WP4_D4.5
TECHNICAL REPORT SUMMARISING THE COST-BENEFIT ANALYSIS

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1. INTRODUCTION

In this document firstly makes a brief introduction to the cost-benefit analysis concept, understanding each of the parts that make up the two terms, applied to the implementation of Solar Thermal Ordinance.

It then makes a summary the analysis by each of the communities participating in the project proSTO (Lazio, Murcia, Lisbon, Giurgiu and Stuttgart).

Finally, it presents a set of conclusions by pooling what each community has made, and some recommendations to improve the analysis by each community and provide the tools for proper cost-benefit analysis of future Solar Thermal Ordinance

2. COST-BENEFIT ANALYSIS

The desirable fundamental formula for cost-benefit analysis is basically:

Benefit> Cost

But when the **market does not support,** this change of direction takes place in the equation:

Benefit <Cost

The purpose of this analysis is to understand better this equation through an analysis of its components and, if possible, to evaluate all of them in monetary terms.

This would help to increase the efficiency of the implementation of STO based on knowledge of what actions will have a greater impact.

What to do?

A. Benefit increment

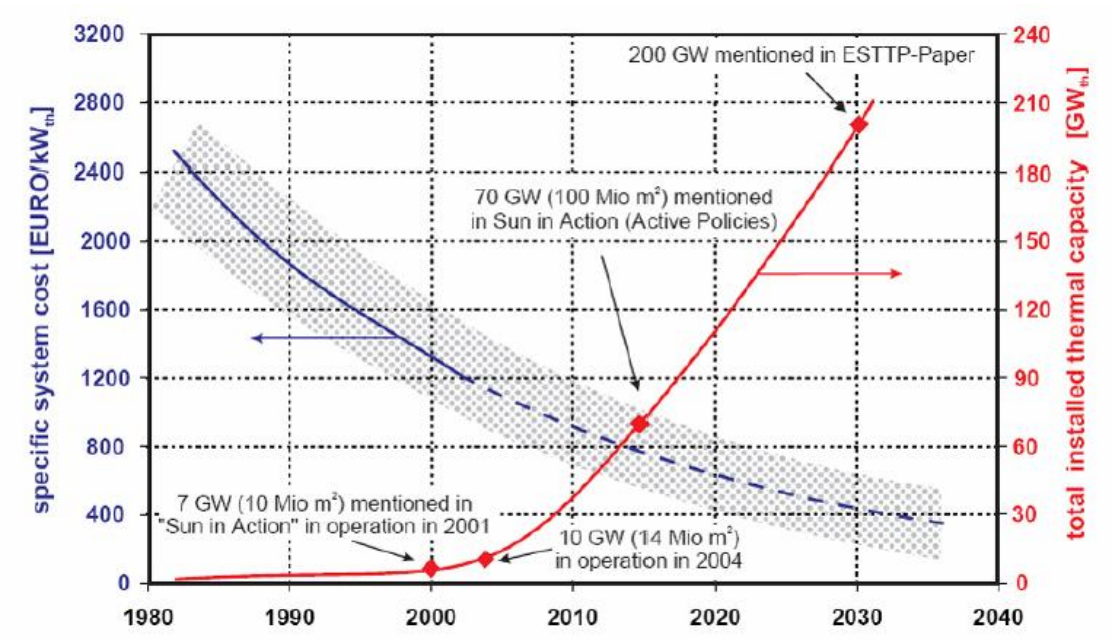
To increase real and perceived benefits of a Solar Thermal Ordinances the following criteria must be established:

- Streamlining administrative procedures for implementation of the ordinance
- Using implement tools available on the internet
- Assess the replaced conventional energy savings
- Rating avoided CO_2 emissions
- It is an obligation that contributes to stop climate change.
- Including incentives in the ordinances
- Improving the social image of solar thermal energy:
    - It is a renewable energy technology that is advanced, reliable, efficient and mature
    - Cheap and clean HOT is produced
    - It is always free with no cost for use
    - It is long-lasting
    - Employment source
    - Housing is revalued

B. Reducing Cost

To reduce the real cost of Solar Thermal Ordinances the following criteria must be established:

- Revitalizing the market by ensuring sustained and sustainable growth
- Searching subventions for help to implementation of the ordinance
- Avoid unwanted costs of implementing ordinance
- Reduce administration procedures
- Tax relief from national governments



Future development costs: Development of specific costs and installed capacity for small centralized systems of forced circulation in Europe. *Source: European Solar Thermal Technology Platform (ESTTP).*

3. SUMMARY OF THE ANALYSIS ELABORATED BY TARGET COMMUNITIES

3.1. INDEX OF WORKS MADE BY COMMUNITIES.

The different communities have given the following documents:

- **Lazio**: this community decided to elaborate an analysis of the ProSTO through the interrelated influential factors, using a SWOT analysis as a tool. A CBA has not elaborated as in the rest of communities.
- **Murcia**: It has made been a simple analysis cost benefit having into account both the administrative costs as technical of the implantation of the ProSTO in the city, and the economic and social benefits.
- **Lisbon**: Similar to Murcia, it has elaborated an analysis cost benefit where it has taken into account the administrative costs of technical installation, as well as the economic benefits (power saving) and social benefits.
- **Giurgiu**: It cannot be used in the case of this community, since this is not about a legal decree but rather recommendations with respect to the solar use of energy in buildings
- **Stuttgart**: Like Murcia and Lisbon, this community carries out a brief analysis cost benefit about the expenses of installation, power saving and social benefit.

3.2. LAZIO

3.2.1. SWOT ANALYSIS

Lazio has elaborated a SWOT (Strengths, Weaknesses, Opportunities, and Threats) to value the potentiality of the diffusion of the STO in its community.

STRENGTHS	WEAKNESSES
• Political will of the community • Will of the public and private parties to use the incentive to buy solar paddles • Citizens sensitivity	• Little knowledge of the utility of the solar paddles of the population • Incapacity to make an analysis cost-benefit for the purchase of the system • Negative aesthetic perception of the solar paddles and deposits of storage • Lack of professionals adapted for the installation
OPPORTUNITIES	**THREATS**
• Fiscal support (economic incentive for the purchase) • Administrative simplification for the installation • Regional financing for the development of professionals and the implantation • Innovation in the professional sector	• Landscaping and artistic bonds (Estate, Region, Province) • No valid consultations of the community to write up an efficient STO

3.3. MURCIA

3.3.1. Design of cost-benefit analysis

Analysis Stage	Parameter of analysis	Value of analysis
1	Object of study	STO in buildings through legal establishment versus fossil fuel consumption (*status quo*)
2	Time spam	25 years
3	Inflation	2% yearly
4	Costs and benefits	Costs: a) Making of STO obligations (talkings, hearings, drafts) b) Solar installation c) Maintenance (resources, time, automation) Benefits: d) Family and shops energy saving
5	Quantification	Costs: a) without a monetary value b) 3.000 € c) 1.000 €/25 years TOTAL: 4.000 €/25 years Benefits: d) 2.191 Toe/year; 25.480 GWh; 7.500 €/year per family/business
6	Social analysis	• Increase of jobs • Economic saving (money for other uses) • Energetic Independence • Decreasing the emissions of CO2 • Information about energy responsibility

1Toe: 11 630 kWh

3.4. LISBON

3.4.1. Design of cost-benefit analysis

Analysis Stage	Parameter of analysis	Value of analysis
1	Object of study	STO in buildings through legal establishment versus fossil fuel consumption (status quo)
2	Time spam	13, 21 and 11 years, following the source of replaced energy
3	Inflation	Not determined
4	Costs and benefits	Costs: a) Previous administrative and technical requirements b) Solar system Benefits: c) Family and shops energy savings
5	Quantification	Costs: a) without a monetary value b) 2.300 € Benefits: c) Substitute of electrical energy: 200 € / 13 years, 2.600€. Substitute of natural gas: 110 € / 21 years, 2.310 €. Substitute of butane gas: 250 € / 11 years, 2.750 €.
6	Social analysis	• Creation of 2.500 jobs by 2009 • Landscape benefit (architectural integration) • Economic saving (money for other uses) • Energetic independence • Decreasing the emissions of CO2 • Information on energy responsibility (continuous monitoring)

3.5. GIURGIU

It cannot be applied in the case of this community, since this one is not about a legal STO but recommendations with respect to the solar use of energy in buildings.

3.6. STUTTGART

3.6.1. Design of cost-benefit analysis

Analysis Stage	Parameter of analysis	Value of analysis
1	Object of study	STO in buildings through legal establishment versus fossil fuel consumption (status quo)
2	Time spam	20 years
3	Inflation	Not determined
4	Costs and benefits	Costs: a. Solar installation Benefits: b. Residential and shops energy savings
5	Quantification	Costs: a. 28-36 € / m2 of house Benefits: b. Savings of 10-20 kWh / m^2 of house for HSW. And 15-25 kWh / m^2 of house for HSW + Heating.
6	Social analysis	• Sustainable and effective development of local solar market • Smaller cost of the administration (compared with the subsidies). • Positive image of the city (modern, sustainable)

4. SUMMARY OF WHAT HAS BEEN DONE

Murcia, Lisbon and Stuttgart agree on the cost benefit analysis model, analyzing on the one hand the administration costs not quantified monetarily in any case, and the expenses of installation of the solar production system and the maintenance of the systems, on the other hand. Then also agree in the analysis of the power saving after the application of the renewable solar energy sources.

The figures numbers are similar between the three communities, displaying differences between the ways forms to analyze them and to express them.

The social analysis is common also in the three communities and in all of them very similar benefits are exposed like:

- The development of the local economy

- The creation of jobs

- The power saving versus CO2 emission

As far as Lazio is concerned an analysis different from the rest of communities has been elaborated concentrating on factors that influence in the development of a STO, without considering economic calculation. The SWOT analysis allows having a global vision of the situation in a less empirical way, where the participation of all the stakeholders of the project becomes necessary with the purpose of agreeing on opinions and decisions.

This system used by Lazio is a good complement to the cost benefit analysis, mainly leading to social improvement and future expectations.

It may be lacked perhaps a more complete and exhaustive economic analysis of the costs of the project (mainly of the externalities, positive as much negative) and of a monetary quantification of the benefits of the same (like the economic values.

5. CONCLUSIONS / RECOMMENDATIONS

What is expected of a STO to get full benefit? :

- Requirement
- Monitoring
- Control

As mentioned above, the solar obligation is another **institutional support** for market development and hence, reduced costs and increased profit. It is a component of the pillars of institutional support.

But this support should be simple, without conflict, without obstacles as far as possible, the **administrative bureaucracy**. Should be avoided and the builder / user should be helped to start the installation.

There is a lack of real **control** over the facilities by national regulations and support. The ordinance can bring this control (the solar ordinance can and should do the control and monitoring of the plant). With this control we can achieve greater energy efficiency of the solar system through a proper and rigorous operation of the system and therefore greater energy and environmental benefit. For the benefit to be maximized, the facilities should be "certified" and as efficient as possible, with high efficiency. If all this is established, the ordinance will increase the benefit.

One of the key tasks to consolidate, expand and improve market conditions is to extend the ordinance to **large installations of consumption** (public buildings, businesses, and industry). With this, we reduce costs and we all obtain greater global benefit.

Likewise, it is **also** necessary to **promote other uses** of solar thermal systems apart from Sanitary Hot Water: heating, cooling, heating fluid, etc.

There are several **fundamental parameters** when assessing and studying the cost / benefit of solar thermal ordinance:

- M^2 potentially installable
- Population energy requirements
- Thermal energy produced per capita, per city, per housing
- € / year saved
- CO_2 equivalents / year
- Jobs
- Efficiency of the system (certification, calculation of losses by shading, control, etc.)
- Community image
- Social benefit
- Unnoticed profit, environmental, global
- Principle of intergenerational responsibility

There is a key point in this analysis: sometimes the benefit is not measurable or noticed by the citizen / user. It requires a change of consciousness and perception. Citizens must understand the global environmental benefit we bring to install a solar heating system. It is what is called **hidden indirect benefit.** A contribution to stop climate change (which has palpable consequences that affect us directly) and avoid crisis and climate catastrophes to future generations.

The actions of the STO that will increase benefit and reduce cost must be considered in each individual case of each community.

The only way is to establish a working **tool** which is used by other communities to analyze the economic, social and environmental impact of its ordinance.

The following table sets out all the factors to be considered in carrying out this analysis. Each community can choose them, but they all are essential and provide criteria to study.

Factors to consider to improve the relationship Benefit> Cost of an STO

1. Economics

ID	Parameter	Units	Valuable	Direct / Indirect	How
1.1	Provision of incentives	€	Yes	Direct	Providing direct financial support to energy efficiency
1.2	Revaluation of property	€	Yes	Indirect (Long term)	Housing sales is more valued for the solar system
1.3	Tax relief	€	Yes	Direct	Solar energy expenditure deductible. Municipal tax or annuity reduction
1.4	Tax Avoidance	€	Yes	Indirect	Saving on energy tax
1.5	Cheaper solar system	€	Yes	Indirect (long term)	Revitalizing the market. Institutional support of the ordinance to the market. Supporting solar systems for big consumers (administration, commerce and industry). There will be a cost reduction
1.6	Best Available Technology	€	Yes	Indirect	Promoting research in solar energy and other solar applications (heat, cold, fluid, ...)

2. Social Aspects

ID	Parameter	Units	Valuable	Direct / Indirect	How
2.1	Job creation	Workers / year	Yes	Direct	Supporting the local economy. Providing workforce of installers (installation and maintenance)
2.2	Bureaucratic	Time & Money	Yes	Indirect	Facilitating the builder / user to start the installation. It saves time and money.
2.3	Image of Clean Technology	-	Not	Indirect (overall benefit)	Awareness about the safety of solar energy
2.4	Image of the city / neighbourhood	-	Not	Indirect (long term)	The image of a sustainable city possible impact on future income (private investment, tourism, ...)
2.5	Principle of intergenerational responsibility	-	Not	Indirect	Raise awareness of climate change impacts and benefits for future generations

3. Environmental aspects					
ID	**Parameter**	**Units**	**Assessable**	**Direct / Indirect**	**How**
3.1	Energy expenditure saved	kWh	Yes	Direct (long-term improving)	Calculating the cost per family per year in conventional energy, minus solar energy consumed
3.2	CO_2 emissions avoided	CO_2 equivalents	Yes	Direct	Calculating the CO_2 that would have been released by consuming conventional energy
3.3	Control of solar systems	-	Not	Indirect	Regularly checking the proper functioning of the solar system we get an efficiency that its affects energy use (energy certification, shading, loss, maintenance, …)
3.4	Solar potential surface	M^2	Yes	Direct	Recording the area of solar panels installed
3.5	Public awareness regarding water and energy saving	-	Yes	Indirect	Creating campaigns to save water and energy (thermal comfort)
3.6	Thermal energy consumption	kWh	Yes	Direct	By monitoring and inspection of facilities (monitoring) we can know what is the real energy consumption per household