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Review Paper

Building Energy Modelling Review

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Abstract: In with parallel to the population growth, the increasing for energy throughout the world causes increase in environmental health problems at the end of energy use have made it necessary to use energy more effectively and efficiently. Reasercher show that most of the energy consumption is caused by buildings. The increase in the buildings with each days causes to Investigate the Inenergy consumption at the same rate. Due to the continuous increase in energy consumption, the global warming and health problems that have become threatening to humanityled to the emergence of the sustainable Building.Sustainable buildings are environmentally friendly structures designed to use energy resources in the most efficient way. In this Review, more effective and environmentally friendly building energy models have become an attractive topic and common in both research and industrial society in recent years. In this study, which aims to evaluate sustainable building in terms of energy efficiency and to determine the criteria that should be found in green building applications; Energy efficiency and Eco- Environment building concepts have been mentioned and a general review has been made on methods of building information modeling (BIM) utilized in building design process for building energy modeling (BEM) process. Finally, explanatory information about a sample energy analysis simulation study to be carried out including use the Design Builder and Energy Plus programs is included.

***Keywords**: Sustainable Buildings, Energy Efficiency, Building Information Modeling (BIM), Building Energy Modeling (BEM),*

Introductıon

Due to the worldwide population growth, the rapid growth of national economies and the desire of individuals to have a better quality of life, the energy consumption required for buildings surrounding living spaces is increasing at an eye-catching pace (Kelso, 2012). Factors that adversely affect human life such as environmental pollution, global warming with climate changes that occur due to the increase in energy consumption around the world are gradually increasing. About 40% the energy consumption from buildings. For this reason, the concept of sustainability has been reflected in the building sector over time and has revealed the concept of energy efficient building. Nevertheless, proper design and construction of buildings can reduce their dependence on energy needs. One of the effective ways to achieve this is to use Building Energy Modeling (BEM) technology, which includes alternative and optimized methods in the design of buildings (Al-Homoud, 2001).

Sustainable buildings are certified according to certain standards like reducing energy consumption, being more valuable, more ecological and more comfortable. Energy efficient building designs should be emphasized to achieve energy efficiency in green buildings. Buildings designed with an energy-efficient approach not only provide energy efficiency, but also offer healthy and comfortable environments to their users.

In the field of BIM technology, a new approach has emerged called Building Energy Modeling (BEM). In this method, building models containing design, mechanical load calculations, material properties and information about the heating, ventilation and air conditioning (HVAC) system are used to create inputs to computer programs. With BIM, users are also provided with the opportunity to operate a building design with ease, time savings, low cost, practicality, and an accurate process and consistent. Using BEM, the designerscan better evaluate design selections and make efficient decisions during the design process of building. In this way, the energy efficiency of building goal can be carrying out more easily (Gao et al 2019).

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When BIM is used, computerized information can be the time of consuming, costly, and labor-intensive. This information should also comply with energy standards. Despite all its advantages, it is thought that BIM, which is an energy efficient building modeling tool with digital modeling, is not fully utilized (Ernstrom *et al* 2006).

This article Provides a comprehensive literature review on the developing of the BIM that based on the BEM methods and their use for energy efficient building design, and explains the concept of energy efficiency in buildings and best practices in this context; It includes requirements for the use of building information modeling (BIM) and building energy modeling (BEM) and BIM-based technologies, industry base classes (IFC) and green building studio-based methods in the building design process. In the study, energy modeling simulation tools that are widely used in buildings were examined and a sample application was presented about a future energy analysis simulation study using integrated programs.

Energy Effıcıency In Buldıngs

Increasing global warming together with the gradual decrease of natural resources and clean water resources affected the building sector as well as many other sectors. These passive factors have led the building sector to environmentally friendly and ecological building construction. The increasing of environmentally friendly building construction design has created the concept Building integration method building. Energy efficiency method are certified according to certain standards. Like orientation, a new sector has emerged against buildings that are more ecological, more valuable, more comfortable and less energy consuming (Yonar, 2009**)**. The World Energy Council defines energy efficiency as reducing the amount of energy used for any life activity. Reducing the amount of energy can be achieved with the development of technology, as well as through better structuring and management and raising awareness of people (World Energy Council, 2008).Energy efficiency is also expressed as the use of less energy in a job or production of the same amount or increasing theor production while remaining the same amount of energy without compromising the quality and quantity of production (Olgun et al 2009) According to another definition, energy efficiency is expressed as taking measures to minimize energy losses, ensure the recovery of some wastes and reduce energy demand by using methods such as gas, heat, steam and air without reducing the amount of production (Tevem & Enverder 2010).Today, energy efficiency is most commonly expressed as the most cost-effective and safe type of energy source (Allen et al 2019). Energy efficiency constitutes with of energy transition strategies around the world. Countries prefer to benefit from energy efficiency in terms of cost. Due to the decrease in energy resources and the increase in global warming, the interest shown in energy efficiency is increasing. For this reason, technological developments are continuously transferred to energy systems (Miller et al 2018). Energy efficiency is of great importance in order to be able to interpret the social effects resulting from energy transitions more accurately and to better understand the developments in technology (Sovacool, 2014). There is no internationally accepted standard definition of the carbon footprint. It derives from the concept of ecological footprint. Global warming gases that occur after people's living activities harm the natural environment and human health. The amount of this damage in terms of unit carbon dioxide is expressed as the carbon footprint (Sivri et at 2015). The concept of carbon footprint is divided into two as primary carbon footprint that directly causes greenhouse gas emission and secondary carbon footprint that indirectly causes greenhouse gas emission. The direct carbon dioxide emission resulting from the combustion of fossil fuels consumed in the heating of buildings, in the transportation sector and in the field of energy production represents the primary carbon footprint. Secondary carbon footprint, on the other hand, refers to the indirect carbon dioxide emission released into the atmosphere during the process from the production stage of the substances used by humans throughout their life until they dissolved and change in natüre (Koçer *et al*., 2015).

Energy Efficiency Concept for Buildings

Energy efficiency is defined as electrical energy produced by using renewable energy sources. Compared to nuclear or conventional energy sources, energy efficiency causes less damage to the environment (Rahbauer, et al 2016) and has some advantages (Petrova, 2010) that energy efficiency buildings have little impact on the natural environment when compared to classical buildings (Krygiel, et al 2008). With the use of resources decreases and a more productive and healthy environment is created. Mixture efficient are that provide healthier and more comfortable environments for their users, while reducing the investment cost and allowing the living cost to be minimized (Magent, 2005).

While designing, constructing and using energy efficiency buildings, care is taken to utilize natural resources, energy and water in the most efficient way. They are designed and built to protect the health of the users and increase their efficiency. Economic benefit is one of the most important reasons for choosing a buildings. The high performance of the buildings reduces the operating costs. This makes the buildings more valuable and the life of the building is longer. Studies show that even though the construction of green buildings costs 2% more, it saves 10 times more compared to traditional buildings during the usage period (Sarıer *et al*., 2012).

Research on energy efficiency buildings shows that compared to classical buildings (Ding, 2008):

- Energy savings between 24% and 50%,
- CO2 emission reduction between 33% and 39%,
- 30% to 50% water savings,
- 70% reduction in the amount of solid waste,
- 13% shows that it provides benefits such as low maintenance cost.

Energy efficient Building Implementations

Figures, Tables and Equations should be given in the same page (not separate pages). If any of them is long as a whole page, it should be given into the Appendixes.

Computer Aıded Buldıng Desıgn Examıned (Cat) Process

In this section examined, prominent design strategies and integrated design concept in the design process of building. According of building information modeling (BIM) and building energy modeling (BEM) and development formats that have the characteristics of the buildings were introduced.

Generally, the design process of a building consists of the design of concept, preliminary design, advanced design and detailed of design stages. During the concept of design phase, a project group is formed to determine the needs of the building with stakeholders. At this stage, project objectives and design of the requirements (site orientation, mass & form, the initial services and building system)are determined. Preliminary design, building layout planning, building and material systems created by considering daylight, thermal and energy performance, lighting, comfort design including acoustic and thermal performance, HVAC options, water and waste water systems and fire, etc. Includes security strategies. In the preliminary design, a detailed energy modeling including thermal heat and daylight lighting should also be made. During the design phase, requirements& protocols for the construction plans should be prepared for formal documentation. Documents created include approval at this stage, tender of drawing, specifications, file report for the each of discipline. Documentation must be coordinated across all disciplines, or else the building and the construction of process could be adversely affected (Web 6).

This process starts with a design ofconcept decided by the client and architect. According to this concept, civil, structural, mechanical and electrical engineers are asked to apply the design (Bragança L, et al 2004). In this design process, low performance and the high of operating costs often arise theduring operation, as a result of insufficient use of BIM and BEM for the additional high cost. At the next stage, advanced and high performance of systems emerge with help of building of simulation. However, if there are errors and flaws in the initial designs, the developed high-performance systems may not be able to overcome them (Larsson, 2009).

In building design with integrated systems, architects work as team leaders to incorporate input from other designers. Therefore, engineersare also expected to take initiative on the design concept rather than just doing the design work. It not only manages construction costs, but also performs life cycle analyzes of elements and in corporates the other of technological systems into designs (Zimmerman & Eng, 2006).

Building Information Modelling (BIM)

Building Information Modelling (BIM) has become a necessary technology for the Integrated Design Process (IDP), which can be summed up as various engineers coming together to improve the

Building design process (Filzmoser M, et al 2016). The BIM concept was first introduced by Chuck Eastman in 1974, demonstrating that it can help visualize and quantitatively analyze a building project using computer-based systems (Eastman et al 1974; Fernandez, 2015).

With BIM technologies, which are preferred to reduce building energy consumption, the following can be done: energy simulation for building mass analysis, daylighting and water consumption potential analysis of the building, researching the suitability of sustainable and recycled materials for the building, thus reducing waste and carbon emissions (Wong JKW, & Zhou J,2015).

BIM allows montage of photo to integrate photo realistic project images with conditions of existing. Again, BIM tools can enable 3dimension interior & exterior models, animations, building energy performance and structural analysis (Azhar S, 2011).

There are different team members in building design made with BIM technologies.The members of building project team may include the managers of project, architects, mechanical, electrical and civil engineers specialized in energy simulation, as well as researchers and construction managers (Web 7). With the advent of BIM technology, the building projects can become more efficient and smarter (Guide B,2015).

Building Energy Modelling (BEM)

Building Energy Modeling (BEM) is apowerful computer system used to evaluate the performance of buildings in terms of architectural and mechanical design (Guide, 2015). With BEM, environmental effects are evaluated in the design of buildings and the energy performance of the building is optimized. The energy characteristics and energy consumption of the building and its subsystems can be calculated. Building daylight performance can be evaluated. Alternatives of architectural design features such as energy consumption of the building, thermal comfort, etc. in areas can be researched. In the design phase, it is recommended to take advantage of the advantages provided by BEM to a great extent (Maile, et al 2007).

The features of BIM applications that are widely used in the literature are included in comparison. The most known BEM tools have a user interface that includes regional loads, building envelope, sunlight, ventilation and airflow, climate data, renewable energy systems, electrical systems and environmental emissions, as well as economic evaluation of HVAC systems and reporting of results (Crawley *et al*., 2008).

In the BEM environment, the simulation engine uses input files of a certain format to perform the simulation and produce an output file. The graphical user interface usually processes the output files to show the results of this process in a more graphical way (Maile *et al.,* 2010). In BEM, simulation-specific parameters such as building geometry, thermal of zones, internal of loads, HVAC components, weather are used as inputs (Bahar *et al.,* 2013). To solve building problems in BEM energy modeling predictions, researchers develop dynamic models to predict building energy performance (Menezes AC. *et al*., 2012; Wang *et al*., 2018).

In the final design phase, the building information required for BEM is more detailed. In particular, a more detailed energy model can be created to evaluate multiple building design concepts, including heating, ventilation and air conditioning (HVAC). By comparing the energy performances of various designs, the design team can achieve design optimization to meet final budget requirements (Buonomano & Palombo, 2014). Examples of common BEM tools are eQUEST, Design Builder, Energy Plus, Autodesk Green of Building Studio (GBS), IES Virtual Environmental and Trace 700 (Dong *et al*., 2007).

BIM Data Formats

There are different inputs that affect the capabilities of BEM applications. For example, DOE-2 and BLAST can select a hardware-only HVAC system as input, while in Energy Plus user configurable cooling and heating equipment components make the simulation more flexible in terms of real conditions 9 (Crawley DB, et al 2001). The ideal workflow for simulation tools for BIM-based energy performance is shown in Figure 1 (Maile T, et al 2007). BIM-based BEM tools use a defined format that includes two building properties: Industry base classes (IFC)based methods and green building-based methods.

Industry foundation classes (IFC) data format

Industry Foundation Classes (IFC) is an ISO certified open and standard 3D object-oriented data processing format. It was originally developed by the International Association for Interoperability (IAI) in 1996. IFC was developed for universal use in information sharing in the construction industry (Bazjanac & Crawley, 1997).

Green building XML (gbXML) data format

Green Building XML is a building data format developed by the Autodesk Green of Building Studio company using the Extensible Markup Language (XML) format (Lam *et al*., 2012). Users can pull awell-formed gbXML file from the BIM tools and upload a summary of the simulation results of the building according to some parameters, into the corresponding BEM tools. It was developed mainly with the aim of facilitating data transformation from BIM to the analysis tools of engineering (Gourlis & Kovacic, 2017).

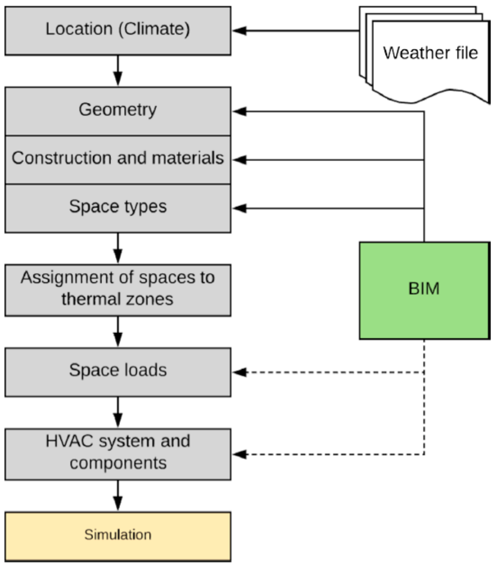

Figure 1. Workflow for performance of energy simulation tools

Commonly Used Building's Energy Modelling Simulation Tools

The historical background of the simulation tools developed for the analysis of buildings goes back to the 1970s. In this process, many simulation programs with different features have been developed. These simulation programs are developed in accordance with their own energy and building standards in many countries, as well as designed with flexibility suitable for international use (Tunali, 2012).

The basic theory of these tools is based on the calculation of the loads of performance parameters such as heating ventilation and air conditioning and the required energy. Simulation programs for calculating thermal-based dynamic interaction associated with user comfort and energy consumption, including building envelopes, HVAC systems, lighting and solar control elements, usually perform separate load calculations for each zone on an hourly basis (Hong et al., 2000).

Comparison of Energy Analysis Tools

In this part of the study, prominent features such as supported data formats have been examined by simulation. These programs are in alphabetical order; ArchiCAD, DOE-2, Ecotect, Energy-10, Energy Plus, EQUEST, ESP-r, Green Building Studio, IES-VE, Lumion, OpenStudio, Revit, Sketch Up, TRACE 700, TRNSYS. HAP, IES, VS.

Design Builder

It is one of the most important simulation programs used for energy modeling. This program is an interface program that works in conjunction with the "Energy Plus" simulation program, which is constantly updated by the United States Department of Energy. Design Builder stands out with its easy-to-understand and easy-to-use interface and system diversity. The Design Builder, used to developed for energy, carbon emissions, lighting and comfort control in the building, the DWG files with Energy Plus axillary weather program (Kayın, 2019).

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DOE-2

It is an energy performance simulation program that calculates energy performance and operating life cost of the entire building with hourly data. Hourly climate data, information have by insert the location and direction of the building, building element and material information, have by insert properties the usage process diagram of the building, service systems data, component prices are entered as input data to the program. 50 different monthly or annual summary reports, analysis reports of 700 different energy variables per hour depending on user configuration are presented as output data. Strengths: It can perform detailed hourly energy analysis even in the most complex buildings. Weaknesses: Due to its complex interface and usage, the user must have a command of the program in order to get the right results. In addition, the program is not supported in recent years, new technology developments are not updated within the program. Since it is written in an old scripting language like Fortran, it runs slower than other programs. Instead of this program, EnergyPlus was developed by combining the features of Blast and DOE (Tunali, 2012).

Eco Designer

Basically, it is a 3D CAD (Computer Aided Design) software produced by Graph iSOFT for architects. This technology allows architects to perform reliable dynamic energy evaluation of their BIM model within Archibald. With Archibald's built-in Eco Designer STAR or Sun Study module, energy analyzes can be easily performed on BIM models to obtain the best performing design. It has its used interface to own energy modeling user interface. Linking to other programs can be established via the Archibald-Grasshopper link or a model export solution. Successful results on energy consumption, carbon footprint and monthly energy balance can be achieved with Eco Designer (Web 1).

Ecotect

It is a commercial program owned by Autodesk. Its visual properties have improved. It combines a 3D building modeling interface with solar, thermal, lighting, acoustics, and cost analysis functions. It has features that will allow the building to be developed in terms of energy and environmental performance, especially during the conceptual design phase. It has a holistic approach that helps engineers design low energy buildings. It can work in collaboration with other building energy analysis programs. Complex 3D CAD models can be included in the program in a simplified form. It can also be used as input data for 3DS and DXF files. Analysis results can be saved as Meta, Bitmaps or visual animations, or presented graphically. Even with a very simple model, basic energy analysis can be made, guiding the users to the design from the first stages of the design. They provide ease of decision-making for the user in complex system solutions with detailed modeling in the final stages of design. Its weaknesses are that since the program has a detailed software in itself, the user must have a command of the program, otherwise the results obtained may mislead the designer (Tunali, 2012).

Energy Plus

Energy Plus is mostly simulation tools used. Basically it is just a simulation tool and by inputs and outputs simple text files. It does not have an improved user interface, but there are interfaces developed by commercial companies. It can perform precise calculations even for complex structures with time steps of less than an hour. In addition to the energy profiles of the building, conditions such as air flow, fuel cells and electrical energy simulation, distributed energy systems, water use can also be modeled for multi-zone situations with the recently added features. The fact that the input data is in the form of text makes it difficult to use compared to other programs with graphical interfaces (Kayın, 2019).

EQUEST

It is an advanced simulation tool for energy performance analysis that is widely used. The building design with high energy performance with easy-to-use interfaces, continuously updated library and parametric analysis in the design process, starting from the first stages of the design to the last stage. Many different levels of input data are used, including schematic design wizard, design development wizard and detailed (DOE-2) interface. The input data in all these interfaces are transferred from the library in the program to the model. Floor-coupling, infiltration and natural ventilation models are simple and limited (Tunali, 2012).

Green Building Studio (GBS)

Green Building Studio was developed by Autodesk. It is a cloud-based service that provides flexibility to the design process in simulation tools used to optimize energy efficiency. It helps to develop high-performance building design skills in a shorter time and lower cost than traditional methods. A Revit building model scraped for energy analysis is packaged in a gbXML file and submitted to Autodesk Green Building Studio for analysis (Web 2).

IES-VE

IES-VE is a simulation program used in energy efficient building design for environmentally friendly building design. It can perform analysis in the design of heating, cooling, and ventilation systems such as indoor climate assessment and energy consumption calculation. Hourly climate data, building element and material information, usage process diagram of the building, service systems data, component prices are entered as input data to the program. Users can obtain the energy consumption data calculated individually, hourly, weekly, monthly or periodically for each zone in the form of a table or graph. It is a program that is constantly developed and updated, but it is more effective in small-scale structures (Tunali, 2012).

Open Studio

The open of Studio is a simulation tool developed by Energy Plus to run on Windows, Mac and Linux. Open Studio is an open source (LGPL) project. It includes the interfaces of graphical along with the Software Development Kit (SDK). Open Studio Sketch Up Plugin is an extension that allows users to create the geometry needed for Energy Plus. Supports importing of gbXML and IFC for geometry rendering. It is a full featured graphical interface including HVAC. It allows to plot and compare simulation outputs containing time series (Web 3).

RIUSKA

RIUSKA is an integrated simulation tool that can be used in the building design process. The program covers the simulation of the entire building life cycle, from preliminary design to renovations. The main components of the system; database, calculation engine and results module. With RIUSKA, users can add building envelope materials, internal loads and HVAC system to the 3D model of the building and perform thermal calculations. RIUSKA & SMOG offers different outputs for different needs during the design process (Jokela et al., 1997).

TRACE 700

TRACE 700 stands for Trane Air Conditioning Economy. TRACE 700 is a Windows-based program for creating virtual buildings, calculating air conditioning loads. It can also perform life-cycle cost analysis. TRACE 700 helps optimize the building's heating, ventilation and air conditioning system based on energy use. TRACE 700 has a simple interface, but has limited capabilities (Web 4; Web 5).

TRNSYS 17

TRNSYS consists of a graphical interface and simulation engine, and a library containing many building components, HVAC system components and renewable energy technology. It also makes it possible to define new components that are not included in the library. For over 30 years, it has been used for HVAC analysis and dimensioning, multi-zone air flow analysis, electrical simulation, solar design and building thermal performance, analysis and control calculations. Due to its modular structure, TRNSYS offers flexibility in modeling energy systems of various complexity levels. Provides access to software code and documentation, allowing the user to make arrangements that allow the user to easily define outside the standard library (Harputlugil, 2014).

Studies in The Literature

Recently, many of the researchers have attempted to develop the BIM that based BEM applications using IFC and GBXML based methods. In this part of the study, it has been mentioned about the studies conducted using these programs in the literature. Studies examining BIM-based BEM applications focused to the geometry and material properties of the building using IFC. Energy Plus, Open Studio, DOE-2, TRNSYS, and Archibald are the best-known tools for BIM/BEM for IFC. Some studies using the IFC method are shown in Table 1 (Cormier A, et al 2011; Pinheiro et al 2016).

Table 1. Research using IFC based methods

Author	Year	Development Level	BIM	BEM
Cormier et al.	2011	Geometry, Material	Revit ArchiCAD	TRNSYS,Energy Plus
Ramaji et al.	2012	Geometry, Material	IFC-compliant BIM	OpenStudio
Kim and Yu	2016	Geometry, Material	ArchiCAD	DOE-2
Bazjanac and Maile	2004	Geometry, HVAC	IFC-compliant BIM	Energy Plus
O'Sullivan and Keane	2005	Geometry, HVAC	ArchiCAD	Energy Plus
Pinheiro et al.	2016	HVAC	Revit	--

The most up-to-date and popular BIM/BEM software using GBXML are Revit, Archibald, Energy Plus, e-QUEST, IES-VE and Green Building Studio particularly building energy analysis. Some studies using the GBXML method are shown in Table 2 (Rahmani Asl M, et al 2013; Amor R, et al 2014).

Table 2. Researches using gbXML based methods

Author	Year	Development Level	BIM	BEM
Garcia and Zhu	2014	Geometry, Material	Revit	eQUEST
Che et al.	2010	Geometry, Thermal Zone	Revit	IES-VE
Rahmani et al.	2013	Geometry, T. Zone	Revit	Green Building Studio
Ali	2010	Geometry, Material, T. Zone	Revit	Trace
Dimitriou et al.	2016	Geometry, Thermal Zone	Revit	Energy Plus
Calquin et al	2014	Geometry, T. Zone	Revit	DesignBuilder & Ecotect
Jalaei and Jrade	2014	Geometry, Space Type, T. Zone, HVAC	Revit	Ecotect

A Case Study

In this chapter, explanatory information about a sample energy analysis simulation study to be carried out in the future is given that Design Builder and Energy Plus programs will be used in the project.

Simulation Parameters of the Study

The following parameters will be used together with the relevant programs:

- Climatic parameters: various information about the outdoor environment such as temperature, relative humidity, wind speed are stored in the weather file of the Energy Plus program.
- Architectural parameters; main architectural parameters related to the building envelope; building shape, thermal permeability coefficients of building components, window transparency ratio, solar heat gain coefficient of transparent components, visible light transmission ratio of transparent components and solar reflectivity percentage of opaque components in Design Builder program.
- Electrical parameters; illumination power density is the most important parameter related to electricity defined in the program. It includes the total electrical power density and socket loads of the entire building. Unit is W/m^2.
- Mechanical parameters; it includes a natural gas etc. boiler heating system and radiators.
- Renewable energy resources design parameters; in the study, photovoltaic panel (PV) panel design parameters using the energy received from the sun and heat pump design parameters using the heat obtained from the soil are included.

Stages of The Study

In the study firstly, two-dimensional (2D) drawing of an existing building is prepared with the AutoCAD program according to the architectural projects and will be saved in DXF format.

Then, used the Design Builder input section, the building location template and building orientation information are entered into the program.

The outline created in 2D DXF format is then converted into DWG format, used three-dimensional (3D) design data format. In the model created in three dimensions (3D) in DWG format, all floors are defined with the add building command and all spaces on the floors are defined with the add partitions command, and the windows of the model whose floors and spaces are defined are defined into floors according to the architectural project and the floors are combined.

In the second stage, all systems that affect energy consumption are modeled separately. In this direction, firstly, the activity segment is entered and projection, computer, hand dryer, elevator, heated air curtain and so on. By entering the socket loads, the equipment load of the building in W/m^2 is defined. In addition, information on whether there is heating in the defined areas, average person density and working hours are recorded.

Insulation values, wall, roof and flooring information etc. Are defined according to the architectural projects of the building on the interface. The glass and joinery information according to the architectural project sections and the lighting intensity values according to the building electrical projects are entered into the program separately for each space in W/m^2.

According to building mechanical projects, heating, ventilation and air conditioning data (HVAC) are entered into the program separately for each location. If natural ventilation is used in the building, Natural Ventilation is activated.

As a result, the annual simulation results can be viewed in detail with the help of the simulation of the model whose data are defined. Various analysis outputs can also be obtained from the Design Builder interface with the help of the Energy Plus program.

Conclusions

Energy is a power that is offered to the service of both society and industry in quality and economical terms and a resource needed human life in order to increase the quality of community life, to increase the comfort level of people with decrease energy consume and to provide healthy environments. In this review, energy use also plays a key role for economic and social development.

Today, the issue of energy efficiency has gained great importance due to the decrease in energy resources and the harmful side effects of primary energy resources on the environment. In this direction, the energy used in binalrad should be used and planned in the most cost-effective way. In this respect, increasing of energy efficiency used in buildings is becoming increasingly common in the world. Countries constantly transfer technological developments to energy systems in order to reduce costs and reduce environmental damage such as global warming.

This article focuses on building energy modeling. In the study, BIM and BEM building modeling systems, Industry Base Classes (IFC) and Green Building XML (gbXML) data formats were examined, and it was determined that these formats constitute the basic standards.

Computer-aided Building Information Modeling (BIM) systems, developed for more efficient design and construction of buildings, have now been taken one step further and Building Energy Modeling (BEM) tools have been developed to examine building energy performance to improve building energy consumption. Building energy modeling can yield more reliable results to the building design process and better energy efficient results compared to calculations made by designers manually.

As a result, in this study, the importance of the Building of Information Modeling based Building Energy Modeling in the energy of efficient building design and improvement of existing buildings has been indicated the importance and proposed that the best known and most widely used BIM / BEM tools as Energy Plus, DOE-2, TRNSYS, Archibald, Revit, Archibald, Energy Plus, e-QUEST, IES-VE and Green Building Studio can be used for building energy simulation modeling.

Henceforth, Design Builder and Energy Plus programs will be used together in the building energy simulation project for future. Thus, the insulation values of the building envelope, glass shading coefficients, equipment efficiencies, lighting parameters, sensors, automation scenarios, building occupancy rates, alternative energy systems, roof material reflection coefficient, etc. By defining many parameters to the program, the model will be created and the annual energy cost of the building will be calculated.

Thanks to this, fast and less costly building energy models can be developed or the energy performance and energy consumption such as existing buildings energy simulation includes thermal of design analysis, cooling and heating loads, overs hadowing, energy consumption,lighting and daylight assessment,lifecycle costing, water usage, airflow can be examined.

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