

RENEWABLE ENERGY



The Solar Thermal Ordinance for Efficient Water Heating in Barcelona

SPAIN

BOOSTING SOLAR ENERGY



Solar Thermal Ordinance brings efficient water heating to Barcelona

As the Spanish city of Barcelona sought to reduce its greenhouse gas footprint, a natural target was the building sector. Absent significant industrial activity, the city's greenhouse gas emissions were due more to energy consumption associated with transportation, as well as from lighting, heating and cooling of public and private buildings. Because it benefits from an average of 2,800 hours of sunshine every year, Barcelona sought to reduce its effect on the environment and lower the carbon footprint of its building sector by harnessing solar energy to provide solar thermal hot water.

In 1999, Barcelona's City Council passed the Solar Thermal Ordinance (STO) to harness their abundant solar energy resource, making it the first city in Europe to have an STO. In 2002, the council established a target of reaching 96,300 square-meters of solar collectors installed in the city, for an estimated thermal generation of some 778 gigawatt hours per year by 2010.¹ The Barcelona Energy Agency estimated that 88,015 square-meters of solar capture would be installed as a result of the STO, achieving more than 90 percent of the city's goal, and a dramatic increase from the 1,650 square-meters of solar thermal surface that was in place at the time the STO came into effect.²

A SOLAR REQUIREMENT

Barcelona's 1999 Solar Thermal Ordinance made it compulsory for all new buildings, renovated buildings, and buildings changing their use (e.g. a villa turned into a hotel), both private and public, to supply at least 60 percent of running hot water with solar energy. The city began implementing the STO in August 2000.

In its first stage (2000 to 2006), the STO required that new buildings, and those undergoing major refurbishment, using more than 0.8 megawatts per day for hot water production, meet at least 60 percent of their demand by using solar heaters. The regulation applied to all commercial buildings and residential buildings with more than 16 apartments. For swimming pools, the ordinance required that 100 percent of energy be generated from solar-heated water.

In its second stage, which started in 2006, the STO was improved to eliminate the 0.8 megawatts per day minimum requirement, and now applies to all new buildings and those undergoing renovation, regardless of size or purpose. Barcelona's 2006 STO also inspired a piece of national legislation requiring minimum levels of solar-heated water and photovoltaic energy in new construction and renovation projects. National requirements call for between 30 and 70 percent of hot water energy in

Spain to be met with solar-heated water; the exact level depends on consumption needs, available back-up fuel, and the climatic zone in which the building is located. Some cities, including Seville, Madrid, Burgos and Pamplona, have followed Barcelona's lead and instituted stringent solar hot water requirements.

Implementing the STO did not come without challenges:

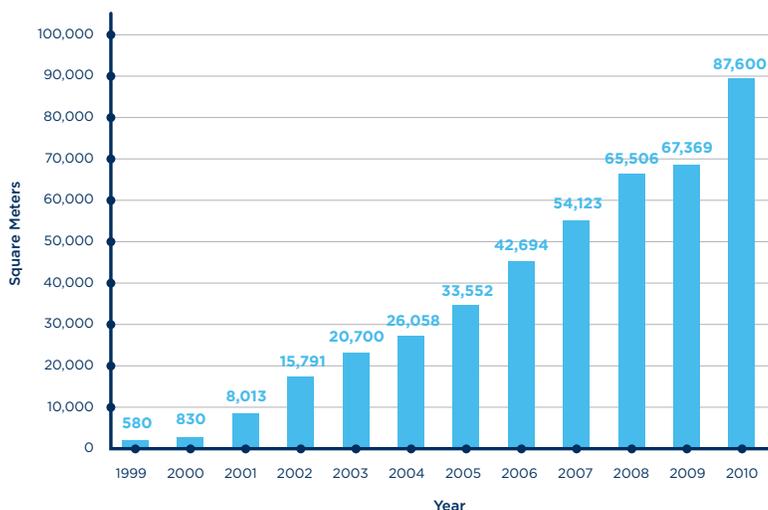
- In the beginning, architects and building promoters feared that building prices would increase as a result of the STO. However, it turned out that the extra cost for solar thermal installations was relatively modest, around 0.5 to 1 percent of total building costs.³
- At the initial stage, all sectors involved lacked information and experience, as well as clear definition and demarcation of the responsibility of each party (architects, building promoters and users). Stakeholder roles were clarified through a period of discussion and implementation of a pilot project.
- Initially there were not enough qualified installation contractors to meet the demand for their services. The Barcelona Energy Agency worked with the federations of builders to introduce and run specific training courses in solar energy to build capacity.
- At first, maintenance of the solar thermal installations was not guaranteed. When the STO was revised in 2006, it contained new obligations to have a quality certification for solar thermal installations, as well as a maintenance contract.

The STO is managed by the Barcelona Energy Agency, a consortium of local institutions involved in sustainable energy. To ensure that the STO is not being sidestepped, the Barcelona Energy Agency requires the approval of building design to be simultaneous with the approval of the construction permit. Building inspectors then check regularly whether the construction meets the stipulated criteria, and apply fines if it does not. Following the approval of the Barcelona Energy Improvement Plan in 2002, implementation of the STO was monitored to ascertain the extent to which the ordinance was accepted, to record the numbers of installations and square meters installed, and to monitor the operation of the installations.

SPAIN'S LEADERSHIP MODEL

The Barcelona STO achieved significant energy savings and carbon dioxide emission reductions, and successfully popularized the use of solar thermal energy, both within Barcelona and beyond the city's borders. As of December 31, 2010, 87,600 square-meters of solar thermal panels had been installed, nearly achieving the goal set forth in the Barcelona Energy Improvement Plan to install 88,015 square-meters of solar thermal panels.

Figure 1: Total Installed Solar Thermal Surface Area



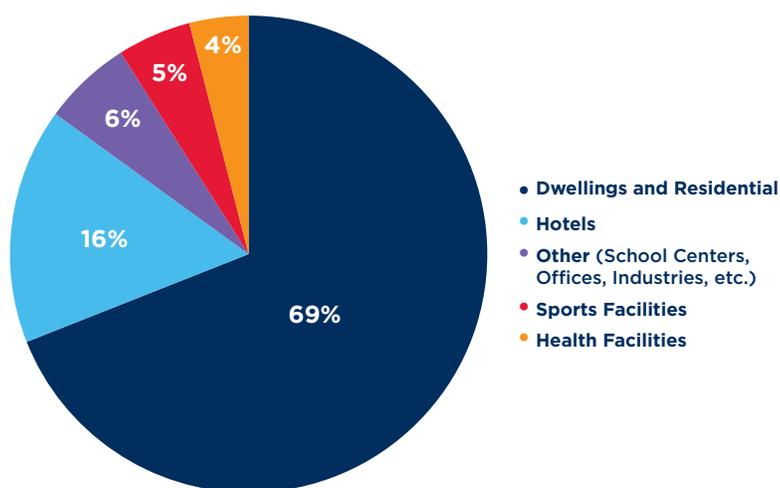
Source: Barcelona Energy Agency.

Between 2002 and 2010, solar thermal energy production reached 70,121 megawatt hours per year, equal to the domestic hot water demand of 171,000 inhabitants. Significantly, the solar thermal system allows for savings of 12,329 tons of carbon dioxide per year.^{4,5} By surface area, the majority of the solar thermal installations were installed in residential buildings (69 percent), with much of the remainder in hotels, sports centers, and health care facilities.⁶ (Figure 2.)

Renewable energy production in Barcelona increased significantly, from 6.68 gigawatt hours in 1999 to 96.53 gigawatt hours in 2008, or in other words from 0.042 percent to 0.57 percent of all the energy consumed. With solar energy now the chief renewable resource of Barcelona, solar thermal became the most widely used renewable energy, accounting for 52 percent of total renewable production in 2008 (compared to 6.9 percent in 1999) and 0.29 percent of total energy production.⁷

Between 1999 and 2008, greenhouse gas emissions in Barcelona were reduced from 4,737,300 tons (3.15 tons per inhabitant per year) to 4,053,766 tons (2.51 tons per inhabitant per year). The average rate of change between 1999 to 2008 was -1.72 percent.

Figure 2: Distribution of Solar Thermal Surface Area by Use (2008)



Source: Barcelona Energy Agency.

The cost of installing solar thermal in buildings is estimated at 0.5 to 1 percent of the total construction costs. The Institute for Energy Diversification—a public business body under the State Secretariat for Energy of the Spanish Ministry of Industry, Energy and Tourism—and Instituto de Crédito Oficial—a state-owned corporate entity attached to the Ministry of Economic Affairs and Competitiveness—provided interest-free credit arrangements for solar thermal installations, covering 70 percent of the total investment. Other financial benefits have since been offered by regional governments and local authorities in Spain, such as tax waivers for property developments that incorporate renewable energy.⁸

Beyond the quantitative results achieved under the STO, there is also an important qualitative aspect: the ordinance changed the perception and handling of solar thermal energy in Barcelona, its surroundings and beyond. Its implementation was an important learning process for policymakers, as well as architects and building engineers, who gained practical experience with solar thermal technology. Construction companies now include solar from the earliest stage of planning, reducing the time and costs needed to integrate it at a later point. Citizens and potential users became more knowledgeable and aware of solar thermal and how it can improve their lives. Through a door-to-door campaign, the Barcelona Energy

Agency instructed the public to measure their energy savings and check to ensure that the solar installations are working.

Communities seeking to reduce their carbon intensity through solar thermal can use the “Barcelona Model” as a roadmap to avoid initial traps and challenges and make similar “green” achievements. The Barcelona Model has been followed by over 70 municipalities in Spain, and in 2006, the principles of the Barcelona STO were adopted in legislation at the national level.

REFERENCES

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ENDNOTES

- ¹ Barcelona Energy Improvement Plan, PMEB, approved in 2002
- ² Barcelona Energy Agency, Spain. 2011. "The energy, climate change and air quality plan of Barcelona (PECQ 2011-2020)." Web. November 2012. <http://w110.bcn.cat/MediAmbient/Continguts/Vectors_Ambientals/Energia_i_qualitat_ambiental/Documents/Traduccions/PECQ_english_def01.pdf>
- ³ Schaefer, B. 2006. "Barcelona Solar Ordinance: Cultural Influences on Renewable Energy Acceptance and tools for the development of communication strategies to promote acceptance among key actor groups." Barcelona, Spain: Ecoinstitut Barcelona.
- ⁴ NYC Global Partners. 2011. "Best Practice: Promoting Solar Energy." New York City Global Partners. Web. June 2012. <www.nyc.gov/html/unccp/gprb/downloads/pdf/Barcelona_SolarEnergy.pdf>
- ⁵ Barcelona Energy Agency, Spain, 2011, *op cit*.
- ⁶ Barcelona Energy Agency, Spain, 2011, *op cit*.

⁷ Barcelona Energy Agency, Spain, 2011, *op cit*.

⁸ Schaefer, B. 2006, *op cit*.

Figure References

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