CAPACITY BUILDING TRAINING MODULES

January 2024

PREPARATION OF MANUAL AND TEMPLATE FOR CASBEE ISKANDAR AND PROPOSAL FOR GREEN INCENTIVES IN THE MBJB AREA

Submitted by:

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CAPACITY BUILDING TRAINING MODULES FOR MBJB OFFICERS AND STAKEHOLDERS

Developing a pool of credited professionals and organisation comprises of an accreditation panel, facilitators, and certifiers among MBJB staff and others is important. This can be done by capacity building, which is an essential part of the implementation of CASBEE Iskandar in MBJB. The development of a module for capacity building can help the participant to understand the assessment processes of CASBEE Iskandar Buildings. More advanced modules are proposed based on two (2) previous training sessions conducted for the 1st and 2nd intake of the professional certification course organised by IRDA on 14-15th September 2020 and 11-12th August 2021.

1.0 Course Synopsis

The Comprehensive Assessment System for Built Environment Efficiency (CASBEE) Iskandar for Buildings is designed to evaluate the environmental performance and sustainability of newly constructed buildings. This course aims to provide participants with an in-depth understanding of CASBEE Iskandar, its scoring methodologies, and its applications in promoting low carbon, environmentally friendly and efficient building practices. Participants will learn how to assess and enhance the sustainability of buildings using the CASBEE Iskandar framework, as well as implementing sustainable strategies for improved environmental performance. The two-day course will cover various aspects of building sustainability, including energy efficiency, indoor environmental quality, resource efficiency, water conservation, and site and environmental sustainability. By combining lectures from both academics and industrial experts, practical/hands-on exercises, case studies (including field visits), and interactive workshops, this course will enhance participants' skills in conducting CASBEE Iskandar assessments and applying sustainable design principles. As a result, this course is ideal for professionals working in the fields of architecture, urban planning, engineering, construction management, and sustainability in general.

2.0 Course Objectives

At the end of this course, participants will be able to:

1. Explain key principles, concepts and assessment processes of CASBEE Iskandar Buildings.

2. Use assessment criteria and indicators of CASBEE Iskandar for evaluating the environmental performance of buildings.
3. Collect, analyse and evaluate relevant building data based on the CASBEE Iskandar assessment template.
4. Propose strategies for improving building sustainability and efficiency based on CASBEE Iskandar assessment results.

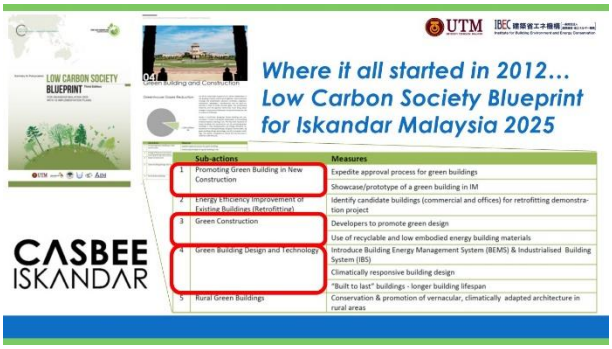
3.0 Course Modules

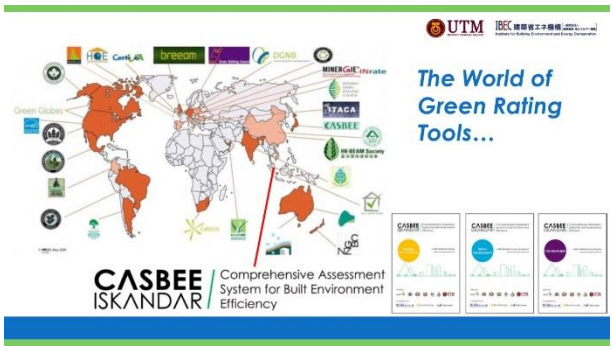
Based on the CASBEE Iskandar Manual and template, the two-day modules cover eight (8) topics, described as follows:

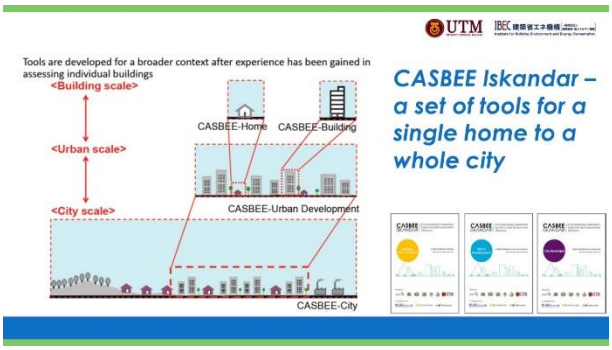
Day	Modules and Descriptions
1	Module 1 Introduction and Overview of CASBEE Iskandar: history, development, and key features and principles of CASBEE, CASBEE importance in in sustainable building, comparison with other green building rating systems, CASBEE Iskandar assessment framework (categories, criteria and sub criteria) on Quality (Q) and Load (LR), scoring methodology (rating and weighting factors), International applications of CASBEE in different countries, and examples of CASBEE Iskandar assessed buildings. Module 2 Environmental Loading Reduction (LR) (Energy): it focuses on energy efficiency and conservation covering energy performance assessment in CASBEE, design considerations for energy-efficient buildings, natural energy utilisation, control of heat load on the outer surface of buildings, efficiency in building services, and its operation. Module 3 Environmental Loading Reduction (LR) (Water): it focuses on water conservation and management assessment, sustainable water use and conservation practices and strategies via e.g., the use of grey water and rain water. Module 4 Environmental Loading Reduction (LR) (Resources and Materials): it focuses on the implementation of resource-efficient technologies and materials via waste management, recycling strategies, and sustainable material resources, covering its assessment criteria, reduction of use of non-renewable resources (promoting 3Rs- Reduce, Reuse, and Recycle), timber from sustainable forestry, efforts to promote the reusability of materials, recyclable from

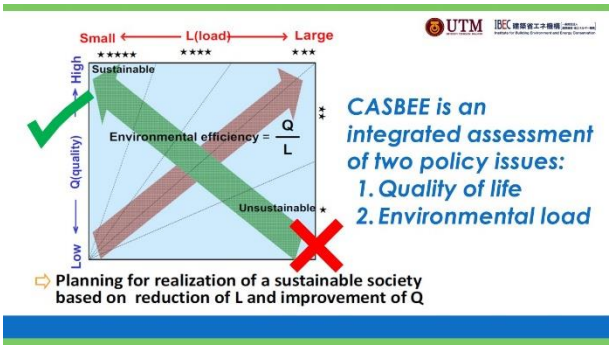
	demolition, use of regional/local resources, use of materials without harmful substances, and elimination/reduction of CFCs and halons
2	Module 5 Quality (Q) (Indoor Environment):it focuses on indoor environment quality of buildings covering criteria for assessing indoor environmental quality, thermal comfort, ventilation, and natural lighting considerations indoor air quality management and low-emitting materials, acoustic comfort and noise reduction strategies. Module 6 Quality (Q) (Services): it focuses on serviceability. It covers service functions of the building for the functionality and usability of its spaces and, in a more positive sense, how pleasant and comfortable it is. Also, aspects of durability, reliability, flexibility, adaptability and daily maintenance of buildings are also taken into consideration. Module 7 Quality (Q) (Outdoor/On Site Environment): it focuses on preservation and creation of biotope, biodiversity conservation, ecological design principles, townscape and landscape, local characteristics and outdoor amenities, and lastly pre-construction and pre completion consideration. Among others, the following are some aspects that will be taken into consideration in this module: use of green space to enhance landscape quality, quality of green space, use of local material to enhance landscape, integration with surrounding landscape through positioning and design of the building, improvement of the thermal environment on site, and local character and improvement of comfort (including crime prevention and participation of building users) Module 8 Hands on Training: CASBEE hands-on exercises for conducting a CASBEE assessment will be provided where groups of participants will evaluate a building's sustainability using CASBEE assessment framework. Presentations of final projects and sharing of key learnings and recommendations are also required.

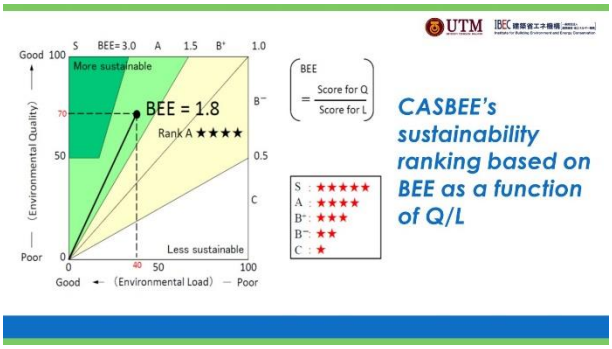
3.1 Module 1 : Introduction and Overview of CASBEE Iskandar



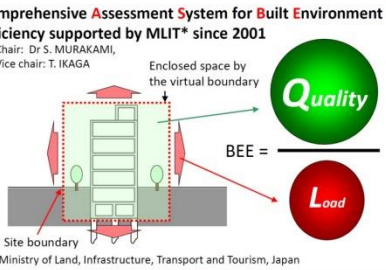








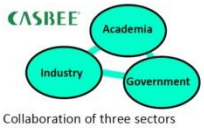
CASBEE's sustainability ranking based on BEE as a function of Q/L



Tracing its root… CASBEE in Japan, where it started…

Development Body of CASBEE

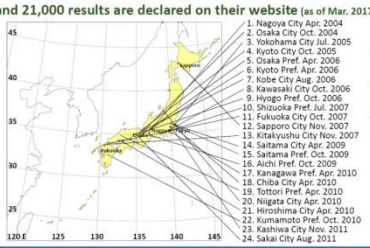
The JSBC, founded in 2001, is constituted of major building- & construction-related organizations from Academia, Industry and Government under the auspice of the Ministry of Land, Infrastructure, Transport and Tourism.



Collaboration of three sectors
Japan Sustainable Building Consortium (JSBC)

Tracing its root… CASBEE in Japan, where it started…

CASBEEs are adopted by 24 authorities for building control and 21,000 results are declared on their website (as of Mar. 2017)



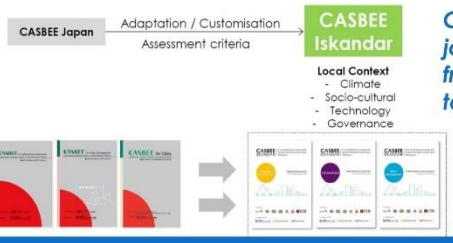
Tracing its root… CASBEE in Japan, growing rapidly

CASBEE Accredited Assessor Registration

1. CASBEE Accredited Assessor for Housing
   1) Objective: Foster and accredit competent assessors exclusively for CASBEE-Home
   2) Course and Test: Twice a year, organized by IBEC
   3) Eligibility: First- and second-class architects, and architects for wooden buildings
   4) Number of registrants: 6,800 (as of Dec. 2013)
2. CASBEE Accredited Assessor for Buildings
   1) Objective: Foster and accredit competent assessors of CASBEE-NC, EB, and RN
   2) Course and Test: Twice a year, organized by IBEC
   3) Eligibility: First-class architects
   4) Number of registrants: 7,100 (as of Dec. 2013)

Tracing its root… CASBEE in Japan, well-established tool

CASBEE : PILOT PROJECT



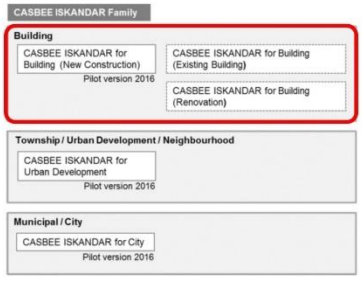
CASBEE's journey from Japan to Malaysia

CASBEE Iskandar Technical Manual Pilot Version 2016

Prepared by:
Iskandar Regional Development Authority (IRDA)
Majlis Bandaraya Johor Bahru (MBJB)
Majlis Perbandaran Johor Bahru Tengah (MPJBT)
Majlis Perbandaran Pasir Gudang (MPPG)
Majlis Perbandaran Kulai (MPKu)
Majlis Daerah Pontian (MDP)
Universiti Teknologi Malaysia (UTM)

In Collaboration with:
Institute for Building Environment and Energy Conservation (IBEC)
Keio University
HOSEI University
*: Comprehensive Assessment System for Built Environment Efficiency

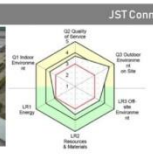
CASBEE Iskandar is developed… FIRST in the world outside of Japan!



Today's training: CASBEE Iskandar for Building

A glimpse of past CASBEE Iskandar assessed buildings

JST Connectors (M) Sdn Bhd



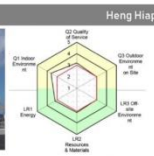
BEE = 1.8

S : ★★★★★ A : ★★★★ B+: ★★★
B-: ★★ C : ★

- Electrical and electronic (E&E) industry plant located at Port of Tanjung Pelepas (PTP)
- Strong features on green roof, green wall, rain water harvesting and day lighting

A glimpse of past CASBEE Iskandar assessed buildings

Heng Hiap Industries Sdn Bhd



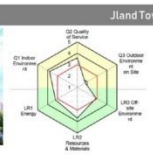
BEE = 1.2

S : ★★★★★ A : ★★★★ B+: ★★★
B-: ★★ C : ★

- Newly built plastic wastes recycling industry factory located in Pasir Gudang.
- Strong features in day lighting harnessing and various energy saving and environmental friendly technology

A glimpse of past CASBEE Iskandar assessed buildings

Jland Tower, Komtar JBCC



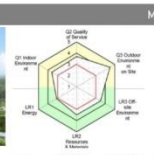
BEE = 1.8

S : ★★★★★ A : ★★★★ B+: ★★★
B-: ★★ C : ★

- 30-storey office tower (assessed from level 8 up of Komtar JBCC)
- Awarded GBI Gold Certification for green building

A glimpse of past CASBEE Iskandar assessed buildings

Molek Pine 4



BEE = 1.8

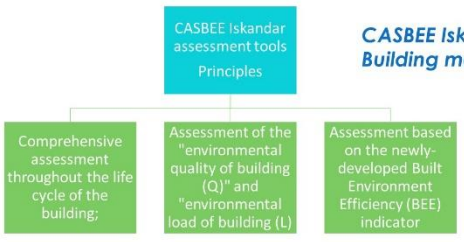
S : ★★★★★ A : ★★★★ B+: ★★★
B-: ★★ C : ★

- 37-storey condominium (260 units), 3-storey clubhouse, 1-storey multipurpose hall, a semi basement car park
- Overall site planning aims to minimise the heat island effect while achieving the lush green ambience effect

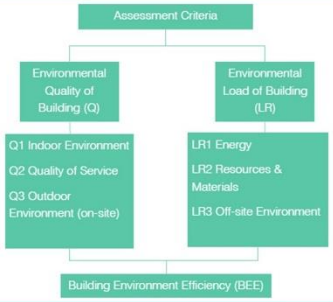
Recent CASBEE Iskandar assessed buildings – Johor Port Authority Building

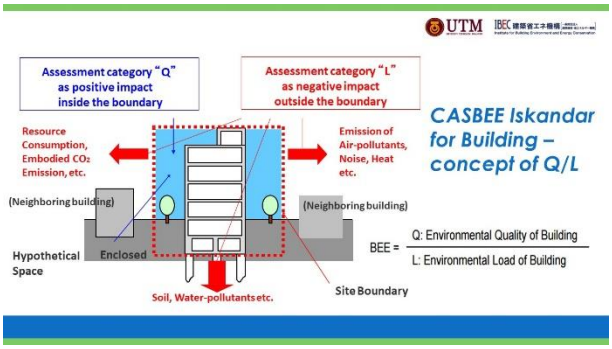
Recent CASBEE Iskandar assessed buildings – Nong Chik Mosque

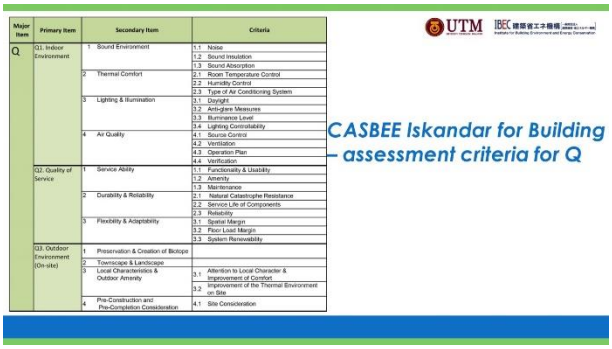
CASBEE Iskandar for Building methodology



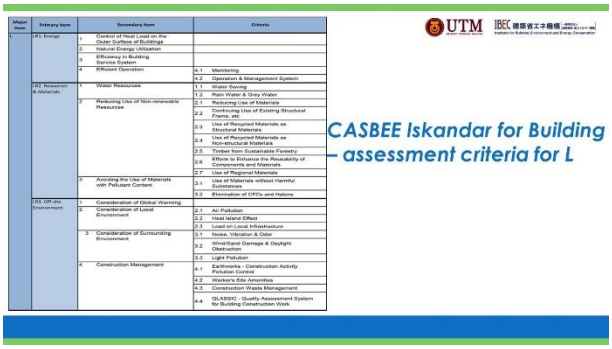
CASBEE Iskandar for Building – assessment criteria



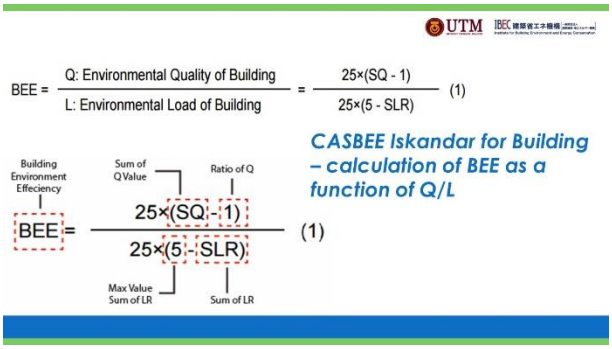


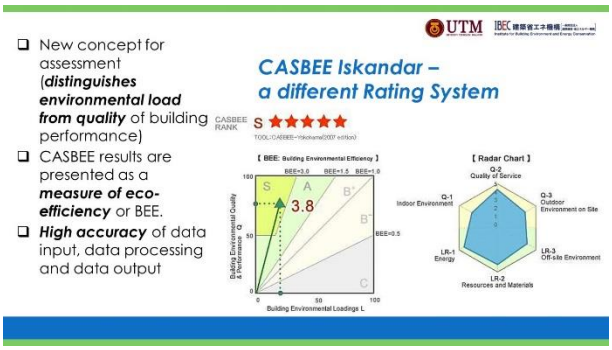


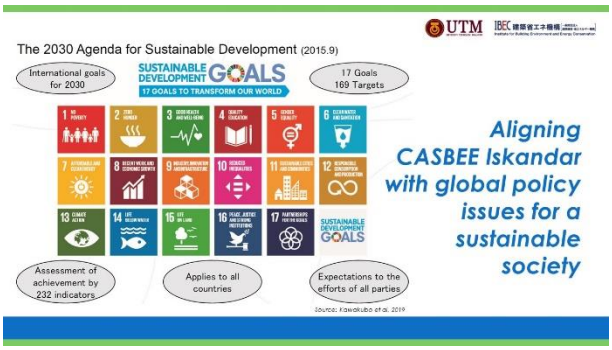
Major Item	Primary Item	Secondary Item	Criteria
Q	Q1: Indoor Environment	1 Sound Environment	1.1 Noise
			1.2 Sound Insulation
			1.3 Sound Absorption
		2 Thermal Comfort	2.1 Room Temperature Control
			2.2 Humidity Control
			2.3 Type of Air Conditioning System
		3 Lighting & Illumination	3.1 Daylight
			3.2 Anti-glare Measures
			3.3 Illuminance Level
			3.4 Lighting Controllability
		4 Air Quality	4.1 Source Control
			4.2 Ventilation
			4.3 Operation Plan
			4.4 Verification
	Q2: Quality of Service	1 Service Ability	1.1 Functionality & Usability
			1.2 Amenity
			1.3 Maintenance
		2 Durability & Reliability	2.1 Natural Catastrophe Resistance
			2.2 Service Life of Components
			2.3 Reliability
		3 Flexibility & Adaptability	3.1 Spatial Margin
			3.2 Floor Load Margin
			3.3 System Renewability
	Q3: Outdoor Environment (On-site)	1 Preservation & Creation of Biotope	
		2 Townscape & Landscape	
		3 Local Characteristics & Outdoor Amenity	3.1 Attention to Local Character & Improvement of Comfort
			3.2 Improvement of the Thermal Environment on Site
		4 Pre-Construction and Pre-Completion Consideration	4.1 Site Consideration

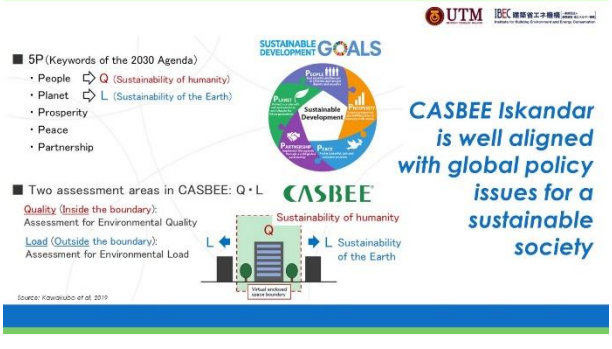


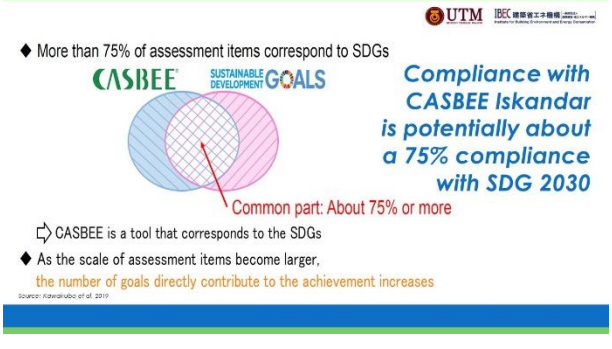
Major Item	Primary Item	Secondary Item	Criteria
L	L1: Energy	1 Control of Heat Load on the Outer Surface of Buildings	
		2 Natural Energy Utilization	
		3 Efficiency in Building Service System	
		4 Efficient Operation	4.1 Monitoring
			4.2 Operation & Management System
	L2: Resources & Materials	1 Water Resources	1.1 Water Saving
			1.2 Rain Water & Grey Water
		2 Reducing Use of Non-renewable Resources	2.1 Reducing Use of Materials
			2.2 Continuing Use of Existing Structural Frame, etc.
			2.3 Use of Recycled Materials as Structural Materials
			2.4 Use of Recycled Materials as Non-structural Materials
			2.5 Timber from Sustainable Forestry
			2.6 Efforts to Enhance the Reusability of Components and Materials
			2.7 Use of Regional Materials
		3 Avoiding the Use of Materials with Pollutant Content	3.1 Use of Materials without Harmful Substances
			3.2 Elimination of CFCs and Halons
	L3: Off-site Environment	1 Consideration of Global Warming	
		2 Consideration of Local Environment	2.1 Air Pollution
			2.2 Heat Island Effect
			2.3 Load on Local Infrastructure
		3 Consideration of Surrounding Environment	3.1 Noise, Vibration & Odor
			3.2 Wind/Sand Damage & Daylight Obstruction
			3.3 Light Pollution
		4 Construction Management	4.1 Earthworks - Construction Activity Pollution Control
			4.2 Worker's Site Amenities
			4.3 Construction Waste Management
			4.4 CLASBEC - Quality Assessment System for Building Construction Work



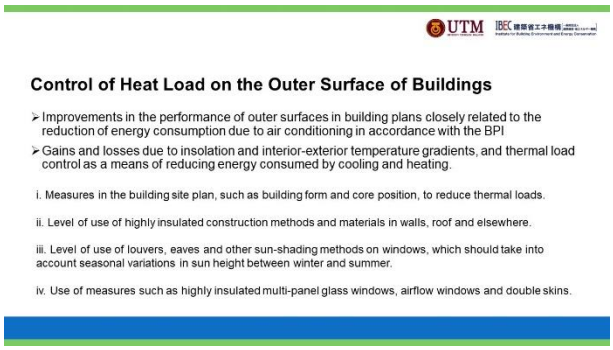


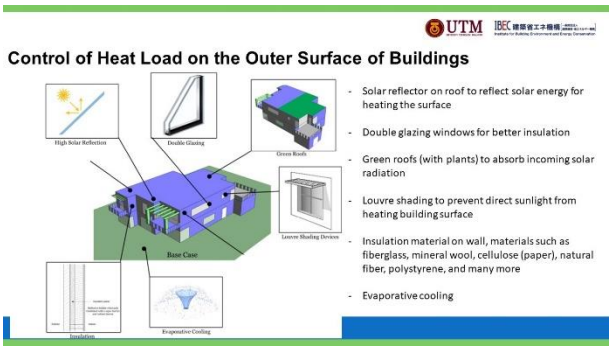






3.2 Module 2 : Environmental Loading Reduction (LR) (Energy)



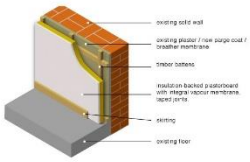


Green Roofs

Louvre Shading

Evaporative Cooling

Wall Insulation



Natural Energy Utilization

❖ Natural Energy that is directly used as energy, without the use of mechanical force, as in the use of daylight and natural air movement and ventilation

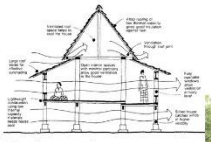
- **Natural Lighting**

Light Shelves

Window

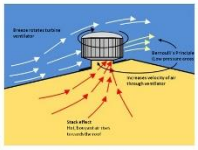
Natural Energy Utilization

- **Natural Air Ventilation**



Allow air movement through passive design

Induce air movement using wind turbine



Natural Energy Utilization - Scoring

❖ Common Building

Entire Building and Common Properties

Score	Off,Sch(Univ., etc), Ret,Rut,Hot,Hsp,Htl,Fct	Note
Level 1	(No corresponding level)	Exclude usage in production rooms in Factory. Factories with only production area are not applicable. (Select "N.A." in the effort to be evaluated, below)
Level 2	(No corresponding level)	
Level 3	No measures of the assessment criteria are implemented. Although some methods are used, their effectiveness, however, has not been examined.	
Level 4	In some of the methods used as part of the efforts subject to the assessment, their effectiveness has been confirmed. (excluding monument design)	
Level 5	Same as level 4 and direct energy usage of 15 MJ/m²·yr or more	

❖ Residential

Entire Building and Common Properties

Score	Sch(ES/JHS/HS),Apt
Level 1	(No corresponding level)
Level 2	Natural lighting and ventilation do not meet level 3.
Level 3	Nearly all private areas (at least 80%) of classrooms or apartments face exterior walls on two sides, ensuring effective natural lighting and ventilation.
Level 4	In addition to the above, building measures, such as ventilation voids, have been used to enhance efficacy. They influence a majority (50% or more) of the building.
Level 5	The above building measures cover at least 80% of the building

Natural Energy Utilization - Scoring

❖ Natural Lighting

Use of natural light - Light shelf installation sample

(1) Building outline Building
type: Hall
Total floor space: 10,000 m²

Light shelf installation area: 1,000 m²

(2) Calculation conditions
- Through general-purpose simulations, confirming that floor illuminance of more than 200 lx (9 W/m²) can be secured in the daytime of a sunny day.
- Effective period: 5 h, Number of effective days: 245 days/year
- Assuming that the sunny day rate is 60%.

(3) Calculating the use of natural energy

- Calculation of the annual direct use
1,000 [m²] x 0.006 [kW/m²] x 9.76 [MJ/kWh]* x 5 [h] x 245 [Day/year] x 60 [%] ≒ 43.0 [GJ/year]

- Calculation of the use of natural energy
43.0 [GJ/year] ÷ 10,000 [Total Floor m²] ≒ 4.3 [MJ/m²-year]

Efficiency in Building Service System

❖Increased efficiency of building service systems is carried out by obtaining the Building Energy Index (BEI) value based on the primary energy consumption of the entire service system

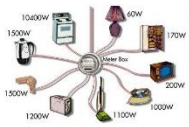
- ❖ prescribed in the 2013 energy conservation standards, or
- ❖ the Building Energy Index for Model Building Method (BEIm), a standard for the primary energy consumption of the entire building based on the Model Building Method.

❖Three method of assessment

- ❖ Assessment Based on the Primary Energy Consumption (Buildings)
- ❖ Assessment based on BEIm of the Model Building Method
- ❖ Assessment Based on the Primary Energy Consumption (Apartments)

Efficiency in Building Demand Side

Appliances	Power (W)	Yearly operating hours (h)
Refrigerator	73	5,840
Rice cooker	550	263
Water heater	2,000	168
Washing machine	360	378
Dryer	90	27
Iron	1,200	186
Fan	95	4,067
Television	80	2,334
Radio	20	839
Air conditioner night time (1 hp)	900	1,207
Air conditioner day time (1.5 hp)	1,210	603
Lighting	40	2,046
Vacuum cleaner	1,200	89
Computers	120	703



- Include not just appliances but large devices such as ventilation system, elevator, water supply, etc

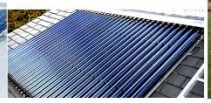
Energy Efficiency Star Rating

❖The **star rating** ranges from 2-**star** to 5-**star**, with 2-**star** representing minimal efficiency and maximum efficiency represented by the 5-**star** label

Efficiency in Building Supply Side

- Generating green energy for consumption can substitute non-renewable energy

- Solar PV to generate electricity



- Solar thermal to generate hot water

- Biogas for cooking purposes

Efficiency in Building Others

- Movement sensors to control indoor lighting

- Photo sensors to control outdoor lighting

- Building Automation system to control overall usage of energy in building

Efficiency in Building Service System

❖Air Conditioning

Air conditioning equipment	Air conditioner conveyance ATF	Amount of heat carried/energy consumed by fan (based on secondary energy)
	Total enthalpy heat exchange effect	Amount of heat reduced, amount of energy
	Cooling effect by external air	Amount of heat reduced, amount of energy
	Multi-COP assessment for buildings	Efficiency in multi-split A/C system

❖Ventilation

Ventilation equipment	Assessment of variable air volume control	

❖Lighting

Lighting equipment	Assessment of various types of control	Amount of energy saved by the use of daylight, occupant sensors, etc.

Efficiency in Building Service System

❖Hot Water Supply

Hot water supply equipment	Heat source machine COP assessment	Amount of generated heat/energy consumed by the heat source (based on primary energy)
	COP assessment of heat source systems	Amount of generated heat/energy consumed by the heat source and related equipment (based on primary energy)
	Heating medium transmission WTF	Amount of heat carried/energy consumed by pump (based on secondary energy)

❖Elevator

Elevator	Individual control operation effect	Reduced energy

Operating and Management System

❖Operating and management refers to the afford by building owner in managing their energy consumption through various initiatives such as energy policy, energy monitoring, energy reporting, etc.

Entire Building and Common Properties	
Score	Off,Sch,Rtl,Rst,Hal,Hsp,Htl,Fct
Level 1	No operation and management has been planned.
Level 2	Organizations, systems or management policies have been planned for operation and management.
Level 3	In addition to level 2, there must be an organized operation and management system, designated manager.
Level 4	In addition to level 3, target values for energy consumption in the whole buildings have been planned and presented to the building owner, based on calculation of annual energy consumption.
Level 5	In addition to level 4, there must be regular verification of equipment performance during building operation, with specific actions planned for repair of malfunctions etc. (commissioning system)

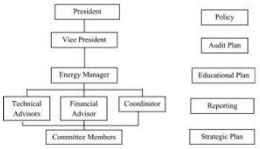
Energy Policy

❖**Energy policy** is the manner in which a given entity (often governmental) has decided to address issues of **energy** development including **energy** production, distribution and consumption.

Energy Management Committee

❖The Energy Management Committee is composed of energy practitioners who work to improve energy efficiency and procurement – including the procurement of renewable and alternative energy. Energy practitioners address issues that affect the management of energy consumption as a retail operational expense and performance related to efficiency, emissions, and/or renewable energy that may be framed by a sustainability goal.

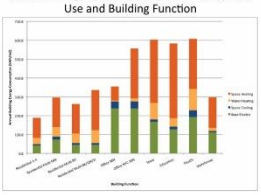
Energy Management Program



Energy Reporting

❖Report of energy consumption is periodically presented to the building owner

Annual Energy Consumption Intensities by End Use and Building Function

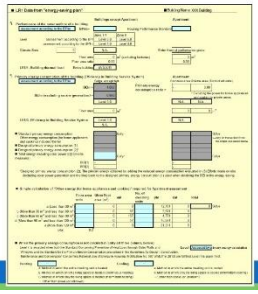


Audit and Verification

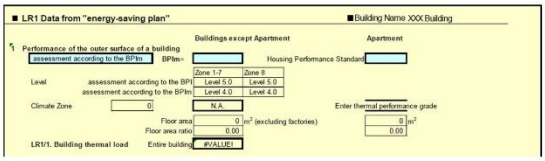
❖Audit and verification, and maintenance of equipment performance are done periodically

❖Audit can measure current performance of equipment is they still within spec and expected performance

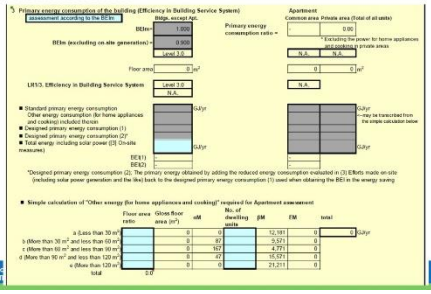
Energy Calculation Sheet



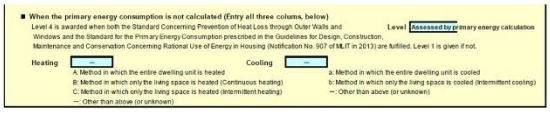
Energy Calculation Sheet



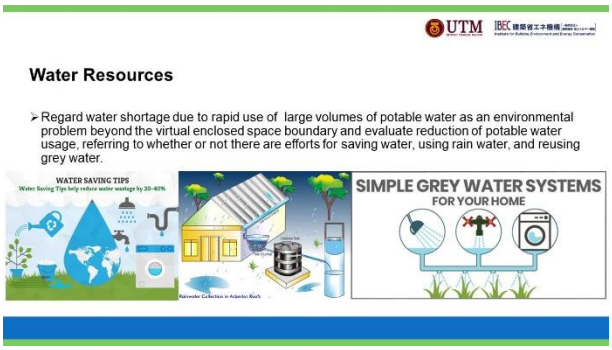
Energy Calculation Sheet

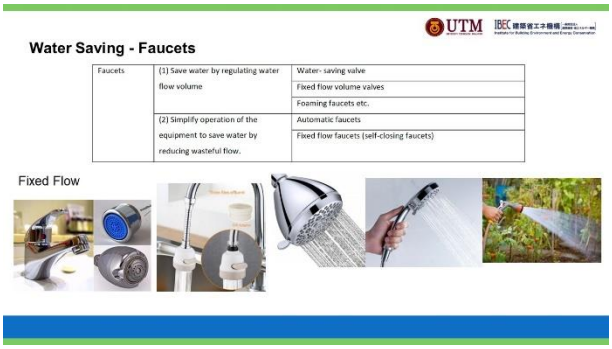


Energy Calculation Sheet



3.3 Module 3 : Environmental Loading Reduction (LR2) (Water)





Water Saving - Faucets

Faucets	(1) Save water by regulating water flow volume	Water- saving valve
		Fixed flow volume valves
		Foaming faucets etc.
	(2) Simplify operation of the equipment to save water by reducing wasteful flow.	Automatic faucets
		Fixed flow faucets (self-closing faucets)

Automatic/Self Closing

Water Saving - Toilets

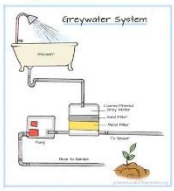
Water-saving toilets	(1) Toilet bowls (Approx. 6 L/use)	Water saving appliances (Improvements to water supply routes and bowl and trap shapes secure waste evacuation performance while saving water).
		Water saving flush valves (Continuous flush prevention mechanism, with regulatable discharge volume).
	(2) Urinals (Approx. 4 L/use)	Flushing in response to usage, with user sensor.
		Fixed-time control system (Combination with lighting, fan switch linkage and 24-hour timers).

Toilet bowls

Grey Water Use System

❖the relatively clean waste water from baths, sinks, washing machines, and other kitchen appliances.

Entire Building and Common Properties	
Score	Off,Sch,RtI,Rst,Hal,Hsp,HtI,Fct,Apt
Level 3	No systems for using grey water
Level 4	Grey water is used
Level 5	More than two type of waste water are used



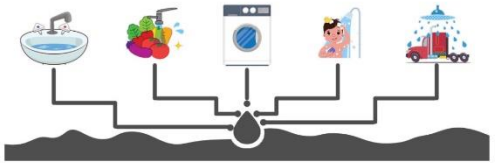
What is greywater?

Clean Water
Springs, wells, purified water, city water, rain water

Greywater
Used water without toxic chemicals and/or excrement

Blackwater
Contaminated water with toxic chemicals and/or excrement

Grey Water Source



❖Grey water source can come from sink, shower, laundry water, washing and cleaning purposes

Rain Water Use System

❖Harvest rain water for daily usage.

❖**Rainwater harvesting** system, also called **rainwater** collection system or **rainwater catchment** system

❖technology that collects and stores **rainwater** for human use.

❖**Rainwater harvesting** systems range from simple **rain** barrels to more elaborate structures with pumps, tanks, and purification systems.

Entire Building and Common Properties	
Score	Off,Sch,RtI,Rst,Hal,Hsp,HtI,Fct,Apt
Level 3	No systems for using rain water
Level 4	Rain water is used
Level 5	Rain water usage rate at least 20%

$$\text{Rain water usage rate} = \frac{\text{Rain water use } (m^3)}{\text{Potable water use } (m^3) + \text{Rain water use } (m^3) + \text{Waste water use } (m^3)}$$

Waste water use (m3) = grey water use (m3) + sewage water use (m3) + industrial water use (m3)

Rain Water Use System

Water Butt
Water collects in the container from drain pipes and/or natural rainfall, and is mainly used for the watering of garden plants.

Direct-Pumped
The pump is located within the underground tank or surface and harvested water is simply pumped directly to the WCs or other appliances.

Indirect Gravity
This type of system differs in that the harvested water is first pumped to a high level tank (header tank), then allowed to supply the outlets by gravity alone.

Indirect Pumped
This arrangement is similar to the above, except that the internal tank can be at any level in the building, as it does not rely on gravity to supply the outlets.

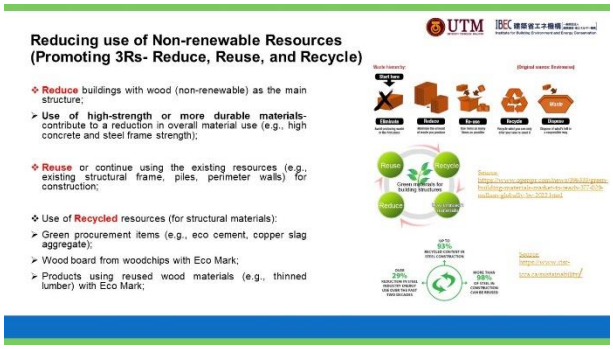
Gravity Only
With this arrangement, rainwater is collected from a part of the roof which has gutters above the filter and collection tank which are in turn above all the outlets.

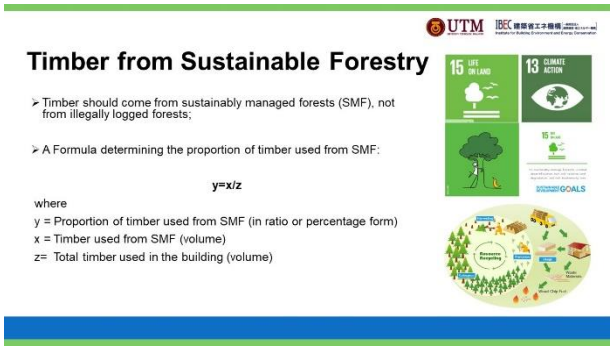
Type of Rain Water Harvesting System

END OF MODULE

Environmental Loading Reduction (LR2) - Water Resources

3.4 Module 4 : Environmental Loading Reduction (LR) (Resources and Materials)





Efforts to promote the reusability of materials, recyclable from demolition

- Recyclable materials from demolition are used either for structural (e.g., cement, wood, processed lumber) or non-structural component (e.g., floor finishing and roofs)

- How efforts are to be evaluated?
- Finishing materials can be separated, removed separately;
- Structural materials and their units can be disassembled easily;
- Interior finishes and equipment are not entangled

Examples of easy separation: structural frames, light steel

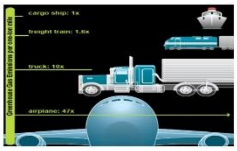
Examples of difficult separation: Mortar and tile/plastered walls

Use of Regional/Local Materials

- Encourage the **use of materials and products that are extracted, harvested, and manufactured within the region (locally);** it reduces the environmental impacts resulting from transportation (e.g., high GHG emissions);

- CASBEE measurement on the regional resources consumption is based on the **costs/value of those local resources of the total material value;**

- Note mechanical, electrical and plumbing components shall not be assessed; **only the materials permanently installed in the project are included**

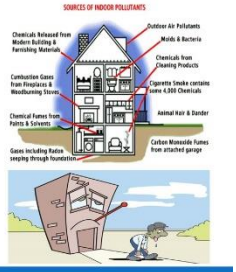


Use of Materials Without Harmful Substances

- **Reduce building materials that are made of (harmful) chemical substances;**
- Chemicals may affect interior air quality and also the overall environment;
- Chemicals may have a harmful effect on human health and cause problems, such as sick house syndrome;
- Follow the **ISO 91: Construction Materials and Building**, a NGO organisation from Switzerland

(Department of Standards Malaysia, under MITI is also a member of this)

Harmful chemical substances include: finishes or paints or materials may **release Lead, CO, SO2, NO2, O3, Radon, formaldehyde and many more**



Elimination of CFCs and Halons

- Both **CFCs** and **Halons** cause depletion of atmospheric ozone;

- In the construction field, such chemical substances have been used frequently as (i) **flame retardants;** (ii) **foaming agents (insulation materials);** and (iii) **refrigerants;**

- In Japan, it only allows the use of **low ozone-depleting potential (ODP) CFCs and halons;**

- In the CASBEE system, both CFCs and halons are measured by their **ODP** and **GWP;**

- The lower the ODP (even zero) and GWP, the better!

Gas	Atmospheric Lifetime (years)	Global Emissions in 2016 (kt/yr)*	Ozone Depletion Potential (ODP)*	Global Warming Potential (GWP)*
Halogen Source Gases				
Chlorine Gases				
CFC-11 (CCl_3F)	52	61 – 84	1	5160
Carbon tetrachloride (CCl_4)	37	29 – 50	0.87	2110
CFC-113 (CCl_2FCClF_2)	93	3 – 13	0.85	6080
CFC-12 (CCl_2F_2)	102	13 – 57	0.73	10300
Methyl chloroform (CH_3CCl_3)	5.0	0 – 4	0.14	153
HCFC-141b (CH_3CCl_2F)	9.4	22 – 66	0.102	800
HCFC-142b (CH_3CClF_2)	18	20 – 29	0.057	2070
HCFC-22 (CHF_2Cl)	12	321 – 424	0.034	1780
Methyl chloride (CH_3Cl)	0.9	4539 – 4873	0.015	4.5
Bromine Gases				
Halon-1301 ($CBrF_3$)	65	1 – 2	15.2	6670
Halon-1211 ($CBrClF_2$)	16	1 – 5	6.9	1750
Methyl bromide (CH_3Br)	0.8	121 – 182	0.57	2
Hydrofluorocarbons (HFCs)				
HFC-23 (CHF_3)	228	12 – 13	0	12990
HFC-143a (CH_3CF_3)	51	29 – 30	0	5080
HFC-125 (CHF_2CF_3)	30	58 – 67	0	3450
HFC-134a (CH_2FCF_3)	14	202 – 245	0	1360
HFC-32 (CH_2F_2)	5.4	21 – 39	0	705
HFC-152a (CH_3CHF_2)	1.6	45 – 82	0	148
HFO-1234yf ($CF_3CF=CH_2$)	0.03	not available	0	less than 1

Fire Retardant

- Note buildings that have no fire-extinguishing equipment or have sprinklers only and those having no gas fire extinguishing facilities are excluded from the assessment;
- A foam extinguisher is also excluded from the assessment;
- A table showing the CASBEE Iskandar Fire Retardant Scoring System

Score	Description
Level 1	Halon flame retardants with high ODP/GWP are used
Level 2	Halogenated flame retardants are used
Level 3	No corresponding level
Level 4	Flame retardants with 0 ODP and less than 50 GWP are used
Level 5	No corresponding level

Foaming Agents (Insulation Materials)

- Expanded plastic materials (e.g., polyurethane, polystyrene and polyethylene) used as insulation materials contain foaming agents (CFCs and HCFs);
- Those materials have their own ODP and GWP;

Polyurethane foam (as thermal insulation)

A table showing the CASBEE Iskandar Foaming Agents Scoring System

Polystyrene foam (Styrofoam)

Polyethylene foam (as sound insulation)

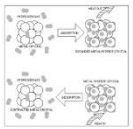
Score	Description
Level 1	Insulation foaming materials with ODP= 0.2 or above are used
Level 2	Insulation foaming materials with ODP= 0.01-0.2 are used
Level 3	Insulation foaming materials with ODP= 0-0.01 are used
Level 4	Insulation foaming materials with ODP less than 0.01 and GWP less than 50
Level 5	Insulation foaming materials with 0 ODP and GWP value of 1 or less

Refrigerants

- Exclude from assessment if no refrigerant gases are used;

- The most common refrigerants include Chlorofluorocarbons (CFCs), Hydrochloroflu orocarbons (HCFCs, Hydrofluorocarbons (HFCs), and Natural Refrigerants (CO2 and hydrocarbons, such as ammonia, propane and butane);

- New chilling systems (Metal Hydride) are those using hydrogen-occluded (MH alloy) that absorb heat and release hydrogen;
- Hydrogen (H2) as refrigerants



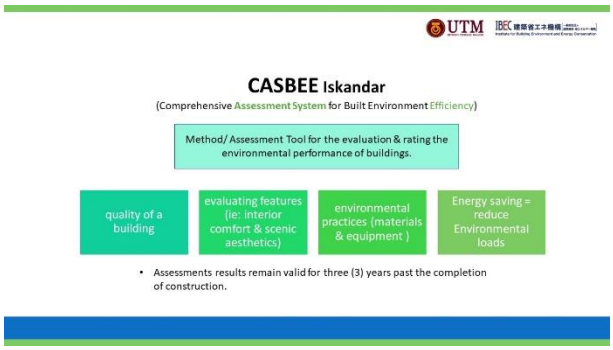
A table showing the CASBEE Iskandar Foaming Agents Scoring System

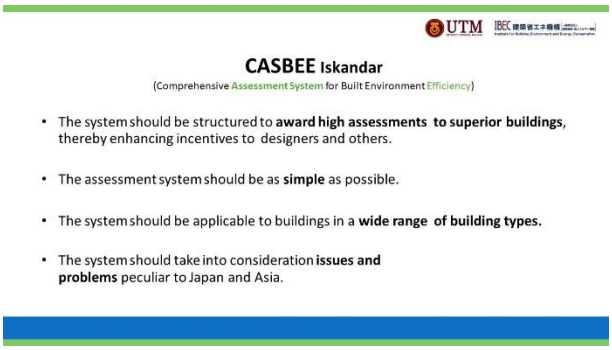
Score	Description
Level 1	No corresponding level
Level 2	HCFC is used as the refrigerant
Level 3	Refrigerant of ODP= 0 is used
Level 4	Natural refrigerants and new chilling systems (ODP = 0) with GWP less than 50 are used
Level 5	No corresponding level

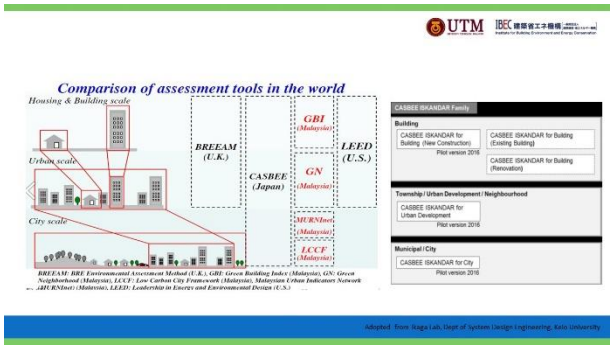
END OF THE MODULE

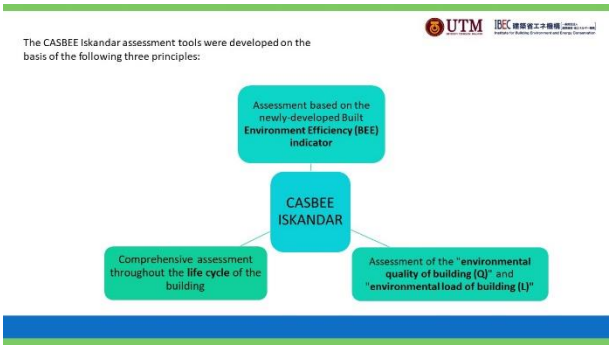
Environmental Load Reduction (LR2) - Resources & Materials

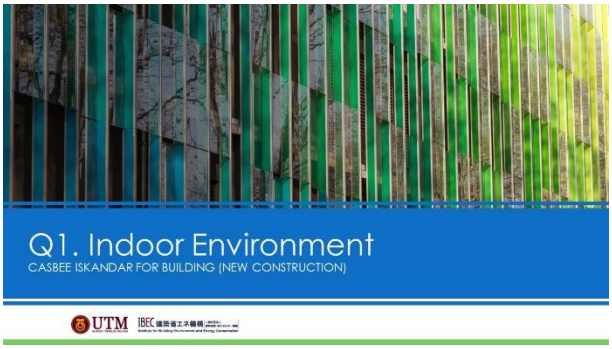
3.5 Module 5 : Quality (Q) (Indoor Environment)









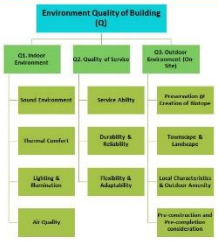


Q1. Indoor Environment

CASBEE ISKANDAR FOR BUILDING (NEW CONSTRUCTION)

UTM IBEC

Environment Quality of Building



AIM:

1. **Simplified the technical evaluation** in target value for Heat, illuminance and noise performance at design & construction stage
2. System of operations, management, monitoring and control are evaluated **as efforts** to improve environmental performance

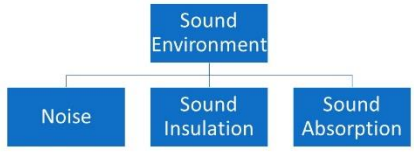
UTM IBEC

Q1.1 SOUND ENVIRONMENT

CASBEE ISKANDAR FOR BUILDING (NEW CONSTRUCTION)

UTM IBEC

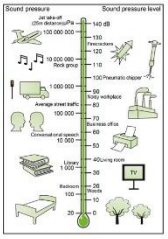
UTM IBEC



- Assessment carried out regarding the level of background noise closely related to:
- **Level of comfort and ease of operation**
- **Level of sound insulation – prevent intrusion of noise**
- **Level of sound absorption – prevent echo**

Q1.1.1 Noise

- Noise measurement is conducted in the room with the largest opening.
- Measure noise levels with no sound generated from TV sets or voices.
- Measure noise levels with the AC system in operation.
- A standard sound level meter can be used for steady noise
- assessment criteria differ between outpatient waiting rooms and medical examining rooms.
- For School (primary / secondary), evaluate classrooms only.
- Refer MS1525 (Non-Residential) & MS2680(Residential)

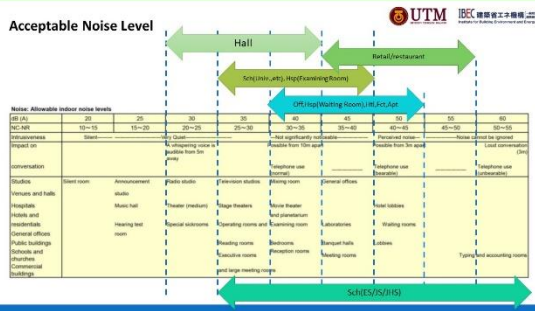


Sound Level Meter

UTM IBEC

UTM IBEC

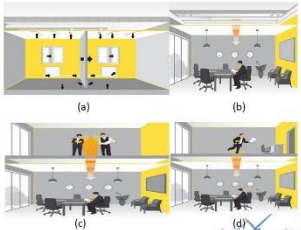
Acceptable Noise Level



Q1.1.2 Sound Insulation

- Sound Proof refer to the overall ability of a building element or building structure to reduce the sound transmission through it
- 2 types of sound insulation: airborne sound insulation and impact sound insulation

a) room to room insulation (combine a sound insulating suspended ceiling with partitions)
b) One-way sound insulation (Suspended acoustic ceilings)
c) Vertical airborne sound insulation (air gap)
d) Impact sound insulation (suspended ceiling)



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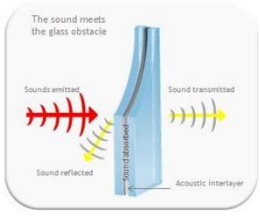
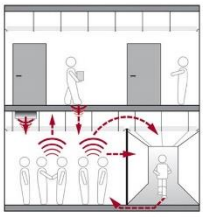


SOUND INSULATION

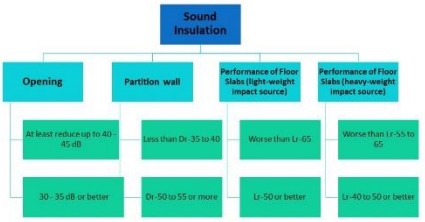
- Evaluate sound insulation of building openings based on the **performance levels of sash windows** and other fixtures.
- The higher the performance, the more effective it is in preventing propagation of external noise (e.g. sound of traffic).
- In cases where multiple openings exist, evaluate **based on the lowest performance level**.
- Exclude if the evaluated room has absolutely no openings.

- For Partition sound insulation, evaluate levels of sound insulation between rooms.
- not applicable to open spaces (ie: retail with open spaces, open meeting hall)
- For Meeting hall, higher sound insulation performance is required for partition walls in these buildings than in other general-use buildings.

- lightweight impact sounds include chairs being dragged over the floor or hard lightweight objects (e.g. spoons, forks) dropped on the floor.
- Heavy impact sounds include noise generated in the room(s) by vibration from the floor above, due to a heavy but soft impact (e.g. child jumping). – *difficult to solve by changing floor material*
- Basic characteristics of lightweight & heavy impact sound insulation depend on the floor structure
- Elasticity of the flooring materials significantly affects performance level.

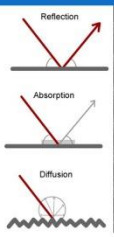


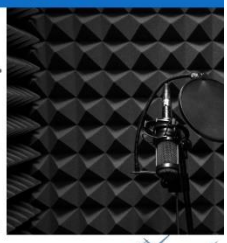
(Quietstone, 2020)



Q1.1.3 Sound Absorption

- In assessing the sound absorption performance, evaluate levels of sound absorption of a room which includes the **interior finish materials**.
- The higher the level of in-room sound absorption, the more effective reverberation control is, so that a conversation can be easily carried out without voices being raised.
- Furthermore, noise propagated into or generated within the room is also attenuated, thereby improving the acoustic environment.





An average rate of in-room sound absorption can be obtained based on the absorption rate of finishing materials.

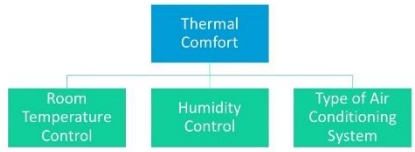
In this assessment, however, simply evaluate whether sound absorbing materials are used in walls, floor or ceiling

Walls: the total area which is covered with sound absorbing materials of all four walls account for more than 70% of the area of the largest wall.

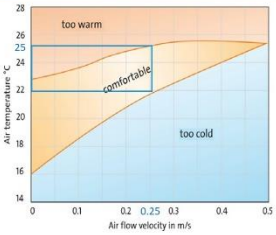
Ceiling and floor: at least 70% of the area is covered with sound absorbing materials

Q1.2 THERMAL COMFORT

CASBEE ISKANDAR FOR BUILDING (NEW CONSTRUCTION)



Q1.2.1 Room Temperature Control



- Room temperature is one of the most representative indicators for an indoor thermal environment.
- As such, characteristics of an indoor thermal environment are determined largely by temperature settings for the room.
- In this assessment, evaluate the capacity of the air conditioning equipment to maintain comfortable room temperature levels under peak load conditions.

Ideal room temperature: 22˚C - 25˚C (*****)
26˚C - 28˚C (***)
>28 ˚C (*)

(Jae9306, 2015)

What is Building Envelope ?

- Physical enclosure of a building and environmental separator is referred to as the **building envelope.**
- **Physical separator** between the conditioned and unconditioned environment of a building (ie: wall resistance to air, water, heat, light, and noise transfer)
- Refer to roof, sub floor, exterior doors, windows and exterior walls.
- A good building envelope involves using exterior wall materials and designs that are climate-appropriate, structurally sound and aesthetically pleasing.

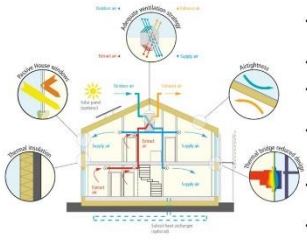
Criteria for Building Envelope ?

- infiltration of heat (thermal break) to the interior through windows systems, outside walls, roof and floor (particularly where piloti/stilt are used)
- building has the insolation blocking and insulation performance.
- Refer MS1525
- Recommendation:
- Window system Shading Coefficient (SC) : around 0.2
- U value of fenestration = 3.0 (W/m2K)
- outer walls and others: U = 1.0 (W/m2K)

OTTV = Heat Conduction through Walls (0.2% to 5%) + Heat Conduction through Windows (10% to 20%) + Solar Heat Gain through Windows (70% to 85%)

$$OTTV = \alpha((1-WWR)*Uw)*TDeq) + (WWR*U*\Delta T) + (WWR*SC*SF)$$

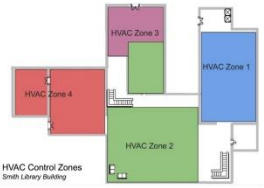
Building Envelope



- Evaluate ability to block thermal infiltration from the surroundings
- exclude outside disturbances
- Inconsistent window surface temperatures = inconsistent indoor air temperature
- Vertical temperature difference and radiation from exterior walls and windows will cause localized discomfort to occupants
- Evaluate buildings based on combined shading coefficient and heat transfer coefficient
- Refer MS1525:2007, Clause 5, Building Envelope

Zoned Control

- Provide separate air conditioning systems for each orientation direction
- Perimeter and interior, allowing more detailed zoning (broadly, zones of 40 m2 or less).
- The air conditioning system can provide individual temperature control for each zone.



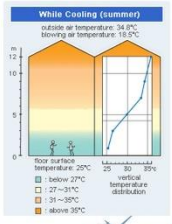
(Stefan.S, 2014)

Q1.2.2 Humidity Control

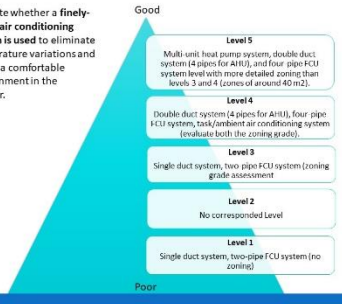
- Evaluate according to the set target value for humidity. **Dehumidification and humidity control** intended to provide comfort in hot season, and humidification for health reasons in cold or rainy seasons are regarded as important services.
- Humidification and dehumidification equipment is sufficient to keep humidity in the range 45-65%.
- Dehumidification functions are provided, and **anti-condensation measures** have been taken on elements that can act as heat bridges, such as **insulation reinforcement, humidity barriers and permeable layers.**

Q1.2.3 Type of Air Conditioning System

- Evaluate whether the air conditioning was chosen to **mitigate the vertical temperature distribution** and airflow speed (residual wind speed) in the room.
- The design stage of air conditioning equipment involves **consideration of various air conditioning methods** to choose the system that will best avoid causing localized discomfort to room occupants.
- should be evaluated on the basis of past results existing experience and design policies

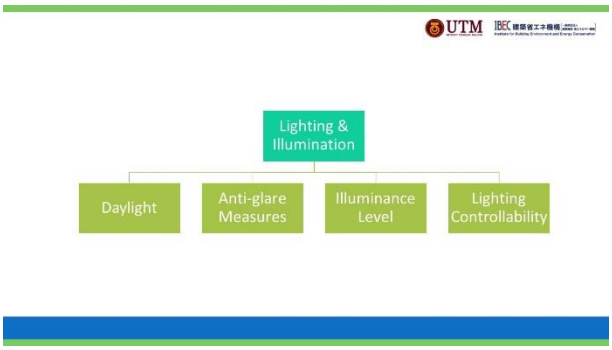


Evaluate whether a **finely-zoned air conditioning system is used** to eliminate temperature variations and create a comfortable environment in the interior.



Q1.3 LIGHTING & ILLUMINATION

CASBEE ISKANDAR FOR BUILDING (NEW CONSTRUCTION)



Q1.3.1 Daylight

THE DAYLIGHTING OPPORTUNITY

- ✓ Designing with daylight can improve energy efficiency by minimizing the use of electricity for lighting as well as reducing associated heating and cooling loads.
- ✓ Daylighting is a critical design factor to those concerned about global warming, carbon emissions, and sustainable design—in addition to visual comfort. Research has found daylight to be an important factor influencing human behavior, health, and productivity.
- ✓ Windows admitting daylight provide occupants with a view and a temporal connection with the outdoors.

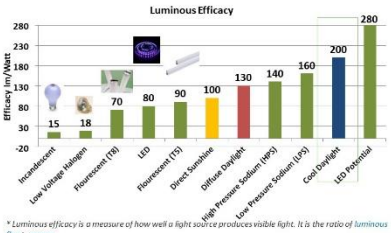
(Qahtan 2017)

Useful Daylight

(Khoay, 2018)

- Dr John Mardaljevic recommended Useful Daylightas
  - **100 lux to 2,000 lux**
- Direct Sunlight
  - **> 100,000 lux**

Daylight: Cool & Free

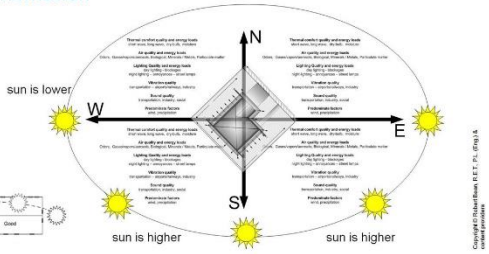


* Luminous efficacy is a measure of how well a light source produces visible light. It is the ratio of luminous flux to power.

HPS & LPS = Conventional Street Lights Today

(Khoay, 2018)

Building Orientation



Daylight Devices

Light Shelf

Light Ducts

(Khan, 2018)

Daylight Devices

Daylight devices optimally utilize daylight in addition to windows installed in the exterior walls. Specifically, such devices include light harvesting or guiding devices which carry light into the room interior

Skylight Atrium Light Ducts

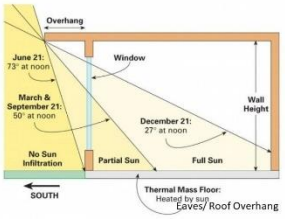
(Khan, 2018)

Q1.3.2 Anti-Glare Measures

- The assessment is carried out regarding glare countermeasures at window portions exposed to direct daylight or high brightness from outside
- Buildings are highly rated when they have a **high degree of control** over direct sunlight according to the position of the sun or brightness control performance.
- Especially in terms of rooms having a high daylight factor, the **daylight control** needs to be taken into consideration.
- daylight devices that also have **daylight control effects** such as a light shelf may be evaluated with respect to both aspects

Daylight Devices

Window blinds



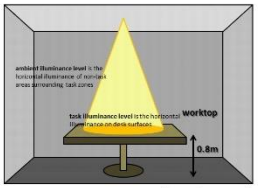
Awning

Eaves/ Roof Overhang

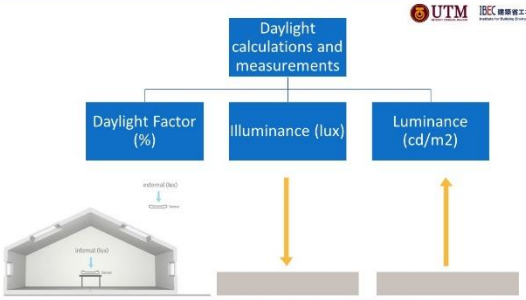
(Khan, 2018)

Q1.3.3 Illuminance Level

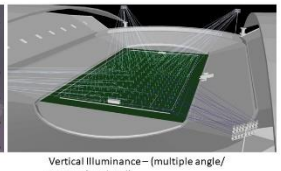
- **lighting equipment is excluded** from assessment if it is installed by occupants
- The assessment focuses on the indoor brightness on desktop surfaces (approximately **80 cm above the floor)**
- In cases where facility use is limited to daytime hours, such as School, apply lux values based on a **minimum daylight levels.**
- In cases of the task/ambient lighting system, the assessment is based on the level of task illuminance and ambient illuminance.



(Complesso, 2014)



Horizontal illuminance (80cm from floor/ workplan level)



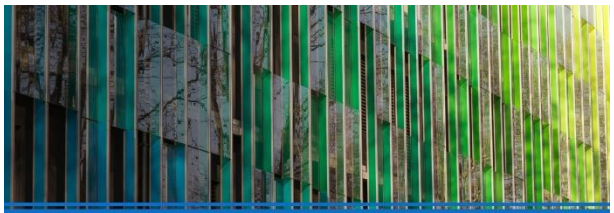
Vertical Illuminance – (multiple angle/ camera/eye level)

- When using an overall lighting system, illuminance exceeding 1,000 lx for Office and 750 lx for School is considered too high
- For apartment/common space, evaluate based on the most principal room of the unit
- Optimum illuminance level for hospital/office/school for working & reading task: **300-500 lux**
- Optimum illuminance level for residential/apartment/common area – **100-150 lux**

(Velux Visualizer, 2018)

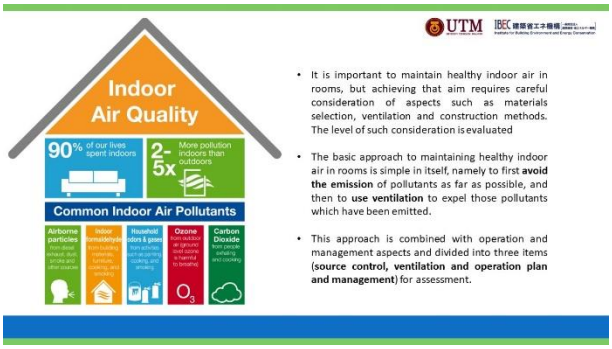
Q1.3.4 Lighting Controllability

- A higher assessment level is awarded for **detailed lighting control or automatic control systems**
- Lighting controllability refers to the **level of control** over brightness, colour, temperatures and lighting positions in a room by on/off switching and light adjustment.
- In this assessment, evaluation is based on the **minimum area in a room** for which lighting control is available and on methods of control (manual/automatic).



Q1.4 AIR QUALITY

CASBEE ISKANDAR FOR BUILDING (NEW CONSTRUCTION)



- It is important to maintain healthy indoor air in rooms, but achieving that aim requires careful consideration of aspects such as materials selection, ventilation and construction methods. The level of such consideration is evaluated
- The basic approach to maintaining healthy indoor air in rooms is simple in itself, namely to first **avoid the emission** of pollutants as far as possible, and then to **use ventilation** to expel those pollutants which have been emitted.
- This approach is combined with operation and management aspects and divided into three items (**source control, ventilation and operation plan and management**) for assessment.

Q1.4.1 Source Control

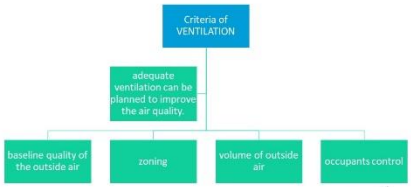
- **Cutting off pollutants** at source is a sure and effective way of maintaining healthy indoor air.
- **Satisfies the ISO 91**: Construction materials and building
- most material used has a **low level of formaldehyde and other VOC (Volatile Organic Compound) emissions**
- Evaluate whether adequate measures have been taken to avoid air pollution by chemical pollutants
- The décor on at least **50%-80% of the area** of floors and external walls has been designed **to restrict the growth of mold**, or to facilitate cleaning and maintenance.

Mould Prevention Item to Assess

Assessment Item
1) Rainwater leakage through roof and walls,
2) Infiltration of moist air,
3) Diffusion of moisture through walls, roof and floors,
4) Groundwater intrusion into basements and crawl spaces through walls and floors.
5) Leaking or burst pipes,
6) Indoor moisture sources,
7) Construction moisture

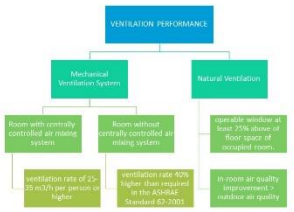
Q1.4.2 Ventilation

- The most effective method for maintaining healthy indoor air is to totally minimize the emission of pollutants from the building and its equipment, but in many cases that ideal must be balanced against cost and design considerations to permit some level of emission



Ventilation Performance (Window)

- Evaluate according to whether there is an **adequate volume of ventilation.**
- A higher level is awarded when **air quality improvement measures** are actively undertaken.
- While this assessment is based on ventilation rates, a localized **air exhaust system** at pollution sources is also important in practice.
- Opening windows to bring in natural ventilation is important, as it gives occupants the power to control ventilation for their own needs at will.



Q1.4.3 Operation Plan

- Evaluate whether a system has been instituted for properly maintaining air quality, and whether the system functions effectively.
- Under the Law for Maintenance of Sanitation in Buildings, CO2 monitoring is to consist of regular manual monitoring, but that should be regarded as minimum management.
- There are variations over time and between seasons in the quality of indoor and outside air, and temporary malfunctions of the equipment can also occur.
- Therefore a constant monitoring system for CO2 is desirable wherever possible.

Q1.4.4 Verification

Reduce indoor air quality problems resulting from the construction process in order to help sustain the comfort and well-being of building occupants

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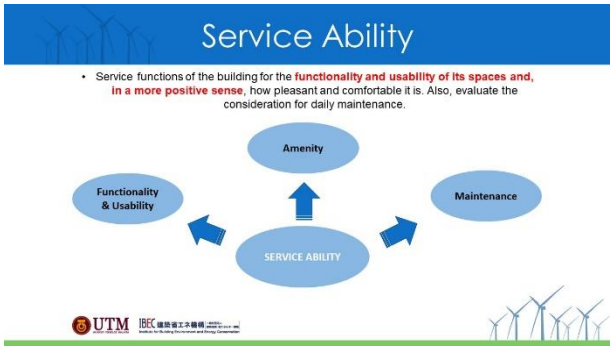
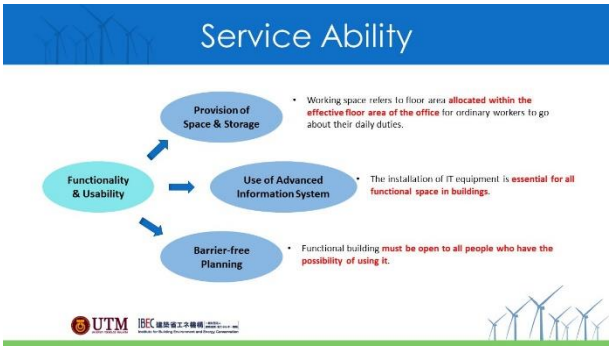
3.6 Module 6 : Quality (Q) (Services)

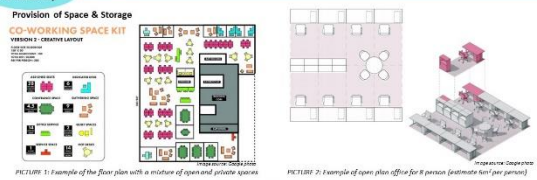




Service Ability

Functionality & Usability

Provision of Space & Storage



PICTURE 1: Example of the floor plan with a mixture of open and private spaces *PICTURE 2: Example of open plan office for 8 person (estimate 6m² per person)*

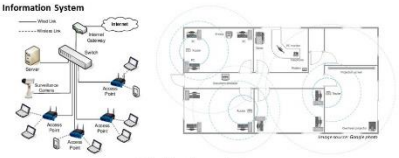
- The primary aspect of interior in the building is **ability to function and ease of use concerns** spaciousness and storage capacity.
- The spaciousness used here as an indicator is not necessarily directly linked to functionality and storage space, but its effects, such as **giving more freedom in layout of fixtures and allowing enough space** for storage, can easily be imagined.

UTM IBEC

Service Ability

Functionality & Usability

Use of Advanced Information System



PICTURE 3: Example of the office wireless network plan

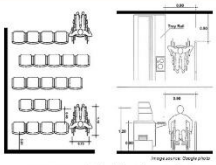
- The installation of IT equipment is **essential for all functional space in buildings**. Measures in offices should go beyond just increasing the capacity of the sockets.

UTM IBEC

Service Ability

Functionality & Usability

Barrier-free Planning



PICTURE 4: Example of the office wireless network plan

- For accessible buildings, at least one entrance per facility **should be accessible to a wheelchair user**.
- For new buildings, the accessible entrance should be the main entrance intended for use by the general public.
- It has been **a mandatory minimum MS 1184 2014 - Universal Design and Accessibility standards** for easing and guiding building use for all Retail, Restaurant, Hall, Hospital, Hotel, and similar facilities of 2,000 m2 or more those are used by the general public.

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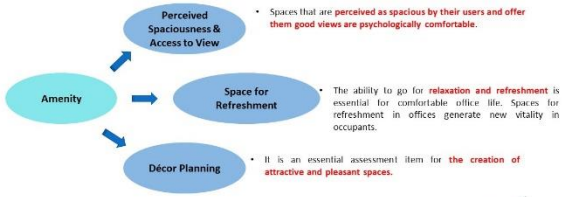
Service Ability



- Spaces that are **perceived as spacious by their users and offer them good views are psychologically comfortable.**
- The ability to go for **relaxation and refreshment** is essential for comfortable office life. Spaces for refreshment in offices generate new vitality in occupants.
- It is an essential assessment item for **the creation of attractive and pleasant spaces.**

UTM IBEC

Service Ability

Amenity

Perceived Spaciousness & Access to View

PICTURE 5: The above illustration demonstrates how absorption or reflection of light can also change our perception of colour within a space.

- Buildings should be evaluated from the point of view that spaces that are perceived **as spacious by their users and offer them good views are psychologically comfortable.**
- The **ceiling height indicator used here is not necessarily directly explanatory of comfort**, but it appears to be effective in imparting various benefits, such as a sense of space and openness.

UTM IBEC

Service Ability

Amenity

Space for Refreshment

PICTURE 6: The above illustration demonstrates suggestion space for refreshment.

- The ability to go for relaxation and refreshment is **essential for comfortable office life.** Spaces for refreshment in offices **generate new vitality in occupants.**
- A spacious social and eating area **will be at the heart of the hospice building,** offering a comfortable place for patients, families, groups and volunteers to meet, chat and support each other. This will be a light, calm and tranquil environment.

UTM IBEC

Service Ability

Amenity

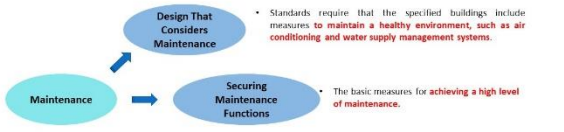
Décor Planning

PICTURE 7: Example of various space different interior design

- The purpose of decoration is **to make the space more aesthetically pleasing and functionally useful for the occupants,** but this may include consideration of wider contextual issues such as fashion, culture, and so on.

UTM IBEC

Service Ability



- Standards require that the specified buildings include measures **to maintain a healthy environment, such as air conditioning and water supply management systems.**
- The basic measures for **achieving a high level of maintenance.**

UTM IBEC

Service Ability

Maintenance

Design That Considers Maintenance

PICTURE 8: Unsuccessful examples of facility design installations

- The purpose of maintainability **is to improve effectiveness and efficiency of maintenance.** One of the major products desired of such an activity is the optimization of building life—cycle costs.
- Design for Maintainability (DfM) is the first step of an effective maintenance program, linking maintenance goals to the design process.

Service Ability

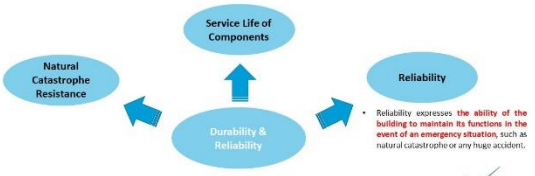
Maintenance

Securing Maintenance Functions

PICTURE 9: Various maintenance service

- A cleaning utensils storage area **requires a space for washing cleaning utensils after use.** It also needs to have drainage facilities connecting to the sewer or a septic tank, through which the **washing water is properly drained.**
- Calculate space requirements for waste, recyclable materials and bulky garbage based on the amounts of such materials anticipated in guideline standards set independently by local authorities on installation areas of storage facilities for garbage and recyclables. According to some standard guidelines stated that **the ratio of a storage space to the total floor space shall be 0.29% for 50,000 m2,** taking an office building as an example.

Durability & Reliability



- Reliability expresses **the ability of the building to maintain its functions in the event of an emergency situation,** such as natural catastrophe or any huge accident.

Durability & Reliability

Natural Catastrophe Resistance

Natural Disaster Resistance

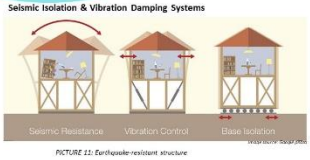
PICTURE 10: Example of natural disaster

- This is based on the design's compliance to local design guideline for roof, wall and structure such as guidelines from **Uniform Building by-Law (UBBL) or International Building Code (IBC).**

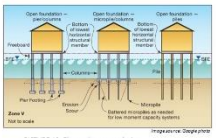
Durability & Reliability

Natural Catastrophe Resistance

Seismic Isolation & Vibration Damping Systems



PICTURE 11: Earthquake-resistant structure



PICTURE 12: Elevated structure design

- The ability to **maintain good operational building condition** over a long period of time.
- Potential **threats to human life** such as building collapse during strong winds or flooded are taken into consideration as environmental factors for the space within virtual boundaries.

Durability & Reliability

Service Life of Components

Service Life of Structural Frame Materials

PICTURE 13: Example of significant corrosion in concrete encased steel internal column

PICTURE 14: Corrosion in steel floor beam covered by wire mesh and plaster

- The **service life of structures** depend on a variety of factors, such as their purpose, socio-economic considerations, materials of construction, surrounding environment and degree of maintenance.
- The factors affecting service life can vary, not only from building to building, but even within a given building.
- For example, the **quality of the substructure, superstructure and even roof structure** in a building may vary if different subcontractors were responsible for them.
- The environment a building is subjected to will **vary from external elements to internal elements** and also from seaward side to landward side (if it is near the coast).
- Different building elements may receive different **degrees of maintenance,** depending on their accessibility and inspectability.

Durability & Reliability

Service Life of Components

Necessary Refurbishment Interval for Exterior Finishes

PICTURE 15: Example of exterior building maintenance

- Maintenance helps preserve the integrity of historic structures.
- If existing materials are regularly maintained and deterioration is significantly reduced or prevented, the integrity of materials and workmanship of the building is protected.
- Proper maintenance is the most cost effective method of extending the life of a building.
- As soon as a building is constructed, restored, or rehabilitated, physical care is needed to slow the natural process of deterioration.
- An older building has already experienced years of normal weathering and may have suffered from neglect or inappropriate work as well.

Durability & Reliability

Service Life of Components

Necessary Renewal Interval for Main Interior Finishes

PICTURE 16: Natural stone flooring in a building lobby

PICTURE 17: Furniture and artwork in the lobby of a building.

- The interior finishes provide comfort, utility and ambiance of the interior common areas, such as lobbies, hallways and amenity rooms.
- The finishes includes the aesthetic surfaces of the floors, walls and ceilings.
- Interior finishes are almost always readily accessible and can therefore be maintained and renewed relatively easily.
- The interior finishes system does not present any significant opportunities for improved energy efficiencies. However, the interior finishes do play an important role in "green management" practices, such as the installation of carpet that has low VOCs (volatile organic compounds) that can affect indoor air quality, and use of cleaning products that are environmentally safe.

Durability & Reliability

Service Life of Components

Necessary Replacement Interval for Air Conditioning and Ventilation Ducts

PICTURE 18: Example of replacement of ducting

- Air ducts can last upwards of 10 years with proper care. It is, however, crucial to note that over time, air duct seals, joints, and seams are susceptible to deterioration.
- Airflow is an essential part of an optimally-functioning HVAC system, and believe it, or not ductwork plays a significant role in the process of efficiently cooling living spaces.
- When the ductwork is damaged, old, filthy, or clogged in any way, your home/office is likely to suffer the consequences- high energy bills and discomfort.

Durability & Reliability

Service Life of Components

Necessary Renewal Interval for HVAC and Water Supply and Drainage Pipes

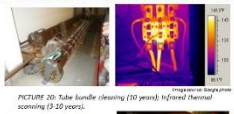
PICTURE 19: Corrosion on Galvanized Steel Piping

- Plumbing pipes for residential and commercial buildings come in a variety of materials, and each type has its advantages, limitations, and particular usage.
- Failure of metal piping systems is generally caused by erosion, corrosion or a combination of the two. Erosion occurs to some degree in every metal piping system. The friction of water flowing within a pipe erodes the metal, gradually wearing it away.
- The internal corrosion also affects the water quality, as lead and other metals leach into the water, causing discoloration and an unpleasant taste.

Durability & Reliability

Service Life of Components

Necessary Renewal Interval for Major Equipment and Services



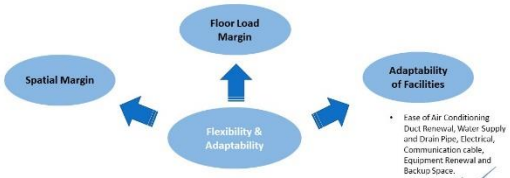
PICTURE 20: Tube bundle cleaning (10 years); Infrared thermal scanning (3-10 years).

PICTURE 21: Left – Re-grouting of tiled finish in pool basin (3-4 years); Right - repacking of sand in pool filter (2-5 years).

- Major maintenance is sometimes distinguished from renewals, which involves the replacement of a capital item. Major maintenance is focused primarily on the preservation of an existing asset.
- May require the services of a consultant and will certainly require an appropriately skilled contractor.
- Some major maintenance tasks are bounded and form part of statutory maintenance.
- However, small items, that occur infrequently can also be considered major maintenance (such as replacement of the batteries on a fire alarm panel).
- Whereas routine maintenance (such as window washing, and hallway carpet vacuuming) is typically funded from the operating budget, major maintenance if funded from the long range replacement reserve account.
- Are often non-discretionary in nature. Some major maintenance tasks are bounded and form part of statutory maintenance

Flexibility & Adaptability

- Evaluate the floor-to-floor height and flexibility in floor layout with **respects to adaptability to potential change in building use**.



- Ease of Air Conditioning Duct Renewal, Water Supply and Drain Pipe, Electrical, Communication cable, Equipment Renewal and Backup Space.

Flexibility & Adaptability

Spatial Margin

Allowance for Floor-to-floor Height

PICTURE 22: Example of minimum height in the building

Flexibility in Floor Layout

PICTURE 23: Example of the flexibility on the housing plan

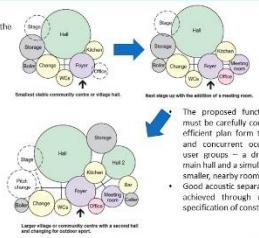
- Ceiling heights should be carefully considered as higher ceilings increase daylight access, assist natural ventilation and contribute to a sense of spaciousness.
- Enable better proportioned rooms - for example, smaller rooms often feel larger and more spacious when ceilings are higher
- Maximise heights in habitable rooms by stacking wet areas from floor to floor - this ensures that services within lower bulkheads are located above bathroom and storage areas rather than above habitable spaces.
- Designing space-saving homes does not necessarily mean to reduce the inner living spaces to their permissible minimums, but to apply several practical techniques directed to optimize and rationalize the available housing area.
- Some of these homes are expandable to adapt to variable family sizes.
- Flexibility is an important consideration in the design of housing if it is to be socially, economically and environmentally viable.

Flexibility & Adaptability

Floor Load Margin

- The building's floor load margin is evaluated to consider the potential for future changes of building type.

PICTURE 25: Interior of a typical village hall with dimensions suitable for sport and with a stage for drama.



- The proposed functions of the building must be carefully considered to achieve an efficient plan form that permits flexibility and concurrent occupation by different user groups – a drama rehearsal in the main hall and a simultaneous yoga class in a smaller, nearby room, for example.
- Good acoustic separation is essential and is achieved through careful planning and specification of construction materials.

Flexibility & Adaptability

Adaptability of Facilities

Ease of Air Conditioning Duct Renewal

PICTURE 22: Example of minimum height in the building

Flexibility in Floor Layout

PICTURE 23: Example of the flexibility on the housing plan

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Flexibility & Adaptability

Adaptability of Facilities

Ease of Air Conditioning Duct Renewal

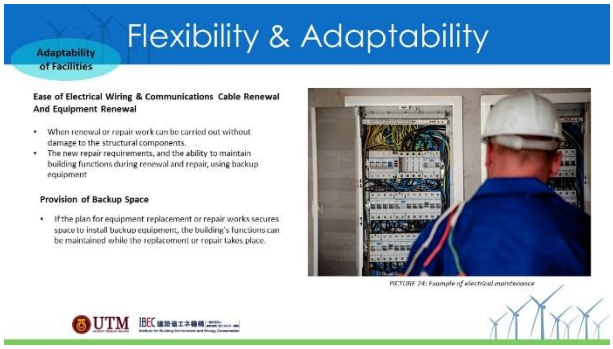
PICTURE 22: Example of Air conditioning maintenance

- Cases where there is no plan for renewal of air conditioning ducts, and ducts cannot be replaced or repaired without partial demolition of structural elements such as beam, columns and bearing walls, result in new repair works and generation of solid waste.
- The replacement work can be carried out without damage to surface finishes

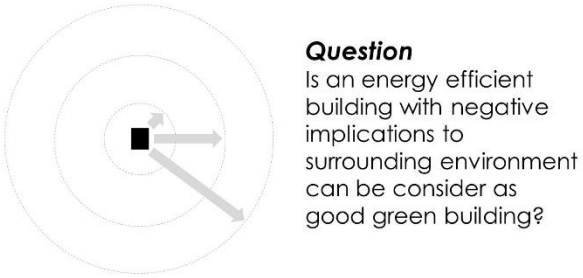
Ease of Water Supply and Drain Pipe Renewal

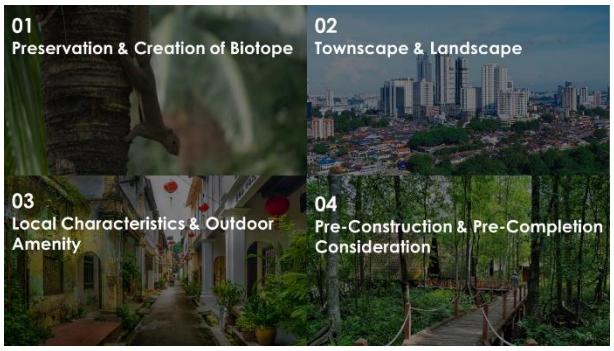
PICTURE 23: Example of Plumbing maintenance

- Cases where there is no plan for renewal of water supply and drainage pipes, and the pipes cannot be repaired or replaced without partial demolition of structural elements such as beams, columns, load-bearing walls, exterior walls and floor slabs result in new repair works and generation of solid waste.
- If spaces and routes have been provided for future use, facilitating renewal, choosing between the two levels according to the amount of repair and waste generation from elements other than water supply and drainage pipes.

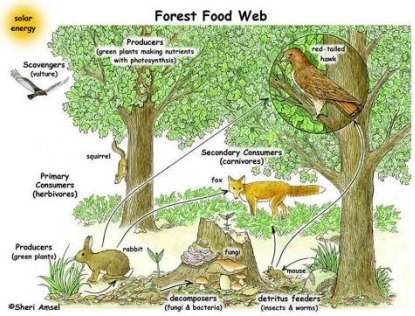


3.7 Module 7 : Quality (Q) (Outdoor/On Site Environment)




01
Preservation & Creation of Biotope
02
Townscape & Landscape
03
Local Characteristics & Outdoor Amenity
04
Pre-Construction & Pre-Completion Consideration


02
Townscape & Landscape
Conserve and create habitat for biodiversity


Forest Food Web
solar energy
Producers (green plants making nutrients with photosynthesis)
Scavengers (vulture)
red-tailed hawk
squirrel
Secondary Consumers (carnivores)
Primary Consumers (herbivores)
fox
Producers (green plants)
rabbit
fungi
mouse
decomposers (fungi & bacteria)
detritus feeders (insects & worms)
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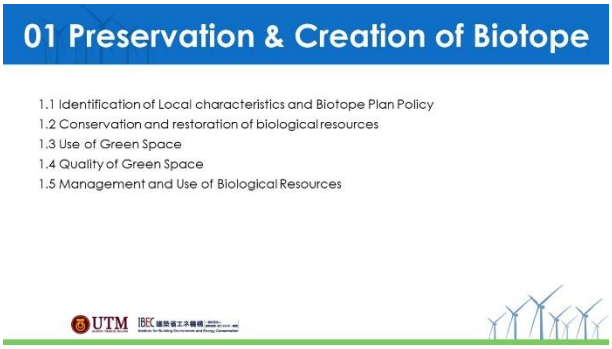

01 Preservation & Creation of Biotope
1.1 Identification of Local characteristics and Biotope Plan Policy
1.2 Conservation and restoration of biological resources
1.3 Use of Green Space
1.4 Quality of Green Space
1.5 Management and Use of Biological Resources
UTM
IBEC


02
Townscape & Landscape
Skyline, context and scenery


02 Townscape and Landscape
2.1 Integration with surrounding landscape through positioning and design of the building
2.2 Use of green space to enhance landscape
2.3 Conservation of historic landscape
2.4 Use of local material to enhance landscape
2.5 Aesthetics from main viewpoints of surrounding area
UTM
IBEC

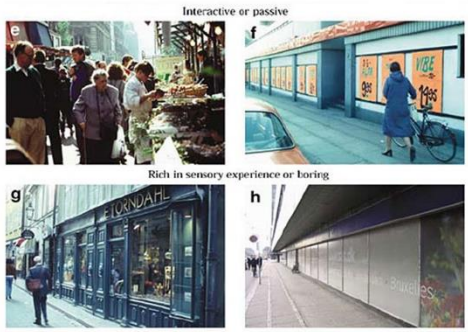
03 Local Characteristic & Outdoor Amenity

3.1 Attention to Local Character and Improvement of Comfort

- 3.1.1 Continuation of unique local character, history and culture
- 3.1.2 Local contribution through provision of functional spaces and facilities
- 3.1.3 Formation of rich intermediate zones linking the building interior and exterior
- 3.1.4 Consideration for crime prevention
- 3.1.5 Participation of building users

3.2 Improvement of the Thermal Environment on Site

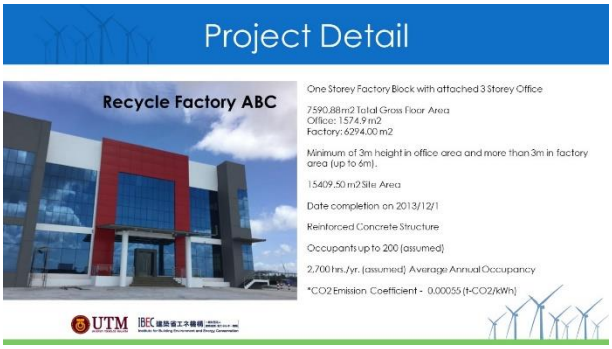
- 3.2.1 Guide wind into the site to relieve the thermal environment
- 3.2.2 Shade space is created to minimise thermal impact on pedestrian areas on the site
- 3.2.3 Green and water spaces are provided to minimise thermal impact on pedestrian areas on the site
- 3.2.4 Exterior finishes of the building to minimise thermal impact on pedestrian areas on the site
- 3.2.5 Heat vents are appropriately located to minimise thermal impact on pedestrian areas on the site

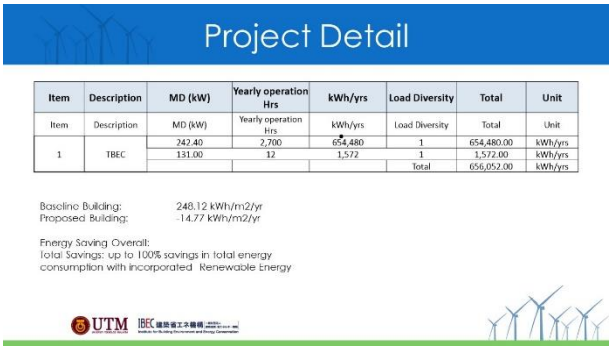


04 Pre-Construction and Pre-Completion Consideration

3.1 Avoid Development at the Prohibited Zone Highlighted by Statutory Development Plan
3.2 Development on the Brownfield Site

3.8 Module 8 : Hands on Training





Project Detail

Environmental friendly products that are certified under local/ international certification body.

- Steel Bar – Recycled
- Maica Office Furniture
- Zincalume (Colorbond) High reflective Metal Roofing
- Mineral wool Heat Insulation from Rockwool Sdn Bhd
- Sunshade Aluminum Louvers

zinc plated steel sheet that are made from stainless steel or Galvalume are used for ducting to extend service life (7-15 years)

Project Detail

Background noise in the office area = 32 – 35 db(A)

Background noise in the factory area = 35 – 38 db(A)

Material	Element	Unit	Est. Quantity	Percentage, %	
				Pre Consumer	Post Consumer
Concrete	Floor	m^2	-	35%	0%
Concrete	Wall Type 1	m^2	-	35%	0%
Concrete	Wall Type 2	m^2	-	35%	0%
Concrete	Wall Type 3	m^2	-	35%	0%
Brick	Wall Finisher	m^2	3,690.00	94%	0%
Mineral Fibre Board	Ceiling Finishes	m^2	960.00	45%	0%
Wall Cladding	Wall	m^2	1,230.00	80%	0%
Metal Door Frame	Frame	m^2	-	80%	0%
Glass	Wall/ Window	m^2	210.00	80%	0%
Roof - Insulation	Roofing	m^2	7,800.00	94%	0%
Mineral Wool Insulation	Roof/Insulation	m^2	7,800.00	40%	0%
Aluminium Louvres- Soft	Roofing			80%	20%
				Total Recycled Content Value	MYR 1,150,692.65
				% of Recycled total value of materials	36.4%

The partition walls insulation value is Dr-40

At least two of the spaces uses wall insulation

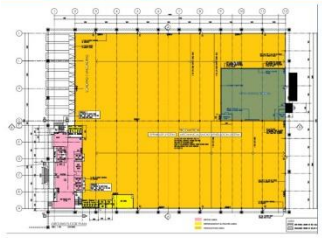
Project Detail

PART 1	North Façade Area [A]	1147.00	m^2
	South Façade Area [B]	1147.00	m^2
	West Façade Area [C]	1550.00	m^2
	East Façade Area [D]	1550.00	m^2
	Total Façade Area [E]	5394.00	m^2
	% Of West Façade/ Total Façade Area [F = C / E]	29	%

Project Detail

PART 2	West Façade Area [A]	1147.00	m^2
	West Window [B]	44.00	m^2
	% Of West Façade/ Total Façade Area [C = B / A]	3.8%	
PART 3	RTTV Baseline	0.4 W/m2.K	
	RTTV CURRENT DESIGN	0.32 W/m2.K	

Project Detail



Factory ABC

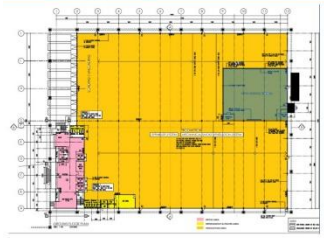
There are separate air conditioning systems for each orientation direction and each spaces, and for perimeter and interior.

Humidification equipment is available, and equipment capacity is generally sufficient to keep humidity to 50%.

The air conditioning systems allows each users of each spaces to control their own temperature separately. The system also automatically adjust the room temperature to desirable level of 25-27 degree.

It also mitigate the vertical temperature distribution and airflow speed in the room

Project Detail



Factory ABC

Daylighting strategy is the usage of windows and openings. The Daylight Factor measurement shows that:

Factory: 2.5%
New mixing room: 2.0%
Office: 2.3%

The perimeter windows of the office are installed with automatic blinds that reacts to the amount if daylight the room received, where the controlled illuminance will be between 300 to 500 lux.

70% of the total area of floors, walls, ceilings and attics uses star rated building materials that satisfies The Building Standard Law.

Project Detail

Description	Areas, sqm	Total power consumption based on fitting type (W)	Design Light Power, W/m2	Reference Total Power Consumption (by area)(W)
Production	6294	**15,000.0**	10	62,940
Office	1145	**2,160.0**	15	17,175
Lobby	151.2	**400.0**	20	3,024
Staircase	103.6	**37.5**	10	1,036
Restroom	175.1	**96.0**	15	2,626.5
		17,693.5		**86,801.5**

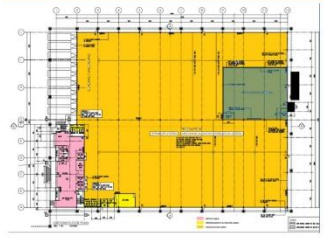
Proposed Lighting Consumption (Improvement)

Description	Areas, sqm	Light Fitting	Power Consumption per fitting (W)	Ballast Loss (W)	No. of Fitting	Total power consumption based on fitting type (W)
Production	6294	LED	150	N/A	100	**15,000.0**
Office	1145	LED	18		120	**2,160.0**
Lobby	151.2	LED	20		20	**400.0**
Staircase	103.6	LED	2.5		15	**37.5**
Restroom	175.1	LED	8		12	**96.0**

Factory ABC

The factory applied a dimmer control for specific tasks required for production.

Project Detail



Factory ABC

Non Air-Conditioned Building Areas (with an aggregate non air-conditioned areas > 10% of total floor area excluding carparks and common areas) for Natural Ventilation.

Ventilation in Car parks
- Car Parking is located at outdoor with Natural Ventilation

Ventilation in Common Areas
Staircases, Corridors and Toilets with Mechanical Ventilation

Ventilation rate is 40% higher than required in the Building Standard Law.

openable windows and valid opening area for natural ventilation of at least 1/30 of the total floor space of an occupied room, where higher than recommended in MS1525 of minimum 10% of the total floor space.

Designated smoking area.

Project Detail

Factory ABC

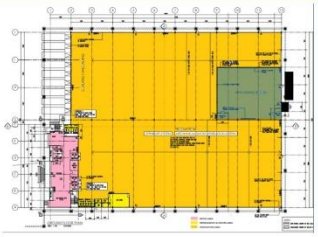
Assumption:
Part One – Energy Resources
Current Pre estimated building energy intensity(BEI) = 248 kWh/m².yr
Predicted building energy intensity (BEI)
< 0Wh/m².yr
% of Electricity Reduction (average) @ RM0.50/kWh
= 100%
Estimated Carbon dioxide emission Reduction annually = ±100 tonnes CO_2 Emission

*This has been monitored and calculated and estimated manually

Part Two – Generation of Waste
Implementation & promotion of solid waste minimization & recycling campaign (paper, aluminium cans, etc.)
% of Waste Generation Reduction (average)
= ±15%
Estimated Carbon dioxide emission Reduction annually = ±3.8 tonnes CO_2 Emission

Part Three – Materials & Resources @ Water Resources
Implementation of Rainwater Harvesting System, selection of drought type native vegetation, selection of water efficient fixtures
% of Water Usage Reduction (average)
= ±100%
Estimated Carbon dioxide emission Reduction annually = ±0.6tonnes CO_2 Emission

Project Detail



Factory ABC

7590.88m2 GFA / 200 occupants = 37.9 m2 per occupants

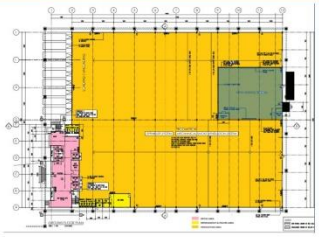
The designed OA floors accommodate layout changes, and electrical sockets for OA equipment are 30 VA/m2 socket capacity. Also, communications lines with capacity for one data communications device per 8 m2 (one phone, one PC) is routed onto each spaces.

This factory satisfies the universal design standards and guidelines requirements up the minimum.

Pantry area has been design for each area with the total area of 76m2.

The factory construction shifts towards natural and ecological materials in a building such as using recycled materials, and produced recycled materials (plastics).

Project Detail



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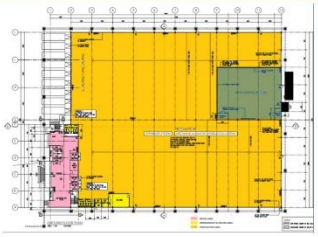
Pantry area has been design for each area with the total area of 76m2.

The factory construction shifts towards natural and ecological materials in a building such as using recycled materials, and produced recycled materials (plastics).

Structures, walls, floors and ceilings finishes are dirt resistant.

Efficient layout planning; ease of access

Project Detail



This factory emphasizes the hygienic values, where the storage, washrooms, toilets, staff rooms, cleaning equipment tools and cleaning staff rooms which follows that standards and guidelines based on the total floor area.

Estimated maintenance of the building is within 10-15 years.

The factory produces own energy through alternative energy generation, hence it creates its own energy source.

Dispersion and duplication of heat/cool source are backed up, where there is no centralized HVAC system.

All electrical appliances, tools, machineries, gensets, power supplies etc. has been elevated above ground level.

Landscaping consist of perimeter edible garden useable for the staff and as well as green walls and green roof at the office area.

Project Detail

Encourage the use of water efficient fittings under Water Efficient Product Labelling Scheme (WELPS) or Water Efficiency Labelling Scheme (WELS)

Ref.	Water Fitting Type	WELS / WEPLS rating				Total
		Efficient	Highly Efficient	Most Efficient	Not Rated	
1	Basin taps and mixers	0	0	0	0	0
2	Normal Bid Tap @ 20s	0	0	0	0	0
3	WH Basin @ 15s	12	0	0	0	20
4	Pantry with Sink Tap @15s	4	0	0	0	4
5	Flushing cisterns	0	20	0	0	44
6	Others (Guardhouse and etc)	0	0	0	4	4
Total no. based on rating (A)		**16**	**20**	**0**	**4**	**36**
Weightage (B)		**6**	**9**	**12**	**0**	**0**
Total (AxB)		**96**	**180**	**0**	**0**	**276**

Project Detail

Promote the use of sub-metering and leak detection system for better control and monitoring of water usage

1. To monitor the water consumption on a monthly basis.
2. Provision of private-meters for major water uses

a) Cooling tower
b) Rainwater Harvesting,
c) Recycling Water and tenant usage

Project Detail

Provision of suitable systems that utilise rainwater or recycled water for landscape irrigation to reduce potable water consumption.

(a) Use of non-potable water including rainwater for landscape irrigation
(b) Use of water efficient irrigation system

Project Detail

Inputs (1 year data)

Description	Inputs	Units
Catchment Area (Podium)	7800.00	m2
First Flush	1	mm
Tank Size	180000.00	L
Water Production (L)	50000.00	L
Landscape (L)	**3840.00**	**L**
Fixture Consumption & Etc	2550.00	L
General Wash (L)	10000.00	L
Run-off Coefficient	0.90	

Results (1 year)

Description	Liter	Percentage (%)
Total Water Consumption (1 years)	10666230.00	100.00%
Total Rainwater Used (1 years)	7075000.00	123.526307%
Total Recycled Wastewater Used (1 years)	6100000.00	
Total Potable Water Used (All)	2509370.00	23.53%

Project Detail

Category	Name	Sub category	(A) LAI	(B) Canopy	(C) Qty/Planted	(A)x(B)x(C) Leaf Area
Trees	Baphia Nitira	Open Canopy	2.5	60	4	600
	Hibiscus	Intermediate Canopy	3	60	166	29880
	Main Tree & Palm Cinnammum	Intermediate Canopy	2.5	60	455	68250
Turf m2		Turf	2		2048	4096
					Total LAI	**102826**
					Site Area,m2	**20234**
					Ratio of LAI/SA	**5.1**

GnP = 0.5 to < 1.0 – 1 credit
GnP = 1.0 to < 1.5 – 2 credits
GnP = 1.5 to < 3.0 – 3 credits

1. Stormwater management Plan
2. Vertical Green Walls
3. Production of Bio- Diesel to cover the own consumption (Forklift and etc.)
4. Waste Composting
5. Rainwater Harvesting Tank
6. Recycling Water System

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Project Detail

The facilities included with a rentable hall for the community nearby, or other institutions.

Tall wall and fences are erected to the perimeter to prevent crime.

The maintenance of the factory (landscaping etc.) are handled by the factory.

The external piping and vents are located above pedestrian height.

Halogenated flame retardants are used.

No pollutant from wallpaper adhesive, sash sealants, undercoats and preservatives (timber product).

Refrigerant of ODP = 0 is used as the refrigerant.

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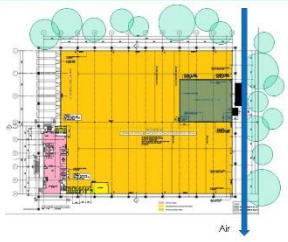
Project Detail



Gas and dust concentrations at sources of NOx, SOx and dust are reduced to below the emission standards set by the Air Pollution Control Law, the Guidelines for Small Capacity Low NOx Combustors (MOE) or local ordinances.

Building spacing index Rw is 0.4

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 # END OF MODULE

Module 9