	67200	0	72800	-5600
Pay Back Period : 1 Year & 11 months				

CASE STUDY - RES 5

Name & Address of Client	HUDA Housing Society, Sector 43, Gurgaon

System Capacity	32000 LPD
Type of Collector	FPC
Type of circulation	Thermo siphon
Final Temperature	60°C
Use of Hot water	Hot water for bath rooms
Cost of the Project	71.00 lakhs
Year of Installation	2008
Fuel used before SWH system	Electric Geysers
Total savings per annum	18.20 lakhs
Payback period	**3 Year & 6 months**
Name of Manufacturer	Inter solar pvt. ltd, Chandigarh Email: info@intersolarsystems.com

Economy Calculations:

Details	Value	Units
Inlet Temperature	25	°C
Outlet Temperature	60	°C
Quantity of Water	32000	LPD
Temperature Difference	35	°C
Heat Input required	1120000	KCals/Day
Calorific Value of 1 KWH of Electricity	860	KCal
Electricity Consumption per day	1302	KWh
Electricity Consumption per annum (233 days)	303366	KWh
Cost of Electricity	6	Rs./KWh
Total Savings per year	1820196	Rs.

Payback Calculation:

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	71,00,000	8,00,000	1820196	44,79,804
Second Year	44,79,804	0	1820196	26,59,608
Third Year	26,59,608	0	1820196	8,39,412
Fourth Year	8,39,412	0	1820196	-9,80,784
Pay Back Period : 3 Year & 6 months				

CASE STUDY - RES 6

Name & Address of Client	**PARAMOUNT PROPERTIES, PUNE**
System Capacity	12500 LPD
Type of Collector	ETC
Type of SWH	Thermo siphon
Final Temperature	60°C
Use of Hot water	Bathing.
Cost of the Project	Rs.8.76 lakhs
Year of Installation	2011-12
Fuel used before SWH system	Electricity
Total savings per annum	Rs.4.65 Lakhs
Payback period	**1 year & 11 months**
Name of Manufacturer	Sudharshan saur, Aurangabad office@sudarshansaur.com

Economy Calculations:

Details	Value	Units
Inlet Temperature	25	°C
Outlet Temperature	45	°C
Quantity of Water	12500	LPD
Temperature Difference	20	°C
Heat Input required	250000	KCals/Day
Calorific Value of 1 KWH of Electricity	860	KCal

Electricity Consumption per day	291	KWh
Electricity Consumption per annum (320 days)	93120	KWh
Cost of Electricity	5	Rs./KWh
Total Savings per year	465600	Rs.

Payback Calculation:

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	876600	0	465600	411000
Second Year	411000	0	465600	-54000
Pay Back Period : 1 Year & 11 months				

CASE STUDY - RES 7

Name & Address of Client	Renaissance PARK-III Apartments Renaissance Holdings (Promoters), 17th Cross, Malleswaram, Bangalore-560055
System Capacity	12000 LPD (6 X 2000 LPD)
Type of Collector	ETC
Type of circulation	Thermo siphon
Final Temperature	60°C
Use of Hot water	Hot water for bath rooms
Cost of the Project	Rs. 19.50 lakhs
Year of Installation	2009
Fuel used before SWH system	New installation (Electric Geysers)
Total savings per annum	Rs.8.78 Lakhs
Payback period	**2 years & 2 months**
Name of Manufacturer	Solar Hitech Geysers, Bangalore Email: solarhitech@gmail.com

Economy Calculations:

Details	Value	Units
Inlet Temperature	25	°C
Outlet Temperature	60	°C
Quantity of Water	12000	LPD
Temperature Difference	35	°C
Heat Input required	420000	KCals/Day
Calorific Value of 1 KWH of Electricity	860	KCal
Electricity Consumption per day	488	KWh
Electricity Consumption per annum (300 days)	146400	KWh
Cost of Electricity	6	Rs./KWh
Total Savings per year	878,400	Rs.

Payback Calculation:

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	1,950,000	0	878,400	1,071,600
Second Year	1,071,600	0	878,400	193,200
Third Year	193,200	0	878,400	-685,200
Pay Back Period : 2 Years & 3 months				

CASE STUDY - RES 8

Name & Address of Client	Karnataka State Police Housing Corporation, (Across Karnataka) 60 locations
System Capacity	200000 LPD
Type of Collector	FPC
Type of circulation	Thermo siphon
Final Temperature	60^{o}C
Use of Hot water	Hot water for bath rooms
Cost of the Project	NA
Year of Installation	2009,2010, 2011, 2012
Fuel used before SWH system	Electric Geysers
Total savings per annum	146.50 lakhs
Payback period	
Name of Manufacturer	Emmvee Solar Systems Pvt.Ltd, Bangalore-560024

Economy Calculations:

Details	Value	Units
Inlet Temperature	25	^{o}C
Outlet Temperature	60	^{o}C
Quantity of Water	200000	LPD
Temperature Difference	35	^{o}C
Heat Input required	7000000	KCals/Day
Calorific Value of 1 KWH of Electricity	860	KCal
Electricity Consumption per day	8139	KWh
Electricity Consumption per annum (300 days)	2441700	KWh
Cost of Electricity	6	Rs./KWh
Total Savings per year	14650200	Rs.

Payback Calculation:

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	NA	NA	14650200	
Second Year		0	14650200	
Pay Back Period :				

CASE STUDY - RES 9

Name & Address of Client	HAPPY VALLEY BLDG., Thane.
System Capacity	1125 LPD X 8 = 9000
Type of Collector	ETC
Type of circulation	Thermo syphon
Final Temperature	60° ℃
Use of Hot water	APPARTMENT
Cost of the Project	1512000/-
Year of Installation	Feb - 2012
Fuel used before SWH system	Electricity
Total savings per annum	6.59 lakhs
Payback period	**1 Year & 10 months**
Name of Manufacturer	SUN ZONE SOLAR SYSTEMS., Bangalore e-mail: sunzonesolar56@yahoo.co.in

Economy Calculations:

Details	Value	Units
Inlet Temperature	25	°C
Outlet Temperature	60	°C
Quantity of Water	9000	LPD
Temperature Difference	35	°C
Heat Input required	315000	KCals/Day
Calorific Value of 1 KWH of Electricity	860	KCal
Electricity Consumption per day	366	KWh
Electricity Consumption per annum (300 days)	109800	KWh
Cost of Electricity	6	Rs./KWh
Total Savings per year	658800	Rs.

Payback Calculation:

Year	Investment cost	MNRE	Energy	Carry

	(Rs.)	subsidy (Rs.)	savings (Rs.)	forward (Rs.)
First Year	1512000/-	324000/-	658800	529200
Second Year	529200/-	0	658800	-129600
Pay Back Period : 1 Year & 10 months				

CASE STUDY - RES 10

Name & Address of Client	Ambavane Associates
System Capacity	1500 LPD X 5 +1000 LPDX3= 10500
Type of Collector	FPC
Type of circulation	Thermosyphon
Final Temperature	60^{o}C
Use of Hot water	Bathing
Cost of the Project	1214286/-
Year of Installation	May - 2012
Fuel used before SWH system	Electricity
Total savings per annum	7.68 lakhs
Payback period	**1 year & 2 months**
Name of Manufacturer	SUN ZONE SOLAR SYSTEMS., Bangalore e-mail: sunzonesolar56@yahoo.co.in

Economy Calculations:

Details	Value	Units
Inlet Temperature	25	°C
Outlet Temperature	60	°C
Quantity of Water	10500	LPD
Temperature Difference	35	°C
Heat Input required	367500	KCals/Day
Calorific Value of 1 KWH of Electricity	860	KCal
Electricity Consumption per day	427	KWh
Electricity Consumption per annum (300 days)	128100	KWh
Cost of Electricity	6	Rs./KWh
Total Savings per year	768600	Rs.

Payback Calculation:

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	1214286/-	364286/-	768600/-	81400/-
Second Year	81400/-	0	768600/-	-687200/-
Pay Back Period : 1 year & 2 months				

SECTOR : NON INDUSTRIAL - HOSPITALS

CASE STUDY - HOSP 1

Name & Address of Client	Fr.Muller, Mangalore, Karnataka
System Capacity	65000
Type of Collector	FPC
Type of circulation	Thermo siphon
Final Temperature	60^{o}C
Use of Hot water	Hot water for bath rooms
Cost of the Project	NA
Year of Installation	2007. 2008, 2009, 2010
Fuel used before SWH system	Electric Geysers
Total savings per annum	47.61 lakhs
Payback period	
Name of Manufacturer	Emmvee Solar Systems Pvt.Ltd, Bangalore-560024

Economy Calculations:

Details	Value	Units
Inlet Temperature	25	^{o}C
Outlet Temperature	60	^{o}C
Quantity of Water	65000	LPD
Temperature Difference	35	^{o}C
Heat Input required	2275000	KCals/Day
Calorific Value of 1 KWH of Electricity	860	KCal
Electricity Consumption per day	2645	KWh
Electricity Consumption per annum (300 days)	793500	KWh
Cost of Electricity	6	Rs./KWh
Total Savings per year	4761000	Rs.

Payback Calculation:

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	NA	NA	4761000	
Second Year		0	4761000	
Pay Back Period :				

CASE STUDY - HOSP 2

Name & Address of Client	M S Ramaih Hospitals, Bengaluru. Karnataka
System Capacity	50500
Type of Collector	FPC
Type of circulation	Thermo siphon
Final Temperature	60°C
Use of Hot water	Hot water for bath rooms
Cost of the Project	NA
Year of Installation	2008, 2009, 2010, 2011
Fuel used before SWH system	Electric Geysers
Total savings per annum	36.99 lakhs
Payback period	
Name of Manufacturer	Emmvee Solar Systems Pvt.Ltd, Bangalore-560024

Economy Calculations:

Details	Value	Units
Inlet Temperature	25	°C
Outlet Temperature	60	°C
Quantity of Water	50500	LPD
Temperature Difference	35	°C
Heat Input required	1767500	KCals/Day
Calorific Value of 1 KWH of Electricity	860	KCal
Electricity Consumption per day	2055	KWh
Electricity Consumption per annum (300 days)	616500	KWh
Cost of Electricity	6	Rs./KWh
Total Savings per year	3699000	Rs.

Payback Calculation:

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	NA	NA	3699000	
Second Year		0	3699000	
Pay Back Period :				

CASE STUDY - HOSP 3

Name & Address of Client	Palakulath Hospital, Ernakulam. Kerala
System Capacity	12000
Type of Collector	FPC
Type of circulation	Thermo siphon
Final Temperature	$60^{o}C$
Use of Hot water	Hot water for bath rooms
Cost of the Project	NA
Year of Installation	2012
Fuel used before SWH system	Electric Geysers
Total savings per annum	8.78 lakhs
Payback period	
Name of Manufacturer	Emmvee Solar Systems Pvt.Ltd, Bangalore-560024

Economy Calculations:

Details	Value	Units
Inlet Temperature	25	^{o}C
Outlet Temperature	60	^{o}C
Quantity of Water	12000	LPD
Temperature Difference	35	^{o}C
Heat Input required	420000	KCals/Day
Calorific Value of 1 KWH of Electricity	860	KCal
Electricity Consumption per day	488	KWh
Electricity Consumption per annum (300 days)	146400	KWh
Cost of Electricity	6	Rs./KWh
Total Savings per year	878400	Rs.

Payback Calculation:

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	NA	NA	878400	
Second Year		0	878400	
Pay Back Period :				

CASE STUDY - HOSP 4

Name & Address of Client	Yashoda Hospitals, Hyderabad. AP
System Capacity	32500
Type of Collector	FPC
Type of circulation	Thermo siphon
Final Temperature	60^{o}C
Use of Hot water	Hot water for bath rooms
Cost of the Project	NA
Year of Installation	2007
Fuel used before SWH system	Electric Geysers
Total savings per annum	23.70 lakhs
Payback period	
Name of Manufacturer	Emmvee Solar Systems Pvt.Ltd, Bangalore-560024

Economy Calculations:

Details	Value	Units
Inlet Temperature	25	^{o}C
Outlet Temperature	60	^{o}C
Quantity of Water	32500	LPD
Temperature Difference	35	^{o}C
Heat Input required	1137500	KCals/Day
Calorific Value of 1 KWH of Electricity	860	KCal
Electricity Consumption per day	1322	KWh
Electricity Consumption per annum (300 days)	396600	KWh
Cost of Electricity	6	Rs./KWh
Total Savings per year	2379600	Rs.

Payback Calculation:

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	NA	NA	2379600	
Second Year		0	2379600	
Pay Back Period :				

SECTOR : NON INDUSTRIAL - HOTELS

CASE STUDY - HOTEL 1

Name & Address of Client	Fountain Hotel, Mahabaleshwar, Maharashtra.
System Capacity	30000 LPD
Type of Collector	FPC
Type of circulation	Thermo siphon
Final Temperature	60^{o}C
Use of Hot water	Hot water for bath rooms
Cost of the Project	NA
Year of Installation	2002 & 2009
Fuel used before SWH system	Electric Geysers
Total savings per annum	10.98 lakhs
Payback period	
Name of Manufacturer	Emmvee Solar Systems Pvt.Ltd, Bangalore-560024

Economy Calculations:

Details	Value	Units
Inlet Temperature	25	°C
Outlet Temperature	60	°C
Quantity of Water	30000	LPD
Temperature Difference	35	°C
Heat Input required	105000	KCals/Day
Calorific Value of 1 KWH of Electricity	860	KCal
Electricity Consumption per day	1220	KWh
Electricity Consumption per annum (300 days)	366000	KWh
Cost of Electricity	6	Rs./KWh
Total Savings per year	2196000	Rs.

Payback Calculation:

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	Not Available	NA	2196000	
Second Year		0	2196000	
Pay Back Period :				

CASE STUDY – HOTEL 2

Name & Address of Client	Hotel City Mark, Mahavir Chowk, Gurgaon
System Capacity	6000 LPD
Type of Collector	FPC
Type of circulation	Thermo siphon
Final Temperature	60°C
Use of Hot water	Hot water for bath rooms
Cost of the Project	16.00 Lakhs
Year of Installation	2010
Fuel used before SWH system	Electric Geysers
Total savings per annum	2.75 lakhs
Payback period	**4 year & 4 months**
Name of Manufacturer	Inter solar pvt. ltd, Chandigarh **Email: info@intersolarsystems.com**

Economy Calculations:

Details	Value	Units
Inlet Temperature	25	°C
Outlet Temperature	60	°C
Quantity of Water	6000	LPD
Temperature Difference	35	°C
Heat Input required	210000	KCals/Day
Calorific Value of 1 KWH of Electricity	860	KCal
Electricity Consumption per day	244	KWh
Electricity Consumption per annum (250 days)	61000	KWh
Cost of Electricity	4.50	Rs./KWh
Total Savings per year	274500	Rs.

Payback Calculation:

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	16,00,000	4,25,000	2,74,500	9,00,500
Second Year	9,00,500	0	2,74,500	6,26,000
Third Year	6,26,000	0	2,74,500	3,51,500
Fourth Year	3,51,500	0	2,74,500	77,000
Fifth Year	77,000.00	0	2,74,500	-1,97,500
Pay Back Period : 4 year & 4 months				

CASE STUDY – HOTEL 3

Name & Address of Client	Hotel Park Premier, Sec 29, Gurgaon
System Capacity	3000 LPD
Type of Collector	FPC
Type of circulation	Thermo siphon
Final Temperature	60°C
Use of Hot water	Hot water for bath rooms
Cost of the Project	6.00 Lakhs
Year of Installation	2010
Fuel used before SWH system	Diesel
Total savings per annum	2.75 lakhs lakhs
Payback period	**2 year & 2 months**
Name of Manufacturer	Emmvee Solar Systems Pvt.Ltd, Bangalore-560024

Economy Calculations:

Details	Value	Units
Inlet Temperature	25	°C
Outlet Temperature	60	°C
Quantity of Water	3000	LPD
Temperature Difference	35	°C
Heat Input required	210000	KCals/Day
Calorific Value of 1 ltr of Diesel	13860	KCal
Diesel Consumption per day	15.12	Ltrs
Diesel Consumption per annum (250 days)	3780	Ltrs
Cost of Electricity	53	Rs./Ltr
Total Savings per year	2.00	Rs.

Payback Calculation:

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	6,00,000	1,70,000	2,00,340	2,29,660
Second Year	2,29,660	0	2,00,340	29,320
Third Year	29,320	0	2,00,340	-1,71,020
Pay Back Period : 2 year & 2 months				

CASE STUDY - HOTEL 4

Name & Address of Client	Sai Thirumala Contructions, Hyderabad. AP
System Capacity	24000 LPD
Type of Collector	FPC
Type of circulation	Thermo siphon
Final Temperature	60°C
Use of Hot water	Hot water for bath rooms
Cost of the Project	NA
Year of Installation	2010
Fuel used before SWH system	Electric Geysers
Total savings per annum	17.56 lakhs
Payback period	
Name of Manufacturer	Emmvee Solar Systems Pvt.Ltd, Bangalore-560024

Economy Calculations:

Details	Value	Units
Inlet Temperature	25	°C
Outlet Temperature	60	°C
Quantity of Water	24000	LPD
Temperature Difference	35	°C
Heat Input required	840000	KCals/Day
Calorific Value of 1 KWH of Electricity	860	KCal
Electricity Consumption per day	976	KWh
Electricity Consumption per annum (300 days)	292800	KWh
Cost of Electricity	6	Rs./KWh
Total Savings per year	1756800	Rs.

Payback Calculation:

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	NA	NA	1756800	
Second Year		0	1756800	
Pay Back Period :				

CASE STUDY - HOTEL 5

Name & Address of Client	Sri Sai Venkateswara Enterprises (Hotel Udayee International), 13/6/771/2 (Opp APSRTC Bus Stand,),Tirupathi-517501 AP
System Capacity	4000 LPD (8 X 500 LPD)
Type of Collector	ETC
Type of SWH	Pressurised system
Final Temperature	60°C
Use of Hot water	Hot water for bath rooms & Kitchen
Cost of the Project	Rs.7.14 lakhs
Year of Installation	2011
Fuel used before SWH system	Electric Geysers
Total savings per annum	Rs.2.93 Lakhs
Payback period	1 year & 10 months
Name of Manufacturer	Solar Hitech Geysers, Bangalore Email: solarhitech@gmail.com

Economy Calculations:

Details	Value	Units
Inlet Temperature	25	°C
Outlet Temperature	60	°C
Quantity of Water	4000	LPD
Temperature Difference	35	°C
Heat Input required	140000	KCals/Day
Calorific Value of 1 KWH of Electricity	860	KCal
Electricity Consumption per day	163	KWh
Electricity Consumption per annum (300 days)	48900	KWh
Cost of Electricity	6	Rs./KWh
Total Savings per year	293,400	Rs.

Payback Calculation:

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	714400	164400	293,400	256,200
Second Year	256,200	0	293,400	--37,200
Pay Back Period : 1 Year & 10 months				

CASE STUDY - HOTEL 6

Name & Address of Client	Hotel Sindu International, Behinnd SSB Kalyana mandap, Thiruchanoor road, Tirupathi-517501. AP
System Capacity	2000 LPD (84X 500 LPD)
Type of Collector	ETC
Type of circulation	Thermo siphon
Final Temperature	60°C
Use of Hot water	Hot water for bath rooms & Kitchen
Cost of the Project	Rs.2.88 lakhs
Year of Installation	2011
Fuel used before SWH system	Electric Geysers
Total savings per annum	Rs.1.46 Lakhs
Payback period	1 year & 5 months
Name of Manufacturer	Solar Hitech Geysers, Bangalore Email: solarhitech@gmail.com

Economy Calculations:

Details	Value	Units
Inlet Temperature	25	^{o}C
Outlet Temperature	60	^{o}C
Quantity of Water	2000	LPD
Temperature Difference	35	^{o}C
Heat Input required	70000	KCals/Day
Calorific Value of 1 KWH of Electricity	860	KCal
Electricity Consumption per day	81	KWh
Electricity Consumption per annum (300 days)	24300	KWh
Cost of Electricity	6	Rs./KWh
Total Savings per year	145800	Rs.

Payback Calculation:

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	288143	83143	145800	59,200
Second Year	59,200	0	145800	-86600
Pay Back Period : 1 Year & 5 months				

SECTOR : NON INDUSTRIAL - INSTITUTIONS

CASE STUDY - INST 1

Name & Address of Client	Kousthubam Guest House, Tirumala Tirupathi. AP
System Capacity	30000 LPD (4 X 2000 LPD, 4 X 2500 LPD & 4 X 3000 LPD)
Type of Collector	FPC
Type of circulation	Thermo siphon
Final Temperature	60^{o}C
Use of Hot water	Hot water for bath rooms
Cost of the Project	Rs.44.56 lakhs
Year of Installation	2010
Fuel used before SWH system	Electric Geysers
Total savings per annum	Rs.29.66 Lakhs
Payback period	1 year & 6 months
Name of Manufacturer	Photon Energy Systems Ltd., Hyderabad-500033 Email : swhs@photonsolar.in

Economy Calculations:

Details	Value	Units
Inlet Temperature	25	^{o}C
Outlet Temperature	60	^{o}C
Quantity of Water	30000	LPD
Temperature Difference	35	^{o}C
Heat Input required	1050000	KCals/Day
Calorific Value of 1 KWH of Electricity	860	KCal
Electricity Consumption per day	1648	KWh
Electricity Consumption per annum (300 days)	494477	KWh
Cost of Electricity	6	Rs./KWh
Total Savings per year	2966860	Rs.

Payback Calculation:

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	4456116	0	2966860	1489256
Second Year	1489256	0	2966860	-1477605
Pay Back Period : 1 Year & 6 months				

CASE STUDY - INST 2

Name & Address of Client	NBCC, H.No:1, Niti Nagar, Opp IIT Main Gate,Roorkee-247667. Phone No:01332275560
Installation Site	Boys hostel, Girls Hostel, bio Technology building, Staff Accomdation-I orkee, Roorkee
System Capacity	98,400 LPD (1800LPD X 18 Nos + 2000LPD X 4 Nos + 2500LPD X 10 Nos + 3000LPD X 11 Nos)
Type of Collector	Flat Plate Collector
Type of the system	Direct heating System
Type of circulation	Thermo siphon & Forced Flow Circulation with pumps based on Differential temperature Control Panel
Final Temperature	60oC
Use of Hot water	Domestic Purpose
Cost of the Project	Rs.1,49,45,000/-
Date / Year of Installation	17th March 2012
Fuel used before SWH system	Electricity in Electric Geysers
Total Electricity Consumption per year	1621884 KWH (for 300 days)
Total Electricity Costs Per year	Rs.97, 31,302.00 (for 300 days)
Total savings per annum	Rs. 97, 31,302.00 (for 300 days)
Payback period	1.1 Years
Name of Manufacturer	PHOTON ENERGY SYSTEMS LIMITED

Economy Calculations:

Details	Value	Units
Inlet Temperature	25	^{o}C
Outlet Temperature	60	^{o}C
Quantity of Water	98400	LPD
Temperature Difference	35	^{o}C
Heat Input required	3444000	KCals/Day
Calorific Value of 1 KWH of Electricity	860	KCal
Electricity Consumption per day	5406	KWh
Electricity Consumption per annum (300 days)	1621884	KWh
Cost of Electricity	6	Rs./KWh
Total Savings per year	9731302	Rs.

Payback Calculation:

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	14945000	4483500	9731302	730198
Second Year	730198		9731302	-9001105
Pay Back Period : 1.1 Years				

CASE STUDY – INST 3

Name & Address of Client	**North Maharashtra University Jalgaon, Maharashtra**
System Capacity	18000 LPD
Type of Collector	FPC
Type of SWH	Thermo siphon
Final Temperature	60°C
Use of Hot water	Bathing.
Cost of the Project	Rs.21.00 lakhs
Year of Installation	2009-10
Fuel used before SWH system	Electricity
Total savings per annum	Rs.9.40 Lakhs
Payback period	2 years & 3 months
Name of Manufacturer	Sudharshan saur, Aurangabad office@sudarshansaur.com

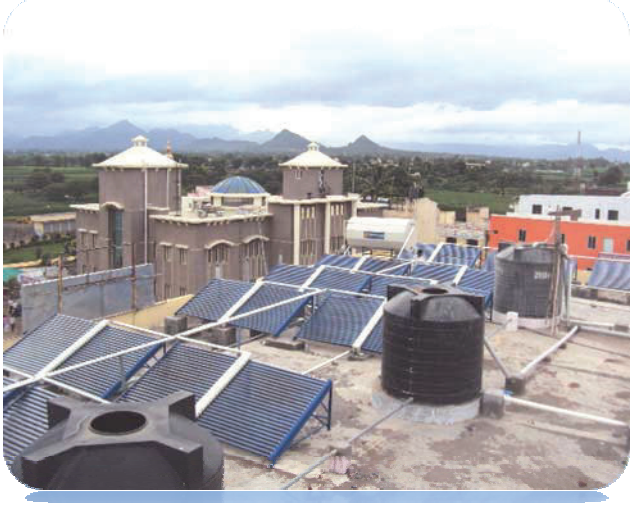
Economy Calculations:

Details	Value	Units
Inlet Temperature	25	°C
Outlet Temperature	45	°C
Quantity of Water	18000	LPD
Temperature Difference	20	°C
Heat Input required	360000	KCals/Day
Calorific Value of 1 KWH of Electricity	860	KCal
Electricity Consumption per day	420	KWh
Electricity Consumption per annum (320 days)	13440	KWh
Cost of Electricity	7	Rs./KWh
Total Savings per year	940800	Rs.

Payback Calculation:

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	2100000	0	940800	1159200
Second Year	1159200	0	940800	218400
Third Year	218400	0	940800	-722400
Pay Back Period : 2 Year & 3 months				

CASE STUDY - INST 4



Name & Address of Client	**Ozar Ganapati Sansthan** **Pune** **Maharashtra**
System Capacity	12,000 LPD
Type of Collector	ETC
Type of SWH	Thermo siphon
Final Temperature	60°C
Use of Hot water	Bathing.
Cost of the Project	Rs.10.00 lakhs
Year of Installation	2009-10
Fuel used before SWH system	Wood
Total savings per annum	Rs.8.25 Lakhs
Payback period	1 year & 2 months
Name of Manufacturer	Sudharshan saur, Aurangabad office@sudarshansaur.com

Economy Calculations:

Details	Value	Units
Inlet Temperature	25	°C
Outlet Temperature	60	°C
Quantity of Water	12000	LPD
Temperature Difference	35	°C
Heat Input required	420000	KCals/Day
Calorific Value of 1 Kg of wood	2441	KCal
Fuel Consumption per day	172	Kg
Fuel Consumption per annum (320 days)	55040	Kg
Cost of Electricity	15	Rs./Kg
Total Savings per year	825,600	Rs.

Payback Calculation:

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	1000000	0	825,600	174400
Second Year	174400	0	825,600	-651200
Pay Back Period : 1 Year & 2 months				

CASE STUDY – INST 5

Name & Address of Client	**College Of Engineering Roorkee** Haridwar, Uttrakhand
System Capacity	10000 LPD
Type of Collector	ETC
Type of SWH	Thermo siphon
Final Temperature	60°C
Use of Hot water	Bathing.
Cost of the Project	Rs.12.97 lakhs
Year of Installation	2001-11
Fuel used before SWH system	Electricity
Total savings per annum	Rs.5.94 Lakhs
Payback period	2 years & 2 months
Name of Manufacturer	Sudharshan saur, Aurangabad office@sudarshansaur.com

Economy Calculations:

Details	Value	Units
Inlet Temperature	20	°C
Outlet Temperature	60	°C
Quantity of Water	10000	LPD
Temperature Difference	40	°C
Heat Input required	399470	KCals/Day
Calorific Value of 1 KWH of Electricity	860	KCal
Electricity Consumption per day	464.5	KWh
Electricity Consumption per annum (320 days)	148640	KWh
Cost of Electricity	4	Rs./KWh
Total Savings per year	594560	Rs.

Payback Calculation:

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	1297000	0	594560	732440
Second Year	732440	0	594560	137880
Third Year	137880	0	594560	-456680
Pay Back Period : 2 Year & 2 months				

CASE STUDY – INST 6

Name & Address of Client	**Shree Gajanan Maharaj Sansthan , Shegaon , District : Buldana ,Maharashtra**
System Capacity	53,500 LPD
Type of Collector	ETC
Type of SWH	Thermo siphon
Final Temperature	60^{o}C
Use of Hot water	Bathing.
Cost of the Project	Rs.80.25 lakhs
Year of Installation	2006-10
Fuel used before SWH system	Wood
Total savings per annum	Rs.36.67 Lakhs
Payback period	2 years & 2 months
Name of Manufacturer	Sudharshan saur, Aurangabad

	office@sudarshansaur.com

Economy Calculations:

Details	Value	Units
Inlet Temperature	25	°C
Outlet Temperature	60	°C
Quantity of Water	53500	LPD
Temperature Difference	35	°C
Heat Input required	1872500	KCals/Day
Calorific Value of 1 Kg of wood	2450	KCal
Fuel Consumption per day	764	Kg
Fuel Consumption per annum (320 days)	244480	Kg
Cost of Electricity	15	Rs./Kg
Total Savings per year	3,667,200	Rs.

Payback Calculation:

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	8,025,000	0	3,667,200	4,357,800
Second Year	4,357,800	0	3,667,200	690,600
Third Year	690,600	0	3,667,200	-2,976,600
Pay Back Period : 2 Years & 2 months				

CASE STUDY – INST 7

Name & Address of Client	Vellore Institute of Technology, Chennai. Tamilnadu
System Capacity	30000 LPD
Type of Collector	FPC
Type of circulation	Thermo siphon
Final Temperature	60°C
Use of Hot water	Hot water for bath rooms
Cost of the Project	NA
Year of Installation	2010
Fuel used before SWH system	Electric Geysers
Total savings per annum	21.96 lakhs
Payback period	NA
Name of Manufacturer	Emmvee Solar Systems Pvt.Ltd, Bangalore-560024

Economy Calculations:

Details	Value	Units
Inlet Temperature	25	°C
Outlet Temperature	60	°C
Quantity of Water	30000	LPD
Temperature Difference	35	°C
Heat Input required	105000	KCals/Day
Calorific Value of 1 KWH of Electricity	860	KCal
Electricity Consumption per day	1220	KWh
Electricity Consumption per annum (300 days)	366000	KWh
Cost of Electricity	6	Rs./KWh

Total Savings per year	2196000	Rs.

Payback Calculation:

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	NA	NA	2196000	
Second Year		0	2196000	
Pay Back Period :				

CASE STUDY – INST 8

Economy Calculations:

Details	Value	Units
Inlet Temperature	25	^{o}C
Outlet Temperature	60	^{o}C
Quantity of Water	13125	LPD
Temperature Difference	35	^{o}C
Heat Input required	459375	KCals/Day
Calorific Value of 1 KWH of Electricity	860	KCal
Electricity Consumption per day	534	KWh
Electricity Consumption per annum (300 days)	160200	KWh
Cost of Electricity	6	Rs./KWh
Total Savings per year	961200	Rs.

Payback Calculation:

Name & Address of Client	Knowledge City Education Pvt. Ltd.
System Capacity	125 LPD X 105 = 13125 LPD
Type of Collector	FPC
Type of circulation	Thermo syphon
Final Temperature	$60^{o}C$
Use of Hot water	HOSTEL
Cost of the Project	2310000/-
Year of Installation	Sept - 2011
Fuel used before SWH system	Electricity
Total savings per annum	961200
Payback period	1 year & 9 months
Name of Manufacturer	SUN ZONE SOLAR SYSTEMS., Bangalore e-mail: sunzonesolar56@yahoo.co.in

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	2310000/-	693000	961200	655800
Second Year	655800/-	0	961200	-305400
Pay Back Period : 1 Year & 9 months				

SECTOR : INDUSTRIAL

CASE STUDY – INDL 1

Name & Address of Client	AAVIN DIARY, Tirunelveli Tamil Nadu
System Capacity	15000 LPD (3 X 5000 LPD)
Type of Collector	FPC
Type of circulation	Forced flow with heat exchanger
Final Temperature	80°C
Use of Hot water	Milk processing
Cost of the Project	Rs.25.34 lakhs
Year of Installation	2012
Fuel used before SWH system	HSD
Total savings per annum	Rs.19.09 Lakhs
Payback period	1 year & 6 months
Name of Manufacturer	Photon Energy Systems Ltd., Hyderabad-500033 Email : swhs@photonsolar.in

Economy Calculations:

Details	Value	Units
Inlet Temperature	25	°C
Outlet Temperature	80	°C
Quantity of Water	15000	LPD
Temperature Difference	55	°C
Heat Input required	825000	KCals/Day
Calorific Value of HS D / ltr	10500	KCal
Fuel Consumption per day	108.07	Ltrs
Fuel Consumption per annum (300 days)	31821	Ltrs
Cost of HSD	53	Rs./Ltr
Total Savings per year	1686536	Rs.

Payback Calculation:

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	2534460	0	1686536	847924
Second Year	847924	0	1686536	-838611
Pay Back Period : 1 Year & 6 months				

CASE STUDY - INDL 2

Name & Address of Client	Accenture Services, Bangalore, Chennai & Hyderabad
System Capacity	20000
Type of Collector	FPC
Type of circulation	Thermo siphon
Final Temperature	60°C
Use of Hot water	Hot water for bath rooms
Cost of the Project	NA
Year of Installation	2011
Fuel used before SWH system	Electric Geysers
Total savings per annum	14.63 lakhs
Payback period	
Name of Manufacturer	Emmvee Solar Systems Pvt.Ltd, Bangalore-560024

Economy Calculations:

Details	Value	Units
Inlet Temperature	25	°C
Outlet Temperature	60	°C
Quantity of Water	20000	LPD
Temperature Difference	35	°C
Heat Input required	700000	KCals/Day
Calorific Value of 1 KWH of Electricity	860	KCal
Electricity Consumption per day	813	KWh
Electricity Consumption per annum (300 days)	243900	KWh
Cost of Electricity	6	Rs./KWh
Total Savings per year	1463400	Rs.

Payback Calculation:

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	NA	NA	1463400	
Second Year		0	1463400	
Pay Back Period :				

Name & Address of Client	Chelsea Textile Mills, Sector-3, IMT Manesar, Gurgaon
System Capacity	50000 LPD
Type of Collector	FPC
Type of SWH	Pumped Circulation
Final Temperature	65°C
Use of Hot water	Boiler make up water heating
Cost of the Project	Rs.46.50 lakhs
Year of Installation	2006
Fuel used before SWH system	Furnace oil
Total savings per annum	Rs.20.02Lakhs
Payback period	**2 Years & 4 months**
Name of Manufacturer	Inter solar pvt. ltd, Chandigarh **Email: info@intersolarsystems.com**

Economy Calculations:

Details	Value	Units
Inlet Temperature	25	°C
Outlet Temperature	60	°C
Quantity of Water	50000	LPD
Temperature Difference	35	°C
Heat Input required	1750000	KCals/Day
Calorific Value of 1 Ltr of FO	9800	KCal
Fuel Consumption per day	178	Ltr
FO Consumption per annum (250 days)	44500	Ltrs
Cost of Electricity	45	Rs./Ltr
Total Savings per year	20,02,500	Rs.

Payback Calculation (for verification only):

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First year	46,50,000	0	20,02,500	26,47,500
Second Year	26,47,500	0	20,02,500	6,45,000
Third Year	6,45,000	0	20,02,500	-13,57,500
Pay Back Period : 2 Years & 4 months				

CASE STUDY – INDL 4

Name & Address of Client	**FORD INDIA, Chengalpattu, Tamilnadu**
System Capacity	20000 LPD
Type of Collector	FPC
Type of SWH	Thermo siphon
Final Temperature	60°C
Use of Hot water	Bathing.
Cost of the Project	Rs.26.00 lakhs
Year of Installation	2011-12
Fuel used before SWH system	LPG Gas
Total savings per annum	Rs.11.32 Lakhs
Payback period	2 years & 4 months
Name of Manufacturer	Sudharshan saur, Aurangabad office@sudarshansaur.com

Economy Calculations:

Details	Value	Units
Inlet Temperature	25	°C
Outlet Temperature	60	°C
Quantity of Water	20000	LPD
Temperature Difference	35	°C
Heat Input required	700000	KCals/Day
Calorific Value of 1 Kg of LPG	10770	KCal
Fuel Consumption per day	60	KGs
Fuel Consumption per annum (320 days)	19200	KGs
Cost of LPG	59	Rs./Kg
Total Savings per year	1132800	Rs.

Payback Calculation:

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	2600000	0	1132800	1456200
Second Year	1456200	0	1132800	334400
Third Year	334400	0	1132800	-798400
Pay Back Period : 2 Year & 4 months				

CASE STUDY – INDL 5

Name & Address of Client	MILMA Dairy, Kannur, Palakad. Kerala
System Capacity	60000 LPD
Type of Collector	FPC
Type of circulation	Pressurised Circulation
Final Temperature	$60^{o}C$
Use of Hot water	Hot water Boiler makeup water
Cost of the Project	46.50 Lakhs
Year of Installation	2003
Fuel used before SWH system	Diesel
Total savings per annum	39.75 lakhs
Payback period	**1 year & 2 months**
Name of Manufacturer	

Economy Calculations:

Details	Value	Units

Inlet Temperature	25	°C
Outlet Temperature	60	°C
Quantity of Water	60000	LPD
Temperature Difference	35	°C
Heat Input required	2100000	KCals/Day
Calorific Value of 1 ltr of Diesel	8400	KCal
Diesel Consumption per day	250	Ltr
Diesel Consumption per annum (300 days)	75000	Ltrs
Cost of Electricity	53	Rs./Ltr
Total Savings per year	3975000	Rs.

Payback Calculation:

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	46,50,000	0	39,75,000	6,75,000
Second Year	6,75,000	0	39,75,000	-33,00,000
Pay Back Period : 1 year & 2 months				

CASE STUDY – INDL 6

Name & Address of Client	Sona Koyo Steering Systems Limited, Sriperumpudur, Chennai
System Capacity	35000 LPD
Type of Collector	ETC

Type of SWH	Pumped Circulation
Final Temperature	65°C
Use of Hot water	Hot solution is used in Degreasing, Phosphating, and Passivation tank.
Cost of the Project	Rs.53.85 lakhs
Year of Installation	2012
Fuel used before SWH system	Furnace oil
Total savings per annum	Rs.11.36 Lakhs
Payback period	Not applicable, since executed under ESCO model
Name of the Installer	Aspiration Energy, Chenni
Name of Manufacturer	Solar Hitech Geysers, Bangalore Email: solarhitech@gmail.com

Economy Calculations:

Details	Value	Units
Inlet Temperature	41.5	°C
Outlet Temperature	65	°C
Quantity of Water	35000	LPD
Temperature Difference	23.5	°C
Heat Input required	825160	KCals/Day
Calorific Value of 1 Ltr of FO	9800	KCal
Fuel Consumption per day	84.20	ltrs
FO Consumption per annum (300 days)	25260	Ltrs
Cost of Electricity	45	Rs./Ltr
Total Savings per year	1,136,700	Rs.

Payback Calculation (for verification only):

Year	Investment cost (Rs.)	MNRE subsidy (Rs.)	Energy savings (Rs.)	Carry forward (Rs.)
First Year	5,385,120	1,365,000	1,136,700	2,883,420
Second Year	2,883,420	0	1,136,700	1,746,720
Third Year	1,746,720	0	1,136,700	610,020
Fourth Year	610,020	0	1,136,700	-526,680
Pay Back Period : 3 Years & 6 months				

Note:
Since this project is under ESCO model, the customer pays only part of the cost of energy saved, which is Rs.40,000.00 per month for 60 months (which is around Rs.4,80,000.00 per year)