The Industrial Estate Authority of Thailand

Guidelines for the evaluation of Eco-Industrial Town

November 2020

Preface

The Industrial Estate Authority of Thailand (IEAT) is aware of the importance of a sustainable industrial development for the economic growth of Thailand. The IEAT has adopted the concept of Industrial Ecology in the industrial development process which operates under symbiosis, environmental conservation and sustainable resource consumption principles as well as health concern and the quality of life of the community. Hence, IEAT's vision to be "The regional leader of integrated solution for industrial estate development with innovation toward sustainability." is set and Eco-Industrial Town (EIT) Development Policy, which includes 5 aspects of development (physical, economic, environmental, social and managerial), is announced. The criteria for EIT are classified into 3 levels which are Eco-Champion, Eco-Excellence and Eco-World Class in order to develop and elevate an industrial estate into an Eco-Industrial Town.

This Guidelines for the evaluation of Eco-Industrial Town is a part of EIT development which covers all 5 aspects mentioned above. The focus is to encourage collaboration, symbiosis and networking among stakeholders which will result in an efficient resource management leading to a sustainable development based on economic, social and environmental balance.

The objectives of this Guidelines for the evaluation of Eco-Industrial Town are to effectively provide the industrial estates as well as related parties an understanding of evaluation criteria and guidance for EIT certification, so that all stakeholders understand and appreciate the concept of EIT development.

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Chapter 1
Concept of Eco-Industrial Town Development by Industrial Estate Authority of Thailand

1.1 Eco-Industrial Town Development

The growth of the industrial sector leads to a transformation into industrial areas, industrial zones, industrial parks, or industrial estates. For convenience in management, the promotion of industrial development, pollution control, as well as resource and waste management to minimize environmental impacts, some industrial estates or industrial parks in Thailand are directly under the supervision of governmental organizations while others conform to private organizations. This is to ensure that they comply with the rules and regulations set by governmental organizations to prevent environmental impacts for the workers and neighboring communities. Furthermore, an orderly management of the industrial area does not solely depend on local authorities or developers, but involves all related parties, such as the entrepreneurs, employees, community and local stakeholders.

Domestic industrial management, which includes the procurement of raw materials and resources, distribution and waste management, was originally an independent internal operation within each factory. It is definite that a manufacturing process would generate core products while some industries may generate secondary and/or by-products as well as industrial wastes. These wastes or by-products often need to be treated before disposal or removal from the factories. On the contrary, some untreated wastes need to be disposed of, which could occur through services offered by authorized businesses. These processes cause significant loss in resources and budget

alongside environmental problems even though there was engagement of 3Rs campaign which may be named as the starting point for raising awareness of environmental responsibility. The 3Rs campaign is a resource management approach which consists of Reduce, Reuse, and Recycle activities. In addition to the reduction of natural resources consumption, the 3R Initiative also encourages efficient use of resources and reduces the quantity of waste generation or wastes disposal into the environment.

1) Concept of Eco-Industrial Town Development

Eco Industrial Town is a town or an area which employs development of industries. It provides connection between industrial estates, industrial parks, industrial zones or industrial communities with the factories, organizations, local authorities and communities so that all would grow together under a fair environmental administration. This promotes collaboration of people within the area, which could occur at any level such as individual level (Eco Family/ Eco Factory), industrial level or community level (Eco Industrial Zone/ Estate), city level (Eco Town/ Eco City), or provincial level.

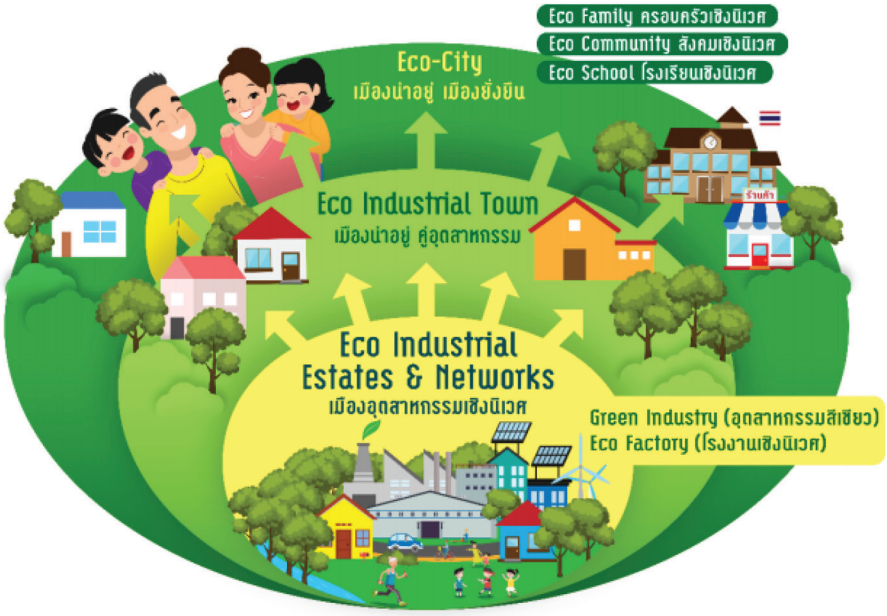

Figure 1-1 Levels of Eco Industrial Town Development

Figure 1-1 shows the levels of an Eco Industrial Town Development, which starts by applying the concept of Industrial Ecology within an enterprise or factory. This application then extends to other factories within the same industrial zone/estate to encourage a harmonious development and symbiosis with the local ecosystem and the environment in general. This development further expands to interconnect various industrial estates in a district and eventually covers a provincial level. Groups of people who are involved in this eco-development are the communities, temples, residences and schools. They could implement the concept of energy saving, efficient use of resources and eco-friendly consumption in daily activities to reduce environmental impacts. Hence, an Eco Industrial Town requires collaboration of every sector, which is the key mechanism for a sustainable development of eco-industries.

Eco Industrial Town development concept is the development of industrial cities and communities by creating a balance between economic, social, and environmental factors to achieve sustainable development through the participation of industrial stakeholders and local communities.

A remarkable characteristic of an Eco Industrial Town is the minimization of waste disposal or emission from a factory by increasing the efficiency of manufacturing process so that resources are used most efficiently. Moreover, waste disposal from industrial estates must also be reduced by employing an environmental management system, especially within individual factories, whether it was a hazardous waste or not, since it could affect human health and the environment, if improperly treated. Therefore, industrial environmentalists and environmental economists have come to an idea of reducing these wastes by introducing the waste exchange system, a process of circulating or exchanging useless materials of one factory to another as raw materials within the same industrial town, thus, reducing the overall amount of wastes. Industrial environmentalists generally consider factories in an industrial park as a network of interconnected organizations that are able to pass on or exchange resources and by-products among each other. Correspondingly, it can be stated that the ultimate goal of the Eco Industrial Town development is to implement 3Rs approach (Reduce, Reuse, and Recycle) more concretely. Examples of benefits gained from managing an Eco Industrial Town include:

- Reducing the amount of resource consumption
- Reducing the amount of pollution and environmental problems
- Using energy more efficiently

- Reducing the quantity of waste treatment or waste disposal
- Increasing market values of by-products or wastes from production process

2) Eco Industrial Town Development in Thailand

Eco Industrial Town development in Thailand has widely gained interest since the case of Map Ta Phut Industrial Estate in Rayong province, which inspired the industrial sector to focus on conducting businesses that would conform with or have less of an impact on the environment and the society, or none at all. The government has amplified the significance of Eco Industrial Town development with the aim to decrease the impacts of the industrial sector on the environment. According to the cabinet resolution of August 25, 2009, the proposal of Eco Industrial Town development by Joint Public and Private Sector Consultative Committee (JPPSCC) was approved. The Office of National Economic and Social Development Board (NESDB) was authorized to revise the missions of Southern Seaboard Development Committee by including the private sector's proposal of establishing a committee responsible for sustainable industrial and social development, which would cover the industrial, environmental, and social aspects of development. The executions were:

- The cabinet resolution on March 31, 2013 has given the Ministry of Industry in association with the Ministry of Interior and the Ministry of National Resources and Environment take the responsibility for establishing a working group to study the model of Eco Industrial Town development for existing industrial estates (Samut Prakan province, Samut Sakorn province, and Map Ta Phut IE in Rayong province) while restrict permissions to the factory establishment in the area. As for the new industrial estates (Chachoengsao and Prachinburi province), the cabinet has allowed them to

consider the reformation plans of upgrading industrial estates into Eco industrial Town and propose to the cabinet afterward.

- The 11th National Economic and Social Development Plan (2012-2016) orients toward sustainable development, environmentally friendly products, heading toward a sustainable economic, and social development in a low carbon community.
  - Strategy 4: Strategy for Restructuring the Economy toward Quality Growth and Sustainability
  - Strategy 6: Strategy for Managing Natural Resources and Environment toward Sustainability
- On March 8, 2016, the cabinet was proposed with the 25th Reformation Agenda regarding Resource Management: A Sustainable Industrial and Urban Symbiosis under Eco City Principles. The cabinet resolutions were:

1) The Ministry of Industry shall accept the opinion of the Ministry of Agriculture and Cooperatives, the Ministry of Natural Resources and Environment, the Ministry of Culture, the Ministry of Science and Technology, the Office of National Economic and Social Development Board, the Budget Bureau, and the Office of the Civil Service Commission as follows:

- Elaborate more on the success indicators of an Eco Industrial Town in the economic aspect and adopt the approach of Pracharath and state enterprise for the society towards an Eco Industrial Town development steering plan.
- Publicize the conceptual idea and definition of Eco-Industrial Town.
- Establish measures to support or promote the economic value added from industrial products to the communities surrounding the industrial estates. Provide location setting and maintenance of Industrial

Buffer Zone. Establish measures of prevention of environmental impacts caused by new industrial estates. Promote Actions on corporate social responsibility for community and environment, as well as a clear water management plan, such as zero discharge.

- Elaborate in detail to compare the roles between eco organizations, internal departments under the Ministry of Industry, and external organizations whose duties are similar

- Consider the use of Life Cycle Assessment (LCA) as one of the criteria to indicate a sustainable symbiosis between industrial and public sectors in all aspects.

- Integrate related laws and regulations in the same direction, improve and develop cooperation management and effective enforcement of existing laws, integrate an explicit work plan for the associated organizations including governmental sectors, private sectors, and local government authorities; provide the opportunity for local stakeholders to participate.

2) The Secretariat of the Cabinet is to submit the report of consideration from the Ministry of Industry to the coordination committee (the Cabinet, the National Legislative Assembly, and the National Reform Steering Assembly) for further consideration in consistency and suitability for the national reformation henceforth. The National Economic and Social Development Board as a coordination secretariat of the committee is to be informed and shall proceed on relevant duties afterwards.

- The 12th National Economic and Social Development Plan (2017-2024), Strategy 3: Strategy for Strengthening the Economy and Underpinning Sustainable Competitiveness, Objective 3 aims to transform 18 areas in 15 provinces into Eco Industrial Towns. The work plan and key

programs for developing Eco Industrial Towns are to raise industrial activities as the main mechanism for driving the economy in the area in a parallel enhancement of the quality of life and the environment, and provide a sustainable industrial and urban symbiosis. The master plan and individual development plans for each province are made as references for managerial and operational frameworks in short, medium, and long-term plans. Driving these plans into action and achieving the defined objectives is to be carried out by the Ministry of Industry, the principal organization responsible for this plan, with an operational timeframe within the fiscal year 2017-2021. Moreover, Strategy 4: Strategy for Environmentally Friendly Growth for Sustainable Development has indicated the key development approaches as follows:

- Restoration of natural resources. Creation of balance between the conservation and the impartial sustainable usage of natural resources.
- Increase in the efficiency of water resource management to achieve stability, balance, and sustainability
- Resolve environmental crisis
- Promote environmentally friendly consumption and production
- Promote the reduction of greenhouse gas emission and raise adaptive capability towards climate change
- Manage the reduction of disaster risks
- Improve management systems and conflict resolution mechanisms for natural resources and environmental issues
- Foster international environmental collaboration

- The National Strategy (2018-2037), Strategy on Promoting Growth of Environmentally Friendly Quality of Life describes as follows:

  - Promoting sustainable and green growth by focusing on impartial growth of socio-economic development on the basis of good environmental quality and natural resources; reducing the risk of environmental impacts and resource scarcity.

  - Promoting sustainable growth of a marine economic society by focusing on the significance of the country's growth from various marine activities in parallel with marine and coastal resource management; providing sufficient and accurate knowledge; increasing the value of marine bioeconomy; re-cultivating and restoring marine and coastal resources systematically; enhancing and increasing the proportion of environmentally friendly marine activities.

  - Promoting sustainable growth of a climate-friendly society by focusing on the reduction of greenhouse gasses and the establishment of low carbon communities; improving the disaster management system as a whole; building the capacity for people to adapt and cope with natural disasters and climate change-related impacts; supporting investment on climate-friendly infrastructure.

  - Developing sustainable and eco urban, rural, agricultural, and industrial areas by providing regulations for land use permission according to their potential and environmental friendliness under the concept of "livable cities, secure countryside, sustainable farming, eco-industry".

  - Developing water security, energy, and environmentally friendly agriculture by focusing on the enhancement of water management as a whole to provide security, productivity, and usage for all sectors; management of water-related disasters; building environmentally friendly

energy security; promotion of renewable energy and alternative energy usage in consideration with suitable development and high efficiency to increase the benefits to their maximum potential; developing environmentally friendly agricultural security to be the most stable, safe and efficient food production base.

- Promoting paradigm projects that could determine the country's future by focusing on fostering desirable behavior and character of Thai people regarding environmental issues; developing tools and mechanism to efficiently manage the environment and its natural resources for quality growth in the future; establishing and developing environmental and natural resources justice; developing environmental democracy to solve and reduce conflicts; developing and implementing paradigm projects to determine the country's future.

The Development of Eco-Industrial Town in Thailand occurs as a result of the collaboration of various sectors, which take part in different roles as follows:

The Office of National Economic and Social Development Board gathers and analyzes statistics from academic documents and research papers, including reviews from national and international scholars. It also arranges stakeholders meeting to conduct public hearings from related sectors and summarizes the revised guidelines and driving mechanisms for eco-development of the economy and social service.

The Ministry of Industry has established an Eco Industrial Town Development Committee in 2007, whose role is to create strategies for supporting and developing Eco Industrial Towns and impel the strategies into actions in Saraburi, Ayutthaya, and Rayong provinces, chosen as pilot sites. In 2011,

a notification of appointing working groups for creating Eco Industrial Development Indicators was delivered to determine the appropriate criteria and indicators for eco industrial development in Thailand, of which the Department of Industrial Works represents as a secretary. Moreover, proactive approaches are implemented and emphasize on a sustainable industrial growth and development. To make this more concrete, Green Industry project is initiated to promote environmentally friendly entrepreneurship, which results in achieving a positive image for the industrial sector as well as gaining reliability and trustworthiness from the people.

Department of Industrial Works, which is accountable for supervising industrial zones, as stated in Factory Act B.E. 2535 (1992), has impelled the industrial zones into implementing the concept of Eco Industrial Development since 1990. From then until year 2014, there have been 9 industrial zones in 6 provinces joining the Eco Industrial Development on the account of collaboration and support from the Department of Industrial Works; namely, Rojana Industrial Zone in Rayong province, Bangkadi Industrial Park in Phathumthani province, 304 Industrial Park in Prachinburi province, Sahapat Group Industrial Park in Kabinburi, Prachinburi province, Sahapat Group Industrial Park in Sriracha, Chonburi province, IRPC Industrial Zone in Rayong province, I.P.P. Industrial Community in Rayong province, Hemaraj Industrial Zone in Rayong province, and Hemaraj Industrial Zone in Saraburi province.

In fiscal year 2014, the Department of Industrial Works has proposed a master plan for developing Eco Industrial Towns in 5 pilot provinces. The cabinet's resolution on March 31, 2013 approved and the pilot provinces were Rayong, Samut Prakan, Samut Sakon, Prachinburi, and Chachoengsao. In fiscal

year 2015, another master plan for developing Eco Industrial Town was proposed. The target areas were provinces with high-density industrial activities and potential for developing more activities which consisted of 10 provinces; namely, Chonburi, Nakhon Pathom, Pathum Thani, Ratchaburi, Khonkaen, Saraburi, Ayutthaya, Nakhon Ratchasima, Surat Thani, and Songkhla.

In fiscal year 2016, the Department of Industrial Works has studied and determined the indicators for Eco Industrial Town as referenced to the characteristics of an Eco Industrial Town concept into 5 aspects, 20 items, and 41 indicators. There are 5 levels of Eco Industrial Town Development: Level 1 Engagement, Level 2 Enhancement, Level 3 Eco-Resource efficiency, Level 4 Symbiosis, and Level 5 Happiness. The Department of Industrial Works has been supporting various projects in order to contribute to the development of Eco Industrial Town up to the present.

The Industrial Estate Authority of Thailand has operated projects regarding the development of Eco Industrial Estates and Networks in cooperation with GTZ, Germany, in 2004. In 2010, the Industrial Estate Authority of Thailand has developed and set requirements for standard characteristics of Eco Industrial Town into 5 aspects, 24 items. The workshop "Thailand Moving Forward to Eco Industry" was held on September 7, 2010, in cooperation with the Ministry of Industry, to launch the policy and convey the concept of Eco Industrial Development and to navigate Thai industrial activities towards the direction of an Eco-oriented approach. Afterwards, the Industrial Estate Authority of Thailand has revised the requirements for standard characteristics of an Eco Industrial Town into each aspect for additional suitability and clarity. The Industrial Estate Authority of Thailand

with the Department of Industrial Works then hosted a Conference on "Thailand Industry Moving Forward through Eco Industry" on January 27, 2011, to determine the requirements for standard characteristics of an Eco Industrial Town into 5 aspects, 22 items. In this regard, the Industrial Estate Authority of Thailand has launched Eco Industrial Town Development policies continuously, serving as the leading organization for creating Eco Industrial Towns with equilibrium and sustainability for the economy, society, community, environment, and quality of life for international competitiveness.

Department of Primary Industries and Mines has worked in collaboration with the Federation of Thai Industries in 2007 to arrange workshops for conveying knowledge about Eco Town at a regional level in 5 provinces; namely, Ayutthaya, Chachoengsao, Khon Kaen, Chiang Mai, and Surat Thani. The concept of circular economy was studied to be applied in industrial wastes and unwanted materials management, specifically 8 types of mining waste, as well as recycling and transferring to other relative entrepreneurs and sectors. The Department of Primary Industries and Mines has continuously worked on feeding knowledge about waste recycling to extract minerals and metals for reusing and upcycling as a source for renewable energy, commonly called as "Urban Mining". On the account of that, there have been ongoing projects about promotion of wastes and recycling by-products since the fiscal year 2008. This provides the industrial sector with the renewable resources and the results in the reduction of natural resource consumption as well as the reduction of wastes and pollution problems for the community and the environment. Since the fiscal year 2014, the Department of Primary Industries and Mines has put the emphasis on promoting utilization of wastes as an alternative renewable

resource and planned on implementing the "Project of Promotion of Recycling Technology for Upcycling Wastes as Alternative Resource and Developing Eco Industrial Town". This project serves as one of the main mechanisms to influence the existence of 10 Eco Industrial Towns as stated in the Green Growth action plan of the National Strategy. The objective is to make use of the wastes generated within the targeted industrial area to their maximum potential, also known as "Zero Waste to Landfill" approach. The approach is determined by the waste recycling rate of 90 percent through domestic activities or the value added on investment within the area of waste generation reaching 500 million baht per year per area. This also includes the use of mine and metallic wastes as a renewable resource and energy for the industrial sector of the country, the reduction of natural resource consumption, and the reduction of waste generation and pollution problems for the community and environment by (1) Promoting, developing, and providing knowledge and recycling technologies for entrepreneurs, both practically and theoretically, so that industrial and household wastes generated within the Eco Industrial Town may be commercially reused and (2) Providing the best practices in industrial waste management for different industries, including the promotion and development of factories as role models in waste management and recycling, especially the main industries within the Eco Industrial Town. To summarize, the goal is to promote and develop the industry to be capable of recycling wastes to the maximum (Near Zero Waste), and to influence the creation of pilot sites of Eco Industrial Town in other regions throughout the country.

Thailand Research Fund has started Area-Based Collaborative Research (ABC) in 2007 under the project "Rayong Eco City Development" with the objectives to build knowledge, which reflects the area's context in

developing people and community along with the economy, and to develop the mechanism for knowledge management, which is the joint collaboration among various organizations with distinctive missions, to trigger integrative actions and navigate the directions of development towards a resolution for people's problems in the area. Different directions of development are investigated, depending on the context and conditions of development in each area, in order to study and prepare preliminary data on the economic ecological-status of Rayong province to outline the fundamental development framework of transforming Rayong province into an Eco Town. In addition to sponsoring academic research in the environmental field, the main focus of study is the fundamental concept of Eco-Resource efficiency is, a collaborative approach between local (Eastern) academic institutes and Rajabhat University research group in order to contribute in the empowerment of local people.

The National Innovation Agency employs the policy of establishing Biomass Town to prevent the greenhouse gas crisis and the policy to construct an environmentally friendly total solution for the businesses investment system. This involves the cultivation of biomass raw materials, manufacturing of added value products in different industry, and disposal in conversion plants to generate thermal energy, electricity, organic fertilizer, and bioplastics.

The Federation of Thai Industries executes the strategy of developing industrial and social sectors sustainably by impelling members and entrepreneurs in general to realize the significance of environmentally friendly production via the implementation of 3Rs principle. There have been campaigns for education and the attempt to create collaborative networks among the entrepreneurs and local organizations in order to push through

the concept of an Eco Industrial Town. In this matter, the Federation of Thai Industries has been working in collaboration with various governmental offices by meeting and discussing with the executives in associated organizations such as the Permanent Secretary of the Ministry of Industry, the Permanent Secretary of the Ministry of Natural Resources and Environment, the Director General of the Department of Industrial Works, the Director General of the Department of Public Works and Town & Country Planning; the Secretary of National Economic and Social Development Board, the Governor of Industrial Estate Authority of Thailand and the Governor of Rayong province.

3) Eco Industrial Town Development of Industrial Estate Authority of Thailand

The Industrial Estate Authority of Thailand (IEAT) is the first organization in the country to implement "Eco" principles in the sustainable industrial development through the Development of Eco Industrial Estate & Networks Project called DEE + Net Project, a collaboration of IEAT and GTZ, Germany. The project was implemented in 5 pilot locations: Map Ta Phut Industrial Estate, Bang-poo Industrial Estate, Northern Region Industrial Estate, Eastern Seaboard Industrial Estate (Rayong Province), and Amata City Industrial Estate (Chonburi province). Afterwards, in 2009, IEAT had stated the vision to become an Industrial Town and had revised it in 2010 to be an Eco Industrial Town for sustainability, awaiting for approval from the public. The vision stated as follows: "The leading organization for an Eco Industrial Town with equilibrium and sustainability in the economy, society, community, environment, and quality of life, for the competency to compete internationally."

In 2010, IEAT had started to develop and set up requirements for standard characteristics and indicators of Eco Industrial Town in 5 aspects and 24 items; namely, 1) Physical Aspect, 2) Economic Aspect, 3) Environmental Aspect, 4) Social Aspect, and 5) Managerial Aspect, including the characteristics and development elements as well as development approaches. After reexamining the indicators in correspondence with the measures and development approaches, IEAT decided on the requirements for standard characteristics and indicators of Eco Industrial Town in 5 aspects, 22 items, which was completed in 2012.

1.2 Characteristics of Eco-Industrial Town

Standard requirements and indicators of Eco Industrial Town in 5 aspects 22 items are 1) Physical Aspect, 2) Economic Aspect, 3) Environmental Aspect, 4) Social Aspect, and 5) Managerial Aspect as shown in Figure 1-2.

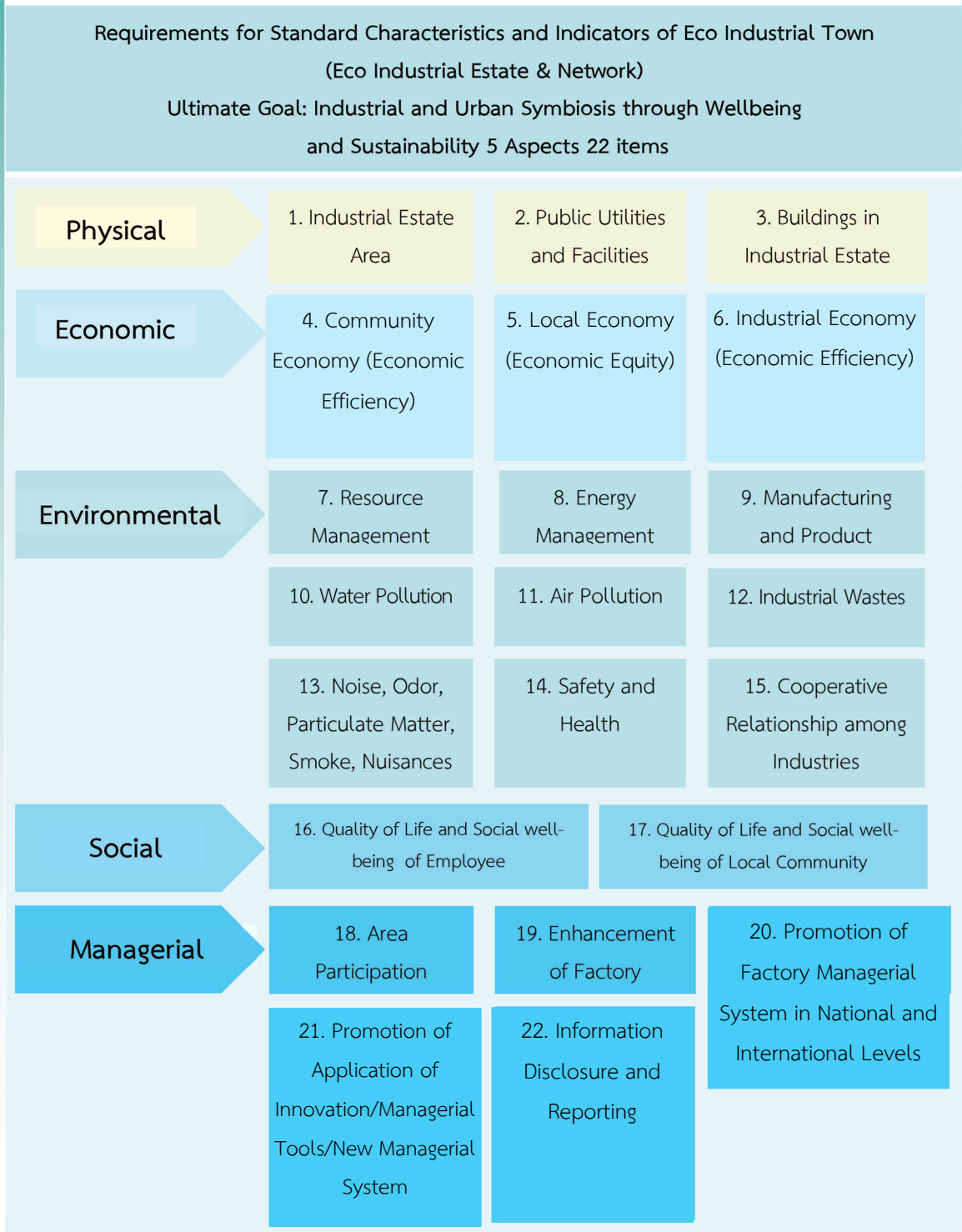

Figure 1-2 Standard Requirement and Indicators of Eco Industrial Town in 5 Aspects 22 Items

1.3 Development and Enhancement of Eco Industrial Town

The requirements for standard characteristics and indicators of Eco Industrial Town in 5 aspects ,22 items are the foundation for every industrial estate to transform itself into an Eco Industrial Town through the drives of master and action plans. Industrial estates who wish/are required to be certified as Eco Industrial Towns are to propose the master plan for enhancing Eco-Industrial Town as follows:

1) Fundamental Characteristics of Eco Industrial Town

- Chief Executive Officer of the industrial estate delivers the policy of enhancing the industrial estate into Eco Industrial Town by studying the requirements for standard characteristics and indicators of Eco Industrial Town. A comparative analysis is being carried out with a focus on fundamental information and stakeholder's needs to fill in the gap or enhance the industrial estate into Eco Industrial Town in 5 aspects 22 items.
- Executive officers establish a working group for Eco Industrial Town development called "Eco Team", which consists of IEAT officers, developers (if exist), and utilities service companies (such as GUSCO and GETCO), whose role is to drive policy into action. In addition, an Eco Committee involving representatives from every related organization is to be established. The required members are IEAT officers, developers (if exist), entrepreneurs, local organizations, and local communities.
- The industrial estate applies for certification of ISO 14001.

2) Preparation of Master Plan for Enhancement of Eco Industrial Town

This process involves the steps and details as follows (as referenced to: Eco Master Plan Guidebook under Thailand Strategic Framework, The Industrial Estate Authority of Thailand (2015))

- Study/Investigate on existing status and activities within the industrial estate (Self-Assessment: SA)
- Perform comparative analysis in accordance with the indicators stated in the requirements for standard characteristics and the indicators of Eco Industrial Town to derive a guideline for developing and enhancing the industrial estate. The outcome of the comparative analysis would identify the openings that need further refinement and point out the strengths which could be elevated.
- Analyze the status, potential, and needs of several sectors, also known as the Situation Analysis and Assessment Report (SAA Report). The initial step is to gather all work plans/ projects that the industrial estate plans to perform and categorize them in each aspect. The consideration of the industrial estate's potential from overall context, number and skills of human resource, and budget leads to the making of a development issue for the industrial estate in each aspect called "Development Issue Draft". The "Development Issue" itself includes work plans/ projects that would contribute in accomplishing the goals of each development issue. The details are explained in ECO-MP04 form.

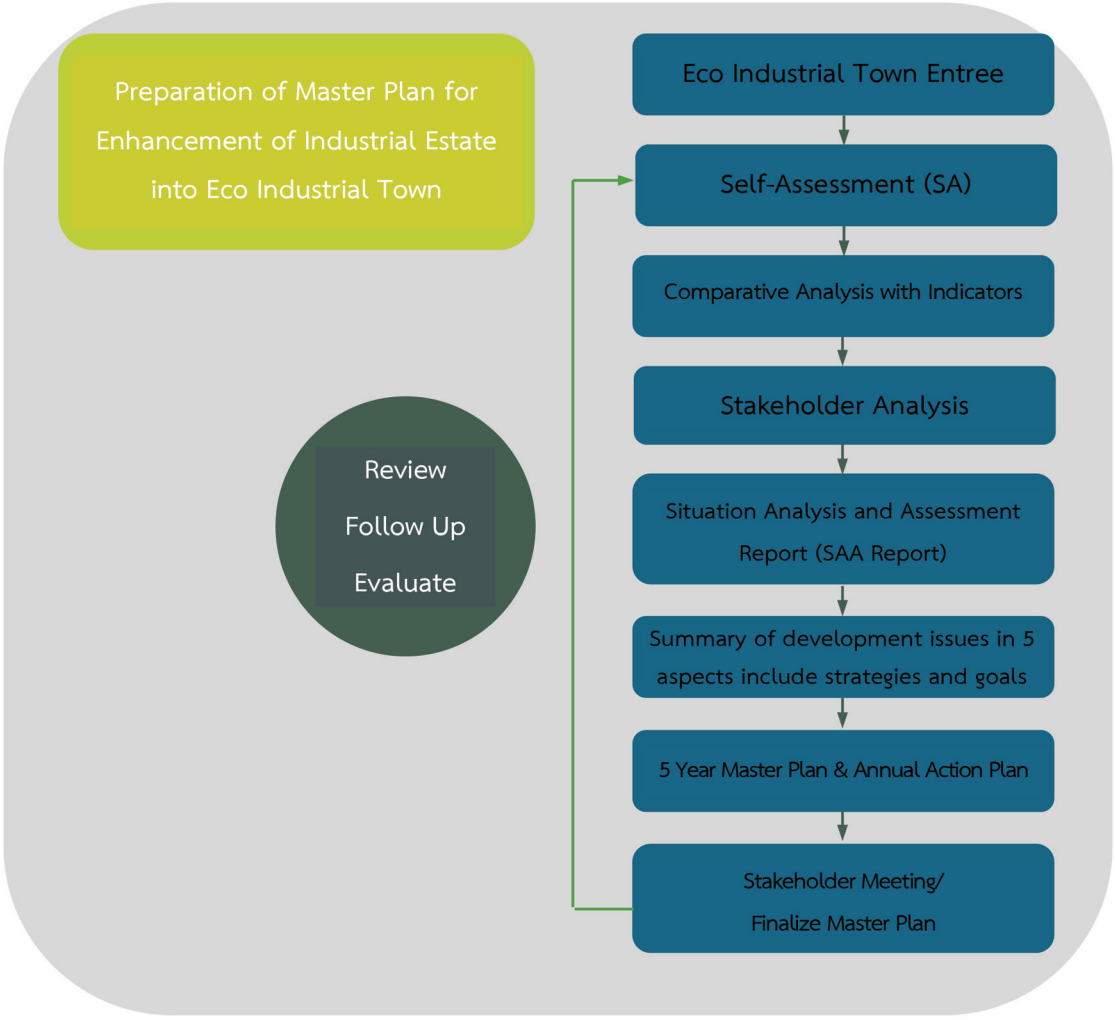

Figure 1-3 Preparation of Master Plan for Enhancement of Eco Industrial Estate and Networks

- Study the needs of stakeholders through a participation process, also known as Stakeholders Analysis, by arranging meetings to brainstorm on problem issues/ opportunities in the enhancement of the industrial estate into an Eco Industrial Town as well as to embrace any further requirements that may be reflected from the stakeholders. Examples of direct

stakeholders are the developers and entrepreneurs, whereas indirect stakeholders are the community, local administrative authorities, governmental organizations, and related private sectors. The Stakeholders Analysis is necessary for the development of SAA in the future.

- Summarize the status and development potential in accordance with the requirements from several sectors, also known as Situation Analysis and Assessment (SAA Report). This is done by assimilating the situation and the potential for development, the problems and opportunities of development in accordance with the stakeholder's need, attitude, and opinion obtained in the brainstorm meeting. Then, with the essential information, the SAA Report can be made and the form ECO-MP05 can be filled in.

- Create Business Model or set the goal of development. The Eco Team of the industrial estate is then to analyze the problem issues of each industrial estate and prioritize these issues by discussing for resolution and enhancement of potential, in accordance with the stakeholder's need, attitude, and opinion. Then, development issues may be derived in each aspect with the aim to pursue, as stated in the requirements for standard characteristics of Eco Industrial Towns. Afterwards, this shall be passed on to the Chief Executive Officer for further revision and will be finalized into development issues for each aspect of development as guidelines for the construction of a master plan.

- Prepare master plan for enhancement of industrial estate into Eco Industrial Town based on development issues. The Eco Team is to elaborate the work plans/ projects with a concrete approach for each development issue and take into consideration the strategy and goal in a period of 5 years (annually and long-term). The work plans/ project for each

development issue must aim towards the indicators stated in the requirements for standard characteristics and criteria for an Eco Industrial Town in “aspects” and “items” in consistency with the “development issue”. The master plan for the enhancement of the Eco Industrial Town must be based on developing the industrial estate and local community with quality in 5 key aspects: physical; economic; environmental; social; and managerial, with active participation from every sector and utilize the industrial sector as a driving mechanism for a livable city and the well-being of people in accordance with the sustainable development concept. In addition, the master plan must also be based on efficient resource management to minimize wastes generation and include the promotion of application of resource and environment management technologies as provided in the forms ECO-MP06-1 and ECO-MP06-2.

- Arrange a meeting to hear the comments from every related sector on “Draft” master plan after addressing the plan, which will include development issues, strategies, work plan, projects, and short and long term goals in 5 aspects of development for enhancing Eco Industrial Estate & Networks.
- Revise and improve the master plan to transform the industrial estate into an Eco Industrial Estate & Networks in accordance with the requirements for standard characteristics and indicator criteria for Eco Industrial Estate & Networks and prepare an annual action plan.

After the completion of master plan and action plan, the industrial estate, led by the executives and the Eco Team, is to proceed with activities as planned and keep records of the outcomes. Then, the estate may submit the application for auditing and the certification of Eco Industrial Town at the desired level. In this matter, the Industrial Estate Authority of Thailand has

divided the criteria for an Eco Industrial Town into 3 levels to enhance and develop industrial estates into Eco Industrial Towns according to IEAT's vision as follows:

Level 1 "Eco-Champion" certification is being given to industrial estates that contribute in the development of the country's economy, and exist on people's wellbeing and environmental governance. For this, the industrial estates are to implement the requirements for standard characteristics and criteria for Eco Industrial Town in 5 aspects, 22 items as a standard framework to determine development issue and direction in the master plan of enhancement of Eco Industrial Town, in which the industrial estate must qualify in 22 mandatory criteria and 10 indicators. The industrial estates are to act according to the score level of indicators and get a total score of not less than 50 percent (25 points) of full score (50 points), so that the industrial estate will be certified as Eco Industrial Town: Eco-Champion level.

Level 2 "Eco-Excellence" certification is being given to industrial estates that are able to "develop and enhance" the quality of life of local people and the environment. These are industrial estates with the aim to sustainably develop industrial activities on the balance of economy, society, and environment through cooperation, dependence, and networks among entrepreneurs, governmental organizations, and the community, so that every sector can benefit altogether. For the enhancement towards an Eco-Excellence level, the industrial estates must be certified as Eco-Champions and the industrial estate and at least 30 percent of large-scale factories of must act according to the Eco-Excellence criteria, which include 9 additional criteria. The audit result of the estates that score at least 60 percent will

certify them as Eco-Excellence E1, whereas with a total score of at least 70 percent, they will be certified as Eco-Excellence E2.

Level 3 "Eco-World Class" certification is being given to industrial estates that are the "leaders" of Eco Industrial Town. These are industrial estates with the aim to develop industrial activities on the basis of Eco-Resource efficiency and energy management as well as efficiency enhancement in production and the community's economy to complement in the country's economy, and are dependable for improving the quality of life and environment of the community. For the enhancement towards an Eco-World Class, the industrial estates must be qualified as Eco-Champion and Eco-Excellence, and the industrial estate including at least 30 percent of large-scale factories within the industrial estate must act according to Eco-World Class criteria, which include 7 additional criteria and receive total score from auditing of at least 80 percent.

Being certified as Eco-Champion is the first step in being Eco Industrial Estate & Networks. For industrial estates who wish to apply for enhancement of Eco Industrial Town (Eco Industrial Estate & Networks), they may start from applying for Eco-Champion then advance to Eco-Excellence and Eco-World Class subsequently. Details of the criteria and indicators for application of Eco Industrial Town: Eco-Champion are elaborated in chapter 2; Eco-Excellence in chapter 3, and Eco-World Class in chapter 4.

Chapter 2

Requirements for Standard Characteristics, Indicators, and Scoring Criteria for Eco-Industrial Town: Eco-Champion Level

2.1 Requirements for Standard Characteristics of Eco-Industrial Town

The industrial estates who require to develop and enhance from "Industrial Estate" towards an "Eco Industrial Town" need to meet the further requirements.

Part 1 Industrial estate must comply with standard requirements

1) Announcement of the industrial development to Eco Industrial Town policy under and Eco concept and explicit goals.

2) Implementation of Eco concept within industrial estate; Establishment of Eco Team and Eco Committee from the industrial estate; Arrange Eco Forum regularly within specified period of time to exchange ideas with the Core Team and every stakeholder towards steering the development and management of industrial estates with continuous participation.

3) Employ environmental management system according to ISO 14001

Part 2 Industrial estate must comply with mandatory criteria of 5 aspects and 22 items

Industrial estates that conform to standard characteristics of Eco-Industrial Town in Part 1 must pass the mandatory criteria of 5 aspects and 22 items, which are practical criteria as referenced in IEAT's guideline for Eco-Industrial Town Development. In this matter, the industrial estates must comply with the mandatory criteria in all 22 items to participate in sustainable

development through the indicators of Eco-Industrial Town: Eco-Champion for evaluation and rating henceforth.

2.2 Indicators and Scoring Criteria for Eco-Industrial Town: Eco-Champion

The industrial estates must comply with 10 indicators for Eco-Champion in 5 aspects in a step by step manner and achieve a total score of not less than 50 percent (25 points) of the full score (50 points), so that the industrial estate will be certified as Eco Industrial Town, Eco-Champion level.

The elements of being "Eco Industrial Town" are categorized in 5 aspects as follows:

1) **Physical Aspect** has 3 items i.e. Industrial Estate Area**;** Public Utilities and Facilities; and Buildings in Industrial Estate

2) **Economic Aspect** has 3 items i.e. Industrial Economy; Community Economy; and Local Economy

3) **Environmental Aspect** has 9 items i.e. Resource Management; Energy Management; Manufacturing and Product; Water Pollution; Air Pollution Control; Industrial Wastes; Noise, Odor, Dust, Smoke, Nuisances; Safety and Health; and Cooperative Relationship among Industries

4) **Social Aspect** has 2 items i.e. Quality of Life and Social well-being of Employee; and Quality of Life and Social well-being of Local Community

5) **Managerial Aspect** has 5 items i.e. Participation area Management; Enhancement of Factory Supervision; Promotion of Factory Managerial System at National and International Levels; Promotion of Application of Innovation/ Managerial Tools/ New Managerial System; and Information Disclosure and Reporting

Details of indicators and score for "Eco Industrial Town: Eco-Champion level" are as follows.

Eco-Champion level

Aspect Physical

Item 1. Industrial Estate Area

Mandatory Criteria
Presence of Green Area in compliance with regulations of IEAT

Indicators for Eco-Champion	
1. Provision of Green Area exceeds the threshold which is regulated by the strongest legislation.	
Score	**Description**
1	Green Area exceeds the mandatory criteria in the quantity of less than or equal to 3 percent of the mandatory criteria.
3	Green Area exceeds the mandatory criteria in the quantity of more than 3 percent but not more than 5 percent of the mandatory criteria.
5	Green Area exceeds the mandatory criteria in the quantity of more than 5 percent and has a specific plan and results of Green Area maintenance

Description

- The definition of Green Area, which is used in IEAT's regulation, refers to the definition of Green Area given by EIA or the master plan.

- EIA defines Green Area as a natural or man-made landscape which is established within an urban area and is covered by perennial plants in majority. The objectives are to create a good, aesthetic, shady, and livable environment. Provision of Green Area also adds to the elements of land use, both directly and indirectly, to enhance the quality of life of the people in urban areas including visitors. (Source: Government Gazette; Announcement of Ministry of Natural Resources and Environment; Re: Master Plan for Environmental Quality B.E. 2555-2559)

- In the establishment of a Green Area, perennial plants are to be mainly used. In the Protection Strip or Buffer Zone, perennial plants are to be grown in a zigzag pattern of not less than 3 layers and shrub trees are to be placed between the perennials. In spite of this, the plant should be one of the local species that help in pollution reduction and edible plant should not be a choice. (For more information, please find academic document on “Suitable Plants for Operation of Community & Industry Symbiosis Project in Rayong Province and Neighborhood”; Office of Natural Resources and Environmental Policy and Planning, Ministry of Natural Resources and Environment; August 2011 ISBN: 978-974-286-984-7)

- For the measurement of a Green Area, it is acceptable to include Green Areas outside the industrial estate within the distance of 5 km, except Map Ta Phut Complex, use the area boundary according to the pollution control area announcement. Operation and maintenance of Green Area must take place regularly for sustainability purposes.

Operating Guidelines

The Industrial estate shows the intention of caring for Green Area explicitly and establishes a Green Area as stated in law and regulations as

well as increasing the Green Area according to the requirements. Examples of documentary evidence to be provided are:

- The master plan which identifies the allocation of Green Area within industrial estate/ site visits for surveying and action
- Green Area database in Environmental Impact Assessment report or photographs of the main Green Area in industrial estate
- A concrete plan and outcomes of the maintenance of a Green Area, inside and outside the industrial estate

Eco-Champion level

Aspect Physical

Item 2. Public Utilities and Facilities

Mandatory Criteria
• Industrial estates that were established before the Regulations from IEAT Committee about Standard Utility, Facility, and Service for Eco Industrial Town B.E. 2557 became effective, are to implement at least 4 categories from Regulations for Standard Utility, Facility, and Service for Eco Industrial Town B.E. 2555. • Industrial estates that were established after the Regulations from IEAT Committee about Standard Utility, Facility, and Service for Eco Industrial Town B.E. 2557 became effective, are to implement at least 4 categories from Regulations for Standard Utility, Facility, and Service for Eco Industrial Town B.E. 2557.

Regulations (B.E. 2555 version)	Regulations (B.E. 2557 version)
Category 1 Road system inside, or connected to the outside; Section 11 or 12	Category 2 Road system; Section 1
Category 2 Rainwater drainage and flood control system; Section 19 or 20 or 21	Category 3 Rainwater drainage and flood control system; Section 26 or 27 or 28
Category 3 Water supply system; Section 26	Category 4 Water supply system; Section 33 or 34 or 35
Category 4 Wastewater treatment system; Section 32	Category 5 WW. treatment system; Section 41 or 42
Category 5 Telecom. system; Section 33	Category 6 Telecom. system; Section 46
Category 6 Electrical system; Section 34	Category 7 Electrical system; Section 48 or 49
	Category 8 Fire suppression and accident prevention system; Section 43 or 55

Regulations (B.E. 2555 version)		Regulations (B.E. 2557 version)	
Category 7	Fire suppression and accident prevention system; Section 40	Category 8	Fire suppression and accident prevention system; Section 43 or 55
Category 8	Industrial waste, garbage, and sewage management system; Section 43	Category 9	Industrial waste, garbage, and sewage management system; Section 60
Category 9	Pollution and environment quality monitoring system; Section 46	Category 10	Pollution and environment quality monitoring system; Section 61 or 62
Category 10	Security system; Section 47 or 48	Category 11	Security system; Section 63
Category 11	Land use; Section 49	Category 12	Land use; Section 65 or 66 or 67
		Category 13	Additional utility, facility, and other services; Section 69 or 70

Description

- Eco Design means a complete design which concerns environmental conservation and avoids harmful impact to the environment. It could be described as an integrated environmentally friendly product and service design, which involves: product environmental competency analysis; expired equipment management; environmental impact reduction through product life cycle; analysis of other factors such as cost, production control process, quality control, and marketing.

- Application of Eco Design in Regulations from the Industrial Estate Authority of Thailand Committee about Standard Utility, Facility, and Service for Eco Industrial Town version B.E. 2555 or B.E. 2557 depends on the year in which the industrial estate announced its establishment as an industrial zone

for reference. The industrial estate is to apply the Eco Design concept of any kind in each regulation of each category for designing utilities, facilities, and services.

Operating Guidelines

The Industrial estate shows the application of Eco Design in Regulations from the Industrial Estate Authority of Thailand Committee about Standard Utility, Facility, and Service for Eco Industrial Town B.E. 2557. Examples of documentary evidence to be provided are:

- Document of utility design which conforms to Eco Design concept as applied in Regulations from the Industrial Estate Authority of Thailand Committee about Standard Utility, Facility, and Service for Eco Industrial Town B.E. 2557.
- Photograph of an Eco utility design

Eco-Champion level

Aspect Physical

Item 3. Buildings in Industrial Estate

Mandatory Criteria
1. The ratio of factories performing environmentally friendly activities is more than 5 percent of total operating factories within the audit year. 2. The number of factories that operate within the year of audit and implement Green Building concept in 2 categories (of 8 categories) as referenced to evaluation criteria of TREE-EB within the factory is not less than 5 percent of factories that operate. 3. Total number of factories from 1 and 2 is not less than 5 percent of factories that operate.

Description

- Green Building is the building which is constructed under efficient utilization of national resources, is environmentally and socially responsible through its life cycle. This includes the steps of location selection, design, construction, operation, maintenance, renovation, and destruction of the building. Since the key objective of this concept is to reduce the impacts of a building or a built environment on human health and natural environment, the Green Building concept focuses on 3 main issues.

1. Water, energy, and other natural resources consumption efficiency
2. Health protection and enhancement of the ability to work for the people in the building

3. Reduction of waste, pollution, and environment destruction

- TREE-EB (Thai's Rating of Energy and Environmental Sustainability for Existing building) consists of 8 categories for evaluation of Green Building design, which are:

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 and Resources (MR)

Section 6 Indoor Environmental Quality (IE)

Section 7 Environmental Protection (EP)

Section 8 Green Innovation in Design (GI)

Operating Guidelines

The Industrial estate shows the support for factories within its estate to apply TREE-EB criteria in the factories, and collects data from factories which have implemented the TREE-EB guideline into practice. Examples of documentary evidence to be provided are:

- The plan and outcome of supporting factories, and data collection from factories which operate conforming to the criteria
- Cover letter of data observation form enclosed with the observation data from the factories
- Database of organization, showing the number of organizations that implement Green Building concept or TREE-EB criteria
- Photograph or evidence that shows factories' activities as observed
- Data observation form or check list of TREE-EB

Eco-Champion level

Aspect Economic

Item 4. Industrial Economy

Mandatory Criteria
Collection and analysis of investment cost data dating at least 3-years back.

Description

- Investment cost means the amount of money reported when registered or relicensed as a factory within an industrial estate.

Operating Guidelines

The Industrial estate shows collection of investment cost database of factories within its estate to identify the growth or regress of its businesses. This is essential data for analyzing and finding an approach for promotion or development that suits the context of the industrial estate. Source of data must be provided and is observed within 90 days dating from the day of audit. Examples of documentary evidence to be provided are:

- Record of investment money from entrepreneurs in the industrial estate
- Letter for data collection of investment money that may be modified
- Detail of source of information for investment money which is used as reference

Eco-Champion level

Aspect Economic

Item 5. Community Economy

Mandatory Criteria
Arrangement of activities or cooperation with other organizations to promote occupation for local people at least 1 time per year

Indicators for Eco-Champion	
2. Achievement of encouraging surrounding community to gather, enhance part-time job and create income	
Score	**Description**
1	Not less than 1 group and creates income
3	Not less than 2 groups and creates income
5	Product/service gets verified by Community Product Standard or other governmental authority qualified standards

Description

- Occupation means participation in activities, work, or doing business that do not threaten the society, and create income by using labor, knowledge and skill, or tools and equipment in different manners. Occupations can be classified according to the context in 6 groups which are:

1. Agriculture; such as farming, gardening, animal farming

2. Industrial works
3. Commercial and Services
4. Home Economics; such as cooking, baking, sewing, beaty salon
5. Handicrafts; such as basketry, carving, hand weaving of fabric, mat weaving
6. Fine Arts; such as drawing; sculpting; musical performances; drama, advertising, photography

- "Community Enterprise" refers to any enterprise of the community that involves production of goods, service, or other activities, which operates by a group of individuals with bonding and a shared way of life whether or not a kind of juristic person, to create income and become self-reliant.
- Community Product Standard is the requirement in quality aspect which is suitable for the community products, so that they are reliable and get approved to create confidence for consumers to purchase. The objective is to create a sustainable development to enhance the community product quality according to specified standard that conforms to OTOP policy.
- Local people refer to the people who live in the community within the distance of 10 km from the industrial estate.

Operating Guidelines

Industrial estate shows the support for occupations in the neighbor community for sustainability and self-reliance, which should be suitable to the context of the community. Examples of documentary evidence to be provided are:

- Document/ Report on the outcome of any activities that promote occupation for local people by mainly considering the number of

communities in which the industrial estate arranges activities as well as photograph of the activities

- Plan and outcome of promoting the establishment of Community Enterprise or supporting the Community Enterprise to show that activities are continuously arranged
- Evidence of income from the products, certified by Community Product Standard, in monthly report as supporting data for claiming that activities are arranged continuously
- Evidence of grouping individuals in the community, which shows that people come together for production, services or other activities, such as verified documents from community leaders, local organizations, or other related organizations

Eco-Champion level

Aspect Economic

Item 6. Local Economy

Mandatory Criteria
The ratio of factories employing local labor, in the year of audit, is not less than 5 percent of total number of existing factories.

Description

- "Labor" according to the definition given by the National Statistical Office, refers to a person who has put effort in doing or working in order to get something in return, which may be money or an object, so that it satisfies the need of the person. Labor is one of the key factors of production and service.

- "Local" according to the definition in the Dictionary of the Royal Institute B.E. 2542 (2546:511) refers to a particular district in a specific boundary, which show geographical and natural environments. "Local" is also defined as sub-district that limits the scope of administrative area or sub-organization such as village, sub-district, district, and province.

- Tolbert and Sizer (1987) stated that a 'local labor' is a person who works without changing residence. Bunting (1962) and Goodman (1970) conformingly defined 'local labor' as a person who works and resides within the factory area. In addition, Roto (2012) stated that 'local labor' is a labor

who works and lives in a certain residence within the factory area, of which the residence information is recorded in national statistics.

- The Department of Industrial Works defines the boundary of Eco Industrial area as the area within the distance of 5 km from the industrial estate.
- Hence, the definition for "Local Labor" is a person whose domicile is in the province where the factory is located, or in a neighboring sub-district, adjacent to the sub-district where the factory is located.

Operating Guidelines

The Industrial estate shows the support for employment of local labor in the existing factories, so that the establishment of factories provides occupation, creates income, and benefits the community. The industrial estate is to collect data of local labor employment and use it in the promotion of higher rate of employment. Examples of documentary evidence to be provided are:

- Letter of requirement for local labor employment data from the factories
- Annual document/report of the number of factories that employ local labor
- Verified document from HR department of the factories in the industrial estate

Eco-Champion level

Aspect Environmental

Item 7. Resource Management

Mandatory Criteria
Record of water resource consumption data (water supply and wastewater), and industrial waste of industrial estate

Indicators for Eco-Champion	
3. Enhancement of Eco-Resource efficiency and resource consumption of industrial estate achieved, in at least one of the following target values. 1) Rate of treated water that is reused to water supplied, is not less than 15 percent of water supplied. 2) Rate of average value of electrical energy consumption to BOD Removing is lower than the rate of the previous year, which is not less than 1 percent. 3) Average amount of Non-Revenue Water of water supply system per month is less than that of the previous year 4) Collection of waste data and the amount of waste in the factory that is treated using 3Rs approach; Analysis of proportion of 3Rs-treated wastes to total amount of wastes; 100% Provision of waste data and 3Rs waste of the factory	
Score	**Description**
1	At least 1 indicator
3	At least 2 indicators
5	At least 3 indicators

Description

- Eco-Resource efficiency data that need to be collected are:

a) Monthly data of water resource consumption of industrial estate, such as the quantity of raw water for production of water supply, the quantity of raw water that is sold to entrepreneurs (for industrial estates that do so), the quantity of water supply that is sold to entrepreneurs

b) Monthly data of the industrial estate's wastewater, such as inflow and outflow including BOD or COD Loading of inflow and outflow of wastewater treatment, and the quantity of treated water that is reused

c) Non-Revenue Water (NRW) refers to the water that enters water supply system but does not create income such as leaking water (Water Leak), water loss from broken pipe (Water Losses), and non-revenue water

d) Annual or monthly data of the quantity of wastes of factories in the industrial estate, which are managed using 3Rs approach, in separate categories of hazardous and non-hazardous wastes

Reference: Waste management approach according to 3Rs principle in "**Notification of Ministry of Industry Re: Waste Management and Disposal, B.E. 2548 (2005)**" and "**Handbook of Waste Management in the Factory, Department of Industrial Works, B.E. 2555 (2012)**", is classified into 5 approaches in accordance with 3Rs principle and stated as follows:

- Method 01 Sorting [code 011]
- Method 03 Reuse [code 031 and 033]
- Method 04 Recycle [code 041, 042, 043, 044, and 049]
- Method 05 Recovery [code 051, 052, and 053]
- Method 08 Other [code 082, 083, and 084]

Remark: The selection of waste management approach is principally determined by an authorized person based on the chemical property/hazard of the waste and impact which may occur through the management approach.

- Guide for data analysis for Eco-Resource efficiency

Eco-Resource efficiency value	Calculation
1) Rate of Water Reuse	$\frac{\text{average quantity of treated water that is reused } (m^3/\text{month})}{\text{average quantity of treated effluent } (m^3/\text{month})}$
2) Rate of Energy Consumption in Wastewater Treatment	$\frac{\text{average electrical energy consumption in wastewater treatment (kWh/month)}}{\text{average BOD loading (kg. BOD/month)}}$
3) Rate of Non-Revenue Water	$\frac{\text{average quantity of NRW } (m^3/\text{month})}{\text{average quantity of water supply sold } (m^3/\text{month})}$
4) Rate of Waste Disposal according to 3Rs	$\frac{\text{average quantity of waste disposal by 3Rs (ton/month)}}{\text{average quantity of total waste (ton/month)}}$

Operating Guidelines

The Industrial estate shows enhancement of Eco-Resource efficiency in resource consumption of its estate; achieves target values in wastewater treatment, electrical energy consumption, Non-Revenue Water, and waste management. Examples of documentary evidence to be provided are:

- Data of water resource consumption of base year and present year

- Data of wastewater treatment and reuse of base year and present year
- Data of electrical energy consumption in wastewater treatment (BOD Removing) of base year and present year
- Monthly data of Non-Revenue Water from water supply system of base year and present year
- Data of waste management that uses 3Rs approach in factories
- Calculation of each value to achieve target value as required
- Eco-Resource efficiency data collection form of industrial estate

Eco-Champion level

Aspect Environmental

Item 8. Energy Management

Mandatory Criteria
Monthly records of statistics and electricity consumption data of activities in the industrial estate's office and every utility dating back 1 year

Indicators for Eco-Champion	
4. Monthly records of statistics and electricity consumption data of activities; Analysis of electrical energy consumption rate and reduction of greenhouse gas emission dating back 3 years	
Score	**Description**
1	Monthly records of electrical energy consumption of the industrial estate, dating back 2 years
3	Monthly records of electrical energy consumption of the industrial estate, dating back 3 years
5	Monthly records of greenhouse gas emission, dating back 3 years

Description

- Electrical Voltage or Electromotive Force means the force that pushes an Electric Current through resistance of a circuit. It is denoted by the letter E and measured in volts (V).

- Electric Current means the movement of free electrons from one atom to another. The flow of an Electric Current is high or low, depending on the resistance of the circuit. It is denoted by the letter I and measured in amperes (A).
- Electrical Resistance refers to something that resists and limits the flow of the Electric Current, which is every electrical appliance such as heating coil of an iron, rice cooker, and light bulb. It is denoted by the letter R and measured in ohms (Ω).
- Electrical Power means the exchange rate of energy or work. It is calculated by multiplying Electrical Voltage and Electric Current. It is denoted by the letter P and measured in watts (W).
- Electrical Energy means the Electrical Power that is used over a certain period of time. Its measuring unit is watt/hour (Wh) or Units and is denoted by the letter W.
- Utility refers to the public service established to benefit factories as consumables, which is necessary for operations such as electrical system, water supply system, bus system, and telephone system.

Operating Guidelines

The Industrial estate shows records of overall electrical energy consumption of its office as well as in utility and activities that affect electrical energy consumption, such as number of times that meeting rooms are used and number of people that use the room, so that the quantity of carbon dioxide gas emission from these activities in the utility for factories can be calculated. Examples of documentary evidence to be provided are:

- Documents that indicate utility system within the industrial estate

- Data of overall electrical energy consumption of industrial estate of present and past years
- Evidence of calculation for carbon dioxide gas emission

Data Collection of electrical energy consumption

- Use Eco-Resource efficiency data collection form of industrial estate
- Method and example for calculation of greenhouse gas emission

Use the Equation

$$GHG_{(tonCO_2eq)} = \frac{A \times EF}{1,000}$$

GHG = quantity of greenhouse gas (CO_2eq)

A = quantity of electrical energy consumption (kWh/month)

EF = Emission Factor, measured in kg CO_2eq/unit

For value of EF, refer to Thailand Greenhouse Gas Management Organization (Public Organization) data of January, 2019:

EF Electricity, grid mix (electrical) = 0.6933 kg CO_2eq/kWh

Example of Calculation

Industrial Estate A consumes electrical energy in utility system at the quantity of 20,000 kWh in January 2018.

$$GHG_{(tonCO_2eq)} = \frac{20,000kWh \times 0.6933kgCO_2eq/kWh}{1,000\ kg/ton}$$

$$= 13.86\ tonCO_2eq$$

So, in January 2018, Industrial Estate A emitted greenhouse gasses at the quantity of 13.86 $tonCO_2eq$

Eco-Champion level

Aspect Environmental

Item 9. Manufacturing Process and Product

Mandatory Criteria
The ratio of factories employing environmentally friendly production process such as Eco Process; Eco-Product; Eco-Service; or Green Purchasing, is not less than 5 percent of total number of existing factories.

Description

- Eco-Process

- Eco-Process is a production process that implements environmentally friendly technology, which involves 3Rs principle (Reduce, Reuse, Recycle), to create efficient resource and energy consumption and reduce the cause of waste and pollution. It considers the implementation of Green Productivity, Clean Technology, or any other similar concept in an activity.

- Green Productivity is a strategy to enhance productivity and environmental operation to create sustainable socioeconomic development by implementing suitable and environmentally friendly technology and management in production and service. The Characteristics of activities for Green Productivity enhancement are 1) Participation of people in the organization and team work; 2) Implementation of KAIZEN (continuous improvement) or operations in PDCA cycle (Plan, Do, Check, Act), which emphasizes in increasing productivity in parallel with environment-friendliness;

3) Improvements driven by data, that is, management of documentary evidence of operation and reporting; 4) Correspondence with environmental factors such as adaptation or actions according to regulations regarding environmental protection.

- Clean Technology is an improvement or a modification in the production process or the product, so that raw materials, energy, and natural resources consumption becomes efficient and causes the least amount of waste or none at all. The order of practices is 1) Reduction of pollution at the source (Reduce); 2) Reuse; 3) Recycle; 4) Treatment; 5) Disposal of unwanted materials in a proper manner. The outcome of Green Technology implementation is a reasonable consumption of raw materials and resources, which results in higher production and lower waste generation.

- Eco-Product

- Eco-Product is a product that focuses on energy saving and environment protection. Energy and water resources are economically consumed during production process. An Eco-Product also reduces waste generation and pollution emission during its lifetime. Furthermore, an Eco-Product is designed in a way that is capable of recovering raw materials and its components for recycle use.

- Green Purchasing

- Procurement of product or service, which considers suitability of quality, price, and delivery and reduces the environmental impact that occurs in production and service.

Operating Guidelines

The Industrial estate shows the support and keeps databases of Eco-Process, Eco-Product/Eco-Service, and Green Purchasing of factories in its estate. Examples of documentary evidence to be provided are:

- Summary data of the number of existing factories in the industrial estate which perform Eco-Process, Eco-Product/Eco-Service, and Green Purchasing
- Explicit and reliable documentary evidence that shows the actions of Eco-Process, Eco-Product/Eco-Service, and Green Purchasing
- Data collection form for the enhancement of an Eco-Industrial Town in Eco-Process and Green Purchasing as shown in Appendix A

Eco-Champion level

Aspect Environmental

Item 10. Water Pollution

Mandatory Criteria
The quality of effluent at the point of discharge conforms to standards as stated in law for each location.

Description

- Effluent means wastewater that is generated from performing an industrial activity in a factory or industrial estate, which is to be discharged into public streams or the environment. It also refers to wastewater that is generated from water consumption of the workers as well as other activities within a factory or an industrial estate. The quality of effluent must conform to the Announcement of Ministry of Natural Resources and Environment; Re: Control Standard for Effluent Discharge of Industrial Factory Industrial Estate, and Industrial Zone; Government Gazette, Page 20, Book No.133, Special Chapter 129; as follows:

1) pH Value; ranging from 5.5 to 9.0
2) Temperature; not exceeding 40 degree Celsius
3) Color; not exceeding 300 ADMI
4) Total Dissolved Solids (TDS) as follows:
   (1) In case of discharge into streams; not exceeding 3,000 mg/L

(2) In case of discharge into streams which has TDS value exceeding 3,000 mg/L; TDS value in effluent must not be higher than 5,000 mg/L of TDS in the stream

5) Total Suspended Solids; not exceeding 50 mg/L
6) Biochemical Oxygen Demand (BOD); not exceeding 20 mg/L
7) Chemical Oxygen Demand (COD); not exceeding 120 mg/L
8) Sulfide; not exceeding 1 mg/L
9) Cyanides (HCN); not exceeding 0.2 mg/L
10) Fat Oil and Grease; not exceeding 5 mg/L
11) Formaldehyde; not exceeding 1 mg/L
12) Phenols; not exceeding 1 mg/L
13) Free Chlorine; not exceeding 1mg/L
14) Pesticide; must not be detected
15) Total Kjeldahl Nitrogen (TKN); not exceeding 100 mg/L
16) Heavy Metals, as follows:
    (1) Zinc (Zn); not exceeding 5.0 mg/L
    (2) Hexavalent Chromium; not exceeding 0.25 mg/L
    (3) Trivalent Chromium; not exceeding 0.75 mg/L
    (4) Arsenic (As); not exceeding 0.25 mg/L
    (5) Copper (Cu); not exceeding 2.0 mg/L
    (6) Mercury (Hg); not exceeding 0.005 mg/L
    (7) Cadmium (Cd); not exceeding 0.03 mg/L
    (8) Barium (Ba); not exceeding 1.0 mg/L
    (9) Selenium (Se); not exceeding 0.02 mg/L
    (10) Lead (Pb); not exceeding 0.2 mg/L
    (11) Nickel (Ni); not exceeding 1.0 mg/L
    (12) Manganese (Mn); not exceeding 5.0 mg/L

Operating Guidelines

The Industrial estate shows treatment of wastewater that is generated in the industrial estate by performing wastewater monitoring at the point of discharge and wastewater quality must conform to the standards. Examples of documentary evidence to be provided are:

- Wastewater monitoring report of effluent at the point of discharge which refers to EIA for sampling, or environmental quality monitoring by central unit, dating back at least 6 months
- If there is no centralized treatment system, wastewater quality can be used effluent inside rail drainage in the industrial estate.

Eco-Champion level

Aspect Environmental

Item 11. Air Pollution Control

Mandatory Criteria
Air quality in atmosphere in industrial estate qualifies to the standard.

Indicators for Eco-Champion	
5. The number of existing factories that keep monthly statistics of greenhouse gas emission, calculated from electricity and main fuel consumption, dating 1 year back	
Score	**Description**
1	Less than or equal to 3 percent of existing factories
3	More than 3 percent but not exceeding 5 percent of existing factories
5	More than 5 percent of existing factories

Description

- Air quality in atmosphere in the industrial estate continuously qualifies to the standard means that the air quality continuously conforms to regulations.
- Significant Greenhouse Gas:

1. Carbon dioxide (CO_2) is a gas which causes heat accumulation in the earth's atmosphere the most, as compared to other greenhouse gases. It is the most significant factor that adds to the greenhouse effect, which is

caused by humans such as deforestation and combustion of coal fuel for generation of electricity.

2. Methane gas (CH_4) is a gas that is generated naturally from animal wastes such as cattle, lowland farming, combustion of coal fuel and natural gas, and coal mining.

3. Nitrous oxide gas (N_2O) occurs naturally and is generated from the use of nitrate fertilizers in field and farmland, the expansion of a cultivated area, combustion, grass burning, decomposition of manure, and coal fuel in industries that use nitric acid in production, such as nylon fiber production industry, chemical industry, or some plastics industry.

4. Chlorofluorocarbon (CFCs) is a gas that is synthesized for use in the industrial production of refrigerants, propellants in pressurized spray bottles, and as a foaming agent in Styrofoam production. CFCs has a strong impact on the atmosphere such as global warming, greenhouse effect, and destruction of the ozone layer.

Operating Guidelines

The Industrial estate shows proper management of air quality in its estate and records of greenhouse gas data of its factories in the past. Examples of documentary evidence to be provided are:

- Parameters and air quality monitoring locations in the industrial estate, dating back at least 6 months
- Air quality monitoring report, only SO_x, NO_x, and Particulate Matter
- Data collection form for enhancement of Eco-Industrial Town in the topic of electrical energy and main fuel consumption in factories, as in Appendix A

Data Collection of electrical energy consumption

- Use Eco-Resource efficiency data collection form of the factory as shown in Appendix A
- Method and example for calculation of greenhouse gas emission

<u>Use the Equation</u>

$$GHG_{(tonCO_2eq)} = \frac{A \times EF}{1{,}000}$$

GHG = quantity of greenhouse gas (CO_2eq)

A = quantity of electrical energy consumption (kWh/month)

EF = Emission Factor, measured in kg CO_2eq/unit

For value of EF, refer to Thailand Greenhouse Gas Management Organization (Public Organization) data of January, 2019:

EF Electricity, grid mix (electrical) = 0.6933 kg CO_2eq/kWh

<u>Example of Calculation</u>

Industrial Estate A consumes electrical energy in utility system at the quantity of 10,000 kWh in January 2018.

$$GHG_{(tonCO_2eq)} = \frac{10{,}000kWh \times 0.6933kgCO_2eq/kWh}{1{,}000\ kg/ton}$$

$$= 6.93\ tonCO_2eq$$

So, in January 2018, Industrial Estate A emitted greenhouse gasses at the quantity of 6.93 $tonCO_2eq$

Eco-Champion level

Aspect Environmental

Item 12. Wastes

Mandatory Criteria
Every existing factory in the year of audit must report on type and quantity of wastes and materials of the factories.

Description

- Industrial waste, as the factory law calls sewage or unused materials, means waste or object that is not in any more use produced from factory activities such as receiving material, production, quality control, pollution treatment, maintenance of machine/tool, destruction/construction of buildings in a factory area, sludge and residuals.

Operating Guidelines

The Industrial estate shows proper management of data and wastes coming from the factories in the industrial estate. Examples of documentary evidence to be provided are:

- Data that report on the type and quantity of wastes of factories in the industrial estate, both hazardous waste and non-hazardous waste, of the present year.

Eco-Champion level

Aspect Environmental

Item 13. Noise, Odor, Particulate Matter, Smoke, and Nuisances

Mandatory Criteria
Records of complaints about noise, odor, particulate matter, smoke pollution, and nuisances; Analysis of complaints and preparation of corrective measures

Description

- Nuisances

1. Water source, drainage, shower, toilet, septic tank, ash, or other places that are located in an inappropriate location, dirty, accumulated or piled up of waste, causing malodorous or toxic aerosol; source of disease carrier breeding causing damage and harm to health

2. Animal farming in a location -or in a manner of- unreasonably high density, which can potentially result in degeneration or harm to health.

3. A building that is the residence for people or animals, a factory, or any operating area that lacks air ventilation; water drainage; waste disposal; lack of toxicity control, or abstaining from control for the sufficient removal of malodorous or toxic aerosol, potentially causing damage and harm to health

4. Action that causes odor, light, radiation, noise, heat, toxic substances, vibration, particulate matter, soot, ash, or any other happenings that can potentially cause damage and harm to health

5. Other events that are determined by a minister as announced in the Government Gazette

Operating Guidelines

The Industrial estate shows proper management in solving the cause of troubles and complaints that are caused by industrial estate activities in a concrete solution and prevents them from re-happening. Examples of documentary evidence to be provided are:

- Documents of action in response to the complaints such as action plan (Procedure) in ISO 14001, or action chart
- Report of responsive actions over a year

Eco-Champion level

Aspect Environmental

Item 14. Health and Safety

Mandatory Criteria
1. Arrange Emergency response plan of the industrial estate 2. Revision of emergency response plan in every fiscal year, and approved by a supervisor 3. Reports of emergency response drills in every fiscal year, which include at least 1 practical drill and 1 on-the-table drill

Description

- An Emergency response plan is a guideline for integration of accident, management, and cooperation of every sector (entrepreneurs, governmental organizations, and community) in communication in case of an emergency, for accident suspension or consequence alleviation with a quick response and effectiveness.

Operating Guidelines

The Industrial estate shows preparedness for responding to an emergency which could occur in the estate. Examples of documentary evidence to be provided are:

- Industrial estate's emergency response plan that is in operation
- Annual revision of emergency response plan

Eco-Champion level

Aspect Environmental

Item 15. Industrial Symbiosis

Mandatory Criteria
Successful and continuous arrangements of cooperative activities resulting in symbiosis between the factory, the industrial estate, and the community as well as encouragement of the reduction in resource consumption or improvement in operation efficiency/effectiveness.

Indicators for Eco-Champion	
6. Successful and continuous arrangements of cooperative activities resulting in symbiosis between the factory, the industrial estate, and the community as well as encouragement of the reduction in resource consumption or improvement in operation efficiency/effectiveness. The effectiveness of the activity/connection must be demonstrated.	
Score	**Description**
1	at least 1 activity/connection between factory, industrial estate, and community
3	Effectiveness of the activity/connection
5	at least 2 activities/connections between factory, industrial estate, and community

Description

- The Industrial estate collects the number of activities/connections that encourage symbiosis between the factory, the industrial estate, and the community (Sharing Resources/Activities) of at least 1 network in 9 areas of Ed Cohen, which are:
  - Material
  - Transportation
  - Human Resource
  - Information and Communication
  - Quality of Life/Community Connection
  - Energy
  - Marketing
  - Environmental, Health, and Safety
  - Production Process

Operating Guidelines

The Industrial estate shows support in creating Sharing Resources/Activities for sustainable and efficient operations. Examples of documentary evidence to be provided are:

- Document of a meeting, MOU, or other documentary evidence of Sharing Resources/Activities of at least 1 network in the following areas: material; transportation; human resource; information and communication; quality of life/community connection; energy; marketing; environmental, health, and safety; production process
- Outcome of the activities such as meeting, or training
- Report on effectiveness of Sharing Resources/Activities and the capability of cost reduction, financially shown

Eco-Champion level

Aspect Social

Item 16. Quality of Life and Social well-being of Employee

Mandatory Criteria
Industrial estate and industrial estate developers must promote the "Happy Workplace" campaign in at least 5 of 8 areas of happiness which is provided by Thai Health Promotion Foundation.

Description

- Happy Workplace is a human resource development process that sets its goal and strategy in accordance with the organization's vision, so that it is prepared for change, which leads to a continuous development (organization management that emphasizes on "people" as a main objective). There are 8 areas of happiness as follows:

1. HAPPY BODY; such as provision of outdoor exercising space so that staffs may enjoy outdoor activities and are surrounded by nature and reduce their stress levels
2. HAPPY HEART; such as expression of generosity, and congratulate staffs on their birthdays (Happy Birthday)
3. HAPPY RELAX; such as watching movies for entertainment, rest body and brain to work effectively.
4. HAPPY BRAIN; such as field trips so that staffs may apply new knowledge to their work, and arrangement of book exchange corner.

5. HAPPY SOUL; such as mid-day relaxation, saying prayers, meditation to clear the mind from morning stress and freshen the brain for new work

6. HAPPY MONEY; such as promoting money saving plan with discipline

7. HAPPY FAMILY; such as promoting good family relationships by giving out documents, promotion of strength in family institution and taking care of family

8. HAPPY SOCIETY; such as promoting the staffs to enjoy 5S campaign and provide opportunities for staffs to show responsibility for the community as volunteers

Operating Guidelines

The Industrial estate shows the promotion of happiness encouragement in a workplace for enhancement of quality of life. Examples of documentary evidence to be provided are:

- Documents of Happy Workplace promotion
- Photographs of activities in each area

Eco-Champion level

Aspect Social

Item 17. Quality of Life and Social well-being of Local Community

Mandatory Criteria
Activities that aim to create good relationship and understanding with stakeholders must be arranged. (Relationship building)

Indicators for Eco-Champion	
7. Community satisfaction level of industrial estate operations	
Score	**Description**
1	Satisfaction score equals to that of last year or ranges between 3.50 – 3.99
3	Satisfaction score increases as compared to last year or higher than 4.00 but less than the organization's target
5	Satisfaction score level equals to or is higher than the organization's target

Description

- 'Relationship building' means a creation of good relationship between the stakeholders and the industrial estate to establish satisfaction in an industrial operation resulting in a sustainable symbiosis.

Operating Guidelines

The Industrial estate shows the promotion of good relationship with key stakeholders in response to stakeholder's demand to create satisfaction in activities within an industrial estate area. Examples of documentary evidence to be provided are:

- Plan and outcome of relationship building
- Report and photographs of community visits by the industrial estate
- Report of satisfaction score on the industrial estate's activities

Eco-Champion level

Aspect Managerial

Item 18. Participated Area-Based Management

Mandatory Criteria
Participated environmental quality monitoring according to EIA Monitoring must be employed.

Indicators for Eco-Champion	
8. Number of activities that promote participated environmental quality protection (apart from EIA Monitoring)	
Score	**Description**
1	There is 1 environmental quality monitoring program per year
3	There are 2 environmental quality monitoring programs per year
5	There are more than 2 environmental quality monitoring programs per year

Description

- Participated environmental quality monitoring is the supervision and monitoring of environmental quality in the area of higher efficiency, so that investigation of problems, resolution, and clarification of information can be

performed in a quick response since the information is given by people who live close-by, which can be done in various manners.

Operating Guidelines

The Industrial estate shows establishment of a participated environmental quality monitoring program so that the related sectors in the industrial estate can contribute to the program closely and effectively. Examples of documentary evidence to be provided are:

- Meeting report of working group for EIA Monitoring of industrial estate
- Monitoring report of White Flag, Green Star campaign in factories by the industrial estate
- Documents showing operations in other equivalent programs which are provided by the industrial estate, such as:
    - Environment Investigator Program; focuses on the context, roles, and clarity of the group
    - Groups participated in the monitoring program should prepare records of environmental monitoring as not to be responsive only to cases of complaints, and documents showing the existence of the group which includes member lists and roles in form of notes.

Eco-Champion level

Aspect Managerial

Item 19. Enhancement of Supervision

Mandatory Criteria
Classification of factories according to the context of industrial estate for a suitable supervision.

Operating Guidelines

The Industrial estate shows operations of monitoring and supervising factories to prevent the environmental impact and complaints caused by the factories, and encourages efficient environmental operations. Examples of documentary evidence to be provided are:

- Criteria for classification or categorization of factories in industrial estate according to risks/complaints etc.
- Plan for factory monitoring in environmental aspect according to law, occupational safety, and energy
- Monitoring report

Eco-Champion level

Aspect Managerial

Item 20. Promotion of Management System in National and International Level

Mandatory Criteria
Number of factories in the year of audit, which are certified ISO 14001; or ISO 50001; or ISO 45001 (TIS/OHSAS 18001); or Green Industry in Level 2 or higher, in either standard or many standards altogether, is not less than 5 percent of the existing factories.

Description

- ISO is the International Organization for Standardization, whose head office is in Geneva, Switzerland. It was officially established on October 14, 1947. In the present, there are 143 countries registered as members. At first, there were representatives from 25 countries participated in the meeting at London. It was decided that the International Organization for Standardization is to be established and the United Nations has approved it as a non-governmental specialized organization. The objectives of ISO are to promote international standardization and related activities to enhance the economic industry and get rid of conflicts, including international trade barriers as well as the enhancement of international collaboration through science and technologies, or organizing world trade by setting up global standards. Standard is a documentary agreement made by collecting information or

Technical Specifications or acceptable working customs, then summarizing them into regulation criteria. This ensures that materials, products, processes, or services achieve the objectives as expected. Standard may also be set up by Procedure Manual or Work Instruction.

Operating Guidelines

The Industrial estate shows support and information collection from factories in its estate that are ISO certified, so that there is a systematic management at an international level. Examples of documentary evidence to be provided are:

- Report on observation of factories with certification or information from certification of the organization's database, shown in summary table
- Evidence of validity such as credentials or certificates which are not expired
- Data observation form for enhancement of Eco-Industrial Town in Management System Certified Factory, as shown in Appendix A

Eco-Champion level

Aspect Managerial

Item 21. Promotion of Application of Innovation/ Managerial Tools/ New Managerial System

Mandatory Criteria
Promotion of application of innovation which are tools or environmental management technology or production technology in factories

Indicators for Eco-Champion	
9. Promotion of application of innovation which are tools or environmental management technology or production technology or green logistics in factories	
Score	**Description**
1	The Industrial estate arranges, or cooperates in arranging, activities for promotion of innovation or environmental management technology or production technology at least 1 time.
3	Industrial estate arranges, or cooperates in arranging, activities for promotion of innovation or environmental management technology or production technology at least 2 times.

Score	Description
5	Industrial estate arranges, or cooperates in arranging, activities for promotion of innovation or green logistic at least 1 time.

Description

- Innovation refers to an idea, practice, or invention of new things that has never existed, or a modification of an existing object so it becomes more modern and has better function. The Implementation of innovation adds to higher efficiency and effectiveness as well as save time and decreases the need for labor.
- Green Logistics means a management in logistics in consideration of the environmental aspect. Apart from energy-saving, it also contributes to cost reduction, resulting in high efficiency as well as competitive capacity building in a free trade era.

Operating Guidelines

The Industrial estate shows the promotion of application of innovation in operation improvement, and green logistics of factories in the industrial estate. Examples of documentary evidence to be provided are:

- Document that shows arrangement of activities or promotion of application of innovation, such as training or exhibition
- Evidence of forwarding information of activities that are arranged by other organizations and encouragement of factories to participate
- Evidence that indicates the cooperation or promotion of the industrial estate in encouraging factories to participate in innovation promotion activities
- Plan and outcome of innovation promotion activities or green logistics

Eco-Champion Level

Aspect Managerial

Item 22. Information Disclosure and Reporting

Mandatory Criteria
Plan and outcome of communication and information disclosure in various forms, channels, and frequencies

Indicators for Eco-Champion	
10. Communicate and disclose information in various forms, channels, and frequencies; arrange knowledge enhanced activities on Eco-Industrial Town for entrepreneurs in the industrial estate	
Score	**Description**
1	Report on operation according to master plan and annual action plan (ECO Report 01); Perform at least 50 percent of the planned activities, and communicate and disclose information in various forms, channels, and frequencies according to the annual plan of the industrial estate
3	Report on operation according to master plan and annual action plan (ECO Report 01); Perform every activity as planned; Report on Eco information annually according to the format designed by the central unit
5	Arrange knowledge enhanced activities on Eco-Industrial Town for entrepreneurs in the industrial estate

Operating Guidelines

The Industrial estate shows the communication and information disclosure for the transformation of the Eco-Industrial Town, so that stakeholders acknowledge and participate in the operation. Examples of documentary evidence to be provided are:

- Plan and report
- Document or evidence of channels that are used for public communication such as Website, leaflet, or communication evidence in Line Application
- Example of media used in communication
- Eco Report 01
- Outcome of knowledge enhanced activities on Eco-Industrial Town for entrepreneurs

Chapter 3
Requirements for Standard Characteristics, Indicators, and Scoring Criteria for Eco-Industrial Town: Eco-Excellence Level

3.1 Requirements for Certificate of Eco-Industrial Town: Eco-Excellence

1) The Industrial estate that plans to get an Eco-Industrial Town: Eco-Excellence certificate must already be certified as Eco-Industrial Town: Eco-Champion with total score at least 50 percent in level C3 and the end of validity must not be less than 120 days.

2) The Industrial estate which will be certified as Eco-Industrial Town: Eco-Excellence must receive total score as follows:

- Total score of at least 60 percent; will be certified as Eco-Excellence E1
- Total score of at least 70 percent; will be certified as Eco-Excellence E2

3.2 Criteria for Calculating the Number of Factories to be Evaluated Regarding the Eco-Industrial Town Certification

At least 30 percent of large-sized factories in an industrial estate operate according to the Eco-Industrial Town: Eco-Excellence criteria. In the case of a large-sized industrial estate (more than 300 factories), a two-year plan is compiled.

- In the first year of audit, at least 20 percent of the large-sized factories, and
- In the 2nd year of evaluation, increase to 30 percent

In any case, 30 percent of large-sized factories are the base for the number of factories that must operate according to the criteria. The ratio of factories performing Environmental Impact Assessment (EIA) or Environmental and Health Impact Assessment (EHIA), or High Risk factories, is 50 percent of the number of factories that must operate according to the criteria.

Remark:

1) Refer to the factory registration number for the number of factories in the industrial estate. In cases that the factory is registered to more than 1 factory registration number, in which the factories are located in the same area and utilize common infrastructure, utilities, staffs, and management system, the number of factories is allowed to be counted as 1.

2) Large-sized factories are determined by 2 factors, i.e. the number of employees are 200 or higher, and the investment capital is more than 200 million baht.

Example of Calculation

IE/Port	Total No. of factories in IE (Factories)	No. of large-sized factories (Factories)	No. of factories with EIA/EHIA/ High Risk (Factories)		No. of factories according to criteria (30% of large-sized factories)	No. of large-sized factories that participated (Factories)	No. of factories with EIA/EHIA/ High Risk that participated (Factories)
A	100	60	20	→	18	9	9
B	100	60	40	→	18	9	9

3.3 Indicators and Scoring Criteria for Eco-Industrial Town: Eco-Excellence

The Industrial estate must operate according to the criteria of an Eco-Industrial Town: Eco-Excellence in 5 aspects, 9 indicators with the following key issues as factors of Eco-Industrial Town development.

1) Physical aspect has 2 indicators i.e. 1) Buffer Zone or Green Zone, and 2) Green Transportation and Green Logistics

2) Economic aspect has 1 indicator i.e. 1) Sustainable Creating Shared Value (CSV)

3) Environmental aspect has 2 indicators i.e. 1) Symbiosis or Circular Economy, and 2) Waste and unused materials management

4) Social aspect has 2 indicators i.e. 1) Implementation of Happy Workplace concept in the organization, and 2) Implementation of Corporate Social Responsibility standard, Department of Industrial Works (CSR-DIW) or the international standard on Social Responsibility (ISO 26000)

5) Managerial aspect has 2 indicators i.e. 1) Publicizing the results of environmental operations, and 2) Green Industry certifications

Details of indicators and scoring criteria for Eco-Industrial Town: Eco-Excellence are as follows:

Eco-Excellence Level

Aspect Physical

Indicator 1. Industrial estate and factories in industrial estate arrange Buffer Zone or Green Zone

Full Score 5 points

Score	Description
1	Total area of Buffer Zone or Green Zone, which the industrial estate and factories in its estate have arranged, is more than 10 percent of the estate area.
3	Total area of Buffer Zone or Green Zone, which the industrial estate and factories in its estate have arranged, is more than 15 percent of the estate area.
5	Total area of Buffer Zone or Green Zone, which the industrial estate and factories in its estate have arranged, is more than 20 percent of the estate area.

Operating Guidelines

- The Industrial estate must present documents showing Buffer Zone and Green Zone, which include common areas of the estate and areas within the factory such as:
  - Layout of the industrial estate and its factories that shows Buffer Zone and Green Zone
  - Report of implementations in expansion and maintenance of Green Zone

Remark:

- Measurement of Buffer Zone and Green Zone may include common areas of the industrial estate and areas within the factory, both horizontal and vertical surface.
- Measurement of Green Zone may include green areas outside the industrial estate, including sea or river within the distance of 5 kilometers from the industrial estate's location. Expansion may cover farther areas but must be within the province the estate is located. In any case, there must be continuous operations and maintenance as well as conservation and restoration of green areas for sustainability.
- Buffer Zone arrangement may not be around the industrial estate, but the affected area must be evaluated and identified.

Eco-Excellence Level

Aspect Physical

Indicator 2. The Industrial estate and factories in the estate operate Green Transportation and Logistics

Full Score 5 points

Score	Description
1	The Industrial estate and factories in the estate prepare work plan, measure target value, and cooperate in Green Transportation and Logistics to reduce transportation accidents, cost of transportation, gasoline and fuel consumption, or to increase transportation efficiency.
3	Outcome of the operation achieves at least 50 percent of the target value.
5	Outcome of the operation achieves the target value.

Description

- Transportation refers to the movement of individuals or objects from one place to another. Transportation is a movement process of goods and services from producers to consumers, or the movement of raw materials to factories for production of goods or services by means of tools and equipment. It refers to transportation on land, water, air, and pipeline.

- Logistics refers to the planning process, operation, and control of movement both back and forth, storage of materials/ finishing products as well as relevant information. It concerns efficiency and effectiveness in every step, from the point of production to the point of utilization, in response to the customer's needs with accuracy in proper time, quality, quantity, cost, and place as indicated.

- Green Transportation and Logistics refers to management of transportation system and logistics with high efficiency and safety, reduction of resource consumption, and application of information technology and automation in transportation and logistics in order to reduce cost and enhance efficiency and safety.

- Examples of operations or measures in enhancement of safety, cost reduction, or efficiency in transportation and logistics are:

  - Specification for the outsource transportation to avoid community paths and rush hour which may affect the community

  - Reduction of gasoline consumption by using alternatives such as natural gas, or any adjustments in means of transportation such as pipeline transportation, shipping, or railway transportation

  - Consideration of reusable packaging and conveying equipment as choices in operations

Operating Guidelines

- The Industrial estate must present documents showing operations or measures in enhancement of safety, cost reduction, or efficiency in transportation and logistics such as:

  - Report of operations or measures in enhancement of safety, cost reduction, or efficiency in transportation and logistics (accident reduction, cost reduction, or increase in transportation efficiency)

  - Monitoring report of transportation route and logistics

  - Report of outcomes of operations in transportation and logistics management compared to company's target

Remark:

- Internal audit considers measures and targets that are suitable for transportation and logistics that conform to that business types.

Eco-Excellence level

Aspect Economic

Indicator 3. The Industrial estate and factories in the estate develop a community enterprise which has a connection with the industrial production base in the area under the concept of Creating Shared Value (CSV).

Full Score 5 points

Score	Description
1	The Industrial estate and factories in the estate share their work plan and target in developing the community enterprise which has a connection with the industrial production base in the area.
3	The Industrial estate and factories in the estate develop a community enterprise which has a connection with the industrial production base in the area in at least 1 program.
5	Population in the community around the industrial estate who participated in the program earn higher income per household or is able to reduce expenses.

Description

- Creating Shared Value (CSV) is a business model which concerns the creation of Economic Value for industrial and social sectors simultaneously, in order to achieve long-term success. It focuses on shared benefits of industrial and social sectors to create a sustainable symbiosis.

Operating Guidelines

- The Industrial estate must present documents showing operations or measures in developing the community enterprise or local partnership, which has a connection with the industrial production base in the area, unless the industrial production base cannot relate to the community.
- The Industrial estate and factories may develop the community enterprise/local partnership by improving the existing community enterprise/local partnership. Enhancement of Creating Shared Value (CSV) must be demonstrated.

Eco-Excellence level

Aspect Environmental

Indicator 4. Factories in the industrial estate plan and analyze, improve or change in production process or technology, to create efficient raw material, water resource, energy, and other resources consumption (Symbiosis or Circular Economy) for the enhancement of production and the reduction of waste.

Full Score 5 points

Score	Description
1	Factories in the industrial estate plan and analyze, improve, or change in production process or technology, to create Symbiosis or Circular Economy for the enhancement of production and the reduction of waste
3	Outcome of the operations (Symbiosis or Circular Economy) that shows effectiveness of analysis, improvement or change in the production process or technology
5	Outcome of the operations can reduce production cost and resource consumption or increase the value of goods and services.

Operating Guidelines

- The Industrial estate must present documents showing inventory of raw materials, water resources, energy, and other resources consumption in the production process of the factories in the estate. These documents should include procurement transactions of raw materials, water resources, energy, and other resources, or the quantity they are used in production process with accuracy and clarity. The outcome of improvement or change

in production process or technology in order to enhance the production efficiency and the reduction of waste should also be presented.

- The Industrial estate must present documents showing operations or measures for enhancement of efficiency in raw material, water resource, energy, and other resources consumption with accuracy and clarity, such as:

  O Report of operations or measures for enhancement of efficiency in raw material, water resource, energy, and other resources consumption (reduction of raw material consumption per production ton) compared to the target

  O Report of data analysis for preparation of work plan on the enhancement of efficiency in raw material, water resource, energy, and other resources consumption

  O Report of waste utilized from factories or other organizations as raw materials to create Symbiosis or Circular Economy and reduce natural resource consumption

- Implementations on analysis, improvement or change in production process or technology to create Symbiosis or Circular Economy among factories within the industrial estate, including the operations between factories in the estate and stakeholders, such as factories outside the industrial estate and the local community. For a guideline for operations, they may refer to Standards for Application of Circular Economy in Organization, Standard No. 2-2562, provided by Thai Industrial Standards Institute (TISI), or related requirements, laws, or standards.

- The case of transferring wastes from factories to the outside of the industrial estate for incineration and generation of heat energy is considered a Symbiosis process. However, the case of incineration of waste for disposal is not considered a Symbiosis process.

Eco-Excellence level

Aspect Environmental

Indicator 5. The Industrial estate provides a waste management system from factories in the estate to enable data service and encourage waste exchange, to reduce waste quantity to landfill or incineration.

Full Score 5 points

Score	Description
1	The Industrial estate provides a waste management system from factories in the estate.
3	Factories in the industrial estate exchange or use waste as raw materials, or exchange among factories and other related organizations.
5	Increase waste utilization rate or decrease quantity of waste to landfill/incineration.

Operating Guidelines

- The Industrial estate collects data of waste from factories in the estate for overview analysis, by presenting documents that show the waste management system from factories in the estate with accuracy and clarity, such as:
  - Waste database and waste flow from factories in the industrial estate
  - Waste database from factories as direct or indirect raw materials in other factories or organizations
  - Outcome of waste utilization or exchange among other factories and organizations
  - Quantity of waste to landfill/incineration compared to last year.
- Waste and by-products from production process

Eco-Excellence level

Aspect Social

Indicator 6. The Industrial estate and the factories in the industrial estate operate Happy Workplace concept in all 8 areas.

Full Score 5 points

Score	Description
1	Industrial estate and its factories operate Happy Workplace concept in all 8 areas and the outcome reaches at least 50 percent of the target.
3	Industrial estate and its factories operate Happy Workplace concept in all 8 areas and the outcome reaches at least 75 percent of the target.
5	Industrial estate and its factories operate Happy Workplace concept in all 8 areas and the outcome reaches the target as indicated and shows effectiveness of the operation.

Description

Happy Workplace is a human resource development process that sets its goal and strategy in accordance with the organization's vision, in order to keep up with change, which leads to a continuous development. There are 8 areas of happiness as follows:

1) HAPPY BODY; be physically and mentally healthy
2) HAPPY HEART; be generous and caring
3) HAPPY RELAX; living in relaxation
4) HAPPY BRAIN; always seeking knowledge for self-improvement to become professional, create stability and progress in work
5) HAPPY SOUL; be religiously faithful and live morally

6) HAPPY MONEY; earn, save, be debt-free, foster the habit of saving and apply sufficiency economy in living

7) HAPPY FAMILY; live in warm and stable family, care for the family, love and be trustworthy, have faith in goodness, become a good person in society

8) HAPPY SOCIETY; show love, harmony, and generosity for the community that one lives and works in, live in a good environment and society

Operating Guidelines

- The Industrial estate must present documents that show the outcome of Happy Workplace concept of the industrial estate and its factories. Each factory can operate on some Happy Workplace element and the industrial estate can gather elements from several factories to cover all 8 elements. The outcomes must achieve the target as indicated.
- Indicators which show effectiveness of Happy Workplace may refer to HAPPINOMETER: The Happiness Self-Assessment[1] manual or another similar guideline.

[1] Kittisooksathit, S. et al. (2012). HAPPINOMETER: The Happiness Self-Assessment. 1st ed. Nakhon Pathom. Institute for Population and Social Research, Mahidol University.

Eco-Excellence level

Aspect Social

Indicator 7. The Industrial estate launches policy and supports factories in the estate to comply with Standards of Corporate Social Responsibility for Industrial Entrepreneurs (CSR-DIW) or International Standards of Social Responsibility (ISO 26000: Guidance on Social Responsibility. The factories in the industrial estate operate CSR-DIW or ISO 26000: Guidance on Social Responsibility and evaluate the community satisfaction rate.

Full Score 5 points

Score	Description
1	The Industrial estate launches policy and supports factories in its estate to comply with CSR-DIW standard or ISO 26000: Guidance on Social Responsibility; factories in the industrial estate prepare work plan and operate CSR-DIW or ISO 26000: Guidance on Social Responsibility
3	The Industrial estate has verified CSR-DIW standard, or shows evidence of compliance with ISO 26000: Guidance on Social Responsibility, or receives The Prime Minister's Industry Award on Social Responsibility
5	Community satisfaction level from communities within radius of 5 kilometers around industrial estate is higher than 4.0.

Description

- Standards of Corporate Social Responsibility for Industrial Entrepreneurs (CSR-DIW) consist of 7 components as follows:

1) Accountability
2) Transparency
3) Ethical behavior
4) Respect for stakeholder interests
5) Respect for the rule of law
6) Respect for international norms of behavior
7) Respect for human rights

Operating Guidelines

- The Industrial estate must present documents that show operations on CSR-DIW standard or ISO 26000: Guidance on Social Responsibility and perform community satisfaction evaluation with accuracy and clarity such as:

  - Outcome report of CSR-DIW compliance or self-evaluation (Self-declare) report of ISO 26000 compliance: Guidance on Social Responsibility, which is internally communicated or publicized or sustainability report (SD Report) that is verified by a third party.
  - CSR-DIW Certification or others documentary evidence
  - Report of community satisfaction survey by the Industrial Estate Authority of Thailand
  - Annual report as Form 56-1 by The Stock Exchange of Thailand

Eco-Excellence level

Aspect Managerial

Indicator 8. The Industrial estate publicizes the outcome of environmental monitoring and pollution discharge monitoring and evaluates satisfaction of environmental information accessibility.

Full Score 5 points

Score	Description
1	The Industrial estate reports environmental monitoring and pollution discharge monitoring.
3	The Industrial estate monthly or quarterly publicizes environmental monitoring and pollutant emission monitoring.
5	Satisfaction level of environmental information accessibility from communities within radius of 5 kilometers around industrial estate is higher than 4.0.

Operating Guidelines

- The Industrial estate must present environmental monitoring reports such as:
  - Environmental monitoring report
  - Operational meeting report to the public
  - Survey report and satisfaction report of surrounding communities around the industrial estate, which is evaluated by the Industrial Estate Authority of Thailand

Eco-Excellence level

Aspect Managerial

Indicator 9. Factories in the industrial estate receive Green Industry certification or other equivalent certification

Full Score 5 points

Score	Description
1	At least 50 percent of selected factories have a work plan and work in progress towards Green Industrial level 4 or Eco Factory certification.
3	Factories in the industrial estate receive Green Industry certification at Level 4 or any other Eco Factory certification or other equivalent certification
5	Factories in the industrial estate receive Green Industry certification at Level 5 or other equivalent certification

Operating Guidelines

- The Industrial estate must present Green Industry certification or other equivalent certification of factories in the industrial estate.

Chapter 4
Requirements for Standard Characteristics, Indicators, and Scoring Criteria for Eco-Industrial Town: Eco-World Class Level

4.1 Requirements for Certificate of Eco-Industrial Town: Eco-World Class

1) The Industrial estate who wishes to become certified as Eco-Industrial Town: Eco-World Class must be certified as Eco-Industrial Town: Eco-Excellence E2, in which the validity of the certification is not less than 120 days.

2) The Industrial estate which will be certified as Eco-Industrial Town: Eco-World Class must receive total score from the evaluation of at least 80 percent.

3) In case the industrial estate wishes to be certified as Eco-Industrial Town: Eco-World Class but is not yet certified as Eco-Industrial Town: Eco-Excellence, the estate must present the outcome of operations in applying for Eco-Industrial Town: Eco-Excellence and Eco-World Class, and receives total score from the evaluation in Eco-Excellence and Eco-World Class Level of at least 70 percent and 80 percent respectively.

4.2 Criteria for Calculating Number of factories among industrial estate in accordance with Eco-Industrial Town certification

At least 30 percent of the number of large-sized factories in the industrial estate operates according to indicators for Eco-Industrial Town: Eco-World Class. Exception is granted for large-sized industrial estates (more than 300 factories) and the work plan may be extended within a period of 2 years, in which:

- In the first year of audit, the estate uses at least 20 percent of the factories, and
- In the 2nd year, it increases them to 30 percent

In any case, the estate must use 30 percent of large-sized factories as the base for "number of factories that need to operate according to indicators" and the number of factories that perform Environmental Impact Assessment (EIA) or Environmental and Health Impact Assessment (EHIA) or High Risk factories, is 50 percent of the number of factories that need to operate according to the indicators.

Remarks:

1) Refer to factory registration number for the number of factories in the industrial estate. In cases that an industrial factory is registered to more than 1 factory registration number, where the factories are located in the same area and utilize infrastructure, utility, staffs, and management system in common, the number of factories is allowed to be counted as 1.

2) Large-sized factories are determined by 2 factors, i.e. the number of employees is 200 or higher; the investment capital is more than 200 million baht.

Example of Calculation

IE/ Port	Total No. of factories in IE (Factories)	No. of large-sized factories (Factories)	No. of factories with EIA/EHIA/ High Risk (Factories)		No. of factories according to indicators (30% of large-sized factories)	No. of large-sized factories that participated (Factories)	No. of factories with EIA/EHIA/ High Risk that participated (Factories)
A	100	60	20	→	18	9	9
B	100	60	40	→	18	9	9

4.3 Indicators and scoring criteria for Eco-Industrial Town

The Industrial estate must operate according to indicators of Eco-Industrial Town: Eco-World Class in 5 aspects, 7 indicators with the following key issues as factors of Eco-Industrial Town development.

1) Physical Aspect has 1 indicator i.e. 1) Eco design or renovation of buildings

2) Economic Aspect has 1 indicator i.e. 1) Research and development in modern technology or innovation

3) Environmental Aspect has 2 indicators i.e. 1) Formulation of measures on greenhouse gas reduction of the organization, and 2) Eco-Resource efficiency analysis

4) Social Aspect has 1 indicator i.e. 1) Promotion of Eco-Community and Eco-School establishment

5) Managerial Aspect has 2 indicators i.e. 1) Green Network establishment and 2) Operations in accordance with Sustainable Development Goals

Details of indicators and scoring criteria for Eco-Industrial Town: Eco-World Class are as follows:

Eco-World Class level

Aspect Physical

Indicator 1. The buildings of the industrial estate and its factories are environmentally friendly

Full Score 5 points

Score	Description
3	The Industrial estate and its factories have a work plan and work in progress according to Green Building standard or energy conservation; they achieve at least 50 percent of the goal.
5	The buildings of the industrial estate and its factories are certified by Thai's Rating of Energy and Environmental Sustainability (TREES Criteria), LEED, or received Thailand Energy Awards in the category of energy conservation.

Operating Guidelines

- The Industrial estate must present the status of Green buildings of its estate and factories such as:
  - Report on operations in renovation of buildings according to Green Buildings standard
  - Green Building certification (TREES[2]), LEED or Thailand Energy Awards or other national awards or other equivalent standard certifications

[2] Find more information about Thai Green Building Institute, http://www.tgbi.or.th/index.php

Eco-World Class level

Aspect Economic

Indicator 2. Factories in the industrial estate promote research and development of modern technology or innovation to enhance competitive capacity of industrial sector.

Full Score 5 points

Score	Description
3	Factories allocate the budget for research and development
5	Newly researched and developed technology, which can be registered as patent or petty patent or the application of knowledge from researches in the development or in improvement of production process and cost reduction

Operating Guidelines

- The Industrial estate must present the promotion of research and development of modern technology or innovation to enhance the competitiveness of the industrial sector such as:

O Work plan of the projects for promotion of research and development, which the factories have researched and developed themselves or application of the work plan developed by parent company for the improvement of production process resulting in higher efficiency and cost reduction

O Research and development report

O Certificate, patent, petty patent, or certificate of Thai Innovation given by the National Science and Technology Development Agency (NSTDA)

Eco-World Class level

Aspect Environmental

Indicator 3. The Industrial estate and factories report on their greenhouse gas (GHGs) emission for the organization and have GHGs mitigation measures.

Full Score 5 points

Score	Description
3	The Industrial estate and factories have been verified for Carbon Footprint for Organization and also have GHGs mitigation measures.
5	The Industrial estate and factories implemented GHGs mitigation measures and achieved at least 50 percent of target.

Operating Guidelines

- The Industrial estate and factories must present the implementation of GHGs mitigation measures such as:
  - Greenhouse gas emission verification sheet, provided by Thailand Greenhouse Gas Management Organization (TGO)
  - Greenhouse Gas Verification Statement or Carbon Footprint for Organization Certificate, or other international standards such as ISO 14064-1 which include the requirements for the design, development, management, reporting and verification of the organization's GHG inventory.
  - Progress report of GHGs mitigation measures compared to the target
- In case of Surveillance Audit, the Greenhouse Gas emission verification sheet can be used. The Verification must be performed by the central committee or an officer who is trained by TGO. In case of auditing for

certification as a new Eco-Industrial Town, or in the case of renewing certification, verification must be performed by a third party.

Eco-World Class level

Aspect Environmental

Indicator 4. Factories in the industrial estate collect and analyze data for Eco-Resource efficiency in the following areas of operations:

for Eco-Efficiency in the following areas of operations:

- Energy management
- Water and wastewater management
- Greenhouse gas emission
- Air pollution control
- Waste management

Full Score 5 points

Score	Description
3	Factories in the industrial estate collect and analyze data for Eco-Efficiency in at least 3 areas; each area has a higher efficiency value (Factor X)
5	Factories in the industrial estate collect and analyze data for Eco-Efficiency in at least 4 areas; efficiency value (Factor X) increases in average of not less than 1

Description

- **Calculation of average value of Factor X**, which is the calculation of Factor X of each area as shown in the equation:

$$\text{average value of Factor X} = \frac{A + B + C + D}{n}$$

In which; A, B, C, D is Factor X in area 1, 2, 3, and 4

n is the number of areas of Factor X that are used in the calculation

- **Calculation of the value of Factor X**, which is the calculation of Eco-Resource Efficiency value and Eco-Resource Efficiency value of the reference year as shown in the equation:

$$\text{Factor X} = \frac{\text{Eco-Resource efficiency value}}{\text{Eco-Resource efficiency value of reference year}}$$

- Calculation of Eco-Resource efficiency value is the comparison of the value of product and service to the environmental impacts in each area as shown in the equation:

$$\text{Eco-Resource efficiency} = \frac{\text{Value of product or service}}{\text{Environmental impact}}$$

- Value of product or service can be the quantity of goods and service that are produced and supplied to the customers, total sales, initial profit, and added values.

- Environmental impacts include raw material used, energy consumption, water consumption, and the amount of wastes that is delivered to landfill or incinerated etc.

Operating Guidelines

- The Industrial estate and factories must present the data of Resource Efficiency of industrial estate and factories in the industrial estate such as:

  - Recording sheet of Eco-Resource efficiency data of factories in the industrial estate

  - Extend the reference year for appropriate Eco-Resource efficiency value in calculation of Factor X so that it is achievable and provable.

Eco-World Class level

Aspect Social

Indicator 5. The Industrial estate and its factories in its estate cooperate in the promotion of establishment of Eco-Community and Eco-School.

Full Score 5 points

Score	Description
3	The Industrial estate and its factories cooperate in the promotion of establishment of Eco-Community and Eco-School in the community around the estate
5	At least 1 Eco-Community and 1 Eco-School are established in the community.

Operating Guidelines

- The Industrial estate must present the cooperation of promotion of an establishment of Eco-community and Eco-School of its estate and factories such as:
  - Work plan for promotion of Eco-Community and Eco-School which is referred to the operation guidelines provided by the Department of Environmental Quality Promotion or other organizations that can be referenced
  - Report of the operation of Eco-Community and Eco-School
- The Industrial estate and factories may operate by enhancing existing Eco-communities or Eco-Schools, which had been promoted by other industrial estates or other organizations, in which case the development of Eco-Community and Eco-School must be in distinctive issue and show improvement in value and outcome.

Eco-World Class level

Aspect Managerial

Indicator 6. Factories in the industrial estate set up a Green Network

Full Score 5 points

Score	Description
3	Factories in the industrial estate set up a Green Network by encouraging at least 50 percent of 1st Tier Suppliers to get Green Industry certification at Level 3. The 1st Tier Suppliers refer to the suppliers, subcontractors, and service providers.
5	Factories in the industrial estate set up a Green Network by encouraging 100 percent of 1st Tier Suppliers to get Green Industry certification at Level 3 or at least 50 percent in Level 4 or Eco Factory certification. The 1st Tier Suppliers refer to the suppliers, subcontractors, and service providers.

Operating Guidelines

- The Industrial estate must present the establishment of Green Network of its estate and factories such as Green Industry or Eco Factory Certification of the 1st Tier Suppliers.

Eco-World Class level

Aspect Managerial

Indicator 7. The operations of the industrial estate and factories are consistent and meet the Sustainable Development Goals.

Full Score 5 points

Score	Description
3	The Industrial estate and selected factories set a framework with goals that conform to Sustainable Development Goals
5	The Industrial estate prepares Sustainability Report (SD Report)

Operating Guidelines

- The Industrial estate must present the operations which conform with the Sustainable Development Goals of its estate and factories such as:
  - Work plan and framework of the estate and factories according to 17 Sustainable Development Goals[3]. In case of a corporate organization, affiliated companies can use the SD Report which is prepared by a parent company.
  - SD Report of the industrial estate based on the Global Reporting Initiative (GRI)[4]

[3] Find more information about United Nations in Thailand (http://www.un.or.th/globalgoals/th/the-goals/)

[4] Find more information about Global Reporting Initiative (http://www.globalreporting.org/standards)

Chapter 5

Surveillance Audit for Eco-Industrial Town in Eco-Champion, Eco-Excellence, and Eco-World Class Level

5.1 Criteria for Surveillance Audit

Certification of an Eco-Industrial Town is a verification which shows that management in an industrial estate conforms to the criteria for "Eco-Industrial Town" in 5 aspects, 22 items. This leads to the announcement of certification for the industrial estate that it operates according to the requirements for Eco-Champion, Eco-Excellence, and Eco-World Class Levels. Certification audit of Eco-Industrial Town by IEAT is separated into 2 manners, that is; 1) Certification Audit for Eco-Champion, performed by internal auditors from IEAT; and 2) Certification Audit for Eco-Excellence and Eco-World Class, performed by external auditors who are assigned according to the announcement of IEAT No. 46/2562 Re: Establishment of audit committee for certification of Eco-Industrial Town: Eco-Excellence and Eco-World Class. However, for conformance of certification audits for Eco-Champion, Eco-Excellence, and Eco-World Class, a standard guideline is determined and there are 3 approaches of audits as follows:

Approach 1 Certification Audit

Validity of the certification of Eco-Industrial Town about 3 years. The requirement criteria for certification audit are:

Part 1 Determination of executive officers and members of working teams, which is considered by:

- Implementation of environmental management system according to ISO 14001
- Formulation of policy, objectives, and goals for becoming Eco-Industrial Estate in terms of ECO master plan
- Assignment of duties or operational structure and establishment of Eco Team and Eco Committee
- Implementation of annual work plan of the Eco Team and Eco Committee, including report of operations

Part 2 Operations according to the requirements for standard characteristics, indicators, and scoring criteria of Eco-Industrial Town: Eco-Champion; Eco-Excellence; and Eco-World Class in 5 aspects, as elaborated in Chapter 2 for Eco-Champion; Chapter 3 for Eco-Excellence; and Chapter 4 for Eco-World Class.

Approach 2 Surveillance Audit

Surveillance audit is a re-evaluation process after an industrial estate is certified as Eco-Industrial Town: Eco-Champion, Eco-Excellence, and Eco-World Class at the frequency of at least 1 time per year through the period of certification validity, before the process of re-certification. The objective of a surveillance audit is to verify that an industrial estate, which was audited by internal auditors, is still operating according to the requirements and indicators, and performs continuous improvement in the management. This approach of the audit focuses on monitoring the progress of operations as compared to last year's operations. It selects only some indicators that are essential for monitoring. The criteria for each level of Eco-Industrial Town are divided into 2 parts, as follows:

1) Surveillance Audit for Eco-Champion

Part 1 Operations according to annual action plan under the master plan of becoming Eco-Industrial Town and summary report of operations as referenced to the format provided by the central unit.

Part 2 Determination of the executive officers and members of working team and continuous operations according to the criteria, which are considered by the indicators and target values in 5 aspects,14 indicators (10 mandatory criteria and 6 indicators), as follows:

Table 5-1 Criteria for Surveillance Audit for Eco-Champion

Aspect	Item	Type	Surveillance Criteria for Eco-Champion
Physical	3. Factory buildings in industrial estate	**Mandatory Criteria**	1. The number of factories in the year of audit that operate in Eco activities is not less than 5 percent of the number of existing factories. 2. The number of factories in the year of audit that implement Green Building concept according to the criteria of TREE-EB in 2 areas (out of 8 areas) is not less than 5 percent of the number of existing factories.

Aspect	Item	Type	Surveillance Criteria for Eco-Champion
			3. The sum of the statement in Point 1 and 2 is not less than 5 percent of the number of existing factories
Economic	5. Community economy	**Mandatory Criteria**	Arrange activities, or cooperate in the arrangement of activities for occupational promotion of people in the community in at least 1 activity per year
Environ mental	7. Resource management	**Mandatory Criteria**	Record of water resource consumption data (water supply and wastewater), and industrial waste of industrial estate.
		Indicator No.3	Enhancement of Eco-Resource efficiency; resource consumption rate of IE achieves target value as indicated: 1) The proportion of reusing treated water compared to water supply consumption is not less than 15 percent of the water supply consumption

Aspect	Item	Type	Surveillance Criteria for Eco-Champion
			2) Average value of electrical energy consumption per BOD Removing is not less than 1 percent lower than previous year's average value. 3) The quantity of NRW in average per month is less than the average of the year before the audit 4) Collection of data on the quantity of wastes, the quantity that is managed by 3Rs of factories in IE and comparative analysis of 3Rs and total wastes; 100% records of data on waste quantity and 3Rs quantity of factories in IE
	8. Energy Management	**Mandatory Criteria**	Monthly records of statistics and electricity consumption data of activities in the industrial estate's office and every utility dating back 1 year

Aspect	Item	Type	Surveillance Criteria for Eco-Champion
		Indicator No.4	Monthly records of statistics and electricity consumption data of activities; Analysis of electrical energy consumption rate and reduction of greenhouse gas emission dating back 3 years
	10. Water Pollution	**Mandatory Criteria**	Quality of effluent at point of discharge of IE conforms to the standard, which is regulated by law for each area
	11. Air pollution control	**Indicator No.5**	Existing factories in the year of audit keep monthly data statistics of GHG emission, which is calculated from electrical energy consumption and main fuel in production process, dating back 1 year
	12. Waste	**Mandatory Criteria**	Every existing factory in the year of audit report notifies on the quantity of waste materials.
	13. Air pollution, odor, particulate matter, smoke,	**Mandatory Criteria**	Records of the number of complaints on air pollution, odor, particulate matter, smoke, and nuisances.

Aspect	Item	Type	Surveillance Criteria for Eco-Champion
	and cause of trouble		IE performs investigation of the complaints and formulates resolution measures.
	14. Safety and health	**Mandatory Criteria**	1. Preparation of emergency response plan of IE 2. Outcome of emergency response plan revision every fiscal year approved by a supervisor
			3. Report of emergency response drill every fiscal year, which covers at least 1 practical drill and 1 on-the-table drill
Social	16. Quality of life and social well-being employee	**Mandatory Criteria**	Promotion of Happy Workplace concept in at least 5 out of 8 areas of happiness according to Thai Health Promotion Foundation
	17. Quality of life and social well-being of neighbor community	**Mandatory Criteria**	Arrangement of activities and understanding with the stakeholders (Building Relationship)

Aspect	Item	Type	Surveillance Criteria for Eco-Champion
Managerial	18. Participated area-based management	**Indicator No.8**	Number of activities, which promote participated environmental quality monitoring (apart from EIA Monitoring)
	21. Promotion of the application of innovation/management tools/new management system in factories	**Indicator No.9**	Promotion of application of innovation, which could be environmental management tools or technology, production technology, or transportation technology Green Logistics in factories
	22. Information disclosure and report	**Indicator No.10**	Communicate and disclose information of IE in various means, channels, and regularity, and arrange activities in knowledge enhancement about Eco-Industrial Town for entrepreneurs in IE

2) Surveillance Audit for Eco-Excellence

Part 1 Consideration of operations according to annual action plan under the master plan of becoming Eco-Industrial Town and summary report of operations as referenced to the format provided by the central unit.

Part 2 Determination of the executive officers and members of the working team and continuous operations according to the criteria, which are considered by the outcome of operations according to score ratings in 10 indicators that are significant and reflect on the continuity of operations, as follows:

Table 5-2 Criteria for Surveillance Audit for Eco-Excellence

Condition	Aspect	Surveillance Criteria
1. Outcomes of operations according to criteria for Eco-Champion in 5 indicators and presentation of evidence of the outcomes	**Physical**	Indicators for Eco-Champion 1. Work plan and outcome of maintenance of green area according to IEAT's regulations
	Economic	Indicators for Eco-Champion 2. Arrange activities or cooperate with other organizations in arrangement of activities for the occupational promotion of local people that conform with the community context of not less than 1 time/year
	Environmental	Indicators for Eco-Champion 3. Data collection of water consumption (water resource and wastewater), wastes materials of IE,

Condition	Aspect	Surveillance Criteria
		as referred to Eco-Resource efficiency evaluation sheet of IE
	Social	Indicators for Eco-Champion 4. Arrangement of activities that promote relationship building and understanding with the stakeholders, which can relate to Indicator 3 or Indicator 4 of criteria for Eco-Excellence and the context of IE
	Managerial	Indicators for Eco-Champion 5. Promotion of application of innovation, which could be environmental management tools or technology, production technology, or transportation technology Green Logistics) in factories
2. Outcome of operations according to criteria for Eco-Excellence in 5 aspects, 5 indicators; the score in each	**Physical**	Indicators for Eco-Excellence 1. The Industrial estate and factories in the estate operate in Green transportation and logistics.
	Economic	Indicators for Eco-Excellence 2. The Industrial estate and factories in the estate develop community enterprise which relates to the

Condition	Aspect	Surveillance Criteria
indicator must not be lower than that of previous year		industrial production base in the area in terms of Creating Shared Value (CSV) sustainably.
	Environmental	Indicators for Eco-Excellence 3. Data collection of water consumption (water resource and wastewater), wastes and electrical consumptions of IE, as referred to Eco-Resource efficiency form
	Social	Indicators for Eco-Excellence 4. The Industrial estate formulates policy and encourages factories in IE to operate according to the standard of corporate social responsibility of entrepreneurs (CSR-DIW) or ISO 26000: Guidance on Social Responsibility; factories in the estate operate according to CSR-DIW or ISO 26000 and perform satisfaction evaluation in the community
	Managerial	Indicators for Eco-Excellence 5. Factories in the industrial estate are certified as Green Industry or other equivalent certification systems

3) Surveillance Audit for Eco-World Class

Part 1 Consideration of operations according to annual action plan under the master plan of becoming Eco-Industrial Town and summary report of operations as referenced to the format provided by the central unit.

Part 2 Determination of the executive officers and members of the working team and continuous operations according to the criteria, which are considered by the outcome of operations according to score ratings in 15 indicators that are significant and reflect on the continuity of operations, as follows:

Table 5-3 Criteria for Surveillance Audit for Eco-World Class

Condition	Aspect	Surveillance Criteria
1. Outcomes of operations according to criteria for Eco-Champion in 5 indicators; presentation of evidence of the outcomes	**Physical**	Indicators for Eco-Champion 1. Work plan and outcome of maintenance of green area according to IEAT's regulations
	Economic	Indicators for Eco-Champion 2. Arrange activities or cooperate with other organizations in arrangement of activities for the occupational promotion of local people that conform with the community context of not less than 1 time/year
	Environmental	Indicators for Eco-Champion 3. Data collection of water consumption (water resource and wastewater), wastes and electrical

Condition	Aspect	Surveillance Criteria
		consumptions of IE, as referred to Eco-Resource efficiency form
	Social	Indicators for Eco-Champion 4. Arrangement of activities that promote building of relationship and understanding with the stakeholders, which can relate to Indicator 3 or Indicator 4 of criteria for Eco-Excellence and the context of IE
	Managerial	Indicators for Eco-Champion 5. Promotion of application of innovation, which could be environmental management tools or technology, production technology, or transportation technology Green Logistics) in factories
2. Outcome of operations according to criteria for Eco-Excellence in 5 aspects, 5 indicators; the score in each indicator must	**Physical**	Indicators for Eco-Excellence 1. The Industrial estate and factories in the estate operate in Green transportation and logistics.
	Economic	Indicators for Eco-Excellence 2. The Industrial estate and factories in the estate develop a community enterprise which relates to the industrial production base in the

Condition	Aspect	Surveillance Criteria
not be lower than that of previous year		area in term of Creating Shared Value (CSV) sustainably.
	Environmental	Indicators for Eco-Excellence 3. Factories in the industrial estate plan and operate on analysis, improvement, or change in production process or technology to create Symbiosis or Circular Economy for efficient consumption of raw materials, water, energy, and other resources to increase productivity and reduce waste generation.
	Social	Indicators for Eco-Excellence 4. The Industrial estate formulates policy and encourages factories in IE to operate according to the standard of corporate social responsibility of entrepreneurs (CSR-DIW) or ISO 26000: Guidance on Social Responsibility; factories in the industrial estate operate according to CSR-DIW or ISO 26000 and perform satisfaction evaluation in the community

Condition	Aspect	Surveillance Criteria
	Managerial	Indicators for Eco-Excellence 5. Factories in the industrial estate are certified as Green Industry or other equivalent certification systems
3. Outcome of operations according to criteria for Eco-World Class in 5 aspects, 5 indicators; the score in each indicator must not be lower than that of previous year	**Physical**	Indicators for Eco-World Class 1. Buildings of the industrial estate and factories in the estate are environmentally friendly
	Economic	Indicators for Eco-World Class 2. Factories in the industrial estate promote research and development of modern technology or innovation to enhance competitive capacity of the industrial sector
	Environmental	Indicators for Eco-World Class 3. The Industrial estate and factories in its estate report on GHG emission of the organization and prepare measures for reduction of GHG emission
	Social	Indicators for Eco-World Class 4. The Industrial estate and factories in the estate cooperate in the promotion of Eco-Community and Eco-School establishment

Condition	Aspect	Surveillance Criteria
	Managerial	Indicators for Eco-World Class 5. The Industrial estate and factories in the estate operate in accordance with Sustainable Development Goals

Approach 3 Re-Certification Audit

The Re-Certification Audit is the evaluation process which considers all areas of Eco-Industrial Town management in the level that is being re-certified. This is to demonstrate that the industrial estate has rectified the flaws detected from previous evaluation and has continuously improved the management system. It uses the same criteria as indicated in Approach 1 of the certification audit, but the emphasis is on the evaluation and presentation of progress in all areas of the operations through the past 3 years.

Appendix A

Factory survey questionnaire

Form of Record No. 1, For Factories

Eco-Industrial Town Registration Survey

The Industrial Estate Authority of Thailand, Fiscal Year.....

Instruction	1) This survey is constructed to collect information of entrepreneurs in IE for the promotion of Eco-Industrial Town Development. 2) Please take a moment to complete the survey below according to performed operations of your organization. For parts that involve operations/activities, please attach evidence such as photograph, copies of project documents, or copies of certificates

Part 1	General Information of Factory

1. Factory Name.....Factory Registration No.....

   Industrial Estate .....

Part 2	Information on Physical Dimension of Factory

2. Your organization has factory buildings that provide Eco activities. *(If so, please attach evidence)*

   2.1 Eco Activities ❑ NO ❑ YES; namely

   1. ..... 2. .....

   Explanation For example; use of energy saving equipment in the building, promotion of energy saving campaigns

   2.2 Implementation of Eco design/Energy-efficient building concept in the factory. *(If so, please attach evidence)*

   ❑ NO ❑ YES; There is implementation of Green Building concept according to TREE-EB criteria in factory as follows:

Cat. 1 Building Management

- ❑ Establishment of working group for energy-efficient building development
- ❑ Preparation of work plan that conforms with Green Building criteria
- ❑ Promotion of Green Building development activities
- ❑ Preparation of instruction/maintenance manual of systems in the building

Cat. 2 Site and Landscape

- ❑ Site survey around factory location such as shops, police station, fire department, government office
- ❑ Measure or promotion for reduction of personal use of car/motorcycle e.g. bicycle, public transport
- ❑ Arrangement of ecological open space such as perennial plantation, landscaping
- ❑ Flood prevention measure such as retention pond
- ❑ Use of Eco products in maintaining and cleaning outside area of the building

Cat. 3 Water Conservation

- ❑ Preparation of policy that shows determination in water-saving in building
- ❑ Work plan for water conservation and efficient water consumption
- ❑ Installation of main water meter and sub-meters for each area of factory

Cat. 4 Energy and Atmosphere

- ❑ Preparation of details for building assembly system e.g. specification, procedure, maintenance plan
- ❑ Preparation of work plan for energy conservation in building
- ❑ Alternative energy production system such as solar cells
- ❑ Energy consumption analysis of various systems
- ❑ Automation in control and management system

Cat. 5 Materials and Resources

- ❑ Employment of green procurement policy
- ❑ Eco waste management such as reuse, recycle, and donation

Cat. 6 Indoor Environmental Quality

- ❑ Smoking area is at least 10 meters away from doors/windows/air inlets
- ❑ Perform indoor air quality monitoring
- ❑ Perform satisfaction survey of building users and identification of corrections
- ❑ Building renovation for use of natural light

Cat. 7 Environmental Protection

- ❑ Use of chemicals that have low environmental impact such as reducing the use of CFC as refrigerant
- ❑ Use of Low-E glass
- ❑ Wastewater quality monitoring

Cat. 8 Green Innovation

- ❑ Creative approaches for sustainability in energy and environment aspects
- ❑ A Green Building expert (TREES-A) is a member of the working group

Part 3	Information on Economic Dimension of Factory

3. Investment capital of the factory in IE at present year.....baht

4. Employment of local labors in the factory *(If so, please attach evidence)*

❑ NO ❑ YES; the number of local labor employee is....., which is.....% of the employees

Part 4	Information on Environmental Dimension of Factory

5. Environmentally-friendly production process and procurement *(If so, please attach evidence)*

5.1 Eco Production Process

❑ NO ❑ YES

Please specify.....

Explanation Environmentally-friendly production process or Eco Process is a production process, which applies Eco technology under the principle of 3 Rs for maximum efficiency in resource and energy consumption; reduction of waste and pollution generation.

5.2 Eco Product/ Eco Service

❑ NO ❑ YES

Please specify.....

Explanation Eco-Product/Eco-Service is a goods/service, which has lower environmental impact as compared to other goods/service that serves the same function, in every step from procurement of raw materials, production, transportation, usage, and waste management.

5.3 Green Purchasing

❑ NO ❑ YES, there is Green Purchasing

Please specify.....

Explanation Green Purchasing is the procurement of goods/service which has lower environmental impact as compared to other goods/service.

6. Data statistics of energy and main fuel consumption in production process, dating back 1 year *(If so, please attach evidence)*

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.
6.1 Electrical energy consumption (kWh/month)												
6.2 Main fuel (L/month)	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.
.....												

7. Sharing Resources/Activities (This is not necessary to operate within the same IE) *(If so, please attach evidence)*

❑ NO ❑ YES; in the following issues .....

Explanation Sharing Resources/Activities among factories, IE, and community according to 9 areas of Ed Cohen's Sharing Resources/Activities are materials; transportation; human resource; information and communication; quality of life and community connection; energy; marketing; environmental, health, and safety; and production process.

Part 5	Information on Social Dimension of Factory

8. Participation in CSR activities with the industrial estate or developer *(If so, please attach evidence)*

❑ NO ❑ YES; please specify the activities.....

Part 6	Information on Managerial Dimension of Factory

9. The factory is certified in national or international standards. *(If so, please attach evidence)*

❑ ISO 9001	Valid until.....	❑ ISO 50001	Valid until.....
❑ ISO 14001	Valid until.....	❑ ISO 26000/CSR-DIW	Valid until.....
❑ TIS/OHSAS 18001	Valid until.....	❑ Eco Factory	Valid until.....
❑ Green Industry Lv.	Valid until.....	❑ Other; i.e.	Valid until.....

10. Participation in activities for promotion of environmental management technology or innovation of industrial estate *(If so, please attach evidence)*

❑ NO ❑ YES; please specify the activities.....

11. Human resource development of the factory becoming Eco-Industrial Town *(If so, please attach evidence)*

❑ NO ❑ YES; please specify the activities .....

Recorder.....Position.....Phone No.....

Thank you for your cooperation in answering the questions

Appendix B

Eco-Resource efficiency data record

Form of Record No. 2, For IE

Eco-Resource Efficiency Data Record

The Industrial Estate Authority of Thailand

Resource Consumption Data Record of IE

Part 1 Water Consumption

1.1 Raw water data

1.1.1 Raw water that is directly sold to the factories (For IE that sells)

1.1.2 Raw water for water supply production

1.2 Data of other water source in water supply production

1.2.1 Reuse quantity of treated water in water supply production

1.2.2 Use of other water source in water supply production, specify.....

1.3 Water Supply Data

1.3.1 Water supply that is sold to factories

1.3.2 Quantity of non-revenue water, which includes 1) Water Losses

Part 2 Wastewater and Treated Water

2.1 Data of wastewater and treated water quantity

Part 3 Energy Consumption

3.1 Data of energy consumption-electricity quantity

3.1.1 Electricity consumption

3.1.2 Electricity consumption from solar energy (Solar cell)

3.2 Energy Consumption-Electricity in Each Utility

3.2.1 Electricity consumption-in wastewater treatment system

3.2.2 Electricity consumption-in water supply production

3.2.3 Electricity consumption-in street light

3.2.4 Electricity consumption-in office building

3.3 Energy-Fuel Consumption

Part 4 Waste and Scrap Materials

4.1 Data on type, quantity, and management of waste of factories in IE by 3Rs

4.1.1 Non-hazardous wastes management by 3Rs

4.1.2 Hazardous wastes management by 3Rs

Part 5 Energy Consumption

5.1 Electrical Energy Consumption of Factories (kWh/month)

5.2 Fuel Energy Consumption of Factories (kg/month)

Eco-Resource Efficiency Analysis

1. Water consumption

= Good Quantity of treated water in water supply production to quantity of water supply

= Good Quantity of other water source in water supply production to quantity of water supplied produced

= Good Ratio of Quantity of non-revenue water in water supply system

2. Wastewater and treated water

= Good Quantity of treated water reuse to quantity of effluent

= Good Quantity of BOD Loading to quantity of effluent

3. Energy consumption

= Good Quantity of Electrical energy to quantity of wastewater

= Good Quantity of Electrical energy to BOD Removing

= Good Quantity of Electrical energy to water supply produced

= Good Quantity of Electrical energy consumption from solar energy to total electrical energy

= Good Quantity of CO_2 emission from total electrical energy consumption (tonCO_2eq)

= Good Quantity of CO_2 emission from total fuel energy consumption (tonCO_2eq)

4. Waste and Scrap Materials

= Good Quantity of non-hazardous waste dispossal by 3Rs to total waste generated

= Good Quantity of hazardous waste disposal by 3Rs to total waste generated

= Good Quantity of total waste disposal by 3Rs to total waste generated

5. Energy consumption

= Good Ratio of GHG emission from energy consumption of factories in IE

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Eco-Resource Efficiency Data Record

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Part 1	Water Consumption

1.1 Raw water data

1.1.1 Raw water that is directly sold to the factories (For IE that sells)

Month	Water Consumption (cu.m./month)			Remark
	Year	Year	Year	
October				
November				
December				
January				
February				
March				
April				
May				
June				
July				
August				
September				
Total				

1.1.2 Raw water for water supply production

Month	Water Consumption (cu.m./month)			Remark
	Year	Year	Year	
October				
November				
December				
January				
February				
March				
April				
May				
June				
July				
August				
September				
Total				

1.2 Data of other water source in water supply production

1.2.1 Reuse quantity of treated water in water supply production

Month	Water Consumption (cu.m./month)			Remark
	Year	Year	Year	
October				
November				
December				
January				
February				
March				
April				
May				
June				
July				
August				
September				
Total				

1.2.2 Use of other water source in water supply production, specify.....

Month	Water Consumption (cu.m./month)			Remark
	Year	Year	Year	
October				
November				
December				
January				
February				
March				
April				
May				
June				
July				
August				
September				
Total				

1.3 Water Supply Data

1.3.1 Water supply that is sold to factories

Month	Water Consumption (cu.m./month)			Remark
	Year	Year	Year	
October				
November				
December				
January				
February				
March				
April				
May				
June				
July				
August				
September				
Total				

1.3.2 Quantity of non-revenue water, which includes 1) Water Losses

2) Water Leak and 3) Non-revenue water

Month	Water Consumption (cu.m./month)			Remark
	Year	Year	Year	
October				
November				
December				
January				
February				
March				
April				
May				
June				
July				
August				
September				
Total				

Eco-Resource Efficiency Data Record

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Part 2	Wastewater and Treated Water

2.1 Data of wastewater and treated water quantity

Data of	Year .....

Month	Water Quantity (cu.m./month)		Water Reuse		Average BOD (mg/L)	
	Influent	Effluent	Reuse of Treated Water	Objective of Reusing i.e. watering, cleaning * Except: water supply production (Fill in Part 1)	Influent	Effluent
October						
November						
December						
January						
February						
March						
April						
May						
June						
July						
August						
Total						

Data of	Year					
Month	Water Quantity (cu.m./month)		Water Reuse		Average BOD (mg/L)	
	Influent	Effluent	Reuse of Treated Water	Objective of Reusing i.e. watering, cleaning * Except: water supply production (Fill in Part 1)	Influent	Effluent
October						
November						
December						
January						
February						
March						
April						
May						
June						
July						
August						
September						
Total						

Data of	Year					
Month	Water Quantity (cu.m./month)		Water Reuse		Average BOD (mg/L)	
	Influent	Effluent	Reuse of Treated Water	Objective of Reusing i.e. watering, cleaning * Except: water supply production (Fill in Part 1)	Influent	Effluent
October						
November						
December						
January						
February						
March						
April						
May						
June						
July						
August						
September						
Total						

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Part 3	Energy

3.1 Energy-Overall Electricity Consumption

3.1.1 Total Electricity Consumption

Month	Electricity Consumption (kWh/month)			Remark
	Year	Year	Year	
October				
November				
December				
January				
February				
March				
April				
May				
June				
July				
August				
September				
Total				

3.1.2 Electricity consumption from solar energy (Solar cell)

Month	Electricity consumption (kWh/month)			Remark
	Year	Year	Year	
October				
November				
December				
January				
February				
March				
April				
May				
June				
July				
August				
September				
Total				

Part 3	Energy

3.2 Energy Consumption-Electricity in Each Utility

3.2.1 Electricity consumption-in wastewater treatment system

Month	Electricity consumption (kWh/month)			Remark
	Year	Year	Year	
October				
November				
December				
January				
February				
March				
April				
May				
June				
July				
August				
September				
Total				

3.2.2 Electricity consumption-in water supply production

Month	Electricity consumption (kWh/month)			Remark
	Year	Year	Year	
October				
November				
December				
January				
February				
March				
April				
May				
June				
July				
August				
September				
Total				

Part 3	Energy

3.2.3 Electricity consumption-in street light

Month	Electricity consumption (kWh/month)			Remark
	Year	Year	Year	
October				
November				
December				
January				
February				
March				
April				
May				
June				
July				
August				
September				
Total				

3.2.4 Electricity consumption-in office building

Month	Electricity consumption (kWh/month)			Remark
	Year	Year	Year	
October				
November				
December				
January				
February				
March				
April				
May				
June				
July				
August				
September				
Total				

Part 3	Energy

3.2.5 Electricity consumption-in drainage and flood prevention system

Month	Electricity consumption (kWh/month)			Remark
	Year	Year	Year	
October				
November				
December				
January				
February				
March				
April				
May				
June				
July				
August				
September				
Total				

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Part 3	Energy

3.3 Energy-Fuel Consumption

Data of	Year					
Month	Type of Fuel					Remark
	Compressed Natural Gas (CNG) (Kg)	Liquid Petroleum Gas (LPG) (Kg)	Diesel Oil (Litre)	Gasoline (Litre)	Other Fuel Ex. Biogas, Gasohol	
October						
November						
December						
January						
February						
March						
April						
May						
June						
July						
August						
September						
Total						

Part 3	Energy

3.3 Energy-Fuel Consumption

Data of	Year					
Month	Type of Fuel					Remark
	Compressed (Kg)	Liquid Petroleum (Kg)	Diesel Oil (Litre)	Gasoline (Litre)	Other Fuel Ex. Biogas, Gasohol	
October						
November						
December						
January						
February						
March						
April						
May						
June						
July						
August						
September						
Total						

Part 3	Energy

3.3 Energy-Fuel Consumption

Data of	Year					
Month	Type of Fuel					Remark
	Compressed (Kg)	Liquid Petroleum (Kg)	Diesel Oil (Litre)	Gasoline (Litre)	Other Fuel Ex. Biogas, Gasohol	
October						
November						
December						
January						
February						
March						
April						
May						
June						
July						
August						
September						
Total						

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Part 4 Waste and Scrap Materials

4.1 Data on type, quantity, and management of waste of factories in IE by 3Rs

4.1.1 Non-hazardous wastes management by 3Rs

No.	Type of Wastes	Disposal Method (Code) only 3Rs	Disposal Method (Code) Other	Year ..... Quantity of Non-Hazardous Wastes (tonnes)			Year ..... Quantity of Non-Hazardous Wastes (tonnes)			Year ..... Quantity of Non-Hazardous Wastes (tonnes)		
				Total	by 3Rs	by Other Method	Total	by 3Rs	by Other Method	Total	by 3Rs	by Other Method
1	Wastes from processes of survey, mining, quarry, and physical/chemical neutralization of minerals											
2	Wastes from agriculture, farming, aquaculture, forestry, hunting, fishery, and food processing											
3	Wastes from production of wood, wood plank, furniture, wood pulp, paper, or cardboard											
4	Wastes from leather; wool; and textile industries											
5	Wastes from processes of petroleum distillation, natural gas extraction, and coal treatment by anaerobic incineration											
6	Wastes from production process of inorganic materials											
7	Wastes from production process of organic materials											
8	Wastes from production process, formula-based mixing, delivery; and uses of paint, coating material, food coating, adhesive, sealant, and printing ink											
9	Wastes from photography industry											
10	Wastes from heat consumption process											
11	Wastes from chemical treatment of metal surface and other material including dip coating; and wastes from non-ferrous hydro-metallurgy process											
12	Wastes from metal or plastic cutting and surface refinement by physical or mechanical process											
13	Wastes in the category of oil or liquid fuel, which does not include cooking oil											
14	Wastes, which are organic solvents; refrigerant; propellant, except wastes that are coded 07 and 08											

Part 4	Waste and Scrap Materials

4.1 Data on type, quantity, and management of waste of factories in IE by 3Rs

15	Wastes in the category of packaging, absorbant, wipe, filter, and protective equipment											
16	Other types of wastes, which are not coded											
17	Wastes from construction and destruction (including dug soil from contaminated area)											
18	Wastes from public health operations for human and animal, including public health researches											
19	Wastes from waste treatment plant, wastewater treatment plant, water supply production plant, and industrial water supply production plant											
Total												

4.1.2 Hazardous wastes management by 3Rs

No.	Type of Wastes	Disposal Method (Code) only 3Rs	Disposal Method (Code) Other	Year			Year			Year		
				Quantity of Hazardous Wastes (tonnes)			Quantity of Hazardous Wastes (tonnes)			Quantity of Hazardous Wastes (tonnes)		
				Total	by 3Rs	by Other Method	Total	by 3Rs	by Other Method	Total	by 3Rs	by Other Method
1	Wastes from processes of survey, mining, quarry, and physical/chemical neutralization of minerals											
2	Wastes from agriculture, farming, aquaculture, forestry, hunting, fishery, and food processing											
3	Wastes from production of wood, wood plank, furniture, wood pulp, paper, or cardboard											
4	Wastes from leather; wool; and textile industries											
5	Wastes from processes of petroleum distrillation, natural gas extraction, and coal treatment by anaerobic incineration											
6	Wastes from production process of inorganic materials											
7	Wastes from production process of organic materials											
8	Wastes from production process, formula-based mixing, delivery; and uses of paint, coating material, food coating, adhesive, sealant, and printing ink											
9	Wastes from photography industry											
10	Wastes from heat consumption process											
11	Wastes from chemical treatment of metal surface and other material including dip coating; and wastes from non-ferrous hydro-metallurgy process											

Part 4	Waste and Scrap Materials

4.1 Data on type, quantity, and management of waste of factories in IE by 3Rs

12	Wastes from metal or plastic cutting and surface refinement by physical or mechanical process											
13	Wastes in the category of oil or liquid fuel, which does not include cooking oil											
14	Wastes, which are organic solvents; refrigerant; propellant, except wastes that are coded 07 and 08											
15	Wastes in the category of packaging, absorbant, wipe, filter, and protective equipment											
16	Other types of wastes, which are not coded											
17	Wastes from construction and destruction (including dug soil from contaminated area)											
18	Wastes from public health operations for human and animal, including public health researches											
19	Wastes from waste treatment plant, wastewater treatment plant, water supply production plant, and industrial water supply production plant											
Total												

Department of Eco-Industrial Town Development
The Industrial Estate Authority of Thailand (IEAT)
618 NikhomMakkasan Road, Makkasan,
Ratchathewi, Bangkok 10400

Telephone 0 2253 0561 Fax 0 2252 6582
Website https://www.ieat.go.th/eco/