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395 - On the Sustainable Development of Solar Thermal Obligations in Buildings in the Framework of the Portuguese Case

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Abstract

This paper starts remembering the steps given in Portugal to prepare the introduction of a solar thermal obligation. Next, it presents a description of the present legislation related to the Solar Thermal Obligation (STO) and to other incentive measures for growth of the solar thermal market in Portugal. The main problems with implementation of the new regulation are analysed and systematized. Based on the acquired knowledge, further actions are presented to guarantee the success of Solar Thermal Obligation, namely proposals for updating the obligation in conformity with best practice for solar thermal installations and taking into account the new realities upcoming from the actual solar thermal market development, without sacrificing the final technical quality and user satisfaction.

Keywords: thermal performance of buildings, solar thermal obligation, solar thermal systems, solar thermal collectors, certification

1. Introduction

The first steps that allowed the present implementation of a solar thermal obligation in Portugal started in the past nineties, with the implementation of courses for installers of solar thermal systems and dissemination campaigns for good practices, in the framework of European ALTENER projects [1, 2], contributing to the development of education material to be used in installers training courses and to the establishment of the Portuguese qualification scheme for installers.

The next steps were given within the Sub Programme “Solar Hot Water for Portugal”, which was part of the general energy policy of the Portuguese Government, published in 2001[3]:

i) the implementation of a new Technical Committee on Energy, within the Portuguese Professional Certification System, that prepared and implemented a scheme for solar systems installers based on what was developed by QUALISOL project [2];

ii) the definition of a certification scheme for solar thermal collectors and factory made solar thermal systems.

In 2002, the rules of the “Incentive Measures for Renewable Energies and Rational Use of Energy” [4], applied the two certification schemes to Guarantee the Quality of Solar Thermal Systems to which the Incentives were applicable [5].

In 2006, the legislation transposing the EU Directive 2002/91/CE (EPBD) [6] was concluded and this was the final step for the implementation of a first solar thermal obligation in Portugal. This obligation is integrated in the new Portuguese Thermal Performance Building Regulation (RCCTE) [7].

2. The Portuguese STO

As it is well known, the EPBD [6] imposes the establishment of minimum requirements for thermal performance of buildings, and, for new buildings with a total useful floor area over 1 000 m^2, Member States shall ensure that the technical, environmental and economic feasibility of alternative systems such as decentralised energy supply systems based on renewable energy is considered and is taken into account before construction starts (Art. 5).

The new Portuguese thermal performance building regulations related with the EU Directive 2002/91/CE [6], were published in the Official Portuguese Journal (DR - Diário da República, http://dre.pt/), on the 4th of April 2006. The official documents are:

- Building Certification National System on Energy and Interior Air Quality (SCE [8]), which transposes, together with both RSECE [9] and RCCTE [7], to the Portuguese legislation the EPBD [6], related with energy performance of buildings, and which defines the requirements of the qualified experts that can manage the certification process;

- Air Conditioning Energy Systems Regulation (RSECE [9]), which defines hygienic and thermal comfort conditions, and imposes rules for the air conditioning systems efficiency, for its maintenance and for keeping the quality of interior air, to achieve a better global energy efficiency of buildings. It imposes as mandatory priority consideration in both new buildings and major renovations, with the exception of fault of technical availability demonstrated by the designer under a mandatory methodology, the usage of flat solar collector systems for hot sanitary water production (Clause 2.a) of RSECE, Article 32);

- The referred Thermal Performance Building Regulation (RCCTE) [7], which improves the already existing regulation, almost duplicating the thermal performance request in the new and renovated buildings and imposing the usage of solar thermal collectors for hot water production if there is favourable conditions for exposure (if the roof or cover runs between SE and SW without significant obstructions) in a base of 1m^2 per person (the total can be reduced to 50% if space is necessary for other important usages of the building).

  Other important requirements of the Portuguese STO defined within RCCTE [7] are the following:

  - For performance calculation of such systems, the product certification according to the European Standards is needed.

  - This performance calculation is done using a programme developed by INETI, the SolTerm code.

  - The installers of these systems must also be certified installers.

  - The solar system must be guaranteed by a six year maintenance contract, covering the whole solar thermal system..

- The implementation calendar **and taxes** of Building Certification National System on Energy and Interior Air Quality [10, 11], is being managed and supervised by the National Energy Agency, ADENE : it began in July 2007 for some type of new buildings, in July 2008 for all new buildings and in January 2009 is extended to existing buildings in the way of a commercial transaction.

- Model of the Certificates of Energetic Performance and Interior Air Quality [12], which defines the types and models of the certificates, the energetic classification (with the criteria for establishing a building (and their fractions) energy rate), and the certificate model application methodology by the qualified experts.

F**iscal incentives** are available at the moment in Portugal:

a) The annual income taxation of individual contributors can be reduced by 30% of the acquisition value of new equipments for renewable energy production, with a limit of €777 [13];

b) The annual income taxation of collective contributors can be reduced by the value invested in renewable energy equipment at the annual rate of 25% of the overall purchase [14].

c) The VAT incident on renewable energy equipment has the intermediate value of 12 % [15].

An incentive scheme is also available:

a) On SME Qualification and Internationalization Regulation [16], which permits to be eligible the cost of acquisition of the equipment used for both energy efficiency and renewable energy production, and their costs with technical assistance, audits and tests. The energy efficiency and renewable energy production is one of 13 components. The maximum incentive for an individual project (with all their components) is € 250,000.

b) In the Azores Islands there is a Regional Incentive Programme. It is a direct incentive to the acquisition of renewable energy systems up to 25% of the system cost and a maximum of 1000 €. For companies, the maximum value of the incentive is 250000€, also up to 25% of system cost [17].

c) Also in Madeira Island there was a Regional Incentive Programme [18] for solar thermal systems for hot water production for dwellings, between years 2002 and 2006. This has now stopped. The collector area installed with this incentive was 3200 m^2. It was an incentive up to 1000€ per apartment or 10000€ per building of apartments and up to 70% of the total investment. The incentive was calculated as a function of the energy delivered by the system.

3. STO implementation main problems

As can be seen in the RCCTE FAQs [19], the main questions are of two different types. One type is related with basic questions denoting the lack of knowledge of some stakeholders (“what is a solar thermal collector?”, and so on). Other, are related with requirements which need clarification or have not good criteria.

One example of those that are not good criteria is the rule of 1 m^2 of solar thermal collector per conventional occupant, without any reference to the thermal performance of the product.. The problem is that a solar collector with both lower performance and lower cost is enough to satisfy the requirement, but the production cost of the sanitary hot water it is not always lower. The rule was also disturbing the market because the unique imposition of the collector area, was giving advantage to the lower performant and potentially lower cost products.

To overcome this problem, it is presently allowed that a lower value of collector area (in comparison to “1m^2 per person” rule) can be accepted if the designer shows that an alternative solution collects yearly an equivalent energy of that of a standard solar thermal collector, which was defined with the following characteristics:

I) optical performance = 69%;

II) thermal losses coefficients a1 = 7.500 W/(m^2.K), and a2 = 0.014 W/(m^2.K^2);

III) incidence angle modifier at 50º = 0.87;

IV) apperture area = 1.0 m^2. ~~

The definition of the previous standard collector also permits to quantify the energy for sanitary purposes captured by solar thermal collectors, that can be substituted in the annual base, by other renewable sources and equipment (PV, wind, geothermal), even for other purposes.

Another example of a requirement which needed clarification is "what is a significant obstruction?": Quantification of this requirement was agreed recently. First, it must be considered significant obstruction, a permanent obstacle between the solar thermal collector field and the Sun, which originate shadow for both a certain collector area an a certain time, to be evaluate under the following step by step methodology ([19] FAQ M.15):

i) evaluate the solar thermal system contribution for heating of sanitary hot water with SolTerm, using an obstruction with an angle of 20º to the horizon (situation correspondent to that of a total solar exposition in a period between 2 hours after sunrise and 2 hours before sunset), without the introduction of any other obstructions;

ii) maintaining the referred obstruction angle of 20º, add the obstruction to be studied "as significant", and evaluate the solar thermal system contribution for heating of sanitary hot water with SolTerm;

iii) if the ratio of the two values of the solar thermal system contribution for heating of sanitary hot water obtained with obstruction and without obstruction is less than 0.7, the obstruction is considered "significant".

Concerning the general problem of the lack of adequate knowledge by the stakeholders, it must be said that the problem is being studied within the framework of an European project [20], where INETI participates. Some points already identified are:

- Information on Certification schemes (also of Solar Keymark) and on the tests performed and their interpretation among manufacturers and installers of Solar Thermal Collectors and Systems, although the Certification based on European Standards is already implemented and several products are already being certified;
- Development of good practice manuals, for design and installation of solar thermal systems as well as for maintenance of both medium and large solar thermal installations, is needed;
- Preparation of updated materials for courses specifically dedicated to i) maintenance of installations, ii) teachers of secondary schools (for children from the ages of 11 to 18), and iii) consumers, addressing the selection of best solution .
- Introduction of modifications in the *curricula* of architecture courses, covering in large scale the general bioclimatic aspects of construction, as well as, specific aspects related to solar thermal performance and its relation to thermal performance of buildings.

4. Further implementation of "Solar Thermal Obligation" measures

Within the recently approved Energy Efficiency National Action Plan [21], some additional actions of the type "Solar Thermal Obligation" are introduced in the following programmes:

i) Energy Eficiency in Buildings

   a. Measure "Micro-production" (R&S6M1) – incentive to micro-power production (PV, wind, hydro, biomass, ...), with the mandatory installation of at least 2 m^2 (on a basis of 1 m^2 per 1 kW installed) of solar thermal to access a bonus on the kWh tariff, with exemption of the municipal licensing for small installations,

   b. Measure "Service Buildings" (R&S5M2) – Implementation of solar thermal and of microproduction in schools;

ii) Renewables in the Moment

   a. Measure "Solar Thermal" (R&S6M2), to get a solar thermal market of 175,000 m^2/year – dissemination campaigns, incentives programme for the installation of new solar thermal (fiscal benefit up to 30% of the investment within the Income

Tax of Natural Persons, with a limit of €777), mandatory installation of solar thermal in new buildings, oriented programmes for specific segments (social dwellings, swimming-pools and showers, solar condominium);

iii) Energy Eficiency in the Public Sector

a. Measure "Buildings" –

i. Energetic Certification of the State Buildings (E8M1), covering 100% of the State buildings until 2015,

ii. Solar thermal in swimming pools (E8M2) – installation of solar thermal systems for solar hot water in swimming-pools and balnearies, covering 285 swimming-pools (property of both the State and the private sector) until 2015, including 100% of public swimming-pools and Balnearies,

iii. Solar thermal in sport parks (E8M3) – installation of solar thermal systems for solar hot water, covering 80% of the actual balnearies until 2015.

Meanwhile, it is expected a revision of the actual regulation [7-9], in the way of the answers given on the RCCTE Questions & Answers [19], as well the implementation of actions to overcome the referred (in point 3) lack of adequate knowledge by the stakeholders.

5. Further actions needed

The knowledge obtained seems to show that the STO contribution to a sustainable growth of a solar thermal marked in Portugal must be viewed in the aspects described in the following subsections, as pointed out in the framework of the RCCTE Questions % Answers [19] of the work carried out within the ongoing European project PROSto [20], and of the Portuguese Efficiency Energy National Action Plan [21]:

5.1. Business environment

The present STO must be integrated as a part of a "policy package", including other legal as well as financial and information/training/awareness instruments.

A "policy package" in the way of "zero building emissions" must include basic requirements for energy savings, namely, limitation of energy demand, energy efficiency of thermal installations, energy efficiency of lighting, minimal Solar contribution for sanitary hot water, and minimal PV or small wind contribution for electricity.

A STO must define clear requirements with as few exceptions as possible (as a means to reduce non-compliance).

Quality is key: certification of thermal solar system and components – solar collectors, factory made systems, and custom built systems; planner, designer and installer certification; technical impositions in the regulations (supported by a very consistent manual of actual good practices for solar thermal applications, with a flexible method to follow new developments); guarantee impositions (maintenance contract).

Public awareness is key (to create an understanding that this is not another awful bureaucratic burden) – on-line information (lists of certified equipments, installers, technical description of the equipments, manual of good practices, schoolar materials (class notes, computer codes, homework assignments, etc.), etc.) is key!.

Leading by example – public buildings!

5.2. Barriers

Complex regulation: Keep it simple! E.g. clear calculation methods to accomplish requirements, checks.

Not clear roles of the actors involved: Separate roles of developing & enacting, operating & monitoring, training, etc.

Lack of knowledge of the actors involved: Improve hearings, training courses for professionals, information campaign from the beginning (before the STO), modification of architecture school curricula to solve the problem of the architectural barrier: what to do to prepare a building to solar (place for the collectors (and their integration); place for technical rooms)), weekly courses for teachers and consumers, etc.

Resistance from ”external” sectors: Involve them from the beginning (hearings), offer them enough alternative solutions.

5.3. Flanking measures

More targeted actions are needed, e.g. training for Municipality personnel, campaigns towards building companies, training on large scale solar plants for designers, etc.

Information & training for suppliers (including planner, designer and installers) and users are key.

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