

On an Integrated DSM package associated to a Solar Thermal Obligation. The ProSTO EU project and the Portuguese Experience

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Abstract

Based on the work that it is running within the ProSTO EU project (<http://www.solarordinances.eu/>), this paper presents a tentative approach to an integrated demand side measures (DSM) package that must be associated to a solar thermal obligation (STO) in a community. All the complete set of measures that must be taken to succeed will be presented.

The experience shows that it is necessary to get an integrated “policy package” in the way of “zero building emissions”, around the kernel key point of clear requirements, aiming energy savings, namely for energy demand limitation, and energy efficiency of thermal installations.

A parent kernel key point of this “policy package” is quality: certification of thermal solar system and components; planner, designer and installer certification; technical mandatory requirements in the regulations; mandatory guarantee (maintenance contract). All relevant documents of these quality items must be integrated in the Building Use Manual for easy management.

Another kernel key point, this one with focus on overcoming barriers, is public awareness, throughout on-line information (lists of certified equipments, installers, technical description of the equipments, manual of good practices, scholar materials (class notes, computer codes, homework assignments, etc.), etc.), and the implementation of training courses for all stakeholders.

1 Introduction

To talk about Demand Side Management is to talk about how to implement policies (based on accepted principles) and measures (actions that must be taken under an accepted principle). It is similar with what happens with quality management – for each one of quality principles we can define several measures. To implement a measure we need to organize and manage a process, which is evaluated throughout their effectiveness and efficiency [1]

The demand side policies and measures that must be followed and undertaken for the energy market were developed by the IEA-DSM Tasks. “DSM offers solutions to problems such as load management, energy efficiency, strategic conservation and related activities” (see <http://www.ieadsm.org/>). Meanwhile, as we can read on page http://www.iea.org/techno/iareults.asp?id_ia=8, “DSM is increasingly finding new applications as a market-based offer in liberalized energy markets. At the same time DSM is being used in emerging energy efficiency policy measures”.

At the European Union level, the first demand side measure with interest to the solar thermal market was taken throughout Directive 2002/91/CE (the so called EPBD), imposing the consideration of decentralized energy supply systems based on renewable energy for new buildings with a total useful floor area over 1 000 m². This mandatory requirement was consolidated throughout Directive 2009/28/EC (the so called renewable energies directive), establishing a common framework for the promotion of energy from renewable sources, imposing the

implementation of a national renewable energy action plan by each Member state, to ensure that the share of energy from renewable sources is at least as established on part A of Annex 1. Meanwhile, the Directive 2005/32/EC was approved, establishing a framework for the setting of ecodesign requirements for energy-using products, which whereas (4) point out energy efficiency improvement as a substantial DSM to be adopted.

By other hand, in the framework of EPBD recast it is well established the link between DSM and „energy efficiency“ (COM(2008) 780 final/2 – 2008/0223(COD)) [2]) - “energy- efficient technologies”, “energy efficiency services”, “efficient energy systems”, “energy-efficient equipment”. “energy efficiency issues” , and “standards for energy efficiency” (COM(2008) 780 final) [3]).

2 The ProSTO EU Project and the Portuguese experience

2.1. The ProSTO EU Project

The EU framework, and base line assessment – including success factors and performance indicators were presented by the ProSTO coordinator elsewhere [4].

Meanwhile, as a conclusion of the study carried out within ProSTO Project, it was presented, as a blueprint [5], a tentative approach for a STO implementation, with focus on:

- a) Preparatory Steps, including a baseline assessment, the legal base for a STO, the potential of solar thermal in a community, the economical tenability, and hearings with stakeholders and society groups;
- b) Drafting the STO, with general recommendations (simple is beautiful), scope of the STO (which buildings included), quantitative obligation, quality requirements, architectural integration / protected buildings, and administration and procedures;
- c) Flanking measures, integrating public relations, local campaigns, demand side measures, supply side measures, financial incentives, and training of staff; and
- d) Monitoring and evaluation, proposing monitoring the market, evaluation as internal procedure, and supervision and penalties.

Of course, this blueprint presents only an introduction, the project team advice, and one or more good practices examples for each item.

By other hand, the ProSTO Project Team has developed an useful tools set, which is also available on the referred project website.

But it must be underlined, as referred in the first project deliverable [6], that a STO need well defined objectives, and well defined processes, with well defined roles and tasks for all actors evolved (promoter, political decision makers, public administration, stakeholders and advisors).

2.2. The Portuguese experience

The Portuguese case was presented elsewhere too [7, 8], and can be summarized as follow:

During 2001 the Forum “Renewable Energies in Portugal” took place, with several groups responsible for studying each area [9]. One of them was the group for the “Solar Thermal”.

The conclusions of the Forum were integrated in the Program E4 (Energy Efficiency and Endogenous Energies) [10]. In the framework of E4, a sub-program was launched, called “SWH - Solar Water Heating for Portugal” [11].

The main measures considered to be implemented were:

- Image Promotion of Solar Thermal Energy:
 - ❖ Implementation of promotional campaigns of information for installers, entrepreneurs, and users.

- ❖ Creation of an information Green Line.
- Development of two structural ways of development for the solar thermal market: selling solar hot water (via ESCOs – Energy Service Companies) and selling/installation of SWH systems.
- Quality Certification:
 - ❖ Certification of products.
 - ❖ Certification of installers and designers.
- Incentives and subsidies:
 - ❖ Reinforcement of fiscal incentives.
 - ❖ Reformulation of the financial support in force (at that time, the so-called MAPE (Support Measure of Energy Production within the Portuguese Economy Operational Program)).
- Complementary measures:
 - ❖ Promotion of active solar thermal within the revision of the building's thermal regulations.
 - ❖ Promotion of solar thermal complementarily with gas and electricity.
 - ❖ Promotion of solar thermal into financing institutions, especially those responsible for housing promotion.
 - ❖ Support of the R&D activities.
 - ❖ Promotion of the Good Practices.
 - ❖ Constitution of a Solar Thermal Observatory.

Taking into account these proposed measures,

- i) it was developed within a sub-task of the European project QUALISOL [12] a complete proposal to be presented to a technical committee within, for the case, Portuguese National System of Professional Certification, defining the solar thermal installer professional profile, with their activity global goal, specific activities, knowledge's, skills – skills-to do and skills-to be, and thematic areas of training;
- ii) it was created (Portaria n.º 1484/2002 (2.^a série) and Despacho n.º 21 871/2002 (2.^a série), in D.R. – II Série N.º 234 — 10 de Outubro de 2002) a Sub-Commission to propose the new energy efficiency in buildings regulation; and
- iii) it was approved by the Portuguese government the public initiative called Solar Hot Water to Portugal [11], within the so-called E4 – Efficiency Energy and Endogenous Energies programme (approved by Council Ministers Resolution n.º 154/2001, D.R. - I Série - B N.º 243 — 19 de Outubro de 2001) [10], implementing all the above referred measures.

Meanwhile, it was approved

- a) The novel solar thermal installer certification scheme (by Portaria n.º 1451/2004, de 26 de Novembro, D.R. - I Série - B N.º 278 — 26 de Novembro de 2004);
- b) The novel set of standards on thermal solar systems and components, concerning solar collector (EN 12975-1&2: 2000 and 2006) and factory made systems (EN 12976-1&2: 2000 and 2006), and, within both Portuguese Quality System and Solar Keymark, a certification scheme for both solar thermal collectors and factory made systems; and
- c) The novel building thermal energy efficiency regulation, transposing EU Directive 2002/91/CE on the energy performance of buildings, but also in the sense now given by Directive 2009/28/EC on the promotion of the use of energy from renewable sources,

establishing as mandatory for all buildings comprised by Thermal Performance Building Regulation (RCCTE) (Decreto-Lei n.º 80/2006, de 24 de Abril) 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 1m² per person (the total can be reduced up to 50% if space is necessary for other important usages of the building); and that

- 1) the annual energy production of the solar system must be calculated with a programme developed by INETI (SOLTERM programme),
- 2) for performance calculation of such systems, the collector certification according to the European Standards is needed,
- 3) the installers of these systems must also be certified installers,
- 4) the solar system must have a six year guarantee of maintenance.

It must be underlined that this regulation is a part of the new Portuguese regulations for buildings arising from EU Directive 2002/91/CE. The other parts are the Building Certification National System on Energy and Interior Air Quality (SCE) (Decreto-Lei n.º 78/2006, de 24 de Abril), and the Air Conditioning Energy Systems Regulation (RSECE) (Decreto-Lei n.º 79/2006, de 24 de Abril).

Within the SCE it was implemented a working group as a consultant of the SCE manager, which prepare the answers for all relevant questions.

- d) The novel National Action Plan on Energy Efficiency (Resolução do Conselho de Ministros n.º 80/2008, de 20 de Maio), with specific programmes for:
 - 1) Energy efficiency in buildings, with specific measures for micro-production (giving an incentive to micro-power production ((PV, wind, hydro, biomass, ...) with the mandatory installation of at least 2 m² (on a basis of 1 m² per 1 kW installed) of solar thermal to access a bonus on the kWh tariff, with exemption of the municipal licensing for small installations), and for Service Buildings (implementing both solar thermal and micro-production in schools);
 - 2) “Renewables in the moment”, with specific measures for solar thermal, to get a solar thermal market of 175,000 m²/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));
 - 3) Energy efficiency in the public sector, with a specific measure for buildings to get state buildings energetic certification (covering 100% of the state buildings until 2015), solar thermal 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), and solar thermal in sport parks (covering 80% of the actual balnearies until 2015).
- e) Several municipalities are approving updates on their edification regulation including well defined requirements concerning building energy efficiency and renewable energy integration as well the existence of one Building Energetic Dossier for each one of the buildings, including copies of all relevant documents, namely Building Energy Performance Certificate, Building Energy Performance Certification Process, Solar Thermal System Design, Installation, Operation and Maintenance Processes, contracts with energy service suppliers, and so on.

2.3. The Portuguese national, regional and municipal legal measures taken

The referred RCCTE Solar Thermal Obligation applies to all Portuguese territory. At regional level are decentralized the responsibility of SCE management and the establishment of both an incentive scheme and the amount of taxes to be paid by citizens and organizations. At local level, the municipalities can establish their own municipal planning and edification regulations, as well their own municipal taxes.

The first Portuguese Municipality that approved a regulation chapter dedicated to energy efficiency and renewable energies integration was Lisbon, throughout the REMUEL (Lisbon Municipal Urbanization and Edification Regulation [13]), with specific rules, complementary of those approved within the referred national regulation, for:

1. Building energy performance improvement and both natural and energy resources rationalization;
2. Energy efficiency (including the referred existence of one Building Energetic Dossier for each one of the buildings);
3. Controlling of solar gains;
4. Natural ventilation gain;
5. Renewable energy using, specifically addressing solar thermal collectors need for architectural integration and also the obligation to install centralized systems in new residential buildings.

The Lisbon example was followed by Almada (in front of Lisbon, on the the other Tagus river side), in their RUMA (Almada Municipal Urbanization Regulation [14]).

At the level of Local Plans there are also examples of good practices, like that of the “Plano de Pormenor de Salvaguarda da Baixa Pombalina” (Historical Lisbon Downtown Local Plan) [15], establishing, among others, specific rules to solar thermal systems integration (see ProSTO Blueprint [5]).

In the field of financial incentives, to promote sustainability of the newel Portuguese solar thermal market, the most important measures taken at national level where those of

- i. a medium level of VAT for solar thermal products (12 until June 30th, 2010, and now 13%);
- ii. a partial deduction applicable to the income tax (30% of the total cost, with the limit of 803€ (value to 2010))
- iii. a higher allowed depreciation rate for companies on the acquisition of solar thermal equipment (annual depreciation rate of 25% since the acquisition year).

To push for an increased market growing it was implemented during 2009 a national campaign to support the acquisition of solar thermal systems by uni-familiar householder, given an incentive of 50% of the acquisition cost, and offering loans at a lower-than-market interest rate.

By other hand, it must be underlined that, to citizen’s awareness rising, there is on line all information concerning:

- building energy certification system (the referred SCE), on the official site of ADENE, <http://www.adene.pt/ADENE/Canais/SubPortais/SCE/Introducao/Apresenta%c3%a7%c3%a3o.htm>, which is the SCE manager;
- solar thermal certification manual, lists of certified both solar thermal installers and equipments, training entities, etc., on an official site managed by ADENE,

<http://www.aguaquentesolar.com/>; and

- national energy policy, on the official site of the Portuguese General Directorate of Energy (<http://www.dgge.pt/>).

At local level, the municipal edification regulations and local plans are also available on-line.

Finally, it must be also underlined, by one hand, that all answers given to all FAQs by the SCE manager are available on-line on the referred web site, and, by other hand, the existence of an on-line platform – *Casa Certificada*, <http://www.casacertificada.pt/>, which promotes and manages the relationship between demand and supply of Energetic Certificates.

2.4. Lessons learned from the Portuguese experience

The Portuguese experience has been studied at university level, namely carried out by some MBA Students of the Manchester Business School, within the “Casa+ Building Codes” study promoted by the referred Portuguese SCE manager – ADENE, to examine “the implementation of improvement measures related to energy efficiency that are recommended by the qualified experts on energy certificates, indicating the most important measures and proposals and how to implement them in Portugal (<http://www.adene.pt/ADENE/Canais/Projectos/BuildCodes.htm>)”.

One of the points that must be here underlined is that of the Portuguese impact the dwellings market:

Table 1 - Impact of the 2006 Portuguese STO regulation: Distribution of level of energy efficient class of Portuguese dwellings per year of construction, source: see reference ‘Financial Incentives for the Adoption of Residential Energy Efficient Products’ [16].

Year Range	High Efficiency Dwellings	Low Efficiency Dwellings
1950-1959	4.64 %	95.33 %
1960-1969	5.62 %	94.38 %
1970-1979	5.00 %	95.00 %
1980-1989	5.98 %	94.02 %
1990-1999	16.26 %	83.74 %
2000-2005	46.08 %	53.92 %
2006-2009	62.83 %	37.17 %

By other hand, it must be underlined also that, the Portuguese SCE manager ADENE has created an adviser group to give answer to all questions concerning the Portuguese STO implementation. Among others it is interesting to refer here those related with

- the Portuguese STO rule of 1 m² of solar thermal collector per conventional occupant, without any reference to the thermal performance of the product, which can now be overcome if the designer shows that an alternative solution collects yearly an equivalent energy of that of a standard solar thermal collector with the characteristics referred elsewhere [7];
- what is a significant obstruction?, which can be overcome following a methodology described also elsewhere [7];

- iii. the question of the maintenance guarantee contract, which requires now a declaration signed by the customer and the certified solar thermal system installer and a solar thermal system preventive maintenance plan (answers to RCCTE questions M10 & M25 to M29) [17].

3 An integrated DSM package associated to a STO

As referred by Christiane Egger on Brussels ProSTO Workshop presentation (slide 9), for the case of the solar thermal market, we have to look for demand side measures that can create an environment favorable for “Creating a market for solar energy”. Egger underlined different types of measures: awareness raising, energy advice services, financial support, legal measures, solar obligation, and contracting [18].

A STO must integrate requirements covering all these DSM, namely calculation methods of energy needs to produce solar hot water, certification of designers, installers and equipments, and maintenance guarantee of solar thermal system efficient operation for a well defined period after installation.

To be effective, the STO should be integrated on both the thermal building behavior characteristics regulation, and the building energy certification national system, with well defined certification procedures and building energy rates (BER).

The municipal edification regulation must define precise requirements concerning building energy efficiency and renewable energy integration. The existence of the Building Energy Manual for each one of the buildings is crucial to assure the building’s adequate use and maintenance, and should include copies of all relevant documents, namely Building Energy Performance Certificate, Building Energy Performance Certification Process, Solar Thermal System Design, Installation, Operation and Maintenance Processes, contracts with energy service suppliers, and so on.

In order to support the citizen, STO implementation management authority must implement institutional STO info point, with all relevant information – legislation, information about FAQs, licensing authorities, professional of the sector, qualified experts, qualified equipment, qualified installers, training, installers certification manual, etc;

4 Conclusion

The gained experience, presented in this paper, shows a complete set of integrated DSMs that must be undertaken by countries, regions and municipalities to implement properly their own STOs.

As can be seen, the Portuguese experience matches well with the tentative approach for a STO implementation given by the both referred ProSTO blueprint methodology and ProSTO tools.

The studies carried out until now show very clearly that the Portuguese STO can be considered a successful case.

It is expected that the in course RCCTE revision will integrate the referred best practices experience gained and new requirements concerning energy efficiency improvement.

References

- [1] ISO/TC 176/SC 2/N 544R3 - ISO 9000 Introduction and Support Package: Guidance on the Concept and Use of the Process Approach for management systems, available, in 05.07.2010, in <http://isotc.iso.org/livelink/livelink/fetch/2000/2122/-8835176/-8835848/8835872/8835883/customview.html?func=ll&objId=8835883&objAction=browse&sort=name>.
- [2] COM(2008) 780 final/2 – 2008/0223(COD) – Opinion of the European Economic and Social Committee on the “Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the energy performance of buildings(recast)”, Off. Jour. of the E. U., C277/75, Brussels, 17.11.2009.

- [3] COM(2008) 780 final –Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the energy performance of buildings(recast), Brussels, 17.11.2008.
- [4] M. Calderoni and R. Battisti, Paper 356 – “Solar thermal in buildings in the light of the new EC draft Directive – The “ProSTO” project”, Eurosun 2008, Lisboa, Portugal.
- [5] ProSTO Blueprint (available, in 05.07.2010, in <http://www.solarordinances.eu/ProSTOProject/Projectoutcomes/tabid/391/Default.aspx>).
- [6] ProSTO deliverable entitled “Solar thermal ordinances - State of the art in Europe”, September 2008 (see <http://www.solarordinances.eu/ProSTOProject/Projectoutcomes/tabid/391/Default.aspx>, Technical report on the state of the art analysis).
- [7] M.L. Prates, J.C. Costa, J.F. Mendes and M.J. Carvalho, Paper 395 – “On the Sustainable Development of Solar Thermal Obligations in Buildings in the Framework of the Portuguese case”, Eurosun 2008, Lisboa, Portugal (see <http://www.solarordinances.eu/Portals/0/Details%20about%20Portuguese%20STO.pdf>).
- [8] M.L. Prates, J.C. Costa, J.F. Mendes and M.J. Carvalho, “On the Best Practice Implementation of Solar Thermal Obligations - The ProSTO EU Project and the Portuguese Experience”, Proceedings of the 3rd International Congress of Energy and Environment Engineering and Management, 25-27 November 2009, Lisboa, Portugal.
- [9] Forum Energias Renováveis em Portugal, Relatório Síntese, edição ADENE/INETI, 2001 (available, in 05.07.2010, in http://www.aguaquentesolar.com/publicacoes/16/FORUM_Relatorio-Sintese.pdf).
- [10] Programa E4 - Eficiência Energética e Energias Renováveis, approved by Resolução do Conselho de Ministros N.º 154/2001, September 27th, DGE edition, 2001 (available, in 05.07.2010, in http://www.aguaquentesolar.com/publicacoes/14/Programa_E4.pdf).
- [11] Programa "Água Quente Solar para Portugal", ADENE/DGE/INETI edition, 2001 (available, in 05.07.2010, in http://www.aguaquentesolar.com/publicacoes/15/Brochura_AQS.pdf).
- [12] QUALISOL Project – *Installer Qualification for Solar Heating Systems (AL/2000/107), Cluster N.º 4 – Promotion of Solar Thermal in Mediterranean Countries (Project Number: 4.1030 / C / 00 / 004)* (available, in 05.07.2010, in <http://www.ambienteitalia.it/solare/download/Extended%20Summary%20Qualisol.pdf>).
- [13] Regulamento Municipal de Urbanização e Edificação, Aviso N.º 1229/2009, in Diário da República – II Série N.º 8, de 13-01-2009 (available, in 05.07.2010, in <http://ulisses.cm-lisboa.pt/data/002/0015/remuel.pdf>).
- [14] Regulamento Urbanístico do Concelho de Almada, Edital N.º 476/2008, in Diário da República – II Série N.º 93, de 14-05-2008 (available, in 05.07.2010, in http://www.m-almada.pt/ngt_server/attachfileu.jsp?look_parentBoui=13418779&att_display=n&att_download=y).
- [15] Plano de Pormenor de Salvaguarda da Baixa Pombalina (available, in 05.07.2010, in <http://ulisses.cm-lisboa.pt/data/002/004/index.php?ml=4&x=ppsbaixa.xml>).
- [16] Dionis Arvanitakis, Financial Incentives for the Adoption of Residential Energy Efficient Products - An analysis of European programmes and best practices, Manchester Business School, edited by ADENE, available, in 05.07.2010, in <http://www.adene.pt/NR/rdonlyres/D25AD380-35C9-4548-8367-7EB5EB7FF793/1214/FinancialIncentives.pdf>.
- [17] Perguntas e Respostas sobre o RCCTE, versão 1.6, November 2009, edition ADENE (available, in 05.07.2010, in http://www.adene.pt/NR/rdonlyres/FDF72595-33F6-4B4E-8904-660506CB50B6/1198/PR_RCCTE_Versao16.pdf).
- [18] Christiane Egger, “Solar Thermal Upper Austria – Systematic market promotion in one of Europe’s leading solar thermal regions”, 31.05.2008, Brussels, (see http://www.solarordinances.eu/Portals/0/04_Egger.pdf).