TGBI

TREES – EB

Version 1.0

Thai's Rating of Energy and Environmental Sustainability

for **Existing Building: Operation and Maintenance**

By

Thai Green Building Institute (TGBI)

Supported by

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INTRODUCTION

Energy crisis and environmental crisis are increasingly serious. Energy resources such as coal, natural gas, and oil are limited but the demand to produce energy from these resources is increasing endlessly resulting in high energy price. While the development of renewable energy is not fast enough to respond to energy demand in the near future, energy production still relies on resources that have negative environmental impacts. Burning coal and oil results in large quantity of Green House Gas which creates Green House Effect that is a threat to human beings. Accessibility to any energy resource also trespass both Terrestrial ecosystems and Marine ecosystem continuously. Fuel transportation such as pumping oil across the ocean floor or fuel extraction activities are risk to the leakage that will destroy ecosystems massively. Energy crisis is in fact closely related to environmental crisis.

Buildings are the main cause of energy and environmental problems due to the fact that they consume a lot of electricity for air conditioning, ventilation, lighting, and electrical equipment, to maintain building occupants' activities, well-being and productivity. Quality of life is important and affect social and economic system. Therefore, energy is needed to maintain the acceptable quality of life level in buildings. Balancing between energy and environment conservation and well-being of the building occupants shall be made properly. Buildings also have other environmental impacts such as built-up land occupying, partly contribute to flooding and heat island effect, water consuming, raw materials extracting for building construction, pollution and waste releasing from construction sites and building operation, etc. Sustainable building design practice shall be able to help solving these problems using appropriate building designs and technologies while still maintaining building occupant good quality of life and productivity.

Thai Green Building Institute (TGBI) launched TREES (Thai's Rating of Energy and Environmental Sustainability) as a rating system that would help guiding construction industry to design and construct architecture that is environmental friendly and can increase occupant well-being and productivity comprehensively. TGBI expects that buildings using this rating system would consume less energy, reduce environmental impacts and reduce pollution while increase quality of life of the building occupants.

Thai's Rating of Energy and Environmental Sustainability for Existing Building

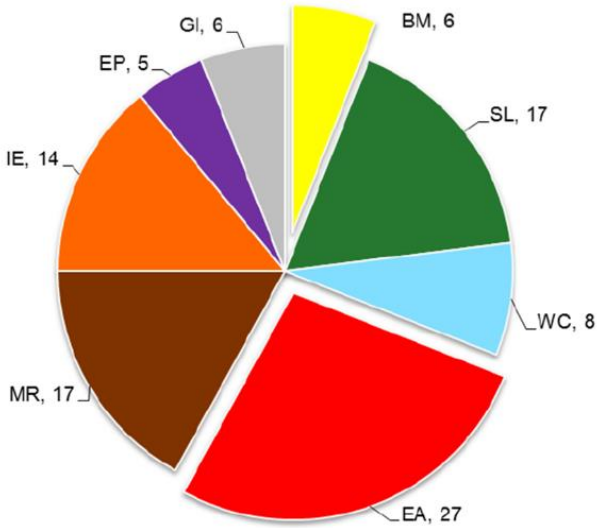
TREES rating systems are designed suitably for various building types, both new buildings and existing buildings. Thai's Rating of Energy and Environmental Sustainability for Existing Building or TREES-EB focuses on existing buildings. Building operation shall be in stable stage because the data from building occupants, energy use, and environment from the actual measurement building are required. TREES-EB is not suitable for new construction or major renovation project because TREES-EB emphasizes on collecting

data from the actual building. However, some building improvements may be required to pass the prerequisite topics and credit topics.

TREES-EB topics can be separated to prerequisite topics and credit topics. The registered project must pass all requirements in 5 prerequisite topics. If the project does not pass only one of the prerequisite topics, the project will fail. For credit topics, there are points in each topic depending on the priority. The rating system total points are 100. If the project passes all 5 prerequisite topics and gets points from credit topics, the total score will be used to judge the award level. For TREES-EB, there are 4 award levels.

PLATINUM	more than 75 points
GOLD	55-74 points
SILVER	45-54 points
CERTIFIED	35-44 points
All levels must pass prerequisite topics	5 prerequisite topics.

TREES-EB has 8 assessment sections: 1) Building Management (BM), 2) Site and Landscape (SL), 3) Water Conservation (WC), 4) Energy and Atmosphere (EA), 5) Materials and Resources (MR), 6) Indoor Environmental Quality (IE), 7) Environmental Protection (EP), 8) Green Innovation (GI). The score proportions are as follows:

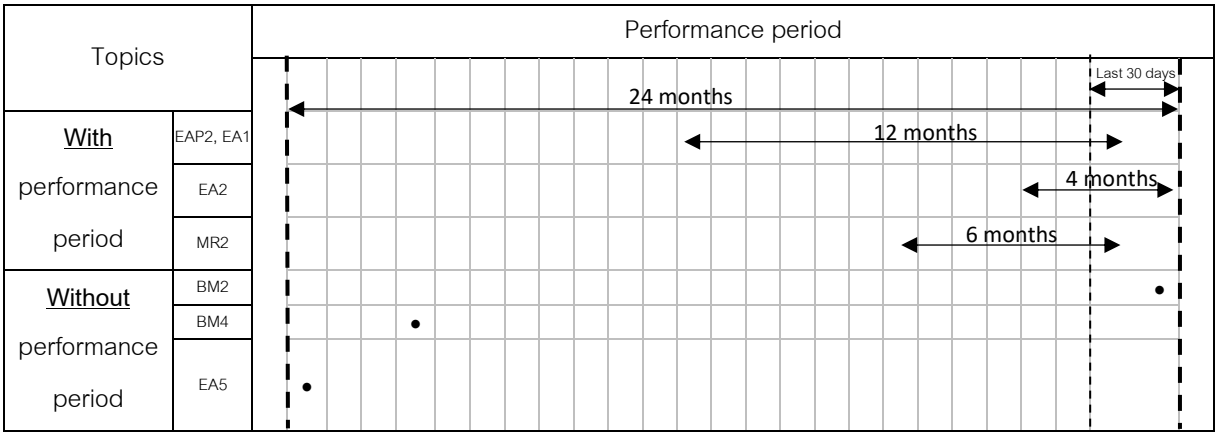


The important characteristic of TREES-EB is performance period. Performance period is the period for data collection as specified in each section. Performance period will be specified for some sections only, especially the topics that are required for data collection such as energy, purchasing, waste, and questionnaire. For the topics that performance period is not required such as changing sanitary wares, changing roofing materials to green roof, if the building has the characteristic as specified in the topics, the building could get credits immediately. TREES-EB topics can be separated to the topics with performance periods or not according to the following table.

Section	Topics with performance period	Topics without performance period
BM	BMP1 BM1 BM3	BM2 BM4
SL	SL2 SL4 SL6	SL1 SL3 SL5
WC	WCP1 WC2	WC1
EA	EAP1 EAP2 EA1 EA2 EA3 EA6	EA4 EA5
MR	MR1.1 MR1.2 MR2 MR3	MR1.3
IE	IEP1 IE2	IE1 IE3 IE4 IE5
EP	EP4 EP5	EP1 EP2 EP3
GI	GI1 GI2	GI1

Minimum performance period for every topic is 3-months continuously except EA P2 and EA 1 that the minimum performance period is 12-months continuously. Performance period shall not more than 24 months and performance period shall be finished in the same time or within 30 days of one another. (Counting from the first finished performance period topic to the last finished performance period topic.)

Examples of performance period table



Topics without performance period must be done within 2 years from the time the last topic with performance period was done. If calibration is needed for equipment used for those topics, calibration certificate must still be valid when the testing was performed.

Example: Topic EA5 (A without performance period topic). Additional meters were installed and a report was written within 24 months (From the time the last topic with performance period was done). However, the electricity meter calibration certificate must still valid when meter measurement is performed. If meters were install before the 24-month period, at the time of measurement within 24-month period, the calibration certificate must still be valid.

Process of TREES-EB assessment starts from registering the project, hiring consultant to plan 3 main working parts which are building retrofit, performance period data collection and policy making. After all works are done, reports and document can be submitted to TGBI for assessment. The submission will be only

1 time. Document must be submitted to TGBI within 90 days after the last performance period has done so that all information is still up to date and correspond with building working conditions. EA P1 and EA1 are topics with longest performance period at 1 year, therefore, they should be considered first in planning. However, if performance recording period of these two topics has begun before the project registration, their performance periods could be shorter.

TGBI specified the preliminary criteria of the project characteristic and qualification as follows:

1. The building shall be legal. If the building is illegal in any case, TGBI reserves the right to withdraw award.
2. The building shall be permanent and shall not have the objective to be relocate because TREES has many criteria involved with site and landscape.
3. The project shall have clear boundary. For group of the building such as industrial estate or university that does not have clear boundary, the project boundary shall be identified properly.
4. The total of the building usable area shall not less than 100 m^2.
5. The minimum regular building occupants is 1 person.
6. Building usable area shall not less than 5% of the land area.
7. TREES-EB is not designed for 3 floors or less small residential buildings.
8. The building shall be in operation for at least 1 year, and have occupants no less than 50% of the total building occupants by average. Buildings with TREES-NC and TREES-CS certification could register without waiting for one year of building operation.

Section 1 Building Management

Existing green building cannot be successful without cooperation from every sector: Owners, Architects, Interior Designers, Landscape Architects, Engineers, Contractors, Building Occupants and other involved sectors including cooperation from the communities around the project. To show intentions and standpoints toward environmental friendly building construction which will not produce pollution to the surrounding context are a good communication to social to create understanding with every sector, and smoothness in building construction and operation. Successful green buildings also need building operation guidelines for building occupants, appropriate management plan and building maintenance plan throughout the buildings' life. Assessment in this section comprises the followings:

Topic	Detail	Point
BM P1	Green building preparation	Prerequisite
BM 1	Promoting green building	1
BM 2	Building manual and building operation and maintenance training	1
BM 3	Building management monitoring and evaluation	1
BM 4	TREES-NC or TREES-CS certified building	3

The outcome from this section will help the green building ongoing activities continue smoothly which would affect Owner and Building Occupants in the scope of economy, health, and well-being in the building.

BMP1 Green Building Preparation (Prerequisite)

Intent

For systematic and smooth green building design and operation, which the project teams and persons in charge could efficiently maintain and fulfil 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. 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-EB. The plan shall start from the beginning period of the project concept formulation, and have chief executive or appointed representative as a project leader.

BM1 Promoting green building (1 Point)

Intent

Green building shall be promoted efficiently.

Requirement

1. Install billboard in front of the project. Specify project green building intention to join TREES officially. Logo and TGBI's full name shall be presented clearly with specific rating system selected for the project (TREES-EB in this case). The billboard shall have 2 languages: Thai and English, during the whole performance period.

2. Provide building information and the project green building features. This information will be promoted for general public benefit. At least two forms of green building promoting from the following list shall be implemented:

- Brochure using recycle paper or others sustainable material for at least 500 copies printed, and shall be distributed in seminar that involved with building design, construction, or operation.
- Website presents concept and details of the project's green building design and operation features.
- Provide project green building features promotion offsite for at least 3 places.
- Green features permanent exhibition in the building.
- Install billboard at various locations in the building comprehensively to provide knowledge regarding the project green building features to building occupants or visitors.
- Building visit: invite at least 3 organizations from government sector or private sector (50 people each) to visit building.
- Presenting the project exceptional green features in academic journal or academic conference (national or international) for at least 1 article.
- Other methods which are concrete, and can be proven and shown the quantitative outcomes. The other methods shall be presented to TGBI for approval.

Implementation

Plan to promote the project using various accepted channels and have billboard in front of the project site during performance period.

BM2 Building manual and building operation and maintenance training (1 Point)

Intent

Building manual for appropriate building operating and management in written format with staff training are required.

Requirement

Have building system operation and maintenance manual and conduct training of green building systems operating and maintaining for involved staffs. Building manual shall consist of systems at least the following: (1) Air conditioned and ventilation systems (2) Electrical and lighting systems (3) Sanitary systems (4) Hot water systems (for hotel and hospital) (5) Service systems (6) Renewable energy systems (if any). Other systems can be added as appropriate of each project.

This manual is collection of document from EA P1 organized orderly and presents specific details of the building. The manual shall present floor plan and single line diagram specific for that building. Providing document as specified in EA P1 is only a preliminary step to provide the manual.

Implementation

Provide building manual and training for necessary building systems for the involved staffs. This section shall be considered with the section EA P1 Building survey and energy conservation plan.

BM3 Building management monitoring and evaluation (1 Point)

Intent

To strengthen the systematic green building design and management further from BM P1 and manage green building design and construction knowledge for future TREES development.

Requirement

Green building project team shall extend the action plan from BM P1 by introducing the topic 5) Evaluation, identify success, limitation, comment and suggestion in performance period. Consequently, the green building project team can monitor the working process efficiently and can learn TREES systematically.

Implementation

Extend the scope of work of the green building project team in monitoring and evaluating activities systematically. Summarize the progress of activities in each period and collect the documents from the progress meeting for the topics that are successful or fail. The team shall summarize the success methods and fail methods for self-learning and produce database for TGBI in the future.

BM 4 TREES-NC or TREES-CS Certified Building (3 Points)

Intent

To persuade green building design from the beginning with TREES. TREES could be used as verification of green building features in certified buildings that they are good quality, environment friendly, and energy efficient. To support the continuing of TREES certified process that each rating system can support each other, especially TREES-NC.

Requirement

TREES-EB project has previously been certified under TREES-NC or TREES-CS as followed:

1. The building certified Certified Level from TREES-NC or TREES-CS: 1 point
2. The building certified Silver Level from TREES-NC or TREES-CS: 2 points
3. The building certified Gold Level from TREES-NC or TREES-CS: 3 points
4. The building certified Platinum Level from TREES-NC or TREES-CS: 3 Points, and can another extra point from GI Section.

Implementation

Long term plan for green building project starting from the project inception to have TREES-NC or TREES-CS certification, and continue to TREES-EB to get credits in this topic.

Section 2 Site and Landscape

For existing building, site, which cannot be changed, still an important factor that can impact the environment. The impact of building site includes private car use reduction, landscape improvement, reduction of Urban Heat Island effect and flooding problem can affect energy efficiency and environmental friendly characteristics of the project. Therefore, SL section is still important for existing building. Apart from the factors mentioned above, the existing building additional topic is landscape and building exterior maintenance that is not mentioned in TREES-NC.

Topic	Detail	Point
SL 1	Locate project on the developed land	1
SL 2	Reduce using private cars	3
SL 3	Sustainable site planning	5
SL 3.1	Appropriate and Sufficient Ecological Open Space	2
SL 3.2	Plant 1 big tree per 100-200 m^2 of open space (do not relocate natural big trees from other sites).	2
SL 3.3	Use local or native plants appropriately	1
SL 4	Infiltration of storm water and flooding prevention.	4
SL 5	Reduce Heat Island Effects in the urban area from project development	3
SL 5.1	Green roof or vertical garden	2
SL 5.2	Hardscape area received direct solar radiation not more than 50% of the total hardscape area.	1
SL 6	Landscape and building exterior maintenance	1

SL1 Locate project on the developed land (1 Point)

Intent

Promote the project located in the previously developed area and in urban areas with existing infrastructure to protect forest, habitat and natural resources from invasion.

Requirement

The project shall have 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 cannel, fence, etc.).

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

Survey and record various and convenient to access urban facilities. Public transport systems shall be recorded to get credits from the Section SL2: Reduce using private cars.

SL2 Reduce using private car (4 Points)

Intent

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

Requirement

Create questionnaire to survey employee commute methods to work according to SCAQMD Rule 2022 to reduce private cars and motorcycles use. Promote alternatives work options such as using information technology, working day reduction, using public transport, walking, using bicycles, carpool or eco car.

Calculation shall present the numbers of private cars and motorcycles that can be reduced comparing to the assumption that all building occupant use private cars or motorcycles during a week of normal working schedule using survey with building occupant samples according to SCAQMD Rule 2022. This survey shall be conducted at least once during the performance period.

Credits will be calculated from the reduction percentage of private car and motorcycle use as specified in the following table.

Percentage reduction of private car and motorcycle use of the regular occupants	Credits
65	1
75	2
85	3

Implementation

Building owner shall support measures to reduce private cars and motorcycles use by offering incentive, for example, support travel cost if travelling by public transport systems, provide special parking spaces for carpool or eco cars, or shuttle bus. Survey following SCAQMD Rule 2022 shall be done by an experts for the report correctness in terms of interpretation, sampling methods and calculations.

SL 3 Sustainable site planning (5 Points)

SL3.1 Appropriate and Sufficient Ecological Open Space (2 Points)

Intent

Design for more open space which add opportunities for increasing green area, animal habitats, reducing flooding problems and urban heat island effects, and increasing outdoor public activity areas.

Requirement

Alternative 1

The project shall have *Ecological Open Space* not less than 10-25% of building footprint, and green area for at least 25-40% 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.

% of ecological open space of building footprint	% of green area of ecological open space	Points
10	25	1
25	40	2

Alternative 2

The project shall have an *Ecological Open Space* 10-20% 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

Consider developing the project for having *Ecological Open Space* as specified in the regulation and select the appropriate alternative for the characteristic of the project. Consider to getting the points with other sections of SL 3: Sustainable site planning and SL 5 Reduce Heat Island Effects in urban area from project development

SL 3 Sustainable site planning (5 Points)

SL 3.2 Plant 1 big tree per 100-200 m^2 of open space (2 Points)

(do not relocate natural big trees from other sites)

Intent

Improve microclimate appropriately for good environment in the building, energy saving, reduce urban heat island effect, and support dwelling that are friendly between human and animals including other creatures.

Requirement

- Plant no less than 1 big tree per 200 m^2 of open space, get 1 point.
- Plant no less than 1 big tree per 100 m^2 of open space, get 2 points.
- The trees shall be fully grown with permanent shading canopy or would be fully grown within 3 years of project green rating assessment registration.
- 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.

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SL 3 Sustainable site planning (5 Points)

SL3.3 Use local or native plants appropriately (1 Point)

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 Appropriate and Sufficient Ecological Open Space, SL 3.2 Plant 1 big tree per 100-200 m^2 of open space (do not relocate natural big trees other sites), and SL 5 Reduce Heat Island Effects in urban area from project development.

SL4 Infiltration of storm water and flooding prevention. (4 Points)

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

Area-Weighted Average Runoff Coefficient Points	Points
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

Get 2-4 Credits if the project can manage storm water by calculation or simulation according to the following conditions:

1. The project can collect storm water for 5-15% of the precipitation falling on the whole project site for an average weather year and for 2-year, 24-hour design storm. Use Bangkok data if there is no data of the project area.

% of storm water collection	Points
5	2
10	3
15	4

2. Management using efficient drain systems or retentions during the whole performance period.

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 Appropriate and Sufficient Ecological Open Space using the open space which has a potential to receive and slow down water, and can be used as green area of the project.

SL 5 Reduce Heat Island Effects in the urban area from project development (3 Points)

SL5.1 Green roof or vertical garden (2 Points)

Intent

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°, 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 x 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) > 0.3 (get 1 point)

GSA/the total of roof area (not include building systems area and void for natural light) > 0.5 (get 2 points)

For GWA, if the vegetate proportion is more than 50% of any GWA, all of that area can be counted as GWA.

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.

SL 5 Reduce Heat Island Effects in the urban area from project development (3 Points)

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

(1 Point)

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.

SL 6 Landscape and building exterior maintenance (1 Point)

Intent

For sustainable, energy saving, and environmental friendly management and maintenance of the exterior space and landscape.

Requirement

1. Provide environmental friendly maintenance practice for building exterior by reducing the use of harmful chemical substances, reducing energy use, pollution, and toxin leakage that shall include the followings;

- Use maintenance and cleaning equipment with low noise and non-gasoline (>20% of the number of the equipment)
- Building envelope and exterior hardscape cleaning use environmental friendly chemical substances (Thai Green Label or equivalent) (>20% of the chemical quantity that are used in performance period)
- Paints and chemical substances that are used to repair and decorate building shall be low-VOC products (>20% of the chemical quantity that are used in performance period)

2. Provide environmental friendly maintenance practice for landscape area as followed:

- Pest control: 1) Reduce attraction of pests (trash management), 2) Reduce pest habitat, 3) Use low impact chemical to control pests, 4) Emergency use of pesticide shall be informed within 24 hours after use.
- Landscape: 1) Check plants grown near the building and maintain the plant to prevent possible damage to the building, 2) Check landscape area to reduce soil erosion impact, 3) If there are construction activities during performance period, the construction activities must conform to requirement in TREES-NC EP P1 Reduce pollution from construction.
- Chemical fertilizer: 1) Do not use chemical fertilizer when there is a sign of possible heavy rain. 2) Do not use chemical fertilizer within 8 m from water sources, 3) Use natural fertilizer as much as possible, 4) Use slow release chemical fertilizer.

Implementation

Plan exterior space and landscape management in advance. Provide environmental friendly products and train related responsible staffs to understand all procedures, objectives and targets. Plan to collect data systematically.

Section 3 Water Conservation

Average water use in Bangkok is approximately 329-340 litres / person / day. The average water use for typical water closet is approximately 13 litres / flush. If every person uses water closet 4 times a day, the water use is 52 litres / person which are 30% of the amount of daily water use per person. Portable water demand is increasing because of rapid population growth while the amount of untreated water is limited. Water saving and efficient water use are the ways to reduce water scarcity problem in the future.

Selecting water saving fixtures and faucets, or green label products instead of using general products can reduce portable water using significantly. Furthermore, rain water collection for use in some parts of the project instead of portable water including water meter installation are helpful for efficient water management in each part of the projects.

For an efficiency of water saving and water use in the building, assessments in this section comprises the followings:

Topic	Detail	Points
WC P1	Water saving policy	Prerequisite
WC1	Water saving and water use efficiency	6
WC2	One to two water end uses sub-metering	2

WCP1 Water saving policy (Prerequisite)

Intent

Green building shall have sustainable and systematic water saving policy.

Requirement

Create indoor water use policy for present and future. The policy shall have details as follow:

1. Scope of the policy
2. Performance period
3. Water saving goal and efficiency measurement
4. Water use efficiency at the present
5. Efficiency improvement in the future
6. Adjustment plan
7. Responsible persons

Implementation

Plan water saving activities systematically with building management teams and involved parties such as Building Owner. Survey and set budget to improve water efficiency of the building. Consider getting points with the section WC1 Water saving and water use efficiency and WC2 One to two water end uses sub-metering.

WC 1 Water saving and water use efficiency (6 Points)

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

1. Reduce water use consumption 10% from baseline (2 points).
2. Reduce water use consumption 20% from baseline (4 points).
3. Reduce water use consumption 30% from baseline (6 points).

Implementation

Survey water fixtures and faucet in the building and plan to reduce water use by improving or changing them to water saving models or 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.

WC 2 One to two water end uses sub-metering (2 Points)

Intent

To promote water use monitoring in building and planning for long term water conservation.

Requirement

1. Have water use monitoring systems. (Both indoor and outdoor use of the building registering for TREES-EB certified)

2. Install water meters for 1-2 water end uses. 1 water endues metering will get 1 points and 2 water endues metering can get 2 points. The meter shall measure at least 80% of the water end use type. Example of water end uses are;

- Indoor water use
- Landscape irrigation
- Air conditioning system water use
- machines water use
- Hot water
- Other process water that are required water use for more than 5% (from estimation)

Water sub-meters shall be digital types, can collect hourly data and can store data for at least 1 month. Measurement during performance period are required. Present measurements result during the whole operation periods. The meter shall have calibration document from the manufacturer or reliable institute for at least 1 year from the first date of the performance period.

Implementation

Plan to install water meters and sub-meters for main water end use in the project. The water end uses that are easy to install and require less number of meters shall be selected. The selected meters shall comply with the regulations and have calibration document within the specified period of time.

Section 4 Energy and Atmosphere

Energy use in the building is one of the most important cause of pollution and greenhouse effect which are serious crisis at the present. In general, the energy use in the building is electrical produced from power plants. Electrical power in Thailand typically requires non-renewable and expensive energy source which also produce pollution during the generation processes. In addition, energy is loss more than 2/3 during transmission in distribution systems (in form of heat dissipation). Electricity generation from clean sources such as solar energy, wind, or water has a very little proportion when compared with total energy sources requirement for electricity production of the country. Therefore, TREES-EB gives the most points for this section with the maximum total score of 27 points, and has 2 prerequisite topics. For green existing building, getting credits will emphasize on assessing actual energy use and renewable energy production. In addition, collecting energy use data systematically for future energy management is also emphasized. The collected data could be used for various energy conservation measures that have economic feasibility with BMS system. Apart from that, this section covers to refrigerant in air conditioned systems that may affect Ozone layer. This section comprises various topics as follows:

Topic	Detail	Point
EA P1	Building survey and energy conservation plan	Prerequisite
EA P2	Minimum Building Energy Efficiency	Prerequisite
EA 1	Building energy efficiency	16
EA 2	Renewable energy Produce renewable energy not less than 0.5-3.5 % of energy cost in the building.	4
EA 3	Energy conservation measure application: Saving result 20%, 30%, 40%	3
EA 4	Refrigerant in air conditioning systems that does not harm ozone layer	1
EA 5	Building energy management system	3
EA 5.1	Basic BMS systems	1
EA 5.2	End use energy metering: 30%, 60%	2

EA P1 Building survey and energy conservation plan (Prerequisite)

Intent

To confirm energy conservation measures and provide appropriate building analysis and building occupants training.

Requirement

Provide documents as followed:

1. Building Operation Plan (BOP) that present the details of building operation methods for systems (at lease heating and cooling systems, air conditioning and ventilation systems, lighting systems and renewable energy systems (if any)) as followed:

- Building use schedules
- Equipment turn on/off schedules
- Temperature setting points for air conditioning system
- Lighting design levels
- Specify changing of schedules and any setting for different season or days in the week
- Confirmation that the plan is used during performance period.

2. Details of System Narrative: Describe the building systems that involved with Building Operation Plan. Minimum systems to be included are heating and cooling systems, air conditioning and ventilation systems, lighting systems and building management systems. Addition systems could be included i.e. water heating systems, renewable energy systems.

3. Sequence of Operation that specifies the operation procedure of building manager for system management in normal working condition.

4. Preventive Maintenance of the systems that are specified in System Narrative, and all loggings during performance period.

Implementation

Have working teams for building system management to collect building system data and document required for this topic. Data and document should also be used for maintaining highest building operation efficiency during the performance period.

EAP2 Minimum building energy efficiency (Prerequisite)

Intent

Specify the minimum standard of energy use for green building.

Requirement

There are 2 alternatives as followed:

Alternative 1

Compare the actual energy use with database in Thailand that is approved from TGBI.

Alternative 2

Compare the actual energy use with database in Energy Star Portfolio Manager. Energy use in 1 year performance period shall be better than the average no less than 19%

Energy Star Portfolio Manager is available at http://portfoliomanager.energystar.gov/pm/login.html

Implementation

Collect data to assess energy use by Energy Star Portfolio Manager for evaluating existing energy use condition. Implement energy saving measures until the building energy use reach the reduction target. Keep adjusting energy use in the Energy Star Portfolio to track building energy saving.

EA1 Building energy efficiency (16 Points)

Intent

To support designing building that save energy more than standard.

Requirement

Alternative 1

Compare the actual energy use with database in Thailand that is approved from TGBI (the order of credits will be announced later).

Alternative 2

Compare the actual energy use with database in Energy Star Portfolio Manager. Energy use in 1 year performance period shall be better than the average for 21% onward as followed

% of energy use that is lower than the average in Energy Star Portfolio Manager	Points
21	1
22	2
23	3
24	4
25	5
26	6
28	7
29	8
30	9
32	10
34	11
36	12
38	13
40	14
42	15
44	16

Implementation

Collect data to assess energy use by Energy Star Portfolio Manager for evaluating existing energy use condition. Implement energy saving measures until the building energy use reach the reduction target. Keep adjusting energy use in the Energy Star Portfolio to track building energy saving.

EA2 Renewable energy (4 Points)

Produce renewable energy not less than 0.5-3.5 % of energy cost in the building.

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 0.5-3.5 % of the building's annual energy cost per year from the actual measurement from the section EA 1 during performance period.

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)
3. Produce renewable energy not less than 2.5 % of energy cost in the building. (get 3 points)
4. Produce renewable energy not less than 3.5 % of energy cost in the building. (get 4 points)

Implementation

The building could install renewable energy systems such as solar power, wind power, biofuel to the building or in the project equal to required demand. The renewable energy shall be used in the building and shall have energy monitoring system during the whole performance period. Renewable energy can reduce energy demand of EA P2: Minimum building energy efficiency and EA 1: Building energy efficiency. So, renewable energy plays a role to increase the rewarded credits in these 2 sections.

EA 3	Energy conservation measure application: Saving result 20%, 30%, 40%	(3 Points)

Intent

Have energy conservation plan and implemented.

Requirement

1. Evaluate energy use in the building and analyse energy conservation measure as specified in ASHRAE Level 1 walk-through. Present the result of energy conservation percentages as shown in table EA 3 T 1

Table EA 3 T 1

Baseline energy use (kWh/ m^2)	% energy saving result analysis	Energy saving in each step (kWh/ m^2)
>201	40%	Calculate from portion that is more than 201
161-200	25%	10
≤160	10%	16

2. Implement measures resulting from 1. Implementing period shall equal to or more than performance period.
   - Saving result 30% of analysis in 1, get 1 point.
   - Saving result 60% of analysis in 1, get 2 point.
   - Saving result 90% of analysis in 1, get 3 point.

Implementation

Analyse energy use according to ASHRAE Level 1 walk-through. Plan to set budget to refurbish the building to be more energy efficiency.

EA4	Refrigerant in air conditioning systems that does not harm ozone layer	(1 Point)

Not use CFC and HCFC-22

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. Air conditioning units with less than 0.3 kg are exempt from this requirement.

In case of the existing systems that use CFC and HCFC-22, the project shall produce

1) Plan to stop using refrigerant

2) Plan to reduce leakage of the refrigerant, and

3) Feasibility report (presents that changing air conditioning system is not feasibility).

Implementation

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

EA 5 Building energy management system (3 Points)

EA 5.1 Basic BMS systems (1 Point)

Objective

Promote building management system for efficiently monitoring and analyzing building operation data, and controlling building operation.

Requirement

1. The building shall have building management system that can record and control main building systems which are air conditioning system, ventilation system and lighting system, at a minimum

2. Have a preventive maintenance plan and ensure that the systems are maintained regularly as specified by the manufacturer.

3. Demonstrate that BMS is being used for energy conservation in the building such as to control temperature in air-conditioned areas properly, and control lighting system on and off operations.

Implementation

Install BMS that can work as specified in this topic. Have a plan to maintain the system continuously and get maximum benefit from BMS for energy management in the building. If the building uses BMS efficiently, the building will get the points from the Section EA P2: Minimum building energy efficiency and EA 1: Building energy efficiency. Consider integrating BMS and measurement of sublevel energy systems to get the points in the Section EA 5.2: End use energy metering: 30%, 60%.

EA 5 Building energy management system (3 Points)

EA 5.2 End use energy metering: 30%, 60% (2 Points)

Objective

To support energy management and conservation by monitoring and recording energy use data.

Requirement

1. Analysis end use energy of the building from the actual energy use such as cooling, heating, exhaust fan, equipment, machine, lighting, water heating, cooking, etc.
2. Demonstrate end use energy metering for more than 30% to get 1 point, and more than 60% to get 2 points.
3. One of the two highest end use energy shall be measured for no less than 80% of that energy end use consumption.
4. Collect energy use data during performance period.
5. Energy meters shall have Calibration Certificate for the period specified by the manufacturer.

Implementation

Have an expert to analyse energy use and separate end use energy. Plan to install appropriate number and efficient sub meter. Request Calibration Certificate with plan to collect data from sub meter. Plan to get the points with the Section EA 5.1 Basic BMS systems because BMS shall work at full efficiency.

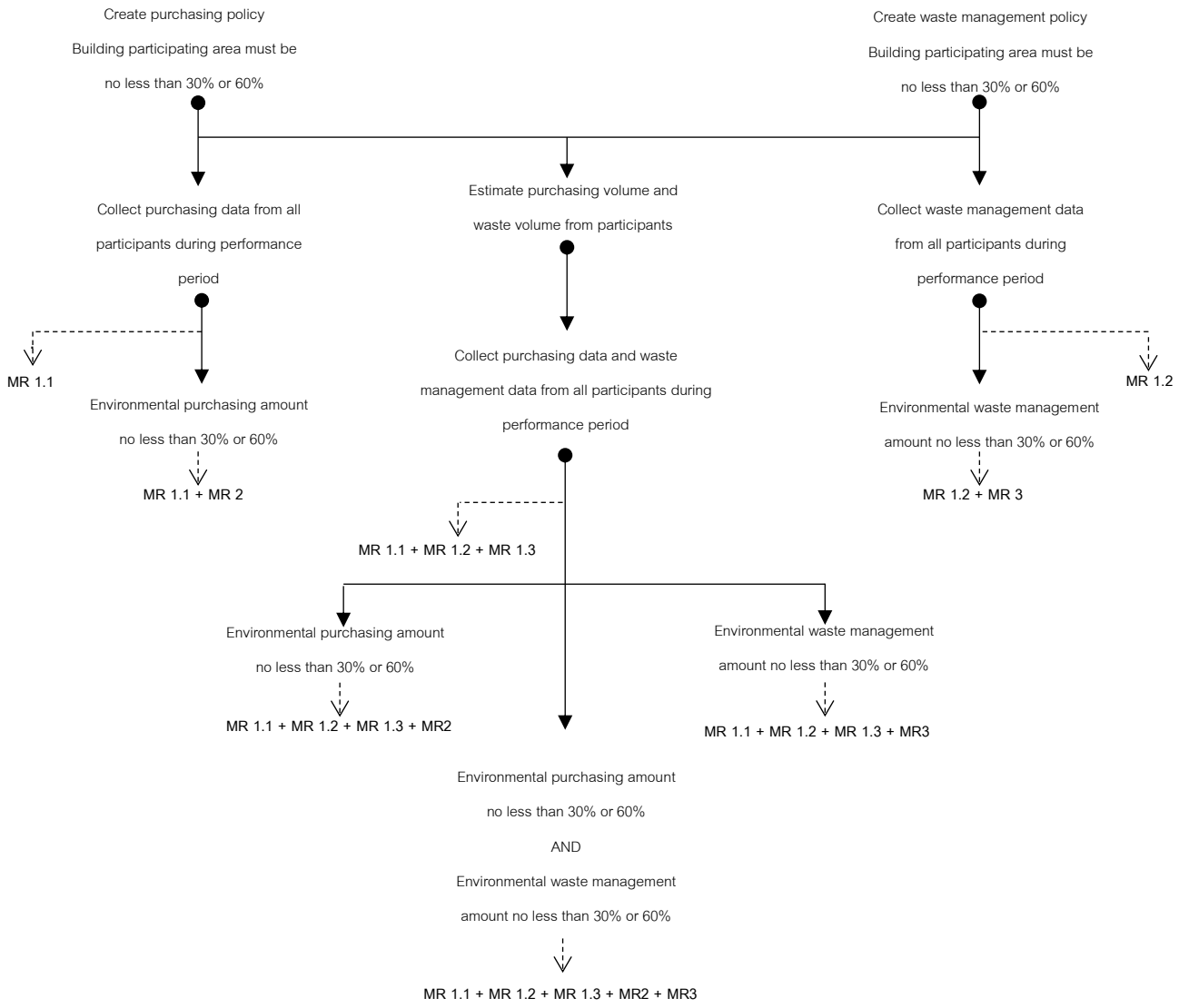
Section 5 Materials and Resources

Materials and resources for existing building are different from new construction. For existing building, this section involves with purchasing consumer products, electric appliances, furniture, and waste management from these 3 topics. Operations in this section can success by cooperation from the Owner, Tenants, and Building Occupants. There are 3 main sections and the total credits are 17 points as followed:

Topic	Detail	Point
MR1	Policy and participation in building management	5
MR 1.1	Purchasing policy and participation of occupants: 30%, 60%	2
MR 1.2	Waste management policy and occupant participation: 30%, 60%	2
MR 1.3	Purchasing estimation and waste proportion	1
MR2	Environmental friendly purchasing	6
MR 2.1	Purchasing: ongoing consumables: 30%, 60%	2
MR 2.2	Purchasing: electrical appliances: 30%, 60%	2
MR 2.3	Purchasing: furniture: 30%, 60%	2
MR3	Environmental friendly waste management	6
MR 3.1	Waste management: ongoing consumables: 30%, 60%	2
MR 3.2	Waste management: electrical appliances: 30%, 60%	2
MR 3.3	Waste management: furniture: 30%, 60%	2

Structure and interrelationship among topic in Section 5 Materials and Resources

Topic in Section 5 Materials and Resources are interrelations and continuous from the first topic to the last topic. Beginning with policy group of topics which are MR1.1 and MR1.2 to define boundary and building occupant numbers used in all topics in this section. The structure of Section 5 can be shown in the following diagram.



From the diagram, for example, MR 1.3 can be done only if the policy is there to identify the amount of participants that would coorporate in implementing and providing purchasing data and waste management data. On the other hand, policy made in MR 1 need to be implemented. The successful of MR1 would then be evaluated in MR2 and MR3. The overall relationship can be explained in the following table

Subjects	Relationship	Involved topics
Building areas participated and non-participated in environmental purchasing policy	Need to be the same across topics except MR1.3 that counted only purchasing policy participated area	MR1.1 MR1.3 MR2
Building areas participated and non-participated in environmental waste management policy	Need to be the same across topics except MR1.3 that counted only waste management participated area	MR1.2 MR1.3 MR3

Subjects	Relationship	Involved topics
Purchase volumes of non-participant areas	Need data in performance period from purchasing policy non-participated areas to calculate total purchasing volume. Purchasing in non-participated areas will be considered non-environmental friendly	MR1.1 MR2
Waste volumes of non-participant areas	Need data in performance period from waste management policy non-participated areas to calculate total purchasing volume. Purchasing in non-participated areas will be considered non-environmental friendly	MR1.2 MR3

MR 1 Policy and participation in building management (5 Points)

MR 1.1 Purchasing policy and participation of occupants: 30%, 60% (2 Points)

Intent

To initiate the discussion and coordination in the project for environmental friendly material purchasing policy.

Requirement

1. Produce an environmentally preferable purchasing policy that includes general consumer products, electric appliances, and furniture.

2. The policy shall control, at a minimum, the parts that the Owner has an authorization such as office of the building manager and all of the common area. If the Owner can get participation from tenants in the process of this policy for more than 30% of the tenant area. (include the area of building management office), the project will get 1 point. If participation from tenants is achieved more than 60% of the tenant areas (include the area of building management office), the project will get 2 points.

3. If the building has the area that cannot participate to this purchasing policy or in case of condominium, unit residential areas and retail areas need not to be included in the calculation. All areas in building such as hospital and hotel, shall be counted to the calculation because the Owner has an authorization in all areas for implementing purchasing policy.

Implementation

Initiate environmental friendly purchasing policy and plan to publicize to tenants. The tenants shall participate with the policy as many as possible.

MR 1 Policy and participation in building management (5 Points)

MR 1.2 Waste management policy and occupant participation: 30%, 60% (2 Points)

Intent

To initiate the discussion and coordination in the project for environmental friendly waste management policy.

Requirement

1. Produce an environmentally preferable waste management policy that includes general consumer products, electric appliances, and furniture.

2. The policy shall control, at a minimum, the parts that the Owner has an authorization such as office of the building manager and all of the common area. If the Owner can get participation from tenants in the process of this policy for more than 30% of the tenant area. (include the area of building management office), the project will get 1 point. If participation from tenants is achieved more than 60% of the tenant areas (include the area of building management office), the project will get 2 points.

3. If the building has the area that cannot participate to this purchasing policy or in case of condominium, unit residential areas and retail areas need not to be included in the calculation. All areas in building such as hospital and hotel, shall be counted to the calculation because the Owner has an authorization in all areas for implementing waste management policy.

Implementation

Initiate environmental friendly waste management policy and plan to publicize to tenants. The tenants shall participate with the policy as many as possible.

MR 1 Policy and participation in building management (5 Points)

MR 1.3 Purchasing estimation and waste proportion (1 Point)

Intent

For having preliminary estimation of purchasing value and waste amount before actual data collection begin that will help and promote efficiency purchasing and waste management.

Requirement

1. Preliminary estimate the volume of consumer products, electric appliances and furniture purchasing, and the proportion of possible environmentally volume. Product included in the estimation shall be specified in details. For example, general consumer products are papers, toners, files, and pens.

2. Preliminary estimates how much waste from general consumer products, electric appliances and furniture, could be managed and how much could be reuse and recycle. Product included in no.1 must be included in no.2.

Implementation

Plan and prepare log sheets for collecting data of purchasing and waste management. Survey environmental friendly materials in the market including waste management options for reuse or recycle. The project shall participate in MR1.1, MR1.2 and MR1.3

MR 2 Environmental friendly purchasing (6 Points)

MR 2.1 Purchasing: ongoing consumables: 30%, 60% (2 Points)

Intent

For environmental friendly ongoing consumables purchasing

Requirement

In performance period, purchase environmental friendly ongoing consumables such as papers, office equipment, battery, toners, and files according to TREES requirement at least 30% of the total product value during performance period to get 1 point. If purchasing achieves at least 60% of the material value during the performance period, the project will get 2 points.

For the area of the building that does not participate in the purchasing policy, value-base will be specified to calculate and estimate purchasing value of each area. Those purchasing value will be added to the total purchasing value during performance period but the environmental friendly product in this part cannot be counted toward points.

Implementation

Collect list of environmental friendly ongoing consumables and purchase those product to use in the building. Try to convince building occupant to participate much as possible. Consider getting the points with the section MR 1.1: Purchasing policy and participation of the building occupants: 30%, 60%.

MR 2 Environmental friendly purchasing (6 Points)

MR 2.2 Purchasing: electrical appliances: 30%, 60% (2 Points)

Intent

For environmental friendly electric appliances purchasing.

Requirement

In performance period, purchase or rent environmental friendly and energy saving appliances such as computers, office electric appliances, and photocopier according to TREES requirement at least 30% of the total product value during performance period to get 1 point. If purchasing achieves at least 60% of the material value during the performance period, the project will get 2 points.

In case of renting, asset value estimation from the seller and renting period equal to equipment's age as specified from the manufacture shall be required to get the points.

For the area of the building that does not participate in the purchasing policy, value-base will be specified to calculate and estimate purchasing value of each area. Those purchasing value will be added to the total purchasing value during performance period but the environmental friendly product in this part cannot be counted toward points.

Implementation

Collect list of environmental friendly and energy saving appliances and purchase those product to use in the building. Try to convince building occupant to participate much as possible. Consider getting the points with the section MR 1.1: Purchasing policy and participation of the building occupants: 30%, 60%.

MR 2 Environmental friendly purchasing (6 Points)

MR 2.3 Purchasing: furniture: 30%, 60% (2 Points)

Intent

For environmental friendly furniture purchasing.

Requirement

In performance period, purchase or rent environmental friendly furniture according to TREES requirement at least 30% of the total product value during performance period to get 1 point. If purchasing achieves at least 60% of the material value during the performance period, the project will get 2 points.

In case of renting, asset value estimation from the seller and renting period equal to equipment's age as specified from the manufacture shall be required to get the points.

For the area of the building that does not participate in the purchasing policy, value-base will be specified to calculate and estimate purchasing value of each area. Those purchasing value will be added to the total purchasing value during performance period but the environmental friendly product in this part cannot be counted toward points.

Implementation

Collect list of environmental friendly furniture and purchase those product to use in the building. Try to convince building occupant to participate much as possible. Consider getting the points with the section MR 1.1: Purchasing policy and participation of the building occupants: 30%, 60%.

MR 3 Environmental friendly waste management (6 Points)

MR 3.1 Waste management: ongoing consumables: 30%, 60% (2 Points)

Intent

For environmental friendly waste management

Requirement

During performance period, environmental friendly waste management such as selling, reuse, or donate as specified in TREES for ongoing consumables shall be achieved for at least 30% by weight or volume of the general consumer waste to get 1 point to the project. If managing to achieve at least 60% by weight or volume of the ongoing consumables waste, the project will get 2 points.

For the area of the building that does not participate in the purchasing policy, value-base will be specified to calculate and estimate waste weight or volume of each area. Those quantity of waste will be added to the total waste weight or volume during performance period but the environmental friendly waste management in this part cannot be counted toward points.

Implementation

Execute waste segregation project and collect list of organization that can manage waste with the most environmental friendly methods. Contact and coordinate with those organizations for waste management in performance period. Consider getting the points with the section MR 1.2: Waste management policy and participation of the building occupants: 30%, 60%.

MR 3 Environmental friendly waste management (6 Points)

MR 3.2 Waste management: electric appliances: 30%, 60% (2 Points)

Intent

For environmental friendly waste management

Requirement

During performance period, environmental friendly waste management such as selling, reuse, or donate as specified in TREES for electric appliances shall be achieved for at least 30% by weight or volume of the electric appliance waste to get 1 point to the project. If managing to achieve at least 60% by weight or volume of the electric appliance waste, the project will get 2 points.

For the area of the building that does not participate in the purchasing policy, value-base will be specified to calculate and estimate waste weight or volume of each area. Those quantity of waste will be added to the total waste weight or volume during performance period but the environmental friendly waste management in this part cannot be counted toward points.

Implementation

Execute waste segregation project and collect list of organization that can manage waste with the most environmental friendly methods. Contact and coordinate with those organizations for waste management in performance period. Consider getting the points with the section MR 1.2: Waste management policy and participation of the building occupants: 30%, 60%.

MR 3 Environmental friendly waste management (6 Points)

MR 3.3 Waste management: furniture: 30%, 60% (2 Points)

Intent

For environmental friendly waste management

Requirement

During performance period, environmental friendly waste management such as selling, reuse, or donate as specified in TREES for furniture shall be achieved for at least 30% by weight or volume of the furniture waste to get 1 point to the project. If managing to achieve at least 60% by weight or volume of the furniture waste, the project will get 2 points.

For the area of the building that does not participate in the purchasing policy, value-base will be specified to calculate and estimate waste weight or volume of each area. Those quantity of waste will be added to the total waste weight or volume during performance period but the environmental friendly waste management in this part cannot be counted toward points.

Implementation

Execute waste segregation project and collect list of organization that can manage waste with the most environmental friendly methods. Contact and coordinate with those organizations for waste management in performance period. Consider getting the points with the section MR 1.2: Waste management policy and participation of the building occupants: 30%, 60%.

Section 6 Indoor Environmental Quality

According to the related research, people usually spend most of time in buildings more than outdoor. If indoor environment is not good or inappropriate, it will affect building occupant health and well-being which might also affect workability, and may result in building occupants paying for medical fee, absenting from work, and consequently affect the productivities the organization. Therefore, providing good indoor environmental cannot be ignored.

Criteria to evaluate indoor environment aim to promote good environment and quality of life in the area of thermal comfort, natural lighting, view, and indoor air quality with no toxin or any contaminant. TREES-EB emphasizes the measurement and assessment the actual building rather than calculation or computer simulation. Overall, the topic in this section comprises the details as follows:

Topic	Detail	Point
IE P1	Ventilation rate in the building Ventilation rate: Pass the standards.	Prerequisite
IE1	Reduce impact from pollution.	5
IE1.1	Air Intake is not located at the position that has heat or pollution.	1
IE1.2	Negative pressure for printing room, photocopying room, chemical storage, and cleaner storage.	1
IE1.3	Prevent pollution from outside to inside of the building.	1
IE1.4	Smoking area is located outside the building and not less than 10 m from doors, windows, or air intakes.	1
IE1.5	The efficiency of air filter: Pass the standard.	1
IE2	Quality of life promotion achievement	4
IE2.1	Indoor air quality measurement results	1
IE2.2	Ventilation system operation measurement	1
IE2.3	Cleaning efficiency	1
IE2.4	Occupant satisfactory survey	1
IE3	Indoor lighting system control Separate artificial lighting circuits at every 250 m^2 or as requirement.	1
IE4	Use natural light in the building 45% 65% Regularly occupied spaces shall be renovated to achieve enough natural light.	2
IE5	Thermal Comfort 50% 70% Temperature and relative humidity at the air conditioned area are conform to the standard of air conditioned and ventilation systems.	2

IE P1	Ventilation rate in the building: Ventilation rate pass the standards.	(Prerequisite)

Intent

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

Requirement

Preliminary verification that air intake and exhausted systems can still work during performance period (Flow rates are not verified in this section).

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 of ventilation standard for indoor air quality (IAQ) of EIT (EIT-3010).

Alternative 3

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

Implementation

Design to bring fresh air into the building in the quantity that shall meet the minimum requirement as specified in building code and EIT standard or international standard. Verify that air intake and exhausted systems are working properly. Consider getting credits from the section IE 1.1: Air Intake is not located at the position that has heat or pollution, and 2.2: Ventilation systems measurement.

IE 1 Reduce impact from pollution (5 Points)

IE1.1 Air Intake is not located at the position that has heat or pollution (1 point)

Intent

To avoid pollution that will get into the building because of inappropriate position 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,

IE 1 Reduce impact from pollution (5 Points)

IE1.2 Negative pressure for printing room, photocopying room, chemical storage, and cleaner storage. (1 point)

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 / s / m^2. 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. This section shall be considered to get credits with the Section IE P1: Ventilation flow rate in the building.

IE 1 Reduce impact from pollution (5 Points)

IE1. 3 Prevent pollution from outside to inside of the building. (1 point)

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.

IE 1 Reduce impact from pollution (5 Points)

IE1.4 Smoking area is located outside the building and not less than 10 m from doors, windows, or air intakes.

(1 point)

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.15) B.E. 2548 (2005), and mark or make signs for non-smoking area.

IE 1 Reduce impact from pollution (5 Points)

IE1.5 The efficiency of air filter: Pass the standard (1 point)

Intent

Reduce indoor air quality problem because of dust and pollution, and to improve air conditioned 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 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. Install at both Return Air and Outdoor Air.

Implementation

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

IE 2 Quality of life promotion achievement (4 Points)

IE 2.1 Indoor air quality measurement results (1 Point)

Intent

To confirm that indoor air quality pass standards as designed.

Requirement

Measure indoor air quality which are Carbon Dioxide, Volatile organic compound (VOC), Formaldehyde, and Particulate Matter (PM). The amount of each contaminant must pass the standards.

1. Measure only at regularly occupied spaces.
2. All results from measurement shall pass standard at the same time. Perform one measurement during performance period.
3. Measure at every 250 m^2 or in each regularly occupied room. If the area is larger than 1000 m^2, measure only 4 locations in that area. Specify the measurement locations evenly and equally at height 1.1 m from the floor.

Implementation

Plan for ventilation appropriately and adequately. Employ the experts to measure air quality. If any contaminant has concentration more than the standard, find the cause and eliminate or ventilate the area with outdoor air.

IE 2 Quality of life promotion achievement (4 Points)

IE 2.2 Ventilation system operation measurement (1 Point)

Intent

Quantitative measurement of ventilation system can be used to confirm the efficiency of ventilation systems.

Requirement

1. Verify air intake systems and ventilation systems according to criteria in the Section IE P1.
2. Ventilation rate of air intake and exhaust shall not be more or less than 10% of the design rate in every area specified in the Section IE P1.
3. Measure equipment shall be appropriate to measurement period and type of openings. Calibration document dated not more than 1 year from the measurement date is required.
4. Measurement can be done for several times, adjust the system until the design rates are met. Measurement shall be done at least once during performance period.

Implementation

Plan to survey air intake and exhaust system specified in Section IE P1. Employ the experts who have reliable equipment and experiences. If any points of measurement do not pass, adjust the system to perform according to the criteria. Consider to get the points with the section IE P1: Ventilation flow rate in the building.

IE 2 Quality of life promotion achievement (4 Points)

IE 2.3 Cleaning efficiency (1 Point)

Intent

For a clean building that will bring good hygiene to the building occupants.

Requirement

Alternative 1

Survey building cleaning efficiency as specified in APPA Leadership in Educational Facilities (APPA) "Custodial Staffing Guidelines". The average score shall be no less than 3. Survey for 1 time in performance period.

Alternative 2

Survey building cleaning efficiency according to the methods of TGBI in TREES-EB manual guide. Survey for 1 time in performance period.

Implementation

Plan to clean the building efficiently considering manpower, equipment, and management. Evaluate cleaning by the experts.

IE 2 Quality of life promotion achievement (4 Points)

IE 2.4 Occupant satisfactory survey (1 Point)

Intent

To include satisfaction of the building occupants to building management and develop building management strategies to improve quality of life of the building occupants.

Requirement

1. Survey satisfaction of the building occupants by sampling to evaluate comfort quality, noise, indoor air quality, lighting systems, cleaning, and other issues. Samples must be at least 30% of building occupants. Evaluations of overall satisfaction and specific problem identification are required in the survey.
2. Summarize the survey results and specify solutions to solve the problems that are found from the survey.
3. Survey for at least 1 time during performance period.

Implementation

Produce questionnaire and plan to ask for cooperation from the building occupants in the survey. Consider to use web-base type for data collecting more systematically than paper systems. If the problems are found, meet with the building manager is required to specify the appropriate solutions.

IE3	Indoor lighting system control	(1 Point)
	Separate artificial lighting circuits at every 250 m^2 or as requirement.	

Intent

Building occupants can control illumination level that is appropriate for task performing and well-being.

Requirement

Alternative 1

Provide lighting systems control for building occupants. Each lighting circuit shall not cover area more than 250 m^2. For the room that is smaller than 250 m^2, 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^2 per circuit, or use Task and Ambient light for regularly occupied space.

IE4 Use natural light in the building 45% 65% (2 Points)

Regularly occupied spaces shall be designed to achieve enough natural light.

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 1% 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 1% (when the minimum value in the room is more than 1%, 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.

For calculation, select the area that Daylight Factor is more than 1% only. 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 lighting, and credits.

Proportion of the area that Daylight Factor (DF) is more than 2%	Points
> 45%	1
> 65%	2

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.

IE5 Thermal Comfort 50% 70% (2 Points)

Temperature and relative humidity at the air conditioned area are conform to the standard of air conditioned and ventilation systems.

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
> 50%	1
> 70%	2

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.

Section 7 Environmental Protection

Environmental Protection Strategy for Construction is required for design team that shall be considered during the whole performance period for preventing long term ecological impact, health, and human health.

Credits in this section emphasize long term negative impact prevention from construction to natural resources in terms of ecosystems and human health and well-being by design and construction processes including construction management.

This section comprises 7 topics: 2 prerequisite topics and 5 credit topics. The project shall pass the requirement in prerequisite topics before considering getting the points in credit topics. The prerequisite topics emphasize to ecological and natural resources protection by planning to manage and control pollution from construction and waste management during building operation. The credit topics emphasize the selection of the product which do not affects, or prevent impact to human health. For example, select the chemical products which not affect to the environment, prevent problem from light and heat, control disease from building systems including promote waste water treatment to reduce environmental impact as follows:

Topic	Detail	Point
EP1	Low environmental impact products in fire suppression systems No CFC, HCFC or Halon in fire suppression systems.	1
EP2	Condensing unit/ cooling tower position Positions of condensing unit (compressor or cooling tower) shall be located far from the nearby area.	1
EP3	External glazing Glazing visible light reflectance not more than 30%	1
EP4	Control disease that involved with the building Comply with the Notice of the Department of Health, Ministry of Public Health of Thailand: Procedure to control Legionella in cooling tower of the building in Thailand.	1
EP5	Wastewater quality measurement result	1

EP1	Low environmental impact products in fire suppression systems: No CFC, HCFC or Halon in fire suppression systems.	(1 Point)

Intent

Reduce to use the chemical that destroys Ozone layer. Do not use Halon, CFC, or HCFC in fire suppression systems.

Requirement

Not use Halon, CFC, or HCFC in fire suppression systems.
(including portable fire extinguisher).

Implementation

Install or replace the chemical products that will be used in fire suppression systems. Collect the confirmation documents of each product to confirm that the products do not contain prohibited chemical as specified.

EP2 Condensing unit/ cooling tower position (1 Point)

Positions of condensing unit (compressor or cooling tower) shall be located far from adjacent land areas.

Intent

Locate or relocate the condensing units or cooling towers of air conditioned systems at the position which not affects to the environment around the building. (If the building does not use air conditioned 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 conditioned 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.

EP3	External glazing	(1 Point)
	Glazing visible light reflectance not more than 30%	

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 30% when measured in right angle. Rvis shall be verified from the reliable organization.

In case of using tint film, the sample of glass and tint film shall be tested for Visible Light Reflectance.

Implementation

Specify Rvis of all type of the glass for building envelope. If Rvis is more than the standard, the glass shall be changed. 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.

EP4	Control disease that involved with the building	(1 Point)
	Comply with the Notice of the Department of Health, Ministry of Public Health of Thailand: Procedure to control Legionella in cooling tower of the building in Thailand.	

Intent

To reduce risk from Legionnaires' disease that may spread to the building occupants both inside and outside of the building including the passers in nearby area.

Requirement

Alternative 1

1. Have maintenance plan for cooling tower as specified in the notice of Department of Health, Ministry of Public Health of Thailand: Procedure to control Legionella in cooling tower of the building in Thailand (for air conditioned systems that install cooling tower).

2. Submit 1 copy of maintenance report done during performance period according to the notice of Department of Health, Ministry of Public Health of Thailand: Procedure to control Legionella in cooling tower of the building in Thailand (for air conditioning systems that have cooling tower only).

Alternative 2

Have no cooling tower in the project.

Implementation

Maintain cooling tower as specified in the notice of Department of Health, Ministry of Public Health of Thailand: Procedure to control Legionella in cooling tower of the building in Thailand.

EP 5 Wastewater quality measurement result (1 Point)

Intent

To confirm wastewater quality of the project that shall have a higher standard than the specified level by law.

Requirement

Measure the result of wastewater treatment for at least once during performance period. BOD5 and TSS shall less than or equal to 20 mg/L. Treat all of wastewater quantity in the project.

Implementation

Improve wastewater treatment systems to increase efficiency as specified in criteria. Then, measure wastewater quality from the project to confirm the efficiency of the systems.

Section 8 Green Innovations

Although TREES has criterions to evaluate energy and environmental issues which cover in 7 topics: Building Management, Site and Landscape, Water Conservation, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, and Environmental Protection, there are many issues that are not mentioned in TREES. Green Innovation (GI) Section opens for presenting the topics that are suitable with the project to receive the points from this section. Furthermore, the points in GI Section can be come from the special points that are specified details in each issue. These special points will be received when the project can be presented the efficiency of each issue more than the specified in one level. Maximum point of GI Section is 6 as follow:

Topic	Detail	Points
GI 1	Technique which are not specified in the rating system (.....)	1-5
GI 2	TREES-A in the working group	1

GI 1-5 Technique which not specified in the rating system (5 Points)

Intent

To encourage building management and improvement 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.

GI 2 TREES-A in the working group (1 Point)

Intent

To support green building consulting profession of Thai Green Building Institute.

Requirement

1. Engage a TREES-A in the project team.
2. Roles and duties of TREES-A as specified in BM P1.

Implementation

Hire a TREES-A to support the project, specify scope and duties of TREES-A clearly.