Solar Power Based Operated Led TV

S.G.Koilwad[1] B. D.Ghadge[2] M.P.Thorat[3] R.H.Jadhav[4] K.S.Patil[5]
[1,2,3.4,5]Department of Electrical Engineering
[1,2,3,4,5]GF'S G. C. O. E. Jalgaon, North Maharashtra University, Jalgaon, Maharashtra, India

Abstract— Solar energy is the most abundant stream of energy. Therefore Solar power operated LED TV is used in future. Because its advantages is saving of power, and requirement of energy received from the MSEB it can be also reduces. The main objective, to increase the usage of renewable energy source for power generation is perfectly implemented. Solar power is non-conventional source of power.so it is easily available for the use so now a day's we use solar power for generation of electricity. New technology are used for generation in future we use more technology to generate electricity easily. Taking into consideration the future energy scenario in the world, solar energy would be a major energy source.

Key words: PV Cell, Charge Controller, Inverter

I. Introduction

Sun is the primary source of Energy. The earth receives 16 x 10^{18}units of energy from the sun annually, which is 20,000 times the requirement of mankind on the Earth. Solar power in India is a fast-growing industry. As of 6 April 2017, the country's solar grid had a cumulative capacity of 12.28 gig watts (GW) compared to 6.76 GW at the end of March 2016. In January 2015, the Indian government expanded its solar plans, targeting US$100 billion of investment and 100 GW of solar capacity, including 40 GW from rooftop solar, by 2022. In day to day life of the use of digital electronics equipment are very largely increases. Along this equipment electrical power consumption is also increases.

Therefore our projects ideas is to use the solar power for operating this equipment to reduce the conventional electrical power.so in our projects we have choose the LED TV to operates on solar power. In case presents life and also in future LED TV is an important parts of everyone life. The use of LED TV in various places such as big shopping mall for advertisement purpose, Railways Station, bus stand, Airport for CCTV. It's also used in everyone house for entertainment purpose be its less power consumption, and good visible quality.

India is one of the countries with the higher solar electricity production per watt installed, with an insolation of 1700 to 1900 kilowatt hours per kilowatt peak (kWh/KWp). On 16 May 2011, India's first solar power project (with a capacity of 5 MW) was registered under the Clean Development Mechanism.

The applications of solar energy which are enjoying most success today are:-

- Heating and cooling of residential buildings
- Solar water heating
- Solar drying of agriculture and animal products
- Solar distillation on a small community scale
- Food refrigeration
- Solar cookers
- Solar engines for water pumping
- Solar furnaces
- Solar electric power generation.

Challenge of availability in the less developed parts of the world.

II. Literature review

A. Solar panel

Solar panel is important role for a system. Photovoltaic modules use light energy (photon) from the Sun to generate electricity through the photovoltaic effects.it is possible to convert solar energy directly into electrical energy by means of silicon wafer-photovoltaic cells, also called solar cells, without any intermediate thermodynamic cycle. The solar cells operates on the works are photovoltaic effects. Which is process of generating an EMF as a result of the absorption of ionizing radiation .thus a solar cells is a transducer, which is converts the sun's radiant energy directly into electrical energy and is basically a semiconductors diode capacity developing a voltage of 0.5 to 1 voltage and current density of 20-40 mA-cm.sq. Depending on the materials used and condition of sunlight. Photovoltaic cells generates a voltage proportional to electromagnetic radiation intensity and are knows as such reasons of their voltage generating capacity or ability.

B. Types of Solar Panels

The solar panels mainly three type mention on:-

1) Mono –crystalline silicon solar panels
2) Polycrystalline Silicon Solar Panel
3) Amorphous Silicon Solar Panel

III. System development

A. Block Diagram

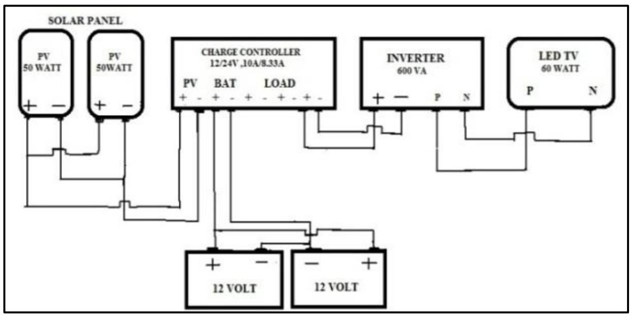

Fig. 1: Block Diagrams of Solar Led TV

- Components And Their Function

The various components of a typical photovoltaic power generation system are:-

- Solar photovoltaic array
- Battery Bank
- Charge Controller
- Inverter
- Load (Led TV)

1) Solar Photovoltaic Array

The solar photovoltaic array consists of an appropriate number of solar cells connected in series and or parallel to provide the required current and voltage. The array is so oriented as to collect the maximum solar radiation throughout the year. There may be tracking arrays or modules or fixed arrays. Solar PV modules are solid-state semiconductor devices that convert sunlight into direct-current electricity. Materials used on PV panels are mono-crystalline silicon, polycrystalline silicon, micro- crystalline silicon, copper indium selenide, and cadmium tellur- ide.

2) Battery Bank

In most alone PV power systems, storage batteries with charge regulators have to be incorporated to provide a backup power source during periods of low solar irradiance and night. The capacity of a battery is the total amount of electricity that can be drawn from a fully charged battery at a fixed discharge rate and electrolyte temperature until the voltage falls to a specified minimum. It is expressed in ampere hour. The capacity of the battery also depends upon the temperature and age of battery.

3) Charge Controller

Thus, there is a need of charge Controller to optimize the battery life. Most charge regulators start the charging process with a high current and reduce it to a very low level when a certain battery voltage is reached. A digital based charge regulator monitors the battery current, and voltage computes the level of charge and regulates the input and output currents so as to avoid both overcharging and excessive discharge.

Features:-

- Automatic selection of 12v/24v battery
- Aesthetic & compact design
- 98% efficiency
- Fuse-less electronic & software controlled protections
- USB port
- Option of SMF and lead acid battery selection
- Load controller with LVD & dusk to dawn feature

Technical specification:-

- PWM (Pulse With Modulation)based technology
- Automatic battery voltage selection 12/24 Volt(Available in 10Amp and 20 Amp)
- In built low voltage disconnect (LVD) & 20% extra power than rated capacity
- 400Watt & 800Watt panels in 12/24Volt system in 20Amps
- 125 Watt panels in 12 system in 6Amps
- 200Watt & 400Watt panels in 12/24Volt system in 10Amps.

4) Inverter

In inverter is a main function depends upon in case a power inverter is an electronics device or circuitry that changes direct current (DC) to alternating current (AC). The input voltage, and overall power handling depend on the design of the specific device or circuitry. Direct current is created by devices such as batteries and solar .When connected, an inverter allows these devices to provide electric power for small household devices. Inverter is a small circuit which will convert the direct current (DC) to alternating current (AC). The power of a battery is converted in to 'main voltages' or AC power.

This power can be used for electronic appliances like television, mobile phones, computer etc. the main function of the inverter is to convert DC to AC and step-up transformer is used to create main voltages from resulting AC.

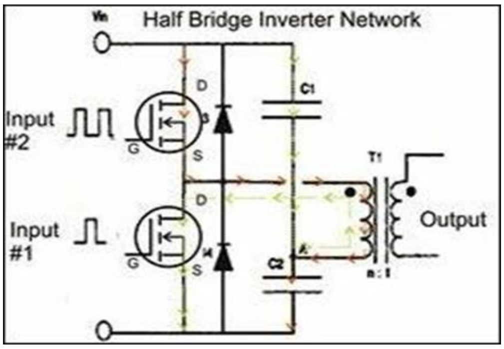

Fig. 2: Inverter

5) Load (Led TV)

An LED (Light-Emitting Display) is a flat panel display, which uses an array of light-emitting diodes as pixels for a video display. Their brightness allows them to be used outdoors in store signs and billboards, and in recent years they have also become commonly used in destination signs on public transport vehicles. LED displays are capable of providing general illumination in addition to visual display, as when used for stage lighting or other decorative (as opposed to informational) purposes.

Power savings are typically 20-30%. On average, LED TVs are priced higher than traditional LCD TVs that use CCFLs for backlighting. Edge-LED backlighting technique allows an LCD TV to be extremely thin. LED televisions that are only 1 inch thick are also available.

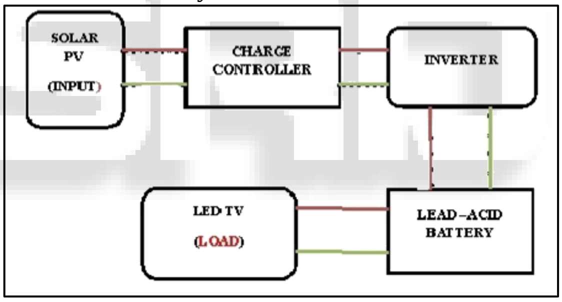

Fig. 3: LED TV (OUTPUT)

IV. IMPLEMENTATION

India has very good conditions for the development of photovoltaic solar power systems due mainly to the high mean daily radiation and the high number of sunny days in most parts of the country. For this reason, the Administration and companies working in the sector are developing policies and investing in photovoltaic solar power systems. One of the best features of rooftop solar PV systems is that they can be permitted and installed faster than other types of renewable power plants. They are clean, quiet, and visually unobtrusive. Users won't even know that the rooftop plants are working there. Keeping in view the impending shortfalls in conventional power generating sources and growing demand of energy, it is important to go for non-conventional sources.

- Components Of Solar Pv System

Solar PV system includes different components depended on your system type, site location and applications. The major components for solar PV system are solar charge controller, inverter, battery bank, auxiliary energy sources and loads (appliances).

Major Components of PV System.

1) PV Module.
2) Solar Charge Controller.
3) Inverter.
4) Battery Bank.
5) Load.

– Requirement Specification

A. Solar PV System Sizing

Determine Power Consumption Demands The first step in designing a solar PV system is to find out the total power and energy consumption of all loads that need to be supplied by the solar PV system as follows:-

1) Calculate total watt-hours per day each appliance used

Add the Watt-hours needed for all appliances together to get the total Watt-hours per day which must be delivered to the appliances.

2) Calculate total Watt-hours per day needed from the PV modules

Multiply the total appliances Watt-hours per day times 1.3 (the energy lost in the system to get the total Watt-hours per day which must be provided by the panels.

B. Size The Pv Modules

Different size of PV modules will produce different amount of power. To find out the sizing of PV module, the total peak watt produced needs. The peak watt (We) produced depends on size of the PV module and climate of site location. We have to consider "panel generation factor" which is different in each site location. For Example Thailand, the panel generation factor is 3.43. To determine the sizing of PV modules, calculate as follows.

1) Calculate the total Watt-peak rating needed for PV modules

Divide the total Watt-hours per day needed from the PV modules by 3.43 to get the total Watt-peak rating needed for the PV panels needed to operate the appliances.

2) Calculate the number of PV panels for the system

Divide the answer obtained in Calculate total Watt-hours per day needed from the PV modules by the rated output Watt-peak of the PV modules available to you. Increase any fractional part of result to the next highest full number and that will be the number of PV modules required.

Result of the calculation is the minimum number of PV panels. If more PV modules are installed, the system will perform better and battery life will be improved. If fewer PV modules are used, the system may not work at all during cloudy periods and battery life will be shortened.

C. Inverter Sizing

An inverter is used in the system where AC power output is needed. The input rating of the inverter should never be lower than the total watt of appliances. The inverter must have the same nominal voltage as your battery. For stand-alone systems, the inverter must be large enough to handle the total amount of Watts you will be using at one time. The inverter size should be 25-30% bigger than total Watts of appliances. In case of appliance type is motor or compressor then inverter size should be minimum 3 times the capacity of those appliances and must be added to the inverter capacity to handle surge current during starting.

D. Battery Sizing

The battery type recommended for using in solar PV system is deep cycle battery. Deep cycle battery is specifically designed for to be discharged to low energy level and rapid recharged or cycle charged and discharged day after day for years. The battery should be large enough to store sufficient energy to operate the appliances at night and cloudy days. To find out the size of battery, calculate as follows:-

– Calculate total Watt-hours per day used by appliances.
– Di-vide the total Watt-hours per day used by 0.85 for battery loss.
– Divide the answer obtained in item 4.2 by 0.6 for depth of discharge.
– Divide the answer obtained in item 4.3 by the nominal battery voltage.
– Multiply the answer obtained in item 4.4 with days of autonomy (the number of days that you need the system to operate when there is no power produced by PV panels) to get the required. Ampere-hour capacity of deep-cycle battery.

Battery Capacity (Ah) = <u>Total Watt-hours per day used by appliances</u> x Days of Autonomy (0.85 x 0.6 x nominal battery voltage)

E. Solar Charge Controller Sizing

The solar charge controller is typically rated against Amperage and Voltage capacities. Select the solar charge controller to match the voltage of PV array and batteries and then identify which type of solar charge controller is right for your application. Make sure that solar charge controller has enough capacity to handle the current from PV array. For the series charge controller type, the sizing of controller depends on the total PV input current which is delivered to the controller and also depends on PV panel configuration (series or parallel configuration). According to standard practice, the sizing of solar charge controller is to take the short circuit current (Isc) of the PV array.

V. Testing and Design System

A. Testing

Sometimes you will want to check that your solar system is performing properly, or you may simply want to know what output your solar panel is giving. In this section we outline how to do this using a multimeter to measure current (amps) and voltage.

– Before You Start

1) Find the voltage (V) and current (A) ratings of your panel, you can usually find these written on the back of the panel.
2) Check that sunlight conditions are suitable for producing readings on your system. To obtain the rated output of your panel you will need full, bright sunlight falling directly onto the panel. Remember, no sun no power. Make sure you understand how to use the multimeter and that you are using appropriate settings for the power you expect to measure.
3) If you are testing a charge controller you will need to make sure that the battery is NOT fully charged otherwise it will not be able to accept current.

B. Testing Overview

1) To Measure Open Circuit Voltage - Volts (V_{oc}),Such as =18 to 21 volt.
2) To Measure Short Circuit Current - Amps (I_{sc}),such as = 3.17 to 4 Amp.
3) To Measure Operating Current - Amps (I_l) such as = 4.16 to 5 Amp.

C. Some Final Checks

1) Check the condition of any fuses that might be in the power path.
2) Verify the system wiring is correct and intact.
3) Check all the connections and terminals for good electrical contact.
4) Should your system for whatever reason not be giving the results you expect, please contact us for further advice.

D. A Solar PV System Design Can Be Done In Five Steps

– number of PV panels
– Load estimation
– Estimation of battery bank
– Cost estimation of the system.
– Base condition: 1 LED TV (50 watt Assume for 10 hours)

1) The total energy requirement of the system (total load) that is Total connected load to PV panel system = No. of units × rating of equipment = 1× 50 = 50 watts
2) Total watt-hours rating of the system= Total connected load (watts) × Operating hours = 50watt × 10 hour = 500 watt-hours
3) Actual power output of a PV panel = Peak power rating × operating factor =50 × 0.75 = 37.50 watt
4) The Total power used at the end use is less (due to lower combined efficiency of the system= Actual power output of a panel × combined efficiency =37.50 × 0.81 = 30.375 watts (VA)
5) Energy produced by one 50 Watt panel in a day =Actual power output × 8 hours/day (peak equivalent) =30.375 × 8 = 243 watts-hour
6) Number of solar panels required to satisfy given estimated daily load :- (Total watt-hour rating (daily load)/(Daily energy produced by a panel) =500/30.375 = 2.05 = 2 Approx.

E. Inverter size is to be calculated as

Total connected load to PV panel system = 50 watts
Inverter are available with rating of 100, 200, 500 VA, etc.
Therefore, the choice of the inverter should be 100 VA.

F. Cost of Estimation of a PV System

1) Cost of arrays = No. of PV modules × Cost/Module = 2 × 3000 (for a 50 Watt panel) = Rs.6000
2) Cost of batteries = No. of Batteries(45 Ah) × Cost/Module =1 × 4000= Rs.4000
3) Cost of Charge controller = No. of solar controller × Cost/charge controller = 1 × 1000 (for a 50 Watt panel) = Rs.1000.
4) Cost of inverter= No of Inverter × Cost/Inverter= 1*2000= Rs.2000.
5) Total cost of system = 1+2+3+4 = 6000 + 4000 + 2000+1000 = Rs.13000 [Additional cost of wiring may be taken as 5% of total system cost]

– Assumptions Taken For Design

1) Inverter Converter DC to AC into AC power with efficiency of about 90%
2) Battery voltage used for operation =12 volt
3) Combined efficiency of inverter and battery will be calculated as:- Combined efficiency =inverter efficiency * battery efficiency =0.9*0.9=0.81=81%.
4) Sunlight available In a day = 8 hours/day (equivalent of peak radiation)
5) Operation of LED TV= 10 hours/day of PV panel.

G. Load Calculation

– AC load: - Total AC load =60 watt (one LED TV)
– AC voltage =230 volt
– AC Load= 60/230 = 0.26 A at 230 Volts

H. Battery Capacity

1) Battery capacity is expressed by how many Amps for how many hours a battery will last - Amp-Hour (A.H.) capacity
2) For a 12-Volt inverter system, each 100 Watts of the inverter load requires approximately 10 DC Amps from the battery.
3) 100 watt from a 12 volt battery required the battery to deliver approximately
4) 100/12 = 8.33 or 8.5 Amp.
5) Suppose LED TV draws about 0.26 A at 230 volt=0.26*230=60 watt
6) Battery will need to deliver 8.5 Amp to run the LED TV(100/12=8.5 Amp approximately)
7) LED TV operated about – 10 hours of a day
8) Therefore the amp-hours drain will be =8.5*10=85Ah
9) I=60watt/12 Volt = 5A

I. Cable of Size Selection

Wire chart for connecting 12 volt solar panel to the charge controller:-
This chart shows the wire distances for a 3% voltage drop or less. These distances are calculated for a 12 volts system. Multiply by 2 for a 24 volt system, multiply by 4 for a 48 volt panel system.

1) The top row represents the wire gauge size,
2) The left column the no. of amperes the solar panel is rated at.
3) Grid cell shows the distances in feet between the solar panel and the charge controller.

J. Cable Size Chart

	Size In Square Mm								
Current In Amp	12	10	8	6	4	3	2	1	1/0
	Distance In Feet								
4	22.7	30.3	57.8	91.6	146	184	232	292	369
6	15.	24.2	38.	61.	97.4	122	155	195	24

	2		6	1					6
8	11.4	18.2	28.9	45.8	73.1	91.8	116	146	184
10	9.1	14.5	23.1	36.7	58.4	73.5	92.8	117	148
12	7.6	12.1	19.3	30.6	48.7	61.2	77.3	97.4	123
14	6.5	10.4	15.5	26.2	41.7	52.5	66.3	83.5	105
16	5.7	9.1	14.5	22.9	36.5	45.9	58.00	73.0	92
18	5.1	8.1	12.9	20.4	32.5	40.8	51.6	64.9	81.9
20	4.0	7.3	11.6	18.3	29.2	36.7	46.4	58.4	73.6

Table 1: Cable Size Chart

It can calculates wire size using 3%, 4%, Or 5% losses plus you can select 12, 24, 48 volt system.

Suppose: - 100 watt Solar plate

DC voltage =12 V

I (dc) =100/12=8.33 approximately i.e. 10 amp.

Length of conductor from panel to charge controller is 40 feet.

Therefore, size of conductor = **6 Sq.mm**

K. Theoretically and Practically Calculation

1) Theoretically Observation Table

Sr. No	Solar Panel			Battery		Ac Load		
	(V)	(A)	(W)	(V)	Volt(Ah)	(V)	(A)	(W)
1.	12	8.33	100	12	45	230	0.260	60

Table 2: Theoretically Observation Table

2) Theoretically Calculation

Power Consumption:-

Ac Power =Ac Voltage*Current

I=P/V

I= 60/230= **0.26 Amp**

3) Practical Observation Table (AC LOAD SIDE)

Sr. No.	Ac Voltage (V)	Starting Current (A)	Stand By Current (mA)	Full Current (A)	Stand By Power (W)	Continuous Power (Watt)	Starting Power (Watt)
1.	**230**	**230**	**0.04**	**230**	**9.2**	**43.7**	**52.9**

Table 3: Practical Observation Table (Ac Load Side)

4) Practical Calculation

a) No Load Readings on Dc Side

Solar Panel Voltage= 14.21volt

Battery Voltage= 14volt

Load Side Voltage= 14volt

No Load Current= 0amp

b) Full Load Readings Dc Side

Solar panel Voltage= 12.54

Battery Current= 4.54amp

Battery Voltage=12 Volt

Dc Power= Dc Voltage*Dc Current

= 12.54*4.54

= 56.94 **Watt**

c) Full Load Readings on Ac Side

Ac Voltage=230 Volt

Full Load Current= 230ma=0.23a

Power Consumption=Ac Voltage*Full Load Current

=230*0.23

= **52.9 Watt**

d) Calculations of Total Watt –Hours Power Consumption

Power Consumption for 1 Hour = 52.9 Watt * 1 Hour

= 52.9 Watt

e) There for Led TV Can Consume the Power in 10 Hours/Day

Power Consumption in A Day = 52.9* 10h

= **529 Watt**

f) Also Calculate Power Consumption in a Month

Power Consumption in A Month= Power Consume In A Day * No. Of Days in a Month= 529*30

= **15870 Watt**

g) Also Calculate Power Consumption in a Year

Power Consumption in a Year = Power Consume In A Day*No. Of Days in a Year = 529*365

= 193085 Watts.

5) Total Practical Observation Table:-

Sr. No	Power Consumption	Wattage	Power Saving (In Units)
1.	In A Hour	52.9 Watt	**0.0529**
2.	In A Day	529 Watt	**0.529**
3.	In A Month	15870 Watt	**15.87**
4.	In A Year	193085 Watt	**193.085**

Table 4: Total Practical Observation Table

L. Technical Specification Table

SR.NO	COMPONENTS	RATING
	SOLAR PANEL	50 WATT TWO
	CHARGE CONTROLLER	12/24 ,10AMP
	INVERTER	600 VA
	BATTERY	12 VOLT,50AH
	LED TV FAETURE	
	LED TV	50 WATT
	SCREEN SIZE	32 " Diagonal
	ASPECT RATIO	16:9
	POWERSUPPLY	AC 90-260V 50/60 Hz
	POWER CONSUMPTION	50 WATT
	WORKING TEMPERATURE	0`C~ 40`C
	WORKING HUMIDITY	20%~80% Non-Condensing

Table 5: Technical Specification Table

VI. CONCLUSION AND FEATURE SCOPE

A. *Feature Scope*

In day to day life of the use of digital electronics equipment are very largely increases. Along this equipment electrical power consumption is also increases. Therefore our projects ideas is to use the solar power for operating this equipment to reduce the conventional electrical power.so in our projects we have choose the LED TV to operates on solar power. Because in presents life and also in future LED TV is an important parts of everyone life. The use of LED TV in various places such as big shopping mall for advertisement purpose, Railways Station, bus stand, Airport for CCTV. For giving the instruction and information to the passengers. It's also used in everyone house for entertainment purpose be its less power consumption, and good visible quality.

Therefore Solar power operated LED TV is used in future. Because its advantages is saving of power, and requirement of energy received from the MSEB it can be also reduces. The main objective, to increase the usage of renewable energy source for power generation is perfectly implemented. Solar power is non-conventional source of power.so it is easily available for the use so now a day's we use solar power for generation of electricity. New technology are used for generation in future we use more technology to generate electricity easily. Taking into consideration the future energy scenario in the world, solar energy would be a major energy source.

B. *Conclusion*

In our projects we concluded that in every hour LED TV consume 52.3 watt for the operation on conventional AC power. Rather than we used solar power instead of AC power. We can considerably save the 52 watt per hours. Therefore we can take the calculation of one month we observed that we save the 15690 Watts energy. Therefore we can save the 15.69 units energy in one month. If used the solar energy. Therefore we can save the cost of energy per month is 125.50 Rs/month of energy light bills of MSEB.

ACKNOWLEDGEMENT

We wish to express our sincere gratitude to our principles Mr.V.G.Arajpure, GF's Godavari College Of Engineering Jalgaon, for providing the facilities to carry out the project work.

We consider our self to be fortunate to get this opportunity to be part of a Project Report on "SOLAR POWER OPERATED LED TV" the We are sincerely grateful to Prof. MAHESH H.PATIL , Sir for his invaluable guidance, motivation and support at all stages and creating a flexible and enjoyable environment to work in.

Special thanks also to Prof. ATUL A. BARHATE (Head of Electrical Engineering) for his valuable support. We are also thankful to all staff members of Electrical Department, without whom the completion of this report world have been impossible Last but not least; We are thankful to the God, Our dearly beloved Parents, all Faculty Members, My Friends and all who directly or indirectly supported for completion….!

REFERENCES

[1] The Energy Blog: About Parabolic Trough Solar
[2] "Large Solar Energy Projects". California Energy Commission. Retrieved2015-10-23.
[3] "Solar Electric Generating System" (PDF). Retrieved 2009-12-13.
[4] "Reducing the Cost of Energy from Parabolic Trough Solar Power Plants", NREL, 2003
[5] "Solar thermal power generation". Solar Systems Ltd. Archived from the original on 2008-06-01. Retrieved 2010-09-30.
[6] Cohen, Gilbert (2006). "Nevada First Solar Electric Generating System" (PDF). Las Vegas, Nevada: Solargenix Energy: 10. contribution= ignored (help)
[7] Friar, Scott (1999). "Parabolic Trough Workshop" (PDF). Ontario, California: KJC Operating Company. Contribution.