COMPARITIVE STUDY OF ENERGY ANALYSIS ON RESIDENTIAL BUILDING IN REVIT SOFTWARE

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ABSTRACT

*Analysis of energy is becoming on crucial factor to be considered in the advance economic construction industry these days because of continuous rising of global warming and other environmental factors. Forecasting the energy usage of the building and using a suitable energy conserving measure and design for construction is a need of the hour. This paper is based on the Autodesk Revit capabilities to perform on energy analysis on **G+2** Residential building. The paper helps to find and seeks into integrate the use of revit .Energy analysis results in the predicting the energy consumption of the building throughout its total life span.*

In this paper, we have compared the results of energy analysis on Residential flat Scheme using different material for same plan. First one is basic model with normal brick and another one with air filled wall. The results are better for second model as compare to first.

For this purpose the Autodesk Revit software i.e. Green Building Studio, which is a cloud based energy analysis program is used.

Keyword: - *Energy Analysis, Autodesk Revit, Methodology of energy analysis, Basic wall model and Air Filled Wall Model*

1. INTRODUCTION

It is estimated that over 50% of the world's population now lives in cities. According to the UN Habitat, that is set to rise to 60% within a couple of decades. Cities are responsible for around 65% of all energy used and 70% of all greenhouse gases produced worldwide. The exponential increase in population, and contemporaneous increase in standard of living for many, will mean that the demand for essential goods and services will increase substantially.

In many fields the limits of what Earth can sustain have already been reached (Fokkema 2007). While there is an exponential growth in population, there is decline in the necessary resources to sustain this population. The key challenge of the 21st century is to redefine the way resources are being consumed and find sustainable solutions to treat materials and energy resources.

The building sector accounts for 50% of global greenhouse gas emission (UNEP-IETC, 2002) which makes it the largest single contributor to greenhouse gas emissions globally. In many countries the construction industry accounts for up to 40% of materials entering the global economy (CIWMB 2000), 50% of waste production, and 40 % of energy consumption. Materials used for buildings will have an impact on building energy consumption, but also on reuse and recycling potential of buildings.

Energy use is a widely used measure of the environmental impact of buildings. Operational energy is the first that needs to be tackled; however, as buildings are becoming better isolated and ever more renewable energy sources are being used, embodied energy has gained additional focus. Buildings use energy throughout their whole life cycle from construction to the end. Studies on the total energy use during the whole life cycle of the building are necessary, in order to identify strategies for energy reduction and its circular flows through the built environment.

This amplifies the need to look into all energy flows throughout the building phases. The life cycle analyses of energy flows have become essential in order to provide an integral view of the energy impact of the building sector on the environment.

Building Information Modelling consist of a digital representation of physical and functional characteristics of a building. It serves as a shared knowledge resource for information about a facility forming a reliable basis for decisions during its lifecycle from inception onward". The models created are approximately close to the real building. The closer the model is to reality, greater the chance to create a high performing building.

This Special Issue aims at addressing the many inter-related aspects of the life-cycle energy analysis of buildings, including green energy strategies for energy positive buildings, CO_2-balanced building, life cycle design of building, life time building energy, bioclimatic design and evaluation methods that guide the design and decision making process towards achieving green buildings and built environment.

In addition, the integration of Building Information Modelling (BIM) and energy assessments tools could have a significant contribution for selecting materials and components with lower impact on the total energy consumption of buildings. In most of the cases, these elements are selected taking into account only functional, financial and technical conditions.

1.1 Energy Analysis

A certain amount of energy is required for a building to operate, maintain user comfort and for functionality. Energy balance is necessary for the estimation of needed energy demand. The energy needed is due to energy losses caused by transmission and ventilation losses from the building envelop. These losses can be compensated fully or partially with help of appliances or by solar energy through the openings. Use of natural energy as much as possible will lead to less amount of fuel consumption of the building. Extra amount of energy input is required for lighting, ventilation and for the operation of building systems. When proper energy gains are attained and deducted from the energy losses of the building determine the overall energy demand of the building. Proper understanding of need of energy analysis will help creating a proper energy model. The main reasons for energy modeling are usually

• Compliance to code and/or project energy use estimation.

• Early stage model, providing assistance during design, construction and maintenance phase.

• Progress models during construction ensures that the project remains on track for energy or emission targets and also for maintenance.

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1.2 Revit Autodesk

Autodesk Revit is building information modeling software for architects, landscape architects, structural engineers, MEP engineers, designers and contractors. The original software was developed by Charles River Software, founded in 1997, renamed Revit Technology Corporation in 2000, and acquired by Autodesk in 2002. The software allows users to design a building and structure and its components in 3D, annotate the model with 2D drafting elements, and access building information from the building model's database. Revit is 4D BIM capable with tools to plan and track various stages in the building's lifecycle, from concept to construction and later maintenance and/or demolition.

Use Energy Analysis for Autodesk Revit to perform energy simulation for conceptual forms and detailed architectural models created in Revit. Use the simulation results to understand building energy use. Then iterate the designs to improve their sustainability ratings.

The energy model created from the Revit building model can be displayed in Revit, so you can view and validate the energy model used for analysis. The energy model can also be exported to third-party applications for further analysis

2. Methodology

2.1 The first stage in Energy simulation is to make 3D model in Autodesk Revit and define the energy target. The pro-posed target was to;

- Simulate code compliance.
- Demonstrate reduction in energy demand and its effect on Energy cost, especially the heating cost because of the location.
- Reduce CO_2 emission. The final target was to,
- Simulate a Net Zero Energy building using software and view the results.

2.2 Energy Simulation Modelling
When the models were modified to an acceptable level the Revit inbuilt energy analysis workflow can be initiated. This is connected to GBS so an Autodesk registration is required and then log in to Autodesk 360.
Under the Analyze tab on the Revit ribbon is the Energy analysis panel shown in Figure

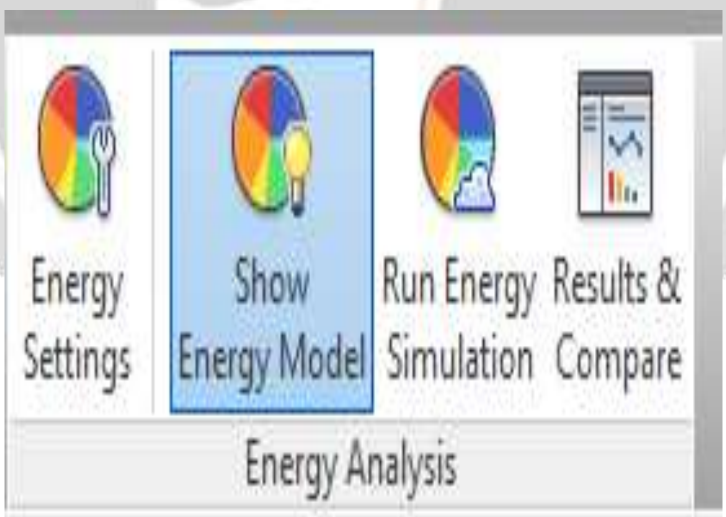
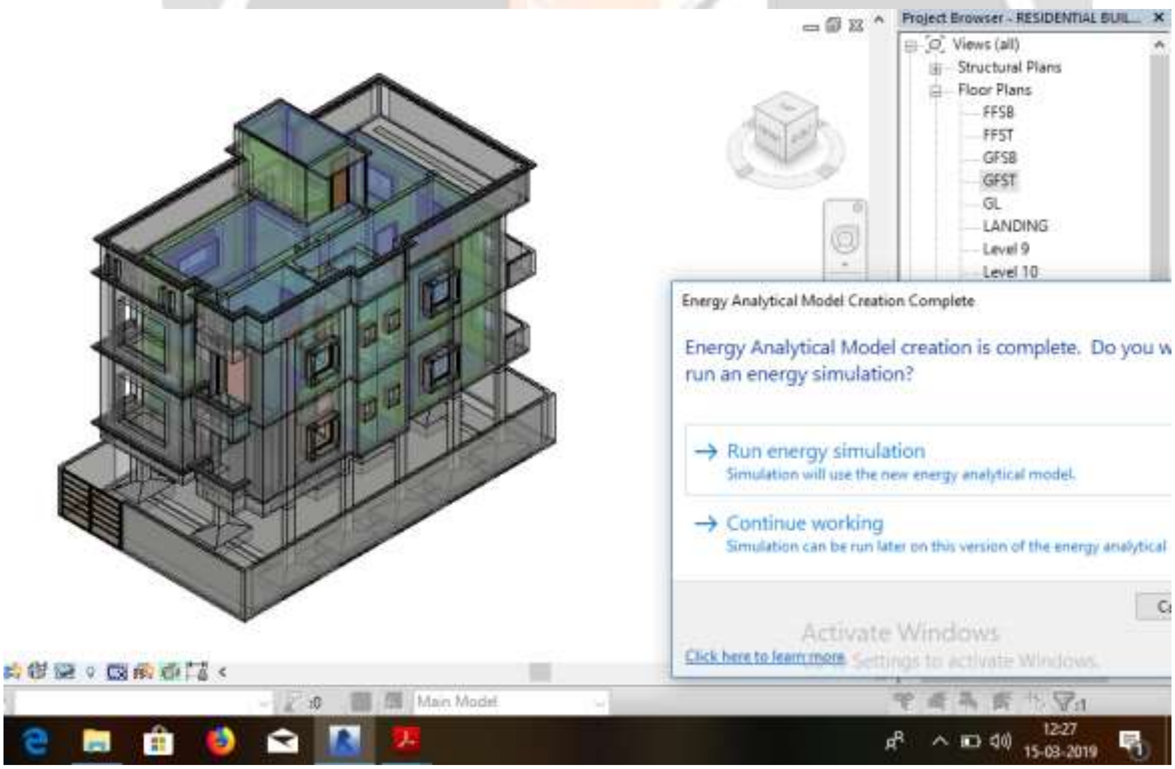


Fig. Energy Analysis Tab

2.3 The first step is to enter the energy settings. The most important basic input parameters using building elements are; building type, location, operation schedule and ground plane. Anything below the ground plane is treated as a basement.

2.4 The next step is to run the energy simulation. The software returns a query asking if you want to use the existing model or to create a new Analytical model. If any change has been made, it is best to create a new analytical model.

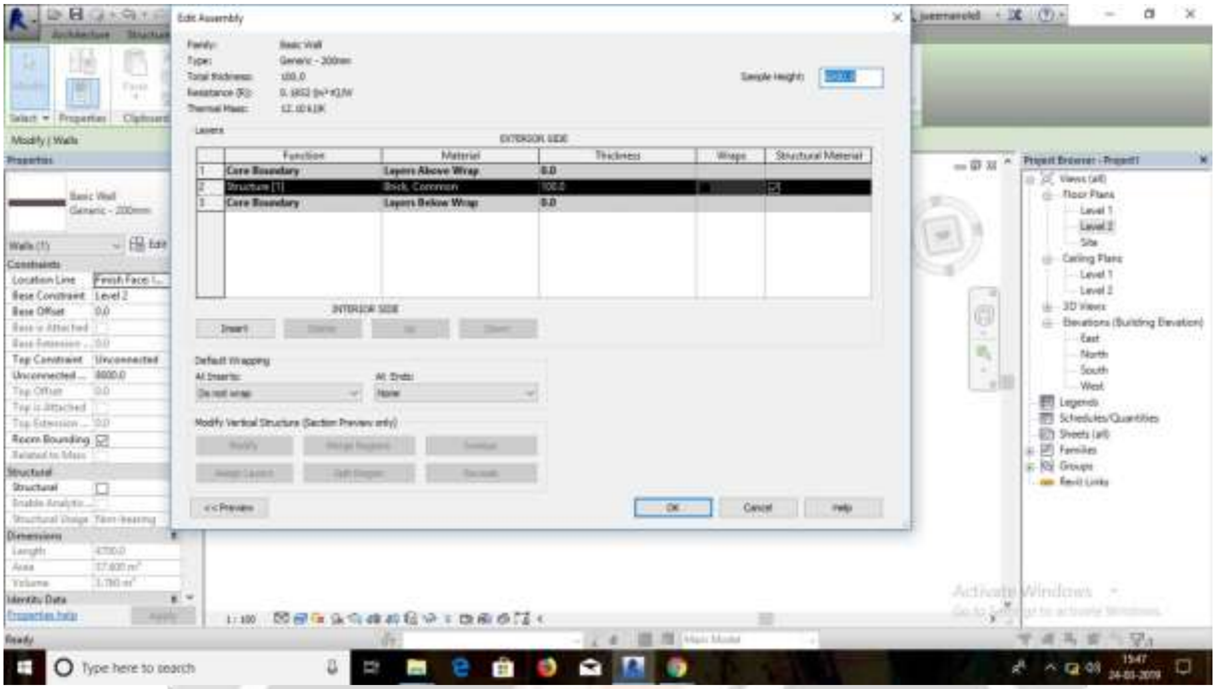
After the completing of analytical model the dialogue box is appear and click on the run energy simulation.



After the analysis completed the energy analysis result is shown with the following factors

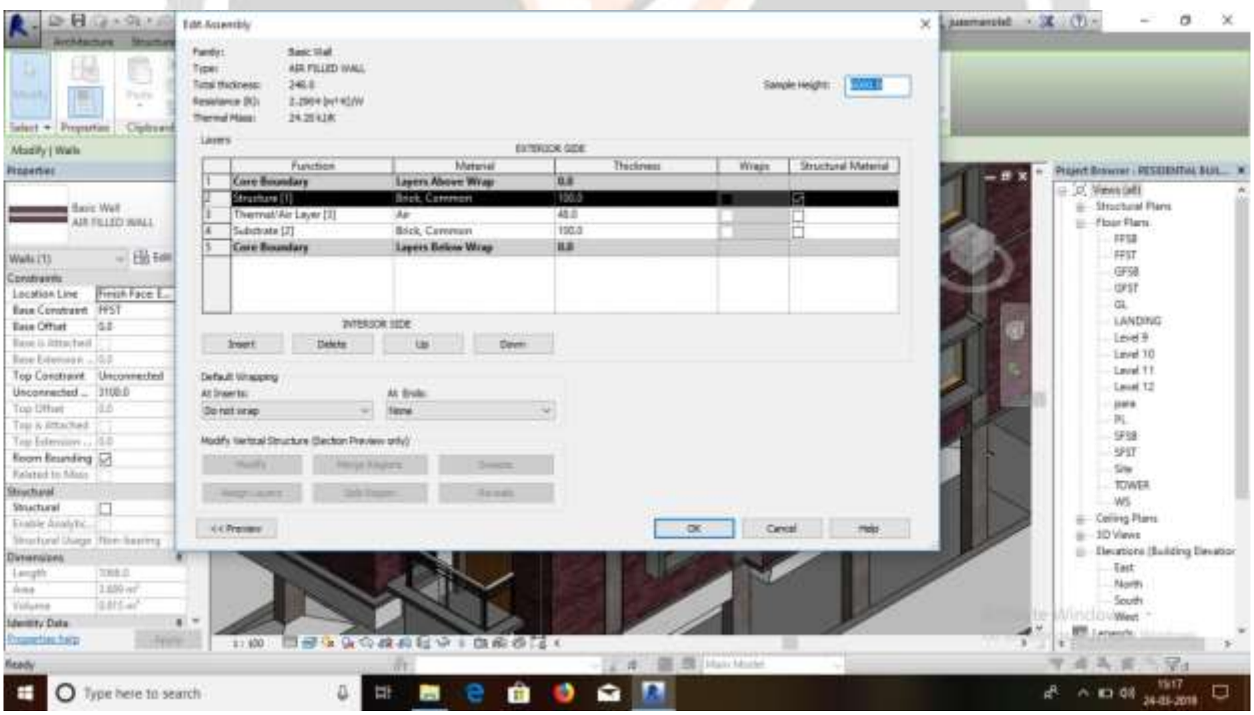
2.5 Basic Wall Model

The material of Basic wall is shown in fig.



2.5 Air Filled Wall Model

The material of Air filled wall is shown in fig.

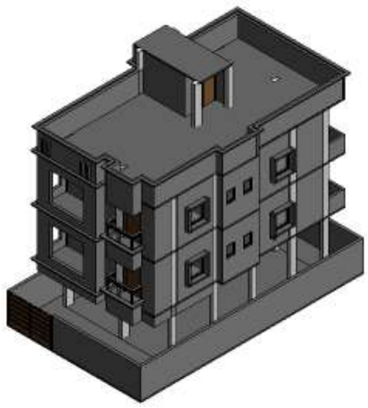


3. Result and Comparison

Result and Comparison of the energy analysis of residential building obtained from REVIT software.

Basic Wall Model

Energy Analysis Result



Building Performance Factors

Location:	Nagpur, India
Weather Station:	427961
Outdoor Temperature:	Max: 45°C/Min: 7°C
Floor Area:	131 m²
Exterior Wall Area:	163 m²
Average Lighting Power:	10.76 W / m²
People:	1 people
Exterior Window Ratio:	0.15
Electrical Cost:	$0.05 / kWh
Fuel Cost:	$0.14 / Therm

Energy Use Intensity

Electricity EUI:	159 kWh / sm / yr
Fuel EUI:	42 MJ / sm / yr
Total EUI:	613 MJ / sm / yr

Life Cycle Energy Use/Cost

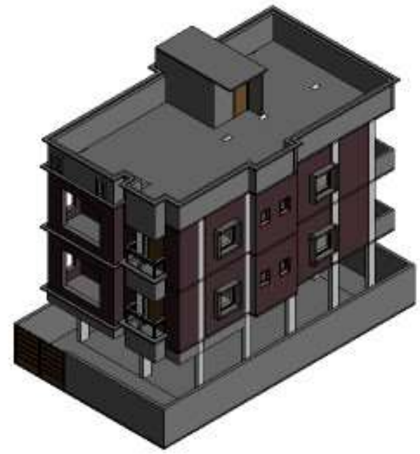
Life Cycle Electricity Use:	621,272 kWh
Life Cycle Fuel Use:	165,480 MJ
Life Cycle Energy Cost:	$13,360

*30-year life and 6.1% discount rate for costs

Renewable Energy Potential

Air Filled Wall Model

Energy Analysis Result



Building Performance Factors

Location:	Nagpur, India
Weather Station:	427961
Outdoor Temperature:	Max: 45°C/Min: 7°C
Floor Area:	134 m²
Exterior Wall Area:	165 m²
Average Lighting Power:	8.50 W / m²
People:	1 people
Exterior Window Ratio:	0.15
Electrical Cost:	$0.05 / kWh
Fuel Cost:	$0.14 / Therm

Energy Use Intensity

Electricity EUI:	137 kWh / sm / yr
Fuel EUI:	45 MJ / sm / yr
Total EUI:	538 MJ / sm / yr

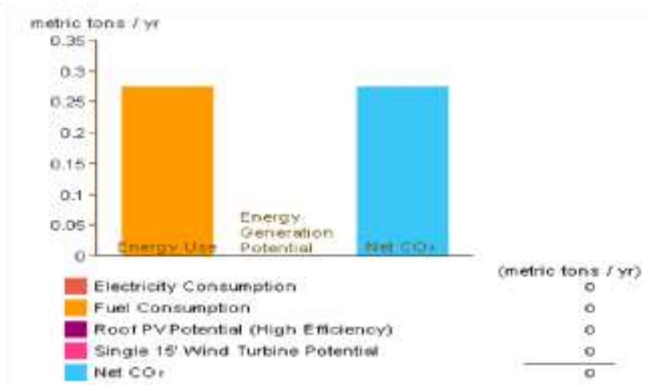
Life Cycle Energy Use/Cost

Life Cycle Electricity Use:	550,551 kWh
Life Cycle Fuel Use:	181,360 MJ
Life Cycle Energy Cost:	$11,861

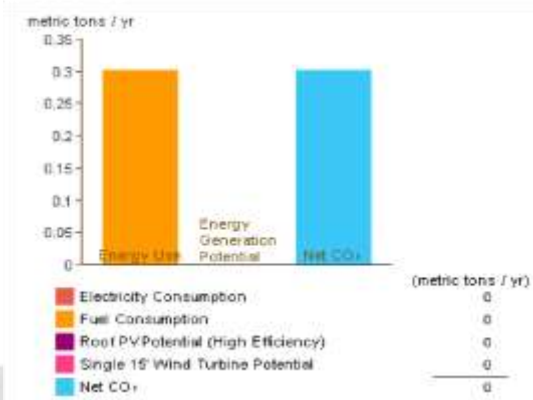
*30-year life and 6.1% discount rate for costs

Renewable Energy Potential

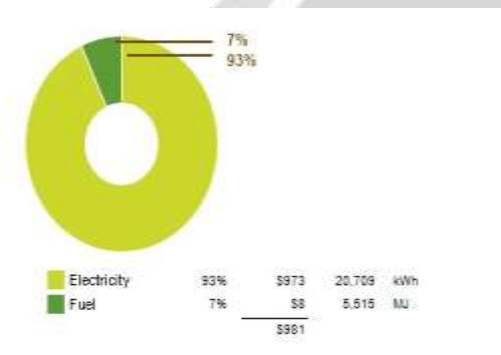
Annual Carbon Emissions



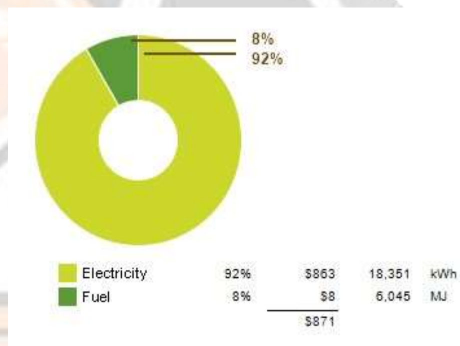
Annual Carbon Emissions



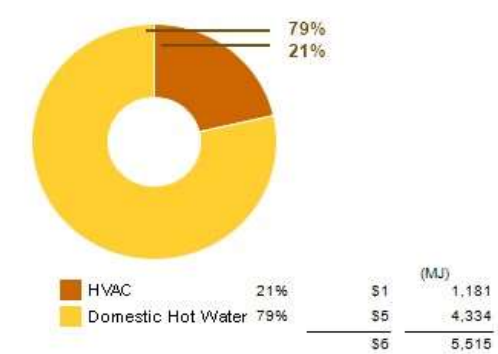
Annual Energy Use/Cost



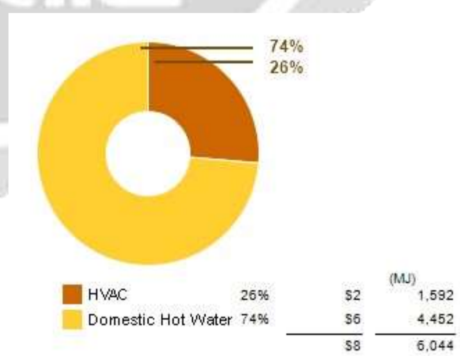
Annual Energy Use/Cost



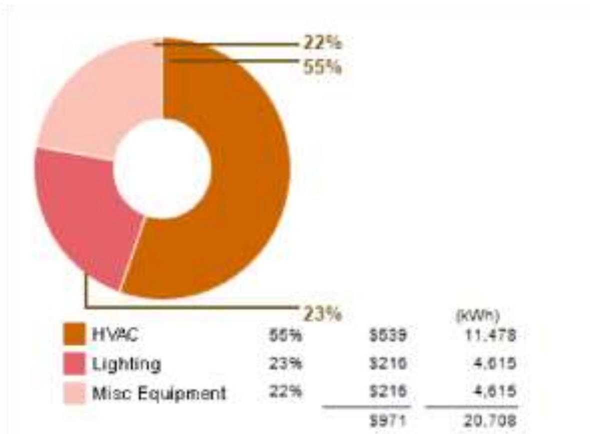
Energy Use: Fuel



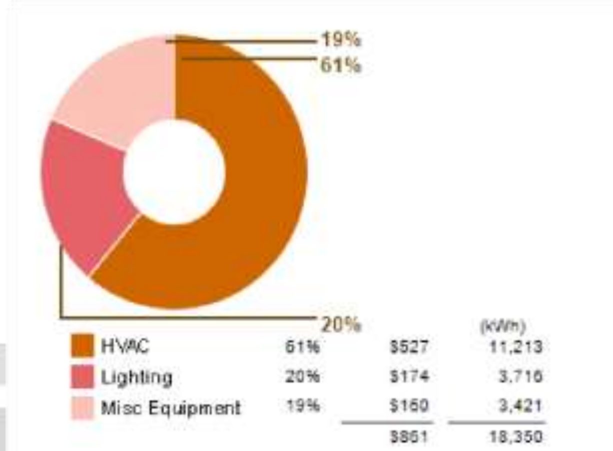
Energy Use: Fuel



Energy Use: Electricity



Energy Use: Electricity



4. CONCLUSIONS

- As the results shows energy use intensity in basic model is 159kwh/sm/hr and in air filled model is 137kwh/sm/hr
- Annual energy use in basic model is $981 i.e. Electricity in 93% and fuel in 7% and in air filled is $871 i.e. Electricity in 92 % and fuel in 8% .almost $110 energy is less in air filled model than the basic model.
- After compare two models the air filled model is more efficient in energy use than basic wall model.

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