

Insights into Hotels with Green Building Certifications:

Case studies from Turkey demonstrating potential savings

Duygu Erten*, Ph.D., P.E. BREEAM Fellow,
DGNB Assessor, LEED Faculty

TURKECO Consulting:Principal



Organisers:



International Co-owners:



Sustainable Buildings and Climate Initiative
Promoting Policies and Practices for Sustainability



HOTEL INDUSTRY and CLIMATE CHANGE

- Hotels like any other building type have a role to play mitigating climate change by reducing carbon emissions.
- The purpose of our research is to simulate annual energy use of selected hotels at different climates by using methodical and iterative processes to evaluate potential decisions and achieve long-term goals in Turkey.
- We selected 3 hotel projects aiming to receive green building certifications. The information provided in this research work is based on a review of relevant literature and the results of EQUEST simulations for 3 hotels across Turkey. Green criterias are evaluated according to LEED V3 certification system.



Organisers:



International Co-owners:



Sustainable Buildings and Climate Initiative
Promoting Policies and Practices for Sustainability



FACTS

- United Nations declared that, emissions generated directly from the tourism sector account today for 5 per cent of global CO₂ emissions but may be higher.
- Due to similar facts, energy consumption and conservation in hotels received growing attention globally in recent years.
- Hotel facilities rank among the top five in terms of energy consumption in the tertiary building sector (minor only to food services and sales, health care and certain types of offices)



Organisers:



International Co-owners:



Sustainable Buildings and Climate Initiative
Promoting Policies and Practices for Sustainability



FACTS

- According to US EPA, for a study that was carried out in the United States for both hotels and motels on their practices and operating costs energy represented roughly six percent of all the operating costs.
- The CHOSE project estimated that European hotels – which are reported to provide nearly half of the world total hotel rooms – used a total of 39 TWh (terawatt hours) in 2000, half of which is in the form of electricity.



Organisers:



International Co-owners:



Sustainable Buildings and Climate Initiative
Promoting Policies and Practices for Sustainability



Global Alliance
for Buildings and
Construction

CO₂ emissions

- Most of this energy is derived from fossil sources, and the hotel sector's contribution to global warming and climate change, is estimated to include annual releases between 160 and 200 kg of CO₂ per m² of room floor area, depending on the fuel mix used to provide energy.
- Global hotel-based CO₂ emissions were assumed to be at the level of 55.7 Mt in 2001, while the estimated annual energy consumption for European hotel of 39 TWh, would result in emissions of more than 10 Mt of CO₂ each year.



Organisers:



International Co-owners:



Sustainable Buildings and Climate Initiative
Promoting Policies and Practices for Sustainability



Global Alliance
for Buildings and
Construction

GREEN BUILDING CERTIFICATION

- International Green Building Certifications like LEED/BREEAM/DGNB/GREENSTAR/BEAM are now widely used locally and internationally for HOTELS.
- Several Cornell Hospitality Reports have demonstrated the importance of green certification in gaining favorable guest notice, including ISO 14001 and LEED.



Organisers:



International Co-owners:



Sustainable Buildings and Climate Initiative
Promoting Policies and Practices for Sustainability



USGBC Rankings-Turkey

- According to USGBC rankings, Turkey has made the top 10 Countries for LEED certification list in 2015 and 2016.
- Maintaining this form of commitment to transforming Turkey's national built environment holds enormous potential for the country's long term economic and environmental future since [42 percent of Turkey's net electricity consumption](#) comes from the country's building sector.



Organisers:



International Co-owners:



Sustainable Buildings and Climate Initiative
Promoting Policies and Practices for Sustainability



Global Alliance
for Buildings and
Construction

HOTELS with GREEN BUILDING CERTIFICATION SYSTEMS

- Turkey's energy demand is increasing so does the number of new hotels built. Out of 477 buildings applying for certification in 2015, only 36 of them are hotels registered to be certified at some level of LEED.
- The Fairmont Hotel in Mecidiyeköy, İstanbul received a DGNB-Gold certification.
- BREEAM as well as LEED and DGNB are widely used green building certification systems in Turkey; there are no BREEAM certified hotels in Turkey as of August 2015.



Organisers:



International Co-owners:



Sustainable Buildings and Climate Initiative
Promoting Policies and Practices for Sustainability



RESEARCH

- A total number of 36 hotel developers were contacted for the study. 35 of these hotels aimed to receive LEED certification at some level while 1 aimed to receive DGNB. The 3 cases under this study received LEED GOLD certifications.
- Energy modelling was performed for each hotel to predict the annual hotel energy usage and to investigate the energy savings. Performing energy simulation is a prerequisite in order to get most green building certifications but energy modeling predates certification systems like LEED, BREEAM and DGNB.
- Energy modelling proved to be a powerful tool in these 3 projects since it was part of an integrated design process. Energy efficiency measures in each project are diverse and have different interactions with other components of the building and it was necessary to evaluate their effectiveness using some sort of modelling approach.



Organisers:



International Co-owners:



Sustainable Buildings and Climate Initiative
Promoting Policies and Practices for Sustainability



ROLE OF ENERGY MODELLING

Baselining: Assessing energy and CO₂ emissions from all energy-related end-uses in buildings, by:

Building energy modelling (predicting energy use) – examples are Ecotect, IES, TAS, Energy Plus, ESPr, DOE

Actual energy measurement (metered energy data)

- 1. Benchmarking** existing performance against best-practice, peers
- 2. Target setting:** establishing ambitious CO₂ reduction targets – Relative (60%, 80%) or Absolute (15kgCO₂/m²/year)
- 3. Evaluation and appraisal** of low-energy and low-carbon measures and technologies to achieve targets. (**Building energy modelling**)
- 4. Implementation of actions**
- 5. Monitoring, reporting and verifying** the energy and CO₂ reductions achieved as a result: sharing experiences. (**Actual energy measurement**)
- 6. Monetisation of savings:** future carbon markets & emissions trading for buildings.

REF: UNEPSBCI- Dr Rajat Gupta

Organisers:



International Co-owners:



Sustainable Buildings and Climate Initiative
Promoting Policies and Practices for Sustainability



Global Alliance
for Buildings and
Construction

Approaches to Energy Modelling

Predictive energy simulation models

- Computer programs which are used to generate an energy performance prediction from calculations.
- IES, TAS, Energy Plus, ESPr, eQuest
- THIS RESEARCH, Energy Analysis is done using eQUEST*.

Scorecard rating tools

- Award points against pre-defined set of criteria which are then weighted and an overall rating is given, such as LEED (US), BREEAM (UK), DGNB (Germany), Griha (India) etc.



Organisers:



International Co-owners:



Sustainable Buildings and Climate Initiative
Promoting Policies and Practices for Sustainability



Hotel A at Eskişehir

- The Hotel consists of 5 basements, ground floor and 3 Guest Room floors. Boilers are designed to meet the heating energy demand of the building. Principal heating source is natural gas.
- According to function of the zones different heating systems are used. 4-piped Fan Coil system is used ballroom, back stage retail areas, foyer. Water cooled VRF system is used in guest rooms; café, restaurant and gym are heated by PTACs. Water cooled chillers are installed for cooling; FCU indoor units are used to meet the cooling energy demand of the building. Geothermal water is used as domestic hot water and laundry process demand.



Organisers:



International Co-owners:



Sustainable Buildings and Climate Initiative
Promoting Policies and Practices for Sustainability

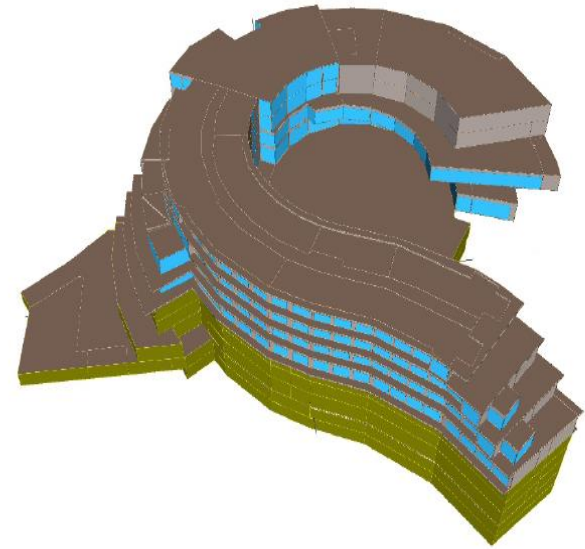


Global Alliance
for Buildings and
Construction

HOTEL A

- In addition to heating and cooling systems; provided fresh air rates are designed according to ASHRAE 62.1-2007.
- *The energy model results show that the actual design for the building performs 30 % better than ASHRAE 90.1-2007 requirements using the LEED performance rating method.*

Note: This program simulates the energy performance of a building using hourly time steps for all 8760 hours in a year and by using Meteonorm Hourly Interpolated Values for Eskisehir weather file.



HOTEL B at Antalya

- Consists of one basement, Ground floor, one Mechanical Floor, and 4 Guest Room floors (including Attic Floor).
- Boilers are designed to meet the heating energy demand of the building. As a fuel type natural gas is used. According to function of the zones different heating systems are used.
- 4-piped Fan Coil system is used office, hotel rooms and circulations. Unitary Heaters are used in technical areas; café, restaurant and gym are heated by PTACs.
- Chillers are installed for cooling; FCU indoor units are used to meet the cooling energy demand of the building. Tri generation unit installation is the most important point for energy efficiency and improvement in the building. In addition to heating and cooling systems; provided fresh air rates are designed according to ASHRAE 62.1-2007.

Note: eQUEST is used to simulate the energy performance of a building using hourly time steps for all 8760 hours in a year and by using TUR_Antalya_MN6.bin weather file.



Organisers:



International Co-owners:

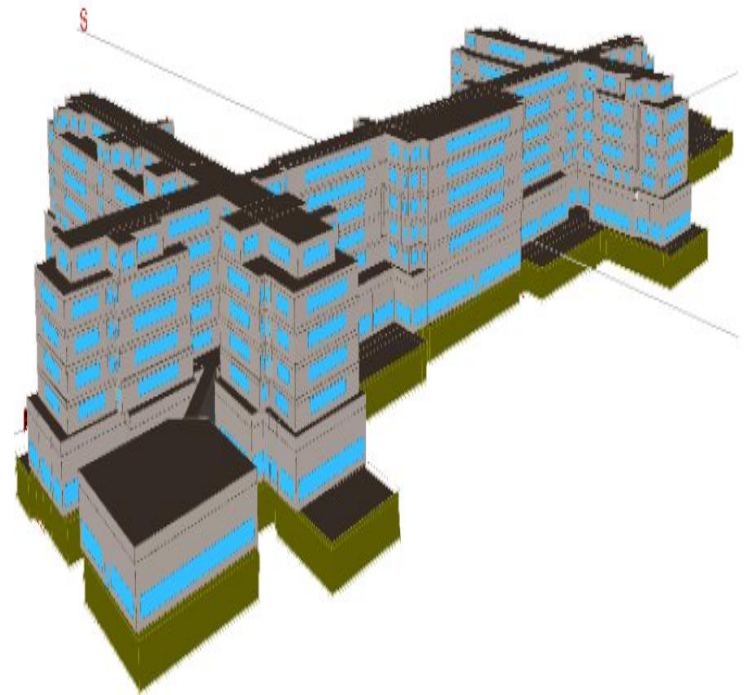


HOTEL B

The proposed design model is based on the actual parameters and actual design considerations and architectural details.

The key measures of an efficient design implemented are: improving glazing, improving exterior wall thermal energy conductivity, using Heat Recovery Wheel;

The energy model results show that the actual design for the building performs 20 % better than ASHRAE 90.1-2007 requirements using the LEED performance rating method.



International Co-owners:



HOTEL C at İstanbul

- Hilton C, consists of 4 basements, ground floor and 22 Guest Room floors. Boilers are designed to meet the heating energy demand of the building. Principal heating source is planned to be natural gas. According to function of the zones different heating systems are used. 4-piped Fan Coil system is used in restrooms, changing rooms, ballroom, boardrooms, offices, fitness room, guest rooms and corridors.
- Variable air volume with under floor static heating is modelled for the pool area. Air cooled chillers are installed for cooling; FCU indoor units are used to meet the cooling energy demand of the building.



Organisers:



International Co-owners:



Sustainable Buildings and Climate Initiative
Promoting Policies and Practices for Sustainability

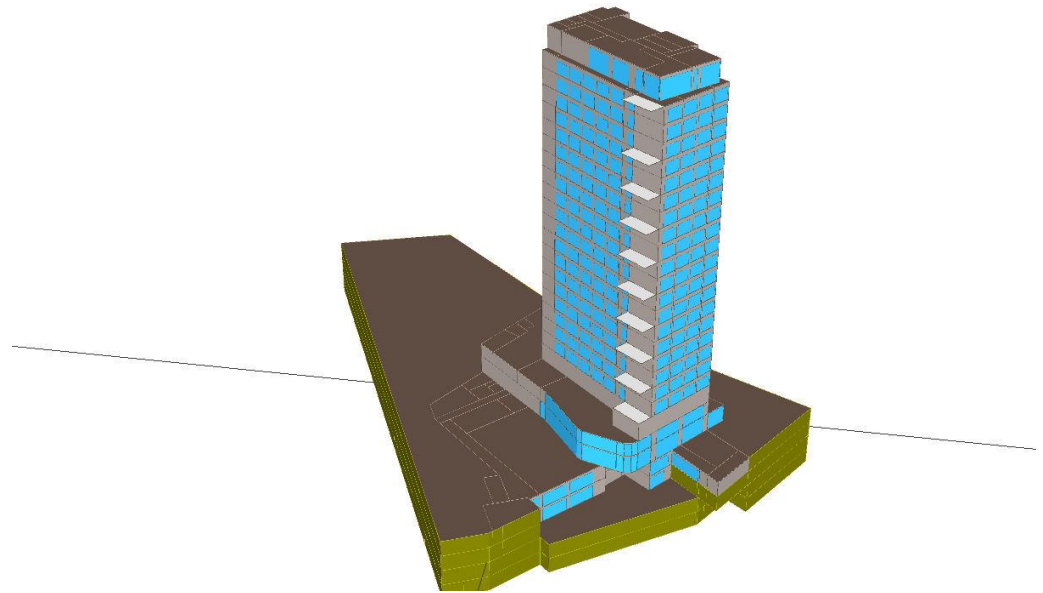


Global Alliance
for Buildings and
Construction

HOTEL C

In addition to heating and cooling systems; provided fresh air rates are designed according to ASHRAE 62.1-2007.

The energy model results show that the actual design for the building performs 26,9 % better than ASHRAE 90.1-2007 requirements using the LEED energy performance rating methodology.



ENERGY MODELLING

- eQUEST is used for all 3 projects to demonstrate the percentage improvement in the proposed building performance rating compared to the baseline building performance rating as per ASHRAE/IESNA Standard 90.1-2007 for a whole building project simulation using the Building Performance Rating Method in Appendix G of the standard.
- The proposed design model is based on the actual parameters and actual design considerations and architectural details.



Organisers:



International Co-owners:



Sustainable Buildings and Climate Initiative
Promoting Policies and Practices for Sustainability



Global Alliance
for Buildings and
Construction

USE of ENERGY SIMULATION for INTEGRATED DESIGN at an early stage

- During schematic design phase a simplified model of building is used to test site and basic design features.
- For the values not available at the pre-design stage, default values are utilized.
- After several runs, alternative scenarios are compared. During design development stage inputs like, building characteristics, occupant characteristics, system characteristics are used to model.
- The outputs show us what the monthly consumption by end use will be as well as equipment type. Once the design development is completed the exact location, size and material characteristics for the envelope, windows, doors, roof and foundation are plugged into the model. During the preparation of construction and bid documents the complete energy model outputs are used.
- Construction management team is asked to install the designed features. Modelling also helped us to examine the life cycle costs.



Organisers:



International Co-owners:



Sustainable Buildings and Climate Initiative
Promoting Policies and Practices for Sustainability



Global Alliance
for Buildings and
Construction

| Category | DATA | HOTEL A | HOTEL B | HOTEL C |
|----------|---|----------------------------|----------------------------|----------------------------|
| ENERGY | Standard of Simulation | ASHRAE 90.1-2007 App. G | ASHRAE 90.1-2007 App. G | ASHRAE 90.1-2007 App. G |
| | Actual Design (kWh/m2/year) | 166,37 | 221,56 | 155,49 |
| | Baseline Design (kWh/m2/year) | 208,05 | 318,14 | 212,71 |
| | % energy cost improvement over baseline | 67 | 37,89 | 19,94 |
| | Actual Design (KgCO2/m2/year) | 90,1725 | 120,0855 | 84,2755 |
| | Baseline Design (KgCO2/m2/year) | 112,7631 | 172,4318 | 115,2888 |
| | % improvement over baseline | 20 | 30 | 26,9 |
| | U values of exterior wall (W/m2.K) | 0,31 | 0,42 | 0,48 |
| | U values of glazing+frame system (W/m2.K) | 4,49 | 2,27 | 4,31 |
| | % of actual energy cost by renewable/trigen sources connected to the building | 56 | 2 | 0 |



Organisers:



International Co-owners:



Sustainable Buildings and Climate Initiative
Promoting Policies and Practices for Sustainability



Global Alliance
for Buildings and
Construction

OTHER PARAMETERS

| Category | DATA | HOTEL A | HOTEL B | HOTEL C |
|-------------|---|---------|---------|---------|
| WATER | % Water consumption improvement over baseline | 33 | 43 | 40 |
| WASTE | Percentage (%) of waste diverted from landfill | 89 | 87 | 88 |
| AIR QUALITY | %30 Increased Ventilation according to ASHRAE 62.1-2007 | YES | NO | YES |



Organisers:



International Co-owners:



Sustainable Buildings and Climate Initiative
Promoting Policies and Practices for Sustainability



Global Alliance
For Buildings and
Construction

HOTEL CONSTRUCTION RATE

- Turkey has a favorable economic environment for foreign direct investment and construction market has a compound annual growth rate (CAGR) of 19%, while investment in the sector is increasing with a CAGR of 10%.
- Every year 100 thousand construction permits are granted for new buildings and 1,2% of these permits are for hotels



Organisers:



International Co-owners:



Sustainable Buildings and Climate Initiative
Promoting Policies and Practices for Sustainability



RESULTS

- Approximately 1200 hotel construction per year where only 3% of these hotels are aiming to receive green building certification systems.
- Based on the analysis of the three hotels which received LEED-GOLD certification, there exists significant energy savings potential for the Turkey's hotel industry if hotels are designed and built with sustainability principles. The main finding after comparing the three hotel designs is that it is technically feasible to increase energy efficiency over 60% without compromising guest comfort by using green technologies.
- From the LEED registered hotel list in Turkey, a high percentage of hotels receiving green building certifications are foreign brands.



Organisers:



International Co-owners:



Sustainable Buildings and Climate Initiative
Promoting Policies and Practices for Sustainability



Global Alliance
for Buildings and
Construction

PROPOSAL for the INDUSTRY

- Turkey, in order to develop its local hotel brands in a sustainable way, has to create a green code for the hotels.
- Turkish NGOs in the real estate sector is on the verge of creating a new national code for buildings.
- Since the ASHRAE 90.1 Energy Standard is being widely used by international green building certification systems, the new building code to be developed for Turkey can embed the requirements of ASHRAE 90.1 Energy Standard into the new code.
- Designers can use the building energy modelling to efficiently meet the new building code standard. This way, developers can evaluate energy saving potential of several possible solutions and pick the one suitable to meet the requirements of the code.



Organisers:



International Co-owners:



Thank you

For questions: derten@turkeco.com

Facebook: turkeco



Organisers:



International Co-owners:



Sustainable Buildings and Climate Initiative
Promoting Policies and Practices for Sustainability

