FINAL REPORT

Building Sector Policies and Regulation for Promotion of Solar Water Heating System

Submitted to Ministry of New and Renewable Energy(Government of India)

This report has three distinct sections, section I deals with National and International best practices on usage of Solar Water Heater; section II deals with case studies in urban local bodies in India especially focussing on the implementation of the MNRE-MOUD directive on SWH. It also highlights the implementation of the Barcelona Model. The section III is the most important volume that assimilates the lessons and best practices from the previous sections to develop a uniform policy framework in form of a Solar Water Heating Order and its implementation framework.

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Content

Acknowledgement

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Ashok Kumar Singha

Director, CTRAN Consulting

Acceptance and Closure

This report has been finalised according to the principles and directions set by the project advisory committee in Delhi and subsequent wish of including a draft Order namely Solar Water Heating Order as a step towards implementation of the Uniform Policy on Solar Water Heating. The document also gives a broad implementation framework which can only be finalised after due wide ranging consultation with the stakeholders and is not part of the current consultancy mandate. If no comments received within seven days of the submission of this report, we would treat the report to have been accepted.

ABBREVIATIONS

AICTE	**All India Council for Technical Education**
APERCA	**Asociacion Espanola De Empresas de Energia Solar Y Alternativas**
AQSIQ	**Administration for Quality Supervision, Inspection and Quarantine**
BBMP	**Bruhat Banaglore Mahanagara Pallike (Greater Bangalore City Corporation)**
BDA	**Bangalore Development Authority**
BEE	**Bureau of Energy efficiency**
BER	**Building Energy Rating**
BIS	**Bureau of Indian Standard**
CMPO	**Calcutta Metropolitan Planning Organisation**
CREB	**Clean Renewable Energy Bonds**
CSC	**Citizen Service Centre**
CTE	**Codigo Technico Edification**
DHBVNL	**Dakshin Haryana Bijli Vitran Nigam Limited**
DMA	**Directorate of Municipal Administration**
DMC	**Durgapur Municipal Corporation**
DPC	**District Planning Committee**
ECA	**Energy Conservation Act**
ECBC	**Energy Conservation Building Code**
EECA	**Energy Efficiency and Conservation Authority**
EERR	**Energy Efficiency and Renewable Resources**
ESCO	**Energy Servicing Company**
ETC	**Evacuated Tube Collector**
FPC	**Flat Plate Collectors**
GDP	**Gross domestic Product**
GEF	**Global Environmental Facility**
GHG	**Green House Gases**
GRIHA	**Green Rating for Integrated Habitat Assessment**
HAREDA	**Haryana Renewable Energy Development Agency**
HMC	**Howrah Municipal Corporation**
HRTC	**Homo Renovation Tax Credit**
HUDA	**Heating, Ventilation and Air Conditioning**
HVAC	**International Council for Local Environmental Initiatives**
ICLEI	**Investment Tax Credit**
IGBC	**Indian Green Building Council**
IREDA	**Indian Renewable Development Agency**
ITC	**International Tobacco Company**
JNURM	**Jawaharlal Nehru Urban Renewable Mission**
KDMC	**Kalyan Dombivli Municipal Corporation**
KERC	**Karnataka Electricity Regulatory Commission**
KMC	**Kolkata Municipal Corporation**
KREDL	**Karnataka Renewable Energy Development Limited**
KSEB	**Karnataka State Electricity Board**
LEED	**Leadership in Energy and Environmental Design**
LPD	**Liters Per Day**
MCC	**Mangalore City Corporation**
MCD	**Municipal Corporation of Delhi**
MDP	**Municipal Development Programmes**
MFI	**Micro Finance Institution**
MoUD	**Ministry of Urban Development**
MUDA	**Mysore Urban Development Authority**
NBC	**National Building Code**
NBFC	**Non Banking Finance Company**
NEC	**National Electrical Code**

ABBREVIATIONS

NCSE	**Non Conventional Sources of Energy**
NDMC	**New Delhi Municipal Council**
NEDA	**Non-Conventional Energy Development Agency**
NHB	**National Housing Bank**
NOC	**No Objection Certificate**
OPF	**Obra Publics Financiada**
PV	**Photo Voltaic**
PWD	**Public Works Department**
REDA	**Renewable Energy Development Agency**
REFSO	**Renewable energy finance and subsidy Office**
RPO	**Renewable Purchase Obligation**
RPS	**Renewable Portfolio Standards**
SEZ	**Special Economic Zones**
SNA	**State Nodal Agency**
SUDA	**State Urban Development Agency**
TERI	**The Energy and Resources Institute**
TMC	**Thane municipal corporation**
U.T.	**Union Territory**
ULB	**Urban Local Body**
UNDP	**United Nations Development Programme**
WBREDA	**West Bengal Renewable Energy Development Agency**

Executive summary

India has an ambitious target of reaching 10 million m^2 of installed Solar Water Heating (SWH) systems in India by 2012. The global UNDP-UNEP Solar Water Heating Market transformation and Strengthening Initiative Project goal is to accelerate and sustain the SWH market growth in India and to use the experiences and lessons learnt in promoting a similar growth in other countries. Many countries have provided enabling policy framework internationally and some states in India recently have followed suit.

The study is a part of the larger study of 'Building Sector Policies and Regulations for Promotion of Solar Water Heater Systems' covering four zones east, west, north and south. The study is supported by UNDP/GEF which is assisting the implementation of a project by the Ministry of New and Renewable Energy, Government of India, on 'Global Solar Water Heating Market Transformation and Strengthening Initiative : India Country Program' which has been taken up with fulfilling the objective of accelerating and sustaining the solar water heater market growth in India.

One of the objectives of the assignment is to review the Building Sector Policies and Regulations in India in the context of Solar Water Heating (SWH) System Promotion and assess their effectiveness. To study that it is also important to understand the national and international best practices. This report has tried to compile best practices from:

- Europe: Germany, Spain, Ireland, Italy
- Asia-Pacific: India, China, Thailand
- Arabic Countries: Egypt, Syria
- African Countries: South Africa (Capetown)
- Latin America: Mexico
- Newzealand
- USA and Canada

Some of the existing best practices in India have been culled out. This has been divided into two parts (a) Status review of some the national level initiatives (b) Implementation experiences of the states. This involves experiences of the following states:

- Uttar Pradesh
- Haryana
- Tamil Nadu
- Delhi

This case study model attempts to examine the barriers and best practices both in national and international level. It also attempts to assess the implementation effectiveness and the practices that have worked and the barriers that have been un-surmountable. The specific objective of the present work is to present an inventory of all relevant cases and experiences, giving both a complete overview of international experiences, and a horizontal evaluation of this inventory at demotic level, in the way of a common business environment, implemented by flanking measures to overcome actual barriers.

The approach used for studying municipal bodies in four zones of India is through a case based method. Twelve Municipalities in four states and four zones one state each per zone have been taken as samples to study the SWH component in the building bye laws.

As the primary objective of the study is to enable the development of a uniform policy and regulatory framework and an effective implementation plan for enabling the market for solar water heaters, review of the existing policies and regulations is of prime importance. This includes studying the processes that are involved in preparing the building bye laws for (a) corporations and (b) municipalities and also to see how many of the Municipalities have issued orders to include SWH.

Views of the various stakeholders- experts in urban laws, staff of Municipal Corporation, Architects, Urban and Town Planners, builders and manufacturers of SWHs have been elicited for the purpose as part of the stakeholder consultation.

The building bye laws vary from city to city and they are framed by each of the Corporations as per the Town and Country Planning Act. While the Zoning regulations are a set of rules framed under the Master Plan for regulation of land use and development of the town or city, the Building bye laws are a detailed set of rules framed in conformity with zoning regulations for regulation of buildings.

We have also attempted to understand the Barcelona City Council Implementation Framework through a comprehensive case study (a short case was attempted in the international best practices and was advised by the Project Steering Group to focus more on Barcelona Model and understand the policy development and implementation issues.

The success of Barcelona Model is due to a fairly long period participatory planning exercise involving key stakeholders, that helped in understanding the problem areas and addressing it. Most of these areas were technical and a few were policy related. Second important point was the amendment taking into account the views and having a cool off period before full enforcement. It also had an institutional mechanism to act as pressure point and conscience keeper as well technical back-stopper. Then finally sustained political commitment saw its steady implementation.

These are the top barriers and suggestions that stakeholders (from Authorities, architects, realtors and end-users).

Barriers	Possible solutions
Amendment and Standardisation of bye-law implementation	MoUD-MNES to work together to sensitise state counter-parts and councillors on the various clauses and transfer the incentive in a time bound manner base on the implementation
Lack of awareness (about the bye-law, about technology, maintenance)	Preference survey from the different segments and awareness levels to develop the baseline then the targeted communication (general communication does not help)
Incentive and Penalty are difficult to administer	Simpler transfer of discount coupon on purchase and installation, penalty at inception in both mandatory and voluntary regime through approval process, new electricity connection phase for new establishments and penalty during holding tax for failing in retrofit. Govt. and institutional buildings should be placed under mandatory regime.
Poor supply and after-sale service chain	Manufacturers to participate with ITIs to develop a cadre of certified installers and strategically place them around distributors; extended warranty schemes.
Poor Lending from FIs	IREDA-MNRE and Banks, MFIs to participate to evolve a simpler mechanism that is acceptable to every-one for private residential sector (real estate project) it should be linked to the builder-credit limit rather than household level. Govt and institutional buildings should be placed under mandatory regime.
Standards	Clear standards to be reinforced through incentives and other spurious ones should not be allowed any subsidy. Manufacturers to run vendor certification or standard programs like solar key-mark with standards agency and clearly demonstrate cost benefits through advertisement in customer education series.
Lack of staff to monitor and verify	ESCO agencies should be brought into work in areas with manufacturers and authorities and should be assigned conversion targets against reasonable incentives.

The last part was to develop a uniform solar thermal order. The main **objective** of this **Solar Water Heating Order (Order)**[1] is to bring in conformity to the National Mission and help in transformation of the solar thermal and water heating market in the country by achieving policy and institutional convergence.

Building **regulations** are part of the state list hence diverse; this diversity has retarded the pace of any implementation of policy guidelines. Centre has come out with a National Building Code (Revised version, 1983), a national instrument providing guidelines for regulating the building construction activities across the country. It serves as a Model Code for adoption by all agencies involved in building construction works, etc. The Code mainly contains administrative regulations, development control rules and general building requirements; fire safety requirements; stipulations regarding materials, structural design and construction (including safety); and building and plumbing services. It has also brought out the 'National Electrical Code' (NEC) and till recently the Energy Conservation Building Code (ECBC) has been given tooth through Energy Conservation Act (EC Act). This Solar Water Heating Order intends to bring in uniformity and convergence and could be notified ceteris paribus, under section 14 of the Energy Conservation Act. All line departments like Town and Country Planning Department, Urban Development Department, PWD (Building and Roads), PHD, Housing Board, Architecture Dept. in the states will revise their byelaws in alignment and corporations where they exist with their Corporation Act /with their Municipal Act and should frame a Uniform Building Rule for the state to conform to the provisions of the EC Act and notify within three months of the notification of this order by the appropriate Government. Since modifications to various central acts like SEZ Act, Railways Act and Rules, Defence Establishment Rules would take time principle of use of Solar Water Heater Usage at source should be linked to the relevant local body (ULB or Pnachayat) or Estate Department of Target state.

The **uses for which the installation of collectors of active solar energy** of low temperature for the heating of sanitary hot water must be foreseen are (but not limited to) given below: (i) Housing; (ii) Residential, cantonment, barracks and prisons including sanatorium; (iii) Sporting complexes; (iv)) Commercial establishments premises like hotels, restaurants, shopping complexes, multi-plexes, IT Complex; (v) Industrial, in general if hot water is needed for the process and, also, when the installation of showers for the staff is mandatory, any other which involves the existence of dining-rooms, kitchens or collective laundries. (vi) High-raise buildings as defined by respective local bodies

[1] Can be notified under section 14 or section 18 of the Energy Conservation Act of 2001 by Ministry of Power

(vii) This Order will also be applied to the installations for the heating of the water in the vessels of the conditioned covered swimming pools with a water volume above 100 m3. **Liability:** The promoter/contractor of the construction or modification/retrofit/refurbishment, the owner of the building affected, or the professional who projects and conducts the works in the ambit of his faculties are responsible for the fulfilment of what this Order prescribes. The user of the activities taking place in the building or constructions which have solar energy at their disposal is also liable by this Order.

Technology: The technology must have been approved by the nodal agency and must have been incorporated in corresponding building-byelaws that is uniformly applicable for the state. BEE-MNRE will approve the **standards** from Flat Plate Collectors (FPC) and Evacuated Tube Collectors (ETC) along with the ancillary equipments as per the recommendation of Bureau of Indian Standards (BIS). BEE accredited **Installer Certification Programme** will run in vocational and technical training organisations for installers, plumbers and mechanics to ensure adequate supply of skilled human resources. The details to be covered as part of the standards and specification study.

Parameter for Estimation: As of now till any change in to any high recovery technology or climate envelope the following parameters could be used.

Sl No	Type of Use	100 litres per day shall be provided for every unit
1	Restaurants serving food /and drinks with seating. Serving area of more than 100 sq.m. and above	40 sq.m of seating or serving area
2	Lodging establishment and Tourist Homes	3 rooms
3	Hostel and Guest Houses	6 beds/persons capacity
4	Industrial Canteens	50 workers
5	Nursing homes and hospitals	4 beds
6	Kalayan Mandap, Community Hall and Convention Hall	30 sq. mtrs of floor area
7	Recreational Clubs	100 sq mtrs of floor area
8	Residential Buildings	
	a) Single dwelling unit measuring 200 sq.m of floor area or site area of more than 400 sq,m whichever is more b) 500 lpd for multi dwelling unit/ apartment for every 5 units and multiplies thereof.	

The policy proposed the following **incentive schemes** continuance of (i) interest subsidy scheme Interest subsidy scheme shall be as notified under No. 3 / 1 / 2007/UICA (SE) but a modified upfront scheme to be operated by banks with realtors (ii) capital subsidy (iii) rebates in utility tariff (iv) RPO (utility) (v) Carbon Finance. The details are to be covered in the report and separate assignment under finance and regulation. It will also include performance based incentives like property tax rebate.

Institutional Framework: The following institutional framework has been envisaged for the implementation of the Order.

Sl No	Name of the Institution	Level	Role
1	Solar Working Group	National	Under Solar Mission shall be the apex strategy planning body and members will be drawn from the departments inclusive MNES, Housing and Urban Development, relevant agencies and CPSUs under Energy Department and independent regulators and relevant officers from the Market Transformation Programme of UNDP, president or secretary of Apex Solar Energy Manufacturing Body.
2	Solar Energy Research Council	National	Apex body under the National Solar Mission for research and technology road map, standards and certifications, technology dissemination. Members drawn from academic institutions, strategic research system of the government and its network partners. This is to be chaired by an eminent researcher (with solar energy back ground) and will be rotational basis.
3	Solar Forum	National/State	This forum shall operate in a public private partnership mode. It will be the partnership between the SWH manufacturers/trade associations and the relevant ministries of the Government and would act as the main advocacy focal point for promoting the Order. The forum can engage the services of specialised agencies in the field of communication, advocacy and policy support.
3	State Level Task Force for Solar Energy	State	To be chaired by the Chief Minister and relevant ministries (housing, urban development, panchayati raj, environment, science and technology, energy, mayors and at least three members from the sustainable habitat council, president Real estate developer association, architect council, representatives of solar water heater manufacturers. At least three independent experts having relevant knowledge in the sector.
4	Sustainable Habitat Council	ULB	Should be notified in the ULBs and ate least one third of the elected members as its constituent. It would have two members each from real estate developers association, representatives of manufacturing companies or its sole selling agency , member of the State Level Banker's Committee, director municipal administration and municipal engineer, one architect, one member from development authority and two independent experts.
5	Village Committee/Village Energy Committee	Village level	This will be the body to promote the SWH in rural areas and would interface with villagers for any grievance , any youth qualified under SWH installation available in the village or nearby cluster shall be co-opted as a member of the committee.

Extensive campaign will be organised by the National Government and State Government under Solar India Mission to educate people about the cost-benefit, maintenance of the SWH. Details have been specified in the report how to use the power of ICT and a separate report on communication talks in detail about how to implement the order and promote it. It will also give a cool off period for one year before enforcing the penal provisions. It also provides for a **monitoring framework grievance handling framework** and a **procedure for modification**.

Section I

This section deals with the secondary research on international and national best practices in solar energy with a special emphasis on the solar water heater. Idea was to pick up critical success factors, barriers and ways these issues were addressed.

Section I

CTRAN Consulting Pvt. Ltd.

Building Sector Policies and Regulation for Promotion of Solar Water Heating System

REPORT ON INTERNATIONAL & NATIONAL POLICY ON SOLAR WATER HEATER INSTALLATIONS IN BUILDING SECTOR

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1 Background

India has an ambitious target of reaching 10 million m^2 of installed Solar Water Heating (SWH) systems in India by 2012. The global UNDP-UNEP Solar Water Heating Market transformation and Strengthening Initiative Project goal is to accelerate and sustain the SWH market growth in India and to use the experiences and lessons learnt in promoting a similar growth in other countries. Many countries have provided enabling policy framework internationally and some states in India recently have followed suit. This report aims to analyse the best practices so that the lessons and experiences can be incorporated in a national level policy framework for solar water heating systems in the building sector.

2 Objective

One of the objectives of the assignment is to review the Building Sector Policies and Regulations in India in the context of Solar Water Heating (SWH) System Promotion and assess their effectiveness. To study that it is also important to understand the national and international best practices. This report has tried to compile best practices from:

- Europe: Germany, Spain, Ireland, Italy
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3 Methodology

This case study model attempts to examine the barriers and best practices both in national and international level. It also attempts to assess the implementation effectiveness and the practices that have worked and the barriers that have been un-surmountable. The specific objective of the present work is to present an inventory of all relevant cases and experiences, giving both a complete overview of international experiences, and a horizontal evaluation of this inventory at demotic level, in the way of a common business environment, implemented by flanking measures to overcome actual barriers.

3.1 Tools

The following tools have been used

- Desk Research [Codes, Mechanisms (Voluntary, Regulatory), Procedures]
- Assessment of Instruments (incentives, rebates, standards)

3.2 Case Structures

3.2.1 Process of Case Development

The process of case study development will be as follows:

- Scope (geographic, which buildings, technologies, exemptions)
- Objective of the STO
- Actors involved and roles
- Foreseen checks : sanctions, incentive
- Flanking measures (communication, training, etc.)
- Qualitative and quantitative results and Costs (side of the Administration, the building company, etc.)
- Barriers, errors and success factors

3.2.2 Structure of the Case

The case study will focus on the following:

- Core Problem or Challenge addressed by the Order/Scheme/Programme
- What was the conventional practice
- Barriers faced during the conventional practice
- Origin or History of the Order/Scheme

4 International Cases

4.1 Experience of Germany

Orgin: Baden-Württemberg is a state in Germany. In November 2007 the parliament of the state of Baden-Württemberg approved its Erneuerbare-Wärme-Gesetz Baden-Württemberg (Renewable Heat Law: Baden-Württemberg).

Figure 1 Germany SWH incidence

Coverage: The law would initially cover all residential building constructed after 1st of April 2008, for which house builders are obliged to cover 20 % of the yearly heat demand with renewable heat sources. From 1st of January 2010 the law will also affect existing residential buildings, which, in the case of a modernisation of the central heating system have to reach a share of renewable heat of 10 % of the yearly heat demand.

Technology: Beside the use of solar thermal, geothermal, biomass (including bio-oil and biogas) and ground coupled heat pumps the law also foresees alternative measures such as improved house insulation, co-generators or the connection to district heating networks fed by co-generators.

Actors: The main actors are city council members who were involved in consultation with various stakeholders, resident welfare associations, builders, municipal engineers, utility representatives.

Mainstreaming: Berlin was the only city working to adopt a Solar Ordinance in 1996 in Europe and the country has yet not reached to a stage to have a uniform solar thermal ordinance.

Critical Success Factors: (1) Simplicity of the order (2) Focus on rapidly growing stock of residential building though some additional segments like elderly homes, hospitals could have been included. (3) Provision for combining multiple technology options.

Barriers: (1) Lack of information (2)Conflict with urban landscapes

4.2 Experience of Spain

Origin: Barcelona, is the Olympic city of Spain. Its urban reform experiences have been widely reviewed. In July 1999, the Barcelona Solar Thermal Ordinance (municipal legislation) was approved and came into in to effect in August 2000. Subsequently it has been updated in 2006.

Figure 2 Map of Spain

Coverage: The purpose of this ordinance is to regulate the incorporation of solar thermal energy and its use for the production of sanitary hot water in the city's buildings. The Solar Ordinance affects new, restored and fully refurbished buildings and those seeking to implement a change of use. This regulation applies to buildings intended for residential, health-care, sports, commercial and industrial use and, generally, any activity involving the existence of canteens, kitchens, laundries or other circumstances that lead to a large consumption of hot water, regardless of whether they are public or privately owned. Already, 60% residential blocks, 20% hotels and 10% are sports facilities have been covered.

Technology: The legislation permitted combination of technology to achieve the ambitious target set by the city council and various Catalan Local Governments thus widening the market penetration. The existing building code "Código Técnico de la Edificación" (CTE) entered into force in 2006 Among the basic quality requirements for buildings, the CTE contains the DB-HE chapter which aims, among others, at the efficiency of thermal installations (HE2 = RITE [25]) and the application of solar thermal systems for hot water preparation for domestic purposes and indoor swimming pools (HE4) in buildings. It is applicable for all new buildings and integral renovation projects (>1000m2) when the hot water demand is higher than 50 litre/day at a reference temperature of 60 ºC.

The HE2 and HE4 sub-chapters contain relevant information regarding the implementation of solar thermal installations: the first one defines all procedures in order to ensure the efficiency of thermal installations (including solar thermal) and the later one, enforces the application of solar thermal systems to partially cover the hot tap water demand. On the second one, it is stated that for all new buildings and renovations a minimum solar fraction from 30 to 70% is required (depending on climate zone, hot tap water demand and energy source for back-up heating). The values established by the CTE are minimum values to cover the basic demand. It is a national STO. The promoter of this legislation is the Spanish government.

Actors: Its main promoter was the Sustainable City Council. The national law was promoted by Spanish Government.

Mainstreaming: "Barcelona model" was adopted by other cities as Madrid or Seville. In February 2006, the Catalan Government adopted the so called Decree on Eco-efficiency, obliging all new buildings to install solar thermal energy systems. The Spanish transposition of the European Building Performance Directive (2002/91/EC), in force since September 2006, also includes the compulsory installation of solar thermal energy systems in new buildings.

Barcelona Ordinance

Programme Origin: The Barcelona-Ordinance (Ordenanza Solar Térmica de Barcelona) was approved by Barcelona's city council in July 1999, came into force in August 2000 and aims at 90,000 m2 newly installed collector area by 2010. The Barcelona-Ordinance forms part of the "Plan de Mejora Energética" and falls in the responsibility of the urban "Agéncia d'Energia de Barcelona" and the city council. In contrast to those promotion mechanisms already introduced, no financial resources are provided in connection with the Barcelona-Ordinance. The Ordinance includes only an obligation to install solar water heaters and is thus not an economic promotion mechanism. In fact the Ordinance can be assigned to police law.

Promotion details: The Ordinance requires that all new buildings with a daily average energy consumption for hot water supply exceeding 292 MJ (approx. 2000 litres) generate at least 60 percent of the required energy is sourced from solar water heaters. Buildings subject to fundamental renovations and replacements are covered by the Ordinance as well. Furthermore, the Ordinance regulates that heating of swimming-pools must be realised with a 100 percent of solar energy.

Installation obligation: The installation obligation covers all residential buildings, hospitals, gymnasiums and commercial buildings, which exceed the limit mentioned above. In case of residential buildings this is usually the case for buildings with more than 16 to 17 units of 4 persons each.

Procedure: The implementation of the Ordinance is based on the requirement placed on constructors to prove already when applying for construction permits or environmental projects how energetic demands of the Barcelona-Ordinance are supposed to be met. The constructor is obliged to actually use and maintain the system, as well as, if applicable, to repair it. This is supposed to assure that the systems are actually used.

Campaigns/ Information strategies: The development of the norm and its dissemination was influenced strongly by the "Mesa Solar de Barcelona". Several stakeholders and associations (architects, energy associations, municipal representatives, associations of renewable energies) were involved in its design. Between the norm's approval and its coming into force a period of one year was chosen for a moratorium deliberately; on the one hand to counteract existing scepticism and refusal by certain stakeholders regarding the integration and maintenance of solar water heaters as such and due to the expectation of rising prices of construction projects and . On the other hand a guidebook was developed during this year to explain the Ordinance and an information campaign was realised that involved the participants of the Mesa Solar de Barcelona.

Quality Assurance: The norm demands compliance with quality standards regarding installation and system specifications. Collectors must be certified by licensed institutions. The "Reglamento Nacional de Instalaciones Térmicas en los Edificios (RITE)" claims.

Outcome: Presently, resulting from the Barcelona-Ordinance about 40 percent of all new constructed buildings posses a solar water heater.

Critical Success Factors and Impacts: (1) It made the installation of solar thermal energy systems mandatory for most new buildings and those undergoing major renovation. (2) The demand spurred the market: Market penetration increased from 1.1 m^2/1000 inhabitants in summer 2000 to 20.7 m^2/1000 inhabitants in December 2005, roughly equivalent to a 2000% increase in just over five years, and nearly reaching the European average of installed collector area per capita. (3) Clear sectoral focus: The building sector has been the prime mover of the Catalan and Spanish economy for many years. E.g. 812,000 new apartments were built just in 2005. Taking into account the mandatory installation of solar thermal energy systems in any new building and the increasing need for refurbishment in the housing sector it has been a pressure on the market itself as the suppliers are not able to cope with orders thus requiring a price stabilisation mechanism. (4) Training and Awareness: special training material and programmes for installers have been designed and used in fact-to-face and on-line courses offered in collaboration with professional associations of the sector. (5) Institutional Mechanism: Development of *Solar Ordinances Support Centre* to help identifying possible difficulties in the implementation; development of *Solar Schools Network* that, at the end of 2006, included more than 100 educational centres with a total solar thermal collector area of 1,500 m^2 and several hundred kWp photo-voltaics, monitored and with real-time published energy yields available via internet. (6) Financial support to solar thermal energy systems through annual subsidy schemes, despite the mandatory introduction in the frame of the new Spanish Building Code CTE (nearly half of the overall budget of 5,000,000 € subsidies for renewable energy systems was allocated to solar thermal projects). The maximum subsidy was fixed at 37% of the investment costs, equivalent to approximately 260 € to 300 € per m2 collector area. (7) Support for Innovation: Substantial higher subsidy for innovative projects as solar cooling, solar thermal for process heat in industry or the promotion of Energy Service Companies (ESCOs) selling solar heat in order to facilitate the market introduction of these technologies or business models. (8) Model Building *CAP Roger de Flor* health centre building has been developed incorporating all aspects of solar technology and energy efficiency for demonstration purpose.

Barriers: (1) Lack of information about solar thermal energy systems among the actors of the building sector and the general public. (2) Trained craftsmanship and especially those with experience in monitoring and maintenance programmes to guarantee the thermal energy yields over the lifetime of the installation are still rare. (3) Involvement of Architects: Integration of the installations as an architectural element is still unusual and quite often parallel building ordinances oblige the installation to be located out of sight from the street so as not to disturb the visual perception of the overall urban landscape. (4) Certification: the existing national procedure to certify the quality of solar thermal equipment – a compulsory requirement to receive public subsidies for

installing a solar thermal system – does not facilitate either the introduction of foreign companies into the Spanish market or the commercialization of new national product developments.

4.3 Experience of Ireland

Origin: Ireland in 2000 promulgated a progressive act. Under the Planning and Development Act, 2000, a planning authority may at any time, alone or in co-operation with other planning authorities, and for any particular area within its functional area, prepare a local area plan in respect of that area, indicating the objectives in such detail as may be determined by the planning authority for the proper planning and sustainable development of the area to which it applies, including detail on community facilities and amenities and on standards for the design of developments and structures.

Figure 3 Europe solar map

Coverage: Based on this Planning and Development Act, starting at the end of 2005, a number of progressive local authorities introduced building energy standards as part of planning requirements in their jurisdiction. The first one was that of Cappagh Road Local Area Plan and then Fingal County.

Technology: These building energy standards require a substantial increase in the energy performance of new buildings (between 40% and 60% reduction in energy usage) as well as a mandatory contribution of renewable energy to their thermal energy requirement through any of the solar thermal energy linkage available (both FPS and ETS but has to be certified under European Quality Standard).

Mainstreaming: A new regulation at national level as been introduced in 2006, transposing article 5 of the EU Directive 2002/91/CE to S.I. No. 666 of 2006, following a first step given in 2005, S.I. No. 872 of 2005, saying that building regulations may be made to make (within other) "provision for the transposition of the requirements of Directive 2002/91/EC". This shows that the local energy standards adopted by several counties were a positive experience.

Critical Success Factors: The new regulation introduced the (1) Certification: BER (Building Energy Rating) Certification, (2) registration of BER assessors, to assess the energy performance of buildings in accordance with the regulations, (3) Institutional mechanism: creation of the issuing authority

(Sustainable Energy Ireland) to appoint persons to be authorised officers to enforce the regulations. Sustainable Energy Ireland has developed and implemented both a Dwelling Energy Assessment Procedure (DEAP), which is the Irish official procedure for calculating and assessing the energy performance of dwellings and a Greener Homes Scheme. (4) Financial Support: Residential Renewable Energy Grants of €250/m2 (to max. of 6m^2) for flat plate solar collectors (sizing of the hot water cylinder: At 60°C use a minimum of 70 litres per m^2), and of €300/m^2 (to max. of 6m^2) for evacuated tube solar collectors (sizing of the hot water cylinder: At 60°C use a minimum of 50 litres per m^2), if the collector is included on the Registered Product List, with a SEI Product ID (which means a certified product under the European quality standards), (5) Installation and Verification through Skilled Technicians: The solar system is installed by an installer included in the Registered Installer List, with a SEI Installer ID (which means a qualified and certified installer, with an accredited training course, and recognized experience in installing solar thermal systems). All completed installations are subject of verification and/or technical inspections.

Barriers: (1) Penetration has not been substantial as the process of adoption by local Governments have been slow (2) Creation of a pool of skilled installers (3) Adequacy of budget provision for successful implementation of the green home scheme.

4.4 Experience of Italy

Origin: In 2003, the small (less than 15,000 inhabitants) Municipality of Carugate adopted a new building regulation which promotes energy efficiency in general . In particular, following the model of Barcelona "Solar Ordinance", the use of solar thermal systems to produce at least 50% of the Domestic Hot Water demand was introduced as a mandatory measure.

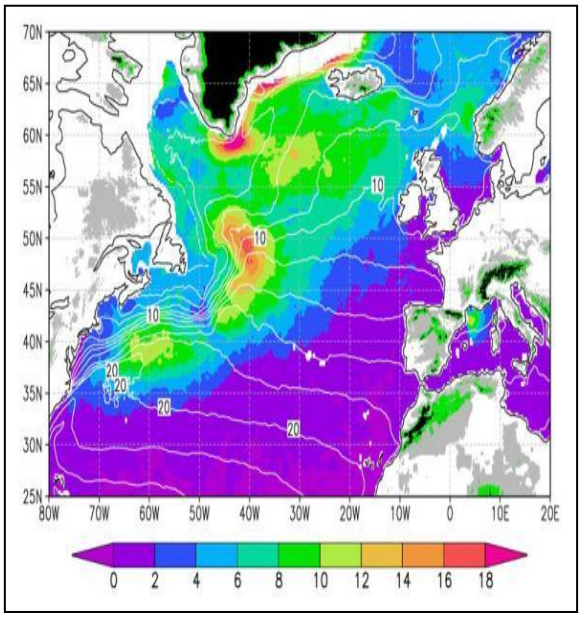

Figure 4 Italy solar potential

Coverage: Apart from Carugate, other municipalities introduced some modifications in the city building code, as the case of Roma: dealing with energy and water saving measures, as well as renewable energies. At regional level: the Law no. 15/2004 of the *Regione di Lazio* foresees the mandatory use of solar thermal energy and the rational use of water in buildings. Its scope includes both new and under refurbishment buildings. The law itself does not go into details regarding specific measures to be applied, leaving to the Municipalities the duty to apply the law in details.

Mainstreaming: The Law no. 192 (19th August, 2005) modified and integrated through Law no. 311 (29th December, 2006) is under implementation, at national level for Italy, of the EC Directive 2002/91/CE, about energy efficiency in buildings. This law foresees minimum requirements for energy efficiency and the use of renewables in new and refurbished buildings.

Critical Success Factors: (1) Mandatory nature has put pressure on the local planning authority to insist solar thermal installation during planning and execution and also their monitoring.

Barriers: (1) The progress has been slow as many local bodies have not amended their local laws. (2) There is no clear institutional mechanism evolving to see the implementation.

4.5 Summary Policy Measures in Europoean Countries

Summary Policy Measures in Europoean Countries relating to SWH sector has been summarised in the following table. The dominant policy is still the capital subsidy followed by fiscal incentives.

Country	Capital subsidies	Feed-in tariffs	Certificates/ Obligations	Competitive tender	Fiscal mechanisms
Austria	x	x	h		x
Belgium	x	x	x		x
Denmark	h	x			x
Finland	x				x
France	x	x		h	x
Germany	x	x			x
Greece	x	x			x
Ireland	x			x	x
Italy	x	h	x		x
Luxemburg	x	x			
Netherlands	x	x	x		x
Portugal	x	x			x
Spain	x	x			x
Sweden	x		x		x
UK	x		x	h	x

H: Historical policy: Now Changed, X: Policy currently in vogue

Source: EEA, 2006

4.6 Experience of USA

Origin: In USA variety of mechanisms exists that the states are using to support renewable energy promotion. Most of it has originated through an Act of US Department of Energy. However, the states continue to serve as a key source of initiatives and programs to advance the use of renewables around the country. Traditionally, state governments have served as the source of tax credit and loan programs but, over the past four years, many states have been taking the lead on advancing renewables through regulatory policies born out of electric utility restructuring.

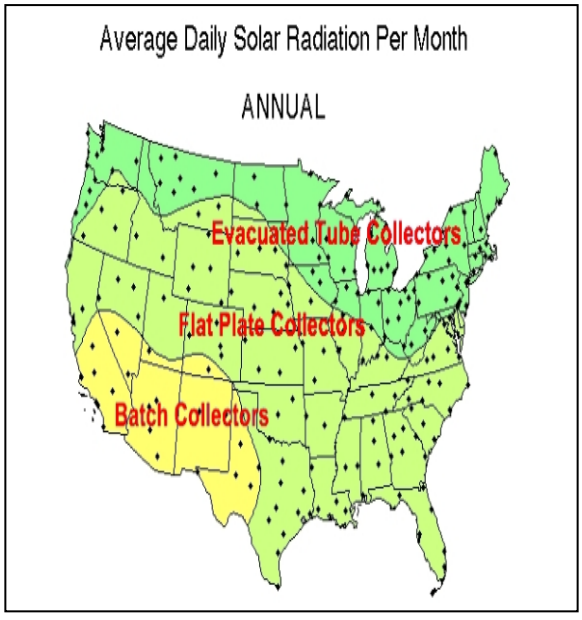

Figure 5 SWH in USA

Coverage: State level activity can be found in all fifty states of US and the District of Columbia whether it is rebates for photovoltaics, solar thermal units, investment tax credits (ITC) for wind turbines, or interconnection rules and

renewable portfolio standards (RPS) for all renewables. In the sections below we highlight the variety of applicable technologies and financial incentives that have driven the promotion of solar thermal applications in the states.

Technology: (1) Solar thermal, solar electric, geothermal, wind, fuel cells, microturbines, solar hybrid lighting may be depreciated according to an accelerated schedule of 6 years "Class life" of 6 years Year 1: 20%; Year 2: 32%; Year 3: 19.2%; Year 4: 11.52%; Year 5: 11.52%; Year 6: 5.76% Additionally, equipment installed in 2008 and 2009 can receive bonus depreciation of 50% in Year 1. (2) Credit is worth 30% of qualified investment required for a project that establishes, re-equips, or expands a manufacturing facility that produces equipment and/or technologies used to produced energy from the sun, wind, geothermal, or "other" renewable resources (3) Retrofit program in HVAC (30% but after 2008).

Policies: Stimulus Package outlines several incentives (1) Extended the Investment Tax Credit[1] (ITC) for SWH including cash grants in commercial property extended up to 12/31/2016 and allows ITC to offset Minimum Alternative Minimum Tax and extends eligibility to utilities(2) Allocated $2400 million for new Clean Renewable Energy Bonds (CREBs)[2] (3) $6 billion to issue loan guarantees for renewable energy projects and cap removed for residential solar water heating, geothermal heat pumps, small wind projects (4) Makes new tax credit for renewable energy manufacturing facilities (incld. SWH) and extends and expands tax credit for energy efficient home improvements.

Critical success factors: (1) Stable, long-term incentive, declining over time (2) Stable funding source by the states making budget provisions (3) Easy application process (4) Administrative flexibility to modify program (5) Cost-effective quality assurance mechanism (6) Tracking of program usage by Solar Energy Centre & share data (7) Partnerships with banks, installers, non-profit organisation engaged in solar energy promotion (8) Education & outreach to provide information and skilled installers.

Barriers: (1) Increasing policy complexity (2) Dominance of RPS policies and crowding out effect (3) Legal clarification: 3rd party sales, local energy financing (4) National market coordination (5) Lack of clarity on 3rd party sales, local energy financing.

The table below summarises the policies and financial incentives in different counties of USA. This gives the depth and breadth of the intervention in a region.

[1] 30 percent of the system cost that includes installation.
[2] To be issued by utility or ULBs

State	PBF	RPS	Net Metering	Inter-connection	Exten. Analysis	Contract. License	Equip. Certific.	Access Laws	Constr. & Design	Green Power Purchasing	Req'd Green Power
Federal				1					1	1	
Alabama											
Alaska			1-S					1-S			
Arizona		1-S	1-S 1-U	1-S	1-S	1-S	1-S	1-S	3-S 4-L	1-L	
Arkansas			1 S	1 S					1 S		
California	1 S	1 S	1 S	1 S		1 S		2 S 8 L	3 S 8 L	3 L	
Colorado	1-L	1-S 1-L	1-S	1-S	1-S			1-S 1-L	3-S 4-L	2-L	1-S
Connecticut	1-S	1-S	1-S	1-S		1-S			2-S	1-S 1-L	
Delaware	1-S 2-U	1-S	1-S	1-S				1-S	1-S		2-U
Florida		1-U	1-S	1-S		1-S	1-S	1-S 1-L	1-S		
Georgia			1-S	1-S				1-S	1-S		
Hawaii	1-S	1-S	1-S	1-S		1-S		1-S	2-S		
Idaho			3-U					1-S			
Illinois	1-S	1-S	1-S	1-S					2-S	1-S	
Indiana			1 S	1 S				1 S	1 S 1 L	1 S	
Iowa		1 S	1 S	1 S				1 S			1 S
Kansas		1-S	1-S	1-S				1-S	1-L		
Kentucky			1-S	1-S				1-S			
Louisiana			1-S 1-L	1-S							
Maine	1-S	1-S	1-S					2-S	1-S	1-S	
Maryland		1-S	1-S	1-S				1-S	1-S	1-S 1-L	
Massachusetts	2-S	1-S	1-S	1-S				1-S	3-S	1-S 1-L	
Michigan	1-S	1-S 1-U	1-S	1-S		1-S			2-S 1-L	3-L	
Minnesota	1-S	2-S	1-S	1-S			1-S	1-S	1-S		
Mississippi											
Missouri		1-S 1-L	1-S	1-S				1-S	1-S		
Montana	1-S	1-S	1-S 1-U	1-S				1-S			1-S
Nebraska			1-S	1-S				1-S			
Nevada		1-S	1-S 1-U	1-S		1-S		1-S			
New Hampshire		1-S	1-S	1-S				1-S	1-L		
New Jersey	1-S	1-S	1-S	1-S				2-S	2-S		
New Mexico		1-S	1-S 1-U	1-S				1-S	1-S		1-S
New York	1-S	1-S 1-U	1-S 1-U	1-S				1-S	2-S 1-L	1-S 1-L	
North Carolina		1-S	1-S	1-S				1-S 1-L	1-S 10-L		
North Dakota		1 S	1 S					1 S			
Ohio	1-S	1-S	1-S 1-U	1-S				1-S	1-S		
Oklahoma			1-S						1-S		
Oregon	1-S	1-S	1-S 1-U	1-S		1-S	1-S	1-S 2-L	3-S 1-L	1-L	1-S
Pennsylvania	1-S	1-S	1-S	1-S					1-S	1-S 1-L	
Rhode Island	1-S	1-S	1-S					1-S	1-S		
South Carolina			3-U	1-S					1-S	1-L	
South Dakota		1-S		1-S					1-S		
Tennessee								1-S			
Texas		1-S 1-U 1-L	1-U	1-S	1-S				2-S 5-L	3-L	
Utah		1 S	1 S 3 U	1 S		1 S		1 S	1 L	1 L	
Vermont	1 S	1 S	1 S	1 S				1 S			
Virginia		1-S	1-S	1-S				2-S	1-S 1-L	1-L	1-S
Washington		1-S	1-S 1-U	1-S				1-S	1-S 1-L	1-L	1-S
West Virginia		1-S	1-S								
Wisconsin	1-S	1-S	1-S	1-S		1-L		1-S 1-L	1-S	1-S 1-L	
Wyoming			1-S	1-S							
District of Columbia	1-S	1-S	1-S	1-S					1-S		
Palau											
Guam		1-S	1-S						1-S		
Puerto Rico			1 S	1 S		1 S	1 S				
Virgin Islands			1-S					1-S			
N. Mariana Islands											
American Samoa			1-S								
Totals	23	45	68	43	3	11	5	55	92	33	9

F = Federal S = State/Territory L = Local U = Utility

Figure 6 Renewable Policy and Regulations in USA

State	Personal Tax	Corp. Tax	Sales Tax	Prop. Tax	Rebates	Grants	Loans	Industry Support	Bonds	Production Incentives
Federal	3-F	4-F				3-F	5-F	1-F		1-F
Alabama	1-S				2-U	1-S	1-S 1-U			1-U
Alaska						1-S	2-S			1-U
Arizona	3-S	1-S	1-S	2-S	6-U		1-U	1-S		
Arkansas					1-U		1-U			
California				1-S	7-S 38-U 3-L	1-S	2-S 1-U 3-L			1-S 1-U
Colorado			2-S 1-L	2-S	9-U 1-L	1-S 1-L 2-P	1-S 4-U 2-L			
Connecticut			2-S	1-S	2-S 2-U	3-S	2-S 1-P	2-S		
Delaware					1-S	2-S				
Florida		2-S	2-S	1-S	1-S 10-U 1-L	1-S	5-U	1-L		2-U
Georgia	1-S	1-S	1-S		1-S 8-U		1-U			2-U
Hawaii	1-S	1-S		1-L	2-U		1-S 2-U 1-L	1-S		1-S
Idaho	1-S		1-S	1-S		1-P	1-S		1-S	1-P
Illinois			1-S	2-S	1-S 1-U	2-S 1-L 1-P	1-S		1-S	1-P
Indiana				1-S	4-U	1-S	1-U			
Iowa	1-S	1-S	1-S	3-S	11-U	1-S	2-S 1-U			
Kansas				1-S	2-U			1-S		
Kentucky	1-S	2-S	1-S		7-U		1-U 1-L 1-P			1-U
Louisiana	1-S	1-S		1-S			2-S			
Maine			1-S		1-S	1-S	1-S 1-P			1-S
Maryland	3-S	3-S	2-S	4-S 7-L	3-S 1-L		3-S			
Massachusetts	2-S	3-S	1-S	1-S	2-S 6-U	4-S	1-S 1-U 1-P	1-S		1-P
Michigan				2-S	3-U	2-S		3-S		1-U
Minnesota			2-S	1-S	2-S 23-U	2-S 2-U	5-S 3-U			1-S 1-U
Mississippi					4-U		1-S 2-U			1-U
Missouri		1-S			7-U		1-S 1-U			
Montana	3-S	1-S		3-S	4-U	1-U	1-S	2-S		1-P
Nebraska			1-S		2-U		1-S			
Nevada			1-S	3-S	1-S		1-S			
New Hampshire				1 S	1 S 1 U		1 S 1 P			
New Jersey			1-S	1-S	5-S	1-S	2-S 1-U	1-S		2-S
New Mexico	4-S	3-S	2-S				1-S	1-S	1-S	3-U
New York	3-S	1-S	1-S	2-S 1-L	5-S 4-U 1-L	2-S	3-S 1-L	2-S		
North Carolina	1-S	1-S	1-S	2-S	6-U	1-S	2-S 1-U			3-U 1-P
North Dakota	1-S	1-S		2-S			2-U			
Ohio		1-S	1-S	1-S 1-L	5-U 1-P	6-S	2-S 1-U 1-L	1-S		
Oklahoma		1 S			3 U		1 S 2 U	1 S		
Oregon	1-S	1-S		1-S	8-S 21-U	1-S 1-P	3-S 11-U	1-S		1-S 1-U 1-P
Pennsylvania	1-S	1-S		1-S	1-S 1-L	8-S 1-U 2-L	6-S 1-U 5-L	3-S		
Rhode Island	1-S	1-S	1-S	2-S	1-U	1-S	1-S 1-P			1-P
South Carolina	1-S	2-S	1-S		4-U		1-S 4-U			1-S 1-U 1-P
South Dakota				3-S	4-U		2-U			
Tennessee				1-S		2-S	1-S	1-S		1-U
Texas		1 S		1 S	19 U 2 L	2 S	2 S	1 S		1 U
Utah	1-S	1-S	1-S		6-U			1-S		
Vermont	1-S	1-S	1-S	1-S	1-S	1-S 1-U	2-S 1-P			1-S 2-U
Virginia				1-S	2-S		1-S	1-S		1-U
Washington			1-S		16-U	1-L 1-P	13-U	1-S		1-S 3-U 1-P
West Virginia	1-S	1-S		1-S						
Wisconsin			1-S	1-S	3-S 4-U	1-S 1-U	2-S	3-S		5-U
Wyoming			1-S		1-S 3-U		2-U			
District of Columbia					1-S					
Palau										
Guam										
Puerto Rico	2-S	1-S	2-S	1-S				1-S		
Virgin Islands					1-S	1-S				
N. Mariana Islands										
American Samoa										
Totals	39	39	36	63	314	70	156	32	3	52

F = Federal S = State/Territory L = Local U = Utility P = Private

Figure 7 Financial Incentives Renewable Sector: USA

4.7 Experience of Canada

Origin: Canada has launched ecoENERGY for Renewable Heat Commercial Deployment Incentive to counter the effect of climate change. 60 percent of the energy consumption for household is for water heating. As part of the Government of Canada's Economic Action Plan, the ecoENERGY Retrofit – Homes program has been expanded to help 200,000 more homeowners cover the cost of making energy-efficiency retrofits to their homes. The expanded time-limited program includes a $300-million increase in funding over two years. Following an extensive program review and consultation with stakeholders, NRCan has made changes to the Commercial Deployment Incentive under the ecoENERGY for Renewable Heat program. The programme of May 2008 has undergone change and is now effective since March 2009.

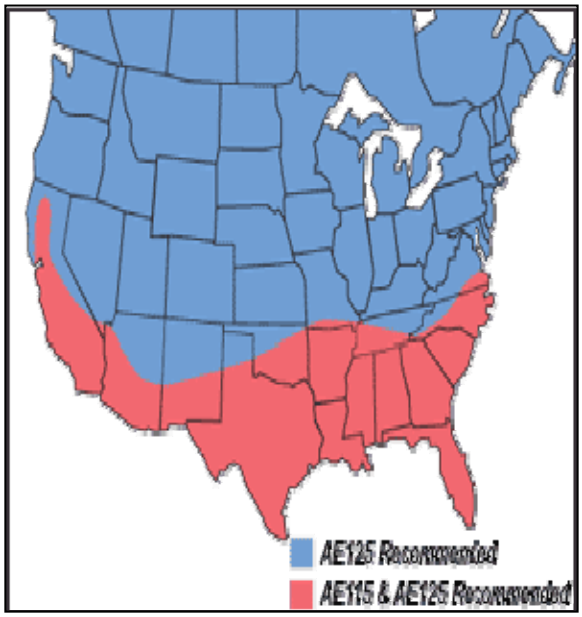

Figure 8 Canada SWH installation as per ecoEnergy

Coverage: The coverage includes several building programmes in (1) Saskatchewan (2) Ontario (3) British Columbia apart from the Federal Building Initiative Programme.

Technology and Process: The ecoENERGY for Renewable Heat program runs from April 1, 2007 to March 31, 2011. Incentives are offered to the industrial/commercial/institutional sector to install active energy-efficient solar air and/or water heating systems. Eligible projects must be completed and commissioned within nine (9) months of the signing of a contribution agreement with NRCan. Preliminary estimates suggest that, by 2011, the program will have supported installations in about 700 buildings and cover (1) Solar domestic hot water system (2) Complementary Programs (3) Solar Water Heating Residential Pilot (4) Residential Solar Water Heating Pilot Initiative.

The program accepts all types all types of approved water heaters. The program guideline very clearly lays out the following:

- Terms and Conditions
- Guidance Document
- Steps to Apply
- List of accepted Solar Collectors
- Incentive Rate Table
- FAQ

- Solar Air Application Form
- Commissioning Report
- Payment Request Forms:
- Attestation form

NRCan's also ran a support initiative for Testing and Certification which has ended recently.

The programme using the power of the sun to heat buildings and water not only helps businesses lower costs, but it reduces the amount of harmful emissions produced. The ecoENERGY for Renewable Heat program is a four-year, $36 million investment to:

- Increase the use of renewable thermal energy by industry, commercial businesses and institutions
- Boost the amount of renewable thermal energy created for these sectors
- Contribute to cleaner air by helping Canadian businesses use less fossil fuel-based energy for space and water heating in buildings across the country

In addition, pilot projects conducted with energy utilities, energy service companies and non-governmental organizations will explore ways of making solar water heating systems more accessible to Canadian homeowners. While the program will not be offering incentives directly to homeowners, these large-scale pilot projects are designed to install solar water heating systems into several thousand homes.

Critical Success Factors: ecoENERGY for Renewable Heat has supported the growing renewable energy market by:

- Supporting the development of industry standards and certification processes
- Promoting the inclusion of new technologies in building codes and provincial and municipal regulations
- Training system designers, technicians and installers

ecoENERGY for Renewable Heat will offer an incentive to industrial, commercial and institutional purchasers of solar heating systems. The anticipated Incentive amount is calculated as follows: Performance Factor x Incentive Rate x Area of Collector.

The ecoENERGY Retrofit grant is based on the type and number of energy improvements that have been made, and how much the efficiency of the home has been improved. The grant is based on how effective that upgrade is in saving energy, not on the cost of the upgrade.

The maximum grant one can receive per home or multi-unit residential building is $5,000; whereas the total grant amount available to one individual or entity for eligible properties over the life of the program is $500,000. The average grant is expected to be more than $1,000 and will yield an average 25 percent reduction in energy use and costs.

In addition, most provinces and territories have complementary programs offering financial assistance based on the results the ecoENERGY Retrofit evaluation. Homeowners participating in the ecoENERGY Retrofit – Homes program are eligible to receive the temporary Home Renovation Tax Credit (HRTC) in addition to the ecoENERGY Retrofit – Homes grant for some of the improvements made. More information on the HRTC is available by viewing the questions and answers on the Canada Revenue Tax Agency site.

Barriers: The scale is not too high. The buy-in from the households has not been substantial as it is largely voluntary.

4.8 ESCWA region

Origin: Economic and Social Commission for Western Asia (ESCWA) comprises Bahrain, Egypt, Iraq, Jordan, Kuwait, Lebanon, Oman, Palestine, Qatar, Saudi Arabia, Syrian Arab Republic, United Arab Emirates and Yemen. The building sector (residential and commercial) in the ESCWA region is the most consuming sector of energy in general and electricity in particular. The building sector in the region consumed more than 54.4 per cent of gross sectoral electric energy consumption and 17.4 per cent of gross sectoral consumption of petroleum products in the region. National consumption of energy in the building sector varies considerably from one place to another and depends upon local circumstances.

Egypt, Jordan and Cyria have made considerable effort in this direction. The programmes include (1) Energy Efficient Buildings through Environmentally sustainable architecture and thermal insulation. (2) Targeted SWH installation Programme: 500,000 solar water heating systems have been already installed in the ESCWA region, mostly in Egypt, Jordan and Syria.

Critical Success Factors: (1) Clear specifications have been developed for the thermal insulation of buildings and SWH installations ensuring uniformity. (2) Focussed programme on installation has helped in area wise coverage

Barriers: (1) Because of stringent specifications markets are not opening up (2) There is no incentive system yet (3) cheaper alternatives are available

4.9 China

At present, the building sector accounts for nearly 20% of final energy consumption in China, and this is very likely to increase to 35% by 2020. Energy-related CO2 emissions in the building sector represent 18% of China's total emissions. Each year, about 12,000–14,000 million m2 of residential buildings are constructed in China, with an investment of nearly 1,000 billion yuan – approximately 20% of China's total fixed assets investment and 8–10% of its GDP. 85% of energy use occurs during the occupancy stage of buildings – the bulk of energy use of during the entire lifespan of buildings. Thus, from a life-cycle analysis viewpoint, energy efficiency measures ultimately allow consumers to reduce energy consumption quite considerably. China's vast geographic zones mean climatic conditions vary significantly. Space heating is the primary energy demand in buildings in the north, whereas air-conditioning consumption dominates in summer in the southern and eastern provinces.

Origin: The first *residential energy conservation* design standard was issued in 1986. It aimed at a 30% reduction in heating energy consumption over the consumption in typical Chinese residential buildings ('base buildings') designed in 1980–81. In 1995, the MOC (Chinese Ministry of Construction) issued a revised standard (JGJ 26–95) with an increased energy-saving goal of 50% (Lang, 2004). A significant reduction of energy consumption was achieved after the implementation of the 1995 Energy Efficiency Standard for New Residential Buildings (JGJ 26-95), but the average energy consumption for heating in an efficient house in China (20W/m²) is still almost twice as high as in the most efficient houses in Sweden, Denmark, the Netherlands and Finland (11W/m²). In 2001, design standard JGJ 134–2001 was approved. Its goal was to reduce electricity consumption by 50% through energy efficiency in residential buildings in both hot summer and cold winter zones. Design standard JGJ 75–2003 came into force in 2003 for energy efficiency in residential buildings in both hot summer and warm winter zones – which covers mainly the southern provinces. District heating exists only in the northern part of China. Design standard JGJ 26–95 regulates heating consumption in the building and district network; JGJ 134–2001 regulates electricity consumption for heating and air-conditioning, assuming the services are provided by heat-pump air-conditioners in residential buildings. In comparison, only cooling consumption in residential buildings is regulated by JGJ 75–2003, since heating is rarely necessary in the southern provinces.

Figure 9 SWH in China

Public buildings (commercial): In 2005, MOC (Ministry of Commerce) and AQSIQ (China's General Administration for Quality Supervision, Inspection and Quarantine) co-issued design standard GB 50189-2005 for energy-efficient design in public buildings (administrative buildings, hospitals, schools, shopping malls, offices etc,), whereby newly constructed public buildings should cut 50% of energy compared with those that do not comply with the norm. This standard regulates the values of energy consuming services in commercial buildings: lighting, heating, air-conditioning, ventilation.

Green building evaluation standards: This national standard defines the mandatory requirements for buildings eligible to be entitled Green buildings, and introduces different assessment indicators, ranging from natural resource recycling to the energy performance of the building envelope. This standard is not mandatory but a technical reference for voluntary implementation of environmentally friendly architectural design by property developers. It came into force in 2006.

Technology: There is a broad array of accessible and cost-effective technologies and know-how that can significantly abate GHG emissions in buildings: advanced insulation materials and techniques; passive solar design, high-efficiency lighting and appliances, highly efficient ventilation and cooling systems, *solar water heaters*, integrated renewable systems such as roof or window PV; and double or triple glazing. Top realize this China has an integrated design process involving architects, engineers, contractors and end-users.

Institutional Framework: To implement this integrated policy, the country has an extensive institutional framework. Listed below are the major authorities in charge of land-use planning, property development and energy infrastructure construction:

- Development and reform commission (energy planning, endorsement of large-scale energy and municipal infrastructure construction);
- Municipal construction commission: enforcement of building efficiency code, elaboration of building energy efficiency policies, inspection of energy efficiency designs for buildings submitted by architects and engineers);
- Municipal energy conservation bureau (subsidiary of construction commission, in charge of management of energy conservation, building materials innovation);
- Municipal security and quality inspection bureau; - Municipal building material association (certification of building materials quality, including insulation material);
- Municipal district heating bureau (specific institution in the northern cities in charge of central heating service);
- Municipal commerce committee (management of commercial buildings in the city);
- Urban planning bureau (urban development strategy elaboration, land-use planning, issuing of land-use permit and construction permit (plot ratio is a major index in the review process)

- Urban housing administration, land and resource bureau (in charge of land and natural resource management, management of transactions for construction on urban land and existing housing stock).

Policy: All new buildings must comply with energy-efficient design standards requiring a 50% reduction of energy for heating. In some major cities including Beijing and Tianjin standards requiring 65% reduction have come into force. In the next few years, standards for heat regimes must be implemented in the northern cities. In order to promote thermal retrofitting in existing buildings in conjunction with urban redevelopment programmes, 25% of existing areas are to be rehabilitated in big cities, 15% in medium-sized cities and 10% in small cities. This area based targeting has helped in effective implementation of the policy.

Barriers: Substantial market barriers persist and need to be overcome through energy efficiency policies and programmes. These barriers include the high costs of gathering reliable information on energy efficiency measures, lack of proper incentives between landlords who would pay for efficiency and tenants who would realize the benefits), limitations in access to financing, subsidies on energy prices, as well as the fragmentation of the building industry and the design process into many professions, trades, work stages and industries. These barriers are especially strong and diverse in the residential and commercial sectors. Urban space heating has been considered a government-sponsored welfare requirement in the northeast, northern and northwestern provinces for decades. Heating consumption is billed on the basis of floor space area instead of actual consumption.

4.10 Thailand

Origin: Solar water heater has been introduce into Thailand since 1984 by the Government Department of Energy Promotion installing 325 square meters of the flat plate collectors for 6 hospitals, 1 hotel and 1 factory, later transferred the ownership and let them operate the system. After the Government initiation, there is about 10 local companies start to import the solar water heater into the country, in 1994 from the study conducted by the same Department, it was estimated that about 50,000 sq.m of the solar flat plate collector has been installed in the country. Even till today, the solar thermal market in Thailnad is still very small and growth of the solar hot water system installation in the past 15 years are only 10% annually and more than 50% are in the residential area.

Financial Incentive: In 2007, series of discussion has been made between the Government and the Solar Thermal Association of Thailand the Government has approved the first Solar Thermal Subsidy program which will give the investor 3,000-4,500 per sq.m of the collector installed providing that

the efficiency of the collector must not less than 500 kwh/ sq.m-yr. And energy from waste heat from the system must also be used. The program is called 'Hybrid solar water system', funding for the first year is available up to 4,000 sq.m with the smallest system not less than 50 sq.m and largest system not more than 500 sq.m.

Barriers: (a) Technical Barriers: -System design and sizing, Quality and selection of materials, Water quality, Installation (b) Nontechnical Barriers:- High investment cost, No products standard, -Lack of Government support, Little public awareness.

4.11 Newzealand

Newzealand has taken important step in the installation of solar water heating systems in public buildings Solar water heating is currently uncommon in non-residential buildings and an important part of this programme will be providing information and demonstrating benefits to help organisations and owners of commercial buildings make informed decisions. Energy Efficiency and Conservation Authority (EECA) provides funding to assist public sector organisations to establish the feasibility of solar water heating and/or install solar water heating systems in buildings they own.

Technology: The solar water heating system must be a packaged system (for applications up to $7m^2$ of collector area) or composed of complying products for a commercial application (above $7m^2$ of collector area) meeting the standard AS/NZS 2712; and For residential sized (up to $7m^2$ of collector area) solar water heating system applications, the packaged systems must have been modelled to draft standard AS/NZS 4234:2007 for energy performance; or For a commercial sized applications (above $7m^2$ of collector area) the solar water heating supplier/ designer must submit expected energy performance for the installation with the calculations and assumptions provided.

Finance assistance scope: Public sector organisations including government departments, territorial local authorities, Crown entities, Crown-owned companies, district health boards, schools and universities are eligible to apply for a Feasibility Study Grant, an Installation Grant, or both. EECA will receive and evaluate applications throughout the financial year. EECA will fund up to 50 percent of the cost of the feasibility study based on the metres of collector area expected to be installed on receipt of the completed feasibility study on a per site basis. There will be a limit of one grant per site per three years. *Criteria:* (1)The entity will report likely energy savings, type of fuel being displaced, ability to be replicated, and/or information and publicity opportunities. (2) The recipient agrees to allow EECA to publish information from the feasibility study for the benefit of other public sector organisations and commercial building owners, subject to the withholding of any

commercially sensitive information in line with the provisions of the Official Information Act 1982 and Privacy Act 1993. Any material to be published will be subject to the approval of both the grant recipient and EECA. Installation Grant: The purpose of this grant is to contribute to reducing the up-front costs of installing a solar water heating system. 1. Quality Assurance 2. Installation is overseen by a party who has attended an approved solar water heating installer training course. All installations must be available for EECA to conduct random audits to ensure compliance with the terms and conditions of financial assistance (3) All installations will require a building consent in order to demonstrate compliance with the requirements of the New Zealand Building Code.

Financial assistance: (1). Standard residential system (up to 7m8 of collector area): A payment of up to 25 percent of the cost of an installed standard residential system, to a maximum of $1,000 per standard residential system, or A payment of up to 50% of the cost of an installed standard residential system in situations where the owner of the building does not benefit from the savings such as tenanted dwellings (council housing etc). (2) Commercial system(above 7m8 of collector area) For a customised solar water heating system application (excluding multiple residential systems being connected in series) EECA may provide funding up to $500 per square metre of collector area installed to no more than 50% of the installed solar water heating cost, to a maximum value of $50,000. Commercial solar water heating systems may be subject to design review prior to funding approval.

Critical success factors: (1) Feasibility Study Grant is given to support public sector organisations in making informed decisions about whether solar water heating is a cost-effective solution, keeping in mind the Government's overall objectives. (2) Like Australia, it has policies to promote the use of SWH to reduce the electrical load under the Renewable Portfolio Standard, under which, all SWHs replacing electrical water heaters are allowed to have green certificates. These certificates are marketable. Electricity suppliers are obliged to purchase a certain share of electricity from renewable energy sources and they can buy these green certificates to meet their obligation. Typically, a SWH will receive between 10 and 35 certificates with an electricity equivalent of 1 MWh over its lifetime. (3) Mass retrofit programmes and price subsidy to customers and installers. (4) segmented targeting (4) Detailed awareness programme and customer education as tried under May be best done through trialling initially with a small number of local councils eg Waitakere, Kapiti and Hamilton City Council who are participating in the BRANZ "Eco Advisor" programme for the next 12 months and nominated suppliers.

Barrier: (1) No mandatory regime and the scale is too small considering it is only focussed on the public sector buildings. (2) Shortage of skill

4.12 Africa

Origin: When we talk about Africa, like Barcelona in Spain, the focus is on Cape Town, South Africa. Cape Town has a wealth of untapped renewable energy resource potential – primarily in wind, small-scale solar, photovoltaics, solar thermal and possibly wave applications. The national target for energy from renewable sources is 10 000 GWh/yr in 2013 (approximately 4% of projected electricity demand). National Department of Minerals and Energy forecasts that only 1% will come from wind and the rest from biomass and landfill gas projects. Most of these projects will not be in the Western Cape area. In the medium and long-term, solar thermal, solar photovoltaic and wave will play a significant role.

Financial and Institutional Commitment: Cape Town's renewable energy focus at present is on wind generation and solar water heaters, and the City has made commitments at the Bonn 2004 International Renewable Energy Conference in this regard. In addition, the City is adopting a strong energy efficiency focus. [In 2005, the Renewable Energy Finance and Subsidy Office (REFSO) was established. A once-off capital grant has been made available for project developers in 2005/06 – 2007/08 financial years. The subsidies for 2005/6 are R250 / kW capacity for electricity; R273 / kl capacity / year for biodiesel and R167 / kl capacity / year for bio-ethanol or equivalents for other RE technologies. The subsidy can not exceed 20% of the total capital cost, and minimum project size is 1 MW (for electricity), implying a subsidy amount of R250 000.]

Critical success factors: (1) Focussing on the wide spread campaign, targeted at residential consumers and sellers. (2) Clear Financial Incentive which is targeted. (3) Provision of business information, training, and consulting services to private dealers, ESCOs and NGOs. (4) Setting an objective target of saving 20-30% energy through Solar Water Heater. This is enshrined in the city building code.

Barriers: The barrier here is the availability of the installers in adequate numbers, less numbers of sellers and high upfront cost.

4.13 Mexico

The Constitution of the United States of Mexico (Section 115, paragraph II) grants municipalities the power to plan and regulate land use and building projects, manage land banks, intervene in the regularization of land tenancy, grant construction licenses and permits, and issue regulations and other provisions on public utilities as well as provide these latter services to the community. Moreover, to a large extent, these activities are carried out in accordance with the regulations stemming from municipal urban development plans and programs, municipal environmental land use planning and building codes, etc. Building codes codify the requirements applicable to the actions of building, making an addition to, modifying or changing the use of a property or of its ownership status, or renovating or demolishing a building. However, building codes do not consider urban planning issues. Until two decades ago, the elaboration of building codes was the responsibility of state governments. The role of municipalities was to see to their application, a situation that is changing, due to the amendment of Section 115. Presently, whereas every state government in Mexico has its own building code, the same may be said of just 72 of the country's 2,435 municipalities (plus 16 boroughs in the Federal District). In a word, less than 3 percent of the municipalities in the entire country have their own building codes, as distinct from those of their respective state governments. A characteristic of the most recently updated building codes (those of the Federal District and the State of Mexico, for example) is the tendency to consign technical standards to appendices separate from the main body of the building code, such that only administrative type regulations and the general rules remain in the main text.

During a construction project, building codes require the maintaining of a project log to record observations, corrections, approvals and instructions from the Project Manager (PM) to the building contractor; an original numbered copy of this project log must, without fail, accompany the Project Completion Certificate, which is signed by the proprietor or his legal representative and the PM so that the competent local authority may grant the occupancy permit. Upon the project's conclusion, the PM delivers to the proprietor the original copies of the official final drawings of the completed project, the project log and the daily calculations log, while keeping a complete set of copies of these documents. Failure to comply shall result in fines for the proprietor and the PM. Observation of these rules contributes to ensuring quality services and works. It is proposed that an assessment be made of the advisability of 1) incorporating the monitoring and certification of the environmental quality of green buildings in the overall project monitoring procedure and 2) giving PMs the authority to act in this area, a step which would simplify progress in this regard.

NOM-008-ENER-2001. Energy efficiency in buildings; non-residential building shells deals with the buildings and their energy efficiency and NOM-003-ENER-2000. Thermal efficiency of domestic and commercial water heaters. Limits, testing method, and labeling.

Furthermore, in the process of updating and issuing building regulations and municipal urban development plans, it will be necessary to refer to a set of codes and standards, still to be drafted, that would take account of the entire life cycle of buildings, including their exterior aspects. The most important of these standards are:

- Federal energy efficiency code
- Bioclimatic building design
- Sustainable water use
- Use of recycled construction materials
- Use and sustainable management of waste
- Greenspaces
- Environmentally efficient use of public spaces, including roads
- Planning for use and final disposal of maintenance and construction materials during and after the useful life of buildings.

Barriers: While on the regulation front it has been very proactive, nothing much has been done on the financial incentive front. Main barriers besides a relatively low environmental awareness are still moderate charges for subsidised alternative energy sources electricity and gas, especially in the low consumption sector. Another fundamental barrier to stronger distribution are high up-front investment costs, although the mostly frost-free Mexican climate allows the use of simple, comparatively low priced thermosyphon systems.

Critical Success Factor: In Mexico, rather than giving direct financial incentives, the policy is targeted towards creating an enabling environment with roundtable talks between the sellers and potential users and developing a virtual marketplace. Integrated Energy Services Project for Small Localities of Rural Mexico, 2006-2011 tried to attract solar thermal suppliers in off grid location but it is too small. The green mortgage programme is being worked out with the housing banks but since it is just starting would be difficult to comment. UNDP-GEF project for a hybrid system could not work out, however later Government of Mexico is now proposing a public sector solar-thermal hybrid under CFE's "Obra Publica Financiada" (OPF) scheme. OPF is essentially a build-transfer scheme.

5 Domestic Action in India

This section is divided in to two parts; one part is dealing with National Level Actions as well as state specific implementation.

India receives receives solar radiation amounting to over 5 x 1015 kWh per annum with the daily average incident energy varying between 4 and 7 kWh per sq.m. depending on the location. In 11th plan period, solar water heating systems & other thermal applications (10 million sq. m of collector area) have been targeted; Energy efficient solar buildings (5 million sq. m. covered area in 1000 buildings); Akshay Urja Shops (2000 No.) & Stockists (3000), Solar /Green/Eco Cities (100 No. with at least one in each State).

5.1 MoUD-MNRE joint action

The Ministry of Non-Conventional Energy Sources (MNES) had requested all the States and Union Territory Governments in 1993 to issue suitable directives for the installation of solar water heating systems in Government hospitals and hotels, besides other categories of buildings like guest houses, laboratories, hostels, police quarters, army barracks, canteens, industrial establishments etc. In April 1994 the Ministry of Urban Development (MOUD) requested the State Governments to consider issuing suitable directives to the local bodies to modify the building bye-laws with a view to making the installation of solar water heating systems mandatory in hotels and hospitals in the commercial sector. In order to assist the local bodies to amend their building bye-laws to make use of solar water heaters mandatory, a model regulation/bye-laws had been drafted and circulated by MOUD in April 1999. The model regulation, when adopted by the local bodies, will make it mandatory for several categories of buildings, including residential buildings of a certain prescribed minimum plinth area, to have solar water heating systems.

So far the following actions have been taken and it has translated into some results:

GOs for amendment of building bye-laws issued: Andhra Pradesh, Madhya Pradesh, Punjab, Himachal Pradesh, Maharashtra, Tamilnadu, Rajasthan, Haryana, Uttar Pradesh, Uttranchal, Chandigarh, Chattisgarh, Nagaland, Delhi, West Bengal, Karnataka, Mizoram , Dadar & Nagar Haveli

Bye-laws amended: Karnataka (1), Gujarat (1), W.B.(1), Maharashtra (9), Andhra Pradesh (2), UP (7), Chhatisgarh(1).

Rebate in electricity tariff: Rajsthan (15 paise/unit), Karnataka (50 paise/uint) , West Bengal (40 paise to Max. of Rs. 80/-), Assam (Rs. 40/-), Haryana (Rs 100/ 100 lpd up to 300 lpd) & Uttranchal (Rs. 75/sq. m.)

Rebate in property tax: Thane, Amravati, Nagpur & Durgapur providing 6- 10% rebate

Rebate in income tax under consideration with Ministry of Finance

5.2 Energy Conservation Building Code (ECBC)

Origin: ECBC was announced in 2006 and has been in force since 2007. The Energy Conservation Act of 2001 mandated the creation of the Bureau of Energy Efficiency (BEE), established in March 2002. The BEE was mandated with establishing an Energy Conservation Building Code (ECBC). A National building code was developed by the Bureau of Indian Standards, and last revised in 2005, however it does not specifically address energy efficiency issues, though it promotes the use of new and innovative technologies and methods. The ECBC was developed in 2006 and issued May 2007.

Scope: The policy specifically targets (a) Buildings (b) Non-Residential (Sports Complex, Shopping Malls(c) Residential (Hostels, Hospitals, Housing Complex). It has been developed to account for five different climatic zones, particularly for envelope component requirements. ECBC is not mandatory for the first three years, and will become so in 2010, to allow the necessary implementation capacity to be developed. The code will be mandatory for all new buildings (commercial buildings or complexes) with a connected load of 500kW or more, or a contract demand of 600 kVA or greater. It will also apply to buildings with a conditioned floor space of 1000m^2 or greater.

The code sets minimum requirements for building envelope components, lighting, HVAC, electrical system, water heating and pumping systems. There would be three ways of being compliant with the ECBC. First, through a prescriptive approach, i.e. all minimum standards for separate components must be met; Second, the envelope and lighting system would be assessed through a systems performance criteria, while other components would have to meet the minimum requirements; Third, setting the whole building target energy use and trading off between systems (Energy cost budget method).

State and municipal governments must implement the code, while state governments are allowed to modify the code if necessary to account for local climatic conditions. In February 2008 an ECBC tip sheet and Technology atlas were distributed to developers, architects, engineers and other building energy efficiency professionals.

Barriers: (1) Users and advisors are not educated about space saving, life cycle costs and do not want any lifestyle change (2)

5.3 MNRE Initiative in Solar Energy

Ministry of New and Renewable Energy Sources has the following programmes in the solar energy sector:

- Development of solar city programme
- Solar water heating systems for domestic and commercial establishments
- Solar photovoltaic programme for street lightings, solar hoardings, traffic signals, Solar power packs
- Solar air heating/steam generating Systems for community cooking and Industry

The target segments for the solar energy have been identified as Housing Complex, Shopping Mall, Hospitals, Hotels, Universities, Colleges, Hostels, etc.

5.3.1 Solar City Programme

MNRE has launched a programme on " Development of Solar Cities" . The program assists Urban Local Governments in :

Objective: To assist urban local bodies in assessing their present energy consumption & future demand and & preparing Master Plans for energy savings & generation through energy efficiency measures & RE installations.

The *components* include:

- Preparation of master plan for increasing energy efficiency and renewable energy supply in the city.
- Setting up institutional arrangements for the implementation of master plan.
- Awareness generation and capacity building activities.

Financial Assistance:

- Up to Rs. 10 lakh for Preparation of a Master Plan for increasing energy efficiency and renewable energy supply in the city with in a year
- Up to Rs. 10 lakh for setting-up institutional arrangements, a solar city cell for the implementation of the master plan during five years
- Up to Rs 20 lakh for awareness generation, capacity building and other promotional activities
- up to Rs. 10 lakh for oversight of implementation during five years
- Support for implementation to be drawn from various schemes of different Ministries

Target: 60 cities with minimum one in each State to a maximum of 5 in a State having population between 5 to 50 lakh. Each city would have to reduce their projected energy demand by 10% over 5

years. Wherever applicable, usage of Solar thermal systems for water heating ,cooking, drying , space heating, process heat applications, air conditioning & refrigeration, etc are promoted and linkages with buyers and sellers are attempted.

Status	Name of the State	City
In Principle Support	Uttar Pradesh	Agra
	Uttar Pradesh	Moradabad
	Gujrat	Rajkot
	Gujrat	Gandhinagar
	Maharashtra	Nagpur
	Maharashtra	Kalyan Dombiwali
	Madhya Pradesh	Indore
	Manipur	Imphal
	Nagaland	Kohima
	Uttrakhand	Dehradun
	Chandigarh	Chandigarh
	Haryana	Gurgaon
	Haryana	Faridabad
	Maharashtra	Thane
	Tamil Nadu	Coimbatore
	Andhra Pradesh	Vijaywada
	Chattisgarh	Bilaspur
	Chattisgarh	Raipur
	Tripura	Agartala
	Assam	Guwahati
	Assam	Jorhat
	Karnataka	Hubli
	Karnataka	Mysore
	Kerela	Thiruvanthapuram
	Punjab	Amritsar
	Punjab	Ludhiana
	Rajasthan	Jaipur
	Rajasthan	Jodhpur
	Orissa	Bhubaneswar
	Uttarkhand	Haridwar
	Madhya Pradesh	Gwalior
Sanctions Issued	Uttar Pradesh	Agra
	Uttar Pradesh	Moradabad
	Gujrat	Rajkot
	Gujrat	Gandhinagar
	Maharashtra	Nagpur
	Maharashtra	Kalyan Dombiwali
	Nagaland	Kohima
	Uttrakhand	Dehradun
	Chandigarh	Chandigarh
	Haryana	Gurgaon
	Haryana	Faridabad
	Maharashtra	Thane

Status	Name of the State	City
Letter of Intent	Assam	Tinsukhia
	Assam	Dibrugarh
	Assam	Silchar
	Punjab	Jalandhar
	Pudduchery	Pudduchery
	Goa	Goa
	Himachal Pradesh	Shimla
	Himachal Pradesh	Hamirpur
	Himachal Pradesh	Solan
	Himachal Pradesh	Mandi
	Himachal Pradesh	Dharamshala
	Meghalaya	Shillong
	Gujrat	Surat

Figure 10 Status of the Proposals for solar city

5.3.2 Financial Assistance and Subsidy Programme for Promoting SWH

Objective: The main objective of the programme is to promote the widespread use of solar water heaters in the country through a combination of financial and promotional incentives, and other support measures so as to save a substantial amount of electricity and other fossil fuels apart from having peak load shavings in cities and towns.

Target: An indicative target of 1.4 million sq. m. of collector area has been set for 2008-09 & 2009-10. Effective date is August 2008 and Target date of expiry is 2010.

Coverage: The target will be achieved by providing interest/ capital subsidy to the users of solar water heaters, incentive to motivators & BIS/MNRE approved manufacturers/suppliers, support for organizing seminars/ symposia/ workshops/ business meets/ exhibitions, training programmes, publicity and awareness campaign, technology up-gradation and studies/ surveys, etc. Support will also be provided to Municipalities/Municipal Corporations that adopt and notify the modifications to their building bye-laws for making the installation of solar water heating systems mandatory in certain categories of buildings and/or provide rebate in property tax to the users of solar water heaters. Support will be available to Electricity Boards/ Utilities also that announce rebate in electricity tariff to such users in their monthly bills.

Financial Support: (a) Interest Subsidy: 0% interest on loans to domestic users in the states of: Assam, Meghalaya, Arunachal Pradesh, Tripura, Manipur, Nagaland, Mizoram, Sikkim, Himachal Pradesh, Jammu and Kashmir, Uttaranchal, Chhattisgarh, Jharkhand and the Indian Islands. Loans in other states/Union Territories: 2% for domestic users; 3% for institutional users not taking advantage of accelerated depreciation; 5% for industrial/commercial users taking advantage of depreciation. (b) Capital Subsidy: Subsidy up front will be available as follows: Non-profit making

institutions: 1,750 INR/m2 , Profit-making institutions and companies: 1,400 INR/m2 , Subsidies up front only for systems with a capacity of 2,500 litres per day (approx. 20 m2) or more: Housing complexes: INR 1,900/m2, Institutional and commercial buildings: 1,750 INR /m2 (Both of the above categories cannot obtain soft loans).

System Requirement: BIS approved flat plate collectors and MNRE approved manufacturers of evacuated tube collectors (System is to comply with IS 12933).

Implementing Agency: Low interest loans and subsidies to be granted by the Indian Renewable Energy Development Agency Limited (IREDA) or public sector, private and co-operative banks as well as Non-Banking Financial Companies (NBFC).

Experience so far: Since 1991, the government removed the percentage-based subsidy in favour of flat subsidies, ranging between Indian Rupees (INR) 2,000 – 6,000 for a collector of 2 m2. In 1996, states like **Maharashtra and Karnataka** dropped their subsidy schemes completely. It is interesting to note that it was only after 1996 that the solar water heater market in these states achieved an average annual growth of 50 %. For example, in the State of Karnataka, India, there were no more than five manufactures before mid-1990. Even a 30 % capital subsidy on solar water heaters did not attract either new manufacturers or potential clients. The policy change in the mid-1990, from capital subsidy to interest subsidy, completely altered the equation. Within ten years, the number of manufacturers in the state jumped to 60 by 2005. The involvement of the banks (both commercial and rural) ensured the sustainability of the programme – since solar water heaters were now seen like any other consumer product. The vast networks of banks in India set a fantastic foundation for spreading solar technologies.

Since the beginning of 2001, the state government of **Jharkhand,** has offered 105 INR/litre for solar water heaters with flat plate collectors and 80 INR/litre for systems with vacuum tube collectors. The installation of such a system typically costs around 150 INR/litre for flat plate collector systems and 115 INR/litre for vacuum tube collector systems. These systems are thus eligible for a nearly 70 % subsidy, independent of the capacity of the system. Since the beginning of the subsidy scheme in 2001, the state government only achieved installations of about 900 m2 in total. It will, however, keep the high subsidy with the goal to reach 4,000 m2 during 2009.

The northern state of **Haryana** is presently offering a 90 % subsidy on solar water heating systems to social institutions that do not benefit from an accelerated 80 % depreciation. During 2008-2009, installers set up solar water heating systems of 1,500 m2 for INR 14 million in various social sector institutions, such as women hostels, orphanages, deaf and dumb centres, crèches, old age homes,

sports hostels, charitable institutes and natural treatment centres and hostels for students of a specific caste. So far, the state's programme has already covered 45 institutions. Individual residents and government employees will get a subsidy of INR 5,000 for 100 litre systems and INR 10,000 for 200 litre systems.

5.4 Green Rating for Integrated Habitat Assessment (GRIHA) System for the Buildings

Origin: Internationally, voluntary building rating systems have been instrumental in raising awareness and popularizing green design. However, most of the internationally devised rating systems have been tailored to suit the building industry of the country where they were developed. In India a US based LEED rating system is under promotion by CII Green Business Centre, Hyderabad which is more on energy efficiency measures in AC buildings. Keeping in view of the Indian agro-climatic conditions and in particular the preponderance of non-AC buildings, a National Rating System - GRIHA has been developed which is suitable for all kinds of building in different climatic zones of the country. The system was initially conceived and developed by TERI (The Energy & Resource Institute) as TERI-GRIHA which has been modified to GRIHA as National Rating System after incorporating various modifications suggested by a group of architects and experts. It takes into account the provisions of the National Building Code 2005, the Energy Conservation Building Code 2007 announced by BEE and other IS codes, local bye-laws, other local standards and laws. The system, by its qualitative and quantitative assessment criteria, would be able to 'rate' a building on the degree of its 'greenness'. The rating would be applied to new and existing building stock of varied functions – commercial, institutional, and residential.

Scope: Criterion 19 of GRIHA specifies: Renewable energy - based hot- water system. Commitment Meet 20% or more of the annual energy required for heating water through renewable energy based water-heating systems. Criteria 18 which also specifies renewable usage is partly mandatory. There are 3 points out of 100 goes for solar water heating.

Coverage: Currently, 28 projects are being evaluated by GRIHA and one building has been rated so far. The following are the sample projects, representative of the type of buildings being evaluated by GRIHA - Institutional, Commercial and Residential.

Barrier: Major barrier so far has been the availability of the requisite site.

5.5 IGBC Green Building Rating as per LEED Standard

The Green Building Movement spearheaded by CII Godrej GBC since 2001 has come a long way. With a meagre green building footprint of 20,000 sq.ft in 2003, today green buildings of over 25 million sq.ft are being constructed all over India. More than 100 buildings have been registered in India under the LEED rating program. There has been tremendous learning from the construction of various green buildings. This paper captures the lessons learnt over the years. LEED India NC (New Construction), a fully indigenous rating to suit the National context has been launched effective 1 Jan 2007. LEED India CS (Core & Shell) has also been launched effective Sep 2007. The Indian Green Building Council (IGBC) would administer the LEED India rating system.

While designing these buildings as Green, there have been many challenges and alongside these challenges there have been enormous opportunities for various stakeholders – architects, builders, developers, manufacturers and others. The market for green building materials and products is estimated to reach Rs.15000 Cr by 2010. Service providers from India will have opportunities to offer green building services to other countries as well.

Rating with respect to SWH: LEED standards cover under mandatory segment solar water heating, equipment efficiency, supplementary water heating systems, piping insulation, heat traps and swimming pools. Residential buildings, hotels and hospitals with centralized water heating systems should have solar water heating or heat recovery to meet demand for at least 1/5 of the design capacity. Wherever gas is available, electric hot water heating can cover no more than 20% of the demand.

Coverage: There are 702 members (74 Founding Members) in Indian Green Building Council; 436 registered buildings; 54 certified buildings with 312 million sqft Green building footprint.

6 Policy Provision of SWH for some special constructions

6.1 SEZ Policy

The Centre has drafted a 'green policy' for making industrial and non-industrial special economic zones (SEZs) more energy efficient. The country has 344 notified SEZs across 40,000 hectares which have so far attracted investment worth Rs 1 lakh crore. Draft Guideline was prepared in consultation with the CII Sohrabji Godrej Green Business Centre. According to the draft guidelines, buildings in the SEZs need to comply with the energy conservation building code by laying down solar power systems to generate a minimum of 50 Kw of power per hectare, meeting 50 per cent of hot water requirements through solar heating and implementing 100 per cent water harvesting while ensuring zero water discharge. "The draft guidelines also include minimising individual automobile use in the SEZ premises, encouraging pedestrian and bicycle use, and landscaping of 75 per cent of open area," he added.

6.2 Railway

Indian Railways is reining in solar power for electrification of railway system assets and bringing in improved technologies to bring down emissions from locomotive engines in its attempt to assay environmental contamination and economize energy. A partial list of solar applications in railway includes space heating and cooling through solar architecture, potable water via distillation and disinfection, daylighting, hot water, thermal energy for cooking, and high temperature process heat for industrial purposes. A consultancy for reducing of exhaust discharges from diesel engines has already been approved and the work is coming along. In addition to this, diverse technology betterments are being adopted up on diesel locos to better operating capabilities and bring down unburnt fuels to check global warming. Thermal absorption panels can be used for water heating in rest houses work-sheds and be used non-traction stationary applications.

Solar power is also being reined in for electrification of manned level crossings, administrative buildings, training institutes, canteens and hospitals and for water heating functions. At present, 128 level crossings and four stations in West Central Railway have already been provided with solar panels for electrification purpose.

7 Some state specific initiatives

7.1 Delhi

Origin: Govt. of NCT Delhi has notified, vide office order no. F. No. 11(149)/2004/Power/2387 dated 28.09.06 for mandatory use of solar water heating system in respect of categories of buildings.

Scope: The buildings targeted are detailed below:- (1) Industries where hot water is Required for processing; (2) Hospitals and Nursing Homes including Government Hospitals; (3) Hotels, Motels or Banquet halls; (4) Jail Barracks; (5) Large Canteens having the capacity to serve more than one hundred persons in a day; (6) Corporate buildings located on plots having an area of Five hundred square meters and above; (7) All residential buildings built on a plot having an area of Five hundred square meters or above, falling within the National Capital Territory of Delhi, excluding Delhi Cantonment Area or areas exempted under Section 61 of the Energy Conservation Act, 2001; (8) ! All government buildings, residential schools, educational colleges, hostels, technical or vocational education institutes, district institutes of education and training, tourism complexes and universities etc. (9) All departments of the Government of National Capital Territory of Delhi including Tihar Jail and other Jails and the Delhi Police, the MCD, NDMC shall amend their rules / bye-laws within a period of six months from the date of issue of this order to make the use of Solar Water Heating Systems mandatory.

The government departments mentioned in clause (2) shall designate a nodal officer to monitor and report the progress of enforcement of the Government decisions to the Agency designated under clause (d) of Section 15 of the aforesaid Act, for energy conservation of National Capital Territory of Delhi. The progress report shall be sent by the nodal officer on quarterly basis to the designated agency. Mandatory use of ISI marked Motor pump sets, power capacitor, foot / reflex valves in the Agriculture sector. For all new connections, the use of ISI marked pump sets and accessories, power capacitors and other energy efficient appliances will be mandatory. This applies to all Private and Government Sector / Government Aided Sector, Government / Semi Government Undertaking and Boards. All Discoms and the New Delhi Municipal Council shall make the amendments in the load demand notices for new connections within six months time, from the date of issue of this order, to ensure use of only ISI marked pumps, its accessories and other energy efficient appliances in the National Capital Territory of Delhi. The designated agency shall ensure the implementation of these directions in the National Capital Territory of Delhi as per the provisions of the Energy Conservation Act, 2001.

Financial Incentive: The Central Government through its Ministry of New and Renewable Energy provides interest subsidy to make soft loans available @ 2% interest to domestic users, 3% to institutional users, not availing accelerated depreciation and 5% to industrial / commercial users availing depreciation from Indian Renewable Energy Development Agency (IREDA), public / private sector banks, scheduled cooperative banks, RBI approved non-banking financing companies, intermediaries of IREDA and other public / private financing institutions (FIs). The borrowers are eligible for loans up to 85% of the cost of the systems, repayable to a maximum period of five years.

The Govt. of NCT of Delhi is promoting the use of Solar Water Heating Systems by granting cost subsidy as an incentive to domestic consumers only, which is aimed at promoting the utilisation of solar power for heating of water in houses to reduce the demand for electricity. Accordingly, Govt. of NCT of Delhi has decided to give a subsidy of Rs. 6000/- per consumer as lumpsum grant (calculated at Rs. 100 per month for a period of 5 years). In case of loan being taken by a bank, this subsidy against the instalments of the loan for the final, would be adjusted against the instalments of the loan for the bank and instalments that are due to the bank. In the case of self-financing of the Solar Water Heating System, the amount shall be released directly to the installer of the system by Delhi Energy Efficiency & Renewal Energy Management Centre of Delhi Transco Limited. However, this will be done only after conducting Third-Party inspection. This subsidy is in addition to the interest subsidy available from the scheme of the Central Government through the Ministry of New Renewable Energy as mentioned above.

7.2 Chandigarh

Origin: Union Territory of Chandigarh has made its commitment to become a solar city. The first step in this direction is a building byelaw which was published in October 2008 and came into effect on the 21st December 2008.

Scope: As per the Byelaw, “All commercial, institutional and hotel buildings which have use of hot water shall have solar water heating systems of adequate capacity installed. The existing buildings which do not have those facilities shall provide this facility within one year from the date these orders are notified in the official gazette.” The byelaw allows residential building owners a transitional period of two years.

The byelaw stipulates the construction of 100 litre solar water heaters in residential houses constructed on a parcel of 506 m2 (1 kanal house) and a solar water heater with 200 litres for residential buildings constructed on a parcel of 1,012 m2 (2 kanal house).

7.3 Uttar Pradesh

Origin: The northern Indian State of Uttar Pradesh (U.P.) currently possesses one of the most attractive subsidy programmes for residents buying solar water heaters. Systems with flat plate collectors have been eligible to receive 6,000 Indian Rupees (INR) since October 2007, ones with vacuum tube collectors INR 5,000. The state agency Non-conventional Energy Development Agency (NEDA) set up this programme. Subsidies will be granted to the first 1,000 applicants, irrespective of the system's type. The NEDA already received more than 400 applications until mid-December last year. Total fund available: INR 5 up to 6 million (first 1,000 applications).

Scope: As per the latest decision of the state government, it has become necessary for multi-storey buildings, educational institutions, hostels etc. to install solar water heaters at their premises.

Coverage: The state has already authorised more than nearly 40,000 m2 since the technology was introduced in 1980. 3,000 m2 more are likely to be installed throughout 2008.

7.4 Tamil Nadu

In view of its inherent advantages, the State Government had made the use of Solar Water heating system mandatory in certain types of new buildings in the State in the year 2002, by amending the building bylaws. The State Government had also earlier provided subsidy to domestic and institutional users for installing the Solar Water heating systems. But now, it has been restricted to providing 100% cost for installation in Government institutions. Every year, a few Government Hostels / Hospitals have been provided with these systems. For the year 2007-08, the State Government has sanctioned Rs.10.00 ,lakhs for installing systems of total Capacity of 5000 LPD in Government Hostels / Hospital buildings. Apart from this, at the instance of Hon'ble Minister for Electricity, and as per the announcement made in the Legislative assembly, installing of Solar Water heating systems in the residences of Ministers, High Court Judges, State Guest House, MLA's Hostel, MLA's Quarters and special houses for IAS & IPS Officers at Government Estate has been proposed at an approximate cost of Rs.2.00 Crores. As on 31.3.2007 of Solar Water Heating System have been installed in 61 Government buildings, 3522 residences for domestic purposes and 440 industries / Institutions for commercial purposes under various subsidy schemes.

The State Government also had provided subsidy for installation of solar air heating system (32 systems) with a total Collector area of 498 sq.m in the years 2003-04 and 2005-06 when the Government of India subsidy was not available. Totally 46 systems with a total Collector area of 4575 sq.m have been installed under subsidy schemes.

7.5 Karnataka

Draft policy of Karnataka shows that solar energy is a focus area for the state and the state is blessed with solar energy, solar insolation available for more than 300 days in a year. Presently solar technology is cost intensive. With necessary incentive from MNRE, GOI and tariff fixation by KERC the solar power projects are likely to be viable. . Grid connected solar photovoltaic and solar thermal power generation of 1 MW and above capacities will be considered as priority projects. Northern Districts of the state like Gulbarga, Raichur, Bidar, Bijapur, Bellary, Bagalkot, Koppal, Belgaum, Gadag, Chitradurga etc are well suited to harness solar potential on MW scale. For villages/ habitations where grid connectivity not feasible or not cost effective, off-grid solutions based on stand-alone isolated lighting systems/ technologies like solar photovoltaic/solar wind hybrid systems may be taken up for supply of electricity. Gram Panchayats and local bodies will be involved in implementation of these plans. Solar steam generating systems at institutions and industries will be encouraged. . All Domestic, Public and Institutional buildings will adopt solar technologies. Solar passive building technology will be encouraged. Solar water heaters, solar lighting systems, solar hoardings etc will be encouraged to conserve electricity in peak hours. Solar cities will be developed in the state. Hubli-Dharwad Municipal Corporation and Mysore Municipal Corporation have been considered initially for developing as solar cities, as per MNRE scheme.

8 Key Conclusions

A. Targeting helps

Residential Sector:

- Aim primarily at the developer and builder (volume and spec)
- Inclusion of solar hot water systems on show homes
- Price subsidy –part to developer and part to the consumer
- Marketing and promotion assistance for developer/builder (point of difference)
  - could be through funding application similar to insulation retrofit programme
- Minimum number of installations to be eligible for assistance (about 20) – or household units supplied with solar systems (e.g.apartments where the complex has a solar hot water "pre-heating" system)

Government Buildings:

- Aim at the developer/tenant (local/central government/public buildings) strating at the tendering stage
- Price subsidy to government agency/authority based on a minimum level of use in each development
- Price subsidy for installers based on large volume installations
- Government take lead, setting standards with own buildings. Solar hot water becomes a key element of in Education, Health, Jail and sports facilities.
- Work with municipalities to ensure that they modify and adhere to the ECBC
- Incentive fund and competitive grants to the states under BRGF, JNURM only showing commitment of effectiveness of installation

B. Breakthrough products are needed

- Green Mortgage (work with National Housing Bank and other Housing Finance Companies as a refinance facility)
- Green Certification (work with BEE on this and factor SWH in all Investment Grade Energy Audit and ESCOs' action plan)
- CDM and Carbon Finance in programmatic mode (Work with Carbon Funds to soften interest rate on loans or offsetting the O&M cost or structuring pay per use model)

C. Regulations may work in India better when voluntary measures are futile

- Enforcement facilitation of ECBC and linking directives to all relevant policies like SEZ, Building Bye-laws, railway and ports and other autonomous bodies.
- Including in Public Tendering Rules
- Regulatory commissions to give green incentives
- Finance Department to give fiscal incentives

D. Subsidies do not work always

A single financial incentive by itself is not likely to ensure significant market penetration of solar water heaters; implementing a set of complementary incentives that may include, low-interest loans, tax credits, property and sales tax exemptions, and/or buy-downs[3], can have a significant market impact.

E. Capacity Building and Awareness

A more comprehensive renewable energy education campaign may be necessary to increase deployment of renewables. An inadequate understanding of the types and benefits of renewables in general is still considered a major barrier to technology adoption. Given the attitudes that appear to play a role in the decision to invest in renewables, marketing campaigns designed to educate and mold attitudes of the general public accordingly are necessary to generate new interest in renewables.

F. Skill Development is key

Currently, there are manpower available, but not skilled enough to install and operate. Installer training is key for market penetration and this can only be done when this is included int he formal curriculum. It requires working with AICTE and other state education departnemtns and UGC to structure specific modules or inculcating the same in mechanical energy or electrical energy course.

G. Quality and Standards are important for customer confidence

Some mechanism for guaranteeing quality is necessary to ensure that states and project owners are investing in systems that perform as designed. Various programs employ various technology and installer requirements, but it is unclear how these provisions impact program effectiveness. Therefore it is necessary to structure a simple "what and how" manual for manufacturers installers, motivators and monitors and also consumers. This should be prepared in consultation with the standards and quality control agency.

[3] The term "buydown" is most often used for reductions in the bottom line cost to purchasers, while "rebate" is used for a payment issued to the purchaser after the system has been installed. Delhi Government has started a successful buy-down programme for SWH.

H. Promote Public Private Community Partnerships for SWH bulk retrofit

Promotion of solar hot water in hot water system replacements can be based on partnerships with local government around streamlined building consent process, and with suppliers/installers and the ward councils and resident welfare associations. Price subsidy should be given to the customers and factored in the concession agreement.

I. Utility support and cooperation can greatly enhance the effectiveness of the programme

Rebate in tariff and a condition of SWH installation for new connection and new construction can give a fillip to the program and it is needed to be discussed with forum of regulators.

J. Improve the delivery Framework and Process

- Offer a generous incentive level with stable, long-term funding which decreases over time as the market matures.
- Design an easy and concise application process without compromising quality assurance.
- Establish a consistent but cost-effective quality assurance mechanism to protect consumers by guaranteeing adequate system performance.
- Incorporate incentives into an overall City or State infrastructure development strategy.
- Develop a coordinated package of incentives across departments and schemes.
- Allow flexibility for program modifications.
- Track the details of program usage, costs, and energy savings/production.

9 Next Steps

Next step in this engagement would be deeper analysis of the implementation of the programmes in some of the targeted municipalities and as directed by the steering committee in four zones. This is now being done in a brainstorming mode with key stakeholders, REDA and municipalities. This analysis will throw up lesson which will be matched with the lessons that have been summarised here. Then this will be shared be regionally and national in workshops to come to a consensus plan of action. This will be incorporated in the policy framework and that would be hosted for wider consultation.

Section II

This section deals with the cases relating to the implementation of the MNES-MoUD directive on solar water heating in 12 municipalities across four zones in India covering West Bengal, Haryana, Maharashtra, Karntataka. The report brings out the best practices and implementation issues.

Section II

CTRAN Consulting Pvt. Ltd.

Building Sector Policies and Regulation for Promotion of Solar Water Heating System

Case studies on Municipalities

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Executive Summary

The study is a part of the larger study of 'Building Sector Policies and Regulations for Promotion of Solar Water Heater Systems' covering a total of 12 Municipalities across India- in four zones east, west, north and south. The study is supported by UNDP/GEF which is assisting the implementation of a project by the Ministry of New and Renewable Energy, Government of India, on 'Global Solar Water Heating Market Transformation and Strengthening Initiative : India Country Program' which has been taken up with fulfilling the objective of accelerating and sustaining the solar water heater market growth in India.

The approach used is a case based method. Twelve Municipalities in four states and four zones one state each per zone have been taken as samples to study the SWH component in the building bye laws.

As the primary objective of the study is to enable the development of a uniform policy and regulatory framework and an effective implementation plan for enabling the market for solar water heaters, review of the existing policies and regulations is of prime importance. This includes studying the processes that are involved in preparing the building bye laws for (a) corporations and (b) municipalities and also to see how many of the Municipalities have issued orders to include SWH.

Views of the various stakeholders- experts in urban laws, staff of Municipal Corporation, Architects, Urban and Town Planners, builders and manufacturers of SWHs have been elicited for the purpose as part of the stakeholder consultation.

The building bye laws vary from city to city and they are framed by each of the Corporations as per the Town and Country Planning Act. While the Zoning regulations are a set of rules framed under the Master Plan for regulation of land use and development of the town or city, the Building bye laws are a detailed set of rules framed in conformity with zoning regulations for regulation of buildings.

We have also attempted to understand the Barcelona City Council Implementation Framework through a comprehensive case study (a short case was attempted in the international best practices and was advised by the Project Steering Group to focus more on Barcelona Model and understand the policy development and implementation issues.

The success of Barcelona Model is due to a fairly long period participatory planning exercise involving key stakeholders, that helped in understanding the problem areas and addressing it. Most of these areas were technical and a few were policy related. Second important point was the amendment taking into account the views and having a cool off period before full enforcement. It also had an institutional mechanism to act as pressure point and conscience keeper as well technical back-stopper. Then finally sustained political commitment saw its steady implementation.

A summary table has been included below:

Location	Date of Notification	Existing	New	Criteria	Collector area estimate	Voluntary	Mandatory	Comments
Chandigarh U.T.	16-Oct-08	Yes	Yes	All Commercial, Institutional Hotel buildings which have use of hot water shall have solar water heating systems of adequate capacity installed. The existing buildings which do not have any such facilities shall provide this facility within one year from the date these orders are notified in the official gazette.	Yes (limited)	Yes		The order provides sunset clause; covers both existing and new buildings. Even though it is having a mandate, it does not specify any provisions for those who fail to comply.
				As regards to residential buildings, all houses on a site of one Kanal will make provisions of solar water heating system having capacity of at least 100 ltrs. And on a site of two Kanal and above that of at least 200 lts. The existing houses will provide these facilities within two year from the date these orders are notified in the official gazette.				
Haryana	22-Oct-05	Yes	Yes	Use of SWH will be mandatory in Hotels, Hospitals including Govt. Hospitals, Nursing Homes and Community Halls, jails, baraks and Canteens, Residential Colony and Housing societies;	Yes			The order is comprehensive and issued by the Renewable Energy Department as per the provisions of the Energy Conservation Act.
				Any houses/complexes built over 500 sq. yard of area built within the municipal limits and HUDA				No penal provisions specified; no review and mid course correction of implementation
				All educational institutions (govt or private) universities, hostels, technical training institutions and tourist complexes				Coordinated implementation of various provisions are missing

Location	Date of Notification	Existing	New	Criteria	Collector area estimate	Voluntary	Mandatory	Comments
				All line departments like Town and Country Planning Department, Urban Development Department, PWD (Building and Roads), PHD, Housing Board, Architecture Dept. to amend their rules and bye laws within two months of the notification.				
				Departments will appoint nodal officers who will report progress quarterly to the Govt.				
				HREDA will act as nodal agency for technical assistance and quality assurance				
Karnataka G.O	13-Nov-07			The use of solar water heater system will be mandatory for the following categories of the building a. Industries where hot water is required for processing b. Hospitals and Nursing Homes c. Hotels, motels, banquet halls and guest houses d. Jail, barrracks, canteens e. Housing complex f. Residential building above 600 sq. ft of floor area under the jurisdiction of municipalities/ municipal corporations and Bangalore development authority g. Govt Building, residential, schools, educational colleges/institution, hostels etc			yes	The Law prescribes departments (Urban development, PWD, Housing department, health and family welfare department, agricultural and horticultural department) to designate a district and state level nodal officer to monitor and report the progress of enforcement of state government decision to KREDL on quarterly basis
Additional GO	16-Nov-07			The Energy Secretariat mandates the use of solar water heater in the building categorised in the Government order In exercise of the powers conferred by Section 18 of			yes	Although the Notification mandates use of Solar water heater in the following category of the building but there is

Location	Date of Notification	Existing	New	Criteria	Collector area estimate	Voluntary	Mandatory	Comments
				the Energy Conservation Act 2001				no penal provision
Karnataka Renewable Energy Policy				A rebate in electricity bill for domestic users at the rate of Rs 100 per month will be extended on installation of Solar Water Heaters		Yes		
Bangalore Municipal Corporation	21-Feb-04			Restaurants serving food and drinks with seating / serving area of more than 100 sq.m and above	Yes			
				Lodging establishments and Tourist Homes, Hostel and guest houses, Industrial canteens, Nursing homes and hospitals, Kalyana Mandira, Community Hall and Convention hall (with dining hall and kitchen) and Recreational clubs				
				Residential buildings: a) Single dwelling unit measuring 200 sq.m. of floor area or site area of more than 400 sq.m. whichever is more b) 500 lpd for multi dwelling unit / apartments for every 5 units and multiples thereof.				
Mysore				The Mysore Municipal corporation amended the building by-law based on the Government order No. Na Aa Ee/94/ACM/2007 dtd. 12.11.2007 . The Amended by law mandates the use of Solar water heater in the domestic, institutional, commercial and industrial sector as per the Karnataka Govt	Yes		Yes	

Location	Date of Notification	Existing	New	Criteria	Collector area estimate	Voluntary	Mandatory	Comments
				notification				
Hubli-Dharwad	Building Bye law 2004			The building bye Law specifies the system size for solar water heater as per the category a. Restaurants serving food and drinks with seating/serving above 100 sq metre should posses 100 LPD SWH per 40 sq metre of seating /serving area b. Lodging establishment and tourist homes to posses 100 LPD for 3 rooms c. Hostels and guest houses should possess 100 LPD for 6 beds d. Industrial canteens - 100 LPD SWH for 50 workers e. Nursing homes and hospitals - 100 LPD for 4 bed f. Community hall - 100 LPD for 30 sq metre floor area g. Recreational clubs - 100 LPD SWH for 100 sq metre floor area i. Residential buildings: a) Single dwelling unit measuring 200 sq.m. of floor area or site area of more than 400 sq.m. whichever is more b) 500 lpd for multi dwelling unit / apartments for every 5 units and multiples thereof.	Yes			

Location	Date of Notification	Existing	New	Criteria	Collector area estimate	Voluntary	Mandatory	Comments
WBREDA	2006			WBREDA Incentive on monthly electricity @Rs.0.40 per unit upto 200 units per month for the initial two years				
Durgapur				The Durgapur Municipal corporation Act 1994 was framed on the basis of West Bengal Municipal Act 1993. The Municipal Corporation is to abide by the building Rules 2007 and current 2009 building rules.	No			
Howrah				The Durgapur Municipal corporation Act 1980 was reframed in line with West Bengal Municipal Act 1993. The Municipal Corporation is to abide by the building Rules 2007 and current 2009 building rules.				
Kolkata	14-Feb-07	Yes*	Yes	a. West Bengal Building Rules Specifies incorporation of provision for use of solar water heater in the building plan in case of new building exceed in 14.5m b. For expansion of Existing building above 14.5 m to include the provision for solar water heater	No	Yes		No penal provisions specified; no review and mid course correction of implementation
	14-Oct-09	Yes*	Yes	The Building Law 2007 was modified and the base height was increased to 15.5m a. West Bengal Building Rules Specifies incorporation of provision for use of solar water heater in the building plan in case of new building exceed in 14.5m b. For expansion of Existing building above 14.5 m to include the provision for solar water heater	No	Yes		No penal provisions specified; no review and mid course correction of implementation

These are the top barriers and suggestions that stakeholders (from Authorities, architects, realtors and end-users).

Barriers	Possible solutions
Amendment and Standardisation of bye-law implementation	MoUD-MNES to work together to sensitise state counter-parts and councillors on the various clauses and transfer the incentive in a time bound manner base on the implementation
Lack of awareness (about the bye-law, about technology, maintenance)	Preference survey from the different segments and awareness levels to develop the baseline then the targeted communication (general communication does not help)
Incentive and Penalty are difficult to administer	Simpler transfer of discount coupon on purchase and installation, penalty at inception in both mandatory and voluntary regime through approval process, new electricity connection phase for new establishments and penalty during holding tax for failing in retrofit. Govt. and institutional buildings should be placed under mandatory regime.
Poor supply and after-sale service chain	Manufacturers to participate with ITIs to develop a cadre of certified installers and strategically place them around distributors; extended warranty schemes.
Poor Lending from FIs	IREDA-MNRE and Banks, MFIs to participate to evolve a simpler mechanism that is acceptable to every-one for private residential sector (real estate project) it should be linked to the builder-credit limit rather than household level. Govt and institutional buildings should be placed under mandatory regime.
Standards	Clear standards to be reinforced through incentives and other spurious ones should not be allowed any subsidy. Manufacturers to run vendor certification or standard programs like solar key-mark with standards agency and clearly demonstrate cost benefits through advertisement in customer education series.
Lack of staff to monitor and verify	ESCO agencies should be brought into work in areas with manufacturers and authorities and should be assigned conversion targets against reasonable incentives.

1 Background

India is a vast country with varied geography and climate. Any unified policy for India, thus is very challenging. The usage profile indicates, the water heaters (electrical) are largely confined to urban areas and in rural areas the water heating is done using the bio-mass and kerosene. Sustainable energy management includes use of alternate energy to reduce the overall energy intensity. However, considering the fact that, India is home to over a billion people and issue of poverty within India has remained a prevalent concern the market transformation is not an easy task. Millions of people in India are unable to meet these basic standards, and according to government estimates, in 2007 there were nearly 220.1 million people living below the poverty line. Nearly 21.1% of the entire rural population and 15% of the urban population of India exists in this difficult physical and financial predicament. This in turn affects the usage of housing and housing appliance consumption behaviour.

GEF project relating to the Solar Water Heating Systems (SWH) has identified the following barriers:

- Policy
- Finance
- Business Skills
- Information
- Technology

The project attempts to overcome these barriers and come up with replicable models for up-scaling.

2 Objective

The objective of this report is to focus on the implementation of policy of SWH systems promotion in building sector in urban local bodies and understand the following:

- Review of Building Sector Policies and Regulations in ULBS in the context of Solar Water Heating (SWH) System Promotion
- Assess their effectiveness and understand the barriers in implementation
- Synthesize the critical success factors for guiding the formulation and implementation of the uniform policy.

3 Overview of the Urban Local Body Administrative System

India is home to 1.1 billion people and 27.8 percent population lives in more than 5,100 towns and over 380 urban agglomerations. At the current rate of urbanisation the urban population in India will reach a staggering total of 575 million by 2030 A.D. As per the National Housing Bank (NHB) the shortage in supply of urban housing units is to the tune of 8.9 million. This gap is seeing a steady widening with the housing stock growth percentage pegged at 1.6% as against the population growth rate of 2.7%.

Municipal governance in India has been in existence since the year 1687 with the formation of Madras Municipal Corporation and then Calcutta and Bombay Municipal Corporation in 1726. In early part of the nineteenth century almost all towns in India had experienced some form of municipal governance. In 1882 the then Viceroy of India, Lord Ripon's resolution of local self-government laid the democratic forms of municipal governance in India. After the 74th Amendment was enacted there are only three categories of urban local bodies:

- nagar nigam (municipal corporation)
- nagar palika (municipality)
- nagar panchayat (city council)

There are 3723 urban local bodies in India. The break up is given as below.

Table 1 Stratification of Urban Local Bodies in India

Stratification	Number
Total No. of Municipal Corporations	109
Total No. of Municipalities	1432
Total No. of Nagar Panchayats	2182
All ULBs	3723

Source: 12th Finance Commission Report (2005-2010), 2004.

Article 243Q of the 74th Amendment requires that municipal areas shall be declared having regard to the population of the area, the density of population therein, the revenue generated for local administration, the percentage of employment in non-agricultural activities, the economic importance or such other factors as may be specified by the state government by public notification for this purpose. This article provides that there be a nagar panchayat for transitional areas i.e. an area in transition from rural to urban, a municipality for a smaller urban area and a municipal corporation for a larger urban area.

Among all urban local governments, municipal corporations enjoy a greater degree of fiscal autonomy and functions although the specific fiscal and functional powers vary across the states. These local governments have larger populations, a more diversified economic base, and deal with the state governments directly. On the other hand, municipalities have less autonomy, smaller jurisdictions and have to deal with the state governments through the Directorate of Municipalities or through the collector of a district. These local bodies are subject to detailed supervisory control and guidance by the state governments.

The municipal bodies of India are vested with a long list of functions delegated to them by the state governments under the municipal legislation. These functions broadly relate to public health, welfare, regulatory functions, public safety, public infrastructure works, and development activities.

Public health includes Water supply, Sewerage and Sanitation, eradication of communicable diseases etc.; welfare includes public facilities such as Education, recreation, etc.; **regulatory functions related to prescribing and enforcing Building regulations**, encroachments on public land, Birth registration and Death certificate, etc.; public safety includes Fire protection, Street lighting, etc.; public works measures such as construction and maintenance of inner city roads, etc; and development functions related to **Town planning** and development of commercial markets. In addition to the legally assigned functions, the sectoral departments of the state government often assign unilaterally, and on an agency basis, various functions such as Family planning, Nutrition and slum improvement, disease and Epidemic control, etc.

The Twelfth Schedule of Constitution (Article 243 w) provides an illustrative list of eighteen functions, that may be entrusted to the municipalities. Besides the traditional core functions of municipalities, it also includes development functions like planning for Economic development and Social justice, urban poverty alleviation programs and promotion of cultural, educational and aesthetic aspects*. However, conformity legislation enacted by the state governments indicate wide variations in this regard*. Whereas Bihar, Gujarat, Himachal Pradesh, Haryana, Manipur, Punjab and Rajasthan have included all the functions as enlisted in the Twelfth Schedule in their amended state municipal laws, Andhra Pradesh has not made any changes in the existing list of municipal functions. Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Tamil Nadu, Uttar Pradesh and West Bengal states have amended their municipal laws to add additional functions in the list of municipal functions as suggested in the twelfth schedule.

There is a lot of difference in the assignment of obligatory and discretionary functions to the municipal bodies among the states. Whereas functions like planning for the social and economic development, urban forestry and protection of the environment and promotion of ecological aspects are obligatory functions for the municipalities of Maharashtra, in Karnataka these are discretionary functions.

Considering that building regulations are part of the state list, the local bodies have to play a pivotal role and the states also have to create a platform through enabling legislation. Since almost a century building activity is being regulated by local “Bye-laws”, “Building Regulations” of municipalities. These reflect to varying degrees latest developments in building science and technology. Some states have state level regulations which local bodies can adopt in to to: e.g. General Development Control Regulations of Gujarat. These bye-laws provide the techno legal basis for enforcing building requirements. In addition several states have brought out Development Control Acts, Town Planning Acts, Fire Safety Acts etc. to control and regulate development. Finding that local bye-laws / building regulations had not kept pace with developments in the science and technology of building, in order to be of assistance in updating them, the Bureau of Indian Standards (BIS) brought out the ‘National Building Code of India’ (NBC) in 1970; in 1983 it brought out a revised version. It has also brought out the ‘National Electrical Code’ (NEC) and till recently the Energy Conservation Building Code (ECBC) has been given tooth through Energy Conservation Act. The tardy implementation of building regulations for promoting SWH has been because of this role dualism.

4 Overview of the Regulations for Energy Efficiency and Environment

The statutory framework for the environment and energy efficiency includes the following:

- Indian Forests Act, 1927,
- Water (Prevention and Control of Pollution) Act, 1974,
- Air (Prevention and Control of Pollution) Act, 1981,
- Forest (Conservation) Act, 1980, and the Environment (Protection) Act, 1986.

Other enactments include:

- Public Liability Insurance Act, 1991,
- National Environment Tribunal Act, 1995,
- National Environment Appellate Authority Act, 1997,
- Energy Conservation Act, 2001, and
- Electricity Act, 2003.

The courts have also elaborated on the concepts relating to sustainable development, and the 'polluter pays' and 'precautionary' principles.

Specific regulations in the building sector include: A building code, or building control, is a set of rules that specify the minimum acceptable level of safety for constructed objects such as buildings and non-building structures. The main purpose of the building codes is to protect public health, safety and general welfare as they relate to the construction and occupancy of buildings and structures. The building code becomes law of a particular jurisdiction when formally enacted by the appropriate authority.

Building codes are generally intended to be applied by architects and engineers although this is not the case in the UK where Building Control Surveyors act as verifiers both in the public and private sector (Approved Inspectors), but are also used for various purposes by safety inspectors, environmental scientists, real estate developers, contractors and subcontractors, manufacturers of building products and materials, insurance companies, facility managers, tenants, and others.

There are often additional codes or sections of the same building code that have more specific requirements that apply to dwellings and special construction objects such as canopies, signs, pedestrian walkways, parking lots, and radio and television antennas.

National Housing and Habitat Policy of India issued the in 1998. The Policy acknowledged the importance of construction techniques and materials in energy conservation. It also emphasized that the government should specify energy efficiency levels for different categories of buildings.

Energy Conservation Act (ECA 2001), enacted in 2001. It promotes energy efficiency and conservation domestically. ECA 2001 mandated the creation of the Bureau of Energy Efficiency (BEE), which was established under the Ministry of Power in 2002. ECA 2001 also authorized BEE to establish an Energy Conservation Building Code (ECBC).

The Bureau of Indian Standards (BIS) issued **National Building Code of India** (NBC) in 2005, or NBC 2005, which covered a range of structural, safety and other design issues. Energy efficiency was marginally addressed.

Circular of MNES: In August 2005, MNES issued a circular (No. 3 / 1 / 2005/UICA (SE)) for Implementation of the Scheme on "**Accelerated development and deployment of solar water heating systems in domestic, industrial and commercial sectors" during 2005– 2006** to all Secretaries of State Nodal Departments, Heads of State Nodal Agencies, Municipal Commissioners, Managing Director, Indian Renewable Energy Development Agency (IREDA), Financial Institutions, Public/Private Sector Banks and Co-operative Banks. The scheme had incentives for users, intermediaries, FIs and Banks, SNAs. It also has funds for training and awareness campaign to educate customers. It also has support for surveys, exposure visits and technology assessment initiatives. Most important for amendment of bye-laws of the municipalities the scheme states the following.

> A model **Regulation/Building Bye-laws for the installation of solar assisted water heating systems** in certain categories of buildings has been circulated by the Ministry of Urban Development to all the States and Union Territories with a request to circulate the same to their local bodies for incorporating it in their building bye-laws. The model regulation, when incorporated by the local bodies in their existing building bye-laws, will make it mandatory for several categories of buildings including residential flats of certain minimum plinth area to have solar water heating systems. A one-time grant @ Rs. 5 lakhs for municipalities and Rs. 10 lakhs for municipal corporations will be available for those that adopt and notify the modification of their building bye-laws making installation of solar assisted water heating systems mandatory in at least some categories of buildings in their respective areas as per the model Regulation/Building Bye-laws. The financial assistance provided by the Ministry is required to be utilized by the grantee organization for training, study tours, awareness creation, demonstration, preparation of brochures/manuals, creating infrastructures etc. for implementing the mandatory provisions. In order to avail this grant, the Municipal corporations/ Municipalities will be required to submit an application to the Ministry through the respective SNAs giving a tentative plan for utilizing the assistance alongwith a copy of the notification / order making use of solar assisted water heating system mandatory based on which MNES will release the grant to respective Municipal corporation/ Municipality.

Under the direction of the Prime Minister, the government's Planning Commission issued the **Integrated Energy Policy in 2006**. This document identifies major areas with large potential for energy savings. Five of the thirteen areas are related to the buildings sector, including building design, construction, HVAC, lighting and household appliances.

An **Energy Conservation Building Code (ECBC)** was launched in May, 2007, which addresses the design of new, large commercial buildings to optimize the building's energy demand. Commercial buildings are one of the fastest growing sectors of the Indian economy, reflecting the increasing share of the services sector in the economy. Nearly one hundred buildings are already following the Code, and compliance with it has also been incorporated into the Environmental Impact Assessment requirements for large buildings. While it is currently voluntary, ECBC establishes minimum energy efficiency requirements for building envelope, lighting, HVAC, electrical system, water heating and pumping systems.

5 Existing Implementation Framework

Municipalities in India have been empowered to implement both voluntary and prescriptive regulations in India and the mechanism for enforcing existing mandatory building codes is also well-established.

5.1 Process of Amendment

Amending the bye-law is a long process[1] in the current regulatory environment and the process is as follows:

- State government to appoint a committee to review existing municipal acts or provisions
- Committee prepared a draft state-level policy options agenda
- Draft state-level agenda to be discussed with different stakeholders
- Finalization of state-level policy agenda
- Identify role of town planning act vs. municipal act and legal basis for DPC/MPC
- Drafting of new act and change of provision based on the policy agenda

Municipal authorities review all building designs for compliance with the code. Municipal inspectors must visit all building sites during the construction phase to ensure that construction matches the approved design. This is where the installation checks for various kind of devices have to be checked and this is the second weakest link in the chain (the first one is the awareness and willingness of the state and local bodies to integrate the SWH through the amendment of the building codes and rules. While these mechanisms all exist, in actual practice, there are many challenges with enforcement and monitoring: the existing enforcement system needs strengthening and local bodies cite the lack of staff as one of the reasons. In addition, inspectors would need additional training and experience in the solar energy aspects of buildings.

5.2 Status of Amendment

The status of amendments to building bye-laws in municipalities (2008)

- *Amended*: Orissa MC, Bihar, Sikkim and TN
- *Draft bills prepared*: AP, MP, Rajasthan and Uttaranchal
- *Committees formed to review acts*: HP, Gujarat, Maharashtra, Karnataka, Punjab, Tripura, Chhattisgarh and Goa
- *Proposed changes in the MCD* act to introduce new building byelaws and local area plans

Overall status of the modification of the building bye-laws to incorporate SWH is given below:

- GOs for amendment of building bye-laws issued: Andhra Pradesh, Madhya Pradesh, Punjab, Himachal Pradesh, Maharashtra, Tamilnadu, Rajasthan, Haryana, Uttar Pradesh, Uttranchal, Chandigarh, Chattishgarh, Nagaland, Delhi, West Bengal, Karnataka, Mizoram , Dadar & Nagar Haveli
- Bye-laws amended: Karnataka (1), Gujarat (1), W.B.(1), Maharashtra (9), Andhra Pradesh (2), UP (7), Chhatisgarh(1). Orissa (1)

[1] See the case of KDMC building bye-law amendment timeline in the case study section

- Rebate in electricity tariff: Rajsthan (15 paise/unit), Karnataka (50 paisa/unit) , West Bengal (40 paise to Max. of Rs. 80/-), Assam (Rs. 40/-), Haryana (Rs 100/ 100 lpd up to 300 lpd) & Uttaranchal (Rs. 75/sq. m.)
- Rebate in property tax: Thane, Amravati, Nagpur & Durgapur providing 6- 10% rebate
- Rebate in income tax under consideration with Ministry of Finance

6 Process of Municipal Case Study Development

Municipal case studies have been attempted to understand the following:

The case study is structured to identify the barrier prevailing that forbids the higher penetration of the technology. As the penetration of the technology is dependent on active participation of the all stakeholders involved like regulatory, manufacturer/supplier, user, builders, society so objective was to understand and analyse the bottlenecks in every sector. The study is structured

1. To review the regulatory gap in the existing policy that could have led to larger penetration of the solar Water heating technology in the ULB
2. To review the barrier from the users (existing) point of view
3. To identify the existing barriers with the manufacturer and Supplier
4. To identify the barriers from the builders point of view
5. To cite possible measures of overcoming barrier through successful case

The following locations have been suggested by Project Advisory Committee for the detailed case studies of the following Municipalities in India.

- Northern Zone
  - Gurgaon
  - Faridabad
  - Chandigarh
- Southern Zone
  - Bangalore
  - Mysore
  - Hubli-Dhrawad
- Eastern Zone
  - Kolkata
  - Howarah
  - Jalpaigudi (subst- Durgapur)
- Western Zone
  - Pune
  - Thane
  - Kalyan-Dombivalli

6.1 Experience in Northern Zone (Haryana)

6.1.1 Experience of Gurgaon and Faridabad

Origin

Ministry of Non Conventional Energy Sources (Now, Ministry of New and Renewable Energy), Government of India issued a circular on scheme on "Accelerated Development and Deployment of solar water heating systems in domestic, industrial and commercial sectors" during 2005-06 to all State Nodal Departments, State Nodal Agencies, Municipal Commissions. Haryana Government issued a notification on 29th July 2005 through Renewable Energy Department regarding ***mandatory use of solar water heaters in response to Section 18 of Energy Conservation Act 2001***. It directed all the official bodies like HUDA, PWDs, and Housing Boards etc. These departments were also directed to submit report on monitoring of enforcement of byelaws.

Implementation

Haryana Government further issued a bye law amendment order to all Urban Local Bodies of Haryana called as Haryana Municipal Building (Amendment) Bye laws, 16th November 2007. The order mentioned that BIS (IS 12933) conforming solar water heating systems must be added in building bye law amendment. The building sectors included was industries with hot water requirements, hotels, hospitals, nursing homes, banquet halls, residential buildings on a plot of 500 square yards, government buildings, school hostels, etc. MNES (Now, MNRE) also directed ULBs to add a clause on penalty or suspension of projects if bye law is not followed or false information is provided by developer/architect.

Haryana Urban Development Authority (HUDA) operates in Hisar, Faridabad, and Gurgaon with its head office in Panchkula. As per the discussion with Town Planning department, in HUDA Gurgaon it is mandatory to install solar water heater in buildings where hot water is a requirement. HUDA added SWH installation in its zoning plan in year 2001 (Memo No. CTP (HUDA)-DTP (N)/6763-6789 dated 20.7.01). This zoning plan was suppressed in response to Haryana government's notification (Notification No. 22/52/05-5P, dated 29th July 2005) on energy conservation measures. The mandatory installation of solar water heater system was further bolstered in following categories of buildings:-

1. Industries where hot water is required;
2. Hospitals and nursing homes;
3. Hotels, motels and nursing homes;
4. Jail Barracks, canteens;
5. Housing complexes;
6. All residential buildings built on plot of 500 yards; and
7. All government buildings.

HUDA amendments are more complete in terms providing detailed information about cost-benefit, assessment methods, verification process and rate contracting of the agencies. It shows the pricing, address and obligations for different types of suppliers. It also provides a comprehensive guidance on quality standards and specifications.

Other Initiatives included the following:

Haryana's Tarriff rebate scheme

Dakshin Haryana Bijli Vitran Nigam Limited (DHBVNL) issued a circular (Memo No. Ch. 7/SE/Comml/R-16/4/2007 Date 09.02.2007) on tariff rebate systems for promoting solar water heaters as a demand side management measures for conserving electricity in building sector. Rebate on domestic electricity bills @ Rs. 100/-, Rs. 200/- and Rs. 300/- per month to the users of SWH capacities of 100 LPD, 200 LPD and 300 LPD respectively for a period of 3 years from the date of installation would be provided.

Gurgaon Solar City Programme

Gurgaon has been selected as one of the cities in Solar City Programme. Mr. RK Khullar, Commissioner of Gurgaon Municipal Corporation informed that a Solar City Action Plan is being developed in conjunction with an NGO – ICLEI South Asia. According to Ms. Supreeti Sahai, project associate of solar city action plan at ICLEI solar water heater and issues (whether policy level, technological or financial) associated with it in building sectors are the essential part of the study. The study has not yet been complete and available in public domain.

HAREDA's promotion of effective installation of SWH

Mr. P.K. Nautiyal, Sr. Technical Officer at HAREDA shared issues associated with solar water heater in Haryana. To ensure installation of appropriate capacity of SWH in buildings, HAREDA has their field level representatives. These representatives take help from relevant building consultants and assess the hot water requirements of a specific building. Accordingly required capacity of SWH is communicated to the building owner/developer.

For promoting solar water heater in building sector HAREDA provides financial assistance to NGOs to raise awareness about benefits of SWH. For example working women's hostels have generally less fund to install any energy efficient equipments. HAREDA with the help from NGOs reach out to those institutions. HAREDA meets 90 % of the total cost of installation SWH in those institutions. This percentage will be reduced to 70 % in 2010-11.

Stakeholder Views

Based on the focus group discussions in Haryana and Faridabad, the stakeholders identified the following **barriers**.

These are:

1. Awareness of about solar water heater technology and its benefits is still low among relevant stakeholders. The beneficiaries generally don't have any idea about how system works and what are the requirements.
2. The rate of flow and supply of water to various building types has still to be taken into consideration in SWH issue for building sectors
3. Mandatory laws are there but they only help in corruption and bribery. For example – Mandatory law on Rain water harvesting pits in housing has resulted in paper work only. In practice, it is being used for storing diesel and petrol. These mandatory bye laws could be effective in public buildings/buildings of public sector corporations/organizations.
4. The Haryana's electricity bill rebate system does not work literally. The time length in availing the benefits is so long that it hardly matters.
5. SWH has not yet reached middle and low middle class housing sector where it could have good potential.
6. Not enough Research & Development has been done. A good science of SWH has not been developed in multi dimensional way – engineering, aesthetic and visual beauty, utility, etc.
7. In multi-storey building (residential or commercial), which are very common in Gurgaon and Faridabad, the penetration almost negligible. The installation of SWH on terrace of multiple story buildings can lead to conflict over sharing of hot water.
8. But some of the barriers are here to stay and will need drastic intervention in any form like technology, policy or awareness: (a) The problem with geometry (slanting areas, etc.) of existing buildings for installation of SWH (b) SWH as an instant alternative to Electric Geysers in building sector has a long way to go as supply chain is pretty weak, so also the repair market.

Possible **solutions** as the stakeholders see are as follows:

1. High level of awareness among stakeholders (builders, architects, and general consumers like hospitals, hotels, restaurants and residential sector) might help.
2. Creation of verification facility with an area wise concession model and tracking system
3. Senior Management commitment in enforcement of SWH integration in building plan approval and analysis of site inspection report.
4. Analysis of initial load survey report by utilities before giving electricity connection
5. Feed in tariff to encourage renewable energy systems may also help: But how to measure the usage of SWH could pose a challenge (May be, one can monitor/record the flow of water in and out of SWH installation in buildings).

6. Per month incentive of Rs. 100/month could be provided to SWH users in order to meet the cost of installation & purchase of SWH.
7. Community hot water systems in multiple buildings could become solution for multiple storey buildings with sharing arrangements worked out with RWA.
8. SWH Components should be sold through general appliance/electronic/electrical shop (rather than exclusive shops like Aditya Solar Shops or any other like this) to increase the reach among building sector costumers. Fiscal measures like higher tax on electrical geysers and benefits to consumers (like Delhi) at the point of sale and sharing a part of the benefit (through tax exemption on sale of SWH) would help.
9. Architects say they don't have much role to play for SWH penetration in building sector. If there is demand, architects are there to help to design the buildings accordingly. Architects mostly work according to customers' requirement.
10. The dealers mainly target new buildings only. Multiple storey buildings are avoided. Many dealers do not have any idea about Haryana's tariff rebate scheme on electricity bill on installation of SWH. Some dealers who are aware say the procedure of electricity bill rebate claim is so long and tedious that it only helps to lose the confidence among consumers for benefits SWH. The dealers mostly communicate the consumers about electricity saving and other benefits of SWH technology to market the product.

Lessons learnt

The major concern is the lack of information of all relevant mandatory bylaws. There should be consolidated plan/scheme/bye law for SWH installation in building sector. There is a scheme/bye law in each official department of Gurgaon and Faridabad. HAREDA has issued mandatory bye law for SWH installation.

The target stakeholders' have not been properly defined in the bye law and the procedure for obtaining No objection Certificate from HAREDA is also not clearly explained for these sets of consumers (like Designated Consumers in EC Act rendering it weak in implementation). There is no penalty for violation of bye law.

Then there is tariff rebate scheme of Electricity Deptt. of Haryana. There is the bye law by HUDA also. Finally, a Solar City action plan for Gurgaon is coming up. All these relevant policy/regulations etc. should be presented in consolidated plan/scheme/bye and put on website so that it can become accessible to everyone.

6.1.2 Experience of Chandigarh

Origin

Chandigarh Union Territory is one of the cities selected for Solar City Programme. The Energy and Resources Institute (TERI) has prepared Detailed Project Report for Solar City Chandigarh. As a first step, Chanadigarh Union Territory Administration has amended building bye laws on October 16, 2008 which came into effect on 21 December 2008.

Implementation

According to it all commercial, institutional and hotel buildings where hot water is required have to install SWH of adequate capacity.

The byelaw stipulates the construction of 100 litre solar water heaters in residential houses constructed on a parcel of 506 m2 (1 kanal house) and a solar water heater with 200 litres for residential buildings constructed on a parcel of 1,012 m2 (2 kanal house).

Chandigarh has clearly notified the *subsidy channelization system in its website*. Three agencies have rate contract for this.

- M/s Surya Shakti
- M/s Inter Solar System (P) Ltd.,
- M/s Merloni Termo Sanitari India Ltd.,

NCSE provides *requisite application form* for SWH under subsidy scheme and also a *certification format* for releasing subsidy. The firm/company/manufacturer/supplier of SWHS is wholly responsible for the technical specifications/workmanship and performance of the System and Guarantee for the satisfactory performance of the system for two years from the date of commissioning of the system.

Subsidy @ 25% of the cost of the system is being provided to the residents of Chandigarh for installing Solar Water Heating Systems. 75% of the cost of the system is provided by the customer to the agency & 25% of the system cost is provided by Department of Science & Technology to the Agency after checking the system installed at customer's place.

Additionally the *quality standards* for the SWH have been specified: (a) BIS Mark 100 lpd to 5000lpd systems. (b) FPCs are with BIS marks and ETCs are form MNRE approved authorized testing centres. ETCs would have minimum 1.22 m2 per 100 lpd or 12 tubes per 100 lpd.

For *monitoring* it specifies formats for reporting on a quarterly basis.

Stakeholders' Views

1. Mr Sanjay Kumar, Chief Administrator, Chandigarh Administration said that they keep on sensitizing relevant stakeholders time to time for effective enforcement of building byelaws. It is not possible to immediately get the compliance.
2. The process has started now, there are also indications of some residential customers opting for SWH and office buildings have started action.
3. Concerned authorities are being sensitized in the review meetings.
4. There are barriers in terms getting guidance on quality products and cost benefits
5. Many existing buildings are difficult to retrofit especially the rooms in the hospitals.
6. Poor supply chain-as after sale service is poor
7. Claiming rebate and subsidy is tardy

6.2 Western Zone Experience (Maharashtra)

6.2.1 Kalyan-Dombivili Municipal Corporation

Origin

Kalyan-Dombivili Municipal Corporation (KDMC) is one of the earliest adopters and a very successful implementer of SWH. The implementation of SWH in KDMC is driven by a modification in the by-law to include SWH in any new buildings. The by-law modification followed the below pattern. First a state government order to amend by-laws was sent to every municipality. KDMC Town Planning Department in consultation with the Electricity department proposed a modified by-law and sent it over to the Urban Development department. Urban planning department invited objections to the proposed changes and thereafter amended the Development Control Rules.

We have been unable to determine the exact time frames in which all these happened. Notification issued by Urban Development Department, Government of Maharashtra (No. TPS-1202/460/CR-4/2002/UD-12) enforces the Development Control Rules which includes the clause about Solar Water Heater. KDMC first published notice for inviting suggestions and objections on 5th December 1996. Then new DC was put in force on 18th January 2006.

The timeline, however, is misleading as the above modification to DC rules had multiple changes and went through many rounds of discussion and modification. Solar Water Heaters was only one of such changes. Mr. Sonawane (Executive Engineer, Electrical, KDMC), believes that a change in DC rules to incorporate SWH should take about 1 year from Town Planning Department proposing the changes and UD accepting them. However orders detailing actual time of notification for the relevant files were not available. The following timeline has been constructed from various documents.

Table 2 Process of amendment of Municipal Bye-laws in KDMC

Key Milestones in Amending Municipal Development and Control Rules	Date
Under Section 26(1) of the Maharashtra Town Planning Act, 1996 Draft Development Plan was published and public opinion sought	5th December 1996
Expert committee formed to review the received objections under Section 28 (2) of the Act	7th July 1997
Expert committee submits report	20th October 1999
Draft Development Plan was submitted to Govt. for sanction and planning committee was constituted	4th December 1999
Substantial modification sought and public opinion invited	16th January 2002
Committee submits report and Govt. sanctions it excld. substantial modification part and further public opinion sought	16th January 2004
Deputy Director Town Planning appointed as Officer u/s 31 (2) of the act to review suggestions	16th January 2004
Final Amendment Notification	1st December 2005
The development and control rules amended	18th January 2006

Implementation

The amendment specified that solar water heating systems should be made mandatory in the building for hospitals, hotels, guest's houses, police men / army barracks, canteens, laboratories and research hostels of school and colleges and other institutions.

- The solar water heating systems should be mandatory in the hospitals and hotels, where the hot water requirement is of continuous nature. In these buildings the systems must be provided with auxiliary back up.

- The use of solar water heating system is recommended is following type of buildings in the Government/ Semi Government and institutional building where the hot water requirement may not be continuous / permanent.

    - Guest Houses
    - Police men/ Army Barracks
    - Canteens
    - Laboratory and research institutions where hot water is needed.
    - Hostels, schools, colleges and other institutes.

The installation of the *electrical back up in all such water heating systems shall be optional* depending on the nature of requirement of the hot water. It is suggested that solar water heating systems of the capacity of about 100 litres per day based on thermo-syphonomical with the necessary electrical back up be installed at residential building like hostels.

- All such buildings where solar water heating systems are to be installed with have open sunny roof area available for installation of solar water heating systems.
- The roof loading adopted in the design of such buildings should be at least 50 kg per sq m for the installation of solar water heating system.

- Solar water heating system can also be integrated with the building design. These can earlier be put on the parapet or could be integrated with south facing vertical, wall or the building. The best inclination of the collector for regular use throughout the year is equal to the local latitude of the place. The collectors should be facing south. However, for the only winters use the optimum inclinations of the collector would be (latitude + 15 degrees of the south). Even if the collector are built in the south facing vertical wall of the building the output from such collectors during winter month is expected to be within 32 % outputs from the optimum inclined collector.
- All the new buildings to be constructed shall have an installed hot water line from the roof top and also insulated distribution pipelines to each of the points where hot water is required in the building.
- The capacity of the solar water heating system to be installed on the building shall be described on the basis of the average occupancy of the buildings. The norms for hospitals, hotels and other functional buildings are given below:

Table 3 Capacity Specification for SWH in KDMC

Type of Buildings	Per capita capacity recommended litres per day
Hospitals	100
Hotels	150
Hotels and other such buildings	35
Canteen	As required
Laboratory and Research Institutions	As required

There have been problems regarding estimation of capacity for determining the specification for SWH in residential sector and the commissioner KDMC issued an office note specifying that the builders have to consider 4 people per flat in the residential sector

An open area of 3. Sq.m would be required for installation of a collector which suppy about 100 liters of water per day. At least 60 % of the roof area may be utilized for installation of the system.

The specification for the solar water heating system laid down by the ministry of Non conventional energy sources can be followed. Flat plate collector confirming to IS No. 12933 shall be used in all such solar water heating systems.

Implementation responsibility lies with the Electrical Department at KDMC. As soon as any new building proposal comes to the department of Town Planning for building sanction a copy of the design is sent to the Electrical Department. Electrical department then sends a notice to the builder and architect asking them to install SWH. The notice contains details of the DC rules specifying what capacities should be installed for which category or building. The notice also specifies the IS standards to be used for all the components in the installation (IS 12933). Town Planning issues a commencement certificate to the builder and when the builder completes the building Electrical department jointly inspects the building site verifying that the SWH installation is as per standards specified. Only when Electrical Department issues a clearance Town Planning issues a No Objection Certificate to the builder. The NOC is required for the building to get water connection.

While this is the ideal process, the actual process is at variance as many buildings which do not have SWH also have obtained NOC.

6.2.2 Experience of Thane Municipal Corporation

The municipal corporation of Thane, covering has an area of 147 sq. km and population of nearly 1.7 million. Thane municipal corporation (TMC) had very similar amendment plan as KDMC. TMC implemented the modified by-law (amending the Municipal Development Control Rules) incorporating SWH in first quarter of 2006. Thane MC set of a Energy Conservation cell which was mandated to identify the EC opportunities in the building sector and work toward implementing the amended bye-law. It leveraged the money from special programs and MNES grant for wide spread awareness programme about the SWH introduction and involved solar manufacturers, real estate developers and councillors. TMC also offer property tax incentives to residential users and started to explore CDM options to provide additional returns to incentivise buyers and sellers.

One major difference between TMC and KDMC is in the implementation of the change. TMC sanctions building plans and issues commencement certificate if SWH in incorporated in the building plan, and similarly NOC is issued one the SWH is implemented in building location. However the verification of SWH is done by the Building Department of TMC. The department of electrical is not involved in the inspection or verification of the installed SWH. The second difference in the TMC and KDMC is the specification of the size of SWH to install, KDMC mandates an installation of 140 Liter per flat in residential sector, Thane mandates only 100 Liters, the difference arises because TMC uses a rate of 25 liter per person where as KDMC uses 35 Liter per person.

Barriers

Main barrier in Maharashtra is the implementation of amended by-laws. KDMC has installed 8.71 lakh liters of total capacity since the start of the program. KDMC's electrical department goes on site to verify the installation thereby ensuring that only proper installations get the NOC. TMC electrical department is out of the loop of the solar water heater, Buildings department verifies and issues NOC without consolation with electrical. Building department may not have the required capability to ensure that the installation is as per standards.

KDMC can manage to ensure compliance since the number of new application is pretty low (ranging from 2 to 3 new installations per month).

To ensure that SWH are installed not just for compliance, we believe that the responsibility of ensuring compliance has to be given to competent people. Either building has to develop the required capability or the local body has to find someone else who has the capability.

Opportunities

Maharashtra is reaching a maturity phase for Solar Water Heater. At this point they should target existing building where the intensity of use is high. Hospitals, hotels and such commercial building are good opportunities. However in this case building laws will not work. A discount in property tax for existing buildings is a possible solution.

6.2.3 Experience of Pune Municipal Corporation

Pune ranks quite high in adoption of Solar water heater Technology in compared to other cities in the country.

Origin

The following table shows the sequence of events leading to the amendment of bye-law in Pune Municipal Corporation.

Table 4 Timeline of Amendments in Pune Municipal Corporation

Description	Year
MNRE Notification No. 3 / 1 / 2005/UICA (SE) Dtd. 24.08.05 mandates the use of solar water heater in following categories of establishment : a) Hospitals & Nursing Homes b) Hotels, Lodges, and Guest houses c) Hostels of Schools, Colleges, Training Centres d) Barracks of armed forces, paramilitary forces and police e) Individual residential buildings having more than 150 sq. mt. plinth area f) Functional Buildings of Railway Stations and Airports like waiting rooms, retiring rooms, rest rooms, inspection bungalows and catering units g) Community Centres, Banquet Halls, Barat Ghars, Kalyan mandaps and buildings for similar use.	24th August 2005
Pune Municipal Notification a) Hospitals & Nursing Homes b) Hotels, Lodges, and Guest houses c) Hostels, Training Centres d) Canteen e) Laboratory and Research Centre f) Community Centre, Welfare Offices, etc.	10th October 2005
Amendments by MNES in changing subsidy pattern and central incentives. Inclusion of Police men/ Army Barracks, Mention of type of hostels (School, college and other institution)	25th April 2007
Voluntary Mechanism – ECO housing policy The Policy was framed to rate building, residential apartments based on planning, environmental criteria, Energy Efficient material, Water conservation, lighting , solar water heater, segregation of Waste and innovative technologies. Based on the rating the municipal corporation is to provide incentives/relaxation on the premium to be paid.	2nd May 2008

The above timeline shows an interesting pattern. Firstly, the municipal corporation was able to amend its by-law fairly quickly to adopt central directive. Secondly, it has not focussed on the residential sector much. Thirdly, it has kept the measures largely voluntary.

Implementation

Pune municipal Published a Notification in 2005 mandating the use of Solar water heater a)Hospitals & Nursing Homes b) Hotels, Lodges, and Guest houses c) Hostels, Training Centres d) Canteen e) Laboratory and Research Centre f) Community Centre, Welfare Offices, etc. Later barracks and educational facilities were added. The Policy does not mandate use of solar water heater in Individual residential buildings and functional building of Railways, airports, etc. offers property tax incentives of 10% if the household or apartment comes up with rain water harvesting, vermiculture and solar architecture. The incentive of 5% is to be offered in case the establishment adopts any two of the aforementioned initiatives.

- There is no specific incentive for inclusion of solar water heating system in household
- There is no clear mandate on the capacity/technical specification that should be implemented to be considered for the tax incentives
- There is no procedure available with the corporation for verification of the functioning of the system. As per the MNRE notification the SNA are responsible for verifying at least twice in a year for the first year of installation of SWH system. But the same notification lacks the clarity on the steps to be undertaken in case the system was observed to be non functioning.
- There is no defined penalty clause to mandate the use of the solar water heater in the establishment where the installation is mandated as per the notification.
- Project under Eco housing scheme that provides incentives on premium are not a common practice in Pune. Around 80 apartments have opted for the same since its inception.

Views of the stakeholders

Maharashtra Solar Manufacturing Association: After briefing about the objective of the study an interview was conducted with the president Mr. Suhas. P. Ghotikar and Vice President Mr. M.D. Akole of Maharashtra Solar Manufacturer Association. The points of view of the association are mentioned herewith:

1. There has been no regulation as such with Pune Municipal Corporation that mandates the use of solar water heater in residential building. Even the government building (in spite of the 1993 notification mandating the use of SWH in govt building) lacks the solar architecture.
2. There is no penalty or verification mechanism in place that could enforce the inclusion of SWH in the mandate type establishment.
3. Maharashtra lacks the subsidy on the electricity duty as provided in West Bengal and Karnataka the tax incentives which were paid cannot be obtained with the solar architecture only in place. The same is combined with either rain water harvesting or vermiculture for 5% benefit and 10% for both.
4. There has been no awareness generation or promotion activity in place either from the SNA, Urban Development Board or from the electricity company for higher diffusion of solar water heater. People are unaware about the cost economics and other environment benefit that the system could render. Either the money sanctioned is lying idle with the department or even not requested for due to lack of unwillingness among the agencies for promotional activity.
5. Lack of training facility for obtaining trained manpower to support the industry development. Provision should also be made for licensing installers, plumbers unlike electricity service provider.
6. No measures as such has been undertaken to enhance the efficiency of the system. Lack of proper R&D in the sector is the major drawback that is hampering the competitiveness with the imported technology.
7. Higher custom duty for imported complete SWH system to support domestic product.
8. Proper specification for the complete systems along with efficiency should be in place to regulate the market.

9. Exercise duty on the input material has further worsened the market scenario of low productivity under high input cost resulting in marginal profit in the bleak scenario of demand.
10. The time lag by the SNA in clearance of subsidy.
11. Housing complex by government bodies whenever opts for procurement of solar water heating they do so through competitive bidding which often result into procurement of inferior quality product. For the department the objective is to justify the implementation of solar water heater project and not the functioning of the same across its life time thereby deviating from the ultimate objective for which the system is being implemented.
12. In some of the area the people sale out the SWH once they receives the occupancy certificate from the nodal agencies.
13. There is no incentives for the manufacturer either fiscal/financial for up scaling of the manufacturing capacity. Government has announced policy directives for setting up solar PV/semiconductor industry, but no such incentive has been announced for setting up of similar units in solar thermal domain.
14. As major manufacturing unit is located in Southern region so interstate OCTRAI is instrumental and adds up to the capital cost which adds on making the product much more economically attractive.

User : The users of SWH had the following views:

1. High Price of the Solar water heater – The price of the 100 LPD with Piping taken into consideration comes around INR 22,000-24,000 (based on the varied response from survey of users) whereas the geyser of 2 KW can be obtained at INR 4250- 4500.
2. The after sales service is very poor and the functioning of the system deteriorates after few months.

Visit has been conducted at a Gym in Pune that have 5000 LPD ETC based system in place. The hot water is used for input to the heater supplying steam to Sauna. The Client has a complaint in deterioration of the functioning of the system after six – seven months of installation. On physical verification it was found that a coating of dust over the glass tube. The user has been asked to clean the same. But the fact identified that the lower awareness among the user related to the maintenance of the system spreads a negative impact.

Builders : The real estate developers had the following views to share:

1. The Solar water heater inclusion in the building often increases the FSI in high-rise building and as a result the promoter has to pay additional premium. Moreover the building height is fixed for certain area so the promoters always look for the maximum utilisation of the height assigned.
2. With the current design of the SWH available in the market the inclusion destroys the aesthetic of the building and results in loss of open terrace area.
3. The solar water heater operates for 250 days in a year as mentioned by MNRE so it cannot be used for most of the time in the year as and when it is mostly required.

4. There has been no change in the system design and efficiency since its primary days of usage in 2000. The system design and efficiency are almost same as before and should be modified if proposed to be fitted in current architectural design.

Barriers: The following barriers were identified during the discussion with the stakeholders.

Barrier
•Rigidity of Financial Institution •Delay by State Nodal Agencies to release incentives •Non MNRE/BIS approved Supplier •Lack of Specification •Lack of Regulatory Policy •Lower Level of Awareness •High Upfront cost •Lack of Adequate Manpower for verification

The barriers indentified in course of the interview process are ranked in accordance to their effect on the adoption of technology with the last one in the series having the least impact.

1. Financial Institution

a. Longer time for clearance of loan. The clearance of loan takes around 6-7 months in normal condition and where the applicants are able to furnish full information.

b. Unusual guarantee are asked from the applicant for disbursement of loan even for a smaller size machine of 100 LPD where the loan amount is as nominal in tune of INR 15,000 (85% of the cost of the system). The amount of hassle and paper work that are required for the SWH loan are not required for the housing or vehicle loan also. In general the types of security asked for are

- FD for the entire amount
- Two guarantor
- Account in the bank
- Existing property details
- Income details

Bharitya Vidyapith Placed an order to "Solar Products "for supply of solar water heater. The project calls for capital investment requirement of 50 Lakhs. The institution opted for bank guarantee as a security for the loan. Apart from the BG the financial institution opted for two independent director in the board of the proponent. The proposal was not acceptable by the proponent at all. This clearly focus on the bottlenecks created by the financial institution.

c. In order to apply for the loan the applicant has to provide the installation certificate so the system has to install before application of the loan. As in most cases the user pays the manufacturer only after disbursement of loan the total money for the manufacturing unit are blocked for the entire period till the loan are disbursed .

d. The willingness of the bank for facilitating the loan is to low as they have to claim the remaining subsidy amount from IREDA.

e. The societies are not entitled to receive the loan as the society itself does not have any income source. This kills the concept of community based solar system in the residential complex.

Even the Best successful case claimed by agencies for use of solar water heater faced considerable barrier (time taken) in loan sanction form IREDA. The financial sound position of the promoter has made the same successful but the same was not possible for mid-range supplier (another Supplier of SWH) to Magarpatta.

2. State Nodal Agencies

a. The slow and rigid functioning of the nodal agency has a major impact and considered to be one of the major bottlenecks in promotion of the technology as pointed out by the suppliers. The state nodal agency responsible for clearance of application takes lot of time in the subsidy clearance procedure. The overall process of inspection, thereafter forwarding the application to the respective central department and disbursement of the subsidy after it receipt takes lot of time. As in most cases the supplier is responsible for facilitating the subsidy so a considerable portion of their capital gets blocked in the process. As per the entrepreneurs of the domain the root cause of the time lag is due to the lack of manpower, interest and willingness of the SNA to carry out the activity.

   The manufacturers are not aware that the SNA are entitled to undertake the verification of the functioning of the units at least twice in a year for the first year and receives central assistance for initial verification and thereafter two verifications in the year.

   A major manufacturer (*name withheld as per the request*) applied to SNA for verification of the installation for capital subsidy for five of their commercial installation in 31st March 2009. Until 8th December 2009 three out of the five applied machine were inspected. The SNA will only forward the application once they clear the inspection of the five systems. Depending on the clout of the Manufacturer the average time taken in disbursement of the capital subsidy is around 12-15 months. So for the entire period the said capital is blocked as the user will pay the amount only after they receive the subsidy. These results in working capital crunch for the manufacturer who operates on low capital.

b. The total approval process lacks serious transparency. The applicant has no way out to know the status of application in relation to the subsidy. There is no online process in place with the SNA therefore every time the applicants have to enquire about the status of subsidy they have to physically visit the SNA which takes lots of time.

c. Most of the manufacturers are not aware of the power of RTI that can be introduced to know the status. The manufacturers who are aware of the process fear that use of RTI may spoil the long term relationship with the SNA.

3. **Functioning of Non MNRE Approved Manufacturer**
    a. A major portion of the market is operated by non MNRE approved manufacturer. Due to the lack of stringent technical specification for the complete system (BIS Specification) specially for ETC type Products most often the suppliers provide inferior quality product in order to be competitive and the system does not last long, moreover the said supplier does not provide after sales service. The inferior quality product and poor service creates negative impact among the user which passes on and destroys the market.
    b. Larger penetration of Lower Grade China based ETC tubes – Due to the lower awareness level among the user many of the supplier imports inferior quality ETC tubes from China , assemble the same in the workshop and sales them. As such the BIS approved FPC system could not match the Price competitiveness and often tries to lower the quality of the accessories in order to be competitive.

4. **Lack of Technical Specification**
    a. There is lack of specification of the solar water heater system as a whole. The BIS specification is for the FPC panel. The other accessories like tank, piping does not have any definite specification in place. Moreover there is no BIS specification in place for the ETC based systems.
    b. There is no estimate or mention on the efficiency of the system and R&D for improving the efficiency.

Action Solar has developed technically sound solar water heater system suited for high rise residential building. The system will have microprocessor based system to judge the water quality like pressure balancing, ultrasonic measurement of the parameters and usage. The Hot water tank is provisioned along near the user location. These reduce the terrace space required and enhance the efficiency by reducing the total pipeline for hot water transport. But there is no provision of government support for promoting similar initiatives.

5. **Lack of Regulatory Policy**
    a. Lack of regulatory mandate to enforce solar water heater installation in the building sector.
    b. VAT is derived from the sale of the machine but the abolition of VAT has not been considered in procurement of the raw material so the price of the product cannot be reduced in order to make the product competitive.
6. **Lack of Adequately Trained Manpower**
    a. Due to the lack of trained installers the after sales service suffers a lot and the same results in negative impact among the consumers as a whole. If the manpower available as on date is insufficient to support the 0.6 million industry the same would be unable to provide the basic support to the 5 million targeted SWH.
    b. There is no course curriculum on solar thermal system in place at the ITI and Diploma level that could build the workforce capacity in system engineering
    c. Proper licensing mechanism to be in place that could test the ability of the human resource to carry out the activity.

7. **Lower Level of Awareness**
    a. Lack of willingness among the architects result in increased cost of piping as the toilets in individual apartment is situated far apart.
    b. The Architects are often more concerned with the aesthetics of the building and less aware about the benefit of the solar architecture and therefore the provision of implementing solar system often becomes too difficult as the as most of the time the architect blocks the southern side and shadow free area is not available. The Architect/builders are not aware of the positioning of solar water heater and it happens that the southern part often comes under shadow area and the output suffers.

> The first phase of Magarpatta faced the problem of architectural design where most of the southern parts are blocked. The building design was remodelled to get for best efficiency – Bipin Engineers

    c. As the architects lack the knowledge about the technology of the SWH system so they most often choose system that are cheaper and not technology efficient.
    d. Municipal authorities are not aware about the regulatory norms and as such they never feel interested in promoting the same.
    e. Lack of awareness among the regulator to monitor and verify the functioning of the system.
    f. Builders are not entitled for any benefit for promoting the technology so they do not have any interest in promoting SWH.
    g. Lack of technical knowledge among the installers led to the lower efficiency and output of the system.

Suggested Solutions

1. Options for the domestic consumers to choose between Capital subsidy/interest subsidies.
2. Introduction of ESCO concepts for implementing Solar Water Heater System at Government Building, Government guest house, Government supported residential colony So that the agency need not incur upfront capital expenditure.
3. Provision for providing income tax benefit unlike accelerated depreciation benefit provided to industrial/commercial units.
4. Development of SPV and creating provision of separate line of credit for financing. The SPV to be provided with a line of credit/ rolling fund for disbursement of loan. The SPV will be responsible for repayment of the loan to the bank on a periodic basis. This will reduce the timelines and burden on the financial institution.
5. Concept like Consent to operate should be in place at least for five years for the building sector so that functioning of the system are ensured.
6. TAX incentives to be provided for the entire period of operation of the system and not for three years.
7. Outsourcing of Agency by the SNA for Verification of functioning of the SWH system. The best agency could be educational institution that won't have a conflict of interest.

8. Definite timelines for clearance of loan and subsidy by the agencies from the date of application.
9. Specification and rating of the system based on the efficiency should be introduced so that uniform pricing mechanism can be introduced.
10. Awareness to be created among builders/architect on solar thermal architecture.

6.3 Experience of Southern Zone (Karnataka)

Unlike other cases, the amendments for inclusion of SWH in most of the ULBs in Karnataka have occurred at the same time after 2007. The Bangalore Mahanagara Palike Building Bye- Laws 2003 came into operation from the 5th of June 2004 (approved by the government in their Order No. UDD/223/MNU/2001, dt: 21-02-2004, published in pursuance of Section 428 of the Karnataka Municipal Corporation Act 1976) and is applicable within the jurisdiction of the Bangalore Mahanagara Palike.[2] The Mysore City Corporation Bye- Law is dated as 1994. Hubli Dharwad Mahanagara Pallike bye law was framed in 2004.

The SWH is introduced in 2007, as per the modifications required by the Council which spelt out- Rain Water Harvesting, Solar Water Heating, Facilities for the physically handicapped persons and disaster management. There is no major difference in terms of processes and issues.

Origin

In Karnataka, the urban local bodies are categorised into four types: The Corporations, City Municipal Councils, Town Municipal Councils and the Town Panchayats. The Corporations cover a population above 3 lakh, the City Municipal Councils cover a population ranging from 50,000 to 3 lakh, Town Municipal Councils cover 20 o 50, 000 population and Town Panchayats 10 to 20,000 . Totally, there are 214 urban local bodies in the State.

Table 5 Urban Bodies in Karnataka

ULB Type	Nos
Bangalore Mahanagara Pallike	1
Corporations	7
City Municipal Councils	44
Town Municipal Councils	94
Town Panchayaths	68
Total	214

The seven Corporations in the State are: Mysore, Hubli- Dharwad, Davanagere, Mangalore, Belagam, Gulbarga and Bellary.

Legislations for ULBs in Karnataka: There are two legislations that govern the urban local bodies: The Karnataka Municipal Corporations (Amendment), Act 1976 and The Karnataka Municipalities Act, 1964. There have been three rounds of elections so far since the passing of the 74th Amendment, placing a total of 214 urban local bodies in the urban landscape of Karnataka. The legislations are supported by Rules.

[2] The Bangalore Mahanagara Pallike has been extended to become Bruhat Banaglore Mahanagara Pallike (BBMP) (Greater Bangalore City Corporation) in 2007, with an area increase from 226 sq. km to 800 sq. km and increase in wards from 100 to 198.

The Karnataka Corporation Act (1976) specifies for the Regulation of Buildings. This is covered from Sections 295 to 321. The broad tenets that the building bye laws made by the corporation should specify are given in Section 295. Some of which include for the following matters- (i) information and plans to be submitted together with applications for permission to build (ii) height of buildings, whether absolute or relative to the width of streets (iii) level and width of foundation, level of lowest floor and stability of structure (iv) number and height of storeys composing a building and height of rooms (v) provision of sufficient open space, external or internal and adequate means of ventilation (vi) provision of means of egress in case of fire (vii) provision of secondary means of access for the removal of house refuse (viii) materials and methods of construction of external and party walls, roofs and floors (ix) position, materials and methods of construction of hearths, smoke escapes, chimneys, staircases, privies, drains, cess-pools (x) paying of yards (xi) restrictions on the use of inflammable materials in building (xii) in the case of wells, dimensions of the well, the manner of enclosing it and if the well is intended for drinking purposes, the means which shall be used to prevent pollution of water (S 295 (3)). In addition, at the time of granting of license, provision should also be made to ensure that space is given for planting of trees and plants.

While applying for construction or reconstruction of the building, the Act insists on submitting the site plan of the land, ground plan, elevations and sections of the building, a specification of the work (S 299) and adds that such other documents as may be prescribed should be submitted- leaving the discretion of including SWH, rain water harvesting and the like to be included in the building bye-law with the respective Corporation/s. The Act also provides for provision to refuse the application, among other things, if the application for such permission does not contain the particulars or is not prepared in the manner required under rules or bye-laws (S. 303)

There is also provision to demolish the buildings[3], if the rules and bye-laws are not adhered to. This is specified as per S 321- The Commissioner is authorised to take steps either to demolish unlawfully commenced, carried on or completed buildings or can make a provisional order requiring the owner of the building to alter or demolish the portion that is unlawfully executed or make alterations- to bring into the conformity of the bye laws, rules, Act.

The building bye laws vary from city to city and they are framed by each of the Corporations as per the Town and Country Planning Act. While the Zoning regulations[4] are a set of rules framed under the Master Plan for regulation of land use and development of the town or city, the Building bye laws are a detailed set of rules framed in conformity with zoning regulations for regulation of buildings. While the zoning regulation is enforced by the planning authority (like MUDA, BDA), the building bye laws are enforced by the respective Corporations.

[3] The term building includes-any structure for whatsoever purpose and of whatsoever materials constructed and every part thereof whether used as human habitation or not and includes foundation, plinth, walls, floors, roofs, chimneys, plumbing and building services, fixed platforms, verandah, balcony, corning or projection, art of a building or anything affixed thereto or any wall enclosing or intended to enclose any land or space and signs and outdoor display structures.

[4] Zoning regulations specified in the Master plan, specify the setbacks required on all the sides of building/s, maximum plot coverage, maximum Floor Area Ratio (FAR), maximum number of floors, maximum height of buildings that are permissible for different dimensioned sites and widths of roads etc. These are revised from time to time.

As mentioned above, the urban local bodies other than the Corporations are ruled by a separate Act and Rules. Two sections of the Karnataka Municipality Act (1964) are of relevance - Section 324 and 325. Section 324 describes the Power of Municipal Council to make bye-law- from time to time make, later or rescind bye-laws. This section broadly covers various issues. Section 325 describes the Power of Government to make model bye-laws and adoption of such bye-laws by municipal councils. The government can make model bye-laws, after publishing the draft for a period of one month, for different classes of municipal area. The council can pass a resolution and adopt the model bye-law, the bye-law will come into force the day the council specifies. If the council wishes to modify certain aspects and does not specify the date, the government can direct the council to adopt the bye-law within three months from the date of receipt of the direction by the Municipal Council and also adopt it as specified by the government. In addition, if the Council does not take any action- of adopting/and or modifying, the government can notify that the bye-law has come into force.

Usually the model bye- laws are prepared by the government, for any suggestions for inclusions for useful things- in favour of the public or the ULB, that can be proposed by the ULB by passing a resolution at the council and thereafter publishing the same for the information of the public, calling for objections and suggestions, giving 30 days of time. To be published in the Gazette and newspaper- both the local newspaper in local language and in a national newspaper, also by affixing copies thereof on the notice board of the municipal councils, reading rooms and places considered by the councils to be conspicuous within the municipality. Any public who is interested to offer his/her remarks should give it in writing to the respective ULBs. The suggestions or objections are to be placed in the council meeting by the Commissioner. The Commissioner suggests ways of correcting and/or incorporating the suggestions received. The council can pass the resolution as it deems fit – with or without acceptance. And along with the copies of all the process carried out from the inception has to be submitted to the government through proper channel to get approval in this behalf. Soon after the receipt of the approval of the government, a final notification has to be published in the gazette as well as in the local newspaper by noting the date of effect with which it will come into effect.

The Karnataka Municipalities Manual lists 37 bye-laws which are in operation at present (listed and prescribed in the Rules) which are applicable to the CMCs, TMCs and TPs[5]. The bye laws include model building bye laws too-

1. City Municipalities Model Building Bye Laws 1979
2. Town Municipalities Model Building Bye Laws 1981.

The other bye laws cover various issues such as Advertisement, Sanitation, Conservancy and Drainage, Disposal of Carcass of animals and so on.[6] All the other bye laws were initiated during 1967 and 1968. It is the building bye law which is more recent.[7] Also, all the other bye laws are the

5 Such details are not given in the Rules attached to the Corporation Act. The reasons given for this are: (i) the corporations are competent authorities to work out the details by themselves and (ii) they could refer to the KM Act which preceded the Corporation Act.

6 Ref: Volume 2, The Karnataka Municipalities Manual, Karnataka Law Journal Publications, Law Publishers, Bangalore

7 The Rules have been framed by the Government of Karnataka for the adoption and publication of bye laws in 1965. This rule applies to all bye laws, even those which are framed at a later point of time.

same for the three categories of urban local bodies i.e. CMCs, TMCs and TPs. There are two different bye laws – one for CMCs and the other for the TMCs and TPs[8]. The local bodies can also frame their own model bye laws suiting to the changing needs, for e.g. there could be one on telecommunication towers, one on parking etc.

The Government of Karnataka vide No. EN 396 NCE 2006 dtd. 13.11.2007 and corrigendum, No. EN 87 NCE 2008 dtd. 8.4.2008 notified the following under section 18, Energy conservation act 2001. (i) the Mandatory use of solar water heating systems. (ii) Mandatory use of Compact Florescent Lamp (CFL) in Government Buildings / aided institutions / Boards/ Corporations. (iii) Mandatory use of ISI mark Energy Efficient Motor pump sets, Power capacitor, Foot valves in Agriculture sector and (iv) Promotion of Energy Efficient Building design. With a view to facilitate and enforce the implementation of various provisions of Energy Conservation Act-2001 and to take policy decisions, a State Level Committee has been constituted vide GO No EN 87 NCE 2008 dated 3.4.2009. This sis positive step as it provides an institutional framework.

As per Government Order dated 13.11.2007 it was proposed that HUD and Energy department would approach KERC for amendments in ES&D code. Similarly Energy department and Urban Development and Housing Departments will come out with proposals to amend the rules for mandatory use of solar water heaters / CFLs/ LEDs etc. accordingly all the urban local bodies will make amendments in the bylaws to enforce Solar Water Heating systems as per Government Order dated. 13.11.2007. In this regard the State Government will approach KERC to obtain necessary clearances. To promote Solar Water Heaters (SWHS), a rebate in electricity bill for domestic users at the rate of Rs 100 per month will be extended on installation of Solar Water Heaters. Energy Efficiency and Energy conservation measures are mandatory for all Public Utilities.

The numbers of Municipal Councils which have adopted the SWH in the building bye-laws are not known. Though there is a direction from the Urban Development Department to issue a directive in this regard to all the ULBs, this is said to be pending.[9] Though the Directorate of Municipal Administration (DMA) is an overarching body of all the ULBs (other than the Corporations), the numbers could not be available from the office.

The bye-laws specify the procedures to be adopted while obtaining the license for construction of building and after the completion of the building and obtaining the occupation certificate. All that is specified in the bye-law should be furnished and this is to be verified by the concerned authority.

Implementation

The Model Building Bye –laws of the three city corporations which specify that SWH should be provided as per the table below for the various categories of buildings. It is the same for the three city corporations as the prototype given by the Town Planning Department has been adopted.

8 Town Panchayats were constituted in 1995 and are added with the TMCs.
9 As said by a retired Karnataka Municipal Administration Service Officer who has been responsible for drafting this.

Table 6 Capacity specifications for SWH

Sl No	Type of Use	100 litres per day shall be provided for every unit
1	Restaurants serving food /and drinks with seating. Serving area of more than 100 sq.m. and above	40 sq.m of seating or serving area
2	Lodging establishment and Tourist Homes	3 rooms
3	Hostel and Guest Houses	6 beds/persons capacity
4	Industrial Canteens	50 workers
5	Nursing homes and hospitals	4 beds
6	Kalayan Mandra, Community Hall and Convention Hall	30 sq. mtrs of floor area
7	Recreational Clubs	100 sq mtrs of floor area
8	Residential Buildings	
	a) Single dwelling unit measuring 200 sq.m of floor area or site area of more than 400 sq,m whichever is more b) 500 lpd for multi dwelling unit/ apartment for every 5 units and multiplies thereof. Solar photovoltaic lighting systems shall be Installed in multi unit residential buildings with more than five units for lighting the set back area, drive ways and internal corridors.	

Despite of the incorporating the provision to introduce SWH in the Model Building Bye Laws of Mysore City Corporation, the implementation of it is lagging behind.

- The Town Planning Authorities working at the City Corporation feel that this is because the efforts are recent. This was introduced last year and it would need at least two to three years for it to become fully operational.
- The SWH regulation in the bye law also specifies that this is compulsory for high rise buildings but not for comparatively smaller constructions of 30 by 40 site dimension. The coverage is therefore restricted.
- The authorities who furnish the Completion Report are not strictly adhering to ensuring that the SWH is incorporated. The government is contemplating on holding the engineer/town planner responsible if the specification in the bye-law is not followed. The thinking is on cancelling his/her license, if there is a lapse. The Town Planning Section of the MCC which is given the overall responsibility is understaffed. For a city with 65 wards, covering 124 sq kilometres of area, a Joint Director and two town planners who support him are placed.
- The attention has also been on new buildings, the existing buildings are largely ignored. (a) because of difficulties in changing the mind sets and (b) there are no incentives or compulsions attached.

KSEB rebate: An incentive is given to install SWH, for encouraging the use of non-conventional energy by the electricity department. At present, a rebate of 40 paisa per unit of electricity to a maximum of Rs 40 is being given. There has been a move to increase this to Rs 50/- recently. KEB also insists that there is SWH while giving new connections. This is said to be, by far, the most effective way of ensuring the increase in the use of SWHs.

Stakeholders view points

Though the Corporation is yet to be strictly enforcing the implementation of SWH regulations, many of the new building owners have opted to voluntarily install and use it. 80 to 90 % of the new owners are opting for it, especially if they do not plan to rent out the building /residence.

The reason for an increase in the usage is: (i) increased awareness (ii) learning from neighbours i.e. advertisement by word of mouth (iii) influx of many reputed companies like TATA BP Solar India Ltd, Kotak Urja, Rashmi Solar, New Tech, Anu Solars etc. with good marketing strategies. Good quality of the product, with less hassles of maintenance (iv) understanding the long term benefits of using SWH i.e. the cost effectiveness and (v) power supply playing truant. The house owners have also been goaded by erratic power supply.

The increase in awareness at the household level - children are being taught the concepts of renewable energy at school, and at the community – many of the NGOs are actively conducting awareness camps- have also contributed to the overall change/s.

The change from fuel use to SWH is also being made by the Hotel Owners- (a) because of non availability of fuel wood at all seasons and the mess that it creates and (b) reduction in labour costs and labour hassles and long implications for investments.

The builders have also been responsible in some ways for ensuring an increase. For e.g. Ramesh of Nagarika Constructions has built 20 houses in the last two years. In all of this, he has made provisions for incorporating SWH requirements, without the clients insisting on it. This, he feels, is necessary to avoid future costs and changes, if the client so requires. This has inspired the client to install SWHs.

Many of the stakeholders- even the builders and contractors -are unaware of the inclusion of SWH in the Model building bye- laws of MCC, many are not aware (especially the house and hotel owners) that there are building bye laws.

Suggested Recommendations

Strengthen Urban Local Bodies: The government's move of declaring cities as Solar Cities and enabling finances should be matched by adequate staff support. At present, the functions and the funds are not matched by functionaries. The skilled functionaries who can competently perform their duties are lacking. Also, job charts are not prepared, institutional mechanisms that strengthen urban local bodies should be placed.

Incentive: Interest free loan to be made available for those installing SWHs (for the SWH part of the loan) especially to those with sites of 30 by 40 and 60 by 40. It would be important to categorise according to income level/the type of building and amounts invested and incentive to be given to those who cannot afford to install SWH at the time of house construction.

Bank loan: To include SWH components too. This solves the hassles of acquiring loan/monies again for the purchase and installation of SWHs.

Penal clause: the following penal clauses could have been useful:

(i) To be introduced by the ULB: To introduce a penalty clause of increasing amounts in property tax, doubling it, if SWH is not installed. This would encourage the old building owners to adopt energy renewable mechanisms.

(ii) To be introduced by the KSEB (Karnataka State Electricity Board): KSEB to advertise/make it public by newspaper and such other media that the power supply would not be given, if the new owners do not install SWH as per the building plan. A time period of 6 to 12 months could be given for necessitating the change.

Transparency: The manufactures do not specify the MRP of SWH. Transparent mechanisms are to be introduced.

Awareness: That use of natural sources of energy is a birth right of every individual is accepted but that the conservation of energy and reuse is the responsibility of an individual is not fully understood. Awareness building exercise to focus on this and also a detailed long term cost benefit analysis to be presented to the citizens/ CSO.

6.4 Experiences in Eastern Region (West Bengal)

Origin

The urban governance or 'Urban Local Bodies' (ULBs). as they are technically called, in state of West Bengal dates back to early 18th century. As a matter of fact, Kolkata Municipal Corporation (then called Calcutta Municipal Corporation) is one of the oldest municipal bodies of the country, initially Kolkata and other municipalities were created mainly to cater to the socio-political needs of the time.

State Government has set up Department of Municipal Services in 1972. Subsequently, in 1978, the Municipal Service Department was renamed as Local Government & Urban Development Department. Present Municipal Affairs Department was created in the year 1991 vide Home (C&E) Department's Notification No 16133-AR dated 29 June, 1991 by bi-furcating the Local Government and Urban Development Department. The Directorate was set up in 1978 with the mandate to oversee the performance of Municipal Bodies, coordinate their activities, analyse their budgets, assess their fund requirement, evaluate progress of ongoing schemes and do general counselling wherever needed. Municipal Engineering Directorate drew its essence from the 'Municipal Engineering Planning Stream' of the erstwhile Calcutta Metropolitan Planning Organisation (CMPO) under T&CP Department of the State. MED thus became responsible for the municipal development of the State for both planning, execution and monitoring of various Municipal Development Programmes (MDP) in the ULBs by providing technical assistance to them. Subsequently, State Government decided to place the services of the engineers in the municipalities. They also play a key role in building plan approval and land use planning, zoning, etc. State Urban Development Agency was set up in 1991 with a view to ensuring proper implementation and monitoring of the centrally assisted programmes for generating employment opportunities and alleviation of poverty throughout the State. SUDA is a Society registered under the West Bengal Societies Registration Act, 1961.

West Bengal consists of 162 municipalities and 6 municipal corporations. Out of the six corporations in West Bengal the study covered Kolkata Municipal Corporation (KMC), Howrah Municipal Corporation (HMC) and Durgapur Municipal Corporation (DMC).

Out of the six corporations in West Bengal the study covered Kolkata Municipal Corporation (KMC), Howrah Municipal Corporation (HMC) and Durgapur Municipal Corporation (DMC). Jalapiguri could not be studied because of agitations and disturbances.

The West Bengal Municipal (Building) Rules, 2007 section 155 (iv) mentions the use of solar energy and harvesting carbon credit in case of tall buildings but this is not very specific to SWH.

The KMC by-laws regarding the promotion of Solar Water Heaters (SWH) has been implemented only in September 2009. Therefore any policy implication on the adoption of SWH is not very clear. DMC on the other hand had modified the by-laws to promote SWH in the year 2006. The table below gives a synopsis of the status of the laws.

Table 7 Status of Building Bye-Law amendment in West Bengal

Municipal Corporation/Local Body	Building by-laws to include SWH (date of modification)	Any other State/ULB level incentives given
Kolkata Municipal Corporation	Compulsory for Building with height 15.5 Meters or more (2009)	No
Howrah Municipal Corporation	No change	No
Durgapur Municipal Corporation	Compulsory for all residential and commercial buildings (2009) Advice to use SWH given in by-laws with tax incentive for compliance (2006)	10% rebate on holding tax.
Other Municipalities covered under Bengal Municipal rules	No change incorporated	No

Implementation status

West Bengal state agency Municipal Engineering department issues Bengal Municipal rules. These rules are used almost universally by all the municipalities in West Bengal other than the corporations and few select municipal bodies.

Durgapur Municipal Corporation (DMC) one of the earliest adopters of SWH in West Bengal was covered in more details to understand the barriers and opportunities in the area. In all the areas the complete list of stakeholders was covered. Below are the highlights of the issues which emerged in the meetings.

6.4.1 Durgapur Municipal Corporation

DMC has made mandatory for all residential and commercial building to install SWH. However DMC has not specified the collector area, or the holding capacity. In absence of such guideline the builders and home owners have difficulty in determining the size of the SWH to install. Moreover absence of any guideline also increases chances of smaller than required installations which are installed just to ensure compliance.

But the corporation is facing major problem in implementing the said order. The 'Building Section' is responsible for issuing the NOC and completion certificate. To claim MNRE subsidy and the holding tax rebate the Completion Certificate is required. However, according to officials very only a few in the commercial segment actually requests for a NOC. Moreover DMC is constrained due to the low staff to make surprise visits to the building sites. All builders are required to implement SHW in the design phase.

The policy is in place since 2006 however till date only on one occasion a rebate on the holding tax has been claimed.

6.4.2 Kolkata Municipal Corporation

The Kolkata Municipal Corporation Building Rules, 2009 applies to all building activities in Kolkata other than activities referred to in section 450 of The Kolkata Municipal Corporation Act, 1980. Section 147 provides for use of solar energy Provision for use of solar energy in the form of solar heater and/or solar photo cells shall be included in building plans in case of any new building whose height is to exceed 15.5 m or expansion of any existing building if its height is to exceed 15.5 m. This is however a very weak measure and applicable to tall buildings.

Stakeholder Viewpoints on Barriers

End Users of SWH: In conversation with residential users of SWH the main problem was the low usage of hot water in everyday domestic purposes. Commercial users were however convinced about the value of SWH, but they were upset about the delay in getting the payments. Apollo hospital in Kolkata has not received the subsidy even 2 years after the application.

Suppliers and Manufacturers of SWH: The opinion of suppliers and manufacturers of SWH vary from region to region. In West Bengal suppliers face a serious lack of interest in the domestic sector. However this is not the case in Maharashtra. But in both cases the main concern was the lack of promotion by any group and also the lack of proper certification and evaluation process to weed out poor quality.

Bye-law amendment: The most important barrier in SWH promotion as far as building sector is concerned is the fact that KMC and other municipalities of West Bengal have not yet formalized the process of SWH installation monitoring. For KMC the **modification to the bye law happened only in September 2009**, and the **by-law fails to specify the size and other quality parameters of SWH**. KMC has mandated buildings with height greater than 15.5 meters. Moreover the amendment does not talk about the type of building – commercial/government/residential, etc.

The process of **subsidy administration** is also complicated and has to be sufficiently overhauled to ensure better processing of the subsidy.

An important barrier in the promotion of SWH in West Bengal is the climatic condition of the region and the behavior of the consumer in this region. Though consumer characteristics is not a part of this project, we just want to comment that consumer in this region is not a very active user of hot water for bathing. Moreover most cold days in this region is accompanied with fog in the morning hours. Low usage of the SWH increases the effective cost of ownership and increases the breakeven time.

Opportunities

West Bengal has a unique opportunity to promote SWH usage in the industrial and commercial sector. But West Bengal has to take initiatives though the State Nodal Agency for promoting and developing the sector. As far as building rules are considered West Bengal has to make the rules explicit and with higher coverage of ULBs. By putting the building height at 15.5 meters many individual single story houses, good opportunities for SWH, are not effectively targeted.

Though not covered in detail the financial incentive of rebate on holding tax is not the most appropriate incentive. The holding tax is calculated based on West Bengal valuation board's assessment of the building and is only partially reflective of the area of the building. The amount of incentive is not related to the investment made on Solar Water Heater. The subsidy does not even take into account the actual capacity of SWH installed.

7 Barcelona Model and our ULBs: Learning

In some sense there are several features that ahs helped the city to be successful in the past is currently present in India. The city started the process only after a national level mission was mounted in Spain. In India, the solar mission is already under National Climate Change Action Plan

7.1 Origin

In 1999 the Barcelona City Council adopted the so-called 'Solar Ordinance', as annex to the general environmental ordinance of the city, in order to stimulate using the solar energy. The overall aim of the solar ordinance is to locally promote and regulate the installation of low temperature systems for collecting and using active solar energy for the production of hot water for buildings. According to this law all new buildings and buildings undergoing major refurbishment are obliged to use solar energy to supply 60% of their hot water demand, starting from August 1st, 2000.

7.2 Negotiation/Consultation & development of institutional mechanism

Before the final adoption of the Solar Ordinance in 1999, a long participation and negotiation process took place. In the process first phase, the main actors were individual local NGOs and a federation of NGOs such as 'Barcelona Estalvia Energia' ('Barcelona Saves Energy'), which was in contact with the Barcelona City Council to put energy efficiency measures and the promotion of renewable energies on the local agenda. Later on the Catalonian Association of Renewable Energy Professionals became involved. And also the Office of the Councillor for Sustainable City was a key actor from 1995 until the adoption in 1999. In the negotiation process for the first version of the Solar Ordinance also different city council departments, the Associations of Architects, engineers, property agents, building promoters and installers, and the Regional Energy Agency (Institut Català de l'Energia) participated. From 2002 onwards the Barcelona Energy Agency is carrying out all actions related to the Solar Ordinance. A Working Group for Solar Energy has been formed with the aim to achieve the maximum consensus on the Solar Ordinance. All stakeholders interested in the legislation application and in the implementation process are represented in this body and were involved in a revision of the ordinance in 2005.

7.3 Stakeholder /Institutions views

Views of different institutions were taken including a detailed market study. The views are given below:

Table 8 Views of Stakeholders

Actors/Institutions	Expectations	Public Concern
Platform 'Barcelona Estalvia Energia'	To start a debate about internalisation of environmental costs in the functioning and policies of the city of Barcelona	Promotion of the health of the planet and global justice
Councillor for Sustainable City	Realise an impulse for the use of solar energy in the cities	Benefits for publics as increasing the quality of life for Barcelona's citizens, and importance to

Actors/Institutions	Expectations	Public Concern
		promote renewable energy enterprises
Buildings Professional Associations	Environmental technologies increase the cost of building promotions	Building professionals: architects, promoters, engineers partcipate
Barcelona Local Energy Agency	Support of initiatives which allow increase of energy efficiency	General concern for promoting the cultural change in the society, promotion of Barcelona as an exemplary city in the handling of energy matters and their repercussion on the environment
APERCA	New installations, perspective of short and log term growing of the sector of renewable energy installers all over Catalonia, more commercial and formative activities	Enterprises in the sector of renewable energies
ICAEN / IDAE (regional and National Energy Agency)	Fulfil the objectives of the Catalonian and the Spanish Energy Plan, solar ordinances as impulse, which moves the whole market	General environmental objectives, improvement of quality of life

7.4 Public Participation with a future focus

A motion elaborated by BEE with 28 proposals in the field of energy, waste, mobility, water, urban planning and taxation reform was presented to the city council in November 1992, signed by more than 100000 citizens. The first public assembly focused on environmental issues was held in April 1993 attracting significant press attention. As one of the direct results, the city council undertook to elaborate the first 'environmental programme' for the City. This was the first step to Local Agenda 21 and to new forms of participation. The platform went on to say that they could now recognise that it was not only the citizen body that would enable the advance towards an environmentally sustainable Barcelona, but that it could be a joint effort.

7.5 Implementation Commitment

Political commitment

From the municipal elections in 1999 on the office of the new third Deputy Major and Chair of the Barcelona City Council's Commission for Sustainability, Urban Services and the Environment, Imma Mayol, assumes the process of implementation of the Solar Ordinance. Due to reservations of

different institutions, architects and especially building promoters the regulation did not come into force before one year of respite, till August 2000.

After the initial reactions of architects and building promoters the need of a consensus period was arrived at for about 18 months. In formal and informal meetings the most important stakeholders were involved i.e. Property developers, Construction companies, the Architects association and the Union of Installation contractors. The approval of Solar Ordinances has been accepted positively by all affected entities, from promoters to consumers.

Piloting to demonstrate

Municipal Housing Company (Patronat Municipal de l'Habitatge) applied the requirements of the solar ordinance in their promotions of residential buildings (in the first phase 6 buildings with 441 flats), this experience served as pilot project, which provided technical and economical arguments for the discussion with the actors of the building sector.

Taking views and being flexible in addressing the concerns

The key to the success has been the addressing the views of the different actors in the project, from the beginning with the initial reaction to the draft. It is important to underline the task of information and consensus building assumed by the Barcelona City Council in the period from March 1999 until the ordinance came into force nearly one and a half years later. Additionally to the meetings with enterprises and affected entities, technical seminars and conferences were prepared, with the participation and collaboration of other entities such as APERCA, the Association of Architects, the Association of Industrial Engineers, the Catalonian Energy Agency, the Association of Building Promoters and the Association of Professionals of Renewable Energy of Catalonia.

7.6 Barriers

In the first phase (1992-1995), the main obstacle was to convince the Barcelona City Council to take into consideration a specific legislation that obliges to install solar energy.

The solar ordinance was approved unanimously by the City Council in July 1999. Due to different institutions fears - especially architects and building promoters - the city council granted an 18 month moratorium in order to enable the sector to adjust to the new obligations. Building promoters feared that there was limited capacity of specialized installers and they also expected a buildings prices increase.

The main difficulties identified in this initial stage are a lack of information and experience of all involved sectors and an initial lack of clarity about the responsibility of the involved sectors such as, architects, buildings promoters, and users. Issues were mostly related to the unavailability of adequate information or adequate contact persons. There was also uncertainty regarding the proceedings for subsidy application.

The Barcelona Energy Agency's experience during the first years following the ordinance entered into force showed some weak points. Corrective measures included for example to address the issue of the lack of qualified installation contractors to cover the complete demand. The installations maintenance was also not guaranteed and represented certain difficulties.

7.7 Solution

The solutions attempted in Barcelona are as follows:

Market mechanism for certification, training

Therefore a quality certification for installations and the obligation to have a maintenance contract have been introduced in the revision. The Agency also made agreement with federations of building professionals in order to improve specific training courses in solar energy.

Effective Financial Sweeteners

In the beginning nobody could anticipate the reaction of the building promoters and architects. After the first rejections arguing that building prices would increase, actually architects and building promoters are in favour of the ordinance. (the extra cost for solar thermal installations are around 0.5-1% of building costs which is not a small amount). A major sweetener was provided to property developers in form of interest-free credit arrangements for solar thermal installations available from IDAE, in conjunction with the public credit institute, Instituto de Crédito Oficial (ICO). The IDAE-ICO credit backs up to 70% of total investment. The credit percentage is based on IDAE's own calculation of eligible installation costs, ranging from € 397 to € 481 per square metre of solar collector area installed, depending on economies of scale and the total surface area required for each building project. Furthermore, regional governments provide additional financing arrangements, while local authorities offer tax relief on property developments incorporating renewable energies, as well as reduced municipal housing rates for individual homeowners.

Solar working group as sheet anchor

The Solar Working Group, formally constituted in January 2005, is the consultation body with representation of all major stakeholders involved in the implementation of the Solar ordinance and the development of solar energy within the city of Barcelona. The Members of the solar working group are:

- Regional Energy Agency (Institut Català d'Energia)
- City Council (Ajuntament de Barcelona)
- Building Promoters Association. (Asociación de Promotores de Edificios de Barcelona)
- Catalan RES Promoters Association (Asociación de Profesionales EERR, APERCA)
- Spanish RES Promoters Association (Asociación Española EERR, ASENSA)
- Community based Association For RES and RUE (BARNAMIL)
- Property Agents Association (Colegio de Administradores de Fincas)
- Architects Association (Colegio de Arquitectos de Catalunya)
- Engineers Association (Colegio de Ingenieros Industriales de Catalunya)
- Union of installers (Gremio de Instaladores de Barcelona, FERCA).

8 Conclusion

The use of case based learning is widespread in the fields of medicine, law and business. Case-based strategies in research are widely used in case study methodology as well as in a number of qualitative methodologies, including grounded theory or policy development. The case-based research process is divided into three types: (1) descriptive, (2) theoretical-heuristic, and (3) theory testing. We have limited our research to descriptive research. Many existing projects are explicitly situated at a certain point on one or more continuum. Some define their approach quite rigidly and rely on rigid tools or questionnaires, instead a policy development process requires to have divergent views or problem based learning so that convergence can be arrived with an informed debate. This has been proven relatively successful and that is the reason this method has been used here.

Broadly the barriers identified by the stakeholders can be explained as follows:

8.1 Institutional Barriers

This is a major barrier amongst the ULBs to use their own powers to amend and enforce instead of waiting for push from the top and this requires mindset change of councillors and mayors.

- The energy conservation act empowers the state government to amend the energy conservation building codes/building laws to suit the regional and local climatic conditions. Once a uniform standard is agreed with the stakeholders (region wise) in from of technology, product standards and specification and collector area segment wise it would not lead to any confusion among builders/developers /designers and consumers.
- Readiness to implement can only arrive through the creation of awareness at all levels the regulatory authorities (HUD, REDAs, Utility and Municipal Administration), Political Authorities, Manufacturers, Technical Educations, Realtors and Architects, User Departments and residential consumers.
- There is no defined mechanism in place to monitor the implementation and results.

8.2 Technical barriers

- Correct information about the product availability to meet the bye-law requirements is a major barrier. Consumers (especially residential types) are price sensitive and they are not aware about the cost-benefit and need to be educated to take an informed decision.
- Associated barrier includes inadequate testing facilities to certify products as per bye-law requirement.
- Lack of technical staff: The technical capabilities of implementing agencies are not adequate to support implementation and verification. There are not enough installers to provide supply chain support in sales and service.
- The building construction industry (contractors, services providers) are not fully geared to apply these measures practically on site and fear consumer backlash for the poor supply chain and also space and aesthetics conflict.

8.3 Financial Barriers

- Many suppliers insist on relaxation of VAT to boost the promotion of quality SWH products and services and keep out the non-standard products. It may even require

import duty relaxation, reduced tax, excise duty. The government could play a major role in realizing the same.

- Utility rebates are difficult to monitor as the usage is not certified or difficult to monitor however, its installation for new building could be enforced in refusing new electricity connection.
- Holding tax can be used as an effective instrument for enforcing usage.
- Bringing in ESCOs and banks as partners have not been in place yet and could be a useful model.

The above discussion gives some areas where initiatives can result in improvement in SWH adoption.

1. Carrying all the stakeholder through wider consultations and creating state specific working groups on solar/renewable could help to act as conscience keeper, peer and pressure group
2. Ensuring proper certification of installation to be by competent people.
3. Widening the base by including existing buildings especially for mature markets.
4. Directive to make SWH installation mandatory initially in all public buildings and institutions and all residential and commercial sectors after a cooling off period.
5. Case to case basis of evaluation of the subsidies given. For example property tax can be used for old building however for new building in a less mature market property tax may not be the correct incentive but utlity rebate and new connections refusal can be used as an effective tool.

Section III

This section deals with the development of a uniform policy for Solar Water Heating in India and development of a draft Solar Water Heating Order based on the experiences of implementation in the country, best practices and lessons from other countries and based on the legal and regulatory policies prevalent in India in the backdrop of National Solar Mission.

Section III

CTRAN Consulting Pvt. Ltd.

Building Sector Policies and Regulation for Promotion of Solar Water Heating System

Uniform Policy Document

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C-TRAN
Complete Transformation

Contents

1 Preamble

India is a vast country with varied geography and climate and being in the tropical region, the country receives sunshine for longer hours per day and in great intensity. Solar energy, therefore, has great potential as future energy source and is a great vehicle to provide scope for decentralised generation and ensure energy and climate security for the country. India has launched its Solar Mission under National Climate Change Action Plan.

The objective of the National Solar Mission is to establish India as a global leader in solar energy, by creating the policy conditions for its diffusion across the country as quickly as possible.

The immediate aim of the Mission is to focus on setting up an enabling environment for solar technology penetration in the country both at a centralized and decentralized level. The first phase (up to 2013) will focus on capturing of the low hanging options in solar thermal; on promoting off-grid systems to serve populations without access to commercial energy and modest capacity addition in grid-based systems. In the second phase, after taking into account the experience of the initial years, capacity will be aggressively ramped up to create conditions for up scaled and competitive solar energy penetration in the country.

2 Objective

The **main objective of this Solar Water Heating Order**[1] is to bring in conformity to the National Mission and help in transformation of the solar thermal and water heating market in the country by achieving policy and institutional convergence.

3 Definitions

Agency: Agency shall be the agency for this Solar Water Heating Order who has responsibility for the implementation of the Solar Water Heating Order under the applicable law.

Appropriate Government: can be the National Government, State Governments, and Governments of the Union Territory and National Capital Region, Rural and Urban Local bodies and autonomous councils under relevant acts.

[1] This Order can be notified as per the provisions of the Energy Conservation of Act of 2001 either under Section 14 or section 18 by Ministry of Power as per the rules of business granted. The state Governments can also issue directions as users.

Energy Services Company (ESCOs) are agencies taking turn key performance contract for solar thermal installations and demonstrate energy savings based on which payment is made to the agencies from designated funds/schemes.

Evacuated tube collector (ETC) are typical Solar water heater comprising of double layer borosilicate glass tubes evacuated for providing insulation. The outer wall of the inner tube is coated with selective absorbing material. This helps absorption of solar radiation and transfers the heat to the water which flows through the inner tube.

Flat Plate Collector (FPC) is solar water heater comprising of an absorber plate which is coated on its sun facing surface with an absorbent coating, also called selective coating. The absorber consists of a grid of metallic tubes and sheets. Water flows through the tubes. Sheet absorbs the solar radiation falling on it and transfers it to water. The absorber plate is placed in a top open box to protect it from weather.

Nodal Agency: Unless otherwise specified, the respective renewable development agency or authorised agencies notified by the state including ESCOs.

Solar Forum: is a public private partnership among the manufacturers of solar energy systems especially the solar thermal units and the relevant ministries of the Government of India and banks and financial institutions, academic institutions, standards body, etc. engaged exclusively on solar energy and membership is on invitation only. This body will be the focal point for advocacy and promotion of the Solar Water Heating Order.

Solar Water Heating Order: is an executive order issued by appropriate Government duly notified and is mandatory in nature unless otherwise a cooling off period specified.

Sustainable Habitat Council: Should be notified in the ULBs and ate least one third of the elected members as its constituent. It would have two members each from real estate developers association, representatives of manufacturing companies or its sole selling agency , member of the State Level Banker's Committee, director municipal administration and municipal engineer, one architect, one member from development authority and two independent experts.

In case of rural areas, it will be the village electricity committee/gram sabha as appropriate. All the elected members from the village must be part of the committee along with the junior engineer from the block and any locally resident or solar installer from the nearby area.

4 Time-frame for the Implementation of the Solar Water Heating Order

The Solar Water Heating Order shall be effective when duly notified by the appropriate Government in the official gazette and it shall be mandatory after a cooling off period decided by the appropriate Government during notification and the upper limit of the cooling off period shall be 12 months from the date of notification of this Order.

5 Applicable Law

Building regulations are part of the state list hence diverse; this diversity has retarded the pace of any implementation of policy guidelines. Centre has come out with a National Building Code (Revised version, 1983), a national instrument providing guidelines for regulating the building construction activities across the country. It serves as a Model Code for adoption by all agencies involved in building construction works, etc. The Code mainly contains administrative regulations, development control rules and general building requirements; fire safety requirements; stipulations regarding materials, structural design and construction (including safety); and building and plumbing services. It has also brought out the 'National Electrical Code' (NEC) and till recently the Energy Conservation Building Code[2] (ECBC) has been given tooth through Energy Conservation Act (EC Act). This Solar Water Heating Order intends to bring in uniformity and convergence and could be notified *ceteris paribus,* under section 14 of the Energy Conservation Act. All line departments like Town and Country Planning Department, Urban Development Department, PWD (Building and Roads), PHD, Housing Board, Architecture Dept. in the states will revise their byelaws in alignment and corporations where they exist with their Corporation Act /with their Municipal Act and should frame a Uniform Building Rule for the state to conform to the provisions of the EC Act and notify within three months of the notification of this Solar Water Heating Order by the appropriate Government.

The Electricity Act 2003 already provides a role for renewable like solar energy but given the magnitude and importance of the activities it would be necessary to make specific amendments.

Implementation in SEZs: Zones notified under SEZ act and in operation in the states will keep 10% of its area for solar energy generation by the State Nodal Agency[3] and 50% of all non-industrial[4] hot water requirements in the SEZ area shall come from the solar energy.

Implementation in Railway Colony and Railway Property: Ministry and Railway Board will direct to implement the Solar Water Heating Order requirement in their respective centres, units (residential and commercial) and appliances as notified by appropriate Government and appropriate agency. For any features specific to the nature of their operation that may require SWH, the aboard will be at liberty to suggest within three months of the notifications of the Solar Water Heating Order for inclusion or modification.

Implementation in Defence Establishments in the state: Ministry and welfare Board/authority authorised under relevant act or defence establishment rules will direct to implement the Solar Water Heating Order requirement in their respective centres, units (residential, cantonment and operational) and appliances as notified by appropriate Government and appropriate agency. For any features specific to the nature of their operation that may require SWH, the Board/authority will be

[2] ECBC is already mandatory for all new building that have a connected load of 500 kW or greater or a contract demand of 600 kVA or greater. The code is also applicable to all buildings with a conditioned floor area of 1,000 m2 (10,000 ft2) or greater. The code is recommended for all commercial buildings.

[3] State Nodal agency shall be the one designated by the state under EC Act and can be a REDA and/or it can take up solar project with a partner in PPP mode and all the buildings.

[4] This shall not include units/facilities where hot water is generated during the industrial process and can be used as recycled

at liberty to suggest within three months of the notifications of the Solar Water Heating Order for inclusion or modification.

Implementation in Central Govt Undertakings, Central Police Organisations and any other Central Government Agencies in the state: Ministry and welfare Board/authority authorised under relevant act or defence establishment rules will direct to implement the Solar Water Heating Order requirement in their respective centres, units (residential, cantonment and operational) and appliances as notified by appropriate Government and appropriate agency. For any features specific to the nature of their operation that may require SWH, the Board/authority will be at liberty to suggest within three months of the notifications of the Solar Water Heating Order for inclusion or modification.

Environment Clearances to large construction projects under the Ministry of Environment and Forest: The EACs/ SEACs will do the grading of the projects. Platinum (90-100 points), Gold (80-89 points), Silver (60-79 points) and Bronze (40-59 points), grade can be earned, depending on the points achieved. The detailed criteria for gradation and the expected performance standards shall include the minimum performance of SWH application of the hot water requirement in the facility and the committee shall decide and include in its recommendation during approval as a condition.

6 Affected uses and Scope

The uses for which the installation of collectors of active solar energy of low temperature for the heating of sanitary hot water must be foreseen are (but not limited to) given below:

- Housing;
- Residential, cantonment, barracks and prisons including sanatorium;
- Sporting complexes;
- Commercial establishments premises like hotels, restaurants, shopping complexes, multi-plexes, IT Complex;
- Industrial, in general if hot water is needed for the process and, also, when the installation of showers for the staff is mandatory, any other which involves the existence of dining-rooms, kitchens or collective laundries.
- High-raise buildings as defined by respective local bodies
- Solar Water Heating Order will also be applied to the installations for the heating of the water in the vessels of the conditioned covered swimming pools with a water volume above 100 m3. In these cases, the energy contribution of the solar installation will be, at least, of 60 % of the annual energy demand coming from the heating of the vessel water. The heating of the uncovered swimming pools will be only allowed with a system of solar energy collection.

This Solar Water Heating Order shall be applicable to all the states and Union Territories of India without any exceptions or exclusion.

7 Liable persons for the fulfilment of this ordinance

The promoter/contractor of the construction or modification/retrofit/refurbishment, the owner of the building affected, or the professional who projects and conducts the works in the ambit of his faculties are responsible for the fulfilment of what this Solar Water Heating Order prescribes. The user of the activities taking place in the building or constructions which have solar energy at their disposal is also liable by this Solar Water Heating Order.

8 Technology

Considering that, solar thermal market is evolving in India. The application of this Solar Water Heating Order will be effected in each case depending on the best technology available. The appropriate agency will dictate the appropriate provisions to adapt the technical contemplation of this Solar Water Heating Order to the technological changes that may take place from time to time.

The technology must have been approved by the nodal agency and must have been incorporated in corresponding building-byelaws that is uniformly applicable for the state[5].

In all cases the Regulation of Thermal Installations in Buildings as per the Energy Conservation Building Code/National Building Code shall be the basis. In the installations only collectors duly authorised by the appropriate agency/ entity will be allowed to be used. The characteristics curve and the performance data as issued by solar research council[6]/MNES will have to be furnished to the agency for the approval of the project[7].

The system to be laid on will consist of the collection subsystem by means of solar collectors with water in closed circuit, of the subsystem of interchange between the closed circuit of the collector and the water of consumption, of the storing up subsystem, of the support subsystem with other energies and of the distribution and consumption system.

Exception, in the case of swimming-pools, a collector subsystem in open circuit will be possible to be used without interchanger and without storage tank when the vessel of the swimming-pool fulfils its functions.

8.1 Orientation and inclination of the collection subsystem:

In order to achieve the maximum efficiency in the collection of solar energy, the subsystem must face south, with a maximum margin of ± 25º. Only in exceptional circumstances, as for example, when there is shade produced by buildings or natural obstacles, the mentioned orientation will be allowed to be modified.

- With the same object obtaining the maximum solar energy use, or to improve its integration in the building, in installations with a noticeable constant demand of hot water over the year, if the inclination of the collection subsystem in relation to the horizontal line is fixed, it has to be the same as the geographical latitude, i.e., 41.25 grades. This inclination may vary

[5] If the state has wide variation and requires different technology then it should be suitably specified in the zone or region plan of the state and accordingly reflect in the bye-laws of the same zone
[6] As proposed under Solar Mission
[7] MNES will notify the approved technology, empanelled suppliers (those who meet the criteria) with their detailed address.

between +10 grades and -10 grades, depending on the existence of hot water needs preferably in winter or in summer.

- When outstanding differences regarding the demand between different months or seasons are foreseeable, a different inclination will be allowed to be adopted only in the case it turns out more favourable in relation to the seasonality of the demand. In any case it will be required the comparative analytical justification that the adopted inclination corresponds to the best use in a global annual cycle.
- In order to avoid an inadmissible visual impact, the realizations in the buildings where a solar collector system is and on, the necessary measures will have to be contemplated in order to achieve its integration in the building.

In any case the railing or containing wall of perimetral enclosure of the flat roof must have the maximum height allowed by the building code so that it make up a natural screen which hide from sight the group of collectors and other complementary kits, as best as possible.

8.2 Solar Irradiation

The measurement of the installation will be done depending on the solar irradiation received, after the orientation and the inclination adopted in the project and as specified the appropriate agency[8].

Solar irradiation data (in MJ/Sq Mt) of Indian cities[9]

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Srinagar	4.77	9.77	14.25	18.24	20.25	22.26	20.16	18.75	18.22	13.89	9.24	6.99	15.40
NewDelhi	13.32	16.42	20.64	24.07	24.43	22.54	19.07	17.79	18.90	16.80	14.13	11.93	18.25
Jodhpur	15.53	18.20	21.76	24.24	25.10	23.58	19.67	19.51	21.06	19.11	16.17	14.84	19.97
Jaipur	15.30	18.02	22.00	25.50	26.11	23.94	18.48	17.60	19.62	18.17	15.40	13.47	19.42
Varanasi	12.91	17.15	20.92	23.12	23.03	20.87	15.67	17.29	16.35	17.16	14.47	12.15	17.68
Patna	13.01	17.00	20.94	22.86	22.66	20.27	15.72	16.71	16.39	16.73	14.71	11.87	17.25
Shillong	14.11	16.67	19.27	21.13	18.41	16.42	16.06	14.93	14.03	15.18	15.63	14.43	16.27
Ahmedabad	16.34	19.57	22.85	25.03	25.18	21.67	15.52	15.50	18.63	18.92	16.74	15.23	19.30
Bhopal	15.80	18.72	22.46	25.34	24.31	19.92	14.42	13.69	18.73	19.17	17.02	16.48	18.65
Ranchi	15.63	17.69	20.82	22.21	21.19	16.75	14.50	13.89	14.90	15.76	15.34	14.68	16.39
Kolkata	13.53	15.68	18.99	21.06	20.64	17.17	15.09	15.57	14.90	15.27	13.85	12.68	16.17
Bhavnagar	17.92	20.92	24.16	26.23	26.54	22.31	16.28	16.16	19.91	21.06	18.33	16.55	20.99
Nagpur	16.15	19.21	21.93	23.95	23.59	18.85	14.81	14.78	17.54	18.66	16.36	15.38	18.34
Mumbai	16.57	19.49	22.24	23.82	23.36	17.49	13.45	14.52	16.35	18.01	16.60	15.46	18.25
Pune	17.29	20.58	23.11	24.49	25.18	19.32	16.10	15.68	18.73	19.25	17.64	16.45	19.51
Hyderabad	19.64	22.03	24.22	24.87	23.87	20.13	18.50	17.56	19.77	18.67	18.07	17.96	20.34
Visakhapatnam	17.42	20.01	21.82	22.99	22.18	17.49	16.02	16.35	17.06	17.62	16.40	16.32	18.51
Panjim	19.88	22.40	23.55	24.22	23.64	16.67	14.78	15.86	19.40	19.53	19.16	18.61	20.00
Chennai	17.62	21.07	23.45	23.76	22.54	20.59	19.00	18.73	19.41	16.41	14.39	14.96	19.34
Bangalore	20.42	23.35	23.70	23.64	22.88	17.72	16.71	16.16	18.89	18.42	17.45	17.35	19.70
PortBlair	18.44	21.06	21.22	20.75	15.76	13.94	13.77	14.50	15.48	16.14	16.74	17.09	17.27
Minicoy	17.77	20.20	21.79	21.38	18.19	16.01	16.49	17.60	18.33	18.01	16.69	16.59	18.34
Thiruvananthapuram	19.93	22.05	23.40	21.38	19.61	17.38	17.84	19.00	20.53	18.17	16.56	18.07	19.45

8.3 Installation of tubes and other piping

In the common parts of the buildings, and in form of installation yards, the necessary piping will be laid on to accommodate, in an orderly and easily accessible way for the operations of maintenance and repairing, the set of pipes for the cold and hot water of the system as well as the other supplies of support and complementaries needed for the system. They will have to pass through the inside of the buildings or inside courts, in what case they will have to be buried or arranged in any other way so that they don't show themselves. It's forbidden in an express way and without exceptions, their

[8] REDA as per the MNES guidelines
[9] Solar radiation handbook 2008, MNRE

tracing along main façades, through block yards and through roofs, except, on the latter case, in the short horizontal stretches to attain the vertical main pipes. This will be maintained as per the generic aesthetic of the city/location if any.

8.4 Standards and Quality Certification

MNRE will approve the **standards** from Flat Plate Collectors (FPC) and Evacuated Tube Collectors (ETC) along with the ancillary equipments as per the recommendation of Bureau of Indian Standards (BIS).

As of now the following standards shall be valid:

The relevant Indian Standards for solar **flat plate collectors** are as follows:

- IS 12933 (Part 1):2003, Solar flat plate collector – Specification, Part 1 –Requirements.
- IS 12933 (Part 2):2003, Solar flat plate collector – Specification, Part 2 –Components.
- IS 12933 (Part 3):2003, Solar flat plate collector – Specification, Part 3 –Measuring instruments.
- IS 12933 (Part 5):2003, Solar flat plate collector – Specification, Part 5 – Test methods.
- These Standards does not apply to concentrating & unglazed collectors and built-in-Solar Water Heating Orderrage water heating systems.

For **ETC types** the MNRE approved standards shall be valid.

Gradual attempt would be to move towards an internationally accepted benchmark for products like solar key mark. During the transition BEE may provide **star-rating for SWH systems**. To weed out spurious products an incentive system would be worked out in consultation with stakeholders.

Installer Certification Program: BEE accredited programme will run in vocational and technical training organisations for installers, plumbers and mechanics to ensure adequate supply of skilled human resources. State Governments-manufacturers can participate in the programme and funding may be provided through National Skill Development Corporation.

9 Parameters for estimation

9.1 Calculation for Installation

Water temperature coming from the public network or from own supply: 10º C, aside from the fact that the actual monthly water temperature of the network can be reliably proved, by means of certification of homologated entity.

- Minimum temperature of the hot water: [45º C]
- Percent fraction (DA) of the whole annual energy demand for hot water to meet with the installation of solar collectors of low temperature: 60%, in accordance with the following expression: DA = [A/(A+C)] x 100 (where A is the thermal solar energy furnished to the water consume places, and C is the additional thermal energy coming from traditional energy sources of support furnished to meet the needs. Percentage fraction (DA) of the whole annual energy demand for the hot water requirement.

The indicative minimum specifications are as below:

Sl No	Type of Use	100 litres per day shall be provided for every unit
1	Restaurants serving food /and drinks with seating. Serving area of more than 100 sq.m. and above	40 sq.m of seating or serving area
2	Lodging establishment and Tourist Homes	3 rooms
3	Hostel and Guest Houses	6 beds/persons capacity
4	Industrial Canteens	50 workers
5	Nursing homes and hospitals	4 beds
6	Kalayan Mandap, Community Hall and Convention Hall	30 sq. mtrs of floor area
7	Recreational Clubs	100 sq mtrs of floor area
8	Residential Buildings	
	a) Single dwelling unit measuring 200 sq.m of floor area or site area of more than 400 sq,m whichever is more b) 500 lpd for multi dwelling unit/ apartment for every 5 units and multiplies thereof.	

Overall it has to be seen that, a minimum 20% of the annual energy requirement for heating water (for applications such as hot water for all needs, like for canteen, washing, and bath rooms/toilets, except for space heating) is supplied from solar energy[10]. Based on climate condition the 60% parameter can more or less and the appropriate body can modify the parameter 60% mentioned above in the calculation.

9.2 Other structures

Other structures that would be mandated to use SWH would include:

- Sports complex
- Swimming pools
- Any other identified by appropriate agency from time to time and notified

The percentage of hot water demand that should come from the SWH would be determined objectively and notified for these structures by the appropriate agency.

Green Building Standards: All Green Buildings shall include SWH as stated in the section 8.1 above.

10 Exemptions

The buildings exempt from the Solar Water Heating Order will be those in which it is technically impossible. In these cases, the corresponding technical study will have to be properly justified by the municipal engineer in case of ULBs and authorised representatives of Junior Engineers of the Block/Mandal Panchayat.

[10] This is to use ECBC provisions however, to bring in conformity with criteria 19 of GRIHA standard and also to meet the IGBC standard (from 50-95%), maximum limit can be examined and extended upto at least 50%.

11 User Obligation

The holder of the activity displayed in the building endowed with solar energy is bound to its utilization and to execute the operations of maintenance and the repairs needed to keep the installation in perfect use and efficiency, so that the system works properly and with the best results.

12 Incentives

The following incentive schemes are now being proposed under the SOLAR WATER HEATING ORDER:

12.1 Interest subsidy scheme and motivator scheme

Interest subsidy scheme shall be as notified under No. 3 / 1 / 2007/UICA (SE), Government of India, Ministry of Non-conventional Energy Sources ((Urban, Industrial and Commercial Group) of August 2008 will be applicable till it is replaced with a better [any other] scheme.

12.2 Upfront scheme

For housing complex the banks would be provided a reimbursement fund for interest subsidy on housing loans that would only be given if the realtors in their master proposal agree to install SWH in buildings before handover to the users. The interest subsidy scheme mentioned above should be gradually converted to this modality.

12.3 Capital subsidy scheme

Approved manufacturers having requisite standard like solar key mark or other standards as specified by MNRE and BIS would be entitled this with pass through benefit on purchase and based on the installation certificate of the SWH. The amount of such benefit shall be determined by the respective states through and notified accordingly.

12.4 Rebates in Utility Tariff

The National Tariff Policy 2006 mandates the State Electricity Regulatory Commissions (SERC) to fix a minimum percentage of energy purchase from renewable sources of energy taking into account availability of such resources in the region and its impact on retail tariff. National Tariff Policy, 2006 would be modified to mandate that the State electricity regulators fix a percentage for purchase of solar power.

12.5 Renewable Purchase Obligation and trade

The solar power purchase obligation for States may start with 0.25% in the phase I and to go up to 3% by 2022. Out of this a certain percentage has to be based on the SWH installation may be taken up as a demand side measure by the applicant entities under the RPO.

This could be complemented with a solar specific Renewable Energy Certificate (REC) mechanism to allow utilities and solar power generation companies to buy and sell certificates to meet their solar power purchase obligations. The ULBs will be eligible entities for this market in partnership with the companies.

Solar Certificates should be a tradable instrument with a market linked pricing and be issued by appropriate issuing body.

12.6 Carbon Finance

As of now the carbon finance shall be treated as an additional incentive to the user and any program operator or manufacturer shall pass on a share of the carbon finance benefit to the users through a benefit sharing agreement upon on issuance. This shall be used as a tool to offset the O&M cost of the users so that they maintain the installations properly and use it regularly. Initiatives under applicable market mechanism under Kyoto-protocol and any other protocol emerging aftermath should take the above arrangement as a guiding principle to use the benefit derived through additional finance to the benefit of the user of SWH.

12.7 Fiscal Incentives

Fiscal incentives like custom duties and excise duties concessions/ exemptions be made available on specific capital equipment, critical materials, components and project imports as specified in Financial Bills and Budgets of appropriate Government from time to time.

Property tax incentives shall be made available to existing users based on installer certification and quarterly performance report of the installations.

13 Institutional Framework

The Solar Water Heating Order 's success shall be based on the commitment to the institutional framework outlined below and enabling policy and legislation duly notified in the gazette and the due notification of the designated agency as nodal agency to implement this order under Energy Clause (d) and section 15 of the Energy Conservation Act of 2001.

Sl No	Name of the Institution	Level	Role
1	Solar Working Group	National	Under Solar Mission, shall be the apex strategy planning body and members will be drawn from the departments inclusive MNES, Housing and Urban Development, relevant agencies and CPSUs under Energy Department and independent regulators and relevant officers from the Market Transformation Programme of UNDP, president or secretary of Apex Solar Energy Manufacturing Body.
2	Solar Energy Research Council	National	Apex body under the National Solar Mission for research and technology road map, standards and certifications, technology dissemination. Members drawn from academic institutions, strategic research system of the government and its network partners. This is to be chaired by an eminent researcher (with solar energy back ground) and will be on a rotational basis.
3	Solar Forum	National/State	This forum shall operate in a public private partnership mode. It will be the partnership between the SWH manufacturers/trade associations and the relevant ministries of the Government and would act as the main advocacy focal point for promoting the Solar Water Heating Order. The forum can engage the services of specialised agencies in the field of communication, advocacy and policy support.
3	State Level Task Force for Solar Energy	State	To be chaired by the Chief Minister and relevant ministries (housing, urban development, panchayati raj, environment, science and technology, energy, mayors and at least three members from the sustainable habitat council, president

Sl No	Name of the Institution	Level	Role
			Real estate developer association, architect council, representatives of solar water heater manufacturers. At least three independent experts having relevant knowledge in the sector.
4	Sustainable Habitat Council	ULB	Should be notified in the ULBs and ate least one third of the elected members as its constituent. It would have two members each from real estate developers association, representatives of manufacturing companies or its sole selling agency , member of the State Level Banker's Committee, director municipal administration and municipal engineer, one architect, one member from development authority and two independent experts.
5	Village Committee/Village Energy Committee	Village level	This will be the body to promote the SWH in rural areas and would interface with villagers for any grievance, any youth qualified under SWH installation available in the village or nearby cluster shall be co-opted as a member of the committee.

14 Flanking Measures

Extensive campaign will be organised by the National Government and State Government under Solar India Mission to educate people about the cost-benefit, maintenance of the SWH. A campaign will be run in form of a public-private-partnership forum that would involve central agencies, banks, industry associations highlighting the above operational dimensions as well as the incentives and penalties associated with compliance and non-compliance. Each ULB will get Rs 50 lakh for this campaign along with the introduction of bye-law amendment and implementation of the Solar Water Heating Order.

The forum will extensively use the ICT power of the country and would create and maintain:

- A central web-site with general information
- An on-line database of products, manufacturers, *akshya urja* shops, relevant ESCOs, nodal agencies, sustainable habitat councils
- State-wise helpline and service centre numbers
- Overview and analysis of the present market situation.
- Quality management tools relevant to solar thermal products
- Trends of installations
- Test report database

To access rural areas, the linkage will be provided to Panchayat Based Citizen Service Centre (CSC) operators, SHG groups and rural franchisees.

15 Cautions

The Development Authority, Mayor or authorised officers of the ULBs as defined by appropriate Government are competent to order the building works taking place not observing this Solar Water

Heating Order, as well as to order the withdrawal of materials or machinery used, carrying the promoter or the owner the charges.

The suspension order will be preceded in every case by a requirement to the accountable for the works, in which a deadline will be conceded to give accomplishment to the obligations arising out of this Solar Water Heating Order.

16 Monitoring and Supervision

Monitoring the implementation of the order at the local level is of utmost importance:

- To earn the trust of all stakeholders (users, solar thermal companies, real estate developers, policy makers)
- To get the feedback and improve the order further
- To assess the performance against set targets
- To set at rest the rumours and doubts on the effectiveness of the order by vested interests

National Level

The monitoring mechanism of the solar mission will be the apex monitoring mechanism for this ORDER and no parallel mechanism will evolve.

State Level

Solar energy task-force at the state level will be the apex body for the consolidation of the performance data and would have responsibility for the implementation and oversight of the Solar Water Heating Order. This multi-department taskforce will be chaired by the Chief Minister of the state who will review the performance at least twice a year.

State Nodal Agencies/Designated Agency will also undertake performance monitoring and data management. SNA will work with Sustainability Habitat Cell in each ULB for data gathering and report to taskforce on a quarterly basis.

Participating banks will share a copy of the performance data with SHC that they send to IREDA for reimbursement.

ULB /Panchayat Level

Third party inspection: ESCOs will be assigned for areas on a performance contract basis for installation and monitoring of the installations. They will be accountable to designated nodal officer of the municipality and the officer will work as the member secretary to the sustainable habitat cell in the ULB. In case of rural areas, the Block/Mandal Panchayat shall have the same status.

17 Sanctions and Proceedings in case of infringement

Infringements to the legal system laid down in this SOLAR WATER HEATING ORDERare the ones contemplated in the general legislations under the applicable law and other relevant state/local level laws on housing and environment, and particularly, the ones following:

Very serious infringement

- It is a very serious infringement not to lay on the solar collection system when compulsory according to what this Solar Water Heating Order prescribes.

Serious infringements are:

- The incomplete or insufficient fulfilment of the solar energy collection installation proceeding, bearing in mind the building characteristics and the foreseeable sanitary water needs.
- The realization of works, the manipulation of the installations or the absence of maintenance involving the reduction of the installations efficiency under what it is required.
- The non observance of the requirements and execution orders dictated in order to assure the fulfilment of this ordinance.
- Blocking or obstruction and wilful damage to the duly approved collector area or solar installations of the neighbour in the neighbourhood.

Medium Infringement

- The absence of use of the sanitary water heating system by the user in the building without any justification.

Light Infringement

- Poor usage and reporting of SWH installation by the user

The sanction corresponding to the perpetration of infractions to the legal system of this Solar Water Heating Order is the following:

- For light infringements, warning
- For medium infringements, fine up to _____.
- For serious infringements, fine up to _____.
- Very Serious infringement_____.

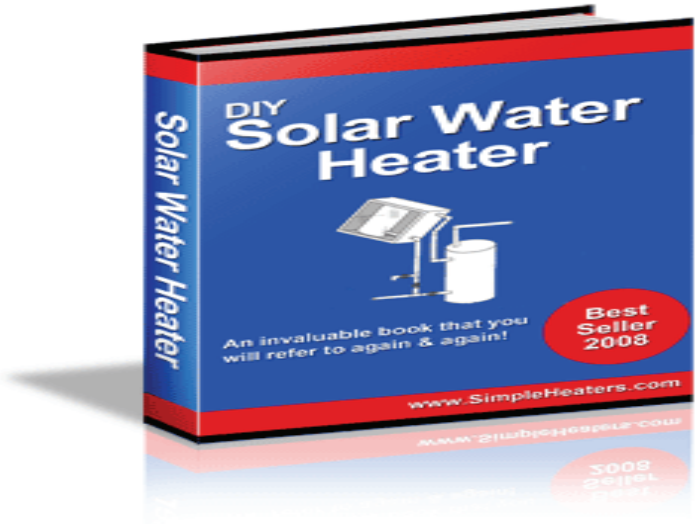
18 Grievance Handling

Appropriate Government will constitute a grievance redressal cell in each ULB and Panchayat in the sustainable habitat cell/VEC under the control of the sustainable habitat council. The designated nodal officer will be in charge of the cell with at least two support staff (one computer literate administrative staff) and a technically qualified staff experienced in non-conventional energy including practical experience of solar energy installation. The cell will also negotiate with reputed manufacturers to provide space for at least 2-3 technical staff members for manning the help line.

All the grievances registered will be resolved within a fortnight and a system generated registration number shall be made available immediately to the party registering the grievance.

19 Notification of the Solar Water Heating Order and Modification

This Solar Water Heating Order will be notified by the appropriate Government in the official Gazette after a consultation and modification and would not be static order for initial three years till it is fully meets the expectation of the stakeholders. The Solar Water Heating Order will only be improved further from its current state and flexibility to the appropriate Government shall be the spirit of the Solar Water Heating Order for its improvement. The notified Order shall be the final order and this document shall serve as the explanatory guidance note of that order for the wider consultation and finalisation and be termed as Uniform Policy. However, the Order in its final notified form shall super-cede and all definitions and sections in the order shall be final and binding for interpretation. This policy shall be treated as the intention of the Government and the Order as the intention and the precinct of the Law.



Annexure

This section deals with the implementation roadmap for the proposed Solar Water Heating Order and description of the sequence of steps to see that it is implemented as per the framework presented in the report involving the key stakeholders.

Annexure

CTRAN Consulting Pvt. Ltd.

Building Sector Policies and Regulation for Promotion of Solar Water Heating System

Annexure : Implementation Plan

CTRAN Consulting Pvt. Ltd.
A1/A2 - 3rd Floor Lewis Plaza, Lewis Road, Bhubaneswar-751014
Telefax: +91-674-2432695, email: ctran@ctranconsulting.com,
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Contents

1 Draft Order

Solar Water Heating Order, 2010 [draft]

In exercise of the powers conferred by section 14 read with sub-sections (p), (q), (r) of the Energy Conservation Act 2001 (52 of 2001), the Central Government issues the following Order, namely:-

1. **Short Title and Commencement.** – (1) These orders may be called the Solar Water Heating Order, 2010 (2) They shall come into force on the date of their publication in the Official Gazette.

2. **Definitions.** – (1) In the following Order , unless the context otherwise requires, -

(a) "Act" means the Energy Conservation Act, 2001;

(b) "Appropriate Government" can be the National Government, State Governments, and Governments of the Union Territory and National Capital Region, Rural and Urban Local bodies and autonomous councils under relevant acts.

(c) "Nodal Agency": Unless otherwise specified, the respective renewable development agency or authorised agencies notified by the state including ESCOs.

(d) Words and expression used herein and not defined, but defined in the Act shall have the meanings assigned to them in the Act.

3. **Affected users** shall be the one defined under section 14 sub section (e) of the Act and the uses for which the installation of collectors of active solar energy of low temperature for the heating of sanitary hot water must be foreseen are (but not limited to) given below:

- Housing;
- Residential, cantonment, barracks and prisons including sanatorium;
- Sporting complexes;
- Commercial establishments premises like hotels, restaurants, shopping complexes, multi-plexes, IT Complex;
- Industrial, in general if hot water is needed for the process and, also, when the installation of showers for the staff is mandatory, any other which involves the existence of dining-rooms, kitchens or collective laundries.
- High-raise buildings as defined by respective local bodies
- SOLAR WATER HEATING ORDER will also be applied to the installations for the heating of the water in the vessels of the conditioned covered swimming pools

4. **The quantum of usage** that is mandated under this Order may follow the following guidance.

Sl No	Type of Use	100 litres per day shall be provided for every unit
1	Restaurants serving food /and drinks with seating. Serving area of more than 100 sq.m. and above	40 sq.m of seating or serving area
2	Lodging establishment and Tourist Homes	3 rooms
3	Hostel and Guest Houses	6 beds/persons capacity
4	Industrial Canteens	50 workers
5	Nursing homes and hospitals	4 beds
6	Kalayan Mandap, Community Hall and Convention Hall	30 sq. mtrs of floor area
7	Recreational Clubs	100 sq mtrs of floor area
8	Residential Buildings	
	a) Single dwelling unit measuring 200 sq.m of floor area or site area of more than 400 sq,m whichever is more b) 500 lpd for multi dwelling unit/ apartment for every 5 units and multiplies thereof.	

This table shall be converted to kwH/m2 and conformity be examined with the Act and overall it has to be seen that, a minimum 20% of the annual energy requirement[1] for heating water (for applications such as hot water for all needs, like for canteen, washing, and bath rooms/toilets, except for space heating) is supplied from solar energy.

Implementation in SEZs: Zones notified under SEZ act and in operation in the states will keep 10% of its area for solar energy generation by the State Nodal Agency and 50% of all non-industrial hot water requirements in the SEZ area shall come from the solar energy.

Implementation in Railway Colony and Railway Property: Ministry and Railway Board will direct to implement the SOLAR WATER HEATING ORDER requirement in their respective centres, units (residential and commercial) and appliances as notified by appropriate Government and appropriate agency.

Implementation in Defence Establishments in the state: Ministry and welfare Board/authority authorised under relevant act or defence establishment rules will direct to implement the SOLAR WATER HEATING ORDER requirement in their respective centres, units (residential, cantonment and operational).

Implementation in Central Govt Undertakings, Central Police Organisations and any other Central Government Agencies in the state: Ministry and welfare Board/authority authorised under relevant act or defence establishment rules will direct to implement the SOLAR WATER HEATING ORDER requirement in their respective centres, units (residential, cantonment and operational)

All the above agencies, the ULBs and Corporations shall align, enact, and incorporate relevant enabling provisions in their respective acts, directions and rules to see that the objective set out in this order is fully met.

5**. Technology:** Solar Water Heater must conform to the standards and labels within the meaning of Section 14 (a), (b), (c), (d) of Act as specified from time to time.

6. **User obligation:** The holder of the activity displayed in the building endowed with solar energy is bound to its utilization and to execute the operations of maintenance and the repairs needed to keep the installation in perfect use and efficiency, so that the system works properly and with the best results.

7. **Incentive and Penalty** shall be as per the uniform policy and guidelines published by MNRE, Regulatory Commissions and as per the directions issued by appropriate Government. A cooling off period may be granted for six months from the date of notification of this Order before the penal provisions are invoked. Inspection power granted to the designated agency shall be within the meaning of section 17 of the Act.

8. The **nodal agency** shall be the agency responsible for the implementation of the order. *Institutional framework* for supervision and guidance at different levels shall be as per the guidance specified in the uniform policy.

9. **Infringement and Grievance Handling**: Infringements to the legal system laid down in this SOLAR WATER HEATING ORDER are the ones contemplated in the general legislations under the applicable law and other relevant state/local level laws on housing and environment, and particularly, the ones following: (a) Very serious infringement (b) Serious infringements (c) Medium Infringement (d) Light Infringement as described in the uniform policy. Appropriate Government shall constitute a grievance redressal cell in each ULB and Panchayat in the sustainable habitat cell/Village Electricity Committee. The designated nodal officer will be in charge of the cell with at least two support staff (one computer literate administrative staff) and a technically qualified staff experienced in non-conventional energy including practical experience of solar energy installation. The cell will also negotiate with reputed manufacturers to provide space for at least 2-3 technical staff members for manning the help line.

10. This SOLAR WATER HEATING ORDER will be notified by the appropriate Government in the official Gazette after a consultation and modification and would not be static order for initial three years till it is fully meets the expectation of the stakeholders. The SOLAR WATER HEATING ORDER will only be improved further from its

[1] As required under Energy Conservation Building Code.

current state and flexibility to the appropriate Government shall be the spirit of the SOLAR WATER HEATING ORDER for its improvement. While this Order will draw heavily in to the guidance provided under Uniform Policy; the Order will super cede the Uniform Policy and Central Government may super cede the Order as per power conferred under the Act.

Solar Water Heating Order, 2010 [draft]

In exercise of the powers conferred by section 18 of the Energy Conservation Act 2001 (52 of 2001), the appropriate Government issues the following Order, namely:-

1. **Short Title and Commencement.** – (1) These orders may be called the Solar Water Heating Order, 2010 (2) They shall come into force on the date of their publication in the Official Gazette.

2. **Definitions.** – (1) In the following Order , unless the context otherwise requires, -

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(c) "Nodal Agency": Unless otherwise specified, the respective renewable development agency or authorised agencies notified by the state including ESCOs.

(d) Words and expression used herein and not defined, but defined in the Act shall have the meanings assigned to them in the Act.

3. **Affected users** shall be the one defined under section 14 sub section (e) of the Act and the uses for which the installation of collectors of active solar energy of low temperature for the heating of sanitary hot water must be foreseen are (but not limited to) given below:

- Housing;
- Residential, cantonment, barracks and prisons including sanatorium;
- Sporting complexes;
- Commercial establishments premises like hotels, restaurants, shopping complexes, multi-plexes, IT Complex;
- Industrial, in general if hot water is needed for the process and, also, when the installation of showers for the staff is mandatory, any other which involves the existence of dining-rooms, kitchens or collective laundries.
- High-raise buildings as defined by respective local bodies
- SOLAR WATER HEATING ORDER will also be applied to the installations for the heating of the water in the vessels of the conditioned covered swimming pools

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6	Kalayan Mandap, Community Hall and Convention Hall	30 sq. mtrs of floor area
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	c) Single dwelling unit measuring 200 sq.m of floor area or site area of more than 400 sq,m whichever is more d) 500 lpd for multi dwelling unit/ apartment for every 5 units and multiplies thereof.	

Implementation in SEZs: Zones notified under SEZ act and in operation in the states will keep 10% of its area for solar energy generation by the State Nodal Agency and 50% of all non-industrial hot water requirements in the SEZ area shall come from the solar energy.

Implementation in Railway Colony and Railway Property: Ministry and Railway Board will direct to implement the SOLAR WATER HEATING ORDER requirement in their respective centres, units (residential and commercial) and appliances as notified by appropriate Government and appropriate agency.

Implementation in Defence Establishments in the state: Ministry and welfare Board/authority authorised under relevant act or defence establishment rules will direct to implement the SOLAR WATER HEATING ORDER requirement in their respective centres, units (residential, cantonment and operational).

Implementation in Central Govt Undertakings, Central Police Organisations and any other Central Government Agencies in the state: Ministry and welfare Board/authority authorised under relevant act or defence establishment rules will direct to implement the SOLAR WATER HEATING ORDER requirement in their respective centres, units (residential, cantonment and operational)

All the above agencies, the ULBs and Corporations shall align, enact, and incorporate relevant enabling provisions in their respective acts, directions and rules to see that the objective set out in this order is fully met.

5**. Technology:** Solar Water Heater must conform to the standards and labels within the meaning of Section 14 (a), (b), (c), (d) of Act as specified from time to time.

6. **User obligation:** The holder of the activity displayed in the building endowed with solar energy is bound to its utilization and to execute the operations of maintenance and the repairs needed to keep the installation in perfect use and efficiency, so that the system works properly and with the best results.

7. **Incentive and Penalty** shall be as per the uniform policy and guidelines published by MNRE, Regulatory Commissions and as per the directions issued by appropriate Government. A cooling off period may be granted for six months from the date of notification of this Order before the penal provisions are invoked. Inspection power granted to the designated agency shall be within the meaning of section 17 of the Act.

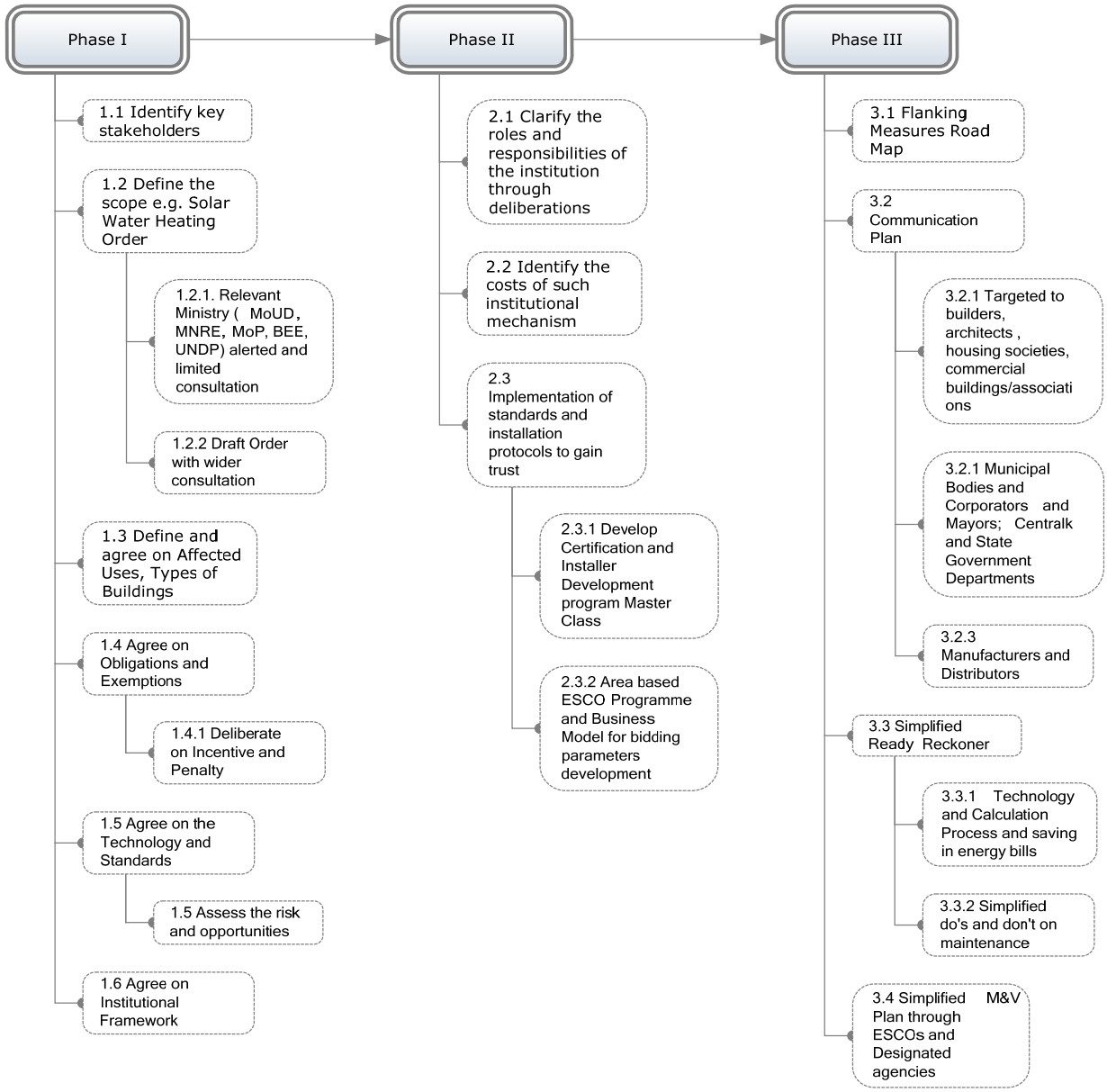
8. The **nodal agency** shall be the agency responsible for the implementation of the order. *Institutional framework* for supervision and guidance at different levels shall be as per the guidance specified in the uniform policy.

9. **Infringement and Grievance Handling**: Infringements to the legal system laid down in this SOLAR WATER HEATING ORDER are the ones contemplated in the general legislations under the applicable law and other relevant state/local level laws on housing and environment, and particularly, the ones following: (a) Very serious infringement (b) Serious infringements (c) Medium Infringement (d) Light Infringement as described in the uniform policy. Appropriate Government shall constitute a grievance redressal cell in each ULB and Panchayat in the sustainable habitat cell/Village Electricity Committee. The designated nodal officer will be in charge of the cell with at least two support staff (one computer literate administrative staff) and a technically qualified staff experienced in non-conventional energy including practical experience of solar energy installation. The cell will also negotiate with reputed manufacturers to provide space for at least 2-3 technical staff members for manning the help line.

10. This SOLAR WATER HEATING ORDER will be notified by the appropriate Government in the official Gazette after a consultation and modification and would not be static order for initial three years till it is fully meets the expectation of the stakeholders. The SOLAR WATER HEATING ORDER will only be improved further from its current state and flexibility to the appropriate Government shall be the spirit of the SOLAR WATER HEATING ORDER for its improvement. While this Order will draw heavily in to the guidance provided under Uniform Policy; the Order will super cede the Uniform Policy and Central Government may super cede the Order as per power conferred under the Act.

3 Overview of the Implementation Framework

The following implementation framework will be attempted in three phases. Some activities will also go parallel and rest in sequence.



4 Phase I : Clarity on Scope and Solar Water Heating Order

First step in implementing the policy is to define the scope and go for a stakeholder consultation. The starting point should be the "Consultation on the Draft Solar Water Heating Order" . To achieve the high impact it is recommended to cover all types of building residential and commercial, but best compromise should be made to issue the solar water heating order to mandate all commercial buildings first and then creating an incentive structure through which other categories can come in and participate. This is how the solar water heating orders have been implemented internationally in a phase wise addition rather than taking an all or none approach.

Affected Uses: Relevant departments such as Ministry of Power, BEE, Ministry of Urban Development, MNRE, Mission officials attached to National Solar Mission, IREDA should have a limited consultation on the Solar Water Heating Order.

Once the affected use is sorted out the Draft Order should be placed for a wider consultation and comments can be invited. At this stage no focus should be on the details or operational elements rather than applicability. The views of the stakeholders can unfold the operational dimensions.

Assessment should be made to determine and cover the mix of existing and new buildings, rural and urban locations as well as climate envelopes. Again here, the focus would be to cover these segments through the incentive mechanism stated above (especially the segment of existing residential which is the most difficult category).

Estimation: Since the order will be notified under Energy Conservation Act, 2001; KwH/Sq M conversion to be linked to the size and height of the building. Therefore this has been presented as an essential feature of this order and since some ULBs are already implementing in this form, those will serve as a demonstrative measure.

Obligation and Exemption: The order clearly outlines the obligations for the occupiers and only the occupiers have the incentives to maintain the water heating system, so also the liability for its violation. There has to be an agreement on exemptions and obligations of the occupiers. This is also an essential part of the order. The parameters of exemptions should be carefully chosen (e.g. protected monuments, temporary buildings, facade and shaded buildings that do not help the installation and any other that is suitably explained by the authorised technical personnel)

UNDP GEF program is working on standards and labels and technology and act compliant labels should only be eligible installations. This will prompt the manufacturers to comply and help in trust

building for the end user. Guarantee, insurance and installer market will also evolve through this process. It is important to determine the risks and opportunities under the standards and labels program.

Incentive: A separate study has outlines the nature of incentives and financing options and their administration and the best practices in uniform policy should be the guidance for this. The principle shall be to allow the direct transfer of the financial benefit against demonstrated usage. The upfront scheme is best handled through a bank-housing company-user partnership for new buildings and utility-ESCO-user partnership for existing buildings in other cases like the works/estate departments of the CPSUs and Central Establishments authorities would have an active role.

Institutional Mechanism: The draft order only talks about the implementing agency under the Act (the designated agency) and refers to the Uniform Policy. Policy has clearly laid out an institutional structure and no separate body. It also tries to fit in all institutional arrangements under the existing institutional framework. If any new entity proposed its cost and statutes need to be drafted. The policy only suggested semi formal forums in a public-private partnership framework as championed in Europe between manufacturing association and the Government. The project advisory committee view has been the same not to go ahead with elaborate institutional framework. The grievance cells of the ULBs can be again used as a cell (referred in policy as sustainable habitat council as mentioned in National Climate Change Action Plan) as the hub. It also suggests the ESCOs to be designated as agencies for installation and monitoring. Due care should be taken to maintain an arm's length relationship with appliances supplying and manufacturing ESCOs.

5 Phase II Formulation Phase

This phase aims to stabilise the order, the institutions, especially the standards for the water heaters through a series of measures.

The most important aspect in this case is the *designating the institution(s)* by the states to implement this order using the provisions of the EC Act. If the provisions of the Energy Conservation Act are used, then BEE or Ministry of Power can designate a nodal agency to implement this order throughout the state and the state defines ULBs as users and ULBs in turn can seek the enabling alignment with the acts that impinge on building and appliances.

This is only possible, if during the limited consultation, the different ministries agree on this and direct the agencies at the state to align and converge. Then during the state and regional consultation with the Department of Energy, Urban Development and Ministry and REDAs can work out the road map for implementation.

If a separate agency is proposed, then of course the organisational structure and costs for such an institution needs to be worked out. Since no fresh regulatory framework is proposed, the uniform policy has delineated the roles and responsibilities of the proposed institutions.

Standards and Labels: The GEF project is already conducting a detailed study on this and appropriate recommendation and guidance should be included in the manual. The project is also preparing a ready reckoner and this should be part of it. The guidance relating to SWH in GRIHA (as in HVAC part of ECBC) should be the principle for computation of hot water demand. The appliance standards should be notified by BEE. This should be incorporated in the website of nodal agencies, BEE and MNRE. A website that is being developed as part of the projects should comprehensively list standards, authorised selling and reselling agencies, manufacturers, etc.

Quality Control: is key for the successful implementation of this program. Since there is no standard for the installation quality, some normative specification should be used to monitor this. The solar check up programme can be attempted in collaboration with ESCOs. It is important to have the appropriate skilled human resources for solar installations. Curriculum should be developed in consultation with manufacturers and standards organisations and for the training National Skill Development Corporation Facility shall be used.

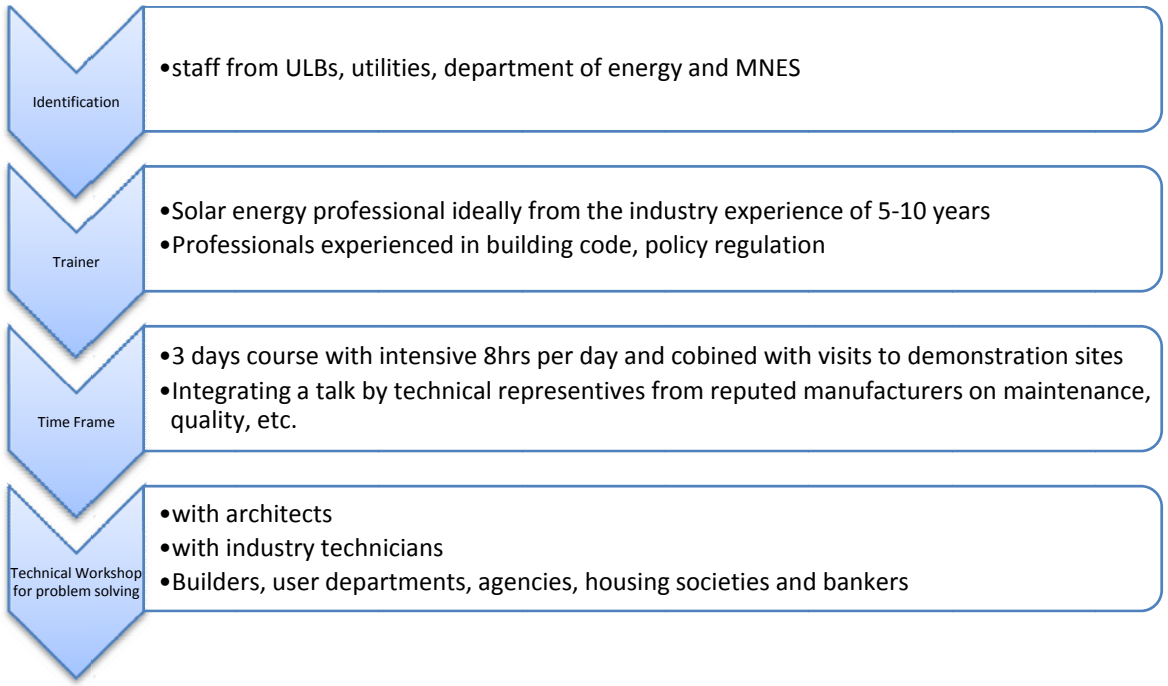
ESCOs shall be used for the installation and monitoring. UNDP GEF project has commissioned a study for area based ESCO business and the recommendation of the study should determine the modalities for ESCOs' participation.

In some sense this phase shall be used as a pilot testing phase of all the concepts proposed in uniform policy, the solar water heating order, business plan for ESCOs, incentive and regulations, etc.

6 Phase III Communication and Stabilisation

This phase will be driven largely through the flanking measures and upscaling of the pilots already attempted in phase II.

The *training approach* shall be as follows:



The user manual being developed through the project should be part of this curriculum.

Communication Plan: This is another important element of this programme. An agency is already engaged to work out the communication framework. Their recommendation shall be used to roll out this campaign.

It should be divided in to three parts and start with identification of various stakeholders and with a thorough understanding of the gaps they have in communications translating in on-usage. This may be the starting point in clearing the misconceptions.

- First part will focus on the stakeholders
- Second part will focus on demand side issues such as: success stories, climate friendliness, savings, quality, price, corporate linked campaigns in educational, health and sporting areas. This part should also highlight the policy, regulation, incentives and penalties.
- Third part shall be linked to the supply side issues such price, quality, tendering, database of installers, manufactures, suppliers, warranty, help line, etc.

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