

ALTERNATIVES OF ENERGY SAVING IN CITY CENTRES DECLARED WORLD HERITAGE

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ABSTRACT

The philosophy marked in the CTE consists primarily in enhancing energy saving in the building, but some of the systems that indicates are difficult at the implementation in the oldest buildings, especially if they are protected damages, due to its aesthetic features, constructive and/or structural.

An alternative, easier to incorporate because it can be done even outside the urban environment protected, would be the use of thermal type usually termed as "neighborhood".

The centralized urban thermal allow significant energy savings due to its better performance compared to a distributed generation, and further facilitate the incorporation of other energies such as fuel cells, extremely difficult to incorporate into existing buildings by their eventual ability to attack on the structures (explosion of the fuel storage in cryogenic temperatures so low that an escape collapse of any structure type of metal or concrete, etc.).

Keywords: the energy saving, installations, renewable energy, rehabilitation, thermal power stations.

1.- Introduction

The philosophy marked in the CTE and in rules encountered in parallel or subsequent to the Code, is essentially to enhance the energy savings in the building through three fundamental lines of acting:

- Improvement of isolation and, in general, the thermic behavior of the buildings.
- Incorporation to the same ones of energies of renewable type.
- Improvement of the performances of the thermic and luminous systems.

However, in the area of the archeological sites protected, the implementation of present-day ground rules, incidents in the energy saving and comfort, are extremely complicated, or even in many cases, incompatible with the logical development of constructive conventional process.

The buildings very old, primarily those who are classified as protected from the patrimonial point of view – even though they may improve their isolation and, of course, incorporating "per se" techniques bioclimatic traditional, did not admit to ease the incorporation of the above-mentioned renewable energy or modification of its thermal installations (the proceedings on the facilities illuminotechnical are relatively simple) due to its aesthetic, constructive and/or structural characteristics.

The own ground rules allow the unfulfillment of certain conditions, anticipating the maximum difficulty that implies the adaptation of some types of buildings to the conditions currently required.

The typologies building prevailing in historic protected helmet, vary greatly depending on the time that the building, the weather conditions prevailing in the topographical conditions, of the materials available in the environment and of a multitude of variables.

It could establish certain conditionalities of departure, given the nature of building of intervention, that would include the following:

- Urbanism.
- Construction and Structure

We will see below the disadvantages which, in each of these aspects, can submit the incorporation of saving techniques energy in these buildings, explaining the different situations on a concrete example (fig. 1): a Casona of s. XVII, located between mediators, Pedraza (Segovia, Spain) which is currently in the process of rehabilitation, incorporating a new installation of air conditioning and developing, in addition, significant changes to the facilities of hot water, due to the addition of new quarters moist. In addition, is coming the adequacy of its electrical installation.

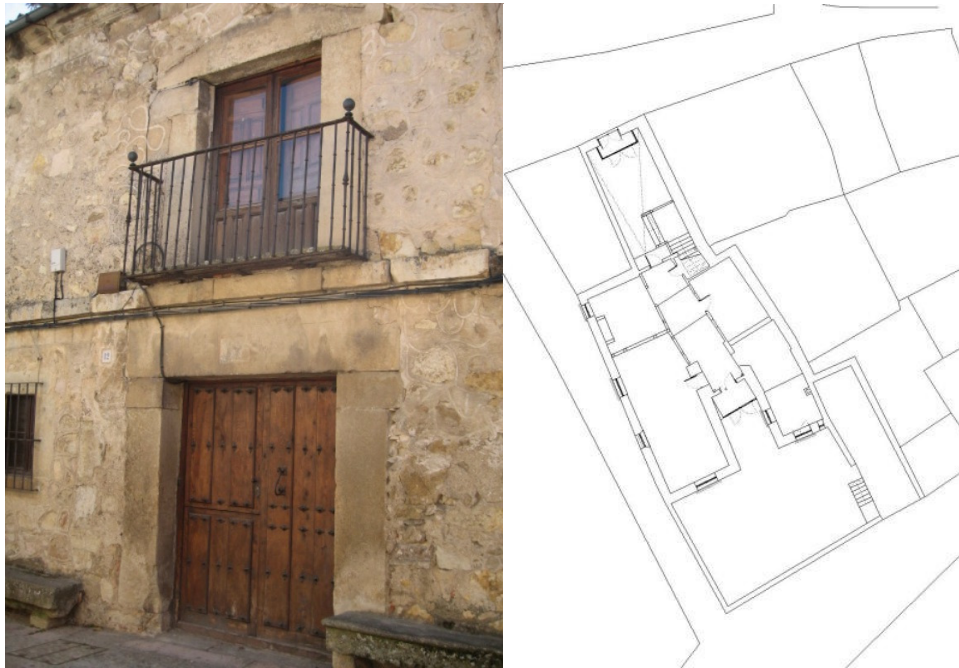


Fig.1.- Main Facade and schematic plant of la casona del siglo XVII that we are going to use as an example in this paragraph.

Thus, based on a exact example, and going from the general to the particular, we can see the real limitations on which will face any designer at the time to introduce the legislation currently in force on energy saving.

1.1.- Urban Contributing Factors

The degree of protection required by the regulating own suchlike orders, implies the adoption or discrimination of one or the other solutions.

The protection patrimonial enforceable goes from an environmental protection, which requires only maintenance typological, until the comprehensive protection that implies the total protection, allowing only works of consolidation. Undoubtedly, the rigor in the implementation of these rules makes it very difficult the alignment in the regulations constructive, and therefore the placing on value of buildings, many times in an advanced state of deterioration.

In the example chosen, the reference standards is the Special Plan for the Protection Monumental Villa of Pedraza, and the degree of protection applied to the property prevents the structural change, allowing only the redistribution inside.

1.2.- Constructive Contributing Factors

Analyzing each part of a building independently, we note that, from the constructive point of view we have to study, both separately and together, the following parties:

- Foundations.
- Structure (including the fences in this type of buildings often often to be a part of the structure).
- Cover
- Panelling interior and exterior doors and windows non-structural, if there.
- Finishings

1.2.a.- Foundation

Accomplished habitually with filling of stone put all together with lime or clay mortar. If the building is important improvement the quality of this but it takes place to the absence of definable elements like such in some case. Only exceptionally we found foundations solved by means of wooden stuck piles or arches of unloading.

The foundation is accomplished with filling of stone put all together with lime and clay mortar even to catch up with the firm at the referential building. Firm saying finds, which is why it has been been able to appreciate, to a considerable depth.

1.2.b.- Structure

Usually carried out with load-bearing walls, either massifs, either type fabric, we can also find types structural punctual, known as usual, feet rights.

In buildings with protection patrimonial, usually dominate the walls of great thickness, with hollow reduced. The networks of wood with filler tend to be more usual in panelling (indoor or outdoor) that structural elements.

The walls that in addition to exercise structural role, troop qualities historical, social, aesthetic, etc. , are items that require varying degrees of protection on the basis of these; a wall medianero hidden usually does not provide equity value to a building may be amended in many cases, but those who make up the different facades, tend to be subject to protection both degree environment as integral.

In fact, virtually all the buildings qualified with protection patrimonial have structural protection, which makes only we can intervene on her replacing parts more damaged by elements of similar type, without alteration in the least. In the housing rehabilitated (fig. 2), The structure consists of load-

bearing walls of different types (seating, masonry of stone, adobe) and pillars of wood, in some cases forming fabric.



Fig. 2.- Aspect of the load-bearing walls of facade of the casona del siglo XVII that we are going to use as an example in this section.

The characteristics of this type of factory do not be able to integrate the facilities through embedded systems type rubs, so that the implementation of these facilities must always be seen. It is very usual, in addition, that the use of cement mortar to receive the elements of anchorage of the same, cause a further deterioration of the facing because of their divergent behavior with regard to the factory in areas such as the dilation or shrink.

With regard to the structural elements horizontal, we can find in buildings protected forged by means of wooden structure with board higher, or supported by means of domes or vaults executed with elements ceramic or stone, and when they are passable tend to possess troops or boards. All of them lack of acoustic insulation or heat, except for its own intrinsic qualities, but it is not exceptional the fact that it has to protect the finishes, which generates difficulties, sometimes insurmountable, in the intervention. In this aspect, the regulations are ordinarily, extremely clear.

To this often added the disadvantage of that, in many cases, the trasdós of forged or vaults has become an attractive by itself. Devoid of coatings of gypsum or plaster, is generally not admitted the incorporation of this type of finishes.

This makes it all was further reduced the chances of drawing networks by walls, floors or ceilings. In addition the needs of thermal and acoustic insulation be conditioned by all this.

As an example, we can see, in the housing rehabilitated (fig. 3), That the forged are duckboard with beams of different escuadrías, made at different times. This implies that the facilities that are integrated into them should be implemented views with an exquisite care.



Fig. 3.- Aspect of the underside of the forged of duckboard of la casona del siglo XVII used as an example in this section.

In addition, usually not desirable increase the burden on all these structural types, which becomes unable to suspend them elements of the installation of great weight, which often coincides with the facilities for large size.

1.2.c.-Cover

The covered often in many cases be inclined, with finish in ceramic roofing tile or slate, except in areas with little rainfall where the roof plana. Normally is drained to the fronts of facade, except for some cases of building isolation that can be found in certain areas of northern Spain.

It is also common that the rules of protection patrimonial oblige the conservation of this element, and in many cases, banning the modification of volumes, which makes it impossible use as space assistant or adoption of structural systems optimal, in addition to hinder the installation of additional volumes as the consisting of antennas, chimneys or elements of energy solar or wind.

In contradiction with the law, which requires the channeling of the storm water and wastewater is very unusual for this type of buildings present the direct discharge of rainwater into the street, powered by the difficulty of perforation of the doors of facade.

In the building example, we can see (figure 4) that there are, in fact, two decks, one to two waters and another three waters – fruit of the divisions in the building during different times. Develops on duckboard, with board and tile to the segoviana (only the reddish channel), received with clay highly waterproof. Since the tiles the collected rainwater through gutter and, since it, the direct discharge into the street.



Fig. 4- Different views of the decks of the casona del siglo XVII used as an example in this paragraph. In the image of the left can be seen the solution of reddish segoviana mentioned

1.2.d.- Panelling interior and exterior doors and windows non-structural.

This type of elements do not usually assumed a limitation special for the implementation of the facilities, except that the separation walls are part of fabric structural, in which case cannot be altered without corrective measures. If you are formed by duckboard fill cannot be implemented clearings internally.

Except in the degrees more demanding of protection (protection) is not usual require its preservation, the elements considered minors in the construction, remains, therefore, easier to carry out their replacement by another type of panelling in the feasible the realization of rozas or the integration of some kind of gutter.

In the building example is the last case: the panelling was carried out by duckboard fill or walls of adobe, making it difficult enormously the step of rozas, to be massifs the elements of facing. Therefore, since it is not

protected elements, in the statement has been carried out its replacement by walls of brick, taking corrective measures in those points where the original elements contributing structural role.

1.2.e.- Finishes

Occasionally protected, they may prevent the incorporation of isolations. For example, we see in la casona de Pedraza used as an example that the pavements, originally settled with simple earth packed, at the time, the change of use (of block to stays livings), were modified installing a floor tile ceramic and stone of rio, placed directly on the earth packed originally (fig. 5).



Fig. 5.- Original pavements of the casona del siglo XVII used as an example.

The protection of the tiled floors with patrimonial value, at specific zones of the house does that the possibility discard the layout of attacks for these, requiring your layout hung up by the in-house roof, with plaster false roofs, where the height allows you or conducts a bottom in the beam fill.

1.3.- Conditions raised by the incorporation of the facilities

The biggest problems in the implementation of the facilities are produced by two fundamental facts: no estimate of the space needed for pipeline and the mandatory conservation of certain elements, incompatible with the parameters of packaging.

Virtually all the listed buildings are made of any or all the elements identified above, and in the intervention to conduct must be taken into account such circumstances, given that the integration and/or modification of the facilities can affect greatly to any of these constructive elements and structural. Although not all affect in equal measure nor are equally mandatory.

At the time of designing the facilities in a building protected that the aim is to reform, of course we proceed from the regulatory requirements, both technical and planning and patrimonial – between those we find, as very condition, the mandatory or not for the inclusion of solar energy for production of hot water. Usually the buildings with protection patrimonial tend to be excluded from this requirement, precisely because of the difficulty of its foothold in this type of buildings.

For the integration of any new installation in these buildings, the condition maximum come marked by the positive opportunities that will allow the building: as has been above, the configuration of the building limits in the form considerable and may even get to preclude some of the possibilities, as it should design the layout of the networks on the basis of the possible elements to retain or to change.

This usually cause that the greater the degree of protection of the property, fewer possibilities and versatility will deal with the installation of the various networks.

This may be tremendously condition in some networks, such as the sanitation, as they are often consist in channels of considerable size and require pending properly. In general, the provision of the network will depend on whether there is the obligation to keep the troops of ground floor or basement, which often compel the implementation of networks of collectors hung, or whether we should retain roofs and forged higher plants, which, by contrast, require the installation of collectors buried.

In any of the two cases, the limitations to the provision of wet rooms are increased considerably. In addition, the provision of the onslaught public also limits the scope of the installation or modification of the network, especially taking into account the possibility of existence of archaeological remains.

In any case, by its very nature, the installation of sanitation can only be undertaken of individually in each building, except some parties exceptional as may be the execution of drains public common or similar elements:

As stated above, in most of these buildings equipped with some kind of protection patrimonial, rainwater collected in facade, discharged directly to the outside. By not afford private boxes in public spaces, the collection of these necessarily passes through its introduction in the building for its concentration and subsequent onslaught to public networks. This makes the outer space, at the foot of stack, often remain deteriorated and moist, problems of claims by frost and wholesomeness.

The installation of a network of neighborhood of drainage, recordable to allow any rush is required, achieved the proper disposal of rainwater, in addition to allow its storage in a warehouse accumulator in order to be subsequently used

for irrigation public or for the service of fires, provided that they take appropriate measures of filtering and pressurization.

On the other hand, the installation of this urban network of drains avoid the drilling of walls of considerable thickness or reduce their foundations made at times with materials disaggregated, requiring only the passage of the network of wastewater interior.

Even, they should be allowed in the case of the wastewater, more than a onslaught to avoid the delineation of long networks interiors, which require technical destructive for its implementation.

On the contrary, the facilities of drinking water and electricity, not often present special problems in terms of its tended: neither occupy excessively nor often present requirements particularly complex.

However, the installation, which often cause more problems in this type of buildings is the thermal –both in its heating and/or refrigeration, as for the production and distribution of hot water. The main problem is caused by the installation of thermal generators, for heating or cooling and Hot Water and its partners: vents, chimneys of evacuation of gases from the combustion, installation of fuel, pressure groups, rooms of accountants, etc.

Its location in an area adequate not always is possible, because the very building adapts its small space to new uses and usually is not expected the incorporation of machinery and noisy with space requirements of special significance.

The placement of the boiler, for example, can be difficult, because of a shortage of width of the corridors, hallways, staircases, hollow access,...but you can get solutions "ad hoc" or of a modular type, which will enable us to solve the problem (in this regard is interesting the existence of boilers modular gas whose modules do not present more than 60 cm wide), but where it is really tend to produce situations insurmountable, is the provision of ducts, both of ventilation as of extraction.

The first problem is the integration of them in facade. It is not always feasible aesthetically modification of elements blind or carpentry. Other times, quite simply the problem is a technical or economic, owing to the cost, in both aspects, which represents the opening of holes in walls of great thickness. Provided that the boiler is next to the openings on the admission of air and evacuation of gases, we will have the advantage of not needing ducts, but as there are to dispose of them, because of its large size, is the difficulty of hide them. And the problem in this type of buildings is that we have a free height default and a few finishes whose aesthetic value in many cases prevents the placement of elements for concealment.

On the other hand, if we have the boiler next to the facade is harder route of the ceilings of evacuation of gases to duty avoided the alero, in addition to that to be this view not only presents inconvenience aesthetic, but that will have to take

special care in its proper isolation, with materials compatible aesthetically and light not overloading the structure. If not, we must make substructures independent for these chimneys. In the building example, the installation of the ceilings accounted for the largest difficulty for the implementation of the installation thermal:

Initially, raised the implementation of the team generator of heat in a space residual garage, considered the only place really appropriate for this because, on the one hand, which had the advantage to have direct access to the outside, which allowed get a proper ventilation, and, on the other, to its position was suitable for ensuring the supply of fuel, in a place with very little maneuverability, by the narrow of the urban fabric, which did not allow many other possible alternatives.

The great disadvantage of this position, however, was the need for a stack of evacuation of fumes, of a considerable size, to be located in the garage in an inlet on the facade of the building adjacent to it. This implies the armed with the ceilings of brick enfoscada (logically do not allow finishes non-traditional) and a special care to the realization of the insulation, before the danger of a steep decline in temperatures to reduce the effectiveness of tire. In the fig. 6 Can see a section of the housing where appreciates accurately the enormous porte concerning this fireplace.

In fact, the need for this fireplace, emerging as an element unsightly, execution and complex with an overload considerable structural, conditioned finally the decision to adopt a system of heat pump geothermal, as the most balanced solution.



Fig. 6.- Section of the casona del siglo XVII used as an example, where it can be seen the enormous porte de la ceilings of evacuation of smokes.

When the boiler is centralized, they are also required space specifically for the installation of it, in some cases lobby of independence, fuel tank with a mouth of food and ventilation, all of them with fences and structure fire resistant (remember that in these buildings is usual the existence of structural elements of wood, and their escuadrías are not designed for this aspect).

Not always the building undergoing reform requires the introduction of a thermal installation "ex novo", but that the current is that there is already some kind of pre-packaged that can be made from simply by a cursory cabling, up by any other type of generator heat. In any case, the updating of policy has been a greater degree of requirement at the level of thermal comfort, so any pre-existing installation require substantial improvements to comply with the current requirements scored in the current Technical Code of the Building.

Other existing requirements that indicates the legislation is the mandatory installation of energies of type renewable, at least for the production of hot water, but also for electricity production photovoltaic (depends on the type of building).

At least, the installation of these presents overloads additional – even if your installation by overlap and/or integration architectural allows us to obviate the efforts of movies) [1]–[very rarely are going to be admissible in building with covered light as the most of the protected, in addition to serious problems constructive and a considerable condition aesthetic of buildings that rarely is going to be accepted by the rules property.

Therefore, we note that precisely the facilities that most affect –constructive and structurally, to a property protected are the thermal installations and the energy saving.

The peculiarities of these facilities are not extraordinary. Their problems are not insurmountable, although very complex with the constructive methods conventional; however, its major drawback is that, despite the fact that the legislation does not regulate the criteria for the implementation of these technical requirements in this type of buildings, nor mark limits of tolerance. Simply, does not face the specific problems of these buildings.

2.- Proceedings in order to promote energy saving in protected buildings.

As we have indicated, the philosophy marked in the CTE and in Policy encountered in parallel or subsequent to the Code, is essentially to enhance the energy savings in the building through two fundamental lines of performance:

- Improvement of isolation and, in general, the behavior heat of the buildings.

- Incorporation into the same energies of type renewable.
- Improved yields thermal systems and bright.

The first two options present inconveniences to the time of their integration into building protected, while the latter tends to be better the greater is the size of the installation.

2.1.- Improvement of the isolation

The constructive system of buildings traditional based their behavior heat in the development of the heat capacity and the inertia of the constituent materials of their doors and windows, both best the greater outside the thickness of the same – by what they are, in general, badly isolated. This implies that peirdan much energy through these doors at the time that they are equipped with heating installation and/or air conditioning.

The incorporation of heating installations in these buildings protected and the resulting rise in temperature often become production of condensation in the fences without isolating. Adding to this the eventual increase in the tightness caused by the improvement of the carpenters (which are elements that unfaillingly generally improved in the reforms of this type of buildings), the problem of condensation –both surface and interstitial – increases and are therefore more damaging the more worthy of protection and more sensitive to the humidity are the doors of the property (case for example of the mural paintings or coatings of wood or any other type of material hygroscopic).

Therefore, provided that the type of finish did not prevent (such as happen in enclosures of the type of those represented in the fig. 6 And 7), will be essential the incorporation of insulation in the fences.

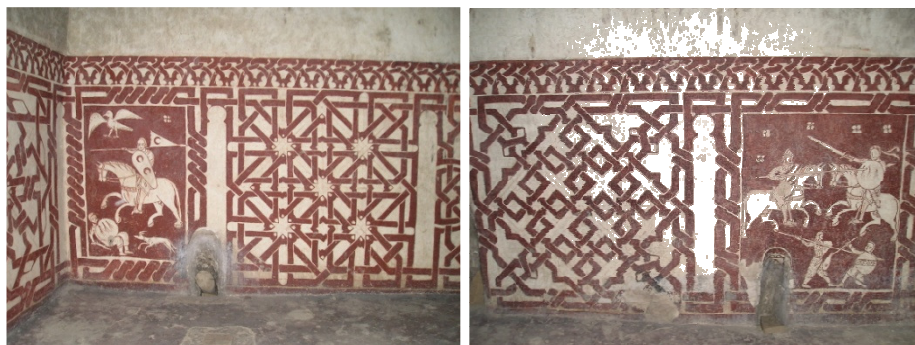


Fig. 6.- Medieval Mural Paintings existing in a enclosure that impede their insulation by the interior

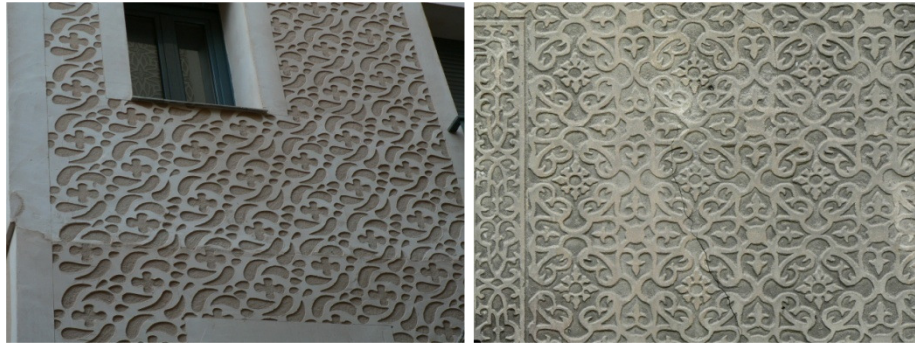


Fig. 7.- Various examples of graffiti segoviano, impeding the insulation of enclosure by abroad.

2.2.- Incorporation into the buildings of energies of type renewable.

The only renewable energy sources that can be incorporated in the buildings in the Spanish geographical framework are solar energy, in its two-pronged thermal and photovoltaic – wind energy with teams of small size (what is called *minieólica*), the geothermal energy, and from chemical processes (fuel cells, also known as Hydrogen cells), Although additionally often seen in the biomass –combustion of which may also be performed in the buildings, as renewable energy. One of the great advantages of the production of energy through the use of these types of renewables is distributed generation. The incorporate methods of production in the place to be caused by the consumption representing the reduction of losses and costs of transport.

This is why, that of all these energies, the current Technical Code of the Building has incorporated the obligation to incorporate in buildings solar panels of type heat for the production of hot water and, in the buildings of high consumption of electricity, solar panels of type photovoltaic.

It is logical, given the loss-making energy production of our country, which for the State to do everything possible to promote these types of energy; and it is logical to try to this production is carried as far as possible in a way distributed to avoid the losses in distribution, however, the incorporation of these types of energy to the buildings is not safe, but that presents a major impact, primarily at the structural level.

On the one hand, solar panels (both thermal and photovoltaic), due both to its form of installation as their own characteristics, presented a series of impacts on structural support, caused not only by its own weight but by the resistance to the wind.

The corresponding stresses caused a reduction of the safety factors considered in the initial calculation on existing structures, and we must consider that the existence of coefficients of increases in charges, i.e. the margin of safety with

which we have, is both more doubtful the more former are the buildings. In addition, can also give rise to deterioration of the construction materials and the start of the disease processes derivatives, both at the local level (union substructure support–elements of covering), as a global level of the structure [1]. For installation undertakes architects to address the analysis of the overload caused by the wind, as well as the determination of whether the inclination of the supports standard offered by manufacturers is the most suitable for this type of situations. The influence of these charges, both of permanent due to the own panels and deposits of accumulation, as the arising from the counterweights installed for the movies, should be analyzed for the States Limits of service of deformation and for the ELU Bending.

The wind energy presents a structural impact similar or even higher than the respondent for the installation of solar panels. Structural Impact for the existing buildings are not at all prepared.

On the other hand, in the case of the hydrogen cells, although the ideal for general use this technology would be the supply channeled in hydrogen on buildings that are installed fuel cells, at least initially, this solution is not feasible, given the important urban infrastructure that this pipeline would result in a city (although it is seriously considering to undertake this substitution by sections while the gas networks can be sector in all cities where there).

The storage of hydrogen in gaseous form involves the use of huge volumes, so it is unlikely to be opts for this type of deposits, especially in pre-existing buildings. It is most likely will be that the deposits used to be two types of – excess or cryogenic –, And both involve impacts structural in buildings, for his weight, and because they can cause explosions which reach to collapse the structure of the same, but in the second of the deposit rates, even more important may be the manner in which a leak of hydrogen to very low temperature affect existing structures to that extent (2).

The geothermal energy is complex to install in existing buildings and may only be made in those whose forged or bottom plate is not protected. In addition to buildings of great development in height presents the problem of getting enough surface of exchange heat.

Finally the heating fuelled by biomass (pellets, wood, shell of pinion, etc.), the proliferation of which is being favored by the consideration of that type of fuel as renewable energy, presents enormous difficulties for the installation of the own boilers, but, above all, for the warehouses of fuel, because of their considerable volume and the essential measures of protection fire fighting that has to take with them.

2.3.- Improved yields thermal systems and bright.

The improvement of the yields of the lighting passes through the substitution of lamps and lighting by existing more effective (for example will prevail the use of discharge lamps on the incandescent provided that the yields chromatic required not discourage, use ballasts electronic, etc.)

As for the improvement of the yields of the installation thermal, also may be limited to the replacement of equipment and systems for other more effective, but we have an additional alternative: the use of thermal power stations of large size that can meet neighborhoods and entire cities.

The energy performance of the generators thermal –both heating and cooling – is greater, the greater the power of the same and this improvement in performance is even more important if it evaluates the whole of the installation thermal, not only because the total power simultaneous represents a smaller percentage of the power tip the higher the number of users served (for example, in winter, the local geared to this demand greater heat energy in the afternoon, while those oriented to the west demand in the morning, when they receive no more solar radiation, while in the summer timetables must be invested, demanding more energy refrigerating the first in the morning and the seconds in the afternoon. If you serve simultaneously to local aimed at east and west, their powers ends do not coincide in time, so that the total installed will be less than the sum of the two powers tip), but because it is simpler improve performance to part load.

We can see, in the following table yields seasonal several types of plants of various sizes:

Type of boiler	Performances (%)				
	Combustion or use	Seasonal	Total	Transport long distance	Total
Unitarian, electric	98	100	98	25 (*)	24.5
Individual- gas mural	75	60	45	–	45
Central building little	80	80	64	–	64
Central big building	84	85	71.4	–	71.4
Central building condensation	100	80	80	–	80
Back-street or urban main station	92	94	86.5	?	?

(*)In the yields of the transport of the electric heating, are included in addition to losses in transport, the yields on the production and processing, so they can be compared all cases from the primary energy.

Table 1.- estimated returns of various types of thermic installations.. Table taken from the doctoral thesis of D. Jose Tovar Larrucea [3].

We note in aforementioned table as yields increase shapes it increases the size of the central, although the author's own indicates that not even has taken into

account the possibility of incorporating burners type modulating. With the incorporation of this type of burners- Infer that obviously also happen to the incorporation of compressors of capacity variable and even more with VRV systems in the case of refrigeration or heat pump – yields to the facilities of greater size will increase further, even in cases of operation to part load.

In the table does not have been introduced the values of the losses by transport in the central neighborhood, because that assessment was precisely the aim of the doctoral thesis. After the completion of the study, notes that the losses per kilometer in distribution are slightly lower than the 0.05% in virtually all cases [4]. Introducing the maximum value, we see that are obtained still yields slightly greater than those provided by the best installation of building (a thermal power of condensation) for distances of distribution of 150 km (the losses would be 7.5 per cent, get yields is transport of 92.5 per cent for this distance). For distances minors, as the normal in a central district, obviously, yields will increase substantially.

3.- Implementation of the possible methods of energy savings in protected buildings.

Whenever the existence of enclosures protected not prevent, the inclusion of best isolates within the existing buildings is the first and basic action must be tackled, and apply to all of the means to prevent condensation, both as interstitial surface, and thermal asymmetries.

The incorporation of any type of renewable energy in a building protected is highly complex and often prohibited by the rules of protection assets.

If you want to improve the performance of the installation thermal existing or the aim is to introduce a new installation, it would be advisable assess the possibility that it has the greatest size possible, in order to improve yields seasonal in the same.

If we except the first of the proceedings, -the improvement of the isolation of the property – an optimal solution to implement the other two with aggression minimum on the building or sets of buildings, is to assess the possibility of distancing the installation of protected environment damages, posing a thermal power in the neighborhood.

Centralizing the thermal production in a point, get the elimination of the impacts in buildings caused by the ducts air intake and exhaust, the chimneys and any other element, releasing the spaces quarters of boilers and fuel tanks, etc. Also, this centralization allows to incorporate without difficulty the use energies of type renewable, given that we can install the central production at a point desirable, without shade, without visual impact and with a structure adapted to any possible aggression that can cause these energies. For example, a possible

introduction of a fuel cell with accumulation of hydrogen "spot" must involve special structures of fine-grained steel or steels austénicos chrome-nickel. The construction of a thermal power urban may designed with this type of structure, in addition to allow the compatibility of the electricity production with an installation of trigeneration.

In addition to eliminate quarters of boilers and fuel tanks in the interior of buildings protected, the risk of fire minimizes, increasing the security of the same. In the thermal power can be expected, on the contrary, without difficulty, relevant facilities for extinction of fires, whereas in addition to any sinister will have less negative consequences to the occur in an area away from any possible public occupation.

The possible loss of thermal energy in the transport of the energy through pipes urban areas will be more than offset, as we have seen, the increase in the performance of the thermal power plant. In addition, it may circulate hot water or steam to a single temperature and vary the arrangements for use with the installation of several exchangers to obtain water under high temperature for heating or low-temperature for hot water. In places with weather extremes, the loss of energy in the transport may be, not only controlled, but even exploited in the form of heating of urban, allowing the elimination of plates of ice when the situation requires, increasing the security.

The maintenance of the facility is outsourced, allowing for a more effective monitoring of the same and the lower costs. The network of neighborhood solve the problems of implantation mentioned with the single contribution of hot water produced externally, spread subsequently by piping network interior that is possibly the most appropriate way to the distribution of the thermal energy, given the frequent need to maintain full roofs or soil.

A better control of emissions to have a single producer of CO₂ that can incorporate debugger smoke without regulatory constraints.

4.- Conclusions.

Given the situation of the rules, the demands of the current users and the needs arising from the current economic situation, that make the energy saving and of the optimization of resources a requirement as important as the structural safety, should be required in buildings protected the same levels of energy savings that in property for new construction.

However, since it is perfectly verifiable that on the hulls protected is the usual progressive building degradation, by aging of the neighborhood and that, simultaneously, is the logical interest by the conservation of our real estate, common solutions must be sought alternatives to get these energy savings.

A solution highly efficient and with low-impact in the protected buildings is the implementation of networks thermal at the urban level. Its forecast eliminate the limitations in existing buildings by the physical space required, remain faithful to the spirit of the law, without loss of benefits compared to the rest of buildings and without arbitrariness.

Given the profits and improvements to the facilities thermal urban would allow us to achieve, worth a legislative effort evolved equity legislation toward these goals, so that no outside prerequisite for the protection patrimonial the sacrifice energy efficiency of protected buildings and their plants, establishing a blatant discrimination between the new buildings and those other, that by its characteristics and belonging to the common heritage of citizens, should be better dealt with by it.

5.- References:

[1] A este respecto puede verse los artículos siguientes:

- Arroba, M. y Mencías, D. *Impacto estructural de paneles solares térmicos*. Actas de la II Jornada Nacional de Investigación en Construcción. Instituto de Ciencias de la Construcción Eduardo Torroja – ISBN 978-84-7292-367-6. 2.008. Madrid (España).
- Arroba, M. y Mencías, D. *Afección estructural de la integración de los paneles solares en edificios existentes*. Actas del XIV Congreso Ibérico y IX Congreso Iberoamericano de Energía Solar – ISBN 978-84-612-4470-6. 2.008. Vigo (España).

[2] A este respecto puede verse los artículos siguientes:

- Arroba, M. *Un reto para la sostenibilidad: la Integración Arquitectónica de las pilas de Hidrógeno*. Actas del Congreso Internacional de la Universidad de Matanzas. 2.007 - ISBN 978-959-16-0555-9. Matanzas (Cuba)
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- Arroba, M. y Mencías, D. *Integración arquitectónica de algunas energías renovables. Impacto estructural*. Actas del congreso CONAMA 9 – ISBN: 978-84-613-1481-2. 2.009. Madrid (España).

[3] Tovar Larrucea, J. *Metodología para la optimización del transporte de energía térmica en redes urbanas*, pag. 63. 2005. Tesis doctoral ETSAM. UPM. Madrid (España).

- [4] Tovar Larrucea, J. *Metodología para la optimización del transporte de energía térmica en redes urbanas*, tabla IV-31, pag. 123. 2005. Tesis doctoral ETSAM. UPM. Madrid (España)