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Envisioning the National Building Star Rating Program

Final Report

Saket Sarraf, Shilpi Anand Saboo, Shravani Gupta
ps Collective

September 2011

Submitted to
Aalok Deshmukh
Chief of Party (Team Leader), USAID ECO-III Project
International Resources Group

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Envisioning the Building Performance Initiative

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Contents

List of Acronyms

BEE	Bureau of Energy Efficiency
BEER	Building Energy Efficiency Recommendations
BPI	Building Performance Institute
BPO	Business Process Outsourcing
EC	Energy Conservation
ECBC	Energy Conservation Building Codes
EPI	Energy Performance Intensity
GHGs	greenhouse gases
GRIHA	Green Rating for Integrated Habitat Assessment
IT	Information Technology
LEED	Leadership in Energy and Environmental Design
NBSRC	National Building Star Rating Cell
NBSRP	National Building Star Rating Program
PVs	photovoltaics

Executive Summary

This document highlights the current status of the National Building Star Rating Program (NBSRP) and suggests activities and actions needed for its development and implementation. The contents are derived from numerous discussions among key contributors to the benchmarking program, and comparisons with other similar programs around the world, such as Energy Smart, Energy Star, Energy Concept Advisor, NABERS, and Labs 21.

This document is in no way meant to replicate the existing documentation on the benchmarking program or tools, but rather, it uses them to understand the advances made so far – as well as the road ahead. The aim is to offer some insights on the anticipated challenges and lessons for the National Building Star Rating Program.

The benchmarking program envisions the existence of a thriving, technically rigorous and user-friendly rating system to continuously achieve better building performance, with the goal of creating a national framework for energy efficiency in buildings, and to help establish meaningful targets for policy formulation. The rating system is designed to be used as a tool to measure and rate energy performance of a building in comparison to the national building stock.

Section 1 discusses the vision, salient features, and benefits of the National Building Star Rating Program. Section 2 delves into the rating methodology. It is based on building-related information, building types and sub-types, prerequisites, and parameters for performance labeling, and suggests a data collection process. The current rating program is developed for offices, hotels, and hospitals and is currently applicable for single-use buildings only. Section 3 briefly presents the existing methodology and known limitations, such as lack of applicability for multi-tenant and multi-use buildings, and its inability in its current state to respond to issues of thermal comfort and indoor air quality. Some of these limitations are dependent on data, monitoring, and maturity of the building industry.

The potential areas of improvement under the existing framework, potential methodological developments for improving the accuracy and relevance of the labeling, and integration of the tool with other evaluation systems and codes are discussed in Section 4. This Section identifies some potential areas of improvement as listed below:

- Establishment of a clear set of prerequisites or eligibility criteria for all building types and sub-types and differentiation of building type and sub-type through industry consultation
- Selection of appropriate metrics for performance labeling, such as kWh/m^2, greenhouse gases (GHGs), etc.
- Combining the distribution-based approach with proportional ranking to get the best of two approaches
- Identification of components and activities in a building for special allowances in determining benchmarks

Some of the proposed methodological developments include:

- Creation of a hybrid dataset to create a comprehensive understanding of building energy consumption
- Use of graduated approach to start off simple and build complexity over time to arrive at systems-level benchmarking, including identification of actionable items
- Creation of asset and operational ratings, where an asset rating accounts for the potential of the building for energy efficiency, while the operational rating is based on the efficiency of the buildings performance depending on the way it is used and operated

At this stage it becomes imperative to think about the administrative issues of the program, such as the implementation agency, institutional structure, role of the Bureau of Energy Efficiency (BEE), proposed organization structure, application procedure, costs, validity and renewal processes. It is suggested that The National Building Star Rating Program will be implemented under the guidance of the BEE and managed by the National Building Star Rating Cell (NBSRC), an entity created under BEE. Other issues discussed include the validity of the rating certificate, renewal procedure, cost of rating, etc.

The milestones of the program are categorized as short- (0-2 years), medium- (2-5 years), and long-term (5+ years) goals. Some short-term goals include robust institutionalization of the Star Rating program; establishment of the Building Performance Institute, which will provide technical assistance to the Star Rating Cell; wider coverage of buildings in terms of size, tier 1 and tier 2 cities, use intensity, ownership

and management structures, levels of service, etc.; and expand the list of building types and sub-types. In the medium term, the priority areas will be development of a graduated approach for benchmarking, extending the program to more building types, establishment of a secretariat, and creation of a robust database management system for benchmarking activities. In the long term, the goal is to bring all types of commercial buildings under the National Building Star Rating Program, transform the NBSRP into legislation, launch a program on system-level benchmarking, and enact a policy on the public disclosure of energy performance for commercial buildings.

The barriers in the development and implementation of the performance labeling program are discussed in Section 7. These include availability and quality of building experts and / or assessors in the field with regard to the magnitude of potential applicants across the country, cost of rating, market apathy about energy efficiency, an uninformed marketplace, inaccuracy of ratings, lack of direct incentives, and absence of an institutionalized mechanism for data collection and model development.

The document concludes with identification of the key points of discussion with the industry and among the program developers, identifying some gaps in the process.

1 The National Building Star Rating Program

1.1 Vision

To develop a thriving, practical, user-friendly, and technically rigorous commercial building rating framework that will push and challenge building owners, designers, and users to continuously strive for better building performance.

1.2 Aim

a. To provide a national framework for energy efficiency in buildings and to help establish meaningful targets for policy formulation
b. To move the building stock to progressively higher levels of performance, which can be measured and verified
c. To provide a simple metric to evaluate and communicate building energy performance among owners, occupants, lenders, appraisers, and energy products and the service community
d. To assist property owners and operators to assess their buildings' energy efficiency in comparison with other similar buildings
e. To facilitate the formulation of targets for percentage energy reductions and to drive the rating program, which also becomes a tool to measure energy reductions
f. To provide a basis for various Indian green building rating schemes for energy performance of existing buildings

1.3 Salient Features

The rating process:

a. Is based on the energy performance of the whole building and uses actual billed energy data
b. Accounts for the physical, operational, and location characteristics of the building, without penalizing for higher levels of use, service, and amenities
c. Provides a technically sound comparison mechanism among peer groups
d. Is simple to use, while analytically rigorous to account for various factors affecting energy consumption in different buildings

1.4 Benefits

a. General benefits:
    i. Serves as an excellent baseline "report card" and becomes the starting point of any energy efficiency exercise without a need for commissioning an energy audit
    ii. Evaluates performance and helps in setting targets
    iii. Increases performance expectations and "raises the bar"
    iv. Helps improve asset value of the building (BBP, 2010)
    v. Facilitates a greater understanding of how a portfolio is operating (BBP, 2010)
    vi. Enables an organization to assess its impact on the environment at both an individual building level and possibly at the portfolio level (BBP, 2010) in future
    vii. Helps to prioritize improvement opportunities across portfolios
    viii. Helps identify key areas of improvement and assess the need for investment grade audit
    ix. Helps towards reduction of CO_2 emission and attaining carbon credits
    x. Directly compares energy use between buildings irrespective of tenant operations (DOER, 2010)
    xi. Enables market valuation of energy performance in buildings (DOER, 2010)
    xii. Motivates comprehensive efficiency investments in existing buildings (DOER, 2010)
b. Benefits to Policy Makers
    i. Provides a factual basis for national goals and standards
    ii. Rewards / incentivizes exemplary building performance
    iii. Penalizes / discourages poor building performance
    iv. Provides a framework for meeting Energy Conservation Building Codes (ECBC) related stipulations in the EC Act

v. Informs existing building rating programs, such as LEED (Leadership in Energy and Environmental Design) and GRIHA (Green Rating for Integrated Habitat Assessment)
vi. Helps prioritize efforts and identify potential areas for improvement across building types and geographic and climatic regions
vii. Helps claim the reductions of the CO_2 emissions (for the entire building sector) through this program, as an initiative towards greenhouse gas emission reduction.

2 Building-Related Information

2.1 Building Types and Sub-types

The benchmarking and performance labeling methodology is specific to different building use types and sub-types depending on the kind and intensity of the activities taking place within the building. It is fundamental to establish categories of buildings in order to enable comparison between assets with similar characteristics. Therefore it is of immense importance for all stakeholders to objectively differentiate an Information Technology (IT) office building from a Business Process Outsourcing (BPO), a multi-specialty hospital from a non-specialty hospital, etc.

As of now, the proposed rating scheme has been developed for offices, hotels, and hospitals. It is applicable only for single-use buildings – i.e. buildings where 80% of the space is dedicated for primary use. Each of these primary use types has sub-types as listed in Table 1. However, clear definitions of the sub-types are not available except for hotels. This not only hampers the rating administration but also affects the data collection efforts. Further, there is no method to handle mixed-use buildings.

Building Types	Sub-types
Office	Office, BPO, and IT Buildings
Hotels	No star to 3, 4, and 5 stars
Hospitals	Multi-Specialty
Retail	Mall

Table 1: Current Building Types and Sub-types

Other similar programs have established elaborate definitions for different building types and sub-types as listed in Table 2 and Table 3. They also allow for more specialized and mixed uses within each type than is commonly observed in their geographic domain, e.g. office with retail, office with bank, hotel with retail, etc.

	Building Types	Energy Smart	Energy Star	ECA	NABERS	Labs 21
		Singapore	US	Europe	Australia	US
1	Office	√	√		√	
2	Hotel	√	√		√	
3	Hospital		√		√	
4	Retail	√	√		√	
5	Data center		√			
6	Educational Institute		√		√	
7	Residence Hall, Dormitory		√		√	
8	Courthouse		√			
9	House of Worship		√			
10	Bank		√			
11	Warehouse		√			
12	Supermarket		√			
13	Plant		√			
14	Senior Care Facility		√			
15	Retrofitting Educational			√		
16	Transport				√	
17	Laboratory					√
18	Municipal Waste Water		√			
19	Medical Office		√			

Table 2: Building Types in Different Programs

Building Types	Energy Smart	Energy Star
	Singapore	US
Office	Pure Office	
	Office / Data Center	
	Office / Retail	
	Office / Bank	
Hospital		Hospital (Acute Care & Children)
		Medical Office
		Senior Care Facility
Educational Institute		K-12 School
Hotel	Pure Hotel	
	Hotel / Retail	
	Hotel / Office	

Table 3: Building Sub-types in Different Programs

2.2 Building Prerequisites

Most of the buildings' physical, location, use, and operation characteristics lie within some "normal" range. It is for these ranges of characteristics that the benchmarking and rating models are developed. Buildings that lie outside the range of generally observable characteristics may have a different energy use and response behavior. They may be either too small or too large in size or use intensity to warrant a comparison with "other similar buildings" about which one may have very little knowledge. It is important that these ranges be translated into clearly established prerequisites so as to avoid rating buildings that lie outside this range. The program should constantly endeavor to bring in a wider range of characteristics within the program scope through sufficient data and model sophistication. Prerequisites are not only needed for compatibility with the benchmarking model but also help to align the tool with national priorities, building trends, and industry participation.

The current prerequisites listed in

Type	Variables	Permitted Values/Range
Offices	Built-up Area (m2)	70 - 578,600
	Hours per day	8-24
	Days per week	5-7
	Fraction of space conditioned	0-1
	Total number of employees	12 – 13,000
	Climatic zone	All climatic zones except Cold
Hotels	Built-up Area (m2)	150 – 72,000
	Number of Rooms	24 - 520
	Air-conditioning	At least 60% conditioned space
	Climatic zone	Any of the 5 zones
Hospitals	Built-up Area (m2)	500 to 46,500
	Number of Beds	15-1,100
	Air-conditioning	At least 60% conditioned space
	Climatic zone	Any of the 5 zones

Table 4 are driven by data availability rather than policy motivation or industry consultation. Prerequisites and eligibility criteria for some other programs are presented in

	Prerequisites	Energy Smart Singapore	Energy Star US
	Criteria	*Eligibility*	
Office	**Physical Characteristics**		
1	Building Age	≤ 25 years	
2	Gross Floor Area with AC	≥ 1000 m2	≥ 464.5 m2
3	% of air-conditioned area	> 60%	
4	% of common area	> 0%	
5	% of retail area	≤ 10%. If > 10%, correction will be applied.	
6	% of data center area	≤ 0.35%. If > 0.35%, correction will be applied	
7	% of car park area	≤ 8% above ground, ≤ 5% below ground, otherwise correction factor will be applied	
8	Primary Space (Office)	Min 50% of GFA	≤ 50%, <50%
	Energy Source		
9	Electricity	Main Source	Any Fuel Type
	Use Characteristics		
10	Occupancy Rate	< 20%	≥ 1

11	Occupancy Hours	≥ 50 Hours/week	≥ 30 Hours/week
12	Building Occupancy	Min 11 months in year	Min 11 months in year
13	Occupant Density	3 to 10m2 per person	
Hotels	**Physical Characteristics**		
1	Gross Floor Area with	≥ 2000 m2	≥ 464.5 m2
2	% of data center area	≤ 2%. If > 2%, correction will be applied	
3	Hotel Rating	3 , 4 or 5 Star	
4	Type of HVAC	Central Air-Conditioning	Central Air-Conditioning
	Energy Source		
5	Electricity	Main Source	Any Fuel Type
	Use Characteristics		
6	Occupancy Rate	> 60%	≥ 1
7	% area occupied by guest rooms	≥ 40%	
8	No. of Hotel Rooms	≤ 200	≥ 1
9	Swimming Pool	must	
10	Restaurants	must	
Hospitals	**Physical Characteristics**		
1	Gross Floor Area with Air-Conditioning		≥ 1858 m2 > 51% must be used
	Energy Source		
2	Electricity		
	Use Characteristics		
3	Occupancy Rate		< 51%
4	No. of Beds		< 51%
5	Building Occupancy		
6	Occupant Density		

Table 5.

Type	Variables	Permitted Values/Range
Offices	Built-up Area (m^2)	70 - 578,600
	Hours per day	8-24
	Days per week	5-7
	Fraction of space conditioned	0-1
	Total number of employees	12 – 13,000
	Climatic zone	All climatic zones except Cold
Hotels	Built-up Area (m^2)	150 – 72,000
	Number of Rooms	24 - 520
	Air-conditioning	At least 60% conditioned space
	Climatic zone	Any of the 5 zones
Hospitals	Built-up Area (m^2)	500 to 46,500
	Number of Beds	15-1,100
	Air-conditioning	At least 60% conditioned space
	Climatic zone	Any of the 5 zones

Table 4: Prerequisites in the Current Benchmarking Program

	Prerequisites	Energy Smart Singapore	Energy Star US
	Criteria	*Eligibility*	
Office	**Physical Characteristics**		
1	Building Age	≤ 25 years	
2	Gross Floor Area with AC	≥ 1000 m^2	≥ 464.5 m^2
3	% of air-conditioned area	> 60%	
4	% of common area	> 0%	
5	% of retail area	≤ 10%. If > 10%, correction will be applied.	
6	% of data center area	≤ 0.35%. If > 0.35%, correction will be applied	
7	% of car park area	≤ 8% above ground, ≤ 5% below ground, otherwise correction factor will be applied	
8	Primary Space (Office)	Min 50% of GFA	≤ 50%, <50%
	Energy Source		
9	Electricity	Main Source	Any Fuel Type
	Use Characteristics		
10	Occupancy Rate	< 20%	≥ 1
11	Occupancy Hours	≥ 50 Hours/week	≥ 30 Hours/week
12	Building Occupancy	Min 11 months in year	Min 11 months in year
13	Occupant Density	3 to 10m^2 per person	
Hotels	**Physical Characteristics**		
1	Gross Floor Area with	≥ 2000 m^2	≥ 464.5 m^2
2	% of data center area	≤ 2%. If > 2%, correction will be applied	
3	Hotel Rating	3 , 4 or 5 Star	
4	Type of HVAC	Central Air-Conditioning	Central Air-Conditioning
	Energy Source		
5	Electricity	Main Source	Any Fuel Type
	Use Characteristics		
6	Occupancy Rate	> 60%	≥ 1
7	% area occupied by guest rooms	≥ 40%	
8	No. of Hotel Rooms	≤ 200	≥ 1
9	Swimming Pool	must	
10	Restaurants	must	
Hospitals	**Physical Characteristics**		
1	Gross Floor Area with Air-Conditioning		≥ 1858 m^2 > 51% must be used
	Energy Source		
2	Electricity		
	Use Characteristics		
3	Occupancy Rate		< 51%
4	No. of Beds		< 51%
5	Building Occupancy		
6	Occupant Density		

Table 5: Prerequisites in Different Programs

2.3 Parameters for Performance Rating

Table 6 lists the parameters currently required for rating different building types. The annual readings are considered for the energy consumption category. Table 7 shows the kind of data used by some other rating programs for office buildings.

	Building Types		
Parameters	Offices	Hotels	Hospital
Building Information			
Sub-type	BPO / Others	Luxury / Other	Multi-Specialty
Address	√	√	√
Area (m^2)	√	√	√
Climate	√	√	√
Energy Consumption			
Energy Purchased from Utility	√	√	√
Energy Generated On-site from Diesel Generators/Gas Generators	√	√	√
Total Energy Consumed	√	√	√
Use Characteristics			
Number of Beds			√
Number of Employees	√		
Operating Hours	√		
Number of Rooms		√	

Table 6: List of Current Input Parameters for Different Building Types

Parameters	Energy Smart Singapore	Energy Star US	NABERS Australia
Building Information			
Contact			
Sub-type	√	√	√
Building Ownership	√	√	√
Name	√	√	√
Address	√	√	√
Climate	√	√	√
Profile			
No. of Storeys (Above Ground)	√		
No. of Basement Floor	√		
Gross Floor Area	√	√	√
Gross Lettable Area	√		
Data Center Area	√	√	√
Air-Conditioned Area	√	√	√
Car Park Area	√		
Gross Office Area	√	√	√
Cafeteria Area	√		
Retail Area	√		
Restaurant Area	√		
Bank Area	√		
Data Storage Area	√	√	√
Other Energy Intensive Area	√		
Energy Consumption Data			
Fuel Type	√	√	√
Energy Consumption	√	√	√
System Energy Consumption	√		
Car park Energy Consumption	√		
Data Center Energy Consumption	√		
Cost (Optional)	√		
Use Characteristics			
No. of Computers & Equipment	√	√	√
No. of Occupants	√	√	√

Table 7: Information Required for Office Buildings in Different Programs

2.4 Suggested Data Collection Process

The first step toward developing an appropriate and robust benchmarking process is collecting accurate, consistently measured and verifiable data that will enable performance and progress to be measured, monitored, and managed. It also helps to focus behavioral changes to achieve the best results in terms of performance (BBP, 2010). The current program is based on information from over 860 buildings in the country; a survey for another 200 buildings is underway. Based on the past data collection efforts, the following is a suggested data collection process for all future surveys:

a. A letter from BEE to provide support and credibility to the data collection process (sample letter included in Annexure A).
b. Preparation of data collection questionnaire: A detailed questionnaire identifying key parameters for rating each building type is needed. It should respond to national priorities and be in line with industry expectations. The questions should be such that it can be reasonably answered by the building users, using ready available data. It should be vetted by industry experts, statisticians and the benchmarking program managers. The key terms used in the questionnaire, such as built-up area, number of employees, etc., should be well defined along the lines of the definitions included in Annexure G, along with a data entry codebook to reduce data collection, recording, and entry errors. A sample questionnaire from the first round of data collection is listed in Annexure B.
c. Sampling design: The data collection should be based on a good sample design ensuring maximum coverage in terms of location, cities, urban-rural continuum, building types, and sub-types. It should try to cover the maximum variation in key parameters covering the entire range of key parameters, such as size, use intensity, etc. It is advisable to begin the exercise by establishing an acceptable range of errors and biases, and should follow all standard survey design techniques for reduction of bias, sampling error, non-response, etc.
d. Survey methodology: The actual survey can be done using hand-held devices using real time checking to ensure data quality. The surveyors should be familiarized with the art and science of data collection and the technical contents and should have a keen eye to spot discrepancies. Further, they should adequately sensitize the respondents to ensure quality responses.
e. The data collection exercise should be repeated often and at least every four years. Repeat data collection is important to control for variations in weather, which may directly affect the performance label.
f. The quality of the data should be verified by a third-party consultant. BEE would have ownership rights of the data and should ensure full privacy of the data.

3 Current Methodology and Limitations

3.1 Methodology

The proposed method compares the whole building energy consumption of the building under consideration with a benchmark building of similar characteristics. A three-step statistical methodology is described below

a. Benchmark building: The benchmark building is defined as a hypothetical building with similar use type and physical and operating characteristics, and located in same climate zone as the candidate building. The estimate is derived through the regression technique applied to a large dataset of surveyed buildings.
b. Performance index: The ratio of actual electricity consumed by the candidate building to estimated electricity use by the benchmarked building is termed as the building performance index. It indicates the relative efficiency of a building.
c. Performance labeling: The building performance index is then converted into performance scores using a distribution-based approach by using the performance differential between the candidate building and the benchmark building. This differential is compared to the performance differential of all other buildings in the database to arrive at a final rating.

Detailed description about the methodology can be found in Kumar et al (2010).

3.2 Limitations

Given that this is the first attempt of its kind in the Indian context, the current methodology has many limitations. The current data is not a completely representative sample of commercial buildings in India, nor are the predictions perfect. Following is a list of known issues in the current methodological framework and available data:

a. Impact of level of service and amenities on energy consumption is not accounted
b. Concerns of thermal comfort and indoor air quality which have high impact on energy consumption are not addressed
c. Multi-tenant and multi-use buildings cannot be rated using the existing method
d. Geographical coverage is largely limited to tier 1 and tier 2 cities. Impact of urban heat island effect, level of service, building schedule, and equipment load are very different in rural and semi-urban areas
e. Role of climate is not satisfactorily captured
f. The range of the sample dataset is not consciously designed
g. The confidence intervals of rating bands are not rigorously defined

The next section suggests various methods and development paths to address the above limitations.

4 Potential Improvements

4.1 Potential Areas for Improvement Under the Existing Framework

a. What is the most appropriate metric for rating or should one use multiple metrics? How does one choose between different ratings based on multiple metrics? Some example of alternative metrics include gross energy consumed (source energy rather than site energy), energy use intensity based on size of the facility in terms of bed, rooms, hours of operation, etc., asset-based rating, etc. The operational performance of a building can be represented in both absolute and normalized terms. They provide a complete picture of an assets performance to support active property management. Absolute performance gives the overall impact of a portfolio/organization, e.g. total CO_2 emissions per year or comparing a consistent portfolio over time. Most real estate organizations collect the necessary data to measure and report absolute environmental performance. Normalized indicators take into account the dynamic nature of the real estate market and allow comparisons of portfolios and buildings performance over time. They have the further advantage of allowing for comparisons against near-peer groups at both the building and portfolio level. This is important in setting a sector-wide benchmark and identifying industry leaders. By providing a more detailed assessment of how assets are performing, they allow organizations to set more appropriate targets (BBP, 2010).
b. How should the rating be calculated? The rating is based on the difference between the energy consumption of the candidate building and the benchmarked building. This difference can be translated into performance ratings in two ways – namely, the distribution-based approach as used in the current methodology along the lines of Energy Star, USA and a linear or proportional ranking along the lines of the European Performance of Building Directive. The former is statistically rigorous and provides a good peer-based comparison, while the later provides more technical insight into the buildings functioning and is thus more useful. A method that can do both will, however, be most useful.
c. How does one account for influences of variables that are not found to be statistically significant but are of importance in determining the energy consumption of a benchmarked building? These include climate, occupant density, occupancy rates, etc. Some of these suffer from issues of multi-collinearity (i.e. their impact is captured through other variables), unreliable data, and information manipulation by building owners, etc.
d. How does one appropriately model the impact of hours of operation (number of hours and its distribution) on office building energy consumption? The energy consumption in office buildings is proportionate to the number of operating hours. However, it is also influenced by how these hours are distributed over the course of the day and over the week. The energy consumed by a building operating for three hours on a weekend is different from the energy consumed by the same building if it operates for additional three hours on a weekday, even though the total number of hours remains same.
e. What components and activities in a building may warrant special allowances in determining benchmarks? These typically include activities and spaces which are not generally found in a regular building establishment but may significantly affect energy consumption. Examples would include heated indoor pools, server rooms, catering facilities, car parks, etc. Creating special allowance provisions will also help to avoid too many categories within a given building type.
f. What does one mean by an office and how is it different from a BPO or an IT building? How does a multi-specialty hospital differ from a general hospital? What building types should be considered for rating and in which order? One needs to establish clear definitions of every building type and sub-type through industry consultation. Some of the potential building types for rating and their sub-type are listed in Table 8. Detailed building type definitions used by various benchmarking programs are provided in Annexure G for reference.

Building Types	**Sub-types**

Office	BPO, IT Parks
Hotel	No Star, 1-3 Stars, 4 Stars, 5 Stars,
Hospital	Primary Health Centre, District Hospitals, Multi-specialty Hospitals, Super-specialty Hospitals, Medical Office, Laboratories, R&D
Retail	Bank, Supermarket, Anchor Stores, Malls, Stand-alone Stores
Data center	Standalone, Part of an Office
Educational Institute	K-12 Schools, Colleges, Universities
Residence	Single and Multi-family Units

Table 8: Proposed Building Types and Sub-types

g. What kind of buildings will be considered eligible for rating? Establish a clear set of prerequisites or eligibility criteria for all building types and sub-types based on national priority, industry consultation, data availability, and model performance. In the future, these prerequisites may also incorporate thermal comfort criteria, indoor air quality, etc., which significantly affect energy consumption but are currently difficult to measure/verify at a national level. Such rigorous eligibility criteria may be enforced as the program matures. This is a difficult task and will require more work.

h. How to account for seasonal variation in weather from year to year? The ratings can be sensitive to the local climate and variations in weather. The benchmarking methodology should take this into account in some way when making benchmark comparisons. Methods for correcting heating energy consumption have been widely used in some countries for many years. (Bordass, 2005)

i. How to incorporate the emission-based rating at source in addition to energy consumption at site? The site and sources energy together give a more comprehensive energy picture.

4.2 Improving the Accuracy and Relevance of Performance Labeling

The accuracy and relevance of benchmarking and labeling can be achieved by merging statistical, technical and simulation-based approaches augmented by data from multiple sources and expert opinion.

a. **Creation of a hybrid dataset** based on survey data for the utilities, municipal corporations and other local bodies, business associations, satellite images, etc. to create a comprehensive understanding of the building sector.
b. **Graduated approach**: Graduated approach advocates that the benchmarking process should start off simple and build complexity over time. Essentially, as data collection becomes more accurate, reliable and routine, the process can be refined to collect further data which give a greater understanding of how a building functions. This data may be at greater level of granularity or of additional building characteristics.
c. **Creation of asset and operational ratings**: A building can be certified based on its "asset rating" and "operational rating." Asset rating accounts for the potential of the building for energy efficiency with standard patterns of use for its type, while the operational rating is based on the efficiency of the buildings performance in use and takes into account its actual occupation, management, and fuel consumption. The asset rating can be calculated first as a "design rating" and then confirmed upon the completion of the building in relation to what actually exists and how good its installation, commissioning, and control potential appears to be. Following experience in use, the asset rating could also be updated based on the evidence of the operational rating (Bordass, Cohen and Field, 2004). The asset rating may be complemented by Building Energy Efficiency Recommendations (BEER). The BEER documents the current energy performance of the building and provides a comprehensive and prioritized list of recommendations for energy efficiency measures to be implemented in order to improve energy performance and subsequently achieve a higher grade. (DOER, 2010)
d. **Augment the statistical labels with a technical scale**. A statistical rating scale rates a building in comparison to its peers, whereas a technical rating scale compares a building's energy performance to technical potential reference points, such as net zero energy performance (DOER, 2010). This provides ways to identify areas of potential intervention and thus, increase the relevance of rating. A parametric approach creates a useful benchmarking system without reliance on a vast database representative of the national stock. It allows not only in evaluating the building efficiency, but also helps in identifying the components that are likely to need attention. For building sectors or sub-types where reliable statistics are not available, appropriate parametric descriptions and benchmarks can still be created *ab initio*, using professional judgment, for what constitutes an iconic building type, and what parameter values should apply for both typical and good practice performance. The principal parameters in this method can be summarized using the energy tree diagram, which goes down to the roots of consumption – separating out the asset (standards and efficiencies) and operational (use, control, and management) elements of energy use. Benchmark values can then be reported not just for the building as a whole, but also for each energy end-use (e.g., lighting, air-conditioning) and their components (Cohen, 2006).
e. **Integration with other tools, codes, rating schemes**: What one does with the benchmarks is equally important as the benchmarking and labeling process itself. One of the key ends of this process is the integration of benchmarks and labels with the Energy Conservation Building Code (ECBC), and other intent based rating tools (like LEED, GRIHA), Simulation based tools, Measurement and Verification processes of different energy conservation measures, etc. The use of benchmarking data can greatly help reduce the credibility gap between design intent and the actual performance during operation stage (Bordass, Cohen and Field, 2004).

5 Administrative Issues

The National Building Star Rating Program will be implemented under the guidance of BEE and managed by the National Building Star Rating Cell. The cell will have its secretariat at the Building Performance Institute (BPI). The BPI is envisaged as the place for the highest level of research and knowledge dissemination on building performance-related issues in the nation. The key stakeholders will be government, academia, research and advocacy organizations, and the industry (Annexure F). Further details about the BPI, are discussed in a separate document titled "Envisioning the Building Performance Initiative." The secretariat will provide technical support to the cell in terms of data collection, model development, stakeholder engagement, and query resolution. The cell will be responsible for administrative functions of the benchmarking program, including application review and verification.

5.1 Role of BEE

As the custodian of the NBSRP, BEE will:

a. Chair the steering committee of the National Building Star Rating Cell
b. Guide the development of the program in line with national priorities
c. Give credibility and provide funding to the secretariat at the Building Performance Initiative
d. Certify buildings based on recommendations from the secretariat
e. Interact with the industry
f. Training of assessors for on-site verification of applications
g. Provide incentive to users during initial period to promote the program. However, it is envisaged that over time, users will understand the benefits and the incentives may be gradually removed. Examples of possible incentives are:
    i. Rating fee waiver and / or free energy audits if the building obtains a higher star rating compared to previous year
    ii. Rating fee waiver for buildings that qualify for five-star rating

5.2 Proposed Organizational Structure

Proposed Structure of Star Rating Office at BEE and its relation with BPI

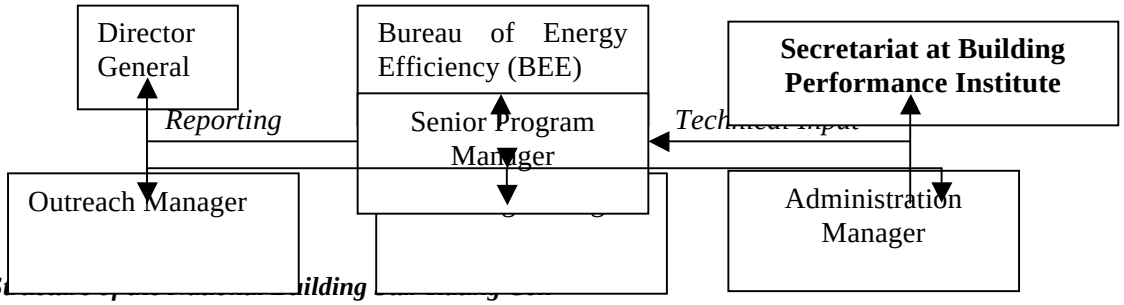


Figure 1*: S ilding*

5.3 Application, Verification, and Certification Process

This section suggests a tentative administrative approach for processing of application, verification and certification to rate building performance.

The applicant will have to log on to http://ecobench.eetools.in, check for eligibility criteria, fill in the data, compute a tentative performance rating and generate a report from the web tool. The application is to be submitted to the NBRSC in the prescribed format along with the report from the web tool, application fee, and copies of documents such as utility bills, approved building plans, and affidavits supporting all the input parameters. If there are any queries or discrepancies, the cell will communicate with the applicant for clarification and further inputs (Figure 2).

The Cell will scrutinize all submitted documents and assess performance rating using the same web tool and the data based on the documents submitted by the applicant. Buildings claiming 1-3 star rating will "self-certify" using an affidavit and by sending a copy of all supporting documents to the Cell. Buildings claiming 4 and 5 star status will undergo an on-site verification of eligibility requirements and all input parameters through an appointed assessor. Once verified, the Cell will communicate the final rating to the applicant. The applicant can petition the rating at this stage. If there are no disputes, the Cell will recommend the building to BEE for certification. BEE will provide a certificate and a plaque on recommendation from the secretariat.

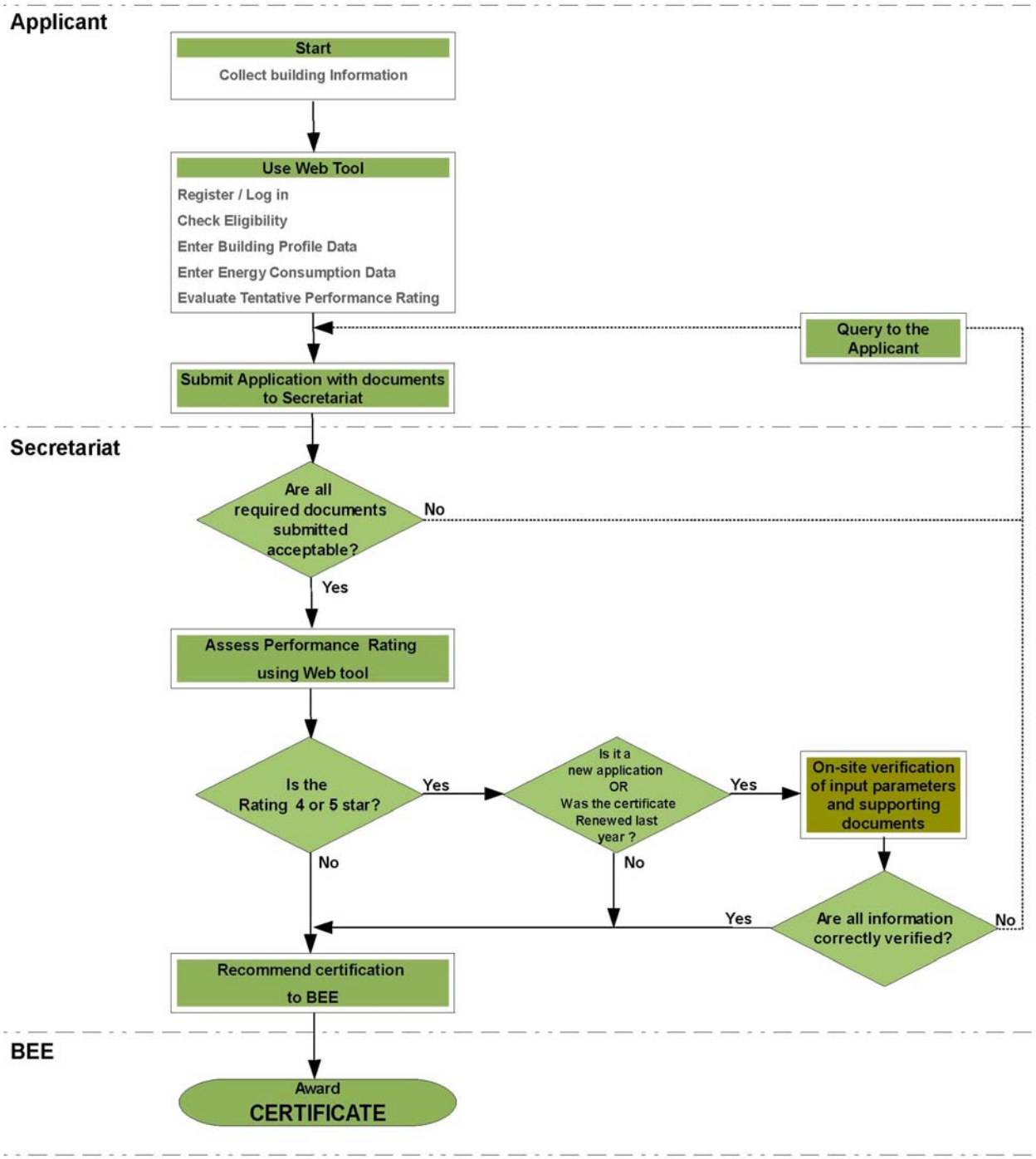


Figure 2: ***Application Process Flowchart for the National Building Star Rating Program***

5.4 Certificate

The contents and the directives towards display of energy certificates are both critical for market transformation. The certificates should be displayed in a prominent area clearly visible to the public. Suggested contents for the certificate plaque are mentioned below. For examples refer to Annexure D and E

a. Building name and address
b. Building type and sub-type
c. Gross floor area for which the certificate is valid (whole of part of the building)
d. Total annual energy consumption (From grid, Generated from DG/GG, Renewable)
e. The percentage of the actual CO_2 emissions resulting from energy supplied to the building compared with the benchmark emissions typical for the building type being assessed (per m^2 per year) (Cohen, 2008)
f. The total carbon footprint of the building in tonnes of CO_2 per year, for the last three years showing separately the contributions from electricity, fuel, and heat. The CO_2 saved by the use of renewable energy sources, either on-site or through delivered energy (Cohen, 2008)
g. Energy performance index based on alternative metrics
h. Asset and operational ratings
i. Operational ratings for the past three years (Cohen, 2008)
j. Version of the rating / tool
k. Date of certification and its validity
l. Note or Disclaimer

Mentioning the Energy Performance Intensity (EPI) can be confusing as buildings with the same EPI can get different ratings. Additional information that may be part of the certificate includes:

a. Key building parameters that were used to obtain the rating
b. Indicator of environmental air quality
c. Key findings and list of measures that can be used by the building owner / manager to improve upon the rating

5.5 Cost of Rating

The cost of the rating will vary for fresh and renewal applications, different building types and sub-types, building size / use (the idea is to cross-subsidize small buildings with large buildings to encourage rating penetration for smaller buildings). The fee will be based on the rating applied for and may be waived if the building qualifies for a five-star rating or a higher rating than the previous year.

5.6 Validity and Renewal

The rating will be valid for a period of one year from the date of issue. It can be renewed remotely for another year by sending the set of prescribed documents. The idea of remote renewal is to reduce the administrative burden on the NBSRC. A second renewal is not permissible as substantial changes may occur in buildings' physical and operational characteristics over a period of two years. The process of fresh application will have to be followed for the subsequent year. Asset ratings may have longer validity of around five years. Rating may have to be renewed earlier if there has been a real estate transaction or major alterations are made to the property. Operational ratings may have to be renewed more often as the equipment, operation, and management change rapidly (Bordass, 2005).

5.7 Process for Tool Upgrade

The rating model should be revised every four years using the most current data available to ensure that the performance rating curve moves with market transformation. The application will be reviewed against the most current version of the model.

5.8 Sustainability of Program

The program will generate its own funding through application fees and also from support of government departments and various bilateral and multilateral agencies and partners.

6 Goals

6.1 Short-Term Goals (0-2 years)

a. Institutionalization of the Star labeling program including visioning, policy formulation, verification (tentative), certification, funding, outreach.
b. Institutionalization of Building Performance Institute that will be responsible for technical development of the benchmarking program.
c. Strengthening the development around the current building types that have already been benchmarked through industry interaction and buy-in. This will include questionnaire redesign through industry consultation, survey of additional buildings ensuring wider coverage in terms of size, tier 1 and tier 2 cities, use intensity, ownership and management structures, levels of service, etc.; identification of key parameters beyond the current set of basic parameters.
d. Rate and certify at least 100 buildings of each building type based on the new methodology.
e. Expand the list of building types and sub-types.
f. Develop strategies to handle multiple tenants, multiple use buildings.
g. Other issues are discussed in 4.1 Potential Areas for Improvement Under the Existing Framework.

6.2 Medium-Term Goals (2-5 years)

a. Development of an appropriate framework (statistical + parametric approach)
b. Extend the program to more building types
c. Create a framework document for mandatory energy performance certificates for real estate transactions
d. Initiate system-level benchmarking
e. Establishment of the secretariat
f. All the institutional (government) buildings to be assessed using the rating system.
g. Creating a robust database management system for quality, reliability, versatility, security and modeling. It should lend itself to be used for additional tasks such as compiling national level statistics on floor space, changes in GHG emissions, etc. Annexure J provides a comparison of database systems used in various countries.

6.3 Long-Term Goals (5+ years)

a. Almost all types of commercial building to be brought under the National Building Star Rating Program
b. The National Building Star Rating Program must be transposed into a legislation mandating labeling for all commercial buildings (say, above 100kW of connected load)
c. All existing government offices to be upgraded to have at least a three-star rating
d. All new government offices to be designed for at least a four-star rating
e. Launch program on system-level benchmarking

7 Barriers

a. **Capacity building**: The success of the implementation of the building star labeling program will depend on availability and quality of building experts and / or assessors in the field. Considering the magnitude of potential applicants across the country, systematic capacity building should be made an integral part of the implementation strategy.

b. **Cost of Rating**: Currently, the cost of rating is seen as a deterrent by small property owners. The fee charges for certificate renewal may be made nominal to encourage more market participation. The cost of the rating should be based on targeted market penetration, cost to the rating agency, and willingness of the owners to pay. In the initial stage of the project, charges can be considerably less to promote early adoption.

c. **Market apathy about energy efficiency**: Most building owners have never measured the energy efficiency of their buildings and display a general disinterest in improving building performance. The desire to improve energy performance and save on energy bills is overridden by assumed negative impact on comfort, ignorance to potential financial and comfort benefits, and over-estimation of the invasiveness of the process (Kevin Mo et al, 2010).

d. **Uninformed marketplace**: The marketplace is unable to obtain comparative building energy information and value energy efficiency, due to the lack of significant differentiation between energy-efficient structures and energy-inefficient structures, inhibiting demand for energy-efficient homes and buildings (Kevin Mo et al, 2010). The system-level approach may help in differentiating energy-efficient structures from energy-inefficient structures. Combining an asset rating with an operational rating can provide detailed information that can enable building operators, owners and tenants to identify, prioritize, and justify energy investments and strategies (DOER, 2010).

e. **Inaccuracy of ratings**: The rating should be robust to reduce the inaccuracies to the extent possible using better data, methodology, and verification process. The protocols should be well defined to preempt the gaming of the system.

f. **Lack of incentives**: Currently, there is no incentive to encourage building owners to participate in the program. The star labeling should create a brand image for the asset which provides a market value for selling/purchase of property. Incentives are to be considered for the small-scale projects. More policies on the national and state levels must be tied with the building rating.

g. **Data**: The way in which data is collected will greatly affect the robustness of the benchmarking results. The questionnaire and sampling design should be verified by independent statisticians to ensure consistency, lack of biases, and adequate coverage. Further, the decision on the kind of data to be collected should be done in consultation with all the stakeholders (especially those representing the building owners/operators) to ensure their acceptance and willing participation in the data collection exercise.

8 Key Discussion Points

a. **Incentive**: Should the benchmarking program be incentivized by the Government? If yes, what are some of the potential incentives? What are the incentives for the owner to renew every year?
b. **Metric**: What should be the metric for rating? Should it be based on total energy consumed per unit of floor area, activity intensity like per bed or per room, tonnes of CO_2 etc.? Should it be measured at site or source?
c. **Rating scheme**: Should all buildings be eligible for at least a one-star rating? If yes, it will encourage participation and also help in differentiating poor performing buildings that have applied for rating from those that have not applied.
d. **Model revision**: What would be the ideal time for the revision of the model: two years or four years? Four years is the expected time to collect data and update the model, publish reports on the state of the building stock etc. The rating model may be revised every four years using the most current data available to ensure that the performance labeling curve moves with market transformation. The application will be reviewed against the current version of the model.
e. **Boundary of the rating**: Should the ratings be done for buildings, sites or premises? Buildings are not always single, free-standing items. Sometimes there are sites with several buildings, often they are divided up, sometimes they overlap and inter-penetrate. For the purpose of energy certification and benchmarking, "building" will often mean "premise." Where a premise is a site, it may often be desirable to break it down into individual buildings (Bordass, 2005).
f. **Public disclosure**: To what extent should ratings and labels be applied and made publicly available? Voluntary certification is often considered a type of "positive branding" for builders that are keen to "advertise" the high level of energy performance their buildings achieve. But as builders achieving lower performance buildings will not "opt in," voluntary schemes tend to identify only the most efficient buildings. In contrast, mandatory schemes applied to a maximum number of buildings help to identify the most inefficient buildings – and often provide advice on how to improve energy ratings (IEA, 2010)
g. **Renewable energy**: Renewable energy can cause difficulties with reporting conventions. Reasoning may need to be developed which systematically takes into account whether it is considered as reducing demand (as is the case with daylighting, passive solar design, and natural ventilation and cooling) or providing renewable supply (as is the case with solar heating panels, photovoltaics (PVs), wind generators and water power). It could (and may well) be argued that it doesn't matter – the important thing is the amount of energy the site imports and the associated CO_2 emissions. However, faced with the choice between an energy-efficient building and an inefficient one, counterbalanced to same CO_2 emissions level by on-site renewable energy, the more efficient building would tend to be the more robust and most cost-effective choice in most circumstances (Bordass, 2005)
h. Modeling methodology
    i. Model correction: In comparing a buildings energy use with a benchmark to reach a grade, one can either adjust the buildings energy performance or adjust the benchmark for factors outside the control of designer, owner, and operator, such as weather corrections (Bordass, 2005). What will be the deciding factor to inform this choice?
    ii. Choice of benchmark: Should building be evaluated against a fixed benchmark scale, or one which evolves with time as standards and/or the stock improves (Bordass, 2005)? What will be the methodology to raise the benchmarks and how often?
    iii. What are the key variables that can be used to game the system and what is the way around them?
    iv. Should the benchmarking be sensitive to the age of the building?
i. **Building-related information**
    i. Definition of building types and sub-types
    ii. Identification of key factors affecting energy consumption
    iii. Identification of allowances for special uses such as swimming pool or data centers
    iv. Identification of program filters or the range of buildings of a given type which will be covered by the same rating
j. **Other factors:** Should issues such as visual comfort, productivity gains, etc., associated with healthy buildings be acknowledged during the rating process?

9 References

Better Buildings Partnership, 2010, Sustainability Benchmarking toolkit for commercial buildings – Principles for best practice

Bordass, W., 2005. Onto the Radar: How energy performance certification and benchmarking might work for nondomestic buildings in operation, using actual energy consumption. The Usable Buildings Trust.

Bordass, W., Cohen, R., and Field, J., 2004. Energy Performance of Non-domestic Buildings: Closing the Credibility Gap. In proceedings of IEECB'04 Building Performance Congress, Frankfurt, Germany.

Cohen, R., Bordass, W., and Field, J., 2006. EPLabel: A graduated response procedure for producing a building energy certificate based on an operational rating

Cohen, R., Bordass, W., and Field, J., 2006. Implementation of EPBD Article 7.3 in Germany and the UK: Comparison of Methodologies and Procedures

DOER, 2010, An MPG Rating for Commercial Buildings: Establishing a Building Energy Asset Labeling Program in Massachusetts, Massachusetts Department of Energy Resources

Energy Trust of Oregon, 2009, Energy Performance Score, 2008 Pilot (EPS)

International Energy Agency, 2010, Energy Performance Certification of Buildings – A policy tool to improve energy efficiency

Kevin Mo, Lane Burt, Bin Hao, Jie Cheng, Andrew Burr and Sonal Kemkar, 2010. Comparative Analysis of U.S and China Building Energy Rating and Labeling Systems

Kumar S., Sarraf, S., Kamath, M., Deshmukh, A., Seth, S., Pandita, S., Walia, A., 2010. Performance Based Rating and Energy Performance Benchmarking for Commercial Buildings in India, BAUSIM Vienna, Austria

7. Annexure

List of annexure documents

A. Letter of introduction from BEE for data collection
B. Data collection questionnaire
C. Web tool screenshots
D. Example of certification and plaque details
E. Benchmarking and performance based labeling report card
F. List of potential partners for building performance initiative
G. Useful definitions from various benchmarking programs
H. Comparison of international benchmarking tools
I. Comparison of international energy research institutes
J. Database management comparison chart for various countries

A. Letter of introduction from BEE for data collection

ENERGY IS LIFE
B E E
CONSERVE IT

ऊर्जा दक्षता ब्यूरो
(भारत सरकार, विद्युत मंत्रालय)
BUREAU OF ENERGY EFFICIENCY
(Government of India, Ministry of Power)

New Delhi, the July 5th, 2011

Subject : Request to participate in nationwide building energy data collection effort.

The Bureau of Energy Efficiency (BEE) has initiated several regulatory and promotional measures for improvement of energy efficiency in the various sectors of the Indian economy. Among them, buildings, which account for about 30% of the total electricity supplied by the utilities, is one of the key thrust areas of BEE.

Under the **BEE-USAID Energy Conservation & Commercialization (ECO) programme,** the International Resources Group (IRG) with the support of its partners – M/s. Eliminate Carbon Emissions (ECE); institutional partners – Indian Institute of Management, Ahmedabad (IIM-A) and CEPT University; and industry partners – Schneider Electric (India) have taken up an initiative for expanding and eventually institutionalizing data collection efforts related to energy use in various commercial buildings.

This data collection effort will form the basis of strengthening the Star Labeling Scheme for buildings, using a robust and internationally recognized peer-group comparison method, which is critical to the development of this database.

This information can help the users and other stakeholders including builders, architects and code enforcing agencies to evaluate a building's energy efficiency and track improvements compared to other buildings. This is also critical for setting benchmarks that can be used for ECBC compliance, labeling of existing buildings, and recognizing the top performers through a systematic evaluation scheme.

As a prominent player in the commercial building sector we solicit your cooperation for partnership with us in helping us to evolve a framework for benchmarking the energy usage in commercial buildings in India. In keeping with this, you are requested to provide all the necessary and timely assistance to the data collection team, as this will help in analyzing the energy usage of commercial building at a national level after normalization for proper comparative analysis. The information collected under this initiative would not be divulged for any individual building but will focus on energy performance and benchmarking of the building stock. The Bureau of Energy Efficiency looks forward to your cooperation in the success of this important national initiative.

(Ajay Mathur)
Director General

स्वहित एवं राष्ट्रहित में ऊर्जा बचाएँ Save Energy for Benefit of Self and Nation
चौथा तल, सेवा भवन, आर० के० पुरम, नई दिल्ली - 110 066 वेबसाईट / Web-Site : www.bee-india.nic.in
4th Floor, Sewa Bhawan, R.K. Puram, New Delhi - 110 066 टेली/Tel : 26179699 (5 Lines) फैक्स/Fax : 91 (11) 26178352

B. Data collection questionnaire

Table 1: Building Information and Energy Data (to be kept Confidential)

Building Name:_____

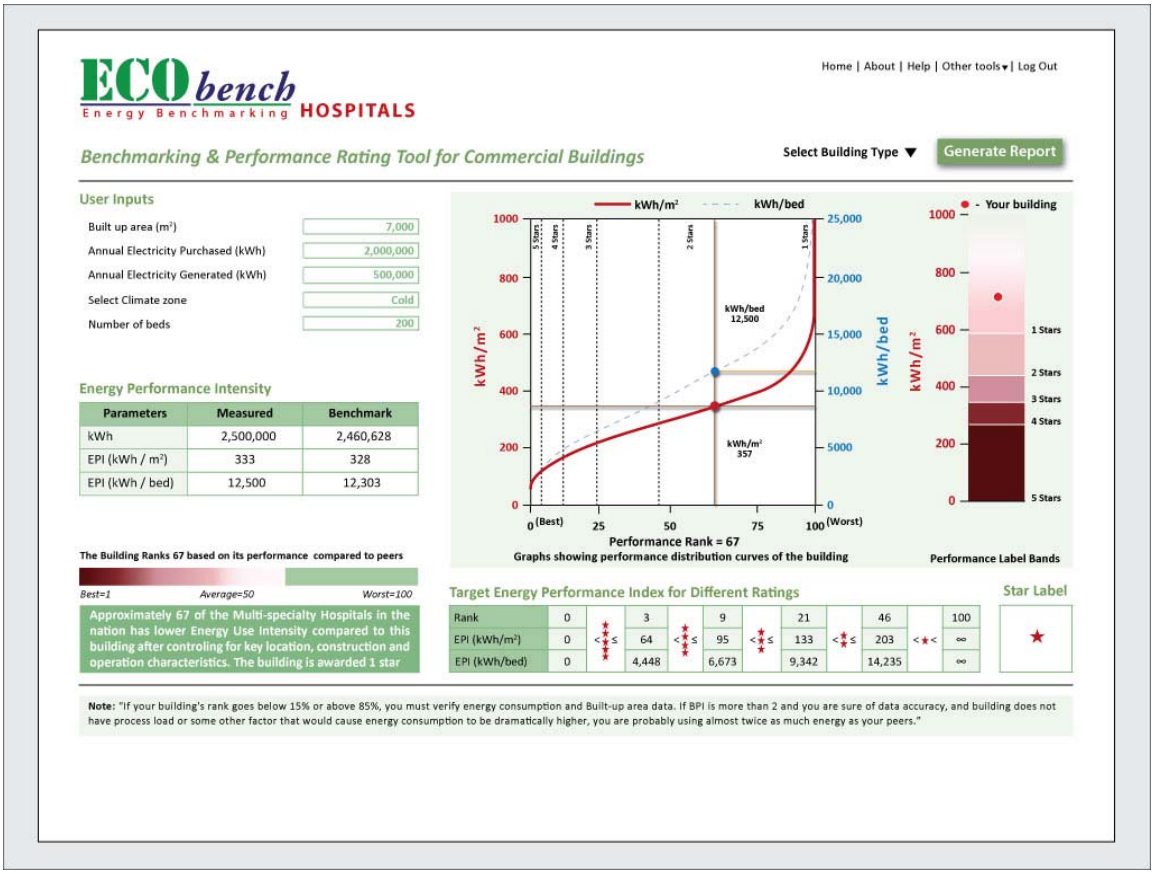
Primary Data			Year:2008- 09/2009-10
No.	**Item**		**Value**
1	Year of Building Construction		
2	Whether your building has received any Green Building Certification? Yes/No		
3	If you have received green building rating , specify the rating program		
1	Connected Load (kW) or Contract Demand (kVA)		
2	Peak Demand or Maximum Demand Indicated (MDI) (kW)		
3	Installed capacity: DG/ GG Sets (kVA or kW)		
4	a) Annual Electricity Consumption, purchased from Utilities (kWh)		
	b) Annual Electricity Consumption, through Diesel Generating (DG)/Gas Generating (GG) Set(s) (kWh)		
	c) Total Annual Electricity Consumption, Utilities + DG/GG Sets (kWh)		
5	a) Annual Electricity Cost, purchased from Utilities (Rs.)		
	b) Annual Electricity Cost generated through DG/GG Sets (Rs.)		
	c) Total Annual Electricity Cost, Utilities + DG/GG Sets (Rs.)		
6	Area of the building (exclude parking, lawn, roads, etc.)	a) Built Up area (sq. ft. or sq.m.)	
		b) Carpet Area (sq. ft. or sq.m.)	
		○ Conditioned area	
		○ Non Conditioned area	
7	No. of Floors in the Building		
8	Working hours (e.g. day working /24 hour working)		
9	Working days/week (e.g. 5/6/7 days per week)		
10	a) Office	Total no. of employees	
		Average .no. of persons at any time in office	
	b) Hotel	Type of Hotel (5 star ,4 star etc)	
		No. of guest rooms	
		Guest overnights in the year (% Occupancy)	
	C) Hospital	Type of Hospital (Govt, Multi-specialty etc)	
		Number of beds	
		Patient overnights in the year (% Occupancy)	
11	Installed capacity of Air Conditioning System	a) Centralized AC Plant (TR)	
		b) Packaged ACs (TR)	
		c) Window / Split ACs (TR)	
		d) Total AC Load (TR)	
12	Installed lighting load (kW)		
13	Equipment Load (kW)*		
14	Water consumption in the building	Water consumption in the year (exclude consumption for garden, lawn, etc.) (kilo liters)	
		Estimated hot water consumption in the year (kilo liters)	
15	Whether sub-metering of electricity consumption for Air Conditioning, Lighting, Plug Loads, etc. done: Yes/No		
16	HSD (or any other fuel oil used, specify)/Gas Consumption in DG/GG Sets (liters/cu. meters) in the year		
17	Fuel (e.g FO, LDO,LPG, NG) used for generating steam/water heating in the year (in appropriate units)		

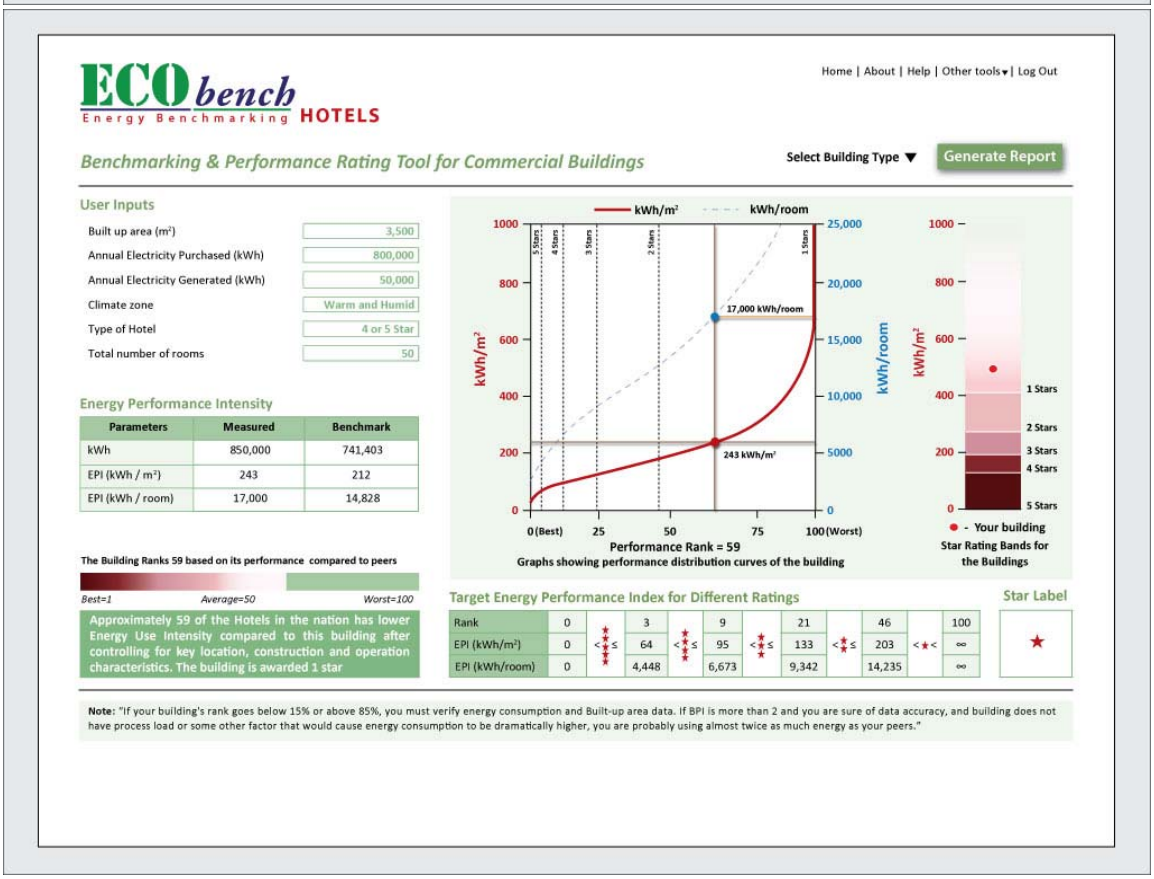
*In many cases, this can be gathered from the UPS system.

Table 2: Contact Details of the Organization and the Contact Person

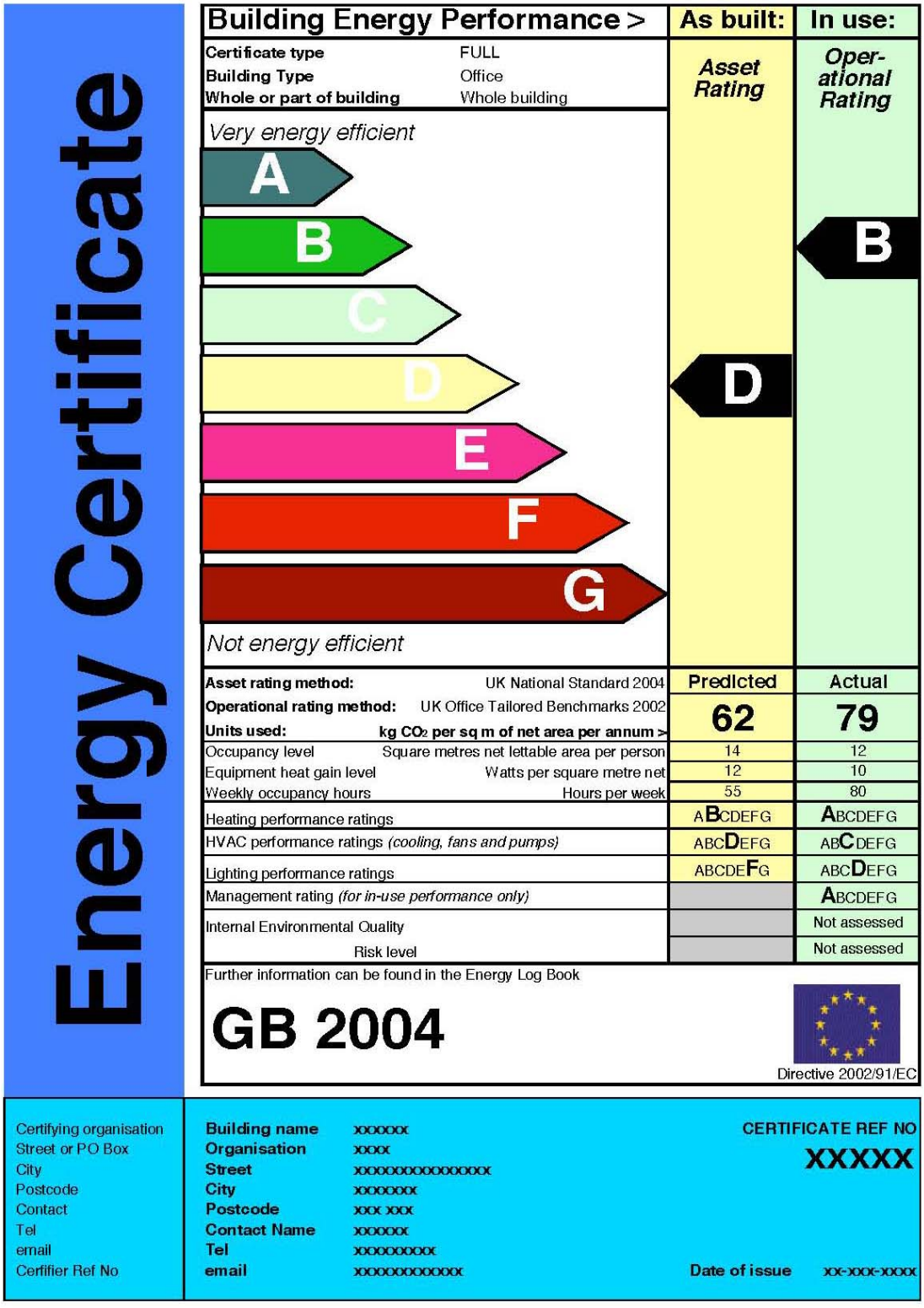
No.		Details
1	**Organization**	
a)	Name of the Organization	
b)	Postal Address	
c)	Phone No.	
d)	Name of the building	
2	**Contact Person**	
a)	Name & Designation	
b)	E-mail Address	
c)	Phone Nos.	

C. Web tool screenshots





D. Example of certification and plaque details



Energy Certificate

Building Energy Performance >	As built:	In use:
Certificate type: FULL Building Type: Office Whole or part of building: Whole building	*Asset Rating*	*Oper-ational Rating*
Very energy efficient A B C D E F G *Not energy efficient*	D	B
Asset rating method: UK National Standard 2004	Predicted	Actual
Operational rating method: UK Office Tailored Benchmarks 2002	62	79
Units used: kg CO_2 per sq m of net area per annum >		
Occupancy level — Square metres net lettable area per person	14	12
Equipment heat gain level — Watts per square metre net	12	10
Weekly occupancy hours — Hours per week	55	80
Heating performance ratings	ABCDEFG	ABCDEFG
HVAC performance ratings *(cooling, fans and pumps)*	ABCDEFG	ABCDEFG
Lighting performance ratings	ABCDEFG	ABCDEFG
Management rating *(for in-use performance only)*		ABCDEFG
Internal Environmental Quality		Not assessed
Risk level		Not assessed

Further information can be found in the Energy Log Book

GB 2004

Directive 2002/91/EC

Certifying organisation	**Building name**	xxxxxx	CERTIFICATE REF NO
Street or PO Box	**Organisation**	xxxx	XXXXX
City	**Street**	xxxxxxxxxxxxxxx	
Postcode	**City**	xxxxxxx	
Contact	**Postcode**	xxx xxx	
Tel	**Contact Name**	xxxxxx	
email	**Tel**	xxxxxxxxx	
Cerfifier Ref No	**email**	xxxxxxxxxxxx	**Date of issue** xx-xxx-xxxx

E. Benchmarking and performance based labeling report card

Building ID	N/A	Building Type	Hotel
Address	14 B, Amravan Society Satellite, Ahmedabad, Gujarat	Date of Reporting	19th April'2011
		Data Period	April 2010 to March 2011
PIN Code	380015	Report Valid up to	19th April'2012

1. Input Summary

Building Detail

Type	Hotel
Sub Type	4 star or above
Built up Area (m^2)	3500
Climate	Warm & Humid
No. of Rooms	50

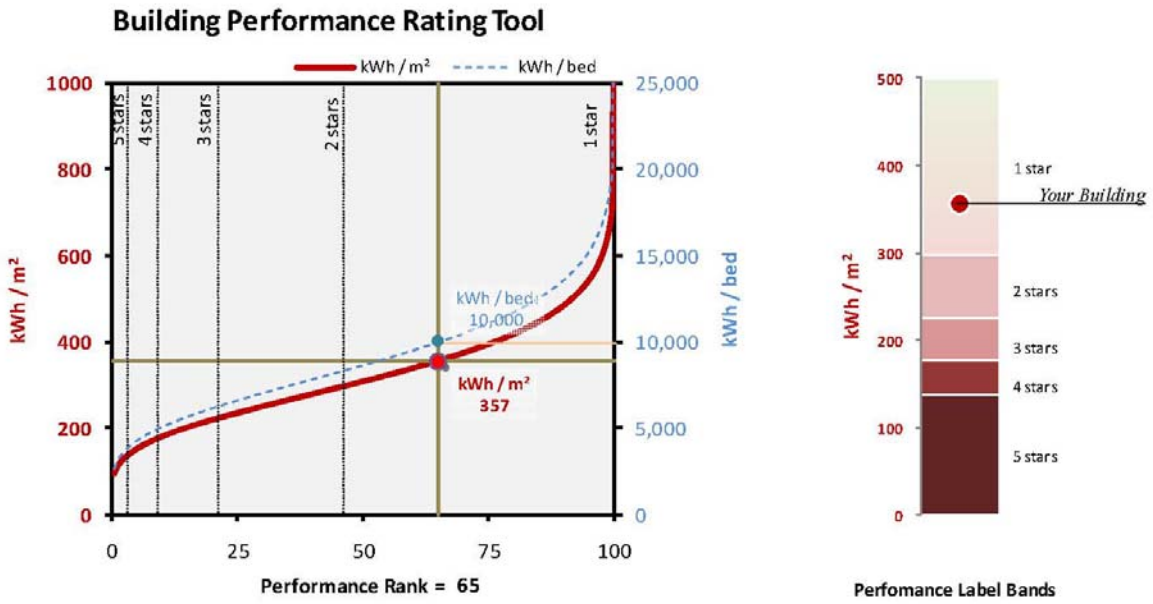
Annual Energy Use Summary

Purchased from Utility	800,000 kWh/m^2
Generated from DG/GG	50,000 kWh/m^2/room
Total Energy Consumed	850,000 kWh

Energy Performance Intensity

kWh/m^2	243
kWh/room	17,000

2. Comparison with National Benchmark



This Building	243 kWh/m^2 or 17,000 kWh/room
Performance rank	Top 59 percentile
National Average	212 kWh/m^2
Best Practice	64 kWh/m^2 or 4,453 kWh/room

The building is eligible for 1 star.

** Poor or Just Average Performance* *** Good Performance,* **** Very Good Performance*
***** Strong Performance (Best Practice)* ****** Exceptional Performance*

E. Benchmarking and performance based labeling report card

3. Evaluation

Energy Performance Intensity of this building is 243 kWh/m^2 or 17,000 kWh/room. The average Energy Performance Index of similar hotels in the national stock is 212 kWh/m^2. It consumes 14% more energy than the national average and is ranked among the top 59 percentile of hotel buildings. It is eligible for 1 star.

4. Targets

This table sets energy performance targets to achieve different star ratings for this building. For example, in order to achieve a 4 star rating, this building's EPI should fall between 94 and 64 kWh/m^2, or should rank among the top 9 percent in terms of energy performance. Note that these targets are specific to this building based on the input parameters and will vary for other buildings.

	Rank	EPI (kWh/m^2)
1 star	> 46	> 203
2 stars	> 21 and ≤ 46	> 134 and ≤ 203
3 stars	> 9 and ≤ 21	> 94 and ≤ 134
4 stars	> 3 and ≤ 9	> 64 and ≤ 94
5 stars	≤ 3	≤ 64

5. Remarks

"Please note that this is a preliminary / general assessment tool kit for building energy performance. Low energy consumption does not necessarily mean your building is efficient and high energy consumption does not always mean that it is inefficient. Many related factors need to be taken into account for an accurate evaluation such as number of computers, operating hours, presence of special building use and high energy use area and tenants, as well as internal environmental settings." *Ref: Summary sheet of Energy Smart Tool, Singapore*

If your building's rank is less than 15 or greater than 85, you must verify your input data. If the national average EPI is twice that of your EPI, and you are sure of data accuracy, and building does not have process load or some other factor that would cause energy consumption to be dramatically higher, you are probably using almost twice as much energy as your peers

6. Certification

Based on the conditions observed at the time of my visit to the building and supporting documents, I certify that the building input data contained in this statement is accurate.
The building should be awarded _____ Stars based on the official benchmarking Tool.

Signature of Certifying Professional
Name:

Stamp
Date:

7. Disclaimer

"The Benchmarking result as indicated above is subject to the data quality input by the User. Energy Sustainability Unit (ESU) does not warrant or represent that any outcome produced as a result of the use of the Tool is accurate, or will be the same as, or is indicative of the outcome of any official rating by ESU. In no event will the ESU be liable for any direct or indirect, special, incidental, tort, economical or consequential damage for negligence or any loss of profit, whether arising out of the use or inability to use the tool. Any outcome produced by the tool or any reliance there on, or otherwise. You must not make any representation to third parties based on any outcome produced as a result of the use of the Tool, and no license is granted to the use or reproduction of any ESU or trade mark or otherwise." *Ref: Summary sheet of Energy Smart Tool, Singapore*

F. List of potential partners for building performance initiative

AEEE	Technical
CWF/SSEF	IITs
GTZ	CII-GBC
Tata Trust	TERI
Infosys Foundation	ISHRAE
USAID	Infosys
US DOE	Tata
Policy	Wipro
BEE	Real Estate Service Providers
EESL	Jones Lang LaSalle
CERC/SERCs	Cushman Wakefield
NBCC	CB Richard Ellis
MUD	Sodexho
Labor/HRD	Energy Service Companies
Statistical	Dalkia Energy Services
NSSO	Johnson Controls
MOSPI	Design Community
Indian Statistical Institute	Council of Architecture
IIM-A	Indian Institute of Architects
CEA	

G. Useful definitions from various benchmarking programs

General Definitions (Source: Energy Performance of Building Directive, Europe)

Building	A roofed construction having walls, for which energy is used to condition the indoor climate.
Technical building system	Technical equipment for the heating, cooling, ventilation and lighting or for a combination of a building or building units.
Energy performance of a building	The calculated or measured amount of energy needed to meet the energy demand associated with a typical use of the building which includes energy used for heating, cooling, ventilation, hot water and lighting.
Energy from renewable sources:	Energy from renewable non fossil sources namely wind, solar, aero thermal, geothermal, hydro thermal and ocean energy, hydro power, biomass, landfill gas, sewage treatment plant gas and bio gases.
Major renovation	The renovation of a building where: the total cost of renovation is higher than 25% of the value of the building excluding the value of land on which it is executed and more than 25% of the surface of the building envelope undergoes renovation.
Building envelope	The integrated elements of a building which separate its interior from the outdoor environment.
Building unit	A section, floor or apartment within a building which is designed or altered to be used separately
Building element	A technical building system or an element of the building envelope.
Energy performance certificate	A certificate recognized by a Member state or by a legal person designated by it which indicates the energy performance of a building or building unit.
Energy Performance & renovation	Major renovations should provide an opportunity to take cost-effective measures to enhance energy performance of the buildings. Given the long renovation cycle for existing buildings, new and existing buildings that are subject to major renovation should meet minimum energy performance requirements adapted to the local climate. It should be possible to limit the minimum energy performance requirements to the renovated parts that are most relevant for the energy performance of the building.
Energy & Existing building	Minimum energy performance requirements are set for building elements that form part of the building envelope and that has a significant impact on the energy performance of the building envelope when they are replaced or retrofitted, with a view to achieving cost-optimal levels.

G. Useful definitions from various benchmarking programs

Benchmark:	A point of reference for measurement; a defined level of performance used as a reference for comparisons. Benchmarks can be based on averages or percentiles of real performance. On the other hand, they can be based on policy –driven objectives such as “net zero carbon”

Space Type of Definitions (Source: Energy Star, US)

Bank/Financial Institution	Space used for financial services. Relevant businesses include bank branches, bank headquarters, securities and brokerage firms. The total gross floor area should include all supporting functions such as vaults, kitchens used by staff, lobbies, atria, conference rooms and auditoria, fitness areas for staff, storage areas, stairways, elevator shafts, etc.
Courthouse	Space used for federal, state, or local courts and associated office space. The total gross floor area should include all supporting functions such as temporary holding cells, kitchens used by staff, lobbies, atria, conference rooms and auditoria, fitness areas for staff, storage areas, stairways, elevator shafts, etc.
Data Center	Spaces specifically designed and equipped to meet the needs of high density computing equipment such as server racks, used for data storage and processing. The total gross floor area should include all supporting functions like raised floor computing space, server rack aisles, storage silos, control console areas, battery rooms, mechanical rooms for cooling equipment, administrative office areas, elevator shafts, stairways, break rooms and restrooms.
Dormitory / Residence Hall	Buildings associated with educational institutions or military facilities which offer multiple accommodations for long-term residents. The total gross floor area should include all supporting functions such as food service facilities, laundry facilities, meeting spaces, exercise rooms, health club/spas, lobbies, elevator shafts, storage areas stairways, etc.
Hospital (Acute Care & Children’s)	Spaces used from 20,000 to 5 million square feet in total gross floor area. These facilities provide acute care services intended to treat patients for short periods of time for any brief but severe medical condition, including emergency medical care, physician's office services, diagnostic care, ambulatory care, and surgical care.

G. Useful definitions from various benchmarking programs

Hotel	Buildings that rent overnight accommodations on a room/suite basis, typically including a bath/shower and other facilities in guest rooms. The total gross floor area should include all interior space, guestrooms, halls, lobbies, atria, restaurant space, conference and banquet space, health clubs/spas, indoor pool areas, and laundry facilities, stairways, mechanical rooms, storage areas, offices, etc.
House of Worship	Buildings that are used as places of worship. This includes churches, temples, mosques, synagogues, meetinghouses, or any other buildings that primarily function as a place of religious worship. The rating applies to worship facilities that have 4,000 seats or fewer.
K-12 School	Space used as a school building for Kindergarten through 12th grade students. This does not include college or university classroom facilities and laboratories, or vocational, technical, or trade schools. The total gross floor area should include all supporting functions such as administrative space, conference rooms, kitchens used by staff, lobbies, cafeterias, gymnasiums, auditoria, laboratory classrooms, portable classrooms, greenhouses, stairways, atria, elevator shafts, small landscaping sheds, storage areas, etc
Medical Office	Medical Office applies to facility space used to provide diagnosis and treatment for medical, dental, or psychiatric outpatient care. The total gross floor area should include all supporting functions such as kitchens used by staff, laboratories, lobbies, atria, conference rooms and auditoria, fitness areas for staff, storage areas, stairways, elevator shafts, etc.
Multifamily Housing	Space type as a residential building equal to or larger than 2 units. Multifamily space types include all square footage in the residential units, common areas, and unconditioned space (boiler room). Occupants of Multifamily housing can include tenants, cooperators, and/or individual owners.
Wastewater Treatment Plant	Facility that is designed to treat municipal wastewater. Treatment processes may include biological, chemical, and physical treatment. This space type is best applied to wastewater treatment facilities of 150 MGD or smaller.
Office	Office applies to facility spaces used for general office, professional, and administrative purposes. The total gross floor area should include all supporting functions such as kitchens used by staff, lobbies, atria, conference rooms and auditoria, fitness areas for staff, storage areas, stairways, elevator shafts, etc.

G. Useful definitions from various benchmarking programs

Parking	Space type is intended for any area connected to the building that is used for parking vehicles. This includes parking lots, fully enclosed parking structures, and unenclosed parking structures that are open on all sides and may or may not include roof parking.
Retail Store	Space used to conduct the retail sale of consumer product goods. Stores must be at least 5,000 square feet and have an exterior entrance to the public. The total gross floor area should include all supporting functions such as kitchens and break rooms used by staff, storage areas, administrative areas, elevators, stairwells, etc.
Senior Care Facility	It applies to individual buildings and campuses of buildings that house provide care and assistance for elderly residents. The total gross floor area of a Senior Care Facility should include all activities such as individual rooms or units, wellness centers, exam rooms, community rooms, small shops or service areas for residents and visitors, staff offices, lobbies, atria, cafeterias, kitchens,
Supermarket	Space type applies to facility space used for the retail sale of food and beverage products. The total gross floor area should include all supporting functions such as kitchens and break rooms used by staff, storage areas (refrigerated and non-refrigerated), administrative areas, stairwells, atria, lobbies, etc.
Swimming Pool	Swimming Pool applies to heated swimming pools that operate on the premises and on the same energy-use meter as the primary facility. This category applies to any heated swimming pools located inside or outside of the facility. Swimming pools are categorized by size, and whether they are an indoor or outdoor pool.
Warehouse	Warehouse applies to unrefrigerated or refrigerated buildings that are used to store goods, manufactured products, merchandise or raw materials. The total gross floor area of Refrigerated Warehouses should include all temperature controlled areas designed to store perishable goods or merchandise under refrigeration at temperature below 50°F.
Water Treatment & Distribution Utility	A water treatment and distribution utility applies to water distribution facilities designed to pump and distribute drinking water through a network of pipes. Depending on the water source (ground or surface) a water utility may or may not contain a treatment process.

H. Comparison of International Benchmarking Tools

List of Benchmarking Programs Referred

1. Energy Smart, Singapore
2. Portfolio Manager, Energy Star
3. Energy Concept Adviser, Europe
4. NABERS, Australia
5. Labs 21, US Department of Energy

Table of Contents

1.1 Program Administration

	Energy Smart	Portfolio Manager-Energy Star	Energy Concept Adviser -IEA	NABERS	Labs21
	Singapore	United States	Europe	Australia	US Department of Energy
Developed By					
	Energy Sustainability Unit (ESU) of the National University of Singapore (NUS) and the National Environment Agency (NEA)supported by European Union through the EU-ASEAN Energy Facility, National Environment Agency of Singapore and Jurong Town Corporation Singapore.	U.S. Environmental Protection Agency (EPA) program that focuses on improving energy performance in buildings as a method of reducing greenhouse gas (GHG) emissions.	The International Energy Agency (IEA) Energy Conservation in Buildings and Community Systems as per One of those international projects is Annex 36 - Energy Retrofit of Educational Buildings.	The Australian Dept. of Environment and Heritage (DEH).	Cosponsored by the U.S. Environmental Protection Agency (EPA) and U.S. Department of Energy (DOE).
Managed By					
	Energy Sustainability Unit (ESU) of the National University of Singapore (NUS)	Energy Star	Fraunhofer- Institute for Building Physics, Stuttgart.	NSW (Office of Environment and Heritage) Government	Voluntary team of nine members (EPA, Lawrence Berkeley National Laboratory, US Department of Energy & National Renewable Energy Laboratory)
Tool initiated in the year					
	Year 2005	-	Year 2004	March 2005	-
Type of Building that can be rated in the Benchmarking Tool					
	1. Hotel 2. Office 3. Retail Mall	1. Courthouse 2. Data Center 3. Hospital (acute care and childcare's) 4. Hotel 5. House of Worship 6. K–12 School 7. Medical Office 8. Municipal Waste water Treatment 9. Bank/Financial Institution 10. Warehouse 11. Supermarket 12. Senior Care Facility 13. Retail Store 14. Residence Hall/Dormitory 15. Plant 16. Office	Retrofitting of Educational Buildings	1. Hotels 2. Offices 3. Retail 4. Homes 5. Schools 6. Hospital 7. Transport	1. Laboratories
Cost of Rating					
Validity					
	Not mentioned (approx 1 year)	Validation For 12 Months	Not mentioned	Expires 12 months after date of rating	Not Mentioned
Main Application : Operational Phase, when building is completed & occupied. Usually 12 months of operational data is required.					

1.2 Vision for the Program

	Energy Smart	Portfolio Manager-Energy Star	Energy Concept Adviser -IEA	NABERS	Labs21
	Singapore	United States	Europe	Australia	US Department of Energy
	Aim				
	It aims to grant recognition for building energy efficiency. It enables facility managers to set target and work towards improving energy efficiency by effectively employing the resources.	It allows you to track and assess energy and water consumption across your entire portfolio of buildings in a secure online environment.	It identifies the energy retrofit measures of educational buildings as per Annex 36. The gained know-how shall be used in exemplary retrofit projects in the participating countries.	It measures environmental performance against the impact of various categories. It helps to recognize the accountability and responsibility for commercial building owners.	It helps minimize overall environmental impacts, protect occupant safety, optimize whole building efficiency on a life-cycle basis, establish goals, track performance, and share results .
	Benefits of the program				
	1. It can assist in tracking the building progress over time. 2. It enables facility managers to set target and work towards improving energy efficiency in the long run by effectively employing the resources. 3. It will signify lower operating energy costs and project an environmentally responsible image. 4. It helps to reduce CO2 emission and consumption of fossil fuels. 5. This also results in lower pressure on infrastructural demand and cost. 6. It helps to achieve energy savings at the national level.	1. Manage Energy and Water Consumption for all Buildings. 2. Rate Building Energy Performance 3. Estimate Your Carbon Footprint 4. Set Investment Priorities 5. Verify and Track Progress of Improvement Projects 6. Gain EPA Recognition 7. Related Tools	1. To provide tools and guidelines for decision makers and designers to improve the learning and teaching environment of educational facilities through energy- efficient retrofitting. 2. To support the decision makers in evaluating the efficiency and acceptance of available concepts. 3. To give recommendations on how to operate the retrofitted buildings. 4. To promote energy- and cost-efficient retrofit measures	1. Provide separate ratings for the different stakeholders within a building (such as landlords and tenants) where appropriate. 2. Provide an explicit and consistent rating system methodology, with a clear performance-based structure and methodologies. 3. Allow for voluntary self-assessment, with the option of seeking a certified rating from an accredited provider if desired. 4. Use measured quantities as the primary means of assessment. 5. Contain appropriate adjustments for factors such as climate and occupancy patterns.	1. Public Recognition as an industry leader committed to environmental excellence. 2. Training and technical assistance from experts around the country. 3. Networking opportunities with other industry professionals at training workshops and an annual conference. 4. Web-based tools to help support new approaches to laboratory design and operation. 5. Working groups actively pursuing sustainable solutions with a variety of lab-intensive industries.
	Future Developments				
	Hospitals Schools Industrial Buildings Shopping Mall	Additional Building Space Benchmarks	Educational Buildings	Refrigerants Storm water run off & pollution Sewage Landscape Diversity	Laboratories

1.3 Pre requisites

	Energy Smart	Portfolio Manager-Energy Star	Energy Concept Adviser -IEA	NABERS	Labs21
	Singapore	United States	Europe	Australia	US Department of Energy
	Criteria				
	1. Physical Characteristics • Gross Floor Area using Air Conditioned space • Primary Space • Secondary Space 2. Energy Source • Electricity should be main source of energy • Electricity meters must cover 365+_30 days • Readings should be recorded, simulated or calculated values are not acceptable. 3. Occupancy Characteristics • Occupancy Rate • Occupancy Hours • Building Occupancy • Occupant Density	1. Gross Floor Area 2. Operating Hours 3. Operating Computers 4. Workers on main shift 5. Licensed Bed 6. Floors Rooms 7. Sheets 8. Exterior Entrance 9. IT Energy Meter 10. No. of Residents	1. Pre requisites are the case studies for retrofitting measures of school.	1. Energy Consumption Data • Utility Bills of all source of energy used in the last 12 months latest bill must not be more than 4 months old. • For Tenancy Rating • For Base Building Rating • For Whole Building Rating 2. Net lettable Data • Layout Plan • Lease Documents • Tenancy Rating • Base or Whole Building Rating 3. Number of Computers 4. Hours of Occupancy	1. Total Area of conditioned & Non conditioned space 2. Net area of laboratory spaces 3. Weather 4. Lab Type :chemical, biological,physical 5. Lab Use : research, teaching, manufacturing. 6. Occupancy Schedule 7. Ventilation Rates 8. Equipment Loads

1.3 Pre Requisites / Eligibility Criteria for Rating Building Energy Performance: Operating Characteristics

Portfolio Manager asks you to enter data for key operating characteristics for each space in your building. There are minimum and maximum thresholds for these values which differ by space type. These limits are designed to make sure that your building falls into an operation pattern consistent with that of the peer group used for comparison.

	Gross Floor Area (ft2)	Operating Hours	Personal Computers	Workers on main shift	Licensed Beds (#)	Floors (#)	Rooms (#)	Seats (#)	Exterior Entrance	IT Energy Meter	Number of Residents
Bank/Financial	≥ 1,000	30 ≤ H/W ≤ 168	# PCs ≥ 1	≥ 1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Courthouse	≥ 5,000	30 ≤ H/W ≤ 168	# PCs ≥ 1	≥ 1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Data Center	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	≥ 11 Months	N/A
Hospital Acute Care	20,000 ≤ ft² ≤ 5,000,000	N/A	N/A	N/A	16 ≤ Beds ≤ 1510	1 ≤ Floors ≤ 40	N/A	N/A	N/A	N/A	N/A
Hotel	≥ 5,000	N/A	N/A	≥ 1	N/A	N/A	≥ 1	N/A	N/A	N/A	N/A
House of Worship	≥ 1,000	H/W ≥ 0	#PCs ≥ 0	N/A	N/A	N/A	N/A	25 ≤ Seats ≤ 4000	N/A	N/A	N/A
K-12 School	≥ 5,000	N/A	#PCs ≥ 0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Medical Office	≥ 5,000	30 ≤ H/W ≤ 168	N/A	≥ 1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Office	≥ 5,000	30 ≤ H/W ≤ 168	# PCs ≥ 1	≥ 1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Residence/Dormitory	≥ 5,000	30 ≤ H/W ≤ 168	N/A	N/A	N/A	N/A	≥5	N/A	N/A	N/A	N/A
Retail	≥ 5,000	30 ≤ H/W ≤ 168	Registers ≥ 1 #PCs ≥ 0	≥ 1	N/A	N/A	N/A	N/A	YES	N/A	N/A
Senior Care Facility	≥ 5,000	N/A	#PCs ≥ 0	≥ 0	N/A	N/A	N/A	N/A	N/A	N/A	≤ Resident Capacity
Supermarket	≥ 5,000	30 ≤ H/W ≤ 168	N/A	≥ 1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Warehouse	≥ 5,000	30 ≤ H/W ≤ 168	N/A	≥ 1	N/A	N/A	N/A	N/A	N/A	N/A	N/A

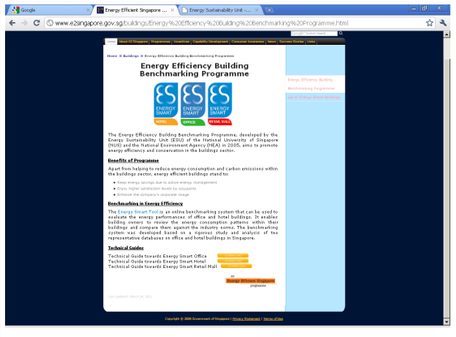
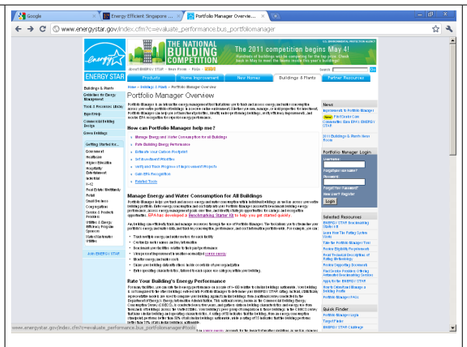
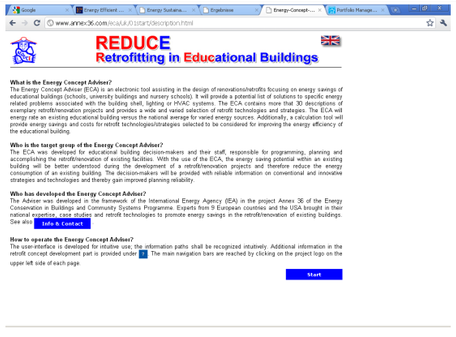
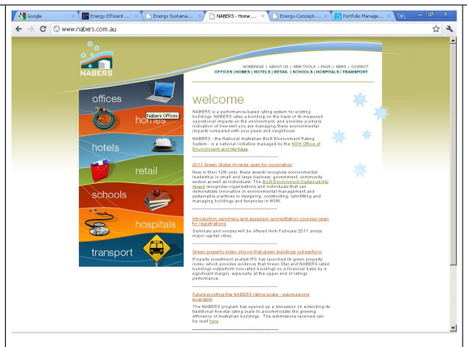
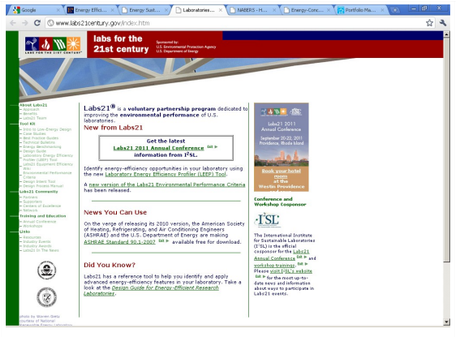
Waste water Treatment Plant Requirements:

Criteria	Average influent flow	Average influent BOD5	Average effluent BOD5	
	MGD > 0.6	30 < mg/liter < 1000	mg/liter > 0	

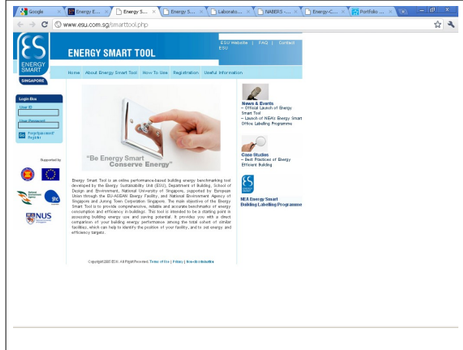
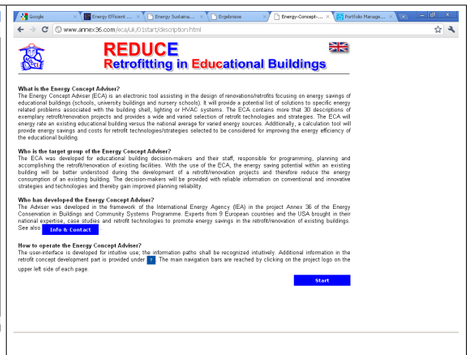
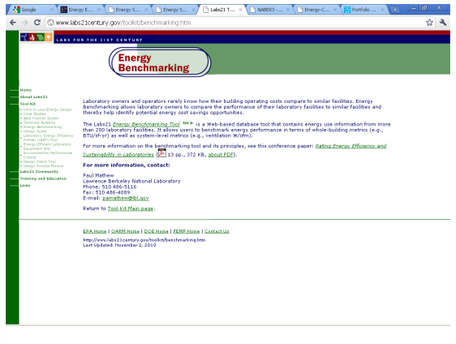
1.4 Data Collection

	Energy Smart	Portfolio Manager-Energy Star	Energy Concept Adviser -IEA	NABERS	Labs21
	Singapore	United States	Europe	Australia	US Department of Energy
	1. General Information 2. Thermal Comfort 3. Visual Comfort 4. Indoor Air Quality 5. Total Building Performance 6. Questionnaire for offices 7. Questionnaire for Hotel	1. The building street address, year built, and contact information. 2. The building gross floor area and key operating characteristics for each major space type. 3. 12 consecutive months of utility bills for all fuel types used in the building. 4. Data Collection Worksheet	1. Data was shared amongst the participants of Annex 36-Energy Retrofit of Educational Buildings.	1. A category of data used in a rating assessment. Data types for NABERS Energy and Water for offices ratings are: 2. area 3. hours 4. number of computers 5. energy consumption: electricity gas fuel oil 6. water consumption: externally supplied potable water externally supplied recycled water water from on-site sources. 7. Data Collection Guidance Document 8. Other Information self assessment page	1. Gross area 2. Lab area 3. Weather 4. Lab type 5. Lab use 6. Occupancy schedule 7. Required ventilation rates 8. Equipment loads 9. Reference Guide
	Energy Consumption Measured in Units				
	kWh/m^2 /year (Energy Usage Intensity EUI)	k Btu / ft^2 / yr (Site) k Btu / ft^2 / yr (Source)	kWh/m^2a (electrical energy) l/m^2a (water consumption) kWh/m^2a (gas)	kWh (electrical use) kWh (energy use) MJ/m^2 (energy density) GJ (gas) kgCO2/m^2 per annum (green house emissions)	kWh/sf-yr (electric) BTU/sf-yr (site) BTU/sf-yr (source) Utility $/sf-yr
	Method of Collection				
		Phone Survey			

2.1Main Page: Overview of the Benchmarking Tool

	Energy Smart	Portfolio Manager-Energy Star	Energy Concept Adviser -IEA	NABERS	Labs21
	Singapore	United States	Europe	Australia	US Department of Energy
	1. [Top Bar] : What is Energy efficiency building Benchmarking ? 2. Benefits of Program 3. Benchmarking in Energy Efficiency **(Energy Smart Tool)** 4. Technical Guides : Office Hotel Retail Mall	1. [Top Bar] : Portfolio Manager Over view 2. How can Portfolio Manager Help me? **3. Portfolio Manager Log-in** 4. [Side Bar] : Benchmarking Starter Kit Portfolio Manager Reference Guide Review Eligibility Requirement Portfolio Manager FAQ New development	1. [Top Bar] : What is energy Concept Adviser? 2. Who is the Target Group? 3. Who has developed Concept Adviser? (info & contact link) 4. How to operate the Energy Concept Adviser?	1. [Top Bar] : About Us FAQ New Tools News Contact 2. Introduction seminars and assessor accreditation courses open for registrations 3. Green property index shows that green buildings out-perform 4. Future-proofing the NABERS rating scale - submissions available 5. Victorian buildings get NABERS rating boost 6. Commercial Building Energy Efficiency Disclosure 7. NABERS Energy and Water for offices: Rules for collecting and using data 8. [Side Bar] : Offices, Retail, School, Hospital, Hotels, Homes, Transport	1. [Top Bar] : New from Labs21 2. News you Can Use 3. Did you Know? Design guide 4. [Side Bar] : About Labs 21 Tool Kit **Energy Benchmarking** Efficiency Profiler Tool Environmental Performance Criteria Case Studies Best Practices Technical Bulletins Labs21 Community Partners, Supporters Center of Excellence Network, Training & Education Conference Workshops Resources Industry Events & Awards, News
Visual Interface:					

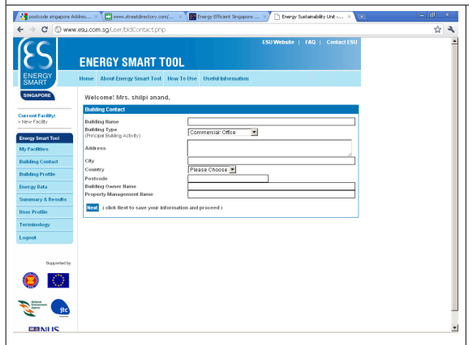
2.2 Second Page : About the Benchmarking Tool

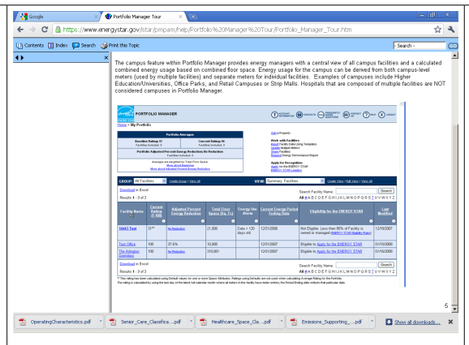
	Energy Smart	Portfolio Manager-Energy Star	Energy Concept Adviser -IEA	NABERS	Labs21
	Singapore	United States	Europe	Australia	US Department of Energy
	1. [Top Bar] : Energy Smart Tool 2. About Energy Smart Tool 3. How to Use? 4. Registration 5. Useful Information 6. ESU Website 7. FAQ 8. Contact 9. [Side Bar L] : Log in 10. [Side Bar R] : News & Events Case Studies (Best Practices of Energy efficient building)	1. [Top Bar] : Create a Portfolio Manager account 2. FAQ, Contact US & Help 3. What's New in Portfolio Manager 4. New Features 5. About Portfolio Manager 6. Technical Guides: Hospital Office Hotel Retail 7. Success through Eenergy Star 8. [Side Bar R] : Log-in News & Events Case Studies (Best Practices of Energy efficient building)	1. Obtain recommendations for specific problems in your building : Recommendations 2. Study more than 30 retrofitted buildings and retrofit measures: Case studies 3. Compare your building's consumption to national data: **Performance Rating** 4. Develop an energy efficient retrofit concept for your building : Retrofit Concept 5. Programs and methods to analyze your building performance :Utilities 6. Any questions : Info & Contact	1. [Top Bar] : **NABERS Rating Calculator** View Rated Office Buildings Commitment Agreement Information Find an Assessor Become an Assessor NABERS Assessor Login 2. [Side Bar] : NABER Office Energy About Us Contact Rate your Premise Improve your Rating Resources & News	**1. Energy Benchmarking Tool** 2. Contacts 3. [Side Bar] : About Labs21 Tool Kit Community Training & Education 4. Links to other website : Lab Rating **Data Query**
Visual Interface					

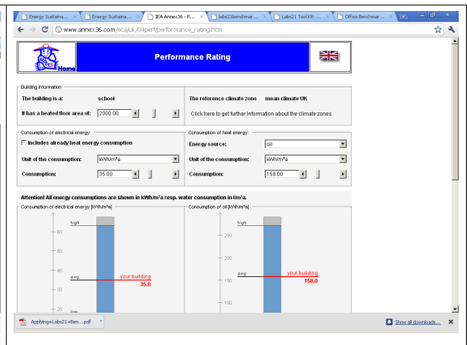
2.3 Benchmarking Tool : Input Parameters

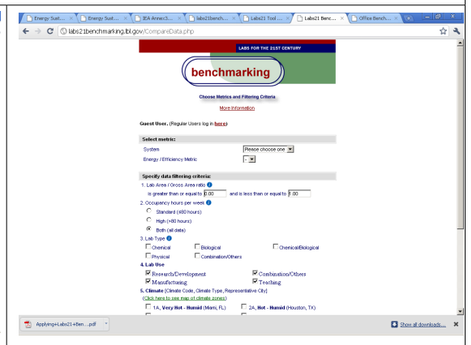
	Energy Smart	Portfolio Manager-Energy Star	Energy Concept Adviser -IEA	NABERS	Labs21
	Singapore	United States	Europe	Australia	US Department of Energy
	1. [Top Bar] : Log-In 2. Before you Start (Prerequisite) 3. Terms & Condition (I Agree Page) 4. Registration Form 5. Input Parameters Building Contact_a Building Contact_b Building Profile Energy Data 6. Summary & Results	1. [Top Bar] : Log -In 2. Add a new Facility 3. Select Property Type & enter general facility information 4. Enter Space Use Data 5. Enter Energy Use Data 6. Create Custom groups **7. View & Interpret results** 8. Request for energy Performance report in Excel Format.	1. [Top Bar] : Building Information Type (NOT Changing) Area Climate 2. Consumption of Electrical Energy Consumption Unit of Consumption 3. Consumption of Heat Energy Unit of Consumption Consumption **4. Consumption Graph:locating your building's consumption** 5. National Survey Consumption **6. Links to other websites**	1. [Top Bar] : Terms & Conditions (I agree) 2. Building Details 3. Rated Area Area Occupancy 4. Rating Type Type of Rating 5. Link to : Energy Water Indoor Environment Waste **6. Results**	1. [Top Bar] : Log-in (as a guest User) 2. Select Metric 3. Specify Data Filtering Criteria Lab Area Occupancy Hours/Week Lab Type Lab Use 4. Climate 5. Measured & Estimated Data

Visual Interface

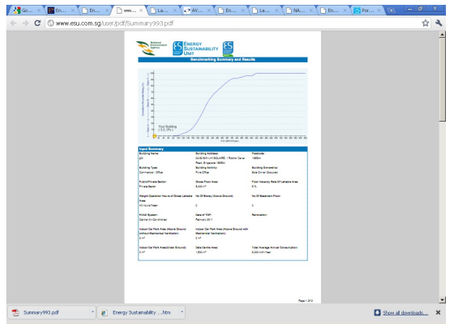
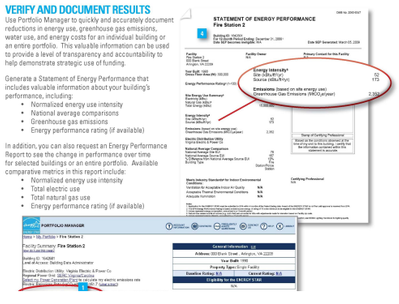
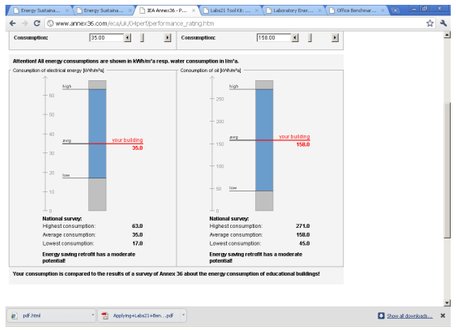
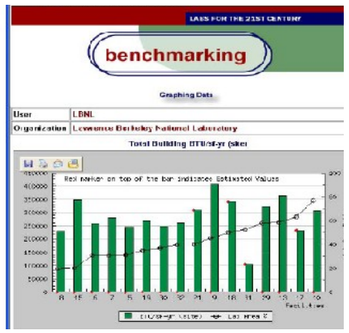








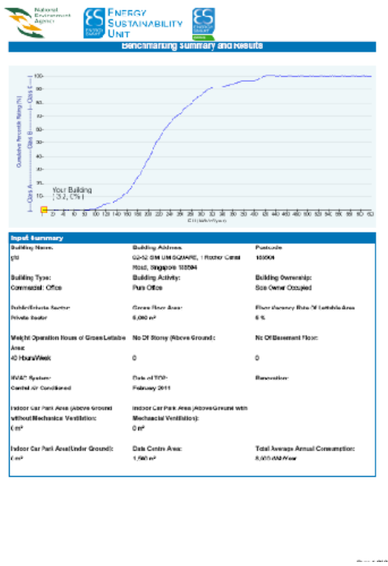
2.4 Benchmarking Tool : Output Parameters

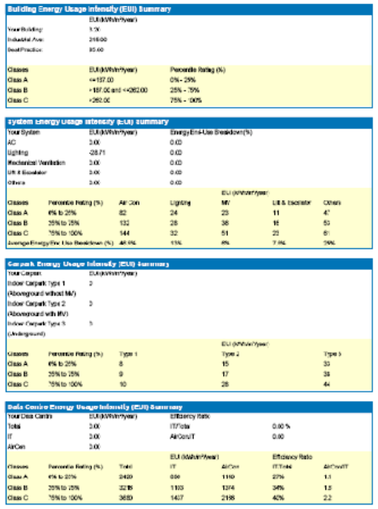
	Energy Smart	Portfolio Manager-Energy Star	Energy Concept Adviser -IEA	NABERS	Labs21
	Singapore	United States	Europe	Australia	US Department of Energy
	1. [Top Bar]: Cumulative Percentile Rating (Graph) 2. Input Summary 3. Building Energy Usage Intensity Summary 4. System Energy Usage Intensity Summary 5. Car park Energy Usage Intensity Summary 6. Data Center Energy Usage Intensity Summary 7. Evaluation of Benchmarking Results 8. Remarks 9. Disclaimer	1. [Top Bar]: Results are in the form of Statement 2. Building ID, Time duration 3. Facility or the type Gross Floor Area, Year Built 4. Site Energy Usage Summary Electricity (k Btu) Natural Gas (k Btu)4 Total Energy (k Btu) 5. Energy Intensity Site (k Btu/ft2/yr) Source (k Btu/ft2 yr) 6. Emissions Green House Gas 7. National Average Comparison 8. Meets Industry Standards	1. [Top Bar]: Consumption of Electrical Energy (kWh/m2a) 2. Results are in the form of Graph 3. Consumption Of Oil (kWh/m2a) 4. It also defines the building has moderate, average or high potential 5. States the existing benchmark, easy to compare your own results	1. [Top Bar] : Date Site Climatic Zone 2. Rating Type 3. Rated Area 4. Hours of Occupancy 5. Links to other TAB: Energy Water Indoor Environment Waste 6. [Side Bar] : Help Reset Form Terms & Conditions Print/Results	1. [Top Bar] : Results are presented in graphical format 2. Graph of Annual Site Energy Use verses gross area ratio 3. Comparing your facility with others export results
Visual Interface					
	 Please refer Summary Sheet	 Please refer Refrence Guid			
Reference					
	http://www.esu.com.sg/smarttool.php	*http://www.energystar.gov*	*http://www.annex36.com/eca/uk/01start/menu.h*	*http://www.abgr.com.au*	*http://www.labs21century.gov*

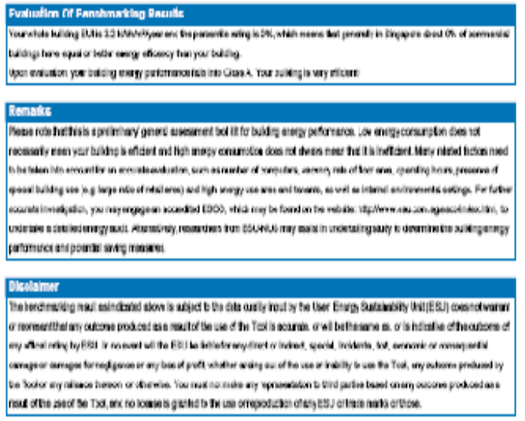
Note: 1. Font: Blue indicate link in the website

2.5 Reports/ Summary/ Statement of Performance

Energy Smart, Singapore







Portfolio Manager, Energy Star US.

2.6 Frequently Asked Questions

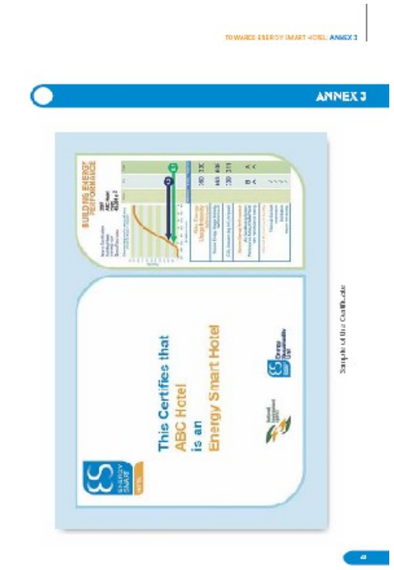
	Portfolio Manager-Energy Star	Labs21	NABERS
	United States	US Department of Energy	Australia
	1. How does the tool calculate source energy? 2. Can this tool be used for LEED-EB?What is the difference between LEED and ENERGY STAR? 3. What types of buildings can be evaluated with Portfolio Manager? 4. Can I apply to earn the ENERGY STAR plaque for an office building that isn't 100% occupied? 5. How can I qualify and apply for the ENERGY STAR label for buildings? 6. What constitutes a single structure? What if multiple buildings are connected via hallways, common spaces, etc? 7. Are there costs involved? 8. What information do I need to enter into Portfolio Manager to get an energy performance rating for my building? 9. How long is the ENERGY STAR label valid on a building? 10. What should be included in the gross square footage of my facility? 11. How were the ENERGY STAR criteria for buildings derived?	1. What are the data sources for the Labs21 tool? 2. Does the Labs21 tool include laboratory buildings from the CBECS database? 3. Is the Labs21 data set a statistically representative sample of all U.S. laboratory buildings? 4. Are the energy use data in the tool measured or estimated? 5. Is my data secure? 6. Does the Labs21 tool provide a rating between 1 and 100, like the Energy Star Portfolio Manager? 7. How does the tool account for differences in weather? 8. How does the tool calculate source energy? 9. Can this tool be used for LEED-EB?	1. What is NABERS? 2. How does NABERS relate to other environmental ratings? 3. Who manages NABERS? 4. Who can use NABERS? 5. What building types does NABERS apply to? 6. What does NABERS do? 7. Why use NABERS? 8. What does NABERS measure?

Other Links for Benchmarking Tool

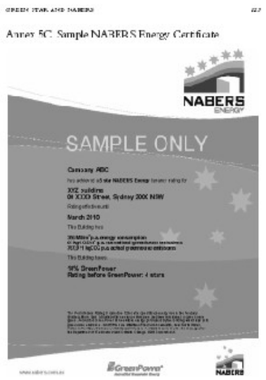
1. Australian Building Greenhouse Rating (ABGR)-NSW Department of Energy and Utilities and Sustainability (DEUS), Australia.
2. Online Benchmarking of Energy Consumption-EMSD, Hong Kong.
3. CALARCH- LBNL, United States.
4. Energy Concept Adviser-IEA, Europe
5. Lab 21- EPA and DOE, United States.
6. On-line energy benchmarking (Danish)- Danish Electricity Saving Trust (Elsparefonden), Denmark.
7. Sorted benchmarking links

3. Certificates

Energy Smart, Singapore : Sample Certificates



NABERS, Australia :



I. Comparison of International Energy Research Institutes

Table of Contents

I. Comparison of International Energy Research Institutes

1. Energy Sustainability Unit, Singapore

1.1. Aim / Vision:

"To advance energy sustainable development in Singapore and the tropics by establishing a knowledge base for fostering healthy, productive and sustainable environmental practices and research".

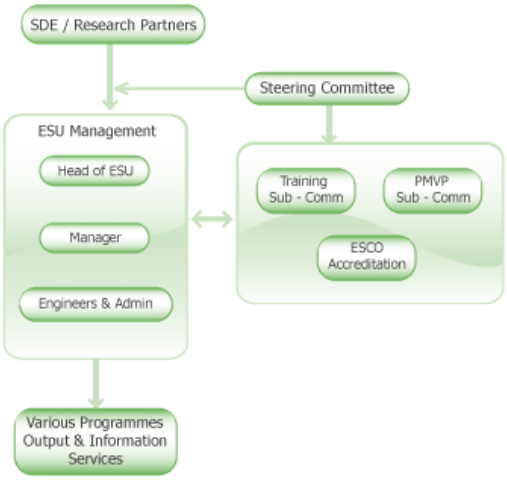
1.2. Partners & Stakeholder:

ESU was established in August 2004 at the School of Design and Environment, NUS through the support of the Economic and Development Board (EDB), the National Environment Agency (NEA) and the Energy Market Authority (EMA). It is a Partner of the Economic Development Board (EDB) Locally-based Enterprise Advancement Program (LEAP) and receives a Partnership grant of $400,000 over a period of 2 years to undertake 4 programmes sponsor by EDB.

1.3. Structure & Governance:

The overall structure of the Energy Sustainability Unit (ESU) is shown as follows. The Unit is jointly supported by the School of Design and Environment, NUS as well as the various Research Partners. The Unit has a Steering Committee to provide visions, direction and guidance to ensure the success of the various programmes under the Unit. The Unit is managed by Head of ESU, with the Manager overseeing the various programmes. To ensure the viability of programmes in the industry, Technical sub-committees are formed, comprising mainly of industry people from the various building sectors to provide valuable feedback and comments to the Unit.

Legend
EDB : Economic Development Board
LEAP : Locally based Enterprise Advancement Program
NEA : National Environment Agency
NUS : National University of Singapore
ESCO :Energy Service Company

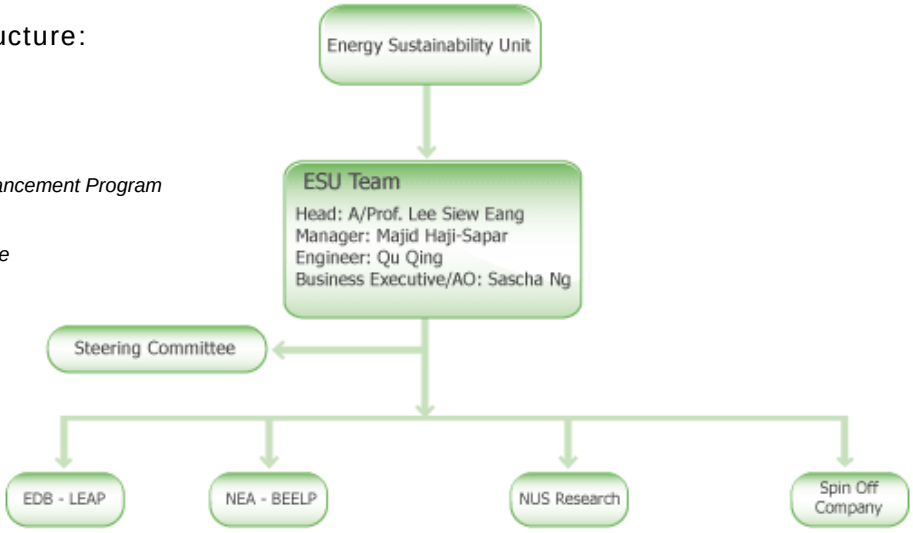


Steering Committee : Total 12 Members		
Chairman	*Building*	*Finance*
Industrial	*Statutory Board*	*Tertiary*

I. Comparison of International Energy Research Institutes

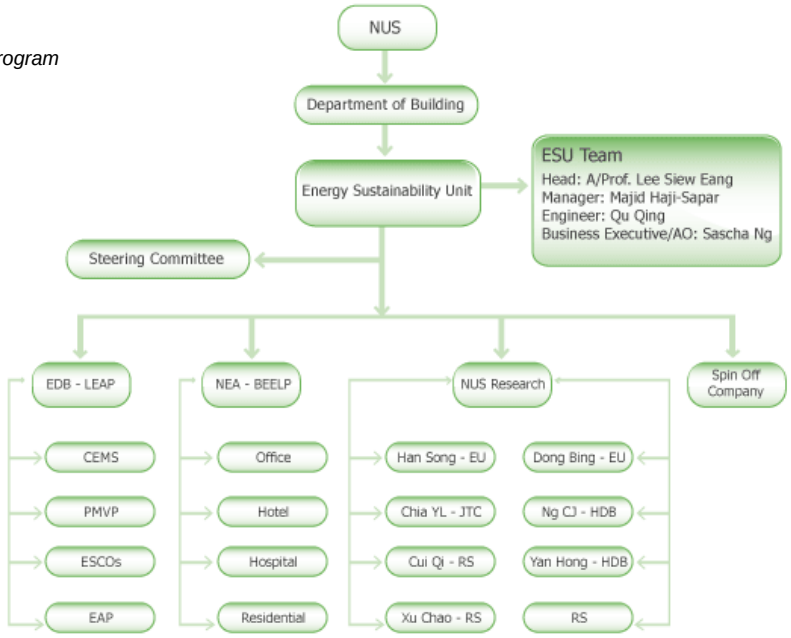
1.4. Organization Structure:

Legend
EDB : Economic Development Board
LEAP : Locally based Enterprise Advancement Program
NEA : National Environment Agency
NUS : National University of Singapore



1.5. Activities & Function:

Legend
EDB : Economic Development Board
LEAP : Locally based Enterprise Advancement Program
NEA : National Environment Agency
NUS : National University of Singapore
ESCO :Energy Service Company



EDB-LEAP Program
The program also oversees the following:

a. Establishing a Training Curriculum and a National Certification System for energy engineers and managers
b. Establishing a measurement and verification protocol on energy utilization for use by ESCOs in Singapore
c. Developing and implement a National Accreditation System of Energy Services Companies (ESCOs)
d. Organizing events to educate professionals, industries and financial institutions

I. Comparison of International Energy Research Institutes

2. Smart Energy Design Assistance Center, Illinois

2.1. Aim / Vision:

The Smart Energy Design Assistance Center (SEDAC) provides advice and analysis enabling private and public facilities in the State of Illinois to increase their economic viability through the efficient use of energy resources.

2.2. Partners & Stakeholder:

SEDAC is sponsored by the Illinois Department of Commerce and Economic Opportunity in partnership with Com Ed and Ameren Illinois Utilities and provides valuable services at *no cost* to for-profit businesses and public facilities. SEDAC is managed by the School of Architecture at the University of Illinois at Urbana-Champaign and the 360 Energy Group.

2.3. Organization Structure :

Managing Director	**Technical Director**
Design Assistance Specialists	**Program Specialists**
Students	**Course Presenters**

2.4. Activities and function:

a. Energy efficiency analysis and technical design assistance services for qualified clients who are planning energy upgrades. These analysis identify opportunities for saving energy and money in both existing buildings and new designs.
b. Feasibility studies designed to identify economic incentives.
c. Introduction to our Pre Qualified Service Energy Provider Network.
d. Identifying economic opportunities with the EP Act 2005 tax incentive program and the Illinois Energy Efficiency Portfolio Standard (EEPS).
e. Education and Training.
f. Goals

1.**Reduce the cost of doing business** for Illinois entities through energy efficiency design assistance projects and through the market transformation which will result from publicity of those projects.

2. Demonstrate to businesses and public entities the **cost-effectiveness of energy efficiency strategies** as a response to higher energy prices.

3. **Support job creation and retention in Illinois** by reducing operating costs, and providing a variety of business opportunities for architects, engineers and other building professionals by offering the chance to learn and practice innovative new efficient building design and construction techniques.

4. **Support electric reliability** in the state by promoting energy efficient building practices that release system capacity and have a reduced peak demand profile.

5. **Reduce pollution** by minimizing wasted energy, and thereby demonstrating that economic growth and environmental protection go hand in hand.

3. New Building Design Institute, US

3.1. Aim / Vision:

New Buildings Institute (NBI) is a nonprofit organization working collaboratively with commercial building market players—governments, utilities, energy efficiency advocates and building professionals— to improve the energy performance of commercial buildings & remove barriers including promoting advanced design practices, improved technologies, public policies and programs that improve energy efficiency.

3.2. Partners & Stakeholders:

Among its founders and project partners are the Energy Foundation, U.S. Green Building Council, American Institute of Architects, U.S. Department of Energy, Environmental Protection Agency, and leading electric utilities and public benefits administrators. Natural Resources Defense Council, American Council for an Energy-Efficient Economy, National Grid, Southern California Edison, the U.S. Green Building Council, and the California Energy Commission are some of the organizations represented on our Board.

3.3. Organization Structure:

Senior Program Manager, Senior Project Manager, Project Analyst, Senior Project Manager, Senior Consultant, Project Associate, Technical Director, Communications Manager, Operations Director, Lighting Manager, Project Manager, Communications Specialist, Contracts Manager, Executive Director, Program Director, Communications Director, Project Analyst, Senior Engineer, Accountant, Project Analyst, Project Analyst, Senior Analyst ,Project Manager.

3.4. Activities & Function:

Benchmarking
Evidence based Design & Operations Research Program
Evaluating Post Occupancy Program
Advanced Buildings
- Core Performance Guide
- Advanced lighting guidelines & Design tools
- Day lighting Pattern Guide
- Day lighting Guide for office interiors
- Mechanical Systems

4. Belgian Building Research Institute, Belgium

4.1. Aim / Vision:

The BBRI has following missions: to perform scientific and technical research for the benefit of its members, to supply technical information, assistance and consultancy to its members, to contribute in general to innovation and development in the construction sector in particular by performing contract research upon request of the industry and the authorities.

4.2. Partners & Stakeholder:

The Belgian Building Research Institute is a private research Institute founded in 1960 under impulse of the National Federation of Belgian Building Contractors in application of the ''De Groote '' Decreelaw of 1947.

4.3. Structure & Governance:

The activities of the BBRI are oriented directly by fifteen Technical Committees. Eleven of them are the direct representation of a branch of the construction industry (painters, joiners, heating equipment installers, etc.) and are composed essentially of contractors. The other Committees focus on subjects of interest to several branches, such as company management or acoustics. These are also composed of professionals active in construction.

4.4. Organization Structure:

To fulfill its mission BBRI pools on the expertise of some 200 highly skilled and motivated staff members with widely varying education, allowing as such setting up multidisciplinary teams as required by the problems to be dealt with.

4.5. Activities & Function:

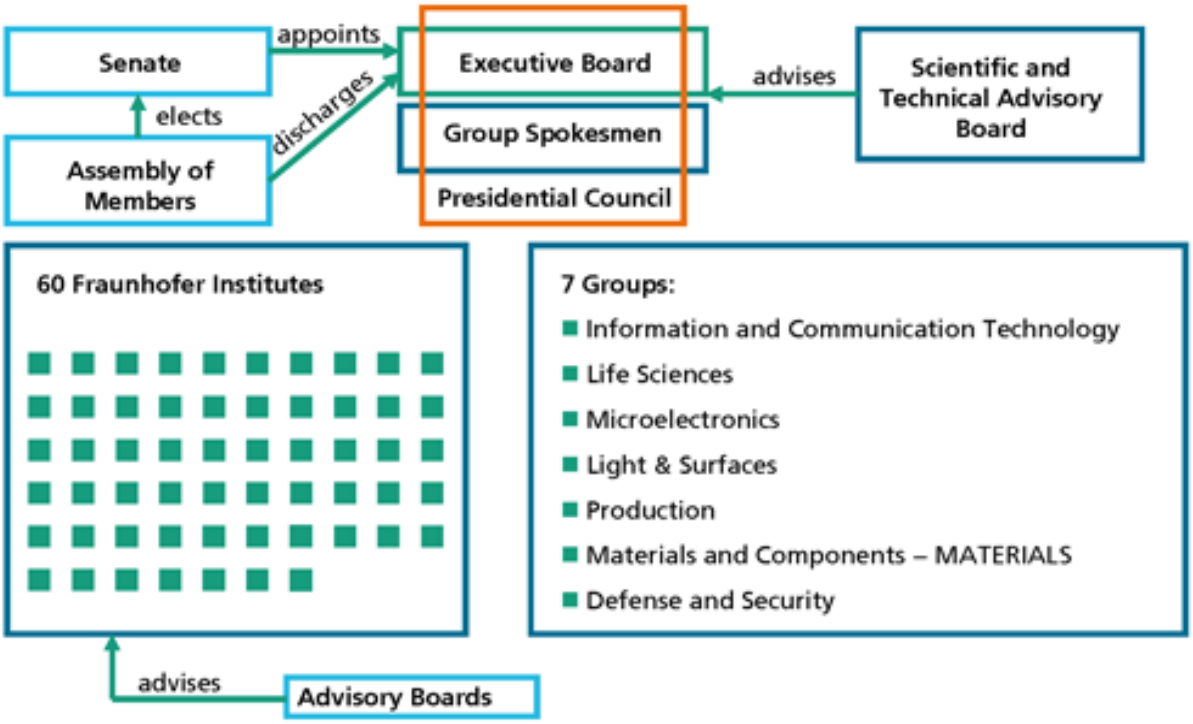
a. Technical Assistance
b. Building Products
c. Innovation Support
d. Planning
e. Technical Approval
f. Virtual Construction
g. Standardization / Regulation
h. CE Marking
i. Patent Units

5. Fraunhofer Research Institute, Europe

5.1. Aim / Vision

Fraunhofer is Europe's largest application-oriented research organization. The activities of the Fraunhofer IAO focus on investigation of current topics in the field of technology management. A holistic approach is applied to the study of commercial success, employees' interests and social consequences.

5.2. Partners & Stakeholders

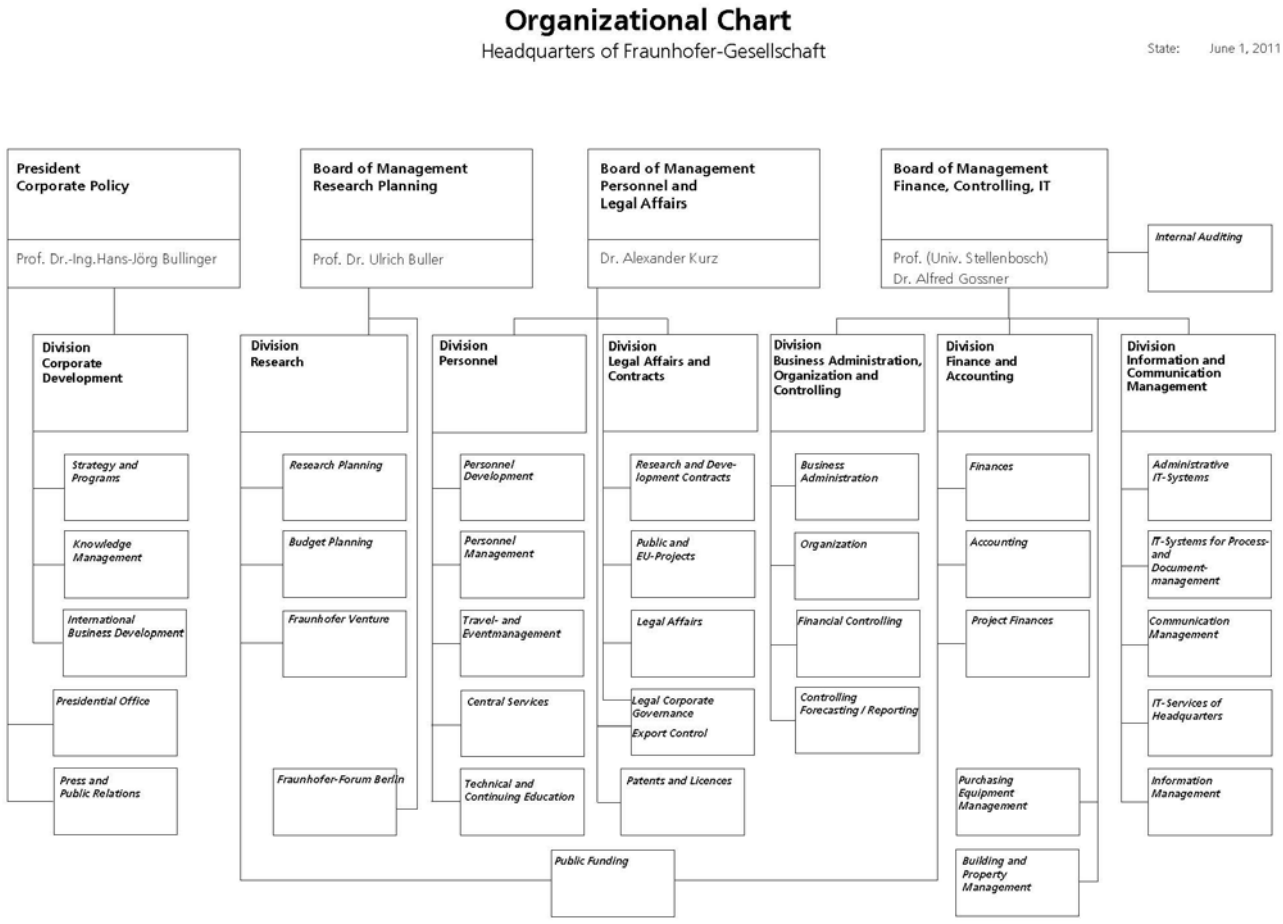


5.3. Structure & Governance

a. Fraunhofer-Gesellschaft, the largest organization for applied research in Europe.
b. More than 80 research units, including 60 Fraunhofer Institutes, at different locations in Germany.
c. The majority of more than 18, 000 staff are qualified scientists and engineers €1.66 billion annual research budget totaling. Of this sum, €1.40 billion is generated through contract research. More than 70 percent of the research revenue is derived from contracts with industry and from publicly financed research projects. Almost 30 percent is contributed by the German federal and Länder governments in the form of institutional funding
d. Research centers and representative offices in Europe, USA, Asia and in the Middle East

I. Comparison of International Energy Research Institutes

5.4. Organizational Structure



6. Frequently Asked Questions

1. Which entities are eligible for Building Performance Institute Services?
2. What services does the BPI program provide?
3. Is there a cost for the program/services?
4. What has the BPI program accomplished?
5. Will I be able to afford BPI recommendations?
6. Does BPI provide funding for energy efficiency projects?
7. How long will it take to get some recommendations?
8. How do I apply for BPI services under the BPI program?
9. What does a BPI energy audit look like?
10. How can Energy Service Providers Participate in BPI?
11. How can Architectural/Engineering Firms Participate in BPI?

7. References

1. Energy Sustainability Unit :*http://www.esu.com.sg/*
2. Smart Energy Design Assistance :*http://smartenergy.arch.uiuc.edu/index.html*
3. New Building Institute :*http://www.newbuildings.org/advanced-energy-codes*
4. Belgian Building Research Institute :*http://www.bbri.be/homepage/index.cfm?cat=bbri&sub=presentation*
5. Fraunhofer Research Institute:*http://www.iao.fraunhofer.de/lang-en/jobs-und-karriere/hiwi-stellen.html*

8. Other International Energy Related Agencies and Organizations

1. American Council for an Energy Efficient Economy :*http://www.aceee.org*
2. ASEAN Center for Energy :*http://www.aseanenergy.org/*
3. Asia Pacific Energy Research Center :*http://www.ieej.or.jp/aperc/*
4. Building Research Establishment, UK :*http://www.bre.co.uk/*
5. Carbon Trust, UK :*http://www.carbontrust.co.uk/Pages/Default.aspx*
6. Energy Conservation Center , Japan :*http://www.asiaeec-col.eccj.or.jp/index.html*
7. Energy Conservation In Buildings And Community System, IEA :*http://www.ecbcs.org/*
8. Energy Star, USA :*http://www.energystar.gov/*
9. European Commission-Energy :*http://ec.europa.eu/*
10. European Council for Energy Efficiency Economy :*http://www.eceee.org/*
11. International Energy Agency :*http://www.iea.org/*
12. International Performance Measurement and Verification Protocol :*http://www.evo-world.org/*
13. International Network for Information on Ventilation and Energy Performance :*http://www.inive.org/*
14. Malaysia Energy Center :*http://www.ptm.org.my/*
15. National & Kapodistrian University of Athens , Greece :*http://en.uoa.gr/*
16. Oak Ridge National Laboratory :*http://www.ornl.gov/*
17. UK National Energy Foundation :*http://www.natenergy.org.uk/*
18. U.S. Environmental Protection Agency :*http://www.epa.gov/*
19. U.S Department of Energy :*http://www.energy.gov/*
20. U.S Lawrence Berkeley National Laboratory :*http://www.lbl.gov/*
21. VTT Technical Research Center of Finland :*http://www.vtt.fi/*
22. Building and Construction Authority: *http://www.bca.gov.sg/*
23. Center for Total Building Performance, National University of Singapore: *http://www.ctbp.bdg.nus.edu.sg/*
24. Department of Building, National University of Singapore: *http://www.bdg.nus.edu.sg/*
25. Economic Development Board: *http://www.edb.gov.sg/edb/sg/en_uk/index.html*
26. Energy Market Authority: *http://www.ema.gov.sg/*
27. Housing Development Board :*http://www.hdb.gov.sg/*
28. Jurong Town Corporation: *http://www.jtc.gov.sg/Pages/index.aspx*
29. National Environment Agency: *http://app2.nea.gov.sg/index.aspx*
30. National University of Singapore: *http://www.nus.edu/*

J. Database management comparison chart for various countries

Country	Austria	Belgium (Flanders)	Bulgaria	Cyprus	Czech Republic	Denmark	Estonia	Finland	France	Germany	Greece	Hungary	Ireland	Italy	Latvia	Lithuania	Luxembourg	Malta	Netherlands	Poland	Portugal	Romania	Slovak Republic	Slovenia	Spain	Sweden	UK (England&Wales)	Croatia	Norway	Switzerland
1. What method do you use for energy performance certification?																														
Calculated energy performance for all building types and ages	X		X	X	-	X					X			X	X	X		-	X	X	X	X	X		-			X	X	X
Measured energy performance for all building types and ages			X		-										X			-					X		-	X				X
Method depends on the building type and/or age		X			-		X	X	X	X		X	X				X	-						X	-		X			
2. How is the database for collecting building energy performance certification data organised?																														
One nation wide database			B	C		C	B		B		C	C	B		B	C			C		C	C		B		B	B	C	C	
Regional databases	C	B												C																
Multiple databases, one for each accepted certification tool																														
Multiple databases, one for each certification method (calculated/measured)																														
No collection in database								B									B			C			B							
Other	C									B				C															M	B
3. Who is responsible for the database in your country?																														
Central, official authority			B	C		C	B		B		C	C	B	C	B	C			C		C		B	B		B	B	C	C	
Regional, official authority	C	B												C																
Private company/companies	C																							B						M
Other										B												C								C
4. How are data collected in the database?																														
Automatically reported from the accredited certification tools		B		C		C							B						C		C						B			
Reported directly from the consultant/expert/assessor			B				B		B		C	C		C	B	C			C			C	B	B		B		C		M
Central secretariat transferring data from the certificates to the database																														
Other	C									B																			C	

J. Database management comparison chart for various countries

Country	Austria	Belgium (Flanders)	Bulgaria	Cyprus	Czech Republic	Denmark	Estonia	Finland	France	Germany	Greece	Hungary	Ireland	Italy	Latvia	Lithuania	Luxembourg	Malta	Netherlands	Poland	Portugal	Romania	Slovak Republic	Slovenia	Spain	Sweden	UK (England&Wales)	Croatia	Norway	Switzerland
5. If you collect data in a database, which data do you collect?																														
All information collected during inspection (U-values, areas, efficiencies, etc), energy label		B				C					C	C	B		B	C					C	C	B	B		B	B	C		
Only energy performance, label and recommendations			C						B					C																
Energy performance	C									B																				M
Energy label												C							C											M
Only building id																														
Other	C						B			B			C			C			C										B	M
6. Quality check on data (tick all that apply)																														
Probability check on entry, e.g. acceptable value range for different parameters		C								B			C			C								B			B		C	M
Field compliance check, e.g. no text in numerical fields		C								B						C			C					B		B	B	C	B	M
Check that all requested data is available before entering the database		C	C				B		B	B			C			C			C					B		B	B		C	
All data from a certificate is rejected if crucial data is missing			C										B			C			C							B	B		C	
Generation of statistical information and cleaning of data and identifica-tion of out-of-range data after input																														
Manual cleaning of data and identification of out-of-range data after input										C														C			C			C
Other										C														C		C	C		C	C
7. Have you tried to generate a full certificate from information in the database?																														
Yes, with success													B								C					B		C	C	M
Yes, but with limited success			C			C																		B						
No	C			C			B		B	B	C	C		C	B	C			C			C					B			
8. Have you tried to use information in the database for other purposes, e.g. calculation of national saving potentials or market penetration?																														
No		B		C			B		B	B	C	C	B		B	C						C		B			B	C	B	
Yes	C		C			C								C					C		C					B				M

the buildings energy performance: C = calculated energy performance; M = measured energy performance;B = both calculated and measured energy performance under certain circumstances.

Source : Energy Performance of Building Directive, Europe

USAID ECO-III Project
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