Investigation of the Residence with respect to the Ecological Criteria

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ABSTRACT
Humanity is now questioning the technology and trying to reduce the damage it inflicts on the environment. This reflects with the emergence of ecological building designs in the building sector. Ecological designs are encouraged by certification systems in the building sector and systems that provide comfort conditions without harming the environment. It is necessary to produce sustainable designs in the current environment in order to be able to achieve this position and to provide sustainability of the environment. It is important to examine design criteria of earlier structures in history if it can provide this. In this study, it is aimed to reveal the ecological characteristics a new residence building in Talas District of Kayseri by making use of the criteria of international certification systems. The new structure that is considered in the concept of ecology has been examined in terms of their suitability to criteria such as ecology, energy, economy, indoor environmental quality, health and welfare, innovation, management, land use, transportation, renewable technology, water, environmental pollution and CO2 emissions material and waste. It is aimed that this study contributes to making sensitive designs in terms of sustainable environment in the future.

Keywords: Ecology, Architecture, Kayseri, Bicer House

1. FIELD STUDY ON THE INVESTIGATION OF ECOLOGICAL TRENDS IN THE CB RESIDENCES

The criteria that are considered in sustainable design are; the system choices that are naturally fed, but that do not consume nature when doing so, street-building positioning, sunshine in space design, use of local materials (Yağmur, 2017). In the new constructions, the solution with low energy consumption for the cold-hot environment setting which is important to provide the comfort of life has been produced with the solutions that can not be reached completely and energy is consumed in high amounts. The first thing to do in ecological solutions is the creation of sustainable building designs to be used in the new structures by taking into account the daytime conditions. In this study, CB house are considered in Talas province, Kayseri. The CB house, which is the subject of the study, also has the energy identity certificate according to the BEP regulation. The result is that sustainable design and environment can be achieved in newly built houses. It is hoped that this study will promote the efficient use of ecological approches in new designs and contribute to sustainable architecture.

2. ECOLOGICAL ARCHITECTURE AND CERTIFICATE SYSTEMS

The term"ecology" that examines the relationship of living beings with each other and with the natural environment they live in have entered into everyday life as a result of the environmental problems emerged due to the change of the world order (Bılgen, S., 2011). The relation between environment and structure has been kept in the forefront of ecology within the scope of sustainability (Sakınç, E., 2006; Van Der Ryn, S., Cowan S., 1996) Today, the topics of ecology have been expanded and ecology has become an interdisciplinary science with human-nature relations leading to environmental problems and affecting the life of living beings in negative direction (Gürpınar, E., 1992). In the 21st century, ecology has become an interdisciplinary force that influences vital issues

such as the use of alternative energy, human nature associations, natural life, and philosophy, economy, and politics (Özeler Kanan, N., 2010).

The discipline of architecture takes place under the heading of the artificial environment that people make by using the natural and the natural environment (Hamamcı, C., Keleş, R., 2002). Ecological architecture is not a architectural style but rather a design criterion that will enable us to fulfill our responsibilities towards the environment. Ecological architecture is a system of thinking that can be achieved by using alternative renewable energy based systems in building design (Tönük, S., 2001). It is important for architects to know that ecological architecture is important in achieving urban and global ecology and that it reflects on their own projects. Ecological architecture, which refers to the affected environment at the minimum level, brings comfort conditions in living spaces while using natural resources and energy with high efficiency (Lan, M., 2011). Producing projects that do not harm natural resources is the first step in designing an ecological structure.

The first design criteria in the planning phase of ecological architectural constructions are to constitute the positioning of the building in accordance with the existing topography, the structures designed according to the climate data and the structures which do not harm the green texture. In order to reduce the heating needs of the building, it is important that the north and south directions are taken into consideration in the organization of the space and that the direction of the wind direction and the direction of the dominant winds are examined so that organization of the rooms are appropriate in plan and in cross section. As a sustainable design approach criterion; it is necessary to design the spaces flexibly so that they can respond to changing needs. Energy efficiency will be increased by making solar energy available for storage and design, and / or by designing the building to use intelligent systems. In order to save energy, designs must be made that will benefit from ventilation and illumination. In material selection; materials that do not harm the environment during production and which are durable and low maintenance cost and which can be recycled after use should be at the forefront. Therefore, environmentally sensitive policies are required for ecological architecture in all decisions to be taken at all stages of a building, from design to use and demolition (Tönük, S., 2001). The use of active and passive systems is prominent in exploiting the potential of solar energy in ecological building design. One of these passive systems is to provide heat gain internally as a result of the increase of the glass surface on the south façade (Demır, M., 2015; Berber, F., 2012). Decisions that the architect will take in the design phase will ensure that the building has sustainable design criteria (Dıkmen, B., Ç., 2011).

Ecological architecture, are considered in a wide range of applications including the use of local materials, conformity with physical environmental, the ability to produce its own energy, the use of building materials requiring less maintenance, the use of passive systems, and the use of active systems as advanced technology. The fact that one or more of the above-mentioned subjects are included in a structure allows a structure to be discussed within the framework of concepts such as energy efficient building design, ecological architecture, green/environmentalist/harmonious building design, sustainable architecture and intelligent building design (Dıkmen, B., Ç., 2011). Objectives of ecological architecture; aims to produce building designs that will fit into future societies, socio-economic, cultural and environmental contexts. Reducing the energy used in buildings, design strategies involving passive systems, designing the zone in accordance with local climatic conditions is important (Tokman, L. Y., Tatar, E., 2011).

Certification systems started to be effective in order to evaluate the energy efficiency of the buildings in the world resulting the problems experienced in the energy resources due to increase in energy consumption, (Tmmob Mimarlar Odası; 2006). LEED, BREEAM, CASBEE, DGNB, IISBE and GREEN STAR are among the most known of these

certifications in Turkey (Özkıranartlı, Y., Parlak Biçer Z. Ö., 2014). It is also acknowledged that the buildings built with the certification system are less expensive when evaluated in the long term (Erten, D, 2016). Along with the mentioned systems, some countries have their own certification systems.

The entrepreneur chooses one of the certification systems according to the design criterion, the region and the budget. Choosing an incorrect system will adversely affect applicability and cost, and will reduce design quality. The right choice will reduce the harm done to the environment, improve the quality of the design and bring a healthier living environment (Özgören, H., 2010). Each country has also improved its certification system according to its climatic, cultural, social life, level of development and the state of its construction methods. Since Turkey has not a certification system of its own, it seems that LEED and BREEAM certification systems are used (Özgören, H., 2010).

In Turkey, where the number of certified buildings is increasing rapidly (Gbıg, 2017), there is the "Building Energy Performance Regulation" (BEP) based on EU Energy Performance Directives of Buildings in order to evaluate the energy performances of buildings (Resmı Gazete, 2017). The Regulation sets out the calculation rules for evaluating the building's energy use. At the same time, the regulations classify the buildings in terms of carbon dioxide emissions and determine minimum energy performance requirements for new buildings. Other purposes of the Regulation are; to assess the feasibility of renewable energy sources, to control heating and cooling systems, to limit greenhouse gas emissions, to set performance criteria and principles of implementation and to protect the environment. In doing so, it considers external climatic conditions, indoor requirements, local conditions and cost effectiveness (Çevre Ve Şehırcılık Bakanlığı, 2015). No permit certificate is given to the administrations related to the building where the Energy Identity Certificate is not issued (Anbarcı, M., Gıran, Ö., Demır, İ.H., 2012). The CB house, which is the subject of the study, also has the energy identity certificate according to the BEP regulation.

3. INFORMATIONS OF TALAS

The Talas District in Kayseri is an important settlement due to its history and hosting of various cultures (Map 1). Talas is geographically divided into two parts: The Lower Talas on a flat plain and the Upper Talas on the skirts of Ali Mountain (Özsoy, H., 1991). In the province of Talas where terrestrial climate characteristics are observed, summers are cooler than in Kayseri, and precipitation and strong winds are seen in spring and autumn seasons (Özsoy, H., 1991).

Map 1. Location of Talas (Google Earth, 2016).

Talas, is a settlement where the Armenian, Greek and Muslim populations lived together and possessed numerous and various historical and cultural heritages belonging to these cultures. Structures that constitute the traditional urban texture of the Talas, which has been inhabited since the late Roman-Early Byzantine period, were formed in the late Ottoman period in centuries (Figure 1) (Eroğlu, Ö., 2016).

Figure 1. Overview of Traditional Housing Pattern in Talas District (Oberhvmer R., Zimerer H, 1899).

In Talas where the slopes were chosen to meet the needs of the shelter and defense, the structure of the traditional houses was shaped according to stone carving structures and stone material reserves in the region. Wooden materials were used in the upholstery of the building parts built with stone stacking system (Eroğlu, Ö., 2016).

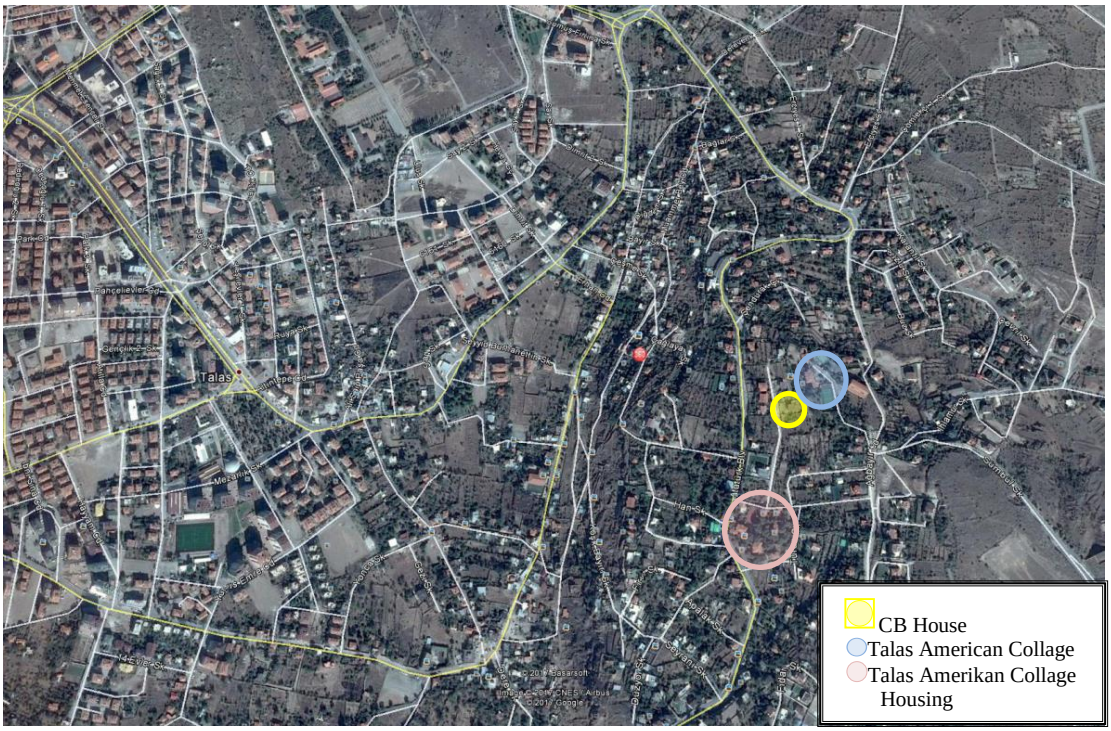
The relationship with the slope in the buildings which are mostly constructed as two storeys except the basement with inclined terraces in Talas was made according to the view (Figure 2). In the traditional houses, the main floor is generally located on the upper floors with no relation to the street, and the plans are shaped according to climate. The traditional residential structure built on the high slopes of Talas is situated to the west of the slope and thus is best benefited from the sun (Figure 3) (Eroğlu, Ö., 2016).

Figure 2. Overview of Talas District(Talas Belediyesi, 2008).

Figure 3. Street Pattern of Talas District (Yağmur, Y., 2016).

4. CB HOUSE

The aspects of the ecological design and construction of the modern dwelling in Talas' traditional housing structure, are examined and analyzed. When the construction was determined, structure was selected taking into account the locations on the land, the number of stories, its size and intended use. It was also important whether or not the energy identity document was selected when the modern structure was selected. The new building with the Energy Identity Certificate is located in the Upper Talas neighborhood (Map 2). We have tried to evaluate ecological aspects of the effects of the environmental data and the solutions of the new housing in order to meet today's needs.



Map 2. Location of Selected Houses (Google Earth, 2017).

There are 4 different terraced terraces arranged in past periods in the land where the building is located. Between each level is about 3 meters. The orientation of the levels constitutes of the east elevation as the upper level and west elevation as the lower level. The registered area where the neighboring registered buildings are located on the eastern front is home to the former Talas American School. (Figure 4) Not looking at American College but looking at the same direction with it, emphasizing with the respect of historical touch behind it, overwhelming history is an ecological approach to the CB house in terms of tarihe and environmental sensitivity. In addition, the building was placed in a lower quota instead of a level close to the old school building. Thus, the inhibition of the historic touch, and its competing with it, is also inhibited (Figure 5). The terraces built in the past years have also been made with the same denim and construction technique and stone material supplied from the same place (Figure 6-7).

Figure 4. The Levels of the Construction site (Parlak Biçer, Z. Ö., 2013)

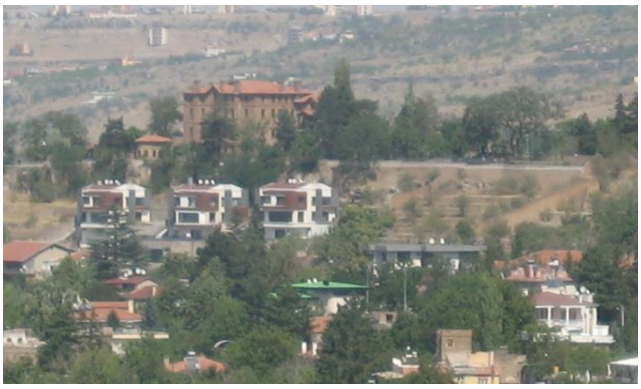


Figure 5. Talas American College and CB House (Parlak Biçer, Z. Ö., 2017)

Figure 6. CB House (Parlak Biçer, Z. Ö., 2016)

Figure 7. CB House (Argeus Architects, 2013)

The structure was planned with the two masses facing the long side of the view and taking advantage of the maximum view and daylight (Figure 8-9). This has led to the perception of scenery from all locations, as well as the cost of heating, especially during the very cold winter time.

Figure 8. CB House Entrance Floor Plan (Argeus Architects, 2013)

Figure 9. CB House First Floor Plan (Argeus Architects, 2013)

The floors of the three-storey building are accessed individually and each floor have their own garden use. During the planning stage, the visitors of the house users are considered in the spaces located on the first level and the guest floor where the bedroom, hall, wet spaces, heat center and depot are located is designed. There is a open living space oriented towards the west, where the main entrance of the building is provided with a landscape view (Fig. 10). This floor, which is accessed from the north side, is located in the south direction where the kitchen is dominated by the view of Ali Mountain. The wet places are located on the north and east mezzanine. This reduced heat loss to the north and east of the structure.

In the design, which is divided into two by mass, there is a one-armed staircase and main corridor in the center. (Figure 11). On the sides of the stairs glass material is used for the purpose of preventing rapid airflow in the house. During this application, space is provided between the glass material and the steps of the stairs, along the entire stairway, to provide air circulation between all the floors.

Figure 10. CB House Living Space (Parlak Biçer, Z. Ö, 2016)

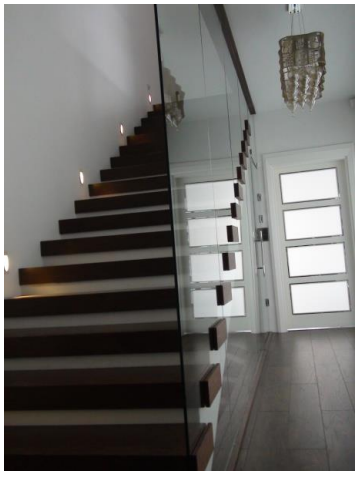


Figure 11. CB House Staircase (Parlak Biçer, Z. Ö., 2016)

The upper floor, where the bedrooms are located, has a parent's room and a dressing room-a bathroom, a children's room and a dressing room-bathroom and There is also a study room (Figure 12). All the spaces are again directed to the western view towards the main landscape and to the south as it is at the entrance floor (Fig. 13). The secondary rooms, such as the laundry room, the children's room bathroom and the dressing room, are located in the east and north directions. Thus, the western and southern view and day heat are also benefited at a high level.

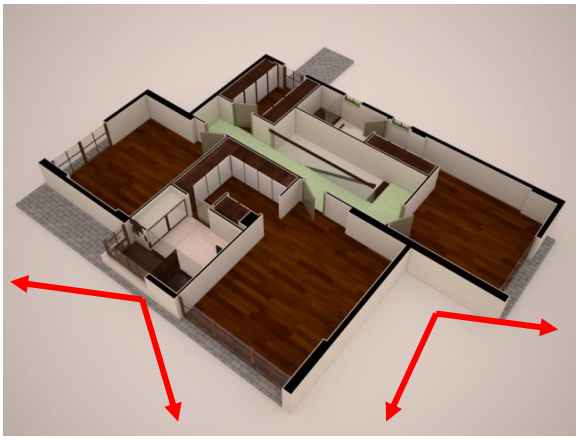


Figure 12. Image of First Floor, CB House (Argeus Architects, 2013)

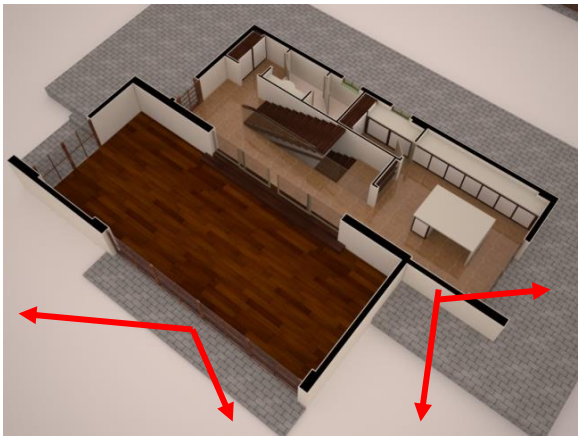


Figure 13. Image of Entrance Floor, CB House (Argeus Architects, 2013)

In CB house, gable roof was chosen. However, in order to be able to adapt to the traditional environment, the gable roof is designed to be concealed (Figs. 14-15).There are blankness in the western and southern façades. The large transparent surfaces increase the dominance of the view and daylight reception and heat penetration (Figure 14-15). This has seriously impacted and reduced the cost of the build in use. Reducing the heat loss from the glass in the large façade openings used in cold regions in the winter months has been a major problem. For this reason, the glasses are chosen from glass with properties that prevent heat transfer between the exterior and the interior. Care has been taken to ensure that ecological approaches are used in the use of materials. In the summer of the western sun there are disturbing effects. In planning, cantilevers were made out, aiming to cut the western sun. In addition, automatic shutters have been made for the disturbing western sunshine in the summer months, using the facilities of modern technology. In the north and east facades, the windows of the spaces that are the reflection of the planning are small (Fig. 15). In the general ventilation of the building, the windows on the south side and the small-sized windows on the north side play an active role in ensuring air circulation. The hot air that will be generated in the summer months is provided by this ventilation system.

Figure 14. CB House Western Façade (Parlak Biçer, Z.Ö, 2016)

Figure 15. CB house South and Eastern Façade (Argeus Architects, 2013)

5. STUDY OF SELECTED DWELLING IN TERMS OF ECOLOGICAL ARCHITECTURAL AND ECOLOGICAL ARCHITECTURE CERTIFICATE EVALUATION CRITERIAS

The CB House's Energy Identity Certificate has become important in the selection of work to be done. The CB house is a detached house. In order to reduce heat losses, materials produced with today's technologies have been used. Positive aspects related to ecological architecture were discussed through plan charts of house consisting of basement, ground and first floors. In the CB House, living and bedrooms were also planned by taking advantage of the slope of the land while still having basement floor service areas. In the CB House, which has an open plan scheme, the daylight interior can be felt at every point and its heat can be utilized.

It was thought that the environmental data are important on the fronts of the construction and the observations were made on this subject. In building, the northern front has fewer and smaller sparsely windows than the other windows. The CB House offers a lot of new materials and the window openings on all fronts are big. In the modern house, an automatic shutters system with plastic lamellae is used for solar control. CB House is carried by carcass system and heat insulated filling material is used on its wall and it is covered with insulation material. The flooring and doors of the CB House were made of wood and window furniture made of plastic based material.

There is a similar or different evaluation criterion for certification systems used for facilitating and standardizing organizations on a structure. It has been observed that the

main similarities of these systems are integrated in ecology, energy, economy, indoor environmental quality, health and welfare, innovation, management, land use, transportation, renewable technology, water, environmental pollution, CO2 release materials and waste (Yağmur, 2017). In this study, the benchmark criteria were examined on new structure. These traces have also been examined in the building which has the subject of study and Energy Identity Certificate, and it is hoped that this work will have an incentive and dissemination effect of new construction in terms of ecological architecture. In ecological certification systems, energy criterion and therefore how energy is to be provided is the front plan. In modern structure; the natural gas system, which is low in nature, is being used with the progress of today's technologies and the improvement of the collective use and infrastructure possibilities.

Economy, another criterion in ecological buildings, is an important issue because ecological building is perceived as non-economic. This situation prevents the construction sector from investing in ecological construction. It is important that the cost of construction from design to construction, use and destruction is low, and that even the recycling of the destruction materials is ensured. It is important to pay attention to the fact that the design decisions made at the design stage are made with durable, frequent maintenance and non-destructive material, and that the life of the material in use is extended with the use of the material (Dikmen, B., Ç., 2011). In addition, the short transport distance of construction materials will reduce transport costs and damage to the environment. The recycling and use of the wastes after the destruction of the structure is also economical. In today's construction systems, materials such as concrete, iron, brick and bonding materials are used. While some of them can be recycled, the cost of recycling is costly because the systems are not adequate. The new building has brought economics with its reinforced concrete system, insulated wall materials, stones from local stone quarries, day-to-day construction techniques and materials.

In all of the certification systems the indoor environment quality is considered important. In ecological constructions, the use of mechanical systems is reduced by considering the indoor living standards since the design phase and the passive systems are aimed at achieving comfort. In the CB House, blinds were also used as the sun breaker for the western sun and balanced indoor comfort was achieved. In CB House, the advantages brought by modern materials are utilized. The walls are made of materials with thermal insulation properties and built with an insulation material that is thicker than the value indicated on the Energy Identity Certificate (15 cm) ensuring that the interior temperature is not affected by the outside temperature during the winter and summer. In order to evacuate the heat generated during the summer months, windows were opened in the direction of the dominant wind. Despite the large window openings in the CB house, heat-sealable materials were preferred.

Most of the certification systems are considered as one of the criteria for evaluation of innovation. CB House is considered to be innovative by using all the techniques and materials in the modern period and by designing it in accordance with the environmental data and directing the further designs. Management with its subtopics such as Project, site, use and demolition is included in certification systems as a subject. In ecological structures, project management is the determining factor for the efficiency of these structures at all stages from design to use. In CB House, the user is required to carry out the maintenance operations at regular intervals and try to remove the snow from the building area during winter.

The full compatibility of the structure with the land in which it is placed is important from an ecological point of view. In addition to the green area, studies on the protection of natural resources such as agricultural land, water resources etc are also the front plan for the sustainability of life. In addition to this, the green area within the region where the structure will be settled is left untouched and the necessary planting is evaluated in the

certification systems. The CB House is designed in accordance with the slope. While the endemic plant cover surrounding the CB House was protected, the green area ratio was five times the building ratio and additional planting was performed.

The provision of energy consumption, especially in relation to buildings with public transport services, is an issue in ecological certification systems. The reason is that transportation is reducing the energy consumed and the environmental pollution while reducing finance. In the CB House, transportation is provided by motorized vehicles due to the inclined landing settlement as well as access to public transportation lines within two minutes walking distance and by bicycle.

In certificate systems, it is important to use passive systems that provide comfort conditions in the indoor environment with the data obtained from the natural environment without harming the environment and without spending energy from a source of active and passive energy usage. It is seen that passive systems are preferred instead of active systems in housesexamined in Talas. CB House, a modern residence, uses only natural gas, which is provided to the surrounding area provided by the city network, for heating only. In house, there can be given examples such as fewer window openings on the facades that do not receive sun and situated on the dominant wind direction, and modern materials used to store heat in modern houses.

The water usage criterion plays an important role in certification systems. It is expected that ecologically designed construction will use some of the water required for the structure during the usage from waste water and be systems that will provide low water consumption, thus saving water. At CB House, rain water was found to be used for some garden irrigation system.

Depletion of natural resources is an important problem today. The use of new and unexploited energy resources is crucial for the conservation and sustainability of natural resources. It is clear that the influence of the buildings in the built environment that creates the fissures is much. In CB House, natural gas systems known to have low environmental damage are used as fuel. In addition, thanks to the good insulation of the build, the amount of fuel consumed for heating up is also reduced. For the ventilation and cooling inside the house, the air conditioner gases are prevented from harming the environment by using the windows which provide mutual ventilation. In addition, none of the building materials used for the building are harmful to the environment.

In the world where 40% of carbon emissions originate from buildings, reduction of carbon dioxide emissions by global warming has become important (Akca, S., 2011, Yağmur 2017). The CO_2 emission criterion is also included in the certification systems. The choice of fuel use in housing also reduces this oscillation.

Selection, production, use, maintenance and recycling of material are important (Yağmur 2017). The fact that it is the local material obtained from the nearby area in supplying the material also brings down the energy consumed in the transportation. All of the materials used in the CB House are materials obtained from nearby people. In the facades where composite panels are used, the selection of this material is mentioned because it is easy to clean and maintain. Plus, when the building finishes, most of the material used is recycled.

5. RESULTS

Structures are checked with a number of criteria found under certification systems. Using these criteria, the modern building sample CB House were examined for Talas traditional housing. The criteria are based on certification system criteria such as ecology, energy, economy, indoor environmental quality, health and welfare, innovation, management,

land use, transportation, renewable technology, water, environmental pollution, CO2 release material and waste.

In the CB House, some of the ecological approaches have been made with the advantage of new materials and technologies, and most of them have been met with natural intentions. In the CB House, renewable resources were used to select energy sources.

Inner living comfort, especially in residential constructions, is the front plan. Interior comfort is defined as heating, cooling, ventilation, natural lighting. At CB House, it is observed that providing passive systems with indoor comfort instead of active systems is at a high level. Not only passive systems but also some intelligent systems and technology provide comfort. Systems that are used without human power have negative effects on human health due to inactivity at the same time. There are designs that encourage the use of human power in modern housing. It is an ecological approach that there is a lot of steps in vertical transportation within the CB House and no mechanical system is used. In addition, the user side of the maintenance and repair work required during the use of the home is also an example of subject and management criteria. The use of passive systems in housing increases efficiency. The use of self-referential materials and the ability to reuse materials with heat-retaining structure outer walls and heat retaining systems demonstrate that it is successful example.

The proportional relationship of buildings with the land is another element of the ecological approach. The approach that protect endemic plant tissue without harming nature due to its large green areas is one of the ecological characteristics of structure. Structure was constructed integrated with the existing urban infrastructure without damaging agricultural land. In addition, the inclination of the land has been decisive in the design. As this increases the cost of construction overhead, favorable settlement is preferred. The structure is fertile for garden plants. Ecological approaches have been pursued with a specific structure using It's own traits.

In certification systems, taking into account unconsciousness and pollution in the use of natural resources, the use of water and its resources has taken place. Waste water is also encouraged to be used while water usage is saved. In the CB House, it was seen that the application of the rain water for the garden has given importance to both issues and ecological approaches. The first issue that affects other environments such as water is pollution. This is also the first order in the design criteria of ecological structures. It is expected that all subjects will not harm the environment until the materials used for the construction are transported. In the CB House, materials that can be obtained by short distances and which do not damage the edges are selected with recyclable materials. The house exhibits an ecological approach to this issue.

In CB House, the conditions brought by the day and the choice of fuel used were made with the system with the least CO2 emission. CB House is ecological in this sense. Another environmental concern in certification systems is the recycling of wastes during construction, use and demolition. CB House was found to use materials that could be recycled. Although the CB House uses reinforced concrete and it is difficult to recycle it, it is clear that after upgrading the technology and waste management to local governments, the material will be recycled after it is completed.

CB House has ecological structure characteristics by using the advantages of today's technology, materials and so on. Although there is no ecological certification system in the country, it should be encouraged to build on the ecological criteria and incentive features of the buildings to be built. Structures that have an Energy Identity Certificate must be included and documented in the certification system with these incentives. Sustainability should be ensured with the titles under many certification systems, such as joint venture pollution, unconscious use of natural resources, and the creation of

economic structures, which will be created by the construction sector by making legal compulsion and incentive policies on the subject. The ecological approaches in the CB house that is considered in the study are in fact examples of the fact that the emphasis can be placed on the issues that are being spoken at any time and that the building can be constructed in the light of these criteria.

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