BARCELONA ORDINANCE ON APPLICATION OF SOLAR THERMAL ENERGY SYSTEMS INTO THE BUILDINGS.

Article 1. - Object

The object of this Ordinance is to regulate the implementation of low temperature systems for collecting and using active solar energy for the production of sanitary hot water in the buildings of the Barcelona municipality.

Article 2.- Liable acts

The present ordinance affects the buildings in which the following circumstances meet:
a) The realization of new buildings or constructions, or rehabilitation, integral reform or change of use of the totality of the building or existing constructions, whether they are of public or of private property. The independent buildings belonging to complex facilities are included.
b) In the case the use of the building corresponds to one or some of the ones contemplated in the following article.
c) When a volume of daily demand of sanitary hot water is foreseeable, and the total demand exceeds 292 MJ (Megajoule) in terms of the annual mean consumption.

Article 3.- Affected uses

1. The installation of low temperature solar energy collectors for the heating of sanitary hot water must be foreseen for the following uses:
- housing
- residential, barracks and prisons included
- sanitary
- sporting
- commercial, refered only to the class 3 establishments of the Ordinance of Public Concurrence Premises
- industrial, in general if hot water is needed for the process and, also, when the installation of showers for the staff is mandatory,
- any other which involves the existence of dining-rooms, kitchens or collective laundries.

2. All these uses must be understood in the sense in which the articles 276 to 284, both included, of the Urban Rules of the Metropolitan General Plan, in force in the moment of enacting this ordinance, are defined.

3. The ordinance will also be applied to the installations for the heating of the water in the vessels of the heated covered swimming pools with a water volume above 100 m^3. In these cases, the energy contribution of the solar installation will be, at least, of 60 % of the annual energy demand coming from the heating of the vessel water. The heating of the uncovered swimming pools will be only allowed with solar energy collection systems.

Article 4.- Liable persons for the fulfilment of this ordinance

The promoter of the construction or reform, the owner of the building affected, or the professional who projects and conducts the works in the ambit of his faculties are responsible for the fulfilment of what this ordinance prescribes. The holder of the activities taking place in the building or constructions which have solar energy at their disposal is also liable by this ordinance.
C/Art. 72 Housing Law 24/91

Article 5.- The best technology available

The application of this ordinance will be done in each case using the best technology available. The Mayor will dictate the appropriate provisions to adapt the technical contemplation of this ordinance to the technological changes that may take place.

Article 6.- Formal requirements to be incorporated to the building or activity licences

With the application of building licence or environmental licence it will be necessary to enclose the basic project of the installation with the appropriate analytical calculation to justify the fulfilment of this ordinance.

Article 7.- Adopted system

1. The system to be laid on will consist of the collection subsystem by means of solar collectors with water in closed circuit, of the subsystem of heat exchange between the collector's closed circuit and the consumption's water, of the solar storage subsystem, of the auxiliary subsystem with other energies and of the distribution and consumption system.
Exceptionally, in the case of swimming-pools, a collector subsystem in open circuit may be used without heat exchanger and without storage tank when the vessel of the swimming-pool fulfils its functions.

2. In the installations only collectors properly homologated by duly authorised organism or entity will be allowed to be used. The characteristic curve and the performance data will have to be furnished to the project.
In all cases the Regulation of Thermal Installations in Buildings -RITE adopted by the Royal decree 175/1998 of 31st July have to be fulfilled and especially its chapters 'ITE 10.1 -Production of SHW by means of Active Solar Systems' and 'ITE 10.2 -Conditioned swimming pools', as well as the 'Quality and Design Criteria for the Solar Energy Installations of Hot Water and Heating' of APERCA - Associació de Professionals de les Energies Renovables de Catalunya.

Article 8.- Demand calculation: Basic parameters

1. The parameters to be used to calculate the installation are the ones following:
- Cold water temperature whether coming from the public network or from own supply: 10º C, except in case that the actual monthly water temperature of the network can be reliably proved, by means of certification of homologated entity.
- Minimum temperature of the hot water: 45º C
- Design temperature for the water of the vessel of the conditioned covered swimming-pool, the ones adopted on the Regulation of Thermal installations in the buildings -RITE, ITE 10.2.1.2. Water Temperature.
- Percentile fraction (DA) of the whole annual energy demand for sanitary hot water to be met with the low temperature solar collectors installation: 60%, in accordance with the following expression:
DA = [A/(A+C)] x 100
(where A is the thermal solar energy provided to the water consume places, and C is the additional thermal energy coming from traditional energy sources (auxiliary source) furnished to meet the needs.
- Percentile fraction (DA) of the whole annual energy demand for the heating of the conditioned swimming- pool's water to be met with the low temperature solar collectors installation: 60%.

2. According to the circumstances the Mayor may increase these parameters in connection with the degree of coverage of the sanitary water demand by the solar energy collection system to achieve an 80%.

Article 9. - Housing consumption specific parameters

1. In the project it will be considered a minimum consumption of hot water, at a temperature of 45ºC or above, of 140 l. per standard dwelling and day (annual average, from a consumption of 35 litres/person.day) equal, after performance, to 22 MJ per day and standard dwelling.

2. For standard dwelling it is meant the one that corresponds to a 4 people functional programme, according to the approach laid down by the "Urban Regulations and Metropolitan Building Code". For dwellings with other functional programmes, the resultant consumption will have to be considered after having applied the proportionality approach in accordance with the number of people which legally correspond to their functional programme, according to the following expression:

$$Ci = 140 \times P/4$$

where: Ci is the sanitary hot water for the installation design, expressed in litres/day corresponding to the dwelling, and P is the number of people of the functional programme of the mentioned dwelling.

3. For collective installation in residential buildings, the sanitary hot water consumption regarding the calculation of the solar installation in accordance with the following expression:

$$C = f^* \sum Ci$$

where: Ci is the sanitary hot water consumption for the installation dessign, expressed in l/day, corresponding to the whole dwelling building, $\sum$ Ci is the addition of the Ci consumption of all dwellings in the building, calculated in accordance with the formula mentioned above, f is the simultaniety factor which is determined depending on the number of dwellings in the building (n), in accordance with the following formula:

f = 1	if n < = 10 dwellings
f = 1,2 - (0,02)*n)	if 10 < n < 25 dwellings
f = 0,7	if n > 25 dwellings

Article 10.- Specific parameters of consumption for other building typologies

In the project, the consumption of hot water at the temperature of 45º C or above, which is listed on the table I enclosed in the present article, will be considered.

Table I: Daily consumption considered in Europe according to the building typology

hospitals and clinics (*)	60 litres/bed
old people's homes (*)	40 litres/person
schools	5 litres/pupil
barracks(*)	30 litres/person
factories and workshops	20 litres/person
offices	5 litres/person
camp sites	60 litres/site
hotels (according to categories) (*)	from 100 to 160 litres/bedroom
gymnasiums	30/40 litres/user
laundries	from 5 to six litres/kilo of clothes
restaurants	from 8 to 15 litres/meal
cafeterias	2 litres/breakfast

(*) without considering the consumption in restauration and laundry

Article 11.- Orientation and inclination of the collection subsystem

1.- In order to achieve the maximum efficiency in the collection of solar energy, the subsystem must face south, with a maximum margin of ± 25º. Only in exceptional circumstances, as for example, when there is shade produced by buildings or natural obstacles, the mentioned orientation will be allowed to be modified.
2.- With the same aim to assure the maximum solar energy use, or to improve its integration in the building, in installations with a noticeable constant demand of hot water over the year, if the inclination of the collection subsystem in relation to the horizontal line is fixed, it has to be the same as the geographical latitude, i.e, 41.25 grades. This inclination may vary between +10 grades and -10 grades, depending whether the hot water demand is bigger in winter or in summer.
When outstanding differences regarding the demand between different months or seasons are foreseeable, a different inclination will be allowed to be adopted only in the case it turns out more favourable in relation to the seasonality of the demand. In any case it will be required the comparative analytical justification that the adopted inclination corresponds to the best use in an global annual cycle.
3.-In order to avoid an inadmissible visual impact, the realizations in the buildings where a solar collector system will be placed, the necessary measures will have to be contemplated in order to achieve its integration in the building.
In any case the railing or containing wall of perimetral enclosure of the flat roof must have the maximum height allowed by the building ordinance so that it make up a natural screen which hide from sight the set of collectors and other complementary equipments, as best as possible.

Article 12.- Solar irradiation

1.- The design of the installation will be done depending on the solar irradiation received, after the orientation and the inclination adopted in the project. The mean values of the total incident solar irradiation, monthly and annual in Barcelona, in kWh/m² for collectors oriented towards south with a fixed inclination of 40º -south orientation- and protected from shades, are gathered in the following table.

January	February	March	April	May	June	July	August	September	October	November	December	Annual
94	103	138	155	173	172	177	168	145	125	97	89	1635

Table II. Solar radiation for collectors inclined in relation to the horizontal 40º.

2.- In order to install the systems calculated in accordance with different parameters it will be necessary to justify the irradiation data applied in any procedure, analytical or experimental, scientifically admissible. In the Atlas de Radiació Solar de Catalunya, published by ICAEN, more data about solar irradiation can be found.

Article 13.- Installation of tubes and other piping

In the common parts of the buildings, and in form of service courtyards, the necessary piping will be installed in a well arranged and easily accessible way for the operations of maintenance and repairing, the set of pipes for the cold and hot water of the system as well as the other auxiliary supplies and complementaries necessary for the system. They will have to pass through the inside of the buildings or service courtyards, in what case they will have to be buried or arranged in any other way but minimising the visual impact. It is strictly forbidden and without exceptions, their tracing along main façades, through block yards and through roofs, except, on the latter case, in the horizontal stretches to attain the vertical main pipes.

Article 14.- Control system

All installations executed fulfilling this ordinance will have to include thermal energy measurement devices and control -temperature, massflow, pressure- which allow to check the normal operation of the system.

Article 15.- Urban landscape protection.

To this kind of installations it is applicable what is laid down in the articles 73 to 75 of the "Normes Urbanístiques del Pla General Metopolità" and in the articles 86 to 89 of the "Ordenances Metropolitanes d'Edificació", in order to hinder the altering of the landscape perspective or the breaking of the landscape harmony and, also, to preserve and protect the buildings, ensembles, environments, and landscapes included in the respective catalogues or urban plans of cultural heritage protection.

Article 16.- Exemptions

1. The buildings exempt from the obligation of covering 60% of the energy demand by means of a solar energy system are those in which it is technically impossible to attain the conditions of the article 8. These will have to be properly justified by the corresponding technical study.

2. The percentage of 60% of the solar energy contribution to the sanitary hot water demand or to the heating of the water of the conditioned covered swimming-pools to which the article 8 refers will be able to be reduced in the following cases:
- there is not available roof space to cover a minimum area of 5 m^2/standard dwelling or equivalent depending on the functional programme of the dwellings. The mentioned equivalent value will be calculated in the same way as specified in the article 9, applying to the 5m^2/dwelling the corrective quotient P/4. In this case it will have to be used the most of the available area. If less than 25% of the demand can be covered, the total exemption proceeds.
- a quantity above the 40% of the total sanitary hot water demand or for heating of the water of the conditioned covered swimming-pools is met by means of the combined generation of heat and electricity (cogeneration) or of cold and heat (gas heat pump), use of waste heat or heat recuperation or of thermal potential of aquifer by means of heat pumps, being the addition of this contribution and the solar contribution 100% of the needs.

Article 17.- Holder's obligations

The holder of the activity displayed in the building endowed with solar energy is bound to its utilization and to execute the operations of maintenance and the repairs needed to keep the installation in perfect use and efficiency, so that the system works properly and with the best results.

Article 18.- Inspection, requirements, execution orders and coercive fine

1. The municipal services have full authority for inspection in relation to the buildings installation in order to check the fulfilment of this ordinance contemplations.

2. Once it has been detected the existence of anomalies in relation to the installations and their maintenance, the corresponding municipal services will perform the corresponding requirements and, in its case, the appropriate execution orders to ensure the fulfilment of this ordinance.

3. Coercive fines will be imposed to ensure the fulfilment of the requirements, and execution orders will be issued of a quantity not above the 20 per cent of the cost of the estimated works, or the corresponding penalty.

C/Arts. 62 and 70 Housing Law 24/91.

Article 19.- Cautionary measures

1. The Mayor or the delegated alderman are competent to order break of the building of houses that does not obey this ordinance, as well as to order the withdrawal of materials or machinery used, carrying the promoter or the owner the charges.

2. The suspension order will be preceded in every case by a requirement to the responsible for the works, in which a deadline will be conceded in order to accomplish the obligations arising of this ordinance.

C/Art. 64 Housing Law 24/91

Article 20.- Infringements

Infringements to the legal system laid down in this ordinance are the ones contemplated in the general legislation on housing and environment, and particularly, the ones following:

1. It is a very serious infringement not to lay on the solar collection system when compulsory according to what this ordinance prescribes.

2. Serious infringements are:
a) The incomplete or insufficient fulfilment of the solar energy collection installation proceeding, bearing in mind the building characteristics and the foreseeable sanitary water needs.
b) The realization of works, the manipulation of the installations or the absence of maintenance involving the reduction of the installations efficiency under what it is required.

c) The absence of use of the sanitary water heating system by the holder of the activity taking place in the building.
d) The non observance of the requirements and execution orders dictated in order to assure the fulfilment of this ordinance.
C/Arts. 57.1, 58.5a,c) and 58.7 Housing Law 24/91

Article 21.- Sanctions

The sanction corresponding to the perpetration of infractions to the legal system of this ordinance are the ones following:
a) For light infringements, fine up to 1.000.000 ptas.
b) For serious infringements, fine up to 8.000.000 ptas.
c) For very serious infringements, fine up to 10.000.000 ptas.
C/Arts. 65 and 71.2 Housing Law 24/91

Article 22.- Sanctioning proceeding

The sanctioning proceeding, the qualification circumstances of the infringements and the complementary measures for the sanctions are the ones established in the legislation on housing of Catalonia.
C/Arts. 61, 62 and 68 Housing Law 24/91