



## TREES - PRE NC

Version 1.1

เกณฑ์การประเมินความยั่งยืนทางพลังงานและสิ่งแวดล้อม  
สำหรับการเตรียมความพร้อมการก่อสร้างและอาคารปรับปรุงใหม่

Thai's Rating of Energy and Environmental Sustainability  
for Preparation of New Building Construction & Major Renovation  
(PRE NC)

จัดทำโดย

สถาบันอาคารเขียวไทย  
Thai Green Building Institute  
TGBI

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Thailand Green Building Institute

## Background

Energy efficient and environmental friendly buildings gain more importance in every sector in Thailand according to support, promotion, and control from government sectors. To support the Energy Conservation Act B.E. 2552 (2009), Department of City Planning, Bangkok Metropolitan, launched the New Ministerial Regulation to enforce Bangkok Comprehensive Plan in B.E. 2556 (2013) that promoting environmental friendly buildings. For example, 50% of open space must be green area that is permeable. Bonus area is also given at 5-20% to green buildings. In order to claim that the building is green, a standard has to be established. Most green building rating systems are checklists and many countries now have their own rating systems suitable for local practices for example, BREEAM (Building Research Establishment's Environmental Assessment Method) in the UK, or The U.S. Green Building Council in the USA that develops LEED (Leadership in Energy and Environmental Design).

These governmental subsidy mechanisms help motivating building industry to move forward to green building design. Department of Alternative Energy Development and Efficiency assigned Chulalongkorn University to research the appropriate energy efficient and environmental friendly rating system for Thailand. The result rating system is called TEEAM (Thailand Energy and Environment Assessment Method) and was used to evaluate if the buildings are eligible for subsidy from the government

TEEAM is a checklist type rating system similar to LEED. There are TEEAM for small residential buildings and TEEAM for commercial buildings. TEEAM emphasizes building design and environmental design that will promote energy saving and reduce negative impact to the environment. There are research teams from various university such as Chulalongkorn University, Khon Kaen University, King Mongkut's University of Technology Thonburi, Silpakorn University, Thammasat University, and Chiang Mai University that help with supporting research works. TEEAM is also presented and get approved in focus group meetings consisted of experts from many other institutes, both private organizations and government sectors involved with the environment.

For energy saving, TEEAM considers giving points beginning from site selection. The project shall be able to link with public transportation. Layout and landscape design shall be able to reduce thermal load coming to buildings. Trees should be native plants that need little maintenance and water. Minimum insulation requirements for building envelope are specified to reduce heat gain into buildings with reference to OTTV and RTTV codes for Thailand. TEEAM also set minimum requirements for artificial lighting systems, air conditioning systems, and sanitary systems.

The Ministry of Energy launched the campaign of Building Energy Saving Label using TEEAM afterward. There are more than 100 buildings got certified using TEEAM under the program within 3 years before the project was terminated. Meanwhile, green building design using LEED rating system has gained more popularity in Thailand. Project such as Kasikorn Thai Bank (Chaeng Watthana Branch), Energy Complex

Center, Park Venture Ecoplex, Thai Health Promotion Foundation Office, SCG Head Office are among pioneer that get certified by LEED. Later, the Pollution Control Department, Ministry of Natural Resources and Environment has developed green building rating system called PCD (Pollution Control Department System) and added many other environmental aspects TEEAM has not covered in the new rating. The added environmental issues cover waste management, wastewater, air pollution, green area. This rating system of Pollution Control Department primarily aims are to support green building design in typical government office buildings. There are 10 registered pilot government office building at the time and the survey of government office the readiness to be renovated to meet the green rating system requirement were conducted as well as the required supporting budget was estimated. However, the PCD rating system has not been implemented until present.

In B.E. 2552, Pollution Control Department took this rating system to Thailand Green Building Institute (TGBI) which is an organization founded by the Association of Siamese Architects under the Royal Patronage of His Majesty the King and the Engineering Institute of Thailand under His Majesty the King's Patronage to develop TREES-NC or Thai's Rating for Energy and Environmental Sustainability for New Construction and Major Renovation. TGBI drafted TREES-NC following requirements in LEED for New Construction and Major Renovation, TEEAM, and PCD. TREES-NC went through numbers of public hearings. It is now considered the most popular Thai green building rating system. TREES-NC was developed from previous TEEAM and PCD rating systems with research support. It is the only Thai rating system in use today. Projects are registered and get certified continuously, while TEEAM and PCD are not in use anymore.

However, assessment process according to TREES-NC could be completed only after the construction process is done since data during construction are used in the assessment process. To assist projects aiming to claim to be green buildings at design stage to get BMA bonus, TGBI decided to create the new rating called TREES-PRE NC or TREES for Pre New Construction and Major Renovation. This rating system is based on the existing TREES-NC but include only topics that involved with design period that can be assessed from blue prints. Examples of topics not included in TREES-PRE NC are verification of construction waste, collection of the purchasing documents of recycle materials or local materials. This affects to the total points of TREES-PRE NC that would be reduced to 62 points. There are 4 levels of certification conforms to the levels of green building specified in the Ministerial Regulation to Enforce Bangkok Comprehensive Plan B.E. 2556 (2013).

TGBI and Department of City Planning, Bangkok also discussed and subsequently provide guidelines for document submission process, forms and this reference guide to accommodate involved stakeholders to work at the same direction and to promote green building design for public benefits.

## TREES – PRE NC 1.1

Thai's Rating of Energy and Environmental Sustainability for Pre New Construction and Major Renovation comprises 8 assessment sections as follows;

- Section 1 Building Management (BM)
- Section 2 Site and Landscape (SL)
- Section 3 Water Conservation (WC)
- Section 4 Energy and Atmosphere (EA)
- Section 5 Material Resources (MR) (No assessment in TREES PRE-NC)
- Section 6 Indoor Environmental Quality (IE)
- Section 7 Environmental Protection (EP)
- Section 8 Green Innovation in Design (GI)

These sections comprise sub assessment topics that provide design criteria for projects. Each topic have integer point. Some topics are Prerequisite which means the project must compile with the requirements and some topics, designers have a choice to select if they are to be pursued. Overall, the total score is 62 points with 7 prerequisite topics as follow

1. Green building preparation
2. Avoid inappropriate construction site.
3. Reduce negative impact to green field areas.
4. Minimum energy efficiency and pass the OTTV/RTTV requirement as specified in the Ministerial Regulations.
5. Ventilation rate in the building.
6. Illuminance in the building.
7. Waste management

Apart from complying with prerequisite topics, the project shall get the total score not less than 22 points and get the minimum score from each section as specified in the following table.

Section	Full marks	The minimum requirement
Section 1 Building Management (BM)	Prerequisite	Prerequisite
Section 2 Site and Landscape (SL)	16	6
Section 3 Water Conservation (WC)	6	2
Section 4 Energy and Atmosphere (EA)	19	8
Section 5 Material Resources (MR)	-	-
Section 6 Indoor Environmental Quality (IE)	13	5
Section 7 Environmental Protection (EP)	3	1
Section 8 Green Innovation in Design (GI)	5	-
<b>Total</b>	<b>62</b>	<b>22</b>

For TREES-PRE NC, there are 4 certified levels according to points received which are:

22-27 points      Level 1

28-32 points      Level 2

33-44 points      Level 3

45-62 points      Level 4

TREES-PRE NC is TREES NC that construction phase points were removed because they cannot be assessed during design period. However, topic numbers are kept the same as TREES-NC. For example, EA1 is Energy and Atmosphere Section, topic: "Efficiency of energy use" in both rating systems.

This reference guide provides only preliminary information of each topic to provide an overview of the rating system. Details, examples of implementations, calculations, including forms and documents can be found in TREES-NC 1.1 reference guide. Additional updates, announced periodically, can be found at the TGBI webpage ([www.tgbi.or.th](http://www.tgbi.or.th)).

## Assessment Procedure

TREES-PRE NC certification process can be separated to 1<sup>st</sup> Phase- TREES-PRE NC1.1 Assessment and 2<sup>nd</sup> Phase- Building inspection during construction, as followed:

### Phase – 1 TREES-PRE NC1.1 Assessment

1.1 The Applicant registers and fills TREES-PRE NC application form, then submit 5 sets of report and CD for assessment, and pay assessment and inspection fees.

1.2 TGBI checks if all required documents are submitted. In case of incompleteness, the Applicant shall correct and resubmit all documents.

1.3 Assessment Subcommittee appoints an Assessment Team for the project within 7 working days.

1.4 The Assessment Team review the documents and provide results within 30 working days after complete documents are submitted. During assessment, if the Assessment Team find that some documents are incomplete, TGBI reserves the right to assess according to the quality of the received documents or may request for additional documents.

1.4.1 The Applicant shall correct or provide additional document (if any) then resubmit the document within 15 working days. The Assessment Team will review the revision documents within 30 working days and send the final results to the Applicant.

1.4.2 After the final results come out, if there is no additional document or the Applicant accept the result TGBI will conclude the final results for the Applicant.

1.4.3 If the Applicant need more than 15 working days to correct the documents, the Applicant shall submit the formal request letter asking to postpone the submission date of the revision documents.

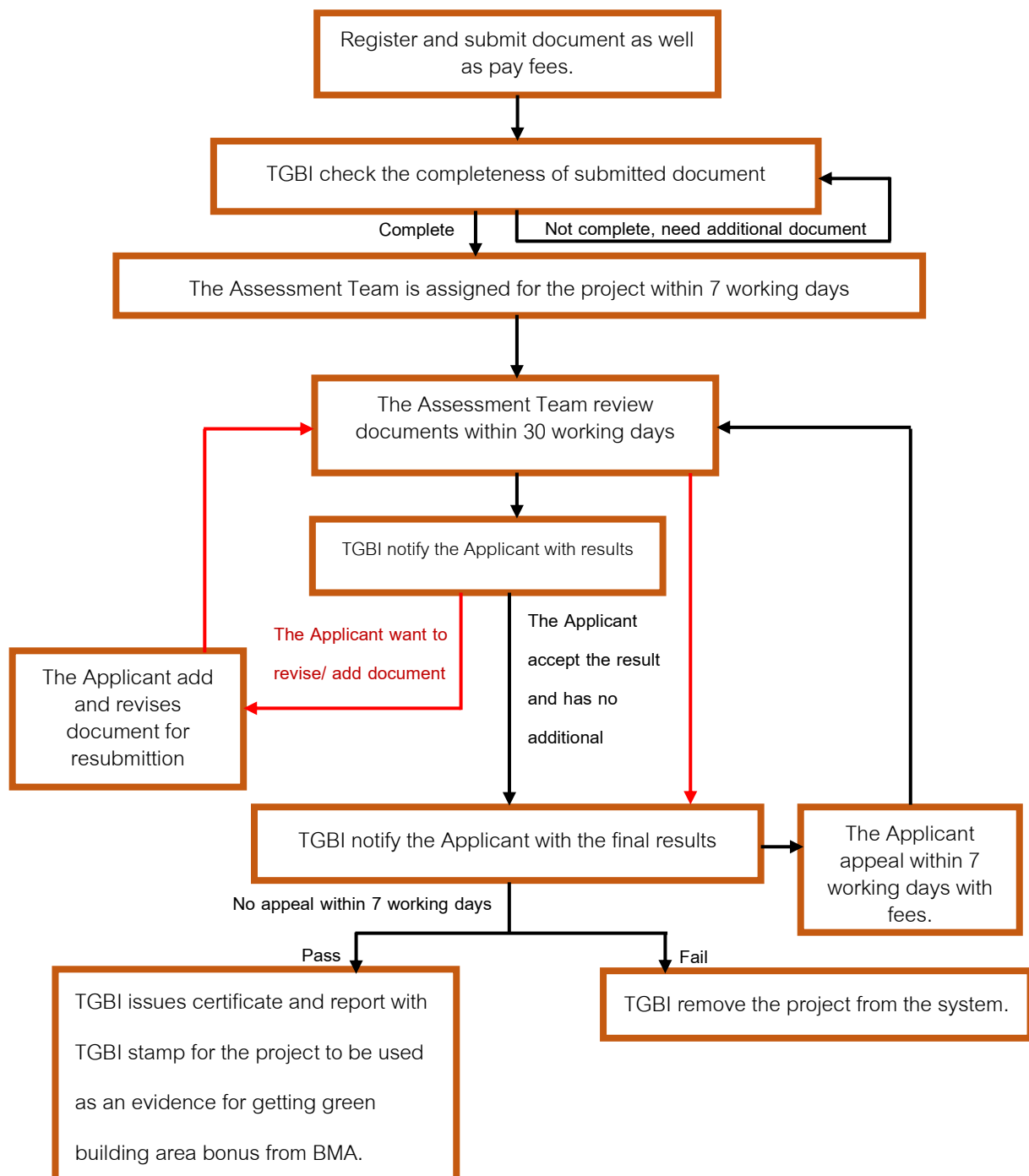
1.4.4 TGBI reserves the right to assess and review documents in some cases more than 30 working days depending on quality and completeness of the submitted documents as well as the size and the complexity of the building design and systems. If this happens, TGBI will send formal notice to the Applicant.

1.5 TGBI will send final assessment results to the Applicant.

1.5.1 In case the Applicant would like to appeal, the Applicant shall submit additional documents within 7 working days for a fee. The project will be in the assessment process again. The appeal result is final. If the Applicant does not send any request for appeal within 7 days, the results will be considered final.

Pass	- TGBI will launch certificate and the level of rewarded TREES-PRE NC, and the report with TGBI's official stamp for 1 set to the Applicant within 7 working days.
Fail	- TGBI will end the assessment and remove the project from the system. In case, the Applicant want the project to be reassessed, the applicant shall start the whole process again from the beginning.

Diagram – 1 TREES-PRE NC1.1 Assessment Procedure





## Step – 2 Building inspection during construction

2.1 During construction period, the applicant shall have “**Green Building Inspector**” to perform building inspection according to the details from TGBI as followed:

### Architectural Work

- 1) Open space, green space, landscape work.
- 2) Model of plumbing fixtures, faucets, toilets.
- 3) Building envelope system, glazing, thermal insulations, shading devices.
- 4) Architectural spaces, forms, and features conform to each topic.

### Engineering Work

- 1) Electricity and lighting systems, light bulbs, and Watt Power.
- 2) Potable water systems, sanitary systems, wastewater treatment systems.
- 3) Air conditioning systems.
- 4) Engineering system and components conform to each topic.

2.2 **Green Building Inspector** shall inspect the building according to checklist from TGBI. Use building inspection form provided from TGBI and sign the form. Licensed Architect shall sign for architectural topics, and licensed engineer shall sign for engineering topics.

2.3 The applicant shall submit the signed inspection document to BMA and send another copy to TGBI.

### Qualification of Green Building Inspector

1. The inspector who signs to confirm green building inspection shall be licensed architect or licensed engineer who have unexpired professional licenses at the time when inspection documents are submitted to BMA and TGBI. The inspector shall also possess TREES-A certification from TGBI.


2. Any person involved or worked with the company that involved with the project such as Owner, Architect, Contractor, Supervisor, and others is not eligible to be a Green Building Inspector for the building they are working with.

3. Green Building Inspectors and the persons who sign to confirm the inspection shall be the same person.

**Note:** TGBI reserves the right to randomly inspect the building that registered with TREES-PRE NC 1.1 for quality control measures of the registered project that shall conform to the rewarded level.

## Relation with TREES NC V1.1

The Applicant can automatically get points from the awarded credits in TREES PRE NC V1.1 when applying the same project in TREES NC V1.1 certification process without having to submit the documents again except for BMP1 which need additional team members and timeline.

 THAI GREEN BUILDING INSTITUTE			Thai's Rating of Energy and Environmental Sustainability for Preparation of New Building Construction and Major Renovation: Design Period (PRE NC 1.1)		
Thai's Rating of Energy and Environmental Sustainability					
(PRE NC 1.1) Pre New Building Construction and Major Renovation					
0 Point	Section	1 Building Management	13 Points	Section	6 Indoor Environmental Quality (The minimum scores : 5 Points)
[Prerequisite]	BM P1	Green Building Preparation	[Prerequisite]	IE P1	Ventilation rate in the building
16 Points	Section	2 Site and Landscape (The minimum scores : 6 Points)	[Prerequisite]	IE P2	Illuminance in the building
[Prerequisite]	SL P1	Avoid inappropriate construction site	1	IE 1.1	Air Intake is not located at the location that has heat or pollution.
[Prerequisite]	SL P2	Reduce negative impact to green field areas	1	IE 1.2	Negative pressure for printing room, photocopying room, chemical storage, and cleaner storage.
1	SL 1	Locate project on the developed land	1	IE 1.3	Prevent pollution from outside to inside of the building.
4	SL 2	Reduce using private cars	1	IE 1.4	Smoking area is located outside the building and not less than 10 m from doors, windows, or air intakes.
1	SL 3.1	Ecological Open Space not less than 25% of the building footprint or 20% of the land area.	1	IE 1.5	The efficiency of air filter: Pass the standard.
1	SL 3.2	Plant 1 big tree per 100 m <sup>2</sup> of open space (do not relocate natural big trees other sites).	1	IE 3	Indoor lighting system control
1	SL 3.3	Use local or native plants appropriately	4	IE 4	Use natural light in the building
4	SL 4	Infiltration of storm water and flooding prevention.	3	IE 5	Thermal Comfort
2	SL 5.1	Green roof or vertical garden	3 Points	Section	7 Environmental Protection (The minimum scores : 1 Points)
1	SL 5.2	Hardscape area received direct solar radiation not more than 50% of the total hardscape area.	[Prerequisite]	EP P2	Waste management
1	SL 5.3	Place big native trees that can shade the building efficiently and do not damage the building at the Western, Eastern, and Southern sides of the building.	1	EP 2	Condensing unit/ cooling tower location
6 Points	Section	3 Water Conservation (The minimum scores : 2 Points)	1	EP 3	External glazing
2	WC 1.1	The total water saving is 15%, or use water saving toilets	1	EP 5	Install meter for wastewater treatment systems electricity use
2	WC 1.2	The total water saving is 25%, or use water saving faucets in WC.	5 Points	Section	8 Green Innovation in Design
2	WC 1.3	The total water saving is 35%, or water management and use rainwater / install enduse water meter	1	GI 1	.....
19 Points	Section	4 Energy and Atmosphere (The minimum scores : 8 Points)	1	GI 2	.....
[Prerequisite]	EA P2	Minimum energy efficiency	1	GI 3	.....
16	EA 1	Energy efficiency	1	GI 4	.....
2	EA 2	Renewable Energy: 0.5-1.5% of building energy cost	1	GI 5	.....
1	EA 4	Refrigerant in air conditioning systems that not destroys ozone layer	62 Points	The total score	
0 Point	Section	5 Material Resources (No assessment in this section)	22-27 Points = Get level 1, 28-32 Points = Get level 2, 33-44 Points = Get level 3, > 45 Points = Get level 4		

## Section 1 Building Management (BM)

BM P1	Green building preparation	Prerequisite
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### Intent

For systematic and smooth green building design and construction process, which the project teams and persons in charge could efficiently maintain and fulfill the green building rating requirements throughout the project.

### Requirement

Have working, monitoring, and evaluating action plans for green building design, construction, planning, and management complying with TREES. The requirement is only plans, not outcomes. The action plan shall comprise 1) Name list of the project team and head of the project: Owners, Architects or Engineers (who designs the building, or who are supervisor or contractor), Building inspector, Building manager, and/or TREES-A and Commissioning agents. [At least one TREES-A must be included in the TREES - PRE NC Project team.](#) 2) Activities specified to the person in charge that correspond to each attempted TREES credit. 3) Activities details including techniques and methodologies that will be used in brief. 4) Schedules of each activity (when the activity will be launched and how long of each activity).

### Implementation

Set up the working group and the action plan that conforms to TREES-NC. The plan shall start from the beginning period of the project concept formulation, and have chief executive or appointed representative as a project leader.

### For further Information

TREES-NC Reference Guide Version 1.1 page 7-11.

### Documents

1. Name list of the project team and head of the project: Architect, Engineer, Owner and TREES-A.
2. Duties specified to the persons in charge of each activity that correspond to each section.
3. Details of the activities including techniques and methodologies that will be use in brief.

## Section 2 Site and Landscape

SL P1	Avoid inappropriate construction site	Prerequisite
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### Intent

To avoid the development on inappropriate sites and reduce the environmental impact from locating the building on the site. Building or land development shall be located on low ecological value area or as specified in city planning regulation.

### Requirement

Do not develop buildings, hardscape, roads, or car parking areas on the land that meet any criterion as follows:

1. Natural habitat of wildlife that are preservation or risk to extinction, or sanctuary or conservation area or wildlife sanctuary area according to Thai's laws including the protected area, water source area, or has various ecosystems, or valuable area which is required for conservation.
2. Undeveloped area within 15 m from natural water resource that are habitat of aquatic animals and animal reproduction.
3. The area used as forestry plantations before developing the project except the Developers trade the land of equal or greater size for the existing area as the new forestry plantation site.
4. Avoid construction at the high ecological valuable area or with city planning conflict such as low area which prone to flooding, area of natural water way, catchment (watershed / drainage / basin) area that receive water from surroundings, retention area, wetland, area with slope more than 30%.

### Implementation

During the site selection process, give preference to sites that do not include sensitive elements or restrictive land by law and city planning regulation before deciding to develop the project. Design the building with minimum development footprint as specified to reduce destruction of existing ecosystems or habitat. Site of the building and appropriate development area shall be considered the possibility to reach the credit requirement in the section SL3 Sustainable site planning and SL4 Infiltration of storm water and preventing flooding problem.

### For further Information

TREES-NC Reference Guide Version 1.1 page 29-34.

### Documents

1. Fill the information in TREES-NC V1 SL P1 form, mention the details of site and location, size of the project area, and building construction boundary.

2. Other related documents such as confirmation letters from the responsible organization to confirm that the selected site is not located at the prohibited area, or layout presented that the construction will not trespass the prohibited area, or the documents presented the replacement green area.



SL P2	Reduce negative impact to green field areas	Prerequisite
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### Intent

Reduce impact from development to green area or the area that the ecosystems are rich. Recover green area in the developing project to increase ecological value and quality of life of the building occupants.

### Requirement

#### Alternative 1

In case of the Previously Developed Area or has low ecological value, have *Ecological Open Space* area for at least 10% of the building footprint area. *Ecological Open Space* shall have green area for at least 25% (natural pools surrounding with relaxing areas can be counted toward *Ecological Open Space*). Do not use this area for roads or car parks. Hardscape can be counted as part of the *Ecological Open Space* if the activities on the hardscape can support quality of life of the building occupants such as walkway or recreation activities. Roof area cannot be counted toward *Ecological Open Space*.

#### Alternative 2

If the area is Not Previously Developed, site survey and list of environmental elements that have high ecological value are required, and construction should be avoided in these areas. Limit development boundary not exceed 15 m from the edge of the building (to prevent high biodiversity area invasion from the building perimeter). The development boundary shall not exceed 5 m from the edge of infiltration area, walkway, road, and car park. Do not disturb the area outside the development boundary.

### Implementation

For the project located on the previously developed area or low ecological value area, study and select the appropriate plant species local to the area. Opportunity to receive the points in the section SL3 Sustainable site planning shall be considered.

For the project located on the existing green area, building construction boundary and the development area shall be limited. Survey the site to specify the necessary environmental elements which lead to the appropriate land use planning. Design the building which affects to the environment or has building footprint as small as possible, and/or has more number of floor. Avoid car park construction. Opportunity to receive the points in the section SL3 Sustainable site planning shall be considered.

### For further Information

TREES-NC Reference Guide Version 1.1 page 35-40

### Documents

Fill the information in TREES-NC V1 SL P2 form.

**Alternative 1:** Previously Developed Area, these documents shall be presented.

1. Confirmation documents specify that the site is previously developed area.
2. Layout presenting project boundary and building perimeter including ecological open space calculation.

**Alternative 2:** Not a Previously Developed Area, these documents shall be presented.

1. Layout presenting project boundary and building perimeter with the 15 m line from building perimeter including hardscapes in landscape area such as road, car parking with the 5 m line from the edge of that hardscape.

<b>SL 1</b>	<b>Locate project on the developed land</b>	<b>1 Point</b>
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**Intent**

Select the construction site in previously developed area and in urban areas with existing infrastructure to protect forest, habitat and natural resources from invasion.

**Requirement**

Select the construction site that has 10 types of urban facilities within 500 m radius from the main entrance of the project. These facilities shall be accessible within the specified radius (not separated by channel, fence, etc).

- |                              |                                    |
|------------------------------|------------------------------------|
| 1. Temple or Religious Place | 10. Museum                         |
| 2. Shop                      | 11. Hospital and Health Station    |
| 3. Post Office               | 12. Supermarket                    |
| 4. Police Station            | 13. Market                         |
| 5. Fire Station              | 14. Beauty Shop                    |
| 6. Beauty Salon and Massage  | 15. Coffee Shop and/or Bakery Shop |
| 7. Restaurant                | 16. Office                         |
| 8. Public Park               | 17. Government Office              |
| 9. Educational Institute     | 18. Etc.                           |

Restaurants and shops can be counted twice for each category. For example, if there are 2 restaurants and 2 shops, they can be counted as 4 types. In case of department store, list of urban facilities that meet the requirement of specified number and type shall be presented, and the department store shall be located within the 500 m radius. Urban facilities not listed may be counted, but approval from TGBI is required. Facilities that do not promote morality or health of building occupants cannot be counted. Stalls or booths shall be considered as a group and regarded as market type (counted as only 1 type).

**Implementation**

Project site shall be located near various and enough urban facilities. In addition, urban facilities shall be convenient to access. Site with public transport systems shall be considered to get credits from the Section SL2: Reduce using private cars.

**For further Information**

TREES-NC Reference Guide Version 1.1 page 41-46

**Documents**

Fill the TREES-NC SL1 form and provide the following documents.

1. Aerial photographs or drawings specified urban facilities.
2. Table presenting the details of name and type of facilities with distance from the main entrance of the project to the entrance of those urban facilities.
3. Other confirmation documents (if any).

SL 2	Reduce using private cars	1-4 Points
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#### Intent

To reduce pollution and land development impact from car and motorcycle use.

#### Requirement

Select the site and/or prepare car parking as follow (1 point for each topic but not more than 4 points):

1. **Public transportation system, Railway:** Select the site within 500 m (measured from main building entrance) from at least 1 rail station, sky train station or underground train station, or have a shuttle service plan to the station that can serve 25% of building occupants per day. The shuttle vehicle shall be eco car, CNG, Hybrid, E20+, electric, or other vehicle types that can reduce petrol and natural gas demand significantly.

2. **Public transportation system, Road:** Select the site within 500 m (measured from main building entrance) from bus stops or bus stations or other public vehicles that has at least 2 routes, and the building occupants can access these stations easily, or have a shuttle service plan to the station that can service 25% of building occupants per day. The shuttle vehicle shall be eco car, CNG, Hybrid, E20+, electric, or other vehicle types that can reduce petrol and natural gas demand significantly.

3. **Bicycle parking system:** Provide bicycle parking not less than 5% of the maximum of regular building occupants and transient building occupants (such as guests or customers). Provide shower rooms not less than 0.5% of the total number of full time equivalent (FTE) occupants. Bicycle parking areas and shower rooms shall be located not more than 80 m from the main building entrance. In case of residential building, shower room is not required but bicycle parking spaces are increased to not less than 15% of the dwellers.

4. **High performance car parking system:** Provide preferred car parking location for eco car, CNG, Hybrid, E20+, electric, or other vehicle types that can reduce petrol and natural gas demand significantly, or for carpool near the main entrance of the building as much as possible for at least 5% of the total vehicle parking of the building.

5. **Other public transportation systems:** Water Transportation or Sustainable Public Transportation.

#### Implementation

Select the project site near public transportation systems. Survey the walking route from the main building entrance to the stations or bus stops. Locate building and main entrance of the building appropriately and near mass transit. Design car parking that has enough area for eco car, CNG, Hybrid, E20+, electric, or carpool including preparing bicycle parking area and shower area that are enough and convenient

**For further Information**

TREES-NC Reference Guide Version 1.1 page 47-55

**Documents**

Fill the information in TREES-NC V1 SL 2 form. Each compliance option need additional documents as follows:

**Alternative 1, 2, and 5: Public transportation system, Railway, Public transportation system, Railway, and Other public transportation systems.**

Document presenting the location of public transportation systems i.e. railway stations, sky train stations, underground stations, bus stops, bus stations, coach bus stations, ports, and other types of public transportation including walking distance from the building in the project to these public transportation stops/stations as well as service time table. In case shuttle service is provided by the project, plan from the project to the station and the service plan shall be attached.

**Alternative 3: Bicycle parking system**

Layout presenting the location and the number of bicycle parkings and shower rooms with calculation of their proportion to building occupants and visitors.

**Alternative 4: High performance car parking system**

Layout presenting the location and the number of high performance car parking spaces with calculation of their proportion to the total parking spaces.

SL 3.1	Ecological Open Space not less than 25% of the building footprint or 20% of the land area	1 Points
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#### Intent

Design for more open space ratio which is the opportunity to increase green area, animal habitats, reduce flooding problems, reduce urban heat island effects, and increase outdoor public activities.

#### Requirement

##### Alternative 1

Design *Ecological Open Space* not less than 25% of building footprint, and green area for at least 40% of *Ecological Open Space* (include the natural pool that is specified to be a relaxing area around the pool). Do not use this area for car and car parking. Hardscape can be counted as part of the *Ecological Open Space* if the activity on the hardscape can support quality of life of the users such as walkway or activity space. Roof area cannot be counted for the points in this alternative.

##### Alternative 2

In case of the project that aims to get the point in the section SL 1 Develop project on the developed land, design the building which has an *Ecological Open Space* not less than 20% of the project area. Roof area can be counted for the points in this alternative but the characteristic of the roof shall be *Ecological Open Space* that is specified in the alternative 1.

#### Implementation

Survey the site to specify the elements that will be used for appropriate land use planning. Locate the building location appropriately or design for as small building footprint as possible. Avoid large building footprint on the site. Avoid large car parking on the ground but stack car parking or build underground car parking. Consider for planning green area in the open space efficiently and reach to the requirement. In case of densely area, use roof area for ecological open space. Consider to get the points with the section SL 5 Reduce Heat Island Effects in urban area from project development.

#### For further Information

TREES-NC Reference Guide Version 1.1 page 56-62

#### Documents

Fill the information in TREES-NC V1 SL 3.1 form. If **Alternative 1: Previously developed land**, is selected, layout presenting project boundary and building boundary with ecological open space calculation shall be provided. If **Alternative 2: Not previously developed land** is selected, the layout presenting project boundary and the quantity of ecological open space and size of roof garden shall be provided.

SL 3.2	Plant 1 big tree per 100 m <sup>2</sup> of open space (do not relocate natural big trees other sites).	1 Points
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#### Intent

Improve microclimate appropriately for good environment in the building, improve energy saving, reduce urban heat island effect, and support harmony living among human being, animals and other creatures.

#### Requirement

- Plant no less than 1 big tree per 100 m<sup>2</sup> of open space.
- The planted trees must be fully grown to provide permanent shading within 5 years.
- Keep the existing plants and/or grow additional native plants. The tree canopy diameter when fully grown shall be no less than 4.5 m or the tree height when fully grown shall not less than 6 m. The trees shall not be relocated from other places except relocated from commercial plantation areas.

#### Implementation

Try to provide shading for outdoor hardscape using medium/large size tree to create comfort microclimate and improve building energy saving. Consider locate big trees correspondent with requirement in SL5 Reduce Heat Island Effects which big trees are used to shade hardscape. High reflectance hardscape materials shall also be used to reduce heat absorption from solar radiation.

#### For further Information

TREES-NC Reference Guide Version 1.1 page 63-69

#### Documents

Fill the information in TREES-NC V1 SL 3.2 form which require information and documents as shown in Table SL 3.2 T 2.

Table SL 3.2 T 2

Source	Possibility to get points	Required documents
Trees from commercial plantations	Yes	Confirmation documents from source
Trees relocated from other places	No.	-
Nursery plants	Yes, if they can fully grow within 5 years and will have crown size not less than 4.5 m in diameter or height not shorter than 6 m	Confirmation documents from landscape architect or responsible person to confirm plant types, growing methods,



Source	Possibility to get points	Required documents
		soil conditions, and maintenance methods to ensure the growth trend in the next 5 years.
Not native species, invasive alien species	No	-
Nursery plant that when fully grown will have crown size smaller than 4.5 m in diameter or height shorter than 6 m	No	-
Deciduous species	Yes, but the proportion of deciduous species in the project shall be less than 10% of all big trees.	Documents presenting plant species, plant numbers, and plant layouts.
Existing plants	Yes, even though, the plants might not be native (such as palm) and they can be relocated within the site.	Existing plant layout, existing area photos.

SL 3.3	Use local or native plants appropriately	1 Points
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**Intent**

Develop the appropriate ecosystems and support good environment for energy saving. Reduce water use for landscape. Reduce urban heat island effect. Promote constructing and recovery of ecosystems.

**Requirement**

Select local or native plants for landscape in the project which are suitable for local climate and environment i.e. withstand drought and disease. Do not use invasive alien species or weed. Plant selection shall be referred to plant species as specified in this section.

**Implementation**

Consult with Landscape Architects to select local or native plants. Consider planning green area to get points from SL 3.1 *Ecological Open Space* not less than 25% of the building footprint area, SL 3.2 Plant 1 big tree per 100 m<sup>2</sup> of open space (do not relocate natural big trees other sites), and SL 5 Reduce Heat Island Effects in urban area from project development.

**For further Information**

TREES-NC Reference Guide Version 1.1 page 70-77

**Documents**

Fill the information in TREES-NC V1 SL 3.3 form and provide the following documents.

1. Planting plan specifying location, quantity, and type of the plants that are used in the project.
2. In case of using existing plants in the project area: provide existing plan and photos showing the area existing condition prior to the beginning of the project construction.
3. Confirmation documents from landscape architect in case of using plant species other than those specified in the reference guide.

<b>SL 4</b>	<b>Infiltration of storm water and flooding prevention.</b>	<b>4 Points</b>
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**Intent**

Reduce flooding problem because of project development by reducing the impervious surface.  
Increase the infiltration area or build retention pond to slow down water flow before releasing to the area outside the project.

**Requirement****Alternative 1**

Calculate area-weighted average runoff coefficient of overall surface area of the project (not include retention pond area). The result from calculation can be transferred to the points as specified in Table SL4 T1

**Table SL4 T1**

<b>Area-Weighted Average Runoff Coefficient Points</b>	<b>Points</b>
more than or equal to 0.70	1
more than or equal to 0.60 but less than 0.70	2
more than or equal to 0.50 but less than 0.60	3
less than 0.50	4

**Alternative 2**

Compare before and after volume and peak discharge rate of storm water runoff from the project.  
Peak discharge rate of storm water runoff that does not exceed the volume and rate before the development or reduce after the project development can be transferred to the points as specified in table SL4 T2.  
calculate Volume and Peak Discharge Rate of Storm Water Runoff from the statistic of rainstorm for the 2-year, 24-hour design storm. Use Bangkok data if there is no data of the project area.

**Table SL4 T2**

<b>Difference of Volume and Peak Discharge Rate of Storm Water Runoff between before and after project development</b>		<b>Points</b>
<b>Case 1:</b> Area-Weighted Average Runoff Coefficient before project development less than or equal 0.5	Not change	4
<b>Case 2:</b> Area-Weighted Average Runoff Coefficient before project development more than 0.5	Reduce 10%	1
	Reduce 15%	2
	Reduce 20%	3
	Reduce 25%	4

**Implementation**

Design the project that has infiltration surface. Select landscape materials such as grass blocks (which has grass area 50% of the surface area), floor planks with space between the planks, or flooring

materials which have gap or hole and water can leak through the ground. Use retention pond which can be natural type or man-made type. Consider possibility to get points from the section SL 3.1 *Ecological Open Space* more than 25% of the building footprint using the open space which has a potential to receive and slow down water, and can be used as green area of the project.

#### For further Information

TREES-NC Reference Guide Version 1.1 page 78-85

#### Documents

Fill the information in TREES-NC V1 SL 4 form. Additional information and documents are required as follows:

##### **Alternative 1**

1. Data and calculation s of area-weighted average runoff coefficient of the project.
2. Site layout specifying area and area-weighted average runoff coefficient of each area.

##### **Alternative 2**

Data and report of water volume and flow rate simulation from the project.

SL 5.1	Green roof or vertical garden	2 Points
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**Intent**

To reduce urban heat island (the different temperature between developed and not developed area) impact from roof and building envelope that affects to microclimate and human dwelling and animal habitat including other wildlife.

**Requirement**

Proportion of green roof and vertical garden [have slope  $< 60^{\circ}$ , measured from horizontal (according to definition of wall and roof in ASHRAE 90.1 2007)] that covered by plants, and use the equation as follow:

$$GSA = GRA + GWA \times 0.5$$

Meaning

GSA = Green Surface Area

GRA = Green Roof Area

GWA = Green Wall Area

GSA/the total of roof area (not include building systems area and void for natural light)

> 0.5 (get 1 point)

GSA/the total of roof area (not include building systems area and void for natural light)

> 0.8 (get 2 points)

**Implementation**

Grow the plants on the roof or outside walls that may be pergola climbing plants, semi-permanent potted plant, and vertical garden. Avoid plot for trees or grass type which is wasteful because of high maintenance requirement, and may be harmful to the environment because of chemical pesticide requirement. Consider to get the points with the section SL 3.1.

**For further Information**

TREES-NC Reference Guide Version 1.1 page 86-90

**Documents**

Fill the information in TREES-NC V1 SL 5.1 form and provide the following documents.

1. Roof plan presenting the proportion of roof garden and elevations presenting the proportion of vertical garden.
2. Detail drawings presenting construction methods, materials, and gardenning systems for presenting the possible of construction and permanent of the work.

SL 5.2	Hardscape area received direct solar radiation not more than 50% of the total hardscape area	1 Points
--------	--	----------

#### Intent

To reduce urban heat island (the different temperature between developed and not developed area) impact from hardscape that affects to microclimate and human dwelling and animal habitat including other wildlife.

#### Requirement

Shade the outdoor hardscape by plants, or select the appropriate construction and material. Apply these strategies for hardscape for more than 50% of the total outdoor hardscape area.

- Shading the hardscape to reduce direct solar radiation by big trees.
- Flooring materials: high solar radiation reflectance value more than 30%
- Roofing materials: high solar radiation reflectance value more than 30%
- Roofing by plants or solar cells.
- Use grass block (planting area 50% or more of grass block area).

#### Implementation

Reduce outdoor hardscape area. Try to shade outdoor hardscape surface by plants including selecting flooring materials which have high solar radiation reflectance value to reduce solar radiation absorption. Consider providing roof for the walkway by materials which have high solar radiation reflectance value. Consider to get the points with the section SL 3 Sustainable site planning, and the section SL 4 Infiltration of storm water and prevent flooding problem.

#### For further Information

TREES-NC Reference Guide Version 1.1 page 91-97

#### Documents

Fill the information in TREES-NC V1 SL 5.2 form and provide the following documents.

1. Project layout presenting the boundary of hardscape with material specifications and area calculation.

2. Technical documents specifying hardscape materials' Solar Reflectance Index (SRI) or Solar Reflectance and Solar Emittance.

SL 5.3	Place big native trees that can shade the building efficiently and do not damage the building at the Western, Eastern, and Southern sides of the building.	1 Points
--------	--	----------

#### Intent

To reduce impact from direct solar radiation to the building, and reduce building surface temperature which may contribute to urban heat island effect including heat to microclimate.

#### Requirement

1. Grow big native trees at the Western, Eastern, and Southern sides of the building. Put the location of the trees that the branch radius of each tree (5 years old) shall be touched or had a distance not more than 1 m from each other for efficient shading.

2. Branch and root radius shall have appropriate distance, and not disturb or damage the building.

#### Implementation

Shade outdoor walls and windows by native big trees, and consider to create landscape around the building. Put the location of the trees for the maximum benefit to reduce solar radiation absorption by the building and other elements. Consider to get the points with the section SL 3 Sustainable site planning, and the section SL 5.2 Hardscape area received direct solar radiation not more than 50% of the total hardscape area.

#### For further Information

TREES-NC Reference Guide Version 1.1 page 98-102

#### Documents

Fill the information in TREES-NC V1 SL 5.3 form and provide the following documents.

1. Site layout presenting the location of native plants in the project that on the Southern, Western, and Eastern sides of the building.
2. Layout of native plants presenting crown size and height.
3. List of native plants in the project.
4. Confirmation from landscape architect that selected plants are native or have adapted to the environment and can shade the building and surrounding area effectively.

### Section 3 Water Conservation



WC 1	Water saving and water efficiency	6 Points
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**Intent**

To increase water efficiency in the building and/or water management and/or rain water collecting which is clean and do not have a cost in order to reduce the burden from potable water supply and treatment.

**Requirement****Alternative 1**

(Select 1 or 2)

1. Use water saving water closet and urinal more than 90% of overall toilet (1 point).
2. Use water saving water closet and urinal 100% of overall toilet (2 points).

(Select 3 or 4)

3. Use water saving faucet or metering faucet more than 90% (1 point).
4. Use water saving faucet or metering faucet 100% (2 points).

(Select 5 and/or 6)

5. Install sub-meter for water in the project (1 point).
6. Install rain water tank to collect rain water for 5% of rain water quantity in 1 year (1 point).

**Alternative 2**

1. Reduce water use consumption 15% from baseline (2 points).
2. Reduce water use consumption 25% from baseline (4 points).
3. Reduce water use consumption 35% from baseline (6 points).

**Implementation**

Reduce water use by installing water saving fixtures and/or water saving faucet or have metering faucet, or use other technologies such as waterless urinal and compost toilet which does not need water including water meter installation to manage water use. Check water leakage regularly especially at the main area and around the building. In addition, rain water collecting may be considered to reduce potable water demand.

**For further Information**

TREES-NC Reference Guide Version 1.1 page 103-117

## Documents

Fill the information in TREES-NC V1 WC 1 form and provide the following documents.

### For Alternative 1

1. Floor plan and/or details drawing of WC.
2. Calculation of the number of toilets and faucets that are installed: water saving type and general type.
3. Details of toilets and faucets that are installed.
4. Average rain water in 1 year and volume of rain water collecting tank.
5. Layout of water valve location.

### For alternative 2

1. Building area and building occupants according to Table WC 1 T 1
2. Details of toilets and faucets that are installed.
3. Volume of rain water collecting tank (if any).
4. Amount of waste water treated for reuse (if any).

Table WC 1 T 1

Building Type	Useable Area per 1 person (m <sup>2</sup> )	
	FTE	Transient
Office	23	0
Department Store	51	12
Restaurant	41	9
Hospital	21	31
Factory	232	0
Warehouse (Storage)	1858	0
Hotel	139	65
Nursery	59	10
School (Primary, Secondary)	121	13
University	195	14

## Section 4 Energy and Atmosphere

EA P2	Minimum Energy Efficiency	Prerequisite
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#### Intent

To establish the minimum level of energy efficiency for green building.

#### Requirement

Get at least 4 points in the section EA 1 and [Pass OTTV/RTTV requirement according to Energy Regulation B.E.2552](#).

#### Implementation

Architects shall consider designing the building which has high efficiency in energy use. Design and select building envelope systems, air conditioning systems, electrical and lighting systems, and other systems involved with energy use that are appropriate with climate and have higher efficiency than general standard. Whole building energy use shall lower than baseline as specified in energy use regulation and law of new building construction in the selected alternative.

#### For further Information

TREES-NC Reference Guide Version 1.1 page 127-153.

#### Documents

Fill the information in TREES-NC P2 EA1 form and provide the following documents:

##### Alternative 1

1. Summary report of energy use with details of inputs in the simulation program.
2. CD containing files from BEC program.

##### Alternative 2

1. Summary report of energy use as specified in ASHRAE 90.1-2007 Appendix G which is presented in the example in TREES-NC Reference Guide Version 1.1.
2. CD contains files and report of simulation from software.

##### Alternative 3

1. TEEAM form (model NR-O 49.02) for each building type, section 3-6 (only energy points).
2. Details of designs, technologies, and equipments that shall be prepared for verification **and/or** confirmation documents of each section from the Ministry of Energy of Thailand.

For all alternative, calculation of OTTV/RTTV must be presented as specified in the Ministerial Regulations B.E. 2552 (2009) for evaluation.

EA 1	Energy Efficiency	16 Points
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**Intent**

To develop efficiency of energy use in the building that shall be higher than the standard: ASHRAE 90.1-2007, or Ministerial Regulation for Energy Saving Building Design B.E. 2552 (2009) under The Energy Conservation Promotion Act (second version) B.E. 2550 (2007), or Thailand Energy and Environmental Assessment Method (TEEAM) for environmental impact reduction from energy use.

**Requirement****Alternative 1**

Use Whole Building Simulation as specified in Ministerial Regulation for Energy Saving Building Design B.E. 2552 (2009). Compare energy use reduction with points using Table EA1 T1.

**Alternative 2**

Use Proposed and Baseline Energy Simulation from ASHRAE 90.1-2007 Appendix G that can be used with Thai's climate. Compare energy use reduction with points using Table EA1 T1.

**Alternative 3**

Use TEEAM model 49 which shall be counted for credits only section 3-9 (only energy points). Transfer the result to the points using Table EA1 T1. Send the evaluation form that is produced by the project team with documents and evidence such as drawings or specifications to confirm.

**Table EA1 T1**

Points	Ministerial Regulations B.E. 2552 (2009) (Energy Value)		ASHRAE 90.1-2007 Appendix G (Energy Cost)		TEEAM	
	Renovate	New Construction	Renovate	New Construction	Renovate	New Construction
4	0-5	6-10	0-5	6-10	51-55	51-55
6	6-10	11-15	6-10	11-15	56-60	56-60
8	11-15	16-20	11-15	16-20	61-65	61-65
10	16-20	21-25	16-20	21-25	66-70	66-70
12	21-25	26-30	21-25	26-30	>=71	>=71
14	26-30	31-35	26-30	31-35		
16	31-35	36-40	31-35	36-40		

**Implementation**

Architects shall consider designing high performance and energy efficient building. Design and select the building envelope systems, air conditioning systems, electrical and lighting systems, and other systems that involved with energy used, appropriate with climate and have efficiency higher than general standard. Whole building energy use shall be lower than baseline as specified in energy use regulation and involved laws for new construction in the selected alternative.

**For further Information**

TREES-NC Reference Guide Version 1.1 page 127-153.

**Documents**

Fill the information in TREES-NC P2 EA1 form and provide the following documents:

**Alternative 1**

1. Summary report of energy use with details of inputs in the simulation program.
2. CD containing files from BEC program.

**Alternative 2**

1. Summary report of energy use as specified in ASHRAE 90.1-2007 Appendix G which is presented in the example in TREES-NC Reference Guide Version 1.1.
2. CD contains files and report of simulation from software.

**Alternative 3**

1. TEEAM form (model NR-O 49.02) for each building type, section 3-6 (only energy points).
2. Details of designs, technologies, and equipments that shall be prepared for verification **and/or** confirmation documents of each section from the Ministry of Energy of Thailand.

For all alternative, calculation of OTTV/RTTV must be presented as specified in the Ministerial Regulations B.E. 2552 (2009) for evaluation.

<b>EA 2</b>	<b>Renewable energy</b>	<b>2 Points</b>
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**Intent**

Give priority to use renewable energy to reduce environmental and social impacts associated with fossil fuel energy use.

**Requirement**

Use on-site renewable energy systems such as solar power (solar cell, water heater), wind power, or bio fuel-based energy for 0.5-1.5 % of the building's annual energy cost which may be calculated from computer simulation model in the section EA 1.

1. Produce renewable energy not less than 0.5 % of energy cost in the building. (Get 1 point)
2. Produce renewable energy not less than 1.5 % of energy cost in the building. (Get 2 points)

In case of choice 3 in the section EA1, use the average of the energy per building area in each building type as specified in Table EA2 T1 and calculate energy cost using 3.5 THB per Unit for the average of energy cost.

**Table EA2 T1**

Building Type	Energy Use per Usable area per Year
<b>1. Office</b>	kWh/year/m <sup>2</sup>
1.1 Large and high-rise building	215.80
1.2 Extra-large but not high-rise building	199.90
1.3 Extra-large and high-rise building	218.50
<b>2. Mall</b>	kWh/year/m <sup>2</sup>
2.1 Discount Store	336.40
2.2 Department Store	240.60
2.3 Shopping Plaza or Area for Rent	204.20
2.4 Supermarket	418.40
<b>3. Hospital</b>	Energy Use per Patient per Year MJ/Bed-Day (in Year)
3.1 Public Hospital	262.00
3.2 Private Hospital	625.00
<b>4. Others building type which are not specified</b>	240 kWh/year/m <sup>2</sup>

**Implementation**

Renewable energy systems such as solar, wind, bio-fuel based energy shall be installed in the project which may be sold back to the electricity grid of the Electricity Authority.

**For further Information**

TREES-NC Reference Guide Version 1.1 page 154-159

**Documents**

Fill the information in TREES-NC V1 EA2 form and provide the following documents.

1. Describe renewable energy type and installation type in the project.
2. Specification of the equipments that involved with renewable energy systems of the project.
3. Renewable Energy Calculation Report as specified in the section EA1 or other methods.



EA 4	Refrigerant in air conditioning systems that does not harm ozone layer	1 Point
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**Intent**

Reduce using refrigerant that harms ozone layer.

**Requirement**

Do not use CFC and HCFC-22 in all air conditioning units that use refrigerant more than 0.3 kg.

In case of new building expansion from old building (that the old building is also assessed), refrigerant of the old building shall be changed to be non-CFC and HCFC-22 except the plan to reduce refrigerant leakage is provided.

**Implementation**

Do not use CFC and HCFC-22 based refrigerants that is harmful to ozone layer in air conditioning systems.

**For further Information**

TREES-NC Reference Guide Version 1.1 page 166-170.

**Documents**

Fill the information in TREES-NC V1 EA4 form and provide the following documents.

1. Confirmation documents from the manufacturer specifying the details of refrigerant used in air conditioning systems or refrigeration equipment.

For the old building, where CFC and HCFC are still in use must provide

1. Plan to reduce refrigerant leakage.
2. Action plan to change all of the air conditioning systems that use CFC and HCFC-22 within 5 years period.
3. Economics Breakeven Report if there is no plan to change the chiller systems to the new systems.

## **Section 5 Materials and Resources**

For TREES PRE-NC V1.1, no credits in this section.

## Section 6 Indoor Environmental Quality

IE P1	Ventilation rate in the building	Prerequisite
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**Intent**

Confirm well-being of the building occupants in the area of appropriate ventilation.

**Requirement****Alternative 1**

Ventilation flow rate in both air-conditioned area and non-air-conditioned area meet the requirements of the Building code, Vol.39 B.E.2537 (1994), according to Building Control Act, B.E. 2522 (1979), and meet the requirements of ventilation standard for indoor air quality (IAQ) of EIT (EIT-3010)

**Alternative 2**

Ventilation flow rate in both air-conditioned area and non-air-conditioned area meet the requirements in ASHRAE62.1-2007.

**Implementation**

Design fresh air volume into the building that shall meet the minimum requirements as specified in the laws and EIT standard or international standard.

**For further Information**

TREES-NC Reference Guide Version 1.1 page 214-221

**Documents**

Fill the information in TREES-NC IE P1 form and provide the following documents.

1. Location or layout of the building presenting air-conditioned areas.
2. Details of ventilation systems and calculation for the selected alternative.

IE P2	Illuminance in the building	Prerequisite
-------	-----------------------------	--------------

Minimum illuminance level: Pass the standard

### Intent

Confirm about well-being of the building occupants in the area of appropriate illuminance.

### Requirement

Illuminance from artificial lighting (not include natural light) pass the requirement as specified in the ministerial regulations in occupational health safety management and working environment that involved with heat, lighting, and noise, and pass the requirement as specified by Illuminating Engineering Association of Thailand (TIEA).

#### Option 1

Computer Simulation: lamp candle distribution curve (such as IES) from the manufacturer or testing shall be obtain for simulation. Horizontal Illuminance at height 0.75 m is to be measured. No natural light and furniture be modelled in the simulation.

#### Option 2

Hand calculation using method such as Lumen Method to confirm the number and type of light bulbs are specified appropriately.

### Implementation

Select the lamp and/or lighting methods that have high performance and appropriate dispersion.  
Select the location and height of luminaire for appropriately installation and for the maximum efficiency.

### For further Information

TREES-NC Reference Guide Version 1.1 page 222-227

### Documents

Fill the information in TREES-NC IE P2 form and provide the following documents.

#### Alternative 1

1. Building plan and artificial lighting plan for every floor.
2. Lamp and luminaire specification.
3. Computer simulation results.
4. Illuminance Summary report of each room/area from simulation.

#### Alternative 2

1. Building plan and artificial lighting plan for every floor.

2. Lamp and luminaire specification.
3. Illuminance Summary report of each room/area from simulation.

IE 1.1	Air Intake is not located at the location that has heat or pollution	1 Point
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#### Intent

To avoid pollution that will get into the building because of inappropriate location and location of air intake.

#### Requirement

Study the site and condition around the building. Design air intake which shall be far from heat or pollution such as car parking building, smoke ventilation outlet from the kitchen, air ventilation outlet from other buildings, road, chimney, etc. The distance from air intake shall far from the pollution sources not less than 10 m and has height from the ground not less than 3 m. Natural ventilation area can pass this section if there are active ventilation systems for enclosed space according to criteria in this section.

#### Implementation

Specify air intake at the green area or not less than 10 m far from the pollution sources and has height from the ground not less than 3 m. In case of high rise building, air intake shall be located at the top of the building to avoid pollution from the road or nearby buildings.

#### For further Information

TREES-NC Reference Guide Version 1.1 page 228-233

#### Documents

Fill the information in TREES-NC IE 1.1 form and provide the following documents.

1. Drawings or photos of site layout around the building.
2. Drawings or photos present the location of air intakes which relates to the surrounding both floor layout and section.
3. Confirmation documents of air intake design which avoid pollution from mechanical engineer or person in charge of building systems design of the project.

For non-air-conditioned building.

Ventilation flow rate calculation documents for enclosed non-air-conditioned spaces, and layout presenting air exhaust systems.

IE 1.2	Negative pressure for printing room, photocopying room, chemical storage, and cleaner storage	1 Point
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**Intent**

To avoid, manage, and control pollution that may happen in the building from direct resources.

**Requirement****Alternative 1**

In the space where pollution or hazardous gases or chemicals may be presented or used (include laundry room, print room, photocopy room), exhaust in each space shall not recirculate air. Provide self-closing doors and exhaust rate not less than 2.5 litres / ls / m<sup>2</sup>. The pressure differential with the surrounding spaces shall be at least 5 Pascals and 1 Pascal at a minimum when the door to the room is closed.

**Alternative 2**

For the building, which does not have the area involved with the characteristic as specified. The building can get the credit in this section automatically.

**Implementation**

High pollution area shall be designed to have enough air ventilation systems to reduce contamination in the building. Air vacuum shall have enough vacuum power to prevent the pollution that may spread to other using areas. To avoid this problem, the best strategy is to separate chemical and harmful toxin storage from the area that have regularly occupied users.

**For further Information**

TREES-NC Reference Guide Version 1.1 page 234-239

**Documents**

Fill the information in TREES-NC IE 1.2 form and provide the following documents.

**Alternative 1**

1. Name list of the rooms or the area that have pollution.
2. Calculation and specifications of air-handling units and ventilation systems to present that the specified areas have negative pressure, do not recirculate air or have air ventilation rate less than the surrounding area as specified.
3. Evidences showing the difference of air pressures both inside and outside of the polluted rooms.

**Alternative 2**

Confirmation documents for the building that does not have pollution rooms or areas from Mechanical Engineer or involved person.



IE 1.3	Prevent pollution from outside to inside of the building	1 Point
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**Intent**

Reduce toxin, harmful chemical, and dust that may come from the building occupants especially at the building entrance.

**Requirement**

Install entryway systems at the main entrance of the building. The accepted system is double layer doors with permanent grate system installation which has a slot for cleaning underneath. If using carpet, the weekly carpet cleaning contract from the cleaning company is required. The contract shall specify to cleaning period for at least 1 year after open the building to use.

**Implementation**

Consider preventing pollution and dust into the building at the building entrance by the appropriate systems. Double layer doors with permanent grate system is a good system with high efficiency. Using carpet shall be the second alternative but if this alternative cannot be avoided, contract with the cleaning company to confirm approximately weekly carpet cleaning is required.

**For further Information**

TREES-NC Reference Guide Version 1.1 page 240-244

**Documents**

Fill the information in TREES-NC IE 1.3 form and provide the following documents.

1. Documents present the location and size of building entrance systems such as drawings, building layout.
2. Summary list of the systems and specifications presenting qualification of entrance mat or flooring materials that used at the entrances.
3. Cleaning and maintenance plan presenting process and details of cleaning for entrance systems, mat, or flooring materials at all locations.

IE 1.4	Smoking area is located outside the building and not less than 10 m from doors, windows, or air intakes	1 Point
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**Intent**

Reduce impact from smoking to the occupants in the building, indoor area, and ventilation systems.

**Requirement**

1. Prohibit smoking in the building
2. Smoking area is not less than 10 m away from building entries or air intakes.

**Implementation**

Specify the smoking area according to the Notice of the Ministry of Public Health of Thailand (Vol.9) B.E. 2540 (1997), and mark or make signs for non-smoking area.

**For further Information**

TREES-NC Reference Guide Version 1.1 page 245-249

**Documents**

Fill the information in TREES-NC IE 1.4 form and provide the following documents.

1. Layout presenting the location of smoking area.
2. Plan or policy for no smoking in the building. The policy shall be signed by Building Manager, Property Manager, or Owner.

IE 1.5	The efficiency of air filter: Pass the standard	1 Point
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**Intent**

Reduce indoor air quality problem because of dust and pollution, and to improve air conditioning systems for promoting building occupants' health especially preventing respiratory diseases.

**Requirement**

Air Handling Unit (AHU) that has supply rate more than 1000 litres/second as specified in the standard of air-conditioned and air ventilation of EIT (EIT-3003) shall have the minimum MERV of air filter for at least MERV 7 (ASHRAE Standard 52.2) or for at least 25-30% (ASHRAE Standard 52.1 Dust Spot), or the air filter which have performance as specified in others reliable equivalent standard. Install at both Return Air and Outdoor Air Intake.

**Implementation**

Select air conditioning systems which air filter can be installed at the proper location especially for AHU size more than 1000 litres/second.

**For further Information**

TREES-NC Reference Guide Version 1.1 page 250-255

**Documents**

Fill the information in TREES-NC IE 1.5 form and provide the following documents.

1. Details and the location of air filter installation for Air Handling Units (AHU) that have handling rate more than 1000 litres/second.
2. Air filter details and certification documents from the manufacturer, which the minimum efficiency is MERV 7 or equivalent.
3. Drawings or details of air filter installation process with Air Handling Units at the return and outdoor air intake.
4. Installation details of air filters at outdoor air intake for all of the split systems used in the building.

IE 3	Indoor lighting system control	1 Point
------	--------------------------------	---------

Separate artificial lighting circuits at every 250 m<sup>2</sup> or as requirement.

#### Intent

Building occupants can control illuminance appropriately for productivity and well-being.

#### Requirement

##### Alternative 1

Provide lighting systems control for building occupants. The circuit shall not cover more than 250 m<sup>2</sup> per circuit. For the room that is smaller than 250 m<sup>2</sup>, the circuit shall be separated for each room.

##### Alternative 2

Design lighting systems control for regularly occupied space such as open plan office. Every user shall have a freedom to control illuminance for his or herself. Design task lighting for 90% of regular users.

#### Implementation

Design the building with lighting system control for each area such as ambient lighting and task lighting. For indoor space, the circuit shall not cover more than 250 m<sup>2</sup> per circuit, or use Task and Ambient light for regularly occupied space.

#### For further Information

TREES-NC Reference Guide Version 1.1 page 278-283

#### Documents

Fill the information in TREES-NC IE 3 form and provide the following documents.

##### Alternative 1

1. Drawings of electrical systems presenting the separation of artificial lighting control circuits for each area in the building.
2. Summary list of lighting control circuit separation as specified in the example.

##### Alternative 2

1. Percentage of the users that can control their task lighting.
2. Drawings of electrical systems presenting the details of equipment and systems for individual illuminance level control.
3. Details or specifications of equipment and systems for individual illuminance level control.

4. Summary list of equipment and systems for controlling individual illuminance level as specified in the example. If two choices are selected and mixed together, summary list can be provided as specified in the example.

**IE 4 Use natural light in the building****4 Points****Intent**

The building shall use natural light appropriately to reduce energy use and increase the quality of lighting in the regularly occupied spaces.

**Requirement**

Simulation by computer to calculate proportion between the areas that Daylight Factor (DF) in Overcast Sky are more than 2% and the total area of the regularly occupied spaces (measure at horizontal height 75 cm from the floor). The credits will be calculated from the minimum DF in the room that is more than 2% (when the minimum value in the room is more than 2%, this result means whole area of the room receive natural light) or only the area that the result is more than specified value such as open plan office.

Credits can be calculated as specified in Table IE 4 T 1.

**Table IE 4 T 1.**

Comparison of regularly occupied spaces proportion that is received natural light, and credits.

Areas with Daylight Factor (DF) more than 2%	Points for NC	Points for CS
45-55%	1	-
56-65%	2	1
66-75%	3	2
76-100%	4	3

Simulation shall reflect the actual physical of the building such as Transmittance of the glass, Reflectance of materials in the building. In simulation, no need to consider curtain in the building or have other buildings or exterior factors to reduce incoming natural light. Only permanent shadings are calculated.

Regularly Occupied Spaces means the area that have regular building occupants such as working room, working desk, meeting room for office building or public building, drawing room or living room for residential building.

**Implementation**

Consider to use natural light in the building. Regularly occupied spaces shall be designed to achieve natural light appropriately. Consider to depth of the room. Have enough area and number of openings, and locate at the appropriate location. Apply natural light design strategies such as light shelf, light pipe for more scattered light. Use skylight if natural light from windows is not enough. Avoid too big openings which may affect to more energy use and may loss the credits in the section EA1 Efficiency of energy use.

**For further Information**

TREES-NC Reference Guide Version 1.1 page 284-288

**Documents**

Fill the information in TREES-NC IE 4 form and provide the following documents.

1. Summary report of computer simulation results for all regularly occupies areas in the building.
2. Detail drawings of the equipment for shading devices used for the building (if any)
3. Summary list of the area and Daylight Factor of regularly occupied areas.

IE 5	Thermal Comfort	3 Points
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**Intent**

Promote well-being and productivity of the building occupants in the area of thermal comfort.

**Requirement**

1. Design air-conditioned area of the building to have temperature and relative humidity as specified in the standard of air-conditioned and ventilation systems of EIT (EIT-3003) or ASHRAE 55-2004.

2. Design non air-conditioned area of the building as specified in the standard of ASHRAE 55-2004: topic 5.3.

The building will get credits when the total proportions of the area meet two requirements. Regularly occupied space (as specified the definition in the section IE4) will be counted only, and shall meet thermal comfort standard (not include irregularly occupied space, corridor, storage). Credits for proportion of the area that meet thermal comfort standard are specified in the Table IE 5 T1.

**Table IE 5 T1**

The proportion of the regularly occupied space that pass the thermal comfort standard	Points
More than 60%	1
More than 90%	2
100%	3

**Implementation**

Design air conditioning systems which can work with full performance in peak operation period. Consider thermal comfort factors in various ways which are not only temperature and relative humidity but also heat radiation, wind velocity, activity, clothing including design which does not create trouble and uncomfortable to the users such as draft, stratification discomfort, radiant asymmetry.

**For further Information**

TREES-NC Reference Guide Version 1.1 page 289-293

**Documents**

Fill the information in TREES-NC IE 5 form and provide the following documents.

1. Summary report of the area that are designed to meet the requirement of thermal comfort.



2. Building floor plans presenting the regularly occupied areas with and without air conditioning systems.

3. List of cool air distribution systems of the project.

4. Cooling load calculation document or other documents as specified in the regulations of air conditioning systems and ventilation systems standard of EIT. (EIT-3003) or ASHRAE 55-2004.

## Section 7 Environmental Protection

EP P2	Waste management	Prerequisite
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**Intent**

Prepare to manage waste or debris for recycle which affects to landfill when the building is operated.

**Requirement**

Provide waste management plan for the building or the project as follows:

1. Provide enclosed and easily-accessible recycling collection area.
2. Provide trash collection point clearly in each floor or each part of the building with litter bins that shall be separated to garbage, hazardous waste, and rubbish. Rubbish shall be separated to papers, metals, glass, and plastics for at least.

**Implementation**

Designate recycling collection area clearly for easy to manage waste in the future.

**For further Information**

TREES-NC Reference Guide Version 1.1 page 302-306.

**Documents**

Fill the information in TREES-NC EP P2 form and provide the following documents.

1. Layout and floorplan of the project presenting the location of waste collection and segregation areas and rooms.
2. Calculation of the requirement area for waste collection and segregation room.

EP 2	Condensing unit/cooling tower location	1 Point
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**Intent**

Locate the condensing units or cooling towers of air conditioning systems at the location which not affects to the environment around the building. (If the building does not use air conditioning systems, this section is not needed to assess.)

**Requirement****Alternative 1**

Not locate compressor, heat extractor, or cooling tower close to the adjacent lands less than 4 m. In case of high rise building or extra-large building, the set back of compressor or cooling tower from the edge of the land shall not less than 8 m.

**Alternative 2**

Air conditioning systems has no condensing unit or cooling tower or other component that disperse heat and moisture into the atmosphere.

**Implementation**

Verify the site around the building. Specify the direction and location of heat ventilation of condensing units or cooling tower appropriately and not disturb the environment around the building, or consider selecting Geothermal or Lake Cooling Systems.

**For further Information**

TREES-NC Reference Guide Version 1.1 page 311-315.

**Documents**

Fill the information in TREES-NC EP 2 form and provide the following documents.

**Alternative 1:** Lay out presenting the installation distance of every compressor and cooling tower to nearest site boundary.

**Alternative 2:** Drawings and specifications of air conditioning systems which do not emit heat or vapour to the air.

EP 3	External glazing	1 Point
------	------------------	---------

**Intent**

Reduce impact from light reflection of the building to the environment because of the glazing of the building.

**Requirement**

All types of glass for building envelope shall be specified to have Visible Light Reflectance (Rvis) not more than 15% when measured in right angle. Rvis shall be verified from the reliable organization.

**Implementation**

Specify Rvis of all type of the glass for building envelope. Consider to select glass characteristic for energy conservation which has the standard score in the requirement in laws, and should consider the impact in the section EA1 Efficiency of energy use.

**For further Information**

TREES-NC Reference Guide Version 1.1 page 316-322

**Documents**

Fill the information in TREES-NC EP 3 form and provide the following documents.

1. Construction drawings or photos presenting all building elevations to show all exterior glazing (building envelope). Specifications specify model, type and manufacture of all exterior glazing (building envelope).
2. Documents to confirm glass specification from the manufacturer, verified from the reliable organization. The documents shall specify Visible Light Reflectance in terms of percentage of all exterior glazing (building envelope).
3. Confirmation documents from the architect or responsible person to confirm that the selected material is matte and does not require Visible Light Reflectance Test.

EP 5	Install meter for wastewater treatment system electricity use	1 Point
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**Intent**

Install meter to measure electricity use for waste water treatment systems.

**Requirement****Alternative 1**

Install specific meter to measure electricity using for waste water treatment systems only.

**Alternative 2**

Install waste water treatment systems that can treat waste water to have BOD5 and TSS equal or less than 10 mg per litre. The systems can treat waste water more than 50% of the total waste water from the project.

**Implementation**

Install meter to measure electricity using for waste water treatment systems only that is separated from other building systems, or install waste water treatment systems that can treat waste water to have BOD5 and TSS equal or less than 10 mg per litre.

**For further Information**

TREES-NC Reference Guide Version 1.1 page 330-334

**Documents**

Fill the information in TREES-NC EP 5 form and provide the following documents.

**Alternative 1:** Installation location and the number of the meters that are used to measure electricity in waste water treatment systems including drawings and diagram of waste water treatment systems.

**Alternative 2:** Drawings and specifications of waste water treatment systems and calculation of the amount of waste water and size of the systems.

## Section 8 Green Innovations

GI 1-5	Techniques not specified in the rating system	1-5 Points
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#### Intent

To encourage design and construction that achieves exceptional performance above the requirements and encourage innovative for green building categories not specifically addressed in this rating system.

#### Requirement

Follow these choices:

##### Alternative 1

Comply with the extra credit topics that are specified in each section above the requirement.

##### Alternative 2

Present the new energy and environmental topics which not addressed in this rating system.

#### Implementation

Study opportunity to receive special points in all topics, and energy and environmental issues that are not specified in the rating system to present to TGBI. In the future, if the innovation criteria for other projects are granted, the project can present topics from the criteria which are not mentioned in this rating system to receive the points in GI Section directly.

#### For further Information

TREES-NC Reference Guide Version 1.1 page 336-339

#### Documents

Fill the information in TREES-NC GI1-5 form. If the project team select **alternative 1**, provide the additional information for those alternatives with related documents. If the project team select **alternative 2**, additional documents and information are required to present the specific objective of each issue. The information in the document shall comprise 1) Intent benefit and requirement, 2) Implementation, 3) Calculation (if any), 4) Documents and time period for submission. This information must be submitted with fees prior to other submission to get approval from TGBI.

**Note:** Having a TREES-A in the project cannot get point in this section because it is a TREES-Pre NC requirement not an option.



## References

Department of Alternative Energy Development and Efficiency B.E. 2550 (2007). The Draft of Energy Conservation Promotion Act (Volume 2) B.E. 2550 (2007) Training Division Ministry of Energy of Thailand

The Energy Conservation Promotion Act B.E. 2550 (2007).

ASHRAE (1994). Thermal Environmental Conditions for Human Occupancy. Standard 55-1994. Atlanta, GA: American Society of Heating, Refrigerating, and Air-Conditioning Engineers.

ASHRAE (2007). Energy Standards for Buildings except Low-rise Residential Buildings. Standard 90.1. American Society of Heating, Refrigerating, and Air-conditioning Engineers. Atlanta, GA. USA.

ASHRAE (2007). Ventilation for Acceptable Indoor Air Quality. Standard 62.1. American Society of Heating, Refrigerating, and Air-conditioning Engineers. Atlanta, GA. USA.

## Appendix A. Checklists of the documents for assessment

## Appendix A. Document preparation

BMP1	Green Building Preparation	Prerequisite
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BM	P1	Green Building Preparation	(Prerequisite)
Information that shall be filled in the template			
Action plan for working, monitoring, and evaluation. Design, construction, planning, and management shall comply with TREES.			
	Name list of the project team and head of the project: Owners, Architects or Engineers (who designs the building, or who are supervisor or contractor), Building inspector, Building manager, and/or TREES-A and Commissioning agents. <b>At least one TREES-A must be included in the TREES - PRE NC Project team</b>		
	Activities specified to the person in charge that correspond to each attempted TREES credit		
	Activities details including techniques and methodologies that will be used in brief.		
	Schedules of each activity (when the activity will be launched and how long of each activity).		
Attached documents			
	Action plan for working, monitoring, and evaluation. Design, construction, planning, and management shall comply with TREES.		
	Name list of the project team and head of the project <b>including TREES-A certificate</b>		
	Activities specified to the person in charge of each activities that correspond to each section		
	Details of the activities including techniques and methodologies that will be use		

	"Yes" or "No"
	Fill data/number

SLP1	Avoid inappropriate construction site	Prerequisite
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SL	P1	Avoid inappropriate construction site	(Prerequisite)
Information that shall be filled in the template			
No building construction, hardscape in landscape, road, or car parking on the land which has characteristic as follow:			
		Natural habitat of wildlife that are preservation or risk to extinction, or sanctuary or conservation area or wildlife sanctuary area according to Thai's laws including the protected area, water source area, or has various ecosystems, or valuable area which is required for conservation.	
		Undeveloped area within 15 m from natural water resource that are habitat of aquatic animals and animal reproduction.	
		The area used as forestry plantations before developing the project except the Developers trade the land of equal or greater size for the existing area as the new forestry plantation site.	
		Avoid construction at the high ecological valuable area or with city planning conflict such as low area which prone to flooding, area of natural water way, catchment (watershed / drainage / basin) area that receive water from surroundings, retention area, wetland, area with slope more than 30%.	
Attached documents			
		Name list of the project team and head of the project	
		confirmation letters from the responsible organization to confirm that the selected site is not located at the prohibited area	
		Layout presented that the construction will not trespass the prohibited area	
		Documents presenting the replacement green area.	

	"Yes" or "No"
	Fill data/number

SLP2	Reduce negative impact to green field areas	Prerequisite
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SL	P2	Reduce negative impact to green field areas	(Prerequisite)
Information that shall be filled in the template			
Previously Developed Area			
		Building footprint (m <sup>2</sup> )	
		Green area (m <sup>2</sup> )	
		Ecological open space (m <sup>2</sup> )	
Not Previously Developed Area			
		Limit development boundary not more than 15 m from the edge of the building (to prevent intrusion to the plentiful area more than the building perimeter). For infiltration area, edge of walkway, road, and car parking shall be limited the development boundary not more than 5 m. Do not disturb the area out of the development boundary.	
Attached documents			
Previously Developed Area			
		Confirmation documents specify that the site is previously developed area.	
		Layout presenting, project boundary and building perimeter including ecological open space calculation.	
Not Previously Developed Area			
		Layout presenting, project boundary and building perimeter with the line 15 m from building perimeter including other hardscape area in landscape such as road, car parking with the line 5 m from the edge of that hardscape.	

	"Yes" or "No"
	Fill data/number

SL1	Locate project on the developed land	1 Point
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SL	1	Locate project on the developed land	1 Point
Information that shall be filled in the template			
Verify 10 types of urban facilities within 500 m radius from the main entrance of the project			
		Temple or Religious Place	
		Shop	
		Post Office	
		Police Station	
		Fire Station	
		Beauty Salon and Massage	
		Restaurant	
		Public Park	
		Educational Institute	
		Museum	
		Hospital and Health Station	
		Supermarket	
		Market	
		Beauty Shop	
		Coffee Shop and/or Bakery Shop	
		Office	
		Government Office	
		Etc.	
Attached documents			
		Aerial photographs or drawings specified urban facilities.	
		Table presenting the details of name and type of facilities with distance from the main entrance of the project to the entrance of those urban facilities.	
		Confirmation documents (if any).	

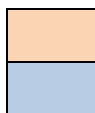

"Yes" or "No"

Fill data/number

SL2	Reduce using private cars	1-4 Points
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SL	2	Reduce using private cars	4 Points
Information that shall be filled in the template			
Alternative 1 Public transportation system, Railway			
	Select the site within 500 m (measured from main building entrance) from at least 1 rail station, sky train station or underground train station		
or			
	Have a shuttle service plan to the station that can service 25% of building user per day. The shuttle vehicle shall be eco car, CNG, Hybrid, E20+, electric, or other vehicle types that can reduce petrol and natural gas demand significantly.		
Alternative 2 Public transportation system, Road			
	Select the site within 500 m (measured from main building entrance) from bus stops or bus stations or other public vehicles that has at least 2 routes, and the building occupants can access these stations easily		
or			
	Have a shuttle service plan to the station that can service 25% of building user per day. The shuttle vehicle shall be eco car, CNG, Hybrid, E20+, electric, or other vehicle types that can reduce petrol and natural gas demand significantly.		
Alternative 3 Bicycle parking system			
	Provide bicycle parking not less than 5% of the maximum of regular building occupants and transient building occupants (such as guests or customers). Provide shower rooms not less than 0.5% of the total number of full time equivalent (FTE) occupants. Bicycle parking areas and shower rooms shall be located not more than 80 m from the main building entrance. In case of residential building, shower room is not required but bicycle parking spaces are increased to not less than 15% of the dwellers.		
Alternative 4 High performance car parking system			
	Provide preferred car parking location for eco car, CNG, Hybrid, E20+, electric, or other vehicle types that can reduce petrol and natural gas demand significantly, or for carpool near the main entrance of the building as much as possible for at least 5% of the total vehicle parking of the building.		
Alternative 5 Other public transport systems			
	Other public transportation systems		

Attached documents	
<b>Alternative 1, 2, and 5</b>	
	Document presenting the location of public transportation systems i.e. railway stations, sky train stations, underground stations, bus stops, bus stations, coach bus stations, ports, and other types of public transportation including walking distance from the building in the project to these public transportation stops/stations as well as service time table. In case shuttle service is provided by the project, plan from the project to the station and the service plan shall be attached.
<b>Alternative 3</b>	
	Layout presenting the location and the number of bicycle parkings and shower rooms with calculation of their proportion to building occupants and visitors.
<b>Alternative 4</b>	
	Layout presenting the location and the number of high performance car parking spaces with calculation of their proportion to the total parking spaces.



"Yes" or "No"

Fill data/number



SL 3.1	Ecological Open Space not less than 25% of the building footprint or 20% of the total land area.	1 Point
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SL	3.1	Ecological Open Space not less than 25% of the building footprint or 20% of the total land area.	1 Point
Information that shall be filled in the template			
Alternative 1 Not include roof area			
	Building footprint (m <sup>2</sup> )		
	Green area (m <sup>2</sup> )		
	Ecological open space (m <sup>2</sup> )		
Alternative 2 Include roof area (Eligible when SL P2 Alternative 2 is also pursued)			
	Building footprint (m <sup>2</sup> )		
	Green area (including green area on roof) (m <sup>2</sup> )		
	Ecological open space (including green area on roof) (m <sup>2</sup> )		
	Green area on roof (m <sup>2</sup> )		
	Ecological open space on roof (m <sup>2</sup> )		
Attached documents			
Alternative 1			
	Layout presenting project boundary and building boundary line with specified quantity of ecological open space area.		
Alternative 2			
	Confirmation documents specifying the site is previously developed area.		
	Layout presenting project boundary and the quantity of ecological open space and size of roof garden.		


"Yes" or "No"

Fill data/number

SL3.2	Plant 1 big tree per 100 m <sup>2</sup> of open space (do not relocate natural big trees other sites).	1 Point
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SL	3.2	Plant 1 big tree per 100 m <sup>2</sup> of open space (do not relocate natural big trees other sites).	1 Point
Information that shall be filled in the template			
Plant no less than 1 big tree per 100 m <sup>2</sup> of open space.			
		Open space in the project (m <sup>2</sup> )	
		The number of big trees in the project.	
		Give permanent shading within 5 years.	
		Keep the existing plants and/or grow additional native plants. The tree canopy diameter when fully grown shall be no less than 4.5 m or the tree height when fully grown shall not less than 6 m. The trees shall not be relocated from other places except relocated from commercial plantation areas.	
Attached documents			
		Plant layout presenting location and type of the big trees (both existing plants and new plants) with calculation table for the number of big trees.	
		Confirmation documents of source of the big trees.	
		Confirmation documents from landscape architect or person responsible present type, growing methods, soil condition, and maintenance to confirm the growth trend in the next 5 years.	
		Documents presenting plant species, plant numbers, and plant layouts.	
		Existing plant layout, existing area photos.	

	"Yes" or "No"
	Fill data/number

SL3.3	Use local or native plants appropriately	1 Point
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SL	3.3	Use local or native plants appropriately	1 Point
Information that shall be filled in the template			
	For all of the project area, select local or native plants for landscape in the project which are suitable for local climate and environment i.e. withstand drought and disease		
	The selected plants shall not be invasive alien species or weed.		
	Refer to plant species as specified in Appendix A or use the existing plants in the project.		
	List other plant species not specified in Appendix A		
Attached documents			
	Planting plan specifying location, quantity, and type of the plants that are used in the project.		
	In case of using existing plants in the project area: provide existing plan and photos showing the area existing condition prior to the beginning of the project construction.		
	Confirmation documents from landscape architect in case of using plant species other than those specified in the reference guide.		

	"Yes" or "No"
	Fill data/number

SL4	Infiltration of stormwater and flooding prevention.	4 Points
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SL	4	Infiltration of stormwater and flooding prevention.	4 Points
Information that shall be filled in the template			
Alternative 1 Calculate area-weighted average runoff coefficient of overall surface area of the project (not include retention pond area.			
Water infiltration data of the project			
	Location/Area of materials		
	Materials		
	Area-weighted average runoff coefficient		
	Area (m <sup>2</sup> )		
Alternative 2 Compare before and after volume and peak discharge rate of storm water runoff from the project.			
Calculate peak discharge rate before project development			
	Location/Area of materials		
	Materials		
	Area-weighted average runoff coefficient		
	Area (m <sup>2</sup> )		
Peak discharge rate of stormwater runoff from computer simulation			
	Stormwater runoff volume before project development (m <sup>3</sup> /day)		
	Peak discharge rate of stormwater runoff before project development (maximum) (m <sup>3</sup> /sec)		
	Stormwater runoff volume after project development (m <sup>3</sup> /day)		
	Peak discharge rate of stormwater runoff after project development (maximum) (m <sup>3</sup> /sec)		
Attached documents			
Alternative 1			
	Data and calculations of area-weighted average runoff coefficient of the project.		
	Site layout specifying area and area-weighted average runoff coefficient of each area.		
Alternative 2			
	Data and report of water volume and flow rate simulation from the project.		

	"Yes" or "No"
	Fill data/number

SL5.1	Green roof or vertical garden	2 Points
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SL	5.1	Green roof or vertical garden	2 Points
Information that shall be filled in the template			
	All roof area (not include area for building systems and openings for day lighting) (m <sup>2</sup> )		
	Green roof area (m <sup>2</sup> )		
	Vertical garden area (m <sup>2</sup> )		
Attached documents			
	Roof plan presenting the proportion of roof garden and elevations presenting the proportion of vertical garden.		
	Detail drawings presenting construction methods, materials, and gardenning systems for presenting the possible of construction and permanent of the work.		

	"Yes" or "No"
	Fill data/number

SL5.2	Hardscape area received direct solar radiation not more than 50% of the total hardscape area	1 Point
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SL	5.2	Hardscape area received direct solar radiation not more than 50% of the total hardscape area	1 Point
Information that shall be filled in the template			
		Hardscape area of the project (comprises road, footpath, activity area, and car park) (m <sup>2</sup> )	
		Shading the hardscape by big trees more than 30 % (m <sup>2</sup> )	
Roofing materials: high solar radiation reflectance value more than 30%			
		Type of materials	
		Manufacturer / Model	
		SRI	
		Roofing by plants or solar cells: size (m <sup>2</sup> )	
		Flooring materials: high solar radiation reflectance value more than 30% (m <sup>2</sup> )	
		Use grass block (planting area 50% or more of grass block area) (m <sup>2</sup> )	
Attached documents			
		Project layout presenting the boundary of hardscape in landscape with material specifications and area calculation.	
		Documents specified Solar Reflectance Index (SRI)	


"Yes" or "No"

Fill data/number

SL5.3	Place big native trees that can shade the building efficiently and do not damage the building at the Western, Eastern, and Southern sides of the building.	1 Point
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SL	5.3	Place big native trees that can shade the building efficiently and do not damage the building at the Western, Eastern, and Southern sides of the building.	1 Point
Information that shall be filled in the template			
	Grow big trees at the West, East, and the South of the sites. Put the location of the trees that the branch radius of each tree (5 years old) shall be touched or had a distance not more than 1 m for efficiency shading.		
	Branch and root radius shall have appropriate distance, and not disturb or damage the building.		
Attached documents			
	Site layout presenting the location of big trees in the project that relate with South, West, and East elevation.		
	Layout of big trees presenting branch size and tree's height and list of big trees in the project.		
	Confirmation from landscape architect to confirm appropriateness and efficiency of the selected big trees that are suitable type to the area, and have appropriate qualification for shading and not harmful to the building and surrounding area.		

	"Yes" or "No"
	Fill data/number

WC1	Water Saving and Water Efficiency	6 Points
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WC	1	Water Saving and Water Efficiency	6 Points
Information that shall be filled in the template			
Alternative 1 Use water saving water closet, urinal, and faucet, install sub water meter, collect rain water.			
	The total number of water closet in the project (sets)		
	The total number of water saving water closet in the project (sets)		
	The total number of urinal in the project (sets)		
	The total number of water saving urinal in the project (sets)		
	The total number of water saving faucet in the project (sets)		
	The total number of water saving kitchen faucet in the project (sets)		
	The total number of water saving shower faucet in the project (sets)		
	Install water meter for each different water enduse in the project		
	Install rain water collecting system to collect 5% of total annual rain water		
Alternative 2 Reduce water use consumption 15-35% from baseline			
Users			
	Name of the user's group		
	FTE		
	Retail customer		
	Visitors		
	Residents		
	% Men		
	% Women		
	The number of working days/year		
Water use calculation of toilets and urinals			
	User's group		
	Type of plumbing fixtures		
	Baseline water use (l/pf)		
Water use calculation of faucets and showers			
	User's group		
	Type of plumbing fixtures		
	Baseline water use (lps)		
	Rain water use (l/year)		
	Recycle water (l/year)		



Attached documents	
Alternative 1	
	Floor plan and/or details drawing of WC.
	Calculation presenting the number of toilets and faucets that are installed: water saving type and general type.
	Details of toilets and faucets that are installed.
	Average rain water in 1 year and volume of rain water collecting tank for using.
	Layout of water valve installation with photo to confirm the actual installation.
Alternative 2	
	Details of toilets and faucets that are installed.
	Calculation of the rain water quantity or recycle water quantity

	"Yes" or "No"
	Fill data/number

EAP2	Minimum Energy Efficiency	Prerequisite
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EA1	Energy Efficiency	16 Points
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EA	P2, 1	Energy efficiency	16 Points
Information that shall be filled in the template			
	Major renovation		
	New construction		
<b>Alternative 1</b> Use Whole Building Simulation as specified in Ministerial Regulation for Energy Saving Building Design B.E. 2552 (2009)			
	Energy of proposed (kWh)		
	Energy of baseline (kWh)		
	Describe energy conservation measure briefly		
<b>Alternative 2</b> Use Proposed and Baseline Energy Simulation from ASHRAE 90.1-2007 Appendix G			
	Energy cost of proposed (Baht)		
	Energy cost of baseline (Baht)		
	Describe energy conservation measure briefly.		
<b>Alternative 3</b> Use TEEAM, model NR-O 49.02 of the Ministry of Energy, Thailand.			
	Get credits in energy section according to the section 3-6 (points).		
	Describe energy conservation measure briefly.		
Attached documents			
Alternative 1			
	Any report of energy use with details of inputs in the simulation program.		
	CD contains files from BEC program.		
	Calculation details of OTTV/RTTV		
Alternative 2			
	Summary report of energy use as specified in ASHRAE 90.1-2007 Appendix G which is presented in the example in TREES-NC Reference Guide Version 1.1.		
	CD contains files and report of simulation from software.		
	CD contains files from BEC program and calculation details of OTTV/RTTV		

Alternative 3	
	TEEAM form (model NR-O 49.02) for each building type, section 3-6 (only energy points)
	Details of designs, technologies, and equipments that shall be prepared for verification <b>and/or</b> confirmation documents of each section from the Ministry of Energy of Thailand.
	CD contains files from BEC program and calculation details of OTTV/RTTV



"Yes" or "No"

Fill data/number

EA2	Renewable Energy	2 Points
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EA	2	Renewable Energy	2 Points
Information that shall be filled in the template			
Energy use simulation			
		Energy cost of energy produced from renewable energy systems (Baht)	
		Energy cost of the proposed building (Baht)	
		Describe renewable energy systems of the project briefly	
Without energy use simulation			
		Energy cost of energy produced from renewable energy systems (Baht)	
		Energy cost of the proposed building (Baht)	
		Describe renewable energy systems of the project briefly	
Attached documents			
		Specification of the equipments that involved with renewable energy systems of the project	
		Renewable Energy Calculation Report as specified in the section EA1 or other methods.	

	"Yes" or "No"
	Fill data/number

EA4	Refrigerant in air conditioning systems that does not harm ozone layer	1 Point
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EA	4	Refrigerant in air conditioning systems that does not harm ozone layer	1 Point
Information that shall be filled in the template			
		Not use CFC and HCFC-22 in all air-conditioned units that use refrigerant more than 0.3 kg and except for air-conditioned units that use refrigerant less than 0.3 kg.	
		In case of new building expansion from old building (that the old building is also assessed), refrigerant of the old building shall be changed to be non-CFC and HCFC-22 except the plan to reduce refrigerant leakage is provided.	
		Refrigerator equipment of air conditioning systems	
		Refrigerant	
		CFC or HCFC-22	
Attached documents			
		Confirmation documents from the manufacturer specifying the details of refrigerant used in air conditioning systems or refrigeration equipment.	
Existing building, where CFC or HCFC are still in use, must provide			
		Plan to reduce refrigerant leakage.	
		Action plan to change all of the air conditioning systems that use CFC and HCFC-22 within 5 years period.	
		Economics Breakeven Report if there is no plan to change the chiller systems to the new systems.	

	"Yes" or "No"
	Fill data/number

IE P1	Ventilation rate in the building	Prerequisite
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IE	P1	Ventilation rate in the building	(Prerequisite)
Information that shall be filled in the template			
	<b>Alternative 1</b> Ventilation flow rate in both air-conditioned area and non-air-conditioned area meet the requirements of the Building code, Vol.39 B.E.2537 (1994), according to Building Control Act, B.E. 2522 (1979), and meet the requirements of ventilation standard for indoor air quality (IAQ) of EIT (EIT-3010)		
	<b>Alternative 2</b> Ventilation flow rate in both air-conditioned area and non-air-conditioned area meet the requirements in ASHRAE62.1-2007.		
Attached documents			
Alternative 1			
	Location or layout of the building presenting air-conditioned areas.		
	Details of ventilation systems and calculation as specified in the Ministerial Regulations, Vol.39 B.E.2537 (1994), according to Building Control Act, B.E. 2522 (1979), and EIT-3010.		
Alternative 2			
	Location or layout of the building presenting air-conditioned areas.		
	Details of ventilation systems and calculation as specified in ASHRAE62.1-2007		


"Yes" or "No"

Fill data/number

IE P2	Illuminance in the building	Prerequisite
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IE	P2	Illuminance in the building	(Prerequisite)
Information that shall be filled in the template			
	Option 1 Computer simulation		
	Option 2 Hand calculation i.e. lumen method		
Attached documents			
Option 1			
	Building plan and artificial lighting plan for every floor.		
	Lamp and luminaire specification.		
	Computer simulation results.		
	Illuminance Summary report of each room/area from simulation.		
Option 2			
	Building plan and artificial lighting plan for every floor.		
	Lamp and luminaire specification.		
	Illuminance Summary report of each room/area from simulation.		

	"Yes" or "No"
	Fill data/number

IE1.1	Air Intake is not located at the location that has heat or pollution	1 Point
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IE	1.1	Air Intake is not located at the location that has heat or pollution	1 Point
Information that shall be filled in the template			
	Air intake which shall be far from heat source or pollution as specified.		
	Non-air-conditioned building but have active ventilation systems in the enclosed space as specified.		
Attached documents			
For the building that have air intake			
	Drawings or photos of site layout around the building.		
	Drawings or photos present the location of air intakes which relates to the surrounding both floor layout and section.		
	Confirmation documents of air intake design which avoid pollution from mechanical engineer or person in charge of building systems design of the project.		
For non-air-conditioned building			
	Ventilation flow rate calculation documents for enclosed non-air-conditioned spaces, and layout presenting air exhaust systems		

	"Yes" or "No"
	Fill data/number



IE1.2	Negative pressure for printing room, photocopying room, chemical storage, and cleaner storage	1 Point
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IE	1.2	Negative pressure for printing room, photocopying room, chemical storage, and cleaner storage	1 Point
Information that shall be filled in the template			
	<p><b>Alternative 1</b> In the space where pollution or hazardous gases or chemicals may be presented or used (include laundry room, print room, photocopy room), exhaust in each space shall not recirculate air. Provide self-closing doors and exhaust rate not less than 2.5 litres / ls / m<sup>2</sup>. The pressure differential with the surrounding spaces shall be at least 5 Pascals and 1 Pascal at a minimum when the door to the room is closed.</p>		
	<p><b>Alternative 2</b> For the building which does not have the area involved with the characteristic as specified. The building can get the credit in this section automatically.</p>		
Attached documents			
Alternative 1			
	Name list of the rooms or the area that have pollution.		
	Calculation and specifications of air-handling units and ventilation systems to present that the specified areas have negative pressure, do not recirculate air or have air ventilation rate less than the surrounding area as specified.		
	Evidences showing the difference of air pressures both inside and outside of the polluted rooms.		
Alternative 2			
	Confirmation documents for the building that does not have pollution rooms or areas from Mechanical Engineer or involved person.		

	"Yes" or "No"
	Fill data/number

IE1.3	Prevent pollution from outside to inside of the building	1 Point
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IE	1.3	Prevent pollution from outside to inside of the building	1 Point
Information that shall be filled in the template			
		Install entryway systems at the main entrance of the building	
		Use mats or any flooring material at the secondary entrance or other entrances of the building.	
Attached documents			
		Documents present the location and size of building entrance systems such as drawings, building layout.	
		Summary list of the systems and specifications presenting qualification of entrance mat or flooring materials that used at the entrances.	
		Cleaning and maintenance plan presenting process and details of cleaning for entrance systems, mat, or flooring materials at all locations	

	"Yes" or "No"
	Fill data/number

IE1.4	Smoking area is located outside the building and not less than 10 m from doors, windows, or air intakes	1 Point
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IE	1.4	Smoking area is located outside the building and not less than 10 m from doors, windows, or air intakes	1 Point
Information that shall be filled in the template			
	Prohibit smoking in the building. Smoking area is not less than 10 m away from building entries or air intakes.		
Attached documents			
	Layout presenting the location of smoking area.		
	Plan or policy for no smoking in the building. The policy shall be signed by Building Manager, Property Manager, or Owner.		

	"Yes" or "No"
	Fill data/number

IE1.5	The efficiency of air filter: Pass the standard	1 Point
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IE	1.5	The efficiency of air filter: Pass the standard	1 Point
Information that shall be filled in the template			
		Air Handling Unit (AHU) that has supply rate more than 1000 litres/second as specified in the standard of air-conditioned and air ventilation of EIT (EIT-3003) shall has the minimum MERV of air filter for at least MERV 7 (ASHRAE Standard 52.2) or for at least 25-30% (ASHRAE Standard 52.1 Dust Spot), or the air filter which have performance as specified in others reliable equivalent standard.	
		For split type system, air filter shall be installed at the outdoor air intake.	
Attached documents			
		Details and the location of air filter installation for Air Handling Units (AHU) that have handling rate more than 1000 litres/second.	
		Air filter details and certification documents from the manufacturer, which the minimum efficiency is MERV 7 or equivalent.	
		Drawings or details of air filter installation process with Air Handling Units at the return and outdoor air intake.	
		Installation details of air filters at outdoor air intake for all of the split systems used in the building.	


"Yes" or "No"

Fill data/number

IE3	Indoor lighting system control	1 Point
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IE	3	Indoor lighting system control	1 Point
Information that shall be filled in the template			
<b>Alternative 1</b> Provide lighting systems control for building occupants. The circuit shall not cover more than 250 m <sup>2</sup> per circuit. For the room that is smaller than 250 m <sup>2</sup> , the circuit shall be separated for each room.			
	Room/Area/Type		
	The total area (m <sup>2</sup> )		
	Specify the number of control circuit		
<b>Alternative 2</b> Design lighting systems control for regularly occupied space such as open plan office. Every user shall have a freedom to control illuminance for his or herself. Design task lighting for 90% of regular users.			
	Room/Area/Type of the regularly occupied spaces		
	The number of regular users in the area		
	The number of users that can control lighting according to their requirement		
	Type of the systems		
Attached documents			
<b>Alternative 1</b>			
	Drawings of electrical systems presenting the separation of artificial lighting control circuits for each area in the building.		
	Summary list of lighting control circuit separation as specified in the example.		
<b>Alternative 2</b>			
	Percentage of the users that can control their task lighting.		
	Drawings of electrical systems presenting the details of equipments and systems for individual illuminance level control.		
	Details or specifications of equipments and systems for for individual illuminance level control.		
	Summary list of equipments and systems for controlling individual illuminance level as specified in the example. If two choices are selected and mixed together, summary list can be provided as specified in the example.		

	"Yes" or "No"
	Fill data/number

IE4	Use natural light in the building	4 Points
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IE	4	Use natural light in the building	4 Points
Information that shall be filled in the template			
Simulation by computer to calculate proportion between the areas that Daylight Factor (DF) in Overcast Sky are more than 2% and the total area of the regularly occupied spaces (measure at horizontal height 75 cm from the floor).			
	Room/Area/Type		
	Regularly occupied spaces (m <sup>2</sup> )		
	The areas that Daylight Factor (DF) are more than 2% (m <sup>2</sup> )		
	Characteristic of shading devices		
Attached documents			
	Summary report of computer simulation results for all regularly occupies areas in the building.		
	Detail drawings of the equipment for shading devices used for the building (if any)		
	Summary list of the area and Daylight Factor of regularly occupied areas.		

	"Yes" or "No"
	Fill data/number

IE5	Thermal Comfort	3 Points
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IE	5	Thermal Comfort	3 Points
Information that shall be filled in the template			
	Air-conditioned area shall be designed to have temperature and relative humidity as specified in the standard of air-conditioned and ventilation systems of EIT (EIT-3003) or ASHRAE 55-2004.		
	Non air-conditioned area shall be designed as specified in the standard of ASHRAE 55-2004: topic 5.3.		
Air-conditioned area			
	Room/Area/Type		
	The total area (m <sup>2</sup> )		
	Regularly occupied spaces (m <sup>2</sup> )		
	Pass thermal comfort standard (m <sup>2</sup> )		
	Criteria		
Non air-conditioned area			
	Room/Area/Type		
	The total area (m <sup>2</sup> )		
	Regularly occupied spaces (m <sup>2</sup> )		
	Pass thermal comfort standard (m <sup>2</sup> )		
	Criteria		
Attached documents			
	Building floor plans presenting the regularly occupied areas with and without air conditioning systems.		
	List of cool air distribution systems of the project.		
	Cooling load calculation document or other documents as specified in the regulations of air conditioning systems and ventilation systems standard of EIT. (EIT-3003) or ASHRAE 55-2004.		

	"Yes" or "No"
	Fill data/number

EP P2	Waste management	Prerequisite
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EP	P2	Waste management	(Prerequisite)
Information that shall be filled in the template			
	The building area or project area (m <sup>2</sup> )		
	<p>The project has recycling collection area that supports all of the building area. Size of recycling collection area shall be appropriate according to the requirement when the building is operated.</p> <p>The implementation can be referred further from the table that specified the appropriate size of the recycling collection area according to TREES-NC EP P2.</p>		
Type of waste or scrap will be segregated and collected in the recycling collection area.			
Trash			
	Plastic		
	Glass		
	Paper		
	Steel		
	Garbage		
	Hazardous waste		
Attached documents			
	Layout and floorplan of the project presenting the location of waste collection and segregation areas and rooms.		

	"Yes" or "No"
	Fill data/number



EP2	Condensing unit/cooling tower location	1 Point
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EP	2	Condensing unit/cooling tower location	1 Point
Information that shall be filled in the template			
	<b>Alternative 1</b> Not locate compressor, heat extractor, or cooling tower close to the adjacent lands less than 4 m. In case of high rise building or extra-large building, the set back of compressor or cooling tower from the edge of the land shall not less than 8 m.		
	<b>Alternative 2</b> Air conditioning systems has no condensing unit or cooling tower or other component that disperse heat and moisture into the atmosphere.		
Attached documents			
Alternative 1			
	Lay out presenting the installation distance of every compressor and cooling tower to nearest site boundary.		
Alternative 2			
	Drawings and specifications of air conditioning systems which do not emit heat or vapour to the air.		

	"Yes" or "No"
	Fill data/number

EP3	External glazing	1 Point
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EP	3	External glazing	1 Point
Information that shall be filled in the template			
	All building envelope area (roof, walls, windows, doors) (m <sup>2</sup> )		
	Glazing area (m <sup>2</sup> )		
Glazing materials			
	Type		
	Visible Light Reflectance (%)		
	Area (m <sup>2</sup> )		
Material of building envelope that are gloss			
	Material		
	Visible Light Reflectance (%)		
	Area (m <sup>2</sup> )		
Attached documents			
	Construction drawings or photos presenting all building elevations to show all exterior glazing (building envelope). Specifications specify model, type and manufacture of all exterior glazing (building envelope).		
	Documents to confirm glass specification from the manufacturer, verified from the reliable organization. The documents shall specify Visible Light Reflectance in terms of percentage of all exterior glazing (building envelope).		
	Confirmation documents from the architect or responsible person to confirm that the selected material is matte and does not require Visible Light Reflectance Test.		

	"Yes" or "No"
	Fill data/number

EP5	Install meter for wastewater treatment system electricity use	1 Point
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EP	5	Install meter for wastewater treatment system electricity use	1 Point
Information that shall be filled in the template			
	<b>Alternative 1</b> Install specific meter to measure electricity using for waste water treatment systems only.		
	<b>Alternative 2</b> Install waste water treatment systems that can treat waste water to have BOD5 and TSS equal or less than 10 mg per litre. The systems can treat waste water more than 50% of the total waste water from the project.		
Attached documents			
<b>Alternative 1</b>			
	Installation location and the number of the meters that are used to measure electricity using for waste water treatment systems.		
	Drawings and diagram of waste water treatment systems.		
<b>Alternative 2</b>			
	Drawings and specifications of waste water treatment systems.		
	Calculation of the amount of waste water and size of the systems.		

	"Yes" or "No"
	Fill data/number

GI 1-5	Techniques not specified in the rating system	1-5 Points
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GI	1-5	Techniques not specified in the rating system	1-5 Points
Information that shall be filled in the template			
	This form is for credits in the Section GI topic (1-5)		
<b>Alternative 1</b> Comply with the extra credit topics that are specified in each section above the requirement.			
	Specify to the topics to get extra credits		
	Topics		
<b>Alternative 2</b> Present the new energy and environmental topics which not addressed in this rating system.			
Credit topics that TGBI have approved			
	Specify the approval details		
Specify the details of credit topics (propose new topics). These informations must be submitted with fees prior to other submission to get approval from TGBI.			
	Topic's name		
	Intent		
	Assessment criteria		
	The requirement documents for presenting		
Attached documents			
Alternative 2			
	Documents with informations comprise 1) Intent benefit and requirement, 2) Implementation, 3) Calculation (if any), 4) Documents and time period for submission.		

	"Yes" or "No"
	Fill data/number

## Appendix B. Definitions

## Appendix B. Definitions

Preserved Animals	Rare wildlife as specified in the list of Wild Animal Reservation and Protection Act B.E. 2535 (1992), and in the royal decree.
Conservation Areas	National Park, Wildlife Sanctuary, Non-hunting Area according to the laws, or other areas that are upstreams or water sources, or the area that has environmental value and shall be preserved as specified in ministerial regulations.
Forest plantations	The land that is registered to plant and maintain the forbidden trees as specified in forest law, and the land that is registered to plant and maintain the forbidden trees as specified in Forest Law and other general plant species.
Biodiversity	The variety of different types of living things including a variety of heredity, species, and ecosystems that are habitats of those living things.
Natural Water Resource	Bog, swamp, marsh, lake, and some parts of canal, waterway, and river. Natural water resource can be freshwater, salt water, still water, or runoff, and may be modified or developed by human but the major parts of that water resources shall still be in existing condition. In addition, natural water resources may include man-made water resources from geography modification by human such as man-made canals, reservoir above the weir or dam that develop itself to have their own condition like natural water sources. Man-made water resources in some places or some parts can be natural sources that shall be conserved as approved from the responsible authorities.
Retention Area	Detention area for agriculture and prevent flooding.
Wetland	Conditions of Geography that are lowland, low plain, wet lowland, the land area that is saturated with water, the area that has flood or waterlogged, bog, or water sources area. Wetland can be either natural or man-made. Flood or waterlogged can be temporary or permanent. Water sources can be still water or runoff, freshwater or salt water or brackish water including seacoast, seashore, and areas of the sea in the area that depth of water level shall not more than 6 m in case of maximum ebb tide.
Development Footprint	The area that has ever been building, road, car park or adjusted the level of the area or developed for human activities.

Previously Developed Area	The area that used to be building, road, car park, has land levelling, or land development for human activities.
Ecological Open Space	The area with no roof or not covered by the building including the area of construction or building that height from ground level not more than 1.2 m with no roof or not covered by the building over that level. Ecological open space comprises green area for at least 40% of the area, and may include to natural pool and hardscape area. Activities on that hardscape area shall promote quality of life of the users such as walkway, activity field but not use this area for car and car park.
Building Footprint	Boundary of construction area that comprises the building by considering to the building area that covers to the ground of the first floor or the ground floor. Building footprint is not including hardscape in landscape, road, and car park on the ground.
Green Area	Outdoor area and semi outdoor that has natural condition, ecological value, and promote quality of life. This area can be used for recreation of the building users or the public that has boundary. All of the land area or some parts of the land area shall be covered by plants that are growth on the soil that have infiltration. This land may have the building or the surface with no infiltration. Man-made hardscape such as grass block is not green area.
Hardscape	The area outside the building that is laid by materials that water cannot seep or can seep very little such as road, car park, multipurpose plaza, walkway, sport court, etc.
Mixed-use Project	The project that comprises residential area and retail shops in the building or same area.
Public Utility	Basic services that people shall deserve in community. Public Utility is important to everyday life of general public such as road, telephone, electricity, water supply, drainage, waste disposal, etc.
Public Facility	Services for public proceeded by public or private organization under government control such as housing, education, religion, culture, health, security, creation, and other services according to the population needs.
Renewable Energy	Energy from energy resources that can replace non-renewable energy such as Wind Energy, Hydroelectric Energy, Biogas, Biomass gas, and Electric Energy.

Eco Car	Eco car shall have 3 properties: fuel efficiency, environmental conservation according to safety and pollution standards, and safety for driving according to the Notice of Ministry of Industry Thailand: Terms and Conditions of Eco Car.
CNG	Compressed Natural Gas, that is natural gas like NGV (Natural Gas Vehicle)
Hybrid Car	Car that uses electric motor and internal combustion engine to move the vehicle.
Urban Heat Island	Urban Heat Island is a phenomenon that temperature of a city or metropolitan area is significantly higher than its surrounding areas. Difference of this higher temperature at night is clearer than in the afternoon and in winter more than summer. Principal causes of urban heat island are heat absorption and reflection of the building surface and hardscape, high rise buildings block the wind, and heat emission from energy and urban development.
Ecological Open Space	The area without roof or not covered by the building including the area of construction or building that height from ground level not more than 1.2 m with no roof or not covered by the building over that level. Ecological open space comprises green area for at least 40% of the area, and may include to natural pool and hardscape area. Activities on that hardscape area shall promote quality of life of the users such as walkway, activity field but not use this area for car and car park.
Open Space	The area without roof or covered by building. This area may be pool, swimming pool, wastewater pond, temporary waste areas, garbage dump, or outdoor car park. Open space meaning is including the area of structure or building that height from the ground level not more than 1.2 m without roof or covered by building over that level according to the definition of "open space" as amended by Act No. 50 B.E. 2540 (1997), issued under the Building Control Act B.E. 2522 (1979).
Building Footprint	Boundary of construction area that comprises the building by considering to the building area that covers to the ground of the first floor or the ground floor but not include hardscape in landscape, road, and car park on the ground.
Green Area	Outdoor area and semi outdoor that has natural condition, ecological value, and promote quality of life. All of the land area or some parts of the land area



	covered by plants that are growth on the soil that water can seep through. Man-made hardscape such as grass block is not green area.
Hardscape	The area outside the building that is laid by materials that water cannot seep such as road, car park, multipurpose plaza, walkway, sport court, etc.
Microclimate	Climate with specific place, Climate around the building or that project.
Urban Heat Island	A phenomenon that temperature of a city or metropolitan area is significantly higher than its surrounding areas. Difference of this higher temperature at night is clearer than in the afternoon and in winter more than summer. Principal causes of urban heat island are heat absorption and reflection of the building surface and hardscape, high rise buildings block the wind, and heat emission from energy and urban development.
Big trees	Type of plants that stem is xylem. Main single stem stands upright. Ramify at the top. Height more than 5 m when growth maturely. Have a long life for many years.
Open Space	The area out of the building that includes hardscape and green area but not include building footprint. Open space is different from ecological open space because open space is including all of the area for car. Open space meaning is different from the definition of open space according to law because open space in this section can be covered by roof such as roof of car park, or the area that covered by canopy of the building.
Invasive alien species	Local or nonlocal species that have high level of adaptability. Invasive alien species can propagate quickly and dangerous to ecosystem. These species are the reason of biodiversity destruction and loss of ecosystem balance.
Alien species	Species of living things that are never appear in the area but these species are imported or come to occupy and live in the area. Alien species may be good or bad living, depends on suitability of surrounding factors and adaptation of those species.
Weed	Plant species that grow in the wrong place. Plant species can grow and propagate quickly and hard to control or limit the number.
Ecological open space	Open space that comprises green area and hardscape for fertility of ecosystem and to promote interaction between human and nature. Ecological open space shall not be road or car park.

Stormwater Runoff	Water from rain that overflow on the surface to drainage system. The amount of rain water from raining and flow from the surface of project area called Stormwater Runoff Volume.
Impervious Surface	The surface area that rainwater cannot seep to the soil when it is raining but rainwater will overflow. The level of Impervious Surface depends on materials that are used to build the surface area.
Green roof area	Structural area at the top floor of the building that covered by plants.
Green wall area	Wall area that slope less than 60 degrees, measured from the horizontal plane that covered by plants.
Urban Heat Island	A phenomenon that temperature of a city or metropolitan area is significantly higher than its surrounding areas. Difference of this higher temperature at night is clearer than in the afternoon and in winter more than summer. Principal causes of urban heat island are heat absorption and reflection of the building surface and hardscape, high rise buildings block the wind, and heat emission from energy and urban development.
Hardscape	The area out of the building that water cannot seep through the materials efficiently.
Solar Reflectance Index, SRI	SRI can be measured from effectiveness to reflect heat from solar radiation or calculated from surface temperature that will be increased because of effect from solar radiation. The material that has high SRI tends to be cooler than the material that has low SRI. So, SRI can be indicated to the tendency of Urban Heat Island of the project when using various types of materials.
Emissivity	The proportion of radiation that emitted from the surface when compared with the radiation that emitted from Black Body Materials at the same temperature.
Reflectance	This value presenting the effectiveness of any materials to reflect solar radiation that presenting natural light, infrared, and ultraviolet. The value is the period from 0-1. In theory, Reflectance of Black Body Materials is 0 and Reflectance of White Body Materials is 1.
Big trees	Type of plants that stem is xylem. Main single stem stands upright. Ramify at the top. Height more than 5 m when mature growth. Have a long life for many years.
Portable Water	Water that is distribute by Metropolitan Waterworks Authority, Provincial Waterworks Authority, Village Water Supply including water from natural

	resources such as river, channel, swamp, marsh, and underground water that the project bring to develop for having a good quality instead of portable water.
Reclaimed Water	Waste water from the project that passes water treatment and water quality improvement. Quality of reclaimed water shall equal to portable water before using again. However, quality of reclaimed water may not be suitable for direct consumption but may be used for flushing toilets and urinals.
Baseline	The building characteristic that is built according to the regulations for simulating condition, energy, energy cost, and other performance issues. The result is base value that will be used to compare performance issues with the proposed.
Proposed	The building characteristic according to drawings that is used to simulate condition, energy, energy cost, and other performance issues. The result will be used to compare performance issues with the base value according to baseline.
Prescriptive	Energy conservation design method for the building by complying with the list as specified. No simulation.
Energy Cost Budget	Energy conservation design method for the building by simulation as specified in ASHRAE 90.1 Section 11. At the present this method is replaced by Performance Rating.
Performance Rating	Energy conservation design method for the building by simulation as specified in ASHRAE 90.1 Appendix G. This method relies on comparison of energy use between proposed and baseline.
Window to Wall Ratio	Proportion between opening area (include frame) per exterior surface area of the building (include wall area under ceiling).
Lighting Power Density	Proportion of all lighting power density (artificial lighting) including ballast per each occupied space.
Photovoltaic, PV	Alternative energy system that converts solar energy into electricity.
Solar Thermal	Alternative energy system that converts solar energy into thermal energy such as water heating in the building.
Geo-Exchange systems	Use piping system to transfer or receive geothermal for cooling and heating because temperature in the soil is quite stable through the year. This system

	plays a role to increase air conditioning efficiency in summer and heating in winter.
Biofuel-based Energy	Energy system that applies alternative energy resources from living things such as saw dust without chemical, agricultural waste, dung or gas from garbage dump.
Geothermal Energy	Energy generation that applies heat energy such as heat water or steam from geothermal.
Renewable Energy	The energy that produced from renewable sources such as solar energy, wind energy, hydroelectric power, geothermal energy, wave energy, etc.
Refrigerant	Refrigerant is a substance in refrigeration cycle. Refrigerant plays a role to absorb heat when the temperature is low and emit heat when the temperature is high.
Infiltration rates of air conditioning system	Period of time that air conditioning system losses refrigerant, measured from the requirement to add a refrigerant in 12 months period. Infiltration rates will be measured as the percentage of refrigerant in the systems that are full.
Chlorofluorocarbon, CFC	Hydrocarbon substance that is often used as refrigerant and affect to ozone layer destruction
Air-conditioning	Air-conditioning is the process of altering the properties of air in the area to the requirement condition by controlling temperature, relative humidity, cleaning, and air spreading.
Ventilation	Ventilation is the process to bring air to the area or from the area that aims to control contaminants level in the air, humidity, or temperature (ASHRAE 62.1-2007).
Active ventilation	Active ventilation has the same meaning as Mechanical ventilation.
Passive ventilation	Passive ventilation is the process that makes air movement or heat transfer in the area without machines. Passive ventilation method examples are site planning, using materials and building form.
Mechanical ventilation	Mechanical ventilation is the process to ventilate air by machines such as fans or blowers that use motor to propel.
Natural ventilation	Natural ventilation has the same meaning as Passive ventilation that creates ventilation from influence of thermal, wind, and radiation through doors, windows or other openings of the building.

Breathing zone	Breathing zone is the area or boundary of the occupied spaces that is breathing area, height 0.90-1.80 m from ground level and distance 0.60 m from the wall or fixed air conditioning.
Thermal comfort	The condition that the building users feel satisfies with thermal of the environment.
Indoor Air Quality: IAQ	Indoor Air Quality is characteristic of the building in the building that affects to health and livelihood of the building users. Good indoor air quality will not collect unknown substances in the level that can be harmful (as specified by organisations that have knowledge and expertise). Majority group of people not less than 80% in that area shall not feel dissatisfaction.
Contaminants	Elements of contaminants in the air. These contaminants
Outdoor air	Outdoor air that come to the building through ventilation system both natural ventilation or air leakage.
Illuminance	the amount of light from lighting sources that illuminate to the any surfaces or planes, Unit of illuminance is Lux or Lumen/m <sup>2</sup> or ft candle or Lumen/ sq ft
Horizontal Illuminance	Horizontal Illuminance is consideration to illuminance that happens on flat or horizontal plane. The plane that illuminance is measured will not be perpendicular to the lighting sources that may be light from spreading from the surrounding area such as illuminance measurement on the table.
Air intake	Channel that brings clean air from outside to inside or air conditioning systems.
Outdoor air	Outdoor air that come to the building through ventilation system both natural ventilation or air leakage.
Enclosed space	Occupied spaces enclosed by solid walls, window system, or glazing at 4 sides such as working room that has wall around the room, enclosed double volume hall in the building but not include open double volume hall, open car park, corridor, open balcony.
Air-handling units	This equipment plays a role to send wind or air to any parts of the building by fan systems and piping systems.
Entryway systems	These systems are designed to collect dust or soil and sand debris from people who access to the building. These systems comprise floor drop that covered by grate at the top with equivalent level to the floor for collecting dust that stick at the grate and drop to the floor below.

Walk-off mats	Materials that are laid or installed at the entrance of the building. Walk-off mats play a role to collect dust, water, or others debris that comes with the building users and other equipments.
Ventilation	Ventilation is the process to bring air to the area or from the area that aims to control air pollution level, humidity, or temperature.
Mechanical ventilation	Mechanical ventilation is the process to ventilate air by machines such as fans or blowers that use motor to propel.
Environmental tobacco smoke: ETS	ETS or smoke from smoking comprises particles in the air from combustion of cigarette. These particles comprise more than 4,000 chemicals. More than 50 chemicals are known carcinogen which can cause cancer.
Minimum efficiency reporting value: MERV	Efficiency of air filter created by ASHRAE. Assessment value is from 1 (minimum efficiency and collect only large size particles) - 16 (very high efficiency and can collect very small particles).
Air-handling units: AHU	This equipment plays a role to send wind or air to any parts of the building by fan system and piping systems.
Task lighting	Lighting for specific location that is required for specific use.
Ambient lighting	Lighting for illuminance throughout the area that is not specified to the location.
Task and Ambient	Two types of lighting mentioned aboved mixed together to control lighting according to the requirement.
Daylight Factor: DF	Illuminance proportion of the amount of indoor light per outdoor light that is not influenced from direct solar radiation.
Regularly Occupied Spaces	The area that people stand or sit while working. These areas are different according to the building type. For example, regularly occupied spaces for residential building are living room and bedroom. Regularly occupied spaces for office building are counter for visitors and office. For school, regularly occupied spaces are classroom and library.
Predicted Mean Vote: PMV	This method is used to predict thermal comfort of the main group of the building users using average from question using thermal sensation scale that has value from +3 (very hot) to -3 (very cold) with the wind velocity not more than 0.2 m/sec.
Mechanical ventilation	Ventilation by machines such as fans or blowers that use motor to propel.
Regularly occupied spaces	The area that people stand or sit while working. These areas are different according to the building type. For example, regularly occupied spaces for residential building are living room and bedroom. Regularly occupied

	spaces for office building are counter for visitors and offices. For school, regularly occupied spaces are classrooms and libraries.
Landfills	The area that waste and debris from human activities will be filled.
Recycling Collection Area	The area in the building that is used to separate and collect trash for recycling. The building may have more than 1 recycling collection area. This area shall be easy for waste to be collected central landfills.
Waste Diversion	Management of waste disposal that prevent waste to be burt or landfilled but support reuse and recycle.
Waste Reduction	Include reduction and avoidance of the new waste by supporting reuse and recycle.
Waste Stream	The total waste of the building or the project that will have to send to landfills or incinerator or other disposal sources.
Air Cooled	Ventilate heat from condenser of air conditioning system by air. This system is usually found in split type and package type. This system is not popular to use in large air conditioning system that has water chillers because performance of air cooling system is lower than water cooling. Principle of operation relies on heat reduction using fan to blow or evacuate air through heating coil from condenser of air conditioning system.
Water Cooled	Ventilate heat from condenser of air conditioning system by water. This system relies on evaporation that water will be cooled down. Hot water that passed condenser of air conditioning will be sprayed through wind from cooling tower's fan that aims to increase evaporation and reduce temperature.
Geothermal or Lake Cooling	Ventilate heat from condenser of air conditioning system to soil or lake by burying copper heating coil in soil or water. Heating coil shall have enough length to ventilate heat to soil or lake according to demand. This system can reduce impact from microclimate that will be increased and can save energy in air conditioning system because this system does not require a fan for heat ventilation.
Visible Light Reflectance; Rvis	Proportion that light in visible spectrum range can reflect from the materials in percentage.
Visible Light Transmittance; VT	Proportion that light in visible spectrum range can transmitt from the materials in percentage.
Energy Efficiency of Glazing	Glass efficiency in terms of Solar Heat Gain Coefficient, and Visible Light transmittance/Solar Heat Gain Coefficient

Solar Heat Gain Coefficient; SHGC	The fraction of incident solar radiation admitted through a window. SHGC is used to specify capability of solar heat gain through the glass including direct solar radiation and heat transfer from the glass by conduction, convection, and radiation.
Visible Light Transmittance / Solar Heat Gain Coefficient; VT/SHGC	Proportion that light in invisible spectrum can transmit through the glass per Solar Heat Gain Coefficient. This value is used to indicate performance of the glass for energy conservation.
Aerobic wastewater treatment system and Anaerobic wastewater treatment system	Wastewater treatment system using biological methods or microorganisms to remove contaminant in wastewater especially organic substances. These organic substances are food and energy source that microorganisms use for growth. So, fluid contamination will decrease. These microorganisms can be Aerobic Organisms or Anaerobic Organisms.
BOD <sub>5</sub>	The amount of Dissolved Oxygen that microorganisms need to digest organic substances. High BOD means that wastewater have high organic substances. Oxygen that microorganisms use to digest is high. That water is higher rotten. BOD is the amount of Oxygen that microorganisms need in 5 days.
TSS	Small and light dust and sediment that cannot be separated from water by sedimentation. Separation shall rely on filter systems mainly.



## Appendix C. Frequently Asked Questions

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Question	Guideline
In case of design revision during construction permission process or or during construction, Is it necessary to inform TGBI for re-assessment?	<p>TREES-A who is a consultant of the project will be responsible to decide that design revision affects to the level of TREES-PRE NC or not.</p> <p>In case the revision decreases TREES- Pre NC points, TREES-A shall inform to TGBI to re-certificate.</p> <p>In case the revision increases TREES- Pre NC points, TREES-A could either inform to TGBI to re-certificate or choose not to inform TGBI.</p> <p>If the revision will not affected TREES- Pre NC points, TREES-A could either inform to TGBI to re-certificate or choose not to inform TGBI.</p>
In case the project use TREES-PRE NC Certification level for FAR Bonus, later re-assess to upgrade for higher certification level. Is it necessary to reapply for construction permission?	<p><b>Necessary:</b> The project shall resubmit upgraded TREES-PRE NC certification to Urban Planning Division to consider new bonus area.</p> <p>Then, the project shall reapply for EIA (if require) and construction permission.</p>
In case the project use TREES-PRE NC Certification level for FAR Bonus and get approval but later changes the design such as reduce the building area; Is it necessary to reapply for construction permission? For example, the owner would like to reduce budget. So, the building cannot be constructed to conform to the level of certification that get constructiona approval previously	<p><b>Necessary:</b> The project shall resubmit upgraded TREES-PRE NC certification to Urban Planning Division to consider new bonus area.</p> <p>Then, the project shall reapply for EIA (if require) and construction permission.</p>
Asking for modification the existing building, Could the project apply for TREES-PRE NC?	<p><b>Possibly,</b> if the details of the existing building modification conform to the regulations of Major Renovation according to TREES-NC that comprises building envelope modification, electricity and lighting systems modification, and air conditioning systems modification.</p>

After the completion of construction, will the project be checked or reassessed?	TGBI reserves the right of randomly inspection buildings registered with TREES-PRE NC rating system if the registered buildings conform to the certificate level.
If the building construction does not conform to TREES-PRE NC certified level, How would be TGBI action?	The owner of the registered building shall find ' <b>TREES Inspector</b> ' who is free from the architect, contractor, supervisor, and not TREES consultant of the project to inspect the project during construction period. If the project fails from inspection, TREES inspector shall inform to the government division that involved with building control to proceed according to laws and regulations of the government sectors if the building construction does not conform to the details that are approved for permission.
After TREES-PRE NC certificate, Will the building get TREES-NC certificate automatically after the project construction complete?	<b>No</b> , because TREES-PRE NC are different from TREES-NC. If the project would like to get TREES-NC certification, the project shall apply for TREES-NC. However, most of the documents for TREES-PRE NC registration could be used for TREES-NC.
In case the project wants to get TREES-NC certification after the construction complete. What would be the process?	The project shall register for TREES-NC with TGBI and submit documents as specified in TREES-NC to TGBI for assessment.
Could there be any chance TGBI need more time than normal to assess and review the documents of some buildings or some cases?	TGBI reserves the right to assess and review documents in some cases more than 30 working days depends on quality and completeness of the documents including size of the building and complexity of architectural and engineering types of the building.  TGBI will send formal notice to the Applicant officially.