EUROSUN 2008
1st International Conference on Solar Heating, Cooling and Buildings
7th to 10th October - Lisbon - Portugal

Maria Isabel Abreu and Rui Oliveira
Polytechnic Institute of Bragança, Campus de Sta Apolónia, Apartado 1134, 5301-875 Bragança, Portugal, isabreu@ipb.pt; roliveira@ipb.pt

The Implementation of Regulations On Solar Collectors in Buildings

1. Introduction

In the beginning of this decade, the Portuguese *Program E4 – Energy Efficiency and Endogenous Energies* have proposed an ambitious goal of 1 million m² of solar collector area in Portugal until 2010. To cope with this, it was implemented in 2001 by Portuguese Government the National Program *Solar Hot Water for Portugal* (IP-AQSpP). The Portuguese new Thermal Regulations (RCCTE) opens to all constructions partners a new opportunity for implementing more strongly renewable energy technologies in buildings.

2. Methodology

Literature review on government and institutions publications, statistics and also interviews to professionals. Analysis of the initial impacts of regulations application. E_{solar} value and SCA simulation using the regulations methodology and the official software for solar collectors, *Solterm*. Base conditions: 3 bedrooms autonomous zone (4 householders/4m² of minimal Solar Collector Area - SCA); a range of tilt roof angles between 20º-50º . Fixed parameters: south oriented panel; water storage tank with 200 l, gas boiler and solar collector standard defined by *ADENE*.

3. Results

The education and training for project design professionals

Civil Engineers are not very comfortable with this new technology. Recent graduate Civil Engineers, faced almost the same problem.

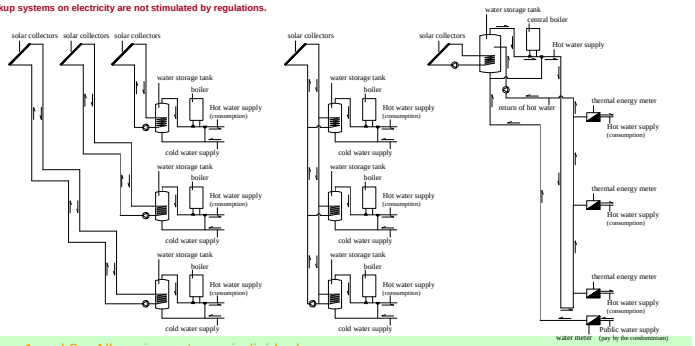
The building water supply design projects

Three types of equipments must function together: the solar collector; the storage tank or cylinder and the backup equipment.

Multi–residential building solar collector system options

	Solar Collector	Water storage tank	Backup DWH System	Operation and maintenance management
System 1	Individual	Individual	Individual Boiler	All expenses in charge of each autonomous zone
System 2	Individual	Individual	storage tank internal burner	
System 3	Collective	Individual	Individual boiler	A thermal energy meter for each autonomous zone or condominium management with a mensal rent
System 4	Collective	Individual	water storage tank internal burner	
System 5	Collective	Collective	Collective boiler	A thermal energy meter for each autonomous zone
System 6	Collective	Collective	water storage tank internal burner	

NOTE: Backup systems on electricity are not stimulated by regulations.



Systems 1 and 2 – All equipments are individual

Advantages: family system management; minimal problems with neighbours; different tilt angles for each apartment adapted to their consumptions needs. **Disadvantages**: great number of water pipes and accessories, higher building interior spaces; individual system maintenance expenses; not possible to redistribute energy; more complex system mounting.

System 3 and 4 – Centralized solar collector

Advantages: less initial investment ; better optimization of the captured solar energy and a more rational distribution; management and maintenance in charge of the building condominium administration; energy redistribution is possible; individual consumers must adapt their consumptions needs to a collective system operation. **Disadvantages:** heat exchanger in inverted system; householders must pay a service not total adapted to their consumptions needs; some homes can take more profit.

System 5 and 6 - All equipments are sheared by all householders

Advantages: less pipes and accessories; less initial investment; no individual system maintenance; total payable service of hot water supply; better optimization of the collector area. **Disadvantages:** inverted supply system; complex management of the return water of the circuit into the water storage tank; variations on hot water temperatures; lack of preparation of the condominium administrations firms; system regulated to a unique level of water temperatures; high capacity equipments and higher building structure loads; building architecture must be prepared for maintenance, repair and substitution of big equipments; local authorities (taxes to pay etc) not prepared for this service; more vulnerability to operation problems and damages.

The building water supply design project for multi-residential buildings is facing important conceptual changes.

The building design project documents and organization

The obligatory for solar collector brings to discussion the implementation of a repair and maintenance design project for residential buildings.

The integration on building architecture and construction

On pitched roofs the ideal choice was to follow the roof tilt angle, south oriented. The simulation results demonstrate that it seems acceptable, for a pitched roof south orientated (including also SW and SE) and for the nine different Portuguese locality-climatic zones, to mount the collectors close to the usual tilt building roof angles. But it would be even better that architects designed the roof tilt angles to mach with the optimal panel tilt angle previous calculated.

The cases of not obligatory implementation of solar collectors

Three mainly measures have to be implemented:
- increment strongly the envelope insulation (minimal 8-10 mm);
- choose the more energy efficient equipments as possible;
- select equipments based on gas or oil supply and not on electricity.

In historical zones usually the conventional energy must be electricity because usually there is not available natural gas supply.
There is a lack of policies and regulations on urban planning to give always guarantees to building sun exposure.

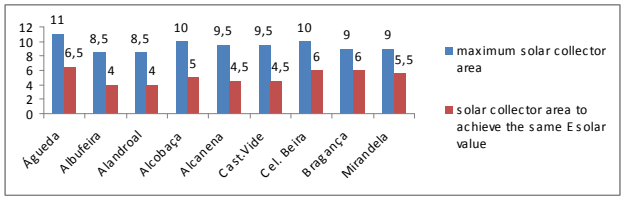
The number of householders in buildings

In cases of emigrant people and second houses there are not regular consumptions. Applying the regulations can originate an wasteful energy production and not a cost-effective solar equipment solution. In some summer occupied homes the solar collector mounting tilt angle should be lower, above 35º, if maintaining the minimal SCA required. But more flexible requirements should be established for these situations.

The application of the regulations minimal solar collector area

The maximum value obtained in simulations for E_{solar} was 2083 kWh/year (Alandroal).

What happens if we would like to reach on the others localities the same energy achieved in this locality?



Maximum SCA to achieve the same Esolar in the nine different localities

Adopting strictly the regulation minimal SCA (4 m²) we can be wasting solar energy in some climatic zones that could have more potential. It could be adopted more efficient collectors to reach a higher value but, as it usual, many designers are going to follow strictly the imposed area and even will try to reduce it to save in costs and to achieve an easily integration on roofs. Calculating the minimal SCA for the rest of the localities (maintaining the same collector efficiency) to reach the same E_{solar} of Alandroal, resulted, in most of them, SCA increments of 0,5 m² to 2,5 m². The maximal possible SCA values, without reaching overheating, was also calculated.

It would be more effective to evolve the regulations requirements to a minimal **E_{solar} value per household** adapted to different climatic zones or groups of zones. This would permit a better energy efficient /cost collector selection.

4. Conclusions

Initial impacts of the implementation of the regulations on solar collectors are inevitable. The new Thermal Regulations brings new challenges for building design and construction and represents a start point to further advances in building sustainability, energy efficiency and global quality. However, as almost all new regulations and new technology implementation, some problems and obstacles have always to be faced initially. Some additional measures and adaptations need to be taken, improving even more the application of the regulations and leading to more cost effective constructive and solar equipment solutions.