ECO bench
Energy Benchmarking

USER MANUAL

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ECObench

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Developed by:
USAID ECO-III Project
International Resources Group
2 Balbir Saxena Marg, Hauz Khas, New Delhi, India

Project Guidance	**Development Team**	**Supporting Partner**
USAID/India	International Resources Group, USAID ECO-III Project	Technical Consultant
Archana Walia		Vikas Arora
	Aalok Deshmukh	
Bureau of Energy Efficiency	Bibhash Das	
Ajay Mathur	Meetu Sharma	
Sanjay Seth	Satish Kumar	
Shabnam Bassi	Madhav Kamath	
Girja Shankar		
Sameer Pandita	*ps* Collective	
Brijesh Manan	Saket Sarraf	
	Shilpi Anand Saboo	
	Ride Softech Solutions LLP (Software Development)	
	Pallavi Phadke	
	Ninad Patil	
	Ishani Ranade	
	Sanket Lele	

How to use this manual

The following symbols and icons are used in this user manual:

Symbol/Icon	Description
§	Section of the user manual
*	Mandatory field
⤢	External web link
(Tip)	Useful tip
⚠	Caution or warning

The text underlined in blue colour is a cross-reference within the user manual itself. In the soft copy, click it to open the section that is cross-referenced.

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1. Introduction

The Ministry of Power, Government of India, set up the Bureau of Energy Efficiency (BEE) under the provisions of the Energy Conservation Act, 2001. As one of its primary objectives, BEE has focused on efforts to reduce energy intensity of the Indian economy by reducing the wasteful use of energy and bridging the power demand-supply gap.

It is with this in mind that BEE, with technical assistance from United States Agency for International Development (USAID) Energy Conservation and Commercialization - Phase III (ECO-III) Project, embarked on an initiative to provide sector-specific energy consumption data and undertook the energy benchmarking initiative. The USAID ECO-III team collected building energy data with inputs from BEE's technical committee members. Under the guidance of BEE, ECO-III Project has developed **ECObench Tool**, an online tool to benchmark and rate the energy performance of the commercial buildings. It is developed by Ride Softech Solutions LLP under the guidance of ECO-III Project.

The purpose of this manual is to familiarize a user with the interface of ECObench Tool and walk through the step-by-step process of building energy benchmarking and performance based rating.

2.　　ECObench Tool

ECObench Tool is an online energy benchmarking and rating tool provided by BEE.

- It is a web-based tool that is made available to the users over the Internet with minimal software requirements or building science expertise.
- It can be used with minimal learning involved.
- It keeps the information secure and confidential.
- It is available in the public domain (http://ecobench.eetools.in) for easy access to the users.

3.   Tool Navigation

ECObench Tool is aesthetically designed, keeping in mind the ease of navigation for the end-user.

ECObench Tool allows the user to provide inputs that do not need to be sequential. The information can be provided in the sequence preferred by the user. This makes it more intuitive and interactive.

(Tip) Across the tool, the fields marked with an asterisk (*) are mandatory.

3.1.   Navigation Bar

The navigation bar at the top right corner of the screen is used to access tool information and help, and perform energy benchmarking.

| Home | Benchmark | About | Help |

|	
Home	Click **Home** to view the home page of the tool (see § 4)
Benchmark	Click to select the building type (hotel, hospital, office) for benchmarking (see § 5)
About	Click **About** to view the tool version and credits
Help	Click **Help** to view Frequently asked questions (FAQs) and this user manual

3.2.   How to Access

Enter the link http://ecobench.eetools.in in the web browser's address bar to access ECObench Tool.

(Tip) See Appendix A: Computer Settings (§ 7) to learn about the settings required on a user's computer before using the tool.

4.   Home Page

The following illustration highlights the composition of ECObench Tool home page.
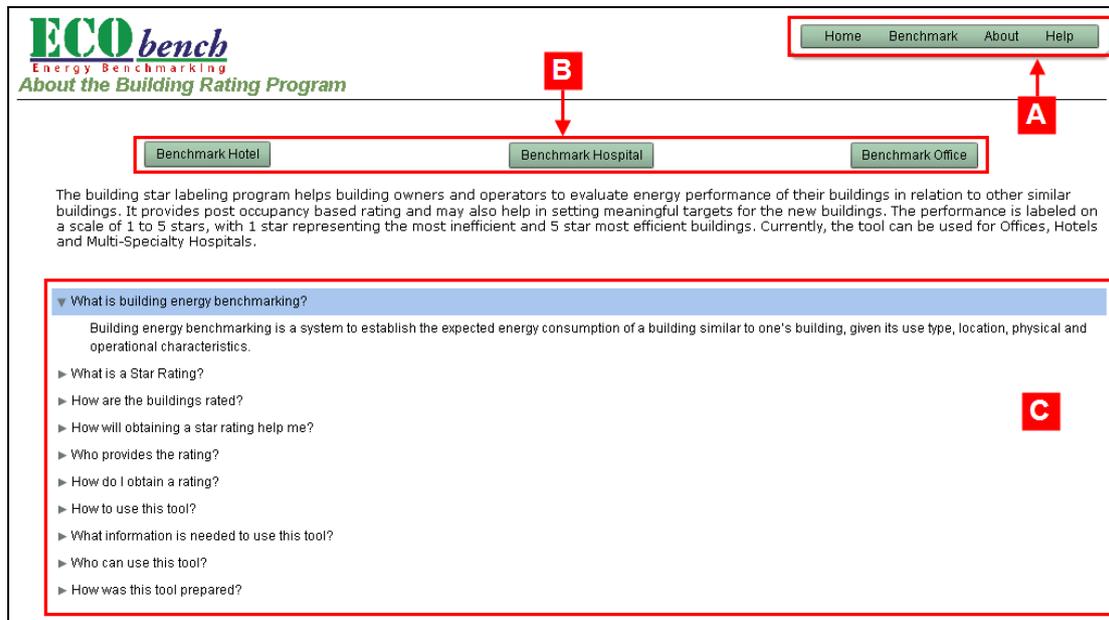
A	Navigation bar (see § 3.1)
B	Links to the benchmarking pages of different building types (see § 5)
C	Concepts related to energy benchmarking and performance rating tool

5.   Energy Benchmarking

Buildings must continuously monitor and improve their performance in order to transit to an energy efficient economy. It is important to measure this performance against the established benchmarks. The aim is to improve the design, construction, maintenance, and operation of buildings by measuring the energy performance against established benchmarks, and recognize and reward exemplary buildings.

Energy benchmarking is a process of creating a whole building energy consumption profile of a group of buildings characterized by their primary use, construction, physical, geographic, and operating characteristics. The rating is derived by assigning a score to the performance differential between the building under consideration and a benchmarked building in relation to all other buildings in the stock.

To achieve this, ECObench Tool gathers inputs from the user to measure the performance of a building against its peers. It displays the benchmarking result in a graphic as well as tabular fashion for the convenience of the user. The tool also generates a report that may be submitted to the *Authority Having Jurisdiction* to demonstrate a building's performance.

Energy benchmarking can be performed using ECObench Tool in one of the following ways:

- Click **Benchmark Hotel**, **Benchmark Hospital**, or **Benchmark Office** on the [home page](#) of ECObench Tool.
- Select the building type (**Hotel**, **Hospital**, or **Office**) from the **Benchmark** drop-down menu on the top navigation bar.

The benchmarking page for the selected building type opens. The following illustration highlights the composition of the benchmarking page.

A	Navigation bar (see § 3.1)
B	Building type (**Hotel**, **Hospital**, **Office**) drop-down menu
C	Building related inputs for performing benchmarking (see § 5.1)
D	Benchmarking results: **Energy Performance Intensity (EPI)** (see § 5.2.1) and **building ranking** and interpretation (see § 5.2.2)
E	Benchmarking results (charts): **Performance distribution curve** and **histogram** (see § 5.2.3)
F	Benchmarking results: **Star rating** for hotels and hospitals, and **performance bands** for offices (see § 5.2.4)
G	Benchmarking report (see § 5.3)

5.1. User Inputs

Select the type of commercial building (**Hotel**, **Hospital**, **Office**) for which the benchmarking is to be performed.

Certain input fields get customized according to the selected building type.

User Inputs	
Built up area (m²)	3,500
Annual Electricity Purchased (kWh)	800,000
Annual Electricity Generated (kWh)	50,000
Climate Zone	Warm and Humid
Type of Hotel	4 or 5 Star
Total number of rooms	50

Enter building's information such as its type, built-up area, electricity consumption details, and climate zone. It is important to provide correct inputs to get accurate benchmarking results.

5.2. Benchmarking Results

Based on the inputs provided, the benchmarking results (which occupy the rest of the screen) get dynamically updated. The following sub-sections help in interpreting the results.

5.2.1. Energy Performance Intensity (EPI)

The Energy Performance Intensity (EPI) is defined as the annual energy consumption measured in kWh per square meter of the built-up area of the building. It is the ratio of the total energy used to the total built-up area and is expressed as kWh/m^2/year. . Alternatively, it is also defined as the annual energy consumption measured in kWh per room in a hotel, per bed in a hospital, or per employee in an office.

Energy Performance Intensity (EPI)

Parameters	Measured	Benchmark
kWh Total	850,000	741,403
EPI (kWh/m^2)	243	212
EPI (kWh/room)	17,000	14,828

The parameters for the measured building are compared with the benchmark building in the national database. In the above example, the building that is being measured is consuming more energy and therefore not performing better than the benchmark building.
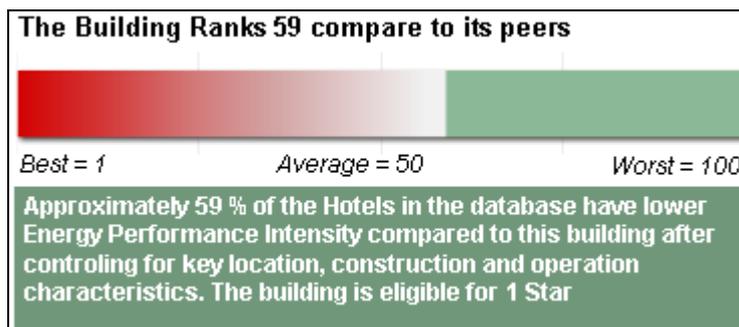
(Tip) The benchmark building is derived from the regression equation performed on the available database of buildings.

5.2.2. Building Rank

The measured building's performance is ranked in percentile terms vis-à-vis all the other buildings of the same type in the database.

(Tip) The best performing building is ranked 1 and the worst one is ranked 100.

The Building Ranks 59 compare to its peers

Best = 1   Average = 50   Worst = 100

Approximately 59 % of the Hotels in the database have lower Energy Performance Intensity compared to this building after controling for key location, construction and operation characteristics. The building is eligible for 1 Star

5.2.3. Charts

The EPI and the performance rank are graphically displayed on the line chart. The performance band of the measured building is depicted on the histogram.
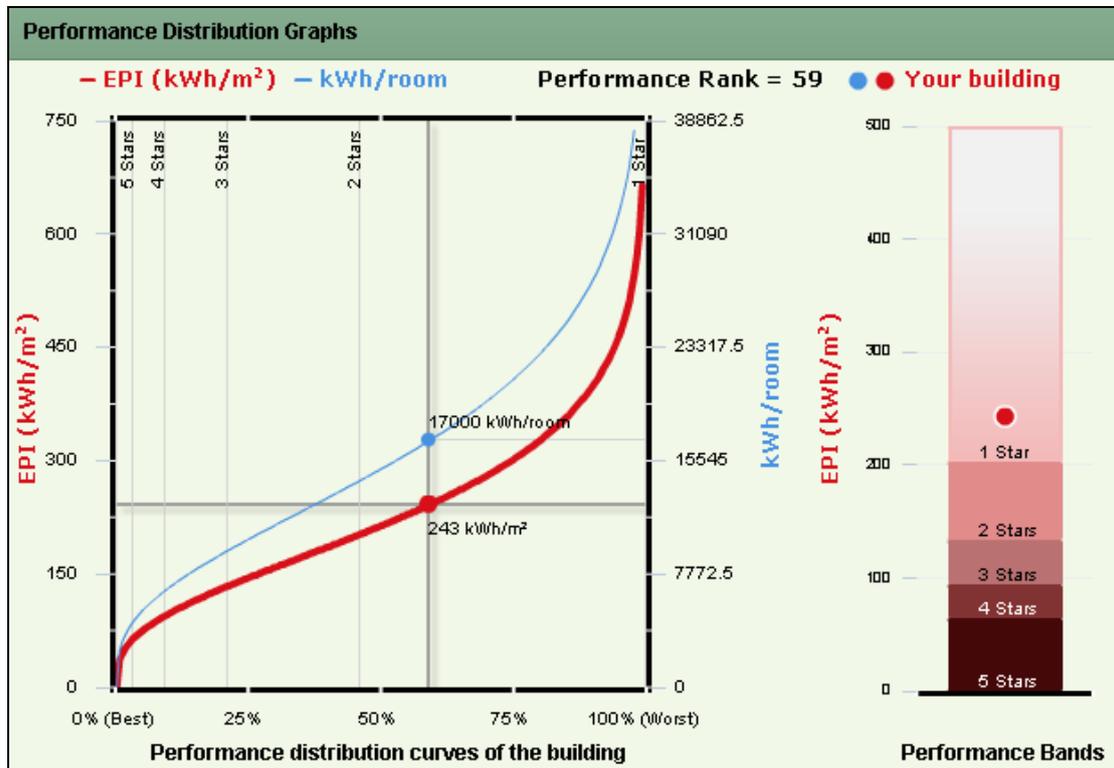
Hover the mouse pointer over the curves of the line chart to see the building's rank details.

The red markers on the two graphs show the building's performance relative to all other buildings.

The red marker on the performance distribution curve (first graph) shows its EPI measured on the left Y-axis and performance rank measured on the X-axis. The red curve is unique to every building. The enhancements in terms of building systems will enhance the performance and the building will slide up and down its own unique curve. The blue curve and the blue marker show the same information, but normalized by the use intensity rather than the built-up area (the number of hotel rooms in the above illustration).

The histogram shows different EPI bands corresponding to different rating levels. The heights of these bands are specific to the building information entered by the user.

5.2.4. Star Rating / Performance Band

The measured building is awarded a star rating/performance band based on its energy efficiency (EPI) as compared to that of its peers. The **Target Energy Performance for Different Ratings** table provides reference points to achieve a different rating for the same building. Thus, a building with the characteristics entered by the user will have to consume 64 to 94 kWh/m^2 of energy per year or alternatively, 4453 to 6602 kWh/room annually to obtain a 4-star rating.

The star ratings are assigned to hotels and hospitals depending upon their EPI.

Target Energy Performance for Different Ratings											Rating
Rank	0		3		9		21		46		100	
EPI (kWh/m^2)	0	< ★ ≤	64	< ★ ≤	94	< ★ ≤	134	< ★ ≤	203	< ★ <	∞	★
EPI (kWh/room)	0		4,453		6,602		9,379		14,179		∞	

Similarly, performance bands are assigned to offices depending upon their EPI.

Target Energy Performance for Different Performance Bands											Band
Rank		25		50		75		100			
EPI (kWh/m^2)	0% ≤	14	< 25% ≤	22	< 50% ≤	33	< 75% ≤	102	< 100%		bottom 25%
EPI (kWh/emplo		183		295		445		1,366			

5.3. Energy Benchmarking Report

The energy benchmarking report can be used for analysis and improvement purposes.

See § 7.2 to understand the settings required on the computer to access the benchmarking report.
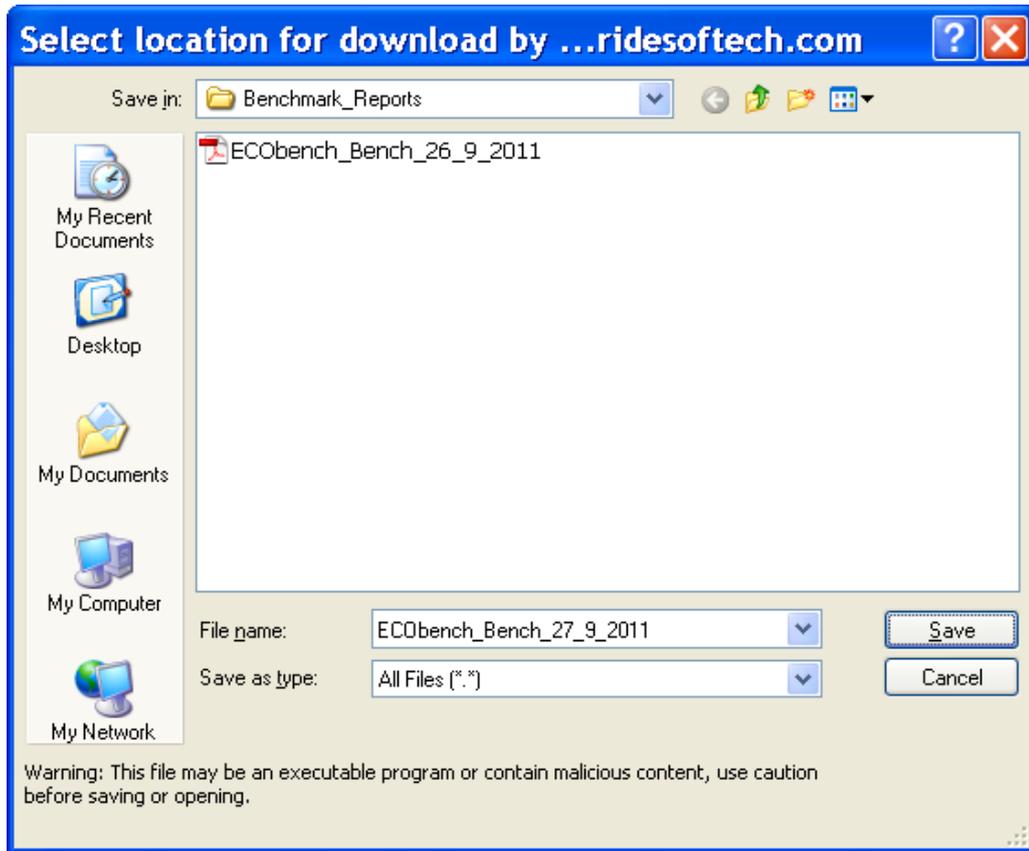
To generate an energy benchmarking report:

- Click **Generate Report** at the top right corner of the screen. A dialog box appears.

- Click **Submit**. A dialog box to select the location for the report appears.

- Select the location and click **Save**. The benchmarking report gets saved at the selected location.

5.3.1. Composition of the Report

The following is the composition of the energy benchmarking report:

Report Section	Details Captured
Input Summary	Summary of the inputs provided by the user
Comparison with national benchmark	Energy comparison with the national benchmark building available in the national database
Evaluation	EPI details of the building vis-à-vis the buildings in the national database
Targets	Various targets for the star ratings assigned to the buildings
Remarks	Remarks related to the building energy benchmarking exercise
Certification	Certification provided by the *Authority Having Jurisdiction*
Disclaimer	Disclaimer related to the building energy benchmarking result

6. Glossary of Acronyms

Term	Description
AC	Air Conditioner
BEE	Bureau of Energy Efficiency
DG/GG	Diesel Generator/Gas Generator
ECO-III	Energy Conservation and Commercialization – Phase III
EPI	Energy Performance Intensity
IRG	International Resources Group
kVA	kilovolt-ampere
kW	kilowatt
kWh	kilowatt-hour
m	Meter
m^2	Square meter
PDF	Portable Document Format
Rs.	Indian Rupees
TR	Tons of Refrigeration
USAID	United States Agency for International Development

7.   Appendix A: Computer Settings

ECObench Tool is a web based rich Internet application (RIA) that has characteristics of a desktop application. It runs on a standard web browser and communicates with a web service. No special software needs to be installed on the computer. Additionally, the following are updated automatically:

- Tool features
- Default inputs in the tool

Unlike traditional applications, the tool runs much faster without using much connectivity bandwidth as a result of minimal data exchange with the servers.

The following are the system settings and recommendations to use the tool:

- Adobe® Flash® Player should be installed on the computer.

  Adobe® Flash® Player can be downloaded free of cost from http://get.adobe.com/flashplayer (consult the System Administrator for assistance, if required).
- No other plug-in or software is required to use the tool.
- The tool is best viewed in 1024x768 or higher screen resolution.

7.1.   Web Browser

- ECObench Tool works with all the popular web browsers. It is recommended to use the latest versions of the web browsers for an optimal experience.
- It takes some time for the tool to load in the web browser for the first time. The loading time reduces subsequently.
- JavaScript must be enabled in the web browser.
- The web browser must be set to accept cookies.
- If the web browser has a provision, add http://ecobench.eetools.in as a trusted site.

7.2. Energy Benchmarking Reports

All energy benchmarking reports are generated as Portable Document Format (PDF) files. Therefore, Adobe® Reader® (version 6.0 or higher) must be installed on the computer to view these reports.

Adobe® Reader® can be downloaded free of cost from http://get.adobe.com/reader (consult the System Administrator for assistance, if required).

USAID ECO-III Project

AADI Building, (Lower Ground Floor)
2 Balbir Saxena Marg, Hauz Khas, New Delhi - 110 016
Tel: +91-11-4597 4597; Fax: +91-11-2685 3114
Email: eco3@irgssa.com; Website: www.eco3.org