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Artículos Científicos

La vivienda sustentable para abatir el cambio climático. Caso Tepatitlán de Morelos

Sustainable housing to reduce climate change. Tepatitlán de Morelos Case

Moradia sustentável para reduzir as mudanças climáticas. Caso Tepatitlán de Morelos

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Resumen

Esta investigación se centró en la búsqueda de materiales y tecnologías para la construcción de viviendas de Tepatitlán de Morelos, Jalisco, México, municipio que se está convirtiendo en un polo de desarrollo de viviendas y servicios atractivo para todo tipo y tamaño de empresas. Aprovechando que la Universidad de Guadalajara cuenta con un campus en Tepatitlán, el Centro Universitario de los Altos (CUAltos), se les solicitó a alumnos allí inscritos que llenaran una encuesta que indagaba sobre los materiales con los que se construyeron las casas que habitaban en ese momento. Participaron 80 alumnos de cuatro grupos. Como parte de los resultados se obtuvo que si a las casas habitación se les provee de dispositivos ahorradores de energía, agua y gas se logrará una reducción importante en la huella ecológica, y por lo tanto, se hará una contribución a la sustentabilidad del medio ambiente.

Palabras clave: ecotecnias, medio ambiente, sustentabilidad, tecnologías sustentables.

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Abstract

This research focused on the search for materials and technologies for the construction of homes in Tepatitlán de Morelos, Jalisco, Mexico, a municipality that is becoming an attractive housing and service development center for all types and sizes of companies. Taking advantage of the fact that the University of Guadalajara has a campus in Tepatitlán, the Centro Universitario de los Altos (CUAltos), students registered there were asked to fill out a survey that inquired about the materials with which the houses that lived in that area were built. moment. 80 students from four groups participated. As part of the results, it was obtained that if the houses are provided with energy, water and gas saving devices, a significant reduction in the ecological footprint will be achieved, and therefore, a contribution will be made to the sustainability of the environment.

Keywords: eco-technologies, environment, sustainability, sustainable technologies.

Resumo

Esta pesquisa teve como foco a busca de materiais e tecnologias para a construção de casas em Tepatitlán de Morelos, Jalisco, México, um município que está se tornando um pólo de desenvolvimento habitacional e de serviços atraente para empresas de todos os tipos e portes. Aproveitando o fato de que a Universidade de Guadalajara possui um campus em Tepatitlán, o Centro Universitário Los Altos (CUAltos), os alunos ali inscritos foram convidados a responder a uma pesquisa que indagava sobre os materiais com que as casas que moravam naquela área eram construído. momento. Participaram 80 alunos de quatro grupos. Como parte dos resultados, obteve-se que se as habitações forem dotadas de dispositivos economizadores de energia, água e gás, conseguir-se-á uma redução significativa da pegada ecológica e, consequentemente, dar-se-á um contributo para a sustentabilidade do meio ambiente.

Palavras-chave: eco-tecnologias, meio ambiente, sustentabilidade, tecnologias sustentáveis.

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Introduction

Currently, one of the main problems, if not the main one, is climate change. This phenomenon affects every country in the world, without exception. While certain natural causes cannot be completely ruled out, climate change is primarily the result of human activity. As stated by the Intergovernmental Panel on Climate Change (IPCC) (Core Writing Team, Pachauri y Meyer, 2014):

> Human influence on the climate system is clear, and recent anthropogenic greenhouse gas emissions are the highest in history. Recent climate changes have had widespread impacts on human and natural systems (p. 2).

Environmentalists have designated global warming as the most representative manifestation of climate change.

> The warming in the climate system is unequivocal, and since the 1950s many of the observed changes have been unprecedented in decades to millennia. The atmosphere and ocean have warmed, volumes of snow and ice have decreased, and sea levels have risen. (Core Writing Team *et al.*, 2014, p. 2).

In countries of Latin America, Africa and Asia, one of the factors that influences climate change is related to the type of materials used in the construction of houses-dwellings, since these materials do not allow the saving of energy and water , or are of non-renewable origin. The opposite case occurs in some of the countries considered first world, where renewable materials are used that allow energy savings, prevent the flow of heat to the outside of the house in times when temperatures drop, or prevent entry of heat to the house in hot seasons. And we must not forget that, in many places, systems have been incorporated that convert solar and wind energy into electrical energy to power devices used in homes and industries, as well as rainwater harvesting systems.

There are regions of the planet where lighting, indoor climate conditioning, cooking and water heating technologies are used to save electricity. Even, thanks to certain technologies, gas is replaced by methane generated from organic waste produced in the home itself. Likewise, from certain implementations, the water from the shower or sink is reused to flush the toilet.

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It might be thought that using saving devices at home or business is very expensive because its initial costs show it, but, with the passage of time, it is possible to see the monetary savings that are achieved, without forgetting that the less waste there is, the more it is cared for. to the environment.

Theoretical framework

In everyday life, inside our homes, we regularly make excessive use of non-renewable materials (inputs or raw materials) And it is no small matter, since we spend a large part of the day there, a third or more of the 24 hours.

The human being depends on electricity, gas and water on a daily basis to carry out many of his activities. For example, according to the Water Advisory Council (La Silla Rota, March 22, 2018), the average daily consumption of a person ranges between 150 and 200 liters. Unfortunately, most people are not concerned with the way these resources reach their homes. Some of the generation processes are highly polluting. Water requires sanitation processes that regularly involve electrical energy and chemicals. Another type of pollution is that generated by burning gas or extracting it. These are cases that take place on a daily basis in countless places on the planet simultaneously.

Therefore, this research will try to expose some of the environmental and economic benefits derived from the use of environmentally friendly technologies, specifically in homes in the region of Tepatitlán, Jalisco, Mexico. Likewise, the reasons why technologies and materials that currently predominate should be replaced by more environmentally responsible ones will be presented. To achieve this purpose, the inhabitants of the region must be made aware of the amount of non-renewable resources that a home requires for its daily operation, in accordance with the demands of current life. In the same way, the calculation of the average cost required to support a home must be presented, including payments for electricity, gas and water, which must be adapted to the life model of the inhabitants of the geographical place under study. On the other hand, and as a counterpart, the existing technological means that help reduce the expenditure of resources in a typical house with the characteristics of Tepatitlán have to be determined. Finally, contrast the expenses incurred with the current characteristics of a home in the Tepatitlan population and the expenses that would be incurred if energy-saving materials and devices are used.

Method

It was proposed to know the current conditions of the average house in the area of Tepatitlán, Jalisco; the average economic conditions of its inhabitants, and the most frequent materials used in construction. In the same way, the technologies that can be used for future constructions and the benefits they present in the economic and ecological fields are being sought.

Developing

Climate change is the result of the excessive use of practices and materials that harm natural resources, pollute the environment and alter the natural order of all living beings that inhabit the planet. It is not a recent phenomenon, on the contrary, it has been brewing for years, what happens is that it is not until just a few decades ago that human beings began to become aware of the damage that the environment was doing to them with the creation and use of many products of constant use. In addition, they are not only harmful when they are created and used, but they are also harmful once they have been used and discarded, since some of them take up to hundreds of years to degrade, during which time they continue to contaminate.

Also, there is an overexploitation of fresh water sources. Many domestic and industrial processes become pollutants of all types of lake bodies, where the water returns after having been used and contaminated.

Likewise, there are many electricity generation systems that involve the burning of fuels that are highly harmful to the Earth. Despite this, they are the ones that prevail practically all over the world, since nowadays non-polluting electrical power generation systems have not managed to consolidate.

Similarly, in a large number of homes liquefied gas is used both for cooking and for heating the water used in the bathroom, whose emissions are a constant threat to the ozone layer.

This is only a small part of the sources of pollutants that are related to houses-rooms. Of course, the sources of pollution from vehicle parks and industries, among others, have not been mentioned.

Relevant data of Tepatitlán

Tepatitlán is classified as a city in continuous population and industrial growth that bases its economy on commercial, livestock and forestry activities, in addition to having educational centers that allow people from neighboring towns to go to prepare instead of traveling to the Metropolitan Area Guadalajara, which causes a greater demand for housing, coupled with that generated by the growth of regional companies that require the services of personnel from other latitudes

As the first part of this study, it was considered of vital importance to take into account the climatic conditions that exist in the region, and thus determine the types of materials and technologies that can be used for construction in the municipality.

Regarding the climate, it is semi-dry, with dry spring and winter, or semi-warm with mild winters. The average annual temperature ranges between 19 ° C and 30.5 ° C. Between the months of June, July and August (an average of 80 days per year), there is an average rainfall of 874.7 mm. On average, there are 18 days with frost. The rest of the days are sunny with prevailing winds from south to north.

Now, its hydrological resources are provided by the Verde and Calderón, del Valle and Tepatitlán rivers. And it has four important dams: Carretas, La Red, Jihuite and El Pantano.

The current home

Taking advantage of the fact that the University of Guadalajara has a campus in Tepatitlán, the Los Altos University Center (CUAltos), students registered there were asked to fill out a survey that inquired about the materials with which the houses that lived in that area were built. moment. 80 students from four groups participated. In addition to their name, they were asked about their place of origin or provenance. Here, 70 of them answered that they came from other populations.

Another question that was posed to them was related to their accommodation in Tepatitlán, and it turned out that they rent houses (among several of them to reduce costs) that are relatively "modern" and are located in newly created subdivisions, so the materials that are used are concrete partition with brick walls, single glass windows and double sheet doors. From a visual inspection of the house of some students who reside on the hill closest to CUAltos, it was established that they are houses developed by construction companies,

that they are inexpensive and are not provided with devices that allow them to have savings in services of electricity, gas and water.

The rest of the students (10) are natives of Tepatitlán and live with their families in the so-called colonias and traditional or old neighborhoods. There they used in the construction red brick with enjarres in walls; the windows, like the doors, some are metal and others made of wood. They are provided with gas heaters. Some use energy-saving or energy-saving bulbs and others are incandescent. The toilet is six liters.

Search for technologies aimed at reversing climate change

As part of the research itself, the meaning of some of the technicalities involved in protecting the environment had to be taken into consideration. Thus, according to Calvente (2007), sustainability can be defined as the capacity developed by a system to satisfy the needs of current generations without compromising resources and opportunities for the growth and development of future generations.

With this principle, we started to look for the materials and devices that could be used in the construction of the new houses-rooms that are intended to be used in the future developments that are made in Tepatitlán. Likewise, it was taken into account that a balance had to be achieved between costs, quality and environmental protection, as proposed by the United Nations [UN] (1987).

Indeed, one of the factors that were taken into consideration in the selection of the technologies to be used was the economic one, since, if the population continues to grow, there will be a greater demand for housing. It is about the opportunity to establish a system of preservation and restoration of nature, as mentioned by Barnett (23 November 2017).

If the houses are provided with energy, water and gas saving devices, a significant reduction in the ecological footprint will be achieved, and therefore, a contribution will be made to the sustainability of the environment, which is consistent with what it explains. Garrett (May 27, 2021).

Properly combining energy saving technologies, construction materials and care for the environment to reverse climate change is to meet the conditions that have been described as typical of sustainable housing. Even more, if it is extended to new housing projects, then we would be talking about a new construction paradigm for the new home. (Baeza, s. f.).

Devices and materials for reducing the human footprint for environmental protection

The search for devices that allow the use of energy-saving materials and devices for the protection of the environment in order to contribute to reversing climate change is directly related to the so-called sustainable architecture, following here Miceli (2016).

The eco-technologies that are part of sustainable architecture emerged as a result of the optimal use of natural resources and fossil fuels. For example, photovoltaic and thermal solar panels, which use solar energy as the main source, are a technology that is gaining a boom and whose use is a great step to reverse climate change (Acciona, 2016; Fehrenbacher, 2016). For his part, Fredrick (November 20, 2017) exposes the advantages of double flush sinks: “In addition to the environmental benefit of saving water, (…) it also reduces [n] your water bill over time” (para . 3). And to avoid the exchange of heat energy from the house to the outside and vice versa, there are double glazed windows (Ral Aluminio, 2018).

The family economy and distribution of spending

All the populations of Mexico are included in the catalog of the National Institute of Statistics and Geography (Inegi) and the National Commission for the Protection and Defense of Users of Financial Services (Condusef), and the population of Tepatitlán is no exception.

Among the data found in the government institutions that were consulted, it was possible to establish that in the areas of housing, income and household expenses, the Los Altos region where Tepatitlán is located is placed in the second income bracket within the state of Jalisco, after the populations that make up the Guadalajara Metropolitan Area.

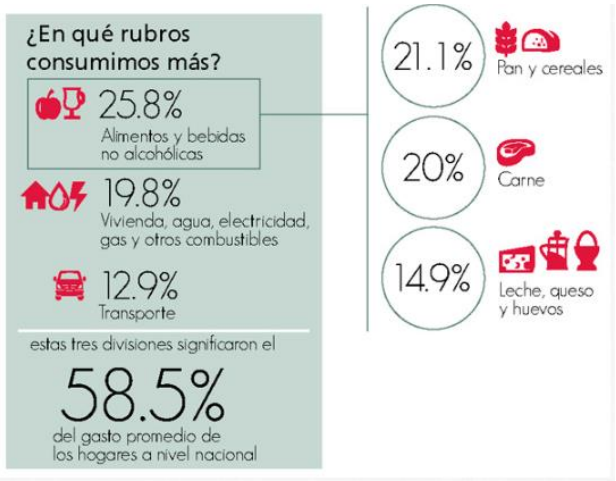
Regarding the most common expenses that people who live in the area have, it was found that an average family distributes their expenses in the payment of housing, water, electricity, gas and other fuels, which represents 19.8% of the total income by family; 25.8% use it in food and non-alcoholic beverages, while 12.9% use it in transportation (see figure 1).

Reducing that 19.8% that you use in housing, water, electricity, gas and other fuels is a great opportunity for savings, especially through devices that allow reducing the consumption of electricity using technologies based on solar energy, or by using windows.

double glazing, which prevent the loss of heat energy from inside the house to the outside and prevent hot or cold air currents from entering the house.

In addition to the above, if the house is provided with a solar heater, the consumption of liquefied gas will reduce and thus there will be another opportunity for savings. And if some other type of toilet is still included, since it is the one that represents the greatest consumption of water in the house, and one that allows water recycling is used, the list of alternative technologies for the house-room marked by Bohoslavski (1998).

Figura 1. Distribución del dinero del rubro en los que más se gasta en las viviendas



Fuente: Condusef (2021) concepto de distribución del dinero en viviendas, recuperado de www.condusef.gob.mx

Although the application of all these implementations will result in cost savings, the greatest benefit is that it contributes to the sustainability of the planet and, therefore, to reverse climate change.

Results

For the application of the survey of this work, we had the support of eight students; Each one was given 30 surveys to support us by applying them to their acquaintances or neighbors. However, one of the interviewers, having more neighbors, chose to make four extra photostatic copies and apply them to four more people. This detail was communicated to us by the person who captured the results and supported us with the graphs, so there was no problem in leaving the graphs and results as they were delivered to us.

They were approached because they know the areas where they live, in addition to the fact that it is a great opportunity for people from the general population to learn about the technologies that are used for sustainability. As we already said, these not only represent, if they incorporate them, economic savings, but also contribute to the care of the environment of their city.

In order to determine how much people know about sustainable housing, as well as in order to establish the degree of knowledge of their current house and of a sustainable home, to know how much of their family spending is used in paying for electrical services, but Above all, knowing how much you are willing to invest in the acquisition of a sustainable house-room, the survey considered four questions, which can be seen in Figure 2.

All this had the initial purpose of determining the urgency that exists for the construction of sustainable homes, or the adaptation of saving devices in their current homes, as well as being able to search among local construction companies for some that, in alliance with the university and businessmen of the region, be willing to invest in reversing climate change.

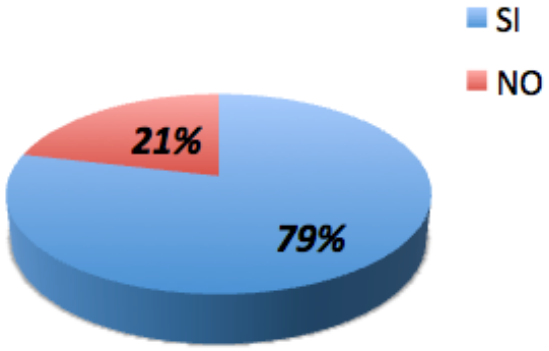
Figura 2. Encuesta que fue presentada a 244 entrevistados

Pregunta 1. ¿Has escuchado de la vivienda sustentable?
Respuestas : SI NO
Pregunta 2. ¿Tienes idea de lo que representaría para tu hogar vivir en una vivienda sustentable?
Respuestas : SI NO
Pregunta 3. ¿Normalmente a cuánto asciende el gasto de energía eléctrica por mes?
Respuestas : o $150 O $250 O$400 O $500 ó más
Pregunta 4. ¿Cuánto estarías dispuesto a pagar por una vivenda sustentable?
Respuestas : o$800 000 o$1´000 000 o$1´500 000 o $2´000 000 o Depediendo qué tan sustentable

Fuente: Elaboración propia

Question number one was "Have you heard of sustainable housing?" and the options to answer were limited to two options, Yes or No (see figure 3).

Figura 3. Conocimiento de viviendas sustentables

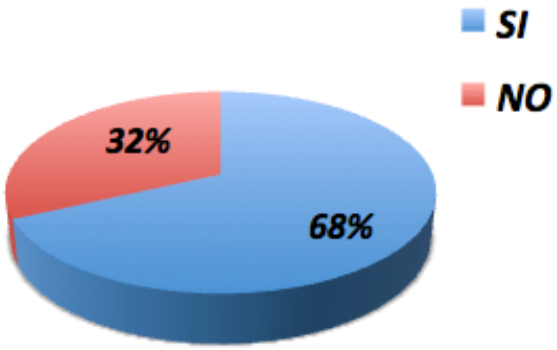


Fuente: Elaboración propia

The number of people who answered affirmatively was 192, which represents a high degree of knowledge about sustainable housing, 79% of the 244 interviewed. The remaining percentage (21%) do not know the benefits of having a home of this type.

Question number 2 was "Do you have any idea what it would mean for your home to live in sustainable housing?" and the options were also limited to a Yes or No (see figure 4).

Figura 4. Ahorro de las viviendas sustentables

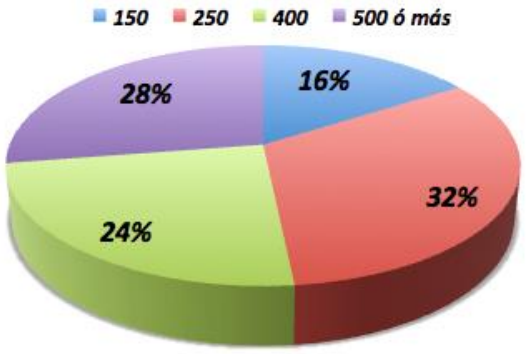


Fuente: Elaboración propia

Figure 4 reflects that 68% of the respondents, 166 of the 244, know of the benefits that can be obtained by living in a sustainable home, while 78 people, that is, 32% of the responses, still do not They have visited a sustainable home, nor have they had any contact with anyone who could be asked about the difference between living in a normal house and a sustainable one.

In question three, "How much does the monthly cost of electricity normally amount to per month?", The options that were presented were: $ 150, $ 250, $ 400 and $ 500 or more (see figure 5).

Figura 5. Gasto mensual de energía eléctrica

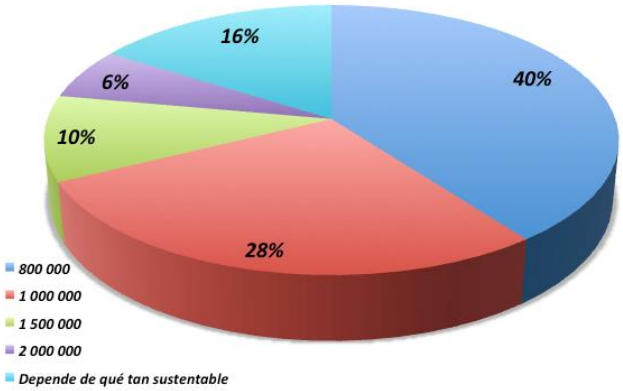


Fuente: Elaboración propia

Regarding the monthly cost of the electric power service, the result indicates that only 67 interviewees out of 244 pay $ 500 pesos or more, which is equivalent to 28%, while 59 interviewees, that is, 24%, pay $ 400 per month for the service. of electrical energy. On the other hand, 79 interviewees (32%) stated that they made a monthly payment of electric power service for $ 250 pesos and only 39 interviewees (16%) pay the electric power service of $ 150 pesos. Therefore, there is an opportunity for sustainable housing, due to the savings that means paying less money for this service.

The fourth and last item consisted of the question "How much would you be willing to pay for sustainable housing?". The possible answers that were raised were in the average costs of current homes (see figure 6).

Figura 6. Disposición de los habitantes al pago económico



Fuente: Elaboración propia

Thus, 40% of those surveyed are willing to pay 800,000 pesos for one of the houses; 28% of those surveyed are willing to pay 1,000,000 pesos; 16% of those interviewed would pay depending on the degree of sustainability of the home; 10% would be willing to pay 1,500,000 pesos for sustainable housing, and only 6% would pay 2,000,000 pesos. A remarkable fact is that 179 interviewees mentioned that it would be very good if houses were built as a preserve in the vicinity of CUAltos, because most of the families of Tepatitlán de Morelos have sons or daughters who are currently pursuing a career there, or they will do so in the future, so their proximity would be one more reason to participate in the acquisition of a sustainable home.

Finally, it can be said that CUAltos is built in what could be said to be the newest part of Tepatitlán, it is 15 minutes from what is the central square; It has acceptable transport and communication services, in addition to the fact that, because it was built in what was an agriculturally oriented area, it has water and unbuilt spaces that little by little have been provided with services such as electricity and derivations of drinking water. Therefore, they could be taken into consideration by developers as the first possibility for the implementation of sustainable housing in the region.

Analysis of the research results

From the data obtained it can be seen that it is extremely urgent to start with the development of sustainable neighborhoods, since it is an area with a large expansion of inhabitants.

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This resides in the phenomenon that the so-called traditional families of the region were made up of 10 or more inhabitants, whose descendants are seeking or will seek their own home in the near future, on the one hand. And on the other hand, the creation of new companies in the region or the growth of existing ones has forced people from other populations to arrive and demand housing, being people who are professionals, many of them work for the university and the different educational centers in the region, as they are used to comfort and are willing to pay for it.

In addition, as it is a population that has companies of international stature, great care is taken to ensure that measures are implemented to help alleviate climate change, not only within them, but throughout the community.

Now, according to population development statistics, the investment made by authorities and companies to continue with a traditional population, such as Tepatitlán, which originally had a mainly livestock vocation, undergoes a metamorphosis with the arrival of CUAltos almost at the end of the last century, as it came to promote the improvements of the companies in the region, which in turn are promoting programs so that their collaborators and families are able to prepare in the various specialties that are offered.

All, jointly, companies, universities and municipal authorities, are willing to do their bit to generate systems that can help or contribute to reverse climate change. It is time to start using energy-saving devices in existing houses-rooms, which could be done with the facilities provided by the municipality to obtain solar heaters and start with the installation of electricity generation systems in houses- room with the support of the companies, since they were the first to place them in their facilities.

Discussion

As has been seen through this document, there is great urgency to start with municipal, state, federal and private programs, preferably combined, so that the new culture of energy saving penetrates among the inhabitants of Tepatitlán. People will be willing to participate simply because they are told that they will be able to have financial savings and that it will benefit their family, but above all because they will contribute to reversing the effects of climate change that are affecting not only them, but also to the whole planet.

Conclusions

The people of any region, for years, were not aware of the damage done to the environment by turning on a light bulb, heating the water in their house or turning on the fan or the artificial climate that they had in their house so that was in better condition.

Although our country signed the treaties that are aimed at reducing the effects of climate change, it seems that the information never reached the general population, even though it was announced by federal authorities, even though offices dedicated to address those problems. Curiously, those people who arrived with the university were the first to make known what was happening in the world, and it seems that even so few people cared, that is why this document looked for a way to people will be interested in environmental problems without mentioning all the theories, without explaining all the elements that compose them or the way in which they interact; it was simply sought to get their attention in the most subtle way possible, and it was found that the easiest way is to tell them about the savings they can obtain by using or not using something.

When people see that they will be able to have more money in their pockets, because they have stopped paying for some services or will pay less for them, they will become fully involved in programs that implement the incorporation of sustainable technologies.

Future work

As members of CUAltos, we have a moral obligation to participate in programs that help mitigate the effects of climate change, but it is also essential that this participation be extended to the students themselves, and that they in turn involve their families and friends.

For this reason, it is pending to propose to the university authorities a program that motivates students by obtaining credits to get involved in environmental activities. Climate change is a very serious problem worldwide, so any small contribution that students can make as part of these programs, no matter how small, will be beneficial for the planet.

Taking advantage of the experience that companies in the region have in the use of sustainable technologies within their own facilities, they have been working on a school-company participation program so that they can be the starting point for them to be based in the region. to promote care for the environment, with which they are committed as their certifications prove it.

Perhaps, in a slightly more distant future, the generation of legislation that encourages the use of sustainable technologies for the benefit of the environment through their use in houses-rooms, firstly, and later in companies.

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