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Research Article

Evaluation of Building Energy Performance Construction Standards of the European Union: Example of Kayseri

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Abstract

In this study, different locations of Turkey in the European Union standards of built complex structures the levels of energy performance of the buildings and sustainability thanks to Ministry of Environment and Urban Planning BEP-TR (Building Energy Performance) Program calculated what the impact of changes in the outcomes of regional sustainability may be examined.
In this context, the project data of buildings (the values of technical building geometry, heating, lighting, mechanic and ventilating) and BEP-TR (Building Energy Performance) Program, entering buildings, the amount of net energy for heating and cooling needs of the buildings, taking into account the effects of sunlight, daylight are not effective while untapped for the areas of lighting energy demand and consumption of carbon emissions buildings shall be determined by calculation and with the data obtained from the evaluation of the sustainability of the structures built in different regions, all the energy of the structure of programs, etc. The data obtained through given the costs will be met from the national budget will bring you to reduce the burden and cost of what measures could be taken to be, intended to be built on the basis of EU standards, given the structures of the energy that will be important to determine the class.

Keywords: Building Energy Performance, Building Energy Certification, BEP-TR, Sustainability.

Avrupa Birliği Standartlarında İnşa Edilen Yapının Enerji Performansının Belirlenmesi: Kayseri Örneği

Özet

Bu çalışmada, Avrupa Birliği normları esas alınarak inşa edilen kompleks bir binanın enerji performans kimliği araştırılmaktadır. Bu yapı, Çevre ve Şehircilik Bakanlığı'na ait BEP-TR (Bina Enerji Performansı) Programı kullanılarak enerji performans değeri ve enerji kimlik belgesi açısından değerlendirilmektedir.
Bu kapsamda, binalara ait proje verileri (bina geometrisi, ısıtma, aydınlatma, mekanik ve havalandırma teknik değerleri) BEP-TR Programı'na girilerek binaların ısıtılması ve soğutulması için binanın ihtiyacı olan net enerji miktarı, binalarda günışığı etkileri göz önüne alınarak, günışığından yararlanılmayan süre ve günışığının etkili olmadığı alanlar için aydınlatma enerji ihtiyacının ve tüketiminin hesaplanması ve yine binalara ait karbon salınımı tespit edilecektir. Elde edilecek veriler sayesinde farklı bölgelerde inşa edilen yapıların enerji analizi açısından değerlendirilmesi, program sayesinde ortaya konan veriler sayesinde yapının tüm enerji, yakıt vb. giderlerinin ulusal bütçeden karşılanacağı göz önüne alındığında; maliyetin getirebileceği olası sıkıntıların ortaya çıkarabilmesi ve maliyetin azaltılabilmesi için ne gibi önlemler alınabileceği; inşa edilecek olan yapıların AB standartları esas alınarak tasarlandığı göz önüne alındığında ait olduğu enerji sınıfının belirlenmesi önemli olacaktır.

Anahtar kelimeler: Binalarda Enerji Performansı, Bina Enerji Performansı Programı (BEP-TR), Sürdürülebilirlik

1. Introduction

As occurring in our country and all over the world is quite fast and steadily increasing population growth and rapid development of technology, mankind is forced to use parallel leads to an increase in energy demand. Therefore, a large part of the energy generated in our residences, workplaces and common areas are known to spending. Particularly rapid growth of the world population will occur inevitably show that the energy expenditure of energy shortages. How to be a more effective use of energy and how to save energy in order to find answers to the questions scientists have done studies. The studies in this area; the method of calculating the energy performance of buildings, the levels of complex and detailed dynamic calculation method of calculating the simple activities of hours studied. When it comes to complex buildings, the thermal behavior of the building zones in the zones with the highest values in terms of effective internal gains, there could be a problem that the energy performance of buildings on health are examined (Atmaca and etc. 2011).

Santamouris M., Argiriou A., their studies The characteristics of the building's energy consumption in

Southern Europe are analysed. The energy potential of solar energy for heating and lighting purposes as well as the potential of passive cooling techniques are investigated. The ecological impact of the energy saving technologies as well as the market opportunities of the alternative technologies are discussed.

Ramesha T., Prakasha R., Shuklab K.K.; their studies on the total energy use during the life cycle are desirable to identify phases of largest energy use and to develop strategies for its reduction. In the present paper, a critical review of the life cycle energy analyses of buildings resulting from 73 cases across 13 countries is presented. The study includes both residential and office buildings. Results show that operating (80–90%) and embodied (10–20%) phases of energy use are significant contributors to building's life cycle energy demand. Life cycle energy (primary) requirement of conventional residential buildings falls in the range of 150–400 kWh/m^2 per year and that of office buildings in the range of 250–550 kWh/m^2 per year. Building's life cycle energy demand can be reduced by reducing its operating energy significantly through use of passive and active technologies even if it leads to a slight increase in embodied energy. However, an excessive use of passive and active features in a building may be counterproductive. It is observed that low energy buildings perform better than self-sufficient (zero operating energy) buildings in the life cycle context. Since, most of the case studies available in open literature pertain to developed and/or cold countries; hence, energy indicative figures for developing and/or non-cold countries need to be evaluated and compared with the results presented in this paper.

F.J. Rey E. Velasco ve F. Varela, their studies the implementation of the EPBD has as its primary aim the establishment and application of energy certification programs. The aim of energy certification programs is to guarantee energy saving and to reduce CO_2 emission as a consequence of the EU commitment to comply with the Kyoto protocol. Obtaining energy effectiveness labelling means the achievement of energy quality, allowing a decrease in CO_2 kilograms emitted from lighting, heating and cooling buildings without any loss in terms of comfort. This work proposes a new methodology called Building Energy Analysis (BEA) that allows implementation of EPBD on energy certification of buildings. In this paper they analyse the different steps of BEA methodology (heat and cooling load, energy demand, energy consumption and CO_2 emission). The program ends with energy labelling of the building. In addition, they present a practical study of a small health centre that is analyzed with BEA methodology and we compare it with other energy simulation programs like Hourly Analysis Program (HAP) and PowerDOE. The results of energy labelling are very similar for both simulation programs.

Eskin N., her study electricity use in the commercial buildings, accounts for about one-third of the total energy consumption in Turkey and fully airconditioned office buildings are important commercial electricity end-users since the mid-1990s. In the presented paper, the interactions between different conditions, control strategies and heating / cooling loads in office buildings in the four major climatic zones in Turkey- hot summer and cold winter, mild, hot summer and warm winter, hot and humid summer and warm winter - through building energy simulation program has been evaluated. This verified model was used as a means to examine some energy conservation opportunities on annual cooling, heating and total building load at four major cities which were selected as a representative of the four climatic regions in Turkey. The effect of the parameters like the climatic conditions (location), insulation and thermal mass, color of external surfaces, shading and window systems including glazing system on annual building energy requirements is examined and the results are presented for each city.

Crawleya D. B. etc. Their studies the energy is being used around the world for analysis by making an assessment of the overall context of improved simulation programs, carried out a comparison of each other.

Aykal D. etc.; their studies evaluation of renewable energy sources, energy, architecture, building design principles to the use of energy efficiency, as well as the importance on creating sustainable environments are expressed. Therefore, under the leadership of the Metropolitan Municipality of Diyarbakır Dicle University, and a variety of EU Project, in collaboration with non-governmental organizations "Solar House Education and Practice in Diyarbakir Park" was built.

Ding G. and Forsythe P. J., their studies in 2010, the Australian residential construction sector contributed about 28% of the value of all construction and was responsible for 8% of the total energy consumption. Residential construction will continue to increase to cope with the demand due to population growth. The research findings reveal that the slope for each type of soil has a positive correlation with life cycle energy consumption. As part of the onsite construction process, the results also show that the energy consumption of construction on sloping sites plays a significant factor in the life cycle energy analysis of a building.

Energy sources in nature, either directly by the people or thanks to the technological systems developed by man to have been. However, taken directly from nature fuels (fossil fuels, and so on.) is rapidly running out, and that people try to find new sources of energy (solar, wind, etc.)., or at least the current level of energy use as much as possible without wasting required.

In this area, Al-Homoud M. S his study Buildings are slowly replacing long-term investments that consume a lot of energy. Given current economic, as well as environmental constraints on energy resources, the energy issue plays an important role in the design and operation of buildings. The availability and ease of use of today's computers make them effective tools in the decision-making process of building design. This paper reviews the most common building energy analysis techniques and the potential applications of computer technology in the energy simulation and optimization of buildings.

The European Union (EU) prepared for the purpose of energy efficiency, the external climate / local conditions, taking into consideration the cost efficiency of indoor climate requirements, the development of energy performance of buildings, the Energy Performance of Buildings Directive 2002/91/EC in 2002 and it published specifying the obstacles encountered in the direction of improvement of energy efficiency a Green Paper on Energy Efficiency in accordance with the solution of problems in 2005. In 2006, it prepared indicates the energy efficiency of buildings is important for the Action Plan for Energy Efficiency.

Our country is a country signatory to Kyoto Protocol, make up a large portion of energy consumption and reduce energy use in buildings, energy performance certification of buildings Energy Performance of Buildings Regulation mandating the Ministry of Environment and Urban Planning (Ministry of Public Works and Settlement) published in 2008 by. Identification required by this regulation to building energy analysis method to be used in the Building Energy Performance Program (BEP-TR) was completed in 2009. This program is published on 5 December 2008 Energy Performance of Buildings Regulations 1000 m2 of new and existing buildings, Energy Performance Certificates to get a great legal mandates. In this context, reception and accommodation centers built on the basis of the above-mentioned directives and laws were necessary planning (Ministry of Environment and Urbanization, 2013).

Prepared within the framework of the EU accession of Turkey in accordance with the National Action Plan on Asylum and Migration Ministry of Interior Affairs (Turkish National Police) between 2007-2013 primarily in the eastern regions of Turkey then the inner regions of the Asylum Seekers, Screening and Refugee Accommodation Centers facility to be operational by and meet the humanitarian needs of illegal immigrants as well as the return of the return housed in temporary centers should be established in order to ensure.

In this context, the Ministry within the framework of the EU harmonization Ankara, Erzurum, Kırklareli, İzmir, Kayseri, Van and Gaziantep will be established in the provinces a total of 7 people capacity 750 to be established in the provinces of "For Refugees and Asylum Seekers Reception, Screening and Accommodation System / Centers Facility" is prepared Pairing and Investment Project (Turkish National Police, 2011).

EU standards and assisted in Kayseri, Kocasinan total 17.000m ² building was built with a accept field, Reception, Screening and Accommodation Centre A-Block, dormitories, laundry and dining sections of Building Energy Performance reviews are part of a total of 942 m² of construction area evaluated in this study.

At this article Kayseri Reception and Accommodation Center, has been recognized as an example. This center housing space names and characteristics of the fields, -2 and -1 for basement floor: Table 1, for the ground and first floors: Table 2, for the second and the third layer is shown in Table 3.

Table 1. Reception and Accommodation Center Basement floors plans and areas

Kayseri Reception and Accommodation Center Independent Sections					
(-2) Basement floor			**(-1) Basement floor**		
1	Power room	50,715m²	**1**	Lift 1	5,94m²
2	Laundry	135,24m²	**2**	High security room 1	143,04m²
3	Food Warehouse	168,245m²	**3**	High security room 2	120,33m²
4	Fire Escape	24,95m²	**4**	High security room 3	120,33m²
5	Lift 1	5,94m²	**5**	Stairs	30,555m²
6	Boiler room	213,65m²	**6**	Lift 2	29,61m²
7	Warehose	153,72m²	**7**	Electric room	53,235m²
8	Stairs	31,03m²	**8**	High security room 4	106,47m²
9	Lift 2	26,62m²	**9**	High security room 5	106,47m²
			10	WC	105,625m²
			11	Fire Escape	26,195m²
Total		**942,00 m²**	**Total**		**942,00 m²**

Table 2. Reception and Accommodation Center ground floor and first floor plans and areas

Ground floor			**First floor**		
1	Lift 1	5,94m²	**1**	Lift1	5,94m²
2	Dish washing area	62,82m²	**2**	Single woman room 1	143,04m²
3	Dining hall	504,00m²	**3**	Single woman room 2	120,33m²
4	Canteen	62,90m²	**4**	Single woman room 3	120,33m²
5	Lift 2	16,065m²	**5**	Stairs 1	31,0275m²
6	Stairs 1	31,0275m²	**6**	Lift 2	29,1375m²
7	Hall1	65,78m²	**7**	Hall	94,20m²
8	Lavatory	67,62m²	**8**	Stairs 2	53,235m²
9	Stairs 2	50,71m²	**9**	Single woman room 4	106,47m²
10	Food Prepared room	33,00m²	**10**	Single woman room 5	106,47m²
11	Fire Escape	24,95m²	**11**	Single woman room 6	105,625m²
12	Hall 2	17,28m²	**12**	Fire Escape	26,195m²
Total		**942,00 m²**	**Total**		**942,00 m²**

Table 3. Reception and Accommodation Center second floor and third floor plans and areas

Second floor			**Third floor**		
1	Lift 1	5,94m²	**1**	Lift 1	5,94m²
2	Single woman room 1	143,04m²	**2**	Single woman room 1	143,04m²
3	Single woman room 2	120,33m²	**3**	Single woman room 2	120,33m²
4	Single woman room 3	120,33m²	**4**	Single woman room 3	120,33m²
5	Stairs 1	31,0275m²	**5**	Stairs 1	31,0275m²
6	Lift 2	29,1375m²	**6**	Lift 2	29,1375m²
7	Hall	94,20m²	**7**	Hall	94,20m²
8	Stairs 2	53,235m²	**8**	Stairs 2	53,235m²
9	Single woman room 4	106,47m²	**9**	Single woman room 4	106,47m²
10	Single woman room 5	106,47m²	**10**	Single woman room 5	106,47m²
11	Single woman room 6	105,625m²	**11**	Single woman room 6	105,625m²
12	Fire Escape	26,195m²	**12**	Fire Escape	26,195m²
Total		**942,00 m²**	**Total**		**942,00 m²**

Asylum / refugee applicants in order to accommodate the different residence halls have been created. These are high security in the Family Room = 24, High Security Room = 48, Single White Female Rooms = 48, Single Male Rooms = 96, Special Interest, including those requiring a total of 222 persons =6 is planned to serve. Reception and accommodation center in Kayseri A-Block sample floor plan is shown in Figure 1 (Turkish National Police, 2011).

Still in the design stage of the center in question, as shown in Table 4, taking into account all kinds of climatic and regional planning all the data were made accordingly (Turkish National Police, 2011).

Table 4. Kayseri-Kocasinan Reception and Accommodation Center regional values

	Kayseri-Kocasinan Regional Values				
Location	Latitude	Longitude	Elevation	Winter outside	Daily Range
Kayseri- Kocasinan	38º 43′ N	35º 23′ E	1092 m	-1,7 °C EW Windy	14,66°C

DB: Dry Bulb Temperature YT: Wet Bulb Temperature K: North D: East

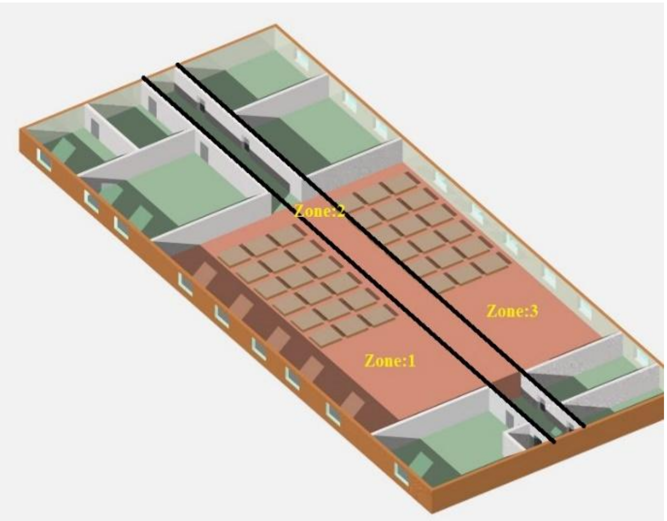

Figure 1 A-Block Floor Plan (Three zones)

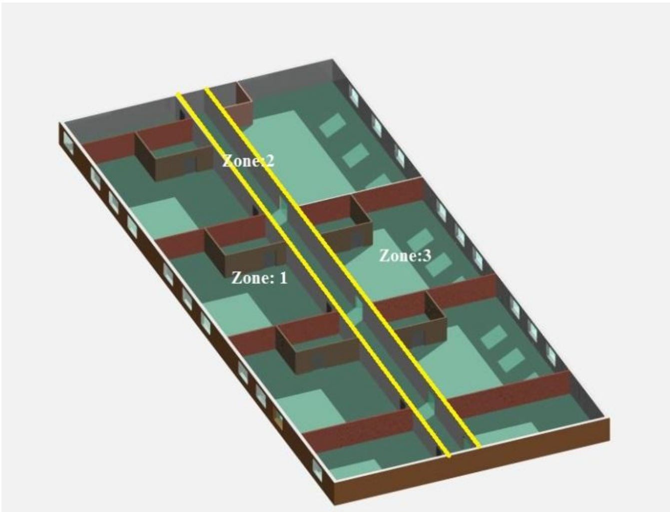

Figure 2 A-Block Floor Plan (three zones)

As shown in Figure 1 and Figure 2, building plans are divided into three zones. In this way, building datas have been entered into the program. The results have been obtained and interpreted by these informations. The results are shown in Table 6.

Picture 1. Kayseri Reception and Accommodation Center

2. Materials and Methods

2.1. Materials used in the calculation of energy

All the necessary mechanical and geometrical data is entered to BEP-TR program, than the building obtained data is shown in

Table 5.

Table 5. Reception and Accommodation Center A-Block floor and wall construction elements

Kayseri Reception and Accommodation Center Floor and Wall Materials					
	Wall Materials	**Thickness**		**Floor Materials**	**Thickness**
1	Interior plaster and plastic paint	0,01 cm	**1**	PVC Floor covering	0,02 cm
2	Aggregate concrete brick wall	19 cm	**2**	Mortar	0,02 cm
3	Plane plaster	0,02 cm	**3**	Levelling concrete	0,02 cm
4	XPS Adhesive plaster	0,01 cm	**4**	Reinforced concrete	10 cm
5	XPS Heat Insulation Sheet	0,02 cm	**5**	Gypsum panel and Metal suspended ceiling	0,03 cm
6	Press Brick adhesive	0,01 cm			
7	Brick elevation cladding	0,03 cm			

2.2. Net Energy Inputs

Ventilation, lighting, heating and cooling for the method of calculating the net energy requirement of the basic inputs, climate data, building geometry, ventilation and thermal properties of the building, building materials and building components of the definition of the function of the building on the internal comfort conditions (temperature and humidity, ventilation amount), depending on the typology of the building methods of zoning are zone information. This information is required to be removed from the building's energy analysis of the data that will login to the system by the user all the information on the building project and regional location are made ready to be analyzed. This information is for the project architectural, structural, mechanical and electrical engineer on the project by examining the files of technical information resulting from the calculations. For example, the geometry of buildings and building components that are required for the system, the architecture of the building supply project and determining the list of needed information is entered into the system. In this way, the program will have entered for the purpose of building energy labelling information (Ministry of Environment and Urbanization, 2013). Process diagram is shown in Figure 3.

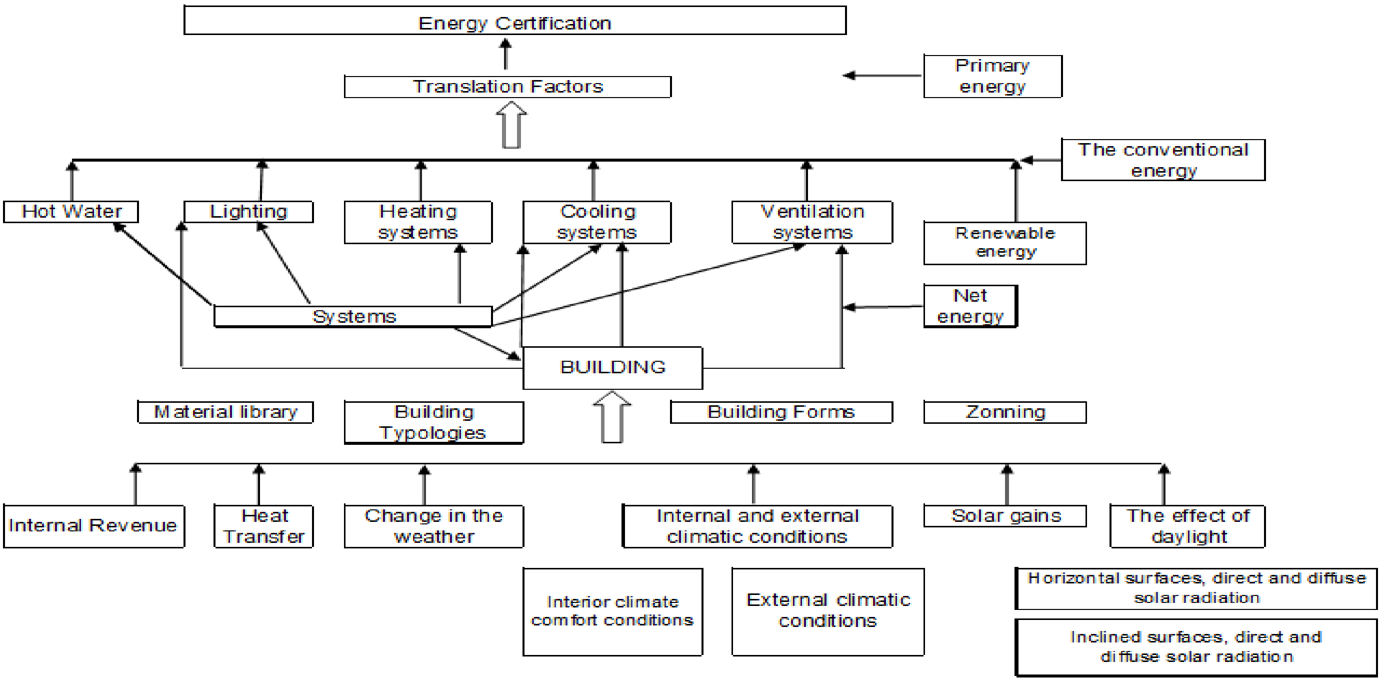

Figure 3. Plan for Building Energy Performance Calculation Method (BEP-TR) (Ministry of Environment and Urbanization, 2013)

2.3. Calculation Method for Energy Performance of Buildings (BEP-TR)

Prepared by the Ministry of Public Works and Settlement (BEP-TR) is a web-based program. This program includes 1000 m^2 large structures Energy Performance of Buildings Directive. The building enables that annual energy consumption per square meter, CO_2 emissions, the datum of the reference values and comparison with a refenrence building A-G placed an inter-energy class operations. This program is also using the method of calculation of the energy performance of buildings (BEP-HY), all the parameters that affect energy consumption, the impact of energy efficiency and energy performance of buildings is used to determine the class.

BEP-TR and BEP-HY programs enable that residences, office buildings, educational buildings, health buildings, hotels, shopping and commercial centers as well as assessment of the energy performance of new buildings and existing building typologies (Ministry of Environment and Urbanization, 2013).

3.0 Experimental Results and Discussion

At this article, entering the data of the Project to BEP-TR (Building Energy Performance) Program was explained that the building needs for heating and cooling of buildings in the net amount of energy, not benefit from daylight saving time, daylight lighting energy demand and consumption is not effective for the calculation of areas and carbon emissions of the building. These results have been interpreted in terms of sustainability.

3.1. Building Energy Performance Program (BEP-TR) Results

Firstly, all of geometric and mechanical datas have been entered to BEP-TR program which information belonging to the building (architectural, structural, mechanical, heating, ventilation and lighting data) as defined in the program. Resulting in heating, cooling, ventilation and lighting systems in addition to greenhouse gas emissions were calculated. These values have been shown in Table 5.

Table 6. Kayseri reception center a block data for the identification of energy.

Data / Results	**Final Consumption (kWh/yıl)**	**Primary Consumption (kWh/yıl)**	**Consumption per m^2**	**Class**
Heating Systems	*10.530.786,41*	*10.530.786,41*	*1.863,20*	***C***
Hot water Systems	*14.851.732,67*	*14.851.732,67*	*2.627,70*	***C***
Cooling Systems	*1.131.073,64*	*2.669.333,80*	*200,12*	***C***
Ventilation Systems	*11.213,06*	*26.462,82*	*1,98*	***E***
Lighting Systems	*192.555,64*	*454.431,32*	*34,07*	***B***
Greenhouse Gas Emissions (CO_2)			*469,42*	***C***
Total	*26.717.361,42*	*28.532.747,02*	*6.305,38*	***C***

According to Table 5, Heating Systems : C, Hot Water: C, Cooling: A, Vantilation Systems: E, Lighting: B and greenhouse gas emissions: C were found. These values can be considered as the average value of building energy class, which C-Class was found. However, the total vantilation system for the evaluation of building energy basis, the D-Class is not an available result. The heating systems of building is not same into library system of BEP-TR Program.

To determine the building heating system was used that the nearest system in BEP-TR.

In this area; Atmaca M. etc., energy demand of hotel buildings, which are having the biggest share in total energy consumption among the non-residential buildings, calculated by BEP-TR and detailed simulation tool EnergyPlus is compared and efficiency of BEP-TR to be used fire energy certification of complex buildings are discussed.

4. Results

For Kayseri Reception, Screening and Accommodation Center are listed by building energy performance (BEP-TR) the energy obtained from the analysis and classification of data and study results below. Firstly, for Kayseri Reception Center of A-Block of the energy performance assessment had been identified that is energy for the class "Class C".

This result which is C Class, that is understood that the building classification of energy is acceptable for in the evaluation of the EU Energy Performance Certificate standard.

Also this conclusion is that for sustainability appropriates building of Kayseri Reception Center. But values of energy building performance

Determining the identification of energy had been observed that to be important the climate and the location of building. But for the program of BEP-TR the location of building data could not be entered for the program exactly as and the project is simulated geometric shapes in the system whereby gets results. These results have been hesitations what can be a positive or negative contribution.

When it comes to center performance evaluation, because it is a complex structure of the center, all construction as whole could not be evaluated. Evaluation of energy analysis sections were separated into blocks. Here again, it is expected that the obtained results might vary. During the evaluation of the analysis was observed that the geometric structure of the building is not fully rectangle, square, U and H format, but the system can be registered in the system was said to resemble geometric shapes. The system didn’t accepted another shape. This situation both user time to spend also the change in the geometry of the building raised the issue of the reliability of the results to be.

Also, entered in the system as separate blocks of the center was prevented that the come out of a common energy for center. Therefore specific areas of the center (Refuge Dormitory, Block Management, Health Unit, etc.) energy analysis was carried out. It is considered to be more convenient to have. It was observed that some of the building materials used in the construction of the building was not the same at BEP-TR program so the similar products were used at BEP-TR. This may have influenced the results evaluated.

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