CHAPTER 9 Solar Water heating systems

9.1 Guidelines

Provide solar water heating system for residential, commercial and institutional buildings to meet the byelaw requirement or a minimum of 50% of water heating requirement on annual basis, whichever is higher. Insulation on pipelines should be provided as mentioned in the guidance notes.

Water re-circulating pump to reduce wastage should be provided in high rise buildings (in high rise buildings, the line losses may result in stagnated cold water in the distribution pipeline that connect hot water tank to individual households. This happens at night time when the ambient temperature reduces. As result of this, during morning usage hours, the cold water has to be flushed out of the line before hot water supply from the tank is circulated. A small pump can be designed to recirculate the cold water in the pipeline.
9.2 Mandatory clause

Current provision
The building bye law of Bangalore has the following provision for installation of solar water heating system:
Solar lighting and solar water heating is mandatory for all new development / constructions as per Table 10 for different categories of buildings. If solar Lighting and Solar Water heating is adopted, then refundable security deposit on fulfilling the conditions shall be returned along with 2% interest.

Table 9.2.1: (Bye law 3.4.10) Solar lighting and water heater requirements

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Type of use</th>
<th>100 liters per day shall be provided for every unit</th>
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<tr>
<td>1</td>
<td>Restaurants serving food and drinks with seating / serving area of more than 100 sq. m and above</td>
<td>40 sq. m. of seating or serving area</td>
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<tr>
<td>2</td>
<td>Lodging establishments and Tourist Homes</td>
<td>3 rooms</td>
</tr>
<tr>
<td>3</td>
<td>Hostel and guest houses</td>
<td>6 beds / persons capacity</td>
</tr>
<tr>
<td>4</td>
<td>Industrial canteens</td>
<td>50 workers</td>
</tr>
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<td>5</td>
<td>Nursing homes and hospitals</td>
<td>4 beds</td>
</tr>
<tr>
<td>6</td>
<td>Kalyana Mandira, Community Hall and Conventional hall (with dining hall and kitchen)</td>
<td>30 sq. m of floor area</td>
</tr>
<tr>
<td>7</td>
<td>Recreational clubs</td>
<td>100 sq. m of floor area</td>
</tr>
<tr>
<td>8</td>
<td>Residential buildings</td>
<td></td>
</tr>
<tr>
<td>a)</td>
<td>Single dwelling unit measuring 200 sq.m of floor area or site area of more than 400 sq.m whichever is more</td>
<td></td>
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<tr>
<td>b)</td>
<td>Solar photovoltaic lighting systems shall be installed in multi unit residential buildings (with more than five units for lighting the set back areas and drive ways)</td>
<td></td>
</tr>
</tbody>
</table>

Figure 9.2.1: Solar water heating system
Revision proposed
Provide solar water heating system for residential, commercial and institutional buildings to meet the byelaw requirement or a minimum of 50% of water heating requirement on annual basis, whichever is higher. The following typologies of buildings should be added to the list of building with mandatory provision for solar water heating: Office buildings
Apartment blocks
Hotels

Existing buildings shall also be required to install solar water heating system as per the above requirement. Pre-feasibility shall be carried out to determine applicability.

It is felt that sizing norms can be developed based on water heating needs for various applications and reflected in the bye law provisions
Some of sizing norms that could be applied are as follows:

**Guidelines for system sizing**
Hot water demand can be assumed as follows.
- For bathing (using bucket water) = 15 litres per person per bath (one bucket)
- For shower bath = 25 litres per person per bath
- For tub bath = 35–50 litres per person per bath
- For cooking = 5 litres per person per day
- For washing clothes = 10 litres per person per day
- For washing utensils = 5 litres per person per meal
- For making tea/coffee = 150 ml per person per cup

(Consumption figures may vary, depending on the lifestyle, age, habits, and weather conditions)

UNDP/GEF is conducting a study (under publication) on assessing the potential of solar water heating systems in India. Some indicative benchmark numbers that are available for estimation of solar water heating requirement for various applications are as follows:

**Hotels:**
- 4 star and above: 150 lpd/room
- 3 star: 125 lpd/room
- 2 star and below: 50 lpd/room

**Hospitals:**
- 30 lpd/bed for government/private hospitals
- 190 lpd/bed for multi speciality hospitals

**Hostels:**
- 30 lpd/student

Applying the above, the hot water demand per bed/person for hostel/guest houses can be estimated as follows:
- For bathing (using bucket water) = 15 litres per person per bath (one bucket)
- For cooking = 5 litres per person per day
- For washing clothes = 10 litres per person per day
- For washing utensils = 5 litres per person per meal

Hence total hot water demand can be estimated as 30-35 lpd and hence 6 beds would require a minimum of 180-210 lpd (say 200 lpd) instead of 100 lpd specified in the current byelaw. The current byelaw provision shall meet 50% of the water heating requirement

Similarly, for industrial canteens,

Applying the above, the hot water demand per worker can be estimated as follows:
- For cooking = 5 litres per person per day
- For washing utensils = 5 litres per person per meal

Hence per person requirement is about 10 lpd and hence one 100 lpd is required per 10 workers, in place of 50 workers. The current byelaw provision would thus meet 20% of the hot water need for this application. The apartment blocks that have dwelling units lower than 200 sqm should also be covered by byelaw and provision for solar water heating system should be mandated. In case of apartment buildings, the available roof area could determine the capacity of solar water heating systems to be provided.
9.3 Technical guidelines:

Solar water heating system
The system is generally installed on the terrace and requires minimum maintenance. It works automatically and one does not have to operate any part of the system. Typically, a surface area of 3 sq m is required to install it. The system can also be installed on a south-facing window sill if space is not available on the terrace. Two types of systems are being promoted—one based on FPC (flat plate collectors) and the other on ETC (evacuated tube collectors). The life of FPC-based systems is generally 15–20 years, and they are costlier than ETC-based systems. There are 57 BIS (Bureau of Indian Standards)-approved manufacturers of these systems, (the ones in Karnataka have been listed below) and they have had a stable market in the country for the last many years. ETC-based systems are relatively new and could be more reliable for colder regions and regions that have hard water. The life of these systems is, however, less since their collectors comprise glass tubes, which are fragile. The installation of a solar water heating system in a home/building needs to be planned at the time of its construction. The following points may be kept in mind while planning for the same.

1) A 3-4 sq m (per 100 lpd system) shadow-free area should be available on the terrace for installation.

Figure 9.3.1: Evacuated tube collector type solar water heating system

Solar water-heating system components
The main components of a solar water-heating system are Solar collectors, Insulated hot water tank, Back-up system, Plumbing, and Control and instruments.
Solar Collectors: Solar collectors are of two types, Flat plate solar collectors and Evacuated-tube Collector or vacuum tube solar collectors.

Hot water tank: Solar water heating tanks are made of stainless steel, copper, or mild steel, with a heat-resistant protective coating inside for avoidance of corrosion. To reduce heat losses, the tanks are insulated with rock-wool insulation pads or polyurethane foam. The insulation is covered with aluminium sheet cladding, reinforced fiber glass, FRP (fiber glass reinforced plastic) cover, or suitable grade plastic cover. The tanks are available in a variety of shapes, sizes, and colors.

Plumbing: Galvanized iron pipes and fittings of BIS-approved class ‘B’ or higher are normally used for the plumbing in solar water heating systems. Piping for a solar water heating system should be well insulated to minimize thermal losses. The insulation should be further protected by suitable aluminium, FRP, or HDPE (high density polyethylene) pipe cladding. Various insulation materials – such as asbestos rope, glass wool, rock wool, or PUF (polyurethane foam) – are used as insulation. For pipes measuring up to 25 mm in diameter, insulation of 25 mm thickness is recommended. Insulation of 50 mm thickness is recommended for pipes with 25–75 mm diameter. If hot water pipes are concealed in walls, they must be insulated; otherwise, there is a chance of the walls developing cracks due to expansion of the metallic pipes. For concealed pipes, asbestos rope is normally used for insulation; however, it is recommended to use 25-mm-thick rock wool/glass wool insulation. Nowadays, composite pipes and polymer pipes, which are considered suitable for hot water applications, are also available.

Controls and instrumentation Valves are used for control of water flow. Gate valves or ball valves of suitable ratings are used. Pressure and vacuum release valves or open vents are provided to take care of the pressure build-up or vacuum formation problems. A temperature gauge is provided for temperature measurement. Additionally, thermostatic controllers, electronic temperature controllers, and pumps are provided for large systems. Use a proper vent or vacuum-release valve/pressure-relief valve for safe operation of the solar water heating system.
Types of solar water heating systems
There are two types of solar water heating systems:

- Thermo siphon-type solar hot water system- For capacities of up to 2000 liters per day.
- Forced flow solar hot water system- For capacities higher than 2000 liters per day.

**Back-up system:** Solar water heating system output depends on the availability of solar energy. In order to meet hot water requirements during periods of low sunshine, a back-up system is used. Typically, an electrical heater is provided in the hot water tank of the solar water heating system for this purpose. The back-up heater is also useful in meeting the additional hot water requirements, over and above its designed capacity. In some cases, a conventional storage electrical geyser is also used as back-up.

**9.3.1 Guidelines for design, installation, and use of solar water heating systems**

- Solar collector should face true south for maximum solar radiation collection.
- The solar collector tilt should be equal to the latitude of the place for maximum annual energy collection.
- The solar collector tilt equal to latitude +15° gives maximum energy collection in winter.
- Solar collector tilt equal to latitude -15° gives maximum energy collection in summer.
- Always check the load-carrying capacity of the roof before placing the solar water heating system. Typically, each solar collector with a 2 m² area weighs approximately 50 kg. When filled with water, the solar tank weighs about 1.2–1.4 kg per litre capacity of the tank (for example, a 100-litre capacity tank weighs around 120–130 kg).
- Ensure proper anchoring of the system, duly considering wind conditions.
- Solar collectors and tank must be easily accessible for cleaning and maintenance. Typically, the solar water heating system requires approximately 1.3–1.5 times collector area for installation. For example, a single-collector system with a capacity of 100 litres and an area...
Development of Building Regulations and Guidelines to Achieve Energy Efficiency in Bangalore City

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<th>Proposed Mandatory Clause</th>
<th>Technical Guidelines</th>
<th>Benefits</th>
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</thead>
</table>

of 2 m² needs about 3 m² of the floor area for installation.

- Gap between nearest tall building and collector surface should be at least twice the building height for buildings in south and east west sides.
- Plumbing to be insulated and if possible inside the wall.
- Check water quality TDS/hardness should be less than 100 ppm consult expert if some minerals are more (refer ISI standard for water quality)

### 9.3.2 Guidelines for system selection and use

- Check the hardness of the water to be used in the solar water heating system. Solacollectors have small diameter pipes, which get blocked due to the deposition of salt from hard water. In cases of hard water, either a water softener or a heat exchanger-type solar water heater can be used.
- It is a good practice to consider the location of the solar water heating system and optimize the associated hot/cold water piping layout during the building design stage, to reduce cost and heat losses caused by longer piping.
- Always use good quality pipes and insulation for longer user-life and trouble-free working.
- It is important to check the operating pressure of the cold water supply line, especially when pressurized water is circulated. Most solar water heating systems available in India are not designed for pressurized water supply.

### 9.3.3 Guidelines for insulated hot water piping

- Heat losses in hot water piping can account for more than 30% of water heating energy. These can be reduced by optimising the length of the hot water piping (minimizing end-use to storage tank distance) and properly insulating the storage tank and piping.
- Reduce construction costs and heating losses by locating the solar water heater in close proximity to showers, washing machine, and kitchen.
- Use jute rope for insulation as this is a cheap option. However, it is recommended that preformed insulation pipe section or foam pipe section, pre-insulated pipes, and polymer/composite pipes – suitable for high temperature applications (up to 100 °C) – are used.
Polymer/composite pipes have lower thermal capacity and lower thermal conductivity compared to GI (galvanized iron)/copper pipes, resulting in lower heat losses as they have better corrosion resistance than metal pipes. While using metal pipes, use the BIS-approved class ‘B’ or higher quality GI.

- Set water heater temperature to an optimu level. The human body can tolerate temperatures up to 45 °C. Human skin burns at water temperatures above 55 °C. Therefore, storage water heater temperature can be set at approximately 55(±5) °C.

9.4 Benefits:

The overall potential in India is estimated to be 140 million sq. m. of collector area. About 1 million sq. m. of solar collector area is estimated to have been installed in the country over the past two decades. The achievement made so far is, therefore, modest compared to such a potential, and also in relation to what has been achieved in other countries, particularly in China. In the residential sector, there are 0.7 million SWH user households; Karnataka is one of the leading states. The empirical data, over a period of time, in terms of SWH sale, its region-wise and segment-wise breakup and behaviour of relevant variations is not available. The present installations are concentrated in Karnataka estimates in terms of SWH penetration and CAGR (compound annual growth rate), for a given segment under the concerned scenario, recognizes the following.

- Historical trends and best-case (Karnataka) performance
- Assessment of potential based estimated growth for a given segment and its response to SWH; considering payback period prospect,
- Variations in SWH penetration vis-à-vis new and old buildings

As per the spatial distribution of projected demand, cumulative SWH potential for state of Karnataka has been projected at 3.88 million sq. m for the year 2022 under the realistic scenario. This projection excludes the industrial sector. As per the
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**Solar water heating systems**

- **Guidelines**
- **Proposed Mandatory Clause**
- **Technical Guidelines**
- **Benefits**

Projection, the SWH potential for residential sector will stand at 3.72 Million Sq.m and for commercial/institutional sector the demand has been projected at 0.16 million sq. m of area. Karnataka falls under category 1 state with respect to the penetration rate of SWH in households. At present the average SWH penetration rate as percentage of urban household owning SWH stands at 6%. It is assumed that the penetration level in new housing would remain constant at 24% as per the estimate of 2022.

The city of Bangalore is in temperate climate zone of India. Hot water is required round the year for daily domestic needs. It receives good solar radiation with almost 5.5 kWh/m²/day. Almost, 89.7% of the households are of permanent construction. Bangalore is the largest market for SWH and has the maximum penetration of SWH in the country. Most of the national players are present along with large number of local players. It has been estimated that, Large SWH potential with cumulative SWH potential in million m² for 2022 under the realistic scenario for Bangalore is **1.94 Million m²**

A solar water heater is a device that uses heat energy of the sun to provide hot water for various applications. In homes, it is useful for bathing, washing, cleaning, and other chores. A domestic solar water heater, with a capacity of 100 lpd (litres per day), is sufficient for a family of four or five members. It can easily replace a 2-kW electric geyser and can save up to 1500 units of electricity a year. It pays back the cost in three to five years depending on the electricity tariff and hot water use in a year. After this, hot water is available almost free of cost during remaining lifespan of the system, which is about 15-20 years. The cost of solar water heaters, with a capacity of 100 lpd) varies between Rs 18 000 and Rs 25 000. To offset the initial high price, a set of incentives are available that are listed below.

It has been estimated (using computer simulation tool RETSCREEN) that energy demand to cater to hot requirement of 100 lpd at 60 deg C (for 10.5 months annually) is 1.34 MWh of which about 0.92-1.00 MWh can be supplemented using solar energy for water heating. The payback period (taking into account the interest subsidy offered through schemes of the Ministry of New and Renewable Energy, Government of India) is about 3.5 years.
Soft loans are available for installation of Solar Water Heating Systems under the MNRE SWH Scheme. The detail of Soft loan is as given below:

a) Domestic : 2%
b) Institutions : 3%
c) Commercial : 5%

Capital subsidy equivalent to upfront interest subsidy has been introduced to registered institutions and registered commercial establishments that do not avail soft loans.

The detail of capital subsidy is as given below:

@ Rs.1100/- per sq.m. of collector area will be available to registered institutions and

@ Rs.825/- per Sq.m. of collector area to registered commercial establishments.

The main objective of the Scheme is to promote the widespread use of solar water heaters through a combination of financial and promotional incentives.

- The subsidy will be provided on re-imbursement basis after the systems have been installed. The applications are to be submitted to the State Nodal Agencies.
- SNAs will be provided service charges @ Rs.100/- sq. m. of installed collector area.
- The Municipal Corporations, Central/State Govt. departments will also be eligible to receive similar service charges for the claims processed and forwarded by them to the Ministry.
- To encourage the use of solar water heaters, which helps in reduction of peak loads, the rebate of 50 ps per unit with a maximum limit of Rs. 50 per installation is being provided by all Electricity Supply Companies.

Benefits of usage of Solar Water Heating system in buildings in Bangalore

As per the data available with KREDL, an average household with an electric water heater spends about 25% of its home energy costs on heating water. It is found that solar water heaters offered the owners saving as much as 50% to 85% annually on their utility bills over the cost of electric water heating. It is possible to get a simple payback of 3 to 8 years on a well-designed and properly installed solar water heater.
Shorter payback is possible in areas with higher energy costs. As soon as the payback period culminates, one can accrue the savings over the life of the system, which ranges from 15 to 40 years, depending on the system and how well it is maintained.

It is observed in ............. buildings, adopting SWH have high energy saving potential. ................. simulation engine was used to quantify energy saving potential in ................. buildings.

In .................. buildings, the annual savings in energy consumption is up to ...................% by adoption of Solar Water Heating system.

Percentage increment in initial investment is up to ..............%.

Pay back period of the increment cost is less than ................. years. (Reference Fig. below)
Table 9.4.1: List of solar water heater manufacturers/providers in Bangalore

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Name</th>
<th>Address</th>
<th>Contact No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M/s. Sundrop Solar Systems</td>
<td>44/2a, Industrial Estate, Opp Gangadharshehwa Kalyana Mantapa NH 7, Bellary Road, Hebbal Bangalore 560024</td>
<td>Tel: 23620077 Mobile: 9844068721 Web: <a href="http://www.sundropsolar.net">www.sundropsolar.net</a></td>
</tr>
<tr>
<td>2</td>
<td>M/s. Sudhanva Industries</td>
<td>65/18, 1st Main,0 7/08/2008 1st Cross, Andrahalli Main Road, Hegganahalli, Bangalore Pin : 560091</td>
<td>Tel: 28366832, Mobile: 9845313912 Email: <a href="mailto:govindnag@gmail.com">govindnag@gmail.com</a></td>
</tr>
<tr>
<td>3</td>
<td>M/s. Kinara Power Systems and Projects Pvt Ltd</td>
<td>Unit 2, 10,10th Cross, Patel Channappa Indl Estate, Andrahalli Main Road, Peenya 2nd Stage, Viswaneedum Post, Bangalore 560091</td>
<td>Tel: 28365944</td>
</tr>
<tr>
<td>4</td>
<td>M/s. Om Shakthi Industries</td>
<td>No2 S.T. Narayana Gowda Industrial estate, Sri Gandha Nagar, Doddanna Industrial Estate, Near Peenya II Stage, Bangalore - 560091</td>
<td>Tel: 28362967,56982645 Mobile: 9448062867 Email: <a href="mailto:shakthisolar@yahoo.co.in">shakthisolar@yahoo.co.in</a></td>
</tr>
<tr>
<td>5</td>
<td>M/s. Sabha Solar Energy</td>
<td>3/1 Behind Balaji Petrol Bunk, 2nd Cross, Lakshmaiah Block, Ganganagar, Bangalore-560032 Pin : 560032</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>M/s. Velnet Non-</td>
<td>No 120, Bhadrappa Layout,</td>
<td>Tel: 23418630,23417940,23512799</td>
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<tr>
<td>1</td>
<td>conventional Energy Systems(P) Ltd.,</td>
<td>Ring Road, Nagashettyhalli, Bangalore 560094</td>
<td>Mobile: 9844050723, Email: <a href="mailto:info@kamalsolar.com">info@kamalsolar.com</a>, Web: <a href="http://www.kamalsolar.com">www.kamalsolar.com</a></td>
</tr>
<tr>
<td>7</td>
<td>M/s. Enolar Systems,</td>
<td>45/29-1, Gubbanna Industrial Estate, 6th Block, Rajajinagar, Bangalore 560010</td>
<td>Tel: 23355333/23385500, Fax: 23355333, Email: <a href="mailto:peekayarr@yahoo.com">peekayarr@yahoo.com</a></td>
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<tr>
<td>8</td>
<td>M/s. Divya Industries,</td>
<td>No 814, Chowdeshwari Nagar, Laggere Main Road Laggere, Peenya Post, Bangalore Pin: 560058</td>
<td>Tel: 8398471, Email: <a href="mailto:disol@vsnl.net">disol@vsnl.net</a></td>
</tr>
<tr>
<td>9</td>
<td>M/s. Shringar Engineering &amp; Energy</td>
<td>System Pvt Ltd, No 93 7th Main 3rd Phase, Peenya Industrial Area, Bangalore 560058</td>
<td>Tel: 28398197, Email: <a href="mailto:suryananthi@vsnl.net">suryananthi@vsnl.net</a></td>
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<tr>
<td>10</td>
<td>M/s. Perfect Solar Bangalore Pvt Ltd,</td>
<td>No.16 Byraveshwara Industrial Estate, Andrahalli Main Road, Peenya 2nd Stage Bangalore</td>
<td>Mobile: 9845106037, Email: <a href="mailto:perfect@bgl.vsnl.net.in">perfect@bgl.vsnl.net.in</a></td>
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<tr>
<td>11</td>
<td>M/s. Sunrise Solar Pvt Ltd,</td>
<td>B-4, Jayabharat Industrial Estate, Yeshwanthpur, Bangalore – 560022</td>
<td>Tel: 23328533,23523644, Fax: 23425115, Email: <a href="mailto:solar@bgl.vsnl.net.in">solar@bgl.vsnl.net.in</a>, Web: <a href="http://www.sunrisesolarsystem.com">www.sunrisesolarsystem.com</a></td>
</tr>
<tr>
<td>12</td>
<td>M/s. Sustainable Power Developers India Pvt Ltd,</td>
<td>604/677, Magadi Road, P&amp;T Layout Road, Sunkadakatte, Bangalore 560079</td>
<td>Tel: 23580066,23581154</td>
</tr>
<tr>
<td>13</td>
<td>M/s. Tata BP Solar India Ltd</td>
<td>Plot No. 78, Electronic City Phase – 1, Hosur Road, Bangalore – 560100</td>
<td>Tel: 080-56601300, Fax: 080-28520972/28520116, Email: <a href="mailto:tatap@tatap.com">tatap@tatap.com</a>, Web: <a href="http://www.tatapolar.com">www.tatapolar.com</a></td>
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<tr>
<td>14</td>
<td>M/s. Kotak Urja Pvt Ltd,</td>
<td>378 10th Cross, 4th Phase, Peenya Industrial Area, Bangalore 560058</td>
<td>Tel: 28363330,28362136, Fax: 28362347, Email: <a href="mailto:kotakurja@gmail.com">kotakurja@gmail.com</a>, Web: <a href="http://www.kotakurja.com">www.kotakurja.com</a></td>
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<tr>
<td>15</td>
<td>M/s. Emmvee Solar Systems Pvt Ltd,</td>
<td>Survey No 13/1 Bellary Road, Jala Hobli Sonnapanahalli, Bettahalsur Post, Bangalore 562157</td>
<td>Email: <a href="mailto:info@emmvee.in">info@emmvee.in</a>, Web: <a href="http://www.emmveesolar.com">www.emmveesolar.com</a></td>
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<tr>
<td>16</td>
<td>M/s. Sun Zone Solar Systems,</td>
<td>¼, Balagangadahara Nagar, Mallathahalli, Behind Sanford college,</td>
<td>Tel: 23282145, 23214777, Mobile: 56979935</td>
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</table>
## Technical Guidelines

### Proposed Mandatory Clause

- **Benefits**
  - Solar water heating systems

### Guidelines

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<th>Contact No.</th>
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<tr>
<td>17</td>
<td>M/s. Nuotech Solar Systems Pvt Ltd</td>
<td>P.B.No.9167, B.M. Shankarappa Industrial Estate, Sunkadakatte, Vishwaneedam Post, Magadi Main Road, Bangalore 560091</td>
<td>Tel: 080-23483766,23481905 Fax: 080-23281730 Email: <a href="mailto:info@nuetechsolar.com">info@nuetechsolar.com</a> Web: <a href="http://www.neutechsolar.com">www.neutechsolar.com</a></td>
</tr>
<tr>
<td>18</td>
<td>M/s. Solar Energizers P Ltd</td>
<td>36/3, 1st Cross, Pukhraj Layout, Bannerghatta Road, Adugodi, Bangalore - 560030</td>
<td>Tel: 22245481 Fax: 22225804 Email: <a href="mailto:nazumm@hotmail.com">nazumm@hotmail.com</a></td>
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<td>19</td>
<td>M/s. Dheemanth Industries</td>
<td>35, Behind, Check Post, Kamakshipalya Layout, Bangalore 560079</td>
<td>Tel: 23489377/2342617</td>
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<tr>
<td>20</td>
<td>M/s. Technomax Solar Devices Pvt Ltd</td>
<td>No 21/B, 4th Main, 1st Cross, Industrial Suburb, Yeshwanthpur, Bangalore – 560022</td>
<td>Tel: 3418723</td>
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<tr>
<td>21</td>
<td>M/s. Digific Controls (India) Pvt Ltd</td>
<td>Sit2e8 /03/2008 No. 9, 2nd Cross, Rajagopala Nagar, Main Road, Bangalore</td>
<td>Tel: 080-28366839 Fax: 080-28362689 Email: <a href="mailto:sales@digiflic.com">sales@digiflic.com</a></td>
</tr>
<tr>
<td>22</td>
<td>M/s. Kateel Engineering Industry (P) Ltd</td>
<td>19 &amp; 20, Bhadrappa Estate, Magadi Main Road, Kamakshipalya, Unit I, Bangalore Pin : 560079</td>
<td>Tel: 23481305,23484179 Fax: 23481305 Email: <a href="mailto:info@kateel.com">info@kateel.com</a></td>
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<td>23</td>
<td>M/s Solar Hitech Geyzers</td>
<td>No. 4, Sri Krishna, Behind Bhima Jyoti LIC Colony, West of Chord Road, Bangalore – 560 079</td>
<td>Tel: 080-23223152, 23221511 e-mail: <a href="mailto:solarhitech@gmail.com">solarhitech@gmail.com</a></td>
</tr>
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<td>24</td>
<td>M/s. EmmVee Solar Systems Pvt. Ltd.</td>
<td>#55, “Solar Tower”, 6th Main, 11th cross, Lakshmaiah Block, Ganganagar, Bangalore – 560 024.</td>
<td>Tel: 080-23337428, Fax: 080-23332060 e-mail: <a href="mailto:info@emmvec.in">info@emmvec.in</a></td>
</tr>
<tr>
<td>25</td>
<td>M/s. Vijaya Industries</td>
<td>Katapady – 574 105, Udupi Dist, Karnataka</td>
<td>Tel: 0820-2557127 Fax: 0820-2557327, Mobile: 09448377327 e-mail: <a href="mailto:vijayasolar@yahoo.com">vijayasolar@yahoo.com</a></td>
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<td>26</td>
<td>M/s. Rashmi Industries</td>
<td>No.60 &amp; 61, Begur Road, Hongasandra, Bangalore – 560 068</td>
<td>Tel: 080-25734114 / 15 e-mail: <a href="mailto:rashmisolar@gmail.com">rashmisolar@gmail.com</a> website: <a href="http://www.rashmisolar.com">www.rashmisolar.com</a></td>
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Reeep: Renewable energy & energy efficiency partnership

Development of Building Regulations and Guidelines to Achieve Energy Efficiency in Bangalore City

Teri: Energy and Environment Technologies

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<th>Sl. No</th>
<th>Name</th>
<th>Address</th>
<th>Contact No.</th>
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<tr>
<td>28</td>
<td>M/s. Anu Solar Power Pvt. Ltd.</td>
<td>248 3rd Cross, 8th Main, 3rd Phase Peenya Industrial Area, Bangalore – 560 058.</td>
<td>e-mail: <a href="mailto:kn.ramesh@orbenergy.com">kn.ramesh@orbenergy.com</a> website: <a href="http://www.orbenergy.com">www.orbenergy.com</a> Tel: 080-28394259, 28393913 e-mail: <a href="mailto:info@anusolar.com">info@anusolar.com</a> website: <a href="http://www.anusolar.com">www.anusolar.com</a></td>
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<td>29</td>
<td>Wipro Eco Energy (A division of Wipro Ltd.)</td>
<td>Wipro Eco Energy, S.B.Towers. 88, MG Road, Bangalore-560001</td>
<td>Tel: 080-41994004, 91-9900582662 <a href="mailto:sudarshan.ananth@wipro.com">sudarshan.ananth@wipro.com</a></td>
</tr>
<tr>
<td>30</td>
<td>M/s Hamshine Electronics &amp; Energy System</td>
<td>B.Katehalli Industrial Area, Plot No.7A/1, Hassan – 573201 (Karnataka)</td>
<td>Tel: 8172-240219 Mob: 9448140219 e-mail: <a href="mailto:hamshine@hotmail.com">hamshine@hotmail.com</a></td>
</tr>
<tr>
<td>31</td>
<td>M/s. Legend Solar Energy Systems Private Limited</td>
<td>295B, KIADB Industrial Area Bommasandra – Jigani Link Road, Jigani Bangalore.</td>
<td>Tel:- 80-7825595 , e-mail:<a href="mailto:-sunakti@legendkingdom.com">-sunakti@legendkingdom.com</a> web-site:- <a href="http://www.legendkingdom.com">www.legendkingdom.com</a></td>
</tr>
<tr>
<td>32</td>
<td>M/s. G.C. Solar Industries</td>
<td>977, Ground Floor, ITI Society Layout, Outer Ring Road, Nagarabhavi Road, Bangalore – 560072</td>
<td>Tel: 080-23210848/ 23183060/ 9845023816 (Mob) Fax: 080-23210848 e-mail: <a href="mailto:info@gcsolarindustries.com">info@gcsolarindustries.com</a> website: gcsolarindustries.com</td>
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