THE BUILDING SUSTAINABLE REGULATIONS FOR SOCIAL HOUSING IN MEXICO

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Key words: Green technologies, construction regulations, architectonic elements.

Abstract
The present project analyzes the conditions of the actual construction regulations and their relation with the conditions of sustainability of the western zone of Mexico. The human activity of production and occupation of the housing activity, has contributed important percentage in the problem of the global warming. The waste production and deterioration of the natural resources force to consider technological alternatives for the production and occupation of the sustainable buildings that incorporates low energy technologies and systems for the water consumption, as well for the energy efficiency using the advantage of the natural lighting, natural ventilation and the treatment of outer areas. The analysis of the energy efficiency will be based mainly on the conditions of sustainability, understanding that the consumption of the energy and the water is certain determined for the conditions of habitability. A sustainable construction can be a space completely integrated to the natural landscape and the natural flows of an ecosystem, or can be an artificial place with a high energy performance, built with low environmental impact materials.

The primary objective is to maximize the energy efficiency, to reduce the carbon dioxide emissions, the conservation of the natural resources, as well as to integrate sustainable technologies and to make integral an urban planning with citizen participation in the different phases from the project.

Introduction
In efforts to promote sustainability in the building sector the present project tries to contribute solutions to the actual construction regulations in western section of Mexico.
The analysis of the energy efficiency will be based mainly on the conditions of sustainability, understanding that the consumption of the energy and the water is certain determined for the conditions of habitability.

The primary objective is to maximize the energy efficiency, to reduce the carbon dioxide emissions, the conservation of the natural resources, as well as to integrate sustainable technologies and to make integral an urban planning with citizen participation in the different phases from the project.

Consequently, a series of sustainable sections was developed to be applied in the construction regulations of the western zone of Mexico, reason for which it is decided to choose a specific place to exemplify the points treated in the development of the investigation.

The main idea is to give a margin of participation to the builders, being they who will have to implement a data set of different nature according in the levels that is decided to use. The present study proposes three levels of intervention:

-By a calculation method.
-By making measurements in the project.
-Imposing values (maximum or minimum) pre-fixed.

This also is valid for the other proposals of regulation depending on the complexity of the architectonic and/or urban element, the levels could be mixed.

According to the "criteria of sustainability" for the urban development and the construction of buildings, the stages of the analysis, the data processing and normative proposals will be grouped as it follows:

- Efficient use of the water
- Efficient use of the energy
- Bioclimatic design
- Design of green areas
- Treatment of solid wastes

This looks for to adapt each of these criteria to the technical, legal and administrative processes in answer to the diverse requirements of the region.

**Objective**

To promote the implementation of the concepts and criteria of sustainability in the activities related to the building construction of social interest at regional level, it is necessary to adapt the technical, legal and administrative processes in answer to the different requirements from the zone the West of Mexico. In the same way, it is necessary to make reference of the indicators of the quality and its homologation to the standards established in the international regulations, involving to the academic sector and construction industry.

To adapt the existing regulations of construction to the characteristics and points of attention that the population demand, it is necessary an analysis of the physical and social conditions to obtain and to classify the modifications of the architectonic spaces in order to assure the power efficiency, the requirements uses and destinies of the water, and the quality of the interior spaces, all it with the purpose of obtaining an economic and social development sustainability.
In the same way, it is necessary to determine the parameters to consider the consumption of energy and water in the social interest houses and the impact that would be had with the implementation of efficient measures with respect to conventional technologies, such as the use of devices and systems of saving water, rain water collecting storage and use, as well as the treatment and recycling of these.

Because the house is a determining element of the growth of the demand of the electricity and other used forms of energy in the air conditioning, the illumination and urban mobility, it is necessary to calculate the reductions of Greenhouse Gas Emissions (GHGs) and to consider the impact in the improvement of the use of the energy and the water in the new houses in Mexico.

Additional to previously exposed, it is tried to make reference to the international norms such as ISO 14 000 of environmental management, in which the company implants a system of environmental management and an organism of third part of certification. In the same way reference to the system is made of classification of green constructions (GBRs), developed by Leadership in Environmental Energy and Design (LEED).

From the Mexican official regulations of the effectiveness of the energy applicable to the constructions (thermal NOM-018-ENER-1997 that isolates for the effectiveness of the constructions), the normalization of the certifiable conducts is taken like reference voluntary that can be promoted by the federal government with the normative faculties, carrying out it to an ample participation of the sector of the company, that must be the main motor of the voluntary environmental certification.

The constructions and the houses have an important impact in the environment and the health of the people. The environmental quality associates the comfort of the human beings to the sustainable development of the natural resources; applied to the architecture this concept supposes the incorporation of new exigencies in all the constructive process of a house, modifying customs of the developers and the users.

**Methodology**

For that reason, it is necessary to analyses the environmental conditions to plan the sustainable energy saving and reduce to the Greenhouse Gas Emissions. Combined to this, it is necessary to develop a line bases to consider the consumption of energy and water in social interest houses, as well as in the same way to determine the reduction in the consumption of the energy resources and water through the instrumentation of efficient measures with respect to conventional technologies.

In order to sustain previously exposed it is required to make reference to the reaches and challenges in the matter of construction that the Mexican government has established in five aspects that are planned guide the national policy of house:

- Eminently social character of the programs of acquisition of house
- To foment the quality house
- To make specific efforts with the different actors and institutions in the construction industry
- To offer greater opportunities to the families
- The infrastructure creation. [2]
The Mexican government has established the creation of an ampler infrastructure, for which requires the construction of a million houses average per year. The impact that will entail this measurement they will require, considering a net density of 50 houses by hectare (without regional services):

- An approximated area of 40,000 hectares of ground - Residual water treatment = US $134 millions  
- Hydraulic infrastructure = US $1 billion  
- Drainage infrastructure = US $900 millions  
- Electrical infrastructure = US $350 millions  

This represents 2.8 billion that will be required annually to grant services from infrastructure to the buildings that are constructed from year 2007.

In order to give recommendations to develop sustainable houses, it is necessary to formulate the following criteria like instruments of environmental policy, in agreement to the state environmental laws: Criteria for the urban development. The relation that must exist between the green areas and the constructions destined to the house, the services and other activities. The conservation of fertile forest and agricultural areas, avoiding its urban division. The limitations to create zones of house around industrial centres.

Criteria for the house development. The use of devices and systems of water saving, rain water collecting, storage and use, as well as the treatment and recycling of these. The optimal advantage of the solar energy, as much in the illumination as for the heating.

Designs that facilitate the natural ventilation. The use of construction equipment that cause the lower environmental impact. Consequently, it is possible to carry out some future actions to consider them like continuation of this project:

- To recommend technological alternatives for the sustainable house.
- To make measurements of the designs and the incorporated clean technologies in the house.
- To analyse a study cost-benefit from technologies and alternative products.
- To make references to the NOM-020-ENER regulation of energy efficiency in constructions.
- To propose indicators that work as it bases to generate policies and standards that will be included in the regulations.
- To create an analysis system to evaluate and to describe the technical aspects as sustainable projects.
- To propose financial mechanisms that allow resolving the costs of incorporating clean technologies in the sustainable house, in reference to applied in the other countries as "green financings".
- To foment the diffusion and qualification for the implementation of clean technologies in sustainable houses.
- To establish programs related to the sustainability at national level.

It is necessary to adapt the existing regulations of construction to the characteristics and points of attention that demand the architectonic spaces in the matter of saving and efficiency of energy, handling of solid remainders, that the rational use of the water, on the way to obtaining sustainable an economic and social development.

This by means of promoting the participation of the client, the academic researchers, as well as of the professionals of the construction, creating criteria for use of clean technologies like alternative to the elements and traditional systems of the house. The results of the investigation project must like intention cause the participation of public and private institutions.

Through the normative proposals it is possible to obtain adequate environmental conditions in the initial stages of the architectonic projects on the way to diminishing the cost of the habitability and obtaining savings in electrical energy, water provision, etc. These norms try to create the suitable parameters to obtain environmentally appropriate designs, with which to generate spaces of quality for the users of such looking for to influence as well in the economic and social conditions of the region.

In the same way it is tried by means of the accomplishment of the investigation project, to analyses the viability to carry out programs on great scale and to identify sources of financing for its development.

It is possible to analyses the possibility of certifying the calls "carbon credits" (reduction of CO\textsubscript{2} emissions in the atmosphere) as result of the saving of electrical energy when executing a program on great scale in this scope. For example, it would be possible to be considered that the client who acquires a house with ecological criteria will be able to have greater amounts of financing. The increase in the financing which they would have the families to acquire houses with saving systems obtains a financing that can be developed in a greater area of the house.

The proposal of the development of the research project tries to regulate the actions that are made in the different stages from the construction, on the way to reduce the environmental impact that generates the construction activities in the place where they are developed. This like turn out to analyses the urgent necessity that it must in Mexico to develop house of social interest and to produce houses that improve the quality of life of the population.
These proposals try to cause necessary the environmental conditions in the architectonic spaces, to improve the labor conditions of habitability and the users in three specific points: power efficiency (diminution of CO₂ emissions), water recycling and treatment of solid remainders.

**Results. Parameters of intervention to the construction regulations**

In order to exemplify the intervention levels that set out for the application of a sustainable regulation it takes the section from "Conditions of natural illumination".

Calculation accomplishment. The measurement method can be used as perspective conic section on a graphical projection or with photography fish-eye. The suitable method to evaluate the daylight factor (FLD) sight from a portion of sky is the call uniform sky that consists of dividing this sky in thousand point sources that have an equal one to be able of illumination on the point of the observer. [3] An analysis of a standard space is developed; the differences of measurements between the different areas, give like result the FLD in a level of 0,80 m. considered like the level of visual work. As it is possible to be observed, the suitable lighting conditions never surpasses of 6 meters from the window alongside opposed. The example is based on a climate warmed up in a latitude of North 20º; other latitudes are enough to adapt the diagram of Dresler to these, as well as the more advisable labour schedule, without considering inner and outer the reflection factors. [4]

![Figure 2. Accomplishment of a calculation.](image)

-Making measurements in the project. The period of occupation in the different architectonic spaces could vary the required rates of lighting in the point furthermore of the window than it does not exceed the five meters. After this distance the reached levels are insufficient.
In all the architectonic spaces for houses the conditions of natural illumination (daylight factor) adapted to the indicated in the table will have to make sure: they will have equal or greater to be measured to 0.80 meters of the ground (work level).

Table 1. Making measurements in the project (distance from the window)

<table>
<thead>
<tr>
<th>Type of space</th>
<th>1 m</th>
<th>3 m</th>
<th>5 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Living room</td>
<td>16.5% FLD</td>
<td>2% FLD</td>
<td>1.0% FLD</td>
</tr>
<tr>
<td>Dinning room</td>
<td>16.0%</td>
<td>3.0%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Kitchen</td>
<td>16.0%</td>
<td>3.0%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Main dormitory</td>
<td>16.5%</td>
<td>3.0%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Additional dormitory</td>
<td>16.5%</td>
<td>3.0%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Washing room</td>
<td>7.5%</td>
<td>0.5%</td>
<td>----</td>
</tr>
<tr>
<td>Sanitary service</td>
<td>7.5%</td>
<td>0.5%</td>
<td>---</td>
</tr>
</tbody>
</table>

Source: Arias 2010

-Imposing values (maximum or minimum) pre-fixed.

Table 2. Imposing values pre-fixed

<table>
<thead>
<tr>
<th>Luxes</th>
<th>Visual task</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-30-50</td>
<td>Entrances</td>
</tr>
<tr>
<td>50-75-100</td>
<td>Circulation area, contact points, etc.</td>
</tr>
<tr>
<td>100-150-200</td>
<td>Non continuous use rooms, slight work, industrial monitoring, storage areas, ward robes, halls.</td>
</tr>
<tr>
<td>200-300-500</td>
<td>Requirements of visual tasks, offices, quarters control.</td>
</tr>
<tr>
<td>300-500-750</td>
<td>Requirements of average visual tasks, offices, quarters control.</td>
</tr>
<tr>
<td>500-750-1000</td>
<td>Requirements of average visual task plaintiffs, task of inspection and test, drawing area.</td>
</tr>
<tr>
<td>750-1000-1500</td>
<td>Requirements of hard visual task, production lines and assembly</td>
</tr>
<tr>
<td>1000-1500-2000</td>
<td>Requirements of special visual task, tasks of engraving by hand.</td>
</tr>
<tr>
<td>2000-2500</td>
<td>Detail of exact visual tasks, electronic miniature, surgical procedures.</td>
</tr>
</tbody>
</table>

Source. Arias 2010

Conclusions
The main intention of the present paper is the analysis of the physical and social conditions of the western zone of Mexico, with the purpose of establishing the environmental parameters necessary to make recommendations of sustainability in the construction regulations. In this project the feasibility considers to take advantage of the natural resources in a system advantage and rational operation of the natural resources. Also to promote the energy saving, the recycling of remainders and advantage of natural sources of energy.
This proposal is tried to offer an alternative of energy saving in the rural and urban communities by means of control mechanisms that assure the used energy efficiency in the air conditioning, the artificial illumination, as well as the equipment connected in all the processes of the construction: From the project, the construction, the habitability and the maintenance of the house.

With base to the results that are obtained through the different stages of the research, it is possible to make a energy audit, on the way to proposing the recommendations of environmental adjustment of the construction regulations in search of the power saving and the optimization of the institutional resources, as well as improving the conditions of environmental comfort of the users.

Visualizing results. In the areas of opportunity, the priority given by the current government administration to the topic of infrastructure, and especially to housing, prompts us to reconsider the experiences that have been accumulated up to this day under the light of the international initiative of “Green Living”, to establish guidelines for federal tasks to adopt sustainable building practices, for which the following items are suggested:

- Create a House Construction Code including regulation for safe, sustainable, reliable, and inhabitable building in an urban context.
- Promote vertical building in urban areas to have access to a house with services located near work places and schools.
- Promote comprehensive city growth through Urban Development Programs that establish the allocation and use of land according to local needs.
- Promote sustainability criteria for urban development and housing construction.
- Promote the incorporation of sustainability elements into building rules of different regions in the country.

References

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