The 7th Meeting of Low Carbon Model Town Task Force (LCMT TF)
The 47th APEC Energy Working Group and Associated Meetings
Kunming, China

Development of APEC Low-Carbon Town Indicator （LCMT-TF7-04.1）

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Purpose

- The ways to review and develop low-carbon cities have a big sort of significant differences from economy to economy, making it difficult for the project to achieve overall progress in the region.
- In order to facilitate and support the overall progress of the project in the region, indicators (standards) that practically manage CO2 emissions at the municipal level need to be developed, disseminated, and widely used.
- It was agreed at the 5th APEC Low-Carbon Model Town Task Force meeting in Samui Island, Thailand in March 2013, to start the study on indicator system to measure the characteristics or quality of low-carbon town and to incorporate the result into the “Concept of Low-Carbon Town in the APEC region”. Task Force Japan and Study Group A were assigned to conduct this study.
- Japan, which is advanced and has long experience in the field of energy saving, could contribute to the further development of the APEC LCMT project by taking the initiative in developing a CO2 (energy-originated CO2) management method for cities.
- we propose anew that a management indicator system should be developed for the APEC LCMT project, which aims to promote the development of low-carbon towns across the region, by leveraging the LCMT concept and the results of the past feasibility studies.

Concept of APEC LCT-I

(1) WHY: Purpose

- Self-assessment and growth management in low carbon town development
- Possible to assessment by every economies

(2) WHO: Assessment Body

Local or central government who will and now engages in low carbon town

(3) WHEN: Assessment Timing

- Current situation diagnosis phase, planning phase, construction phase, operation phase

(4) WHERE: Scope of Assessment

- Administrative districts under the jurisdiction of local governments in APEC economies

(5) WHAT: Assessment Areas and Items

- Comprehensive areas and items required for low carbon towns

(6) HOW: Assessment and Operational Methods

- Simple and easy-access assessment tool
- “ PDCA” can get more proceeding to develop LCT by this Index

Study Flow

Examination of existing low carbon, Energy efficiency and Smart city Indicators

- Collect major evaluation systems for urban areas, projects, cities
- Perform analysis based on the principles of the study and LCT-I structure

■Existing Evaluation systems for Cities

(1) Universal Type	(2)Domestic Type
①LEED-Neighborhood Development (LEED-ND) ②CASBEE-urban ③CASBEE-city ④Green Growth Indicators (Green Cities programme) ⑤Global City Indicators ⑥Green City Index	⑦Sino-Singapore Tianjin Eco-city ⑧Smart city index (智慧城市指標) ⑨Reference Framework for Sustainable Cities ⑩European Initiative on Smart Cities ⑪J-CODE ⑫Tianjin Yujiapu CBD ⑬Other domestic tools

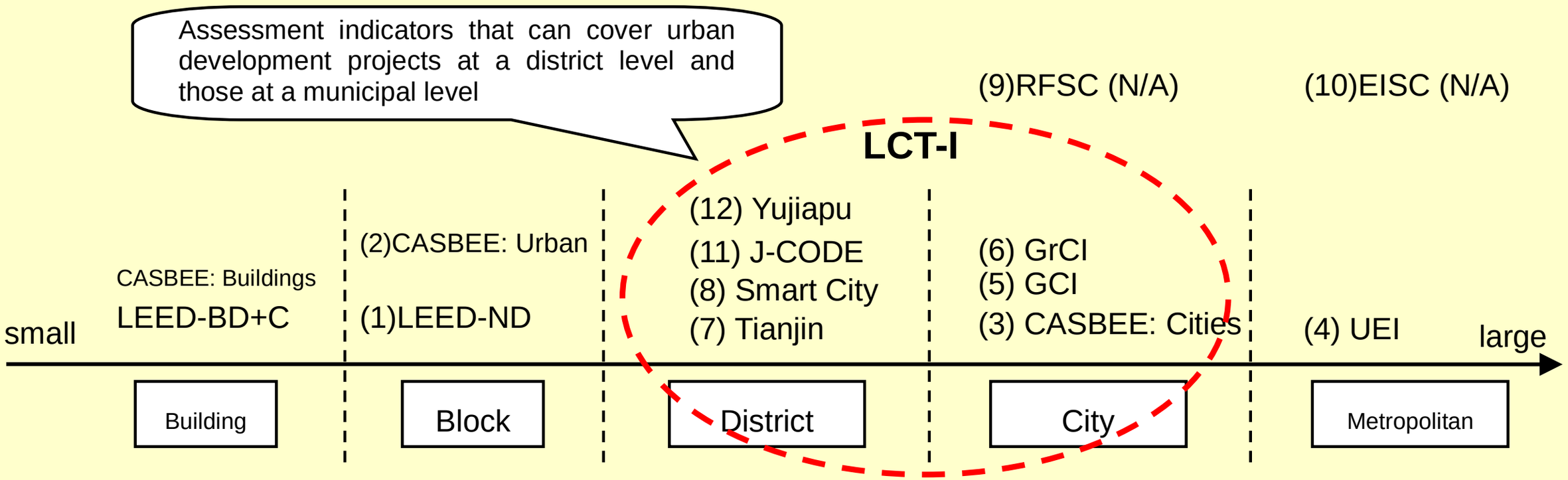
■Classification attributes

・Scope of evaluation ・Field of evaluation ・Purpose of evaluation ・Evaluation format ・Date of implementation	・Origin (country) of implementation ・Number of indexes ・Evaluation methods (quantitative/qualitative) ・Applicants/Evaluator ・Required data	・Practical applications ・Example of practical applications ・Complexities ・Regional adaptability ・Consistency with international trends (e.g. ISO)

Applicability of Existing Indicators

Ex) Where: What is the scope of the assessment?

An assessment should be made on a municipal or administrative district basis.

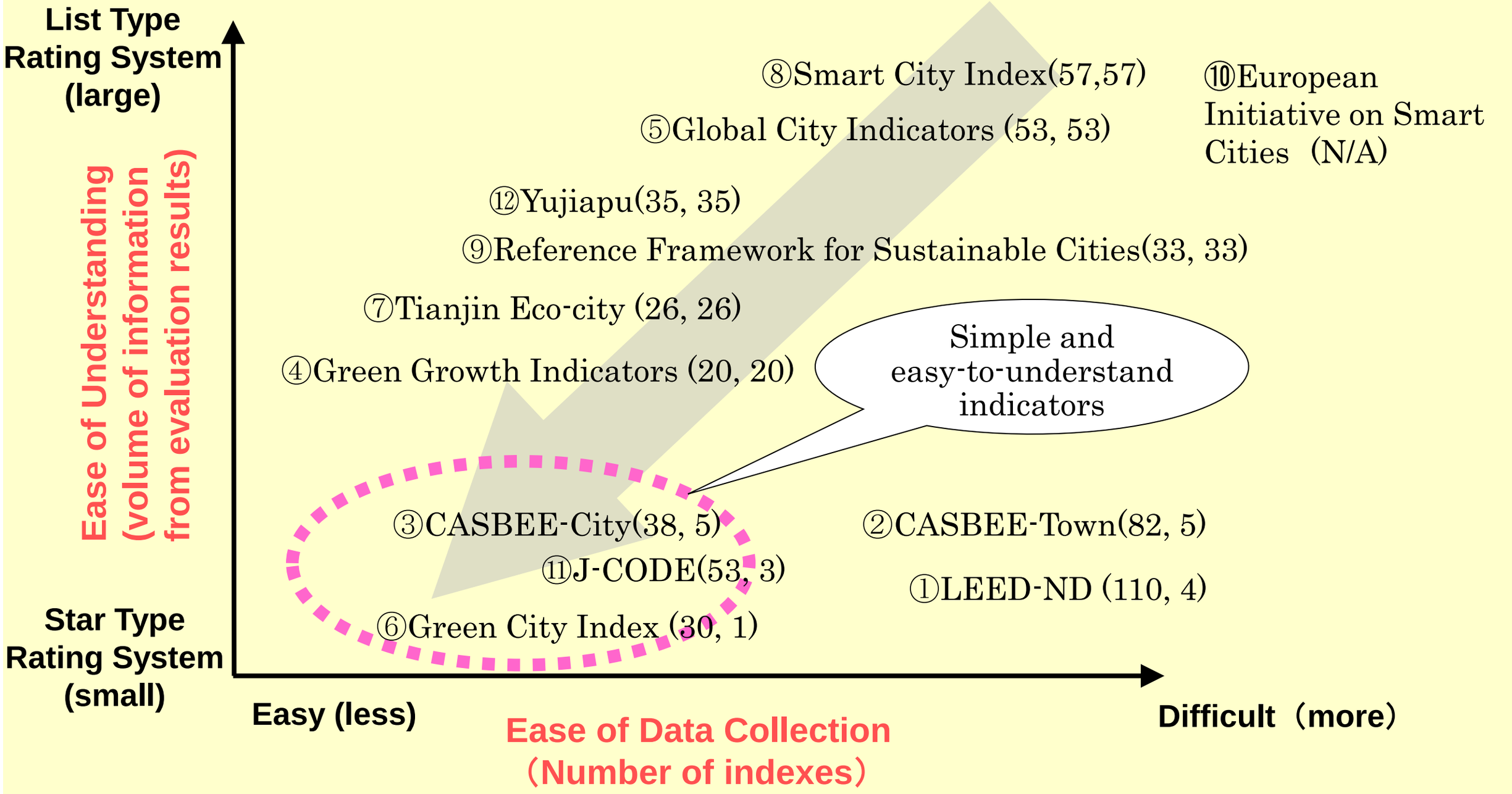


Categorization of existing indicators by the size of the

Applicability of Existing Indicators

Ex) How: How should the assessment be approached?

The assessment process should be simple and easy to understand and should reflect the circumstances of each economy, project characteristics, and international trends.



Applicability of Existing Indicators

Based on the above analyses, we found the following:

-There exist no indicators that fully match the LCT-I we aim at or any indicators that can serve as reference across all aspects of 5W1H (see Summary Table on the next page).

-Therefore, a new set of low carbon city assessment indicators should be developed.

-However, since some of the aforementioned existing indicators have characteristics that can serve partially as reference in each aspect of Who, Why, When, Where, What, and How, the effective way to develop new low carbon city assessment indicators is to skillfully combine these characteristics.

-Use the indicators below as reference and tap into and leverage their essence when developing LCT-I:

-CASBEE: Cities (scope of assessment, CO_2 calculation method)

-J-CODE (assessment ranks, assessment criteria)

-Tianjin Yujiapu CBD (assessment criteria, core + additional)

-Global City Indicators (World Bank) (use of existing statistical data)

LCT-I Development Principles

(i) Indicators are simple and easy to understand

(ii) Indicators reflect the conditions of each economy and project characteristics

(iii) Indicators are based on existing APEC LCMT FS outcomes, existing assessment indicators, and international trends

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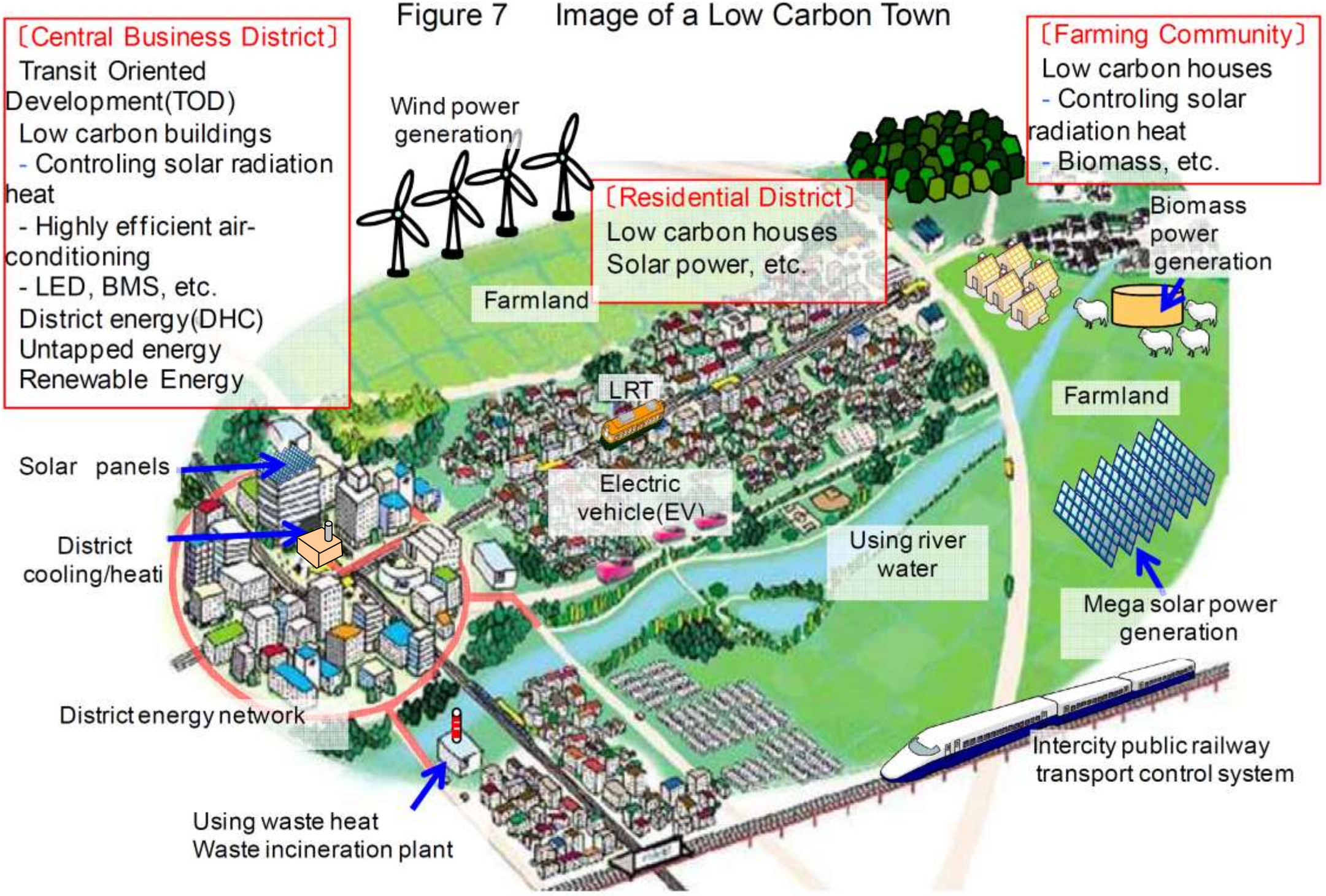
LCT-I Development Principles

Image of Low Carbon Town and LC measures

Figure 7 Image of a Low Carbon Town



Source: based on Special Report SR-79,2008, National Institute for Environmental Studies

LCT-I Development Principles

Space Scale Setting

Low Carbon Town in the APEC by APEC LCMT CONCEPT

Type of Town	Low Carbon Town Project	Economy	Population
(I) Urban - 1 (Central Business District : CBD)	Yujiapu CBD,Tianjin*1	China	500,000
	Sino-Singapore Tianjin Eco City	China	350,000
	Quezon City Green CBD	Philippine	
(II) Urban - 2 (Commercial Oriented Town)	Putrajaya Green City	Malaysia	68,000 (300,000 planned)
	Chiang Mai	Thailand	160,000
	Da Nang *3	Viet Nam	1million *
	Cebu City *3	Philippine	820,000
	Surabaya *3	Indonesia	2.8 million *
	Yokohama Smart City Project	Japan	3.7 million *
(III) Urban – 3 (Residential Oriented Town)	Plunggol Eco Town	Singapore	
	San Borja *4	Peru	110,000
(IV) Rural	Muang Klang Low Carbon City	Thailand	17,000
	Jeju Island Smart Green City	Korea	6,000 households
	Low Carbon Island (Penghu Island and Others)	Chinese Taipei	88,000
	Samui Island *2	Thailand	53,990

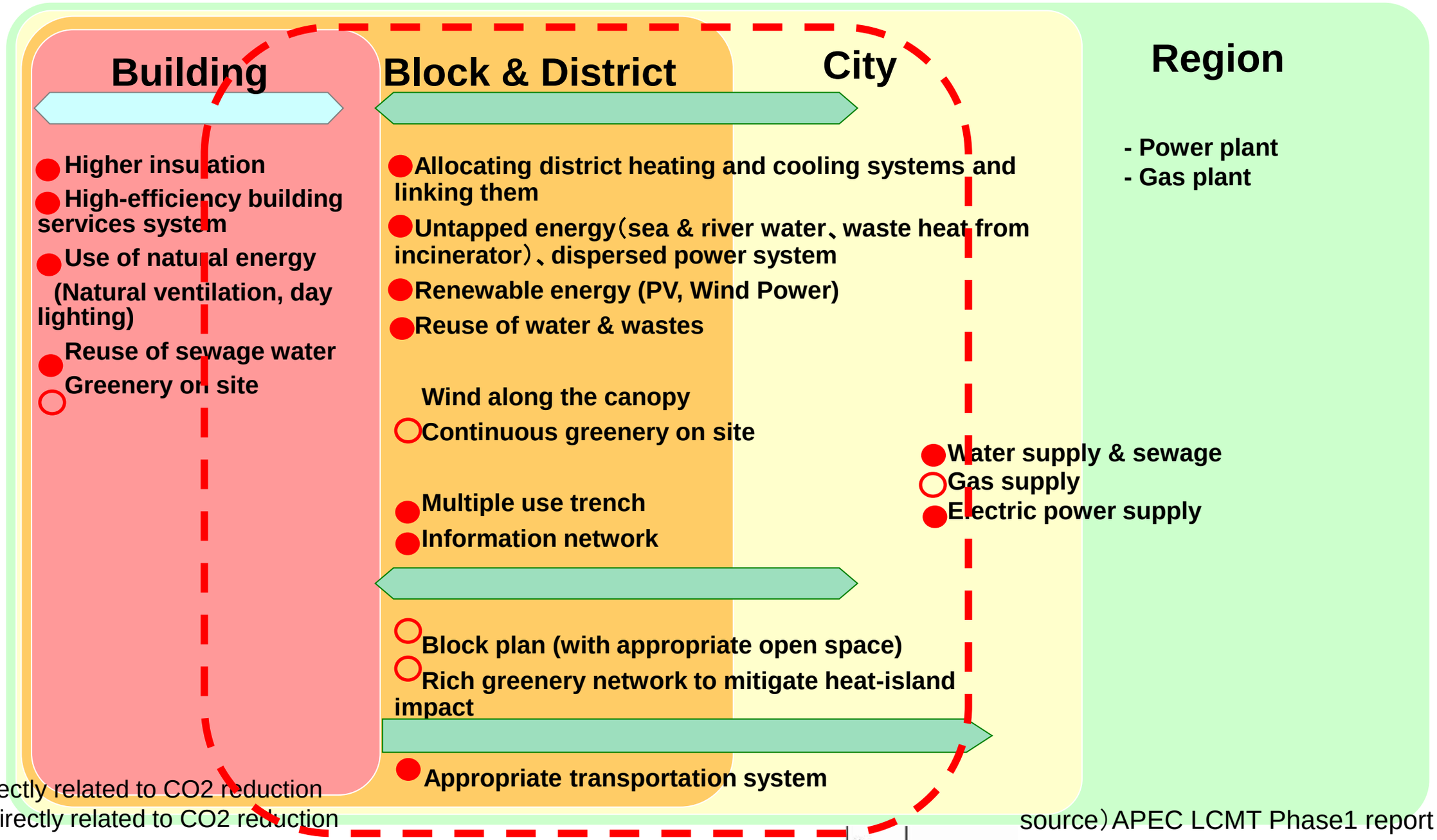
*1 LCMT Phase I feasibility study *2 LCMT Phase II feasibility study source) APEC LCMT CONCEPT

*3 Pilot City of WB Eco2 Cities Project *4 LCMT Phase Ⅳ feasibility study * Total population

LCT-I Development Principles

Areas and measures covered by APEC LCT-I

- Since low-carbon measures vary with the scale of a target project, the scope of assessment and target technology are closely connected.
- The scope of assessment shall include buildings, transportation, and district/block infrastructure within an LCMT boundary (project boundary, administrative boundary).



source）APEC LCMT Phase1 report

LCT-I Development Principles

Assessment Areas

- Not only the areas that have a direct impact on low-carbonization, but also those that indirectly impact it (areas that contribute to the enhancement of appeal for and sustainability of LCT) should be targeted.
- While the APEC LCMT CONCEPT states measures to achieve low-carbonization as one of areas, the APEC LCT should assess the results (output) of using such measures.
- The assessment areas shall include nine basic categories (Qualitative Assessment: 8 areas, Quantitative Assessment: CO2) and each economy shall be allowed to add extra categories on an as-needed basis.

Category	Area	Connection with the Concept of the Low-Carbon Town in the APEC Region
Qualitative Assessment	(1) City Structure	1 Town structure (Low-Carbon Town Structure)
	(2) Building	2 Building (Low-Carbon Building,)
	(3) Energy Management System (EMS)	Business EMS, home EMS, Factory EMS, Area EMS
	(4) Transportation	4 Transportation (Low-Carbon Traffic)
	(5) Energy	5. Area Energy Network 6 Untapped Energy 7 renewable Energy 8 Smart Grid System
	(6) Environment	Nature conservation, air, water quality, soil, noise, recycled water, waste
	(7) Lifestyle	Education, culture, health, environmental awareness
	(8) Management	Organization, BCP
Quantitative Assessment	(9)CO_2	Reduction and absorption

LCT-I Development Principles

Assessment Method

- Set goals using a three-star scale (★ to ★★★).
- A numerical value for each of ★, ★★, ★★★ shall be set by each economy.
- When the numerical values cannot be set, reference values shall be provided in the reference so that they can be used as reference.
- For assessment results, strive to visualize the overall assessment rank, area assessments (radar chart), and individual assessments.

While the numerical value for each level can be set by each economy (they will vary with the economy), each secretariat should provide some reference values.

LCT-I Development Principles

Assessment Method Approach to assessment Criteria

■ Approach to Assessment Criteria

Area	Core & Additional	Assessment Item	★	★★	★★★
(1) City Structure	●	**Public green area per person**	**12 m^2/person or more**	**15 m^2/person or more**	**18 m^2/person or more**
	●	***			
	(Optional)	***			
	(Optional)	***			
	(Optional)	***			
	Assessment by area (calculate based on ★= 1 point)		Average: 0.5 to 1.5 points	Average: 1.6 to 2.5 points (Required items must be ★★ or more.)	Average: 2.6 points or more (Required items must be ★★or more.)
(2) Building	●				
	●				
	(Optional)				
	(Optional)				
	(Optional)				
	Assessment by area (calculate based on ★= 1 point)		ditto	ditto	ditto
(3) EMS					
---					
(8) Management					
Overall Assessment ((1) to (8))					
(9)Qualitative assessment (CO_2)	●	CO_2 reduction (tCO_2/year)	—	—	—
	(Optional)	CO_2 absorption (tCO_2/year)	—	—	—

The same assessment method applies to all areas.

Average is adopted since the number of optional items varies.

It can be set based on advanced cases (such as a Japanese case).

The same assessment method applies to all areas.

Optional items can be set by each economy.
(At least one item must be set.)

LCT-I Development Principles

Assessment Method　Output Image

■ Output Image

Assessment based on the average of each area

Overall Assessment

Overall Rank

★★☆

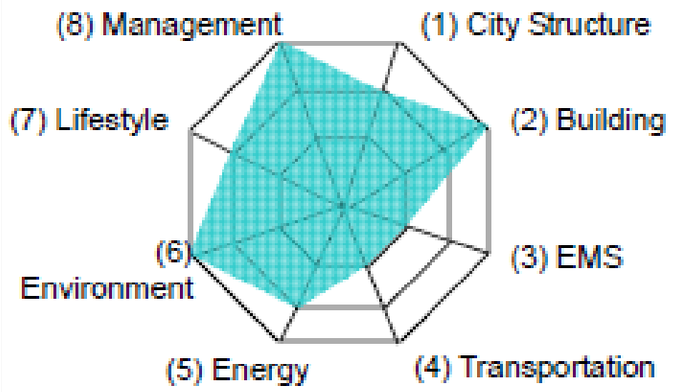
Total Point (average of (1) to (8))

1.7

CO2 Reduction ((9))

470 tCO_2/year

Radar Chart



Individual Assessment

Average by area for the total point ([1] to [8])

Area	★	★★	★★★
(1) City Structure			
(2) Building			
(3) EMS			
(4) Transportation			
(5) Energy			
(6) Environment			
(7) Lifestyle			
(8) Management			
Total (average)			

1.7

Breakdown of CO_2

Category	Breakdown	tCO_2/year
Reduction (9)	Civil	100
	Industry	20
	Transport	300
	Other	50
	Subtotal	470
(Reference) Absorption	Existing green space	
	Afforestation	
	Subtotal	

Items by Area

(1) City Structure

	★	★★	★★★
● Required: ***			
● Required: ***			
Optional: ***			
Optional: ***			
Optional: ***			
Total (average)			

(2) Building

	★	★★	★★★
● Required: ***			
● Required: ***			
Optional: ***			
Optional: ***			
Optional: ***			
Total (average)			

LCT-I Development Principles

Assessment Indicators by Area (draft) 1/3

- Set required items, which correspond to a city category, by assessment area.
- Use qualitative indicators ([1]–[8]) as much as possible.
- Assessment criteria for each indicator shall be developed by a local/central government. For economies without criteria, standard values or assessment methods should be given in the Reference section.

Area	Item	Expected Effect	Assessment Indicator (to promote low-carbonization)
(1)City Structure	Homes and places of work in close proximity	Less traffic jams by reducing the use of motorbikes and cars	Percentage of workers to residents in the district
	Intensive land use	Control of suburban sprawl by leveraging volume	Total floor area per unit area in the center of a city
	Securing of green space	Increase in absorption of CO_2, decrease in heat island effect	High tree rate
			Area of green space per capita
	TOD	Promotion of use of public transportation	Presence/absence of an intensive land use plan for the area within a one-kilometer radius from a station
	Universal	Promotion of walking by eliminating a difference in level and promotion of comfortable movement within the region by setting up signs	Presence/absence of barrier-free and universal design
(2) Building	Energy-saving construction	Reduction of CO_2 attributable to buildings	Ratio of buildings certified as green buildings to total buildings in the district (%)
	Building Insulation	ditto	Thermal performance standard
	Energy efficiency of building equipment of	ditto	Energy reduction rate of building equipment
(3) EMS	Energy management in buildings and in the district	Peak shaving and supply-demand adjustment by leveraging IT, reduction of total energy consumption	Presence/absence of a building EMS introduction plan
		ditto	Presence/absence of a home EMS introduction plan
		ditto	Presence/absence of a factory EMS introduction plan
		ditto	Presence/absence of an area EMS introduction plan

LCT-I Development Principles

Assessment Indicators by Area (draft) 2/3

Area	Item	Expected Effect	Assessment Indicator (to promote low-carbonization)
(4) Transportation	Promotion of public transportation (improvement of share ratio)	Promotion of public transportation use, control of use of vehicles	Public transportation share ratio
	Formation of transportation nodes	Control of use of vehicles by the development of walk zones	Presence/absence of more than two types of public transportation nodes
	Introduction of leading public transportation system	Development and promotion of use of public transportation network, control of vehicle use	Presence/absence of a BRT or LRT introduction plan
		CO_2 reduction among public vehicles via introduction of low-carbon vehicles	Presence/absence of an EV bus and natural gas vehicle introduction plan
	Introduction of low-carbon vehicles	CO_2 reduction among vehicles for private and business uses	EV and PHV penetration rates
	Transportation demand management (TDM)	Promotion of use of public transportation and control of vehicle use via IT	Presence/absence of plans for car sharing and bicycle sharing systems
(5) Energy	Introduction of district heating and cooling (DHC)	Improvement of district-wide energy efficiency, backup function in times of disaster	District energy utilization ratio to total energy
	Introduction of renewable energy	Reduction in energy derived from fossil fuel	Utilization ratio to total energy
	Introduction of unused energy	ditto	Utilization ratio to total energy
	Introduction of smart grid (AEMS)	Area-wide supply-demand adjustment of energy via IT, reduction in energy consumption, awareness raising via visualization	Presence/absence of a smart grid introduction plan

LCT-I Development Principles

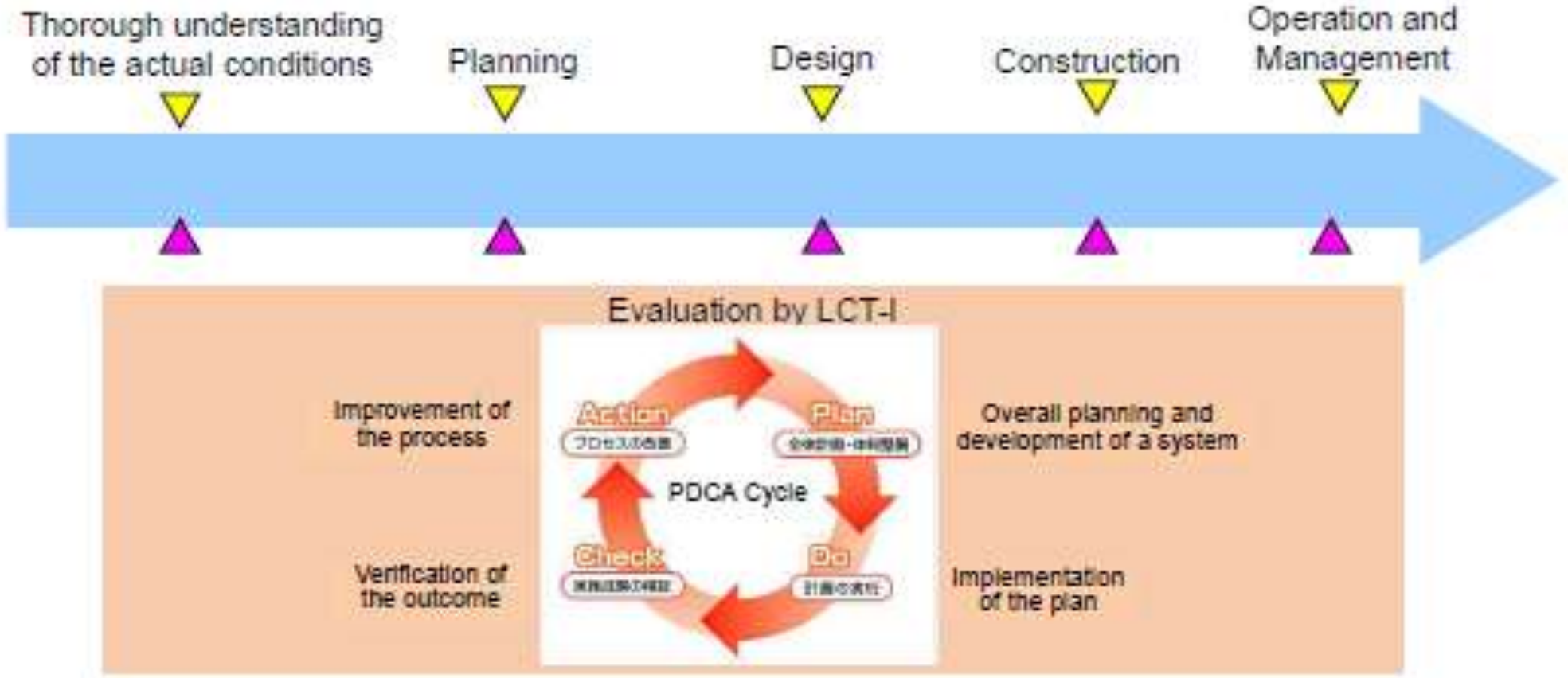
Assessment Indicators by Area (draft) 3/3

Area	Item	Expected Effect	Assessment Indicator (to promote low-carbonization)
(6) Environment	Nature Conservation	Coexistence with nature	Presence/absence of an ecosystem conservation area
	Air	Prevention of health hazards	Whether or not standard values have been attained
	Water	ditto	ditto
	Soil	ditto	ditto
	Noise	ditto	ditto
	Water Reuse	Improvement of hygienic environment	Penetration rate of water and sewage services
		Effective use of resources	Presence/absence of a water reuse plan
	Water use reduction	Effective use of resources	Water consumption per capita
	Waste Reuse	Effective use of resources	Presence/absence of a separate collection and recycling plan
(7) Lifestyle	Environmental Education	Enhancement and promotion of environmental awareness	Presence/absence of educational curriculums
	Environmental awareness raising activities	ditto	Presence/absence of an eco-point and green purchasing plan
(8) Management	Low-carbon initiatives	Promotion of low-carbon initiatives	Presence/absence of low-carbon-related departments
		ditto	Presence/absence of a plan for low-carbon projects
	BCP	Improvement of the added value of towns	Presence/absence of a project continuity plan against disasters and power outages
(9) CO_2		—	CO_2 reduction
		—	CO_2 absorption

LCT-I Development Principles

How to implement an LCT-I assessment system

- An assessment should be conducted under the leadership of a local/central government.
- Based on the assessment results, develop and implement an improvement plan (what, how, and by when) (PDCA).
- When in operation, monitor progress on a regular basis (annually or once in a few years).
- The LCT-I of each district should be managed by each economy and APEC.
- Report progress at an APEC meeting on a regular basis and give an LCT-I certification to or commend the economies that are actively conducting the LCT-I process.
- It is desirable to establish an incentive program, such as provision of preferential project assistance (or low interest rates) to award-winning municipalities by the World Bank.



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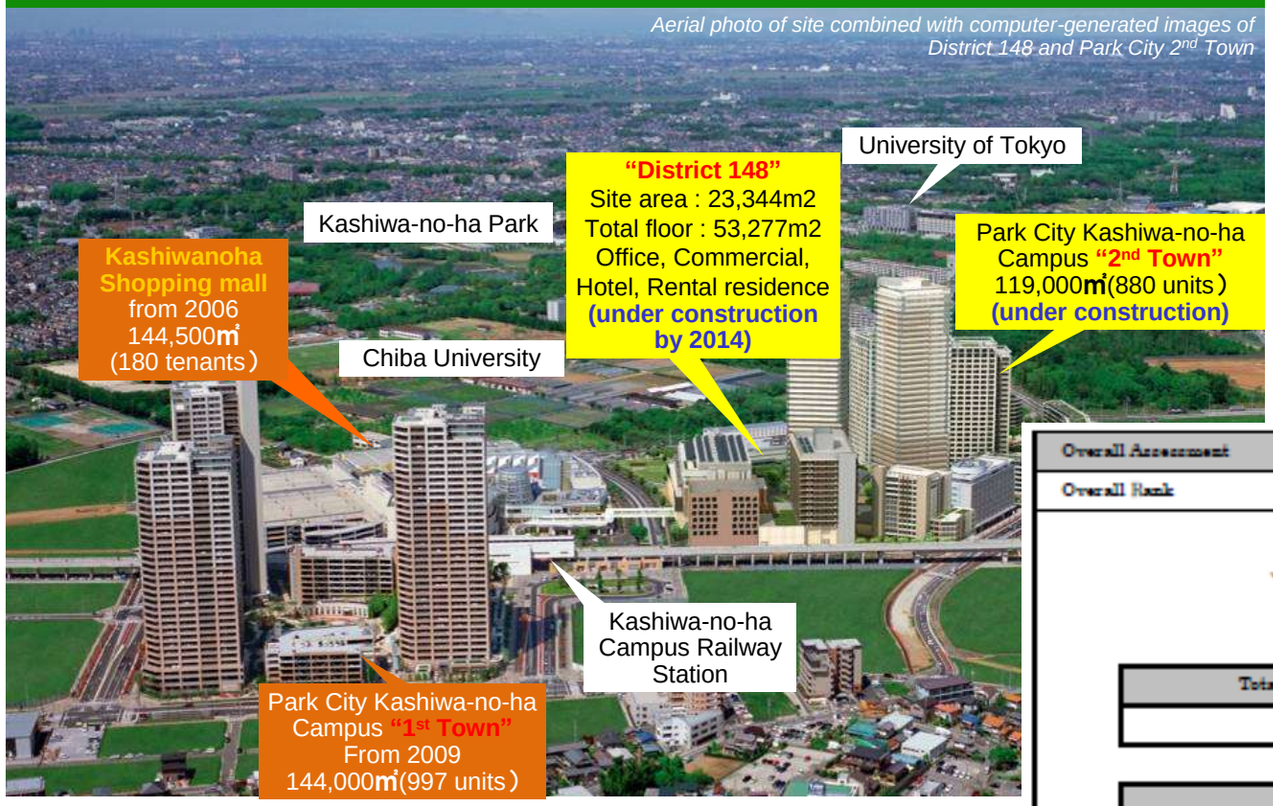
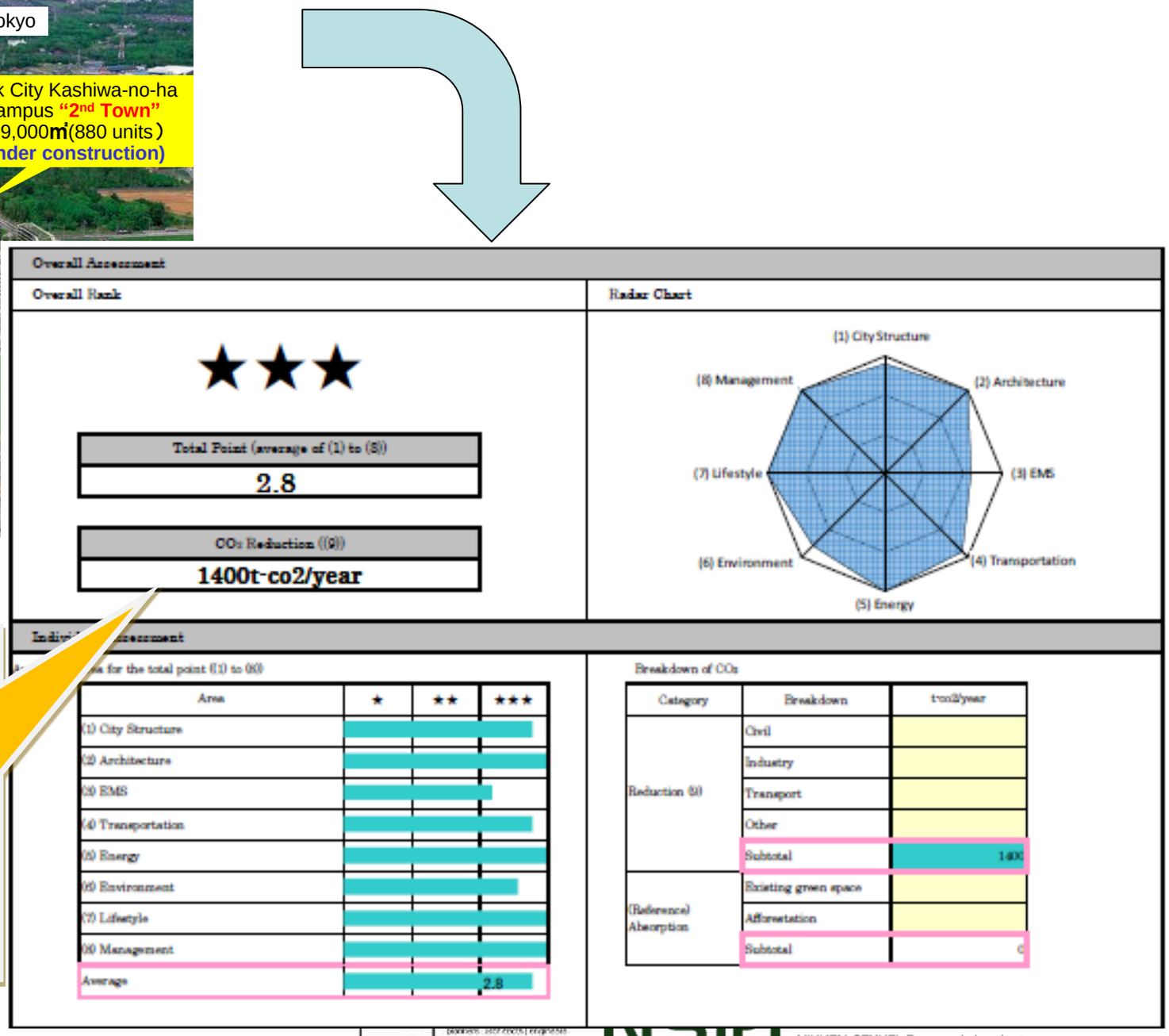
Sensitivity Analysis (case study)

Kashiwanoha Campus (Chiba, Japan), an established, well-known smart city

Development around Kashiwa-no-ha Campus Station



Kashiwanoha Project is the most comprehensive and complex Smart City project in Japan, but this Index evaluates its specification of low carbon planning and grasp its performances to reduceCO2



Conclusion

Advantages of using LCT-I

Following characteristics of LCT-I can be considered as the advantages to utilize LCT-I in the APEC region:

-Simple and easy to understand LCT development

- ·Use existing statistics data to make it intuitively easy to understand the comprehensive and quantitative status of low carbon town development

-Reflect the circumstances of each economy and project characteristics

- ·Take into account the economic conditions of each economy and project characteristics so as not to hamper sustainable growth
- ·Easy to grasp a long-term trend in achievement level at each stage of conception, planning, construction, and maintenance

-Reflect existing APEC LCMT Feasibility Study results, existing assessment indicators, and international trends

- ·Reflect international trends such as smart infrastructure assessment standards (TC268) and OECD activities, and combined use of such items is expected to be supported in the future

Conclusion

Issues for the next step

-Validation of assessment indicators in each assessment area
-Setting of quantitative values for assessment standards in each assessment area (with referring existing indexes)
-Provision of reference indicators and reference calculation equations to economies without their own assessment standards
-Sensitivity analysis of selected cities/towns
-Method of operation and method for awarding incentives
-Method of combining it with smart infrastructure standards (TC268)

Thank you for your attention

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Annex

Study Flow

（1）Examination of existing low carbon, energy efficiency and smart city indicators

⇩

（２） Examination of management indicator system structure
① Examination of scope of management indicator system
② Examination of evaluation field and indicators
③ Examination of quantitative (or qualitative) evaluation method

⇩

（３） Sensitivity analysis of management indicators
① Selection of target cities for evaluation studies
② Execution of evaluation studies and sensitive analysis

⇩

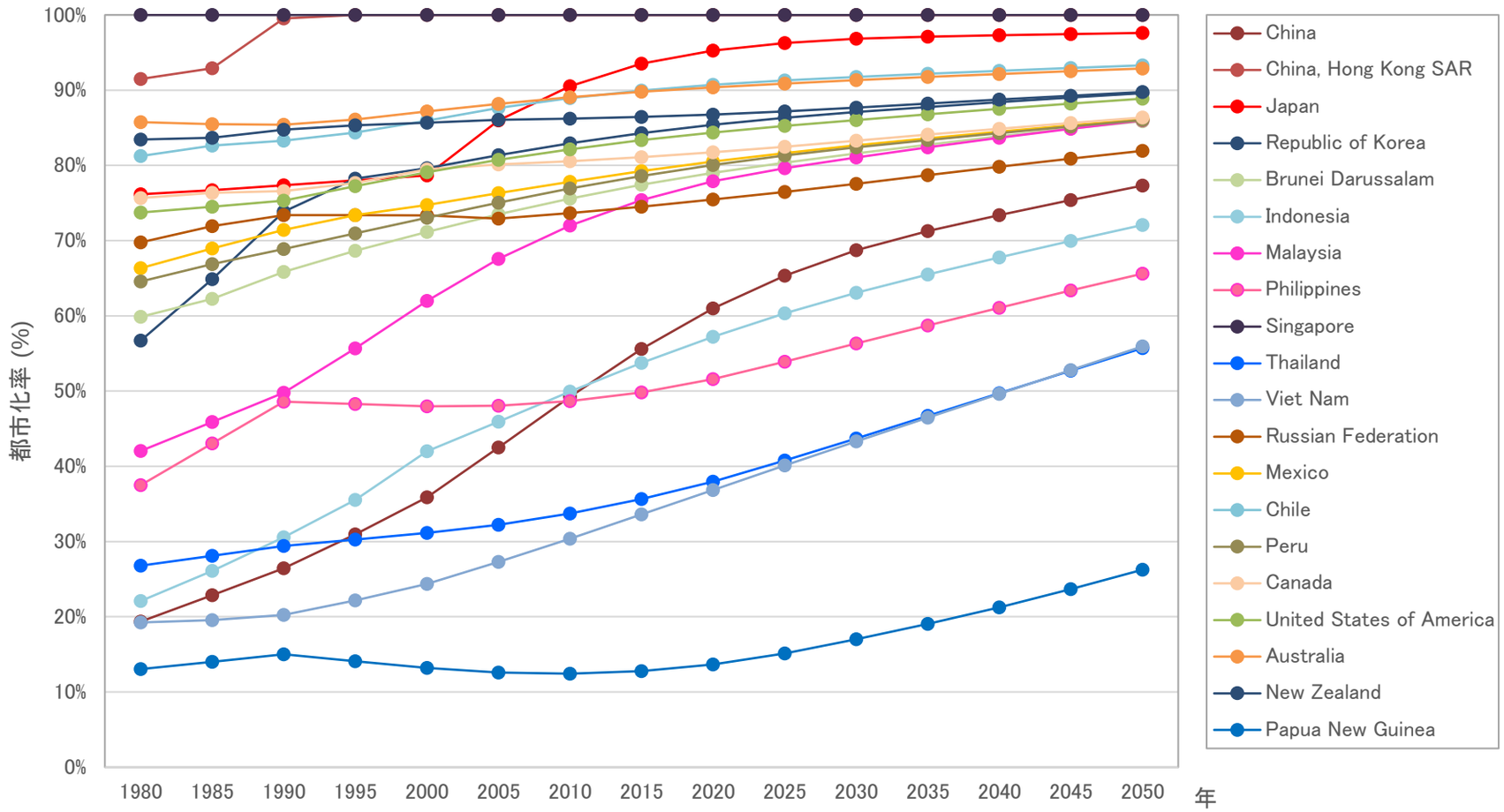
（４） External activities for the creation of management indicators

⇩

（５） Preparation of report

Background

- Current conditions of global warming
- Global increase in urban population and city development projects
- Energy issues incidental to urban population increase
- Relationship between income level and urbanization



Urbanization trends in APEC Economies

Urbanization = urban population / total population
Urban population: population residing in “cities” as defined by national census.
Source: United Nations, “World Urbanization Prospects, the 2011 Revision”

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Review of Existing Indicators

<City assessment systems collected>

1. LEED-Neighborhood Development (LEED-ND)
2. CASBEE for Urban Development
3. CASBEE for Cities
4. Urban Environmental Indicators (UEI) (OECD : Green Cities programme)
5. Global City Indicators (GCI) (World Bank)
6. Green City Index (GrCI)
7. Tianjin Eco City (Tianjin)
8. Smart City Indicators
9. Reference Framework for Sustainable Cities (RFSC)
10. European Initiative on Smart Cities (EISC)
11. J-CODE
12. Tianjin Yujiapu CBD (Yujiapu)）

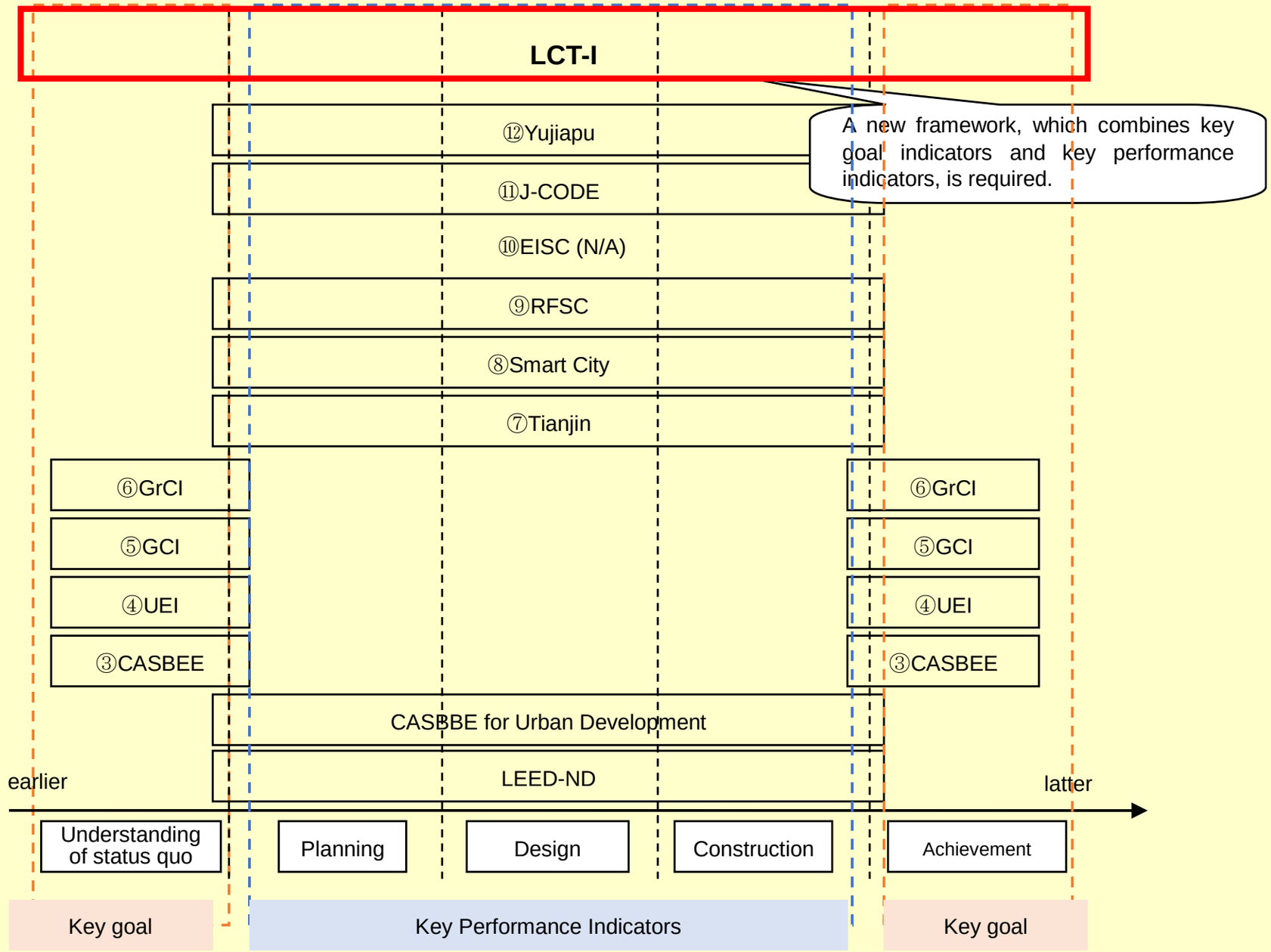
<City assessment systems collected>

- Scope of Assessment
- Target Area
- Assessment Purpose
- Assessment Approach
- Year of Creation
- Creator (country)
- Number of Assessment Indicators
- Assessment Method (quantitative/qualitative)
- Participating parties (Applicant and Assessment/Certification Agency)
- Required Statistical Data
- Purpose of Use
- Case Examples
- Complexity
- Applicability to different regions or cities
- Alignment with international trends (ISO, etc.)

Applicability of Existing Indicators

Ex) When: What phase should be assessed?

Assess each of the following phases: thorough understanding of the actual conditions, planning, design, construction, and operation.



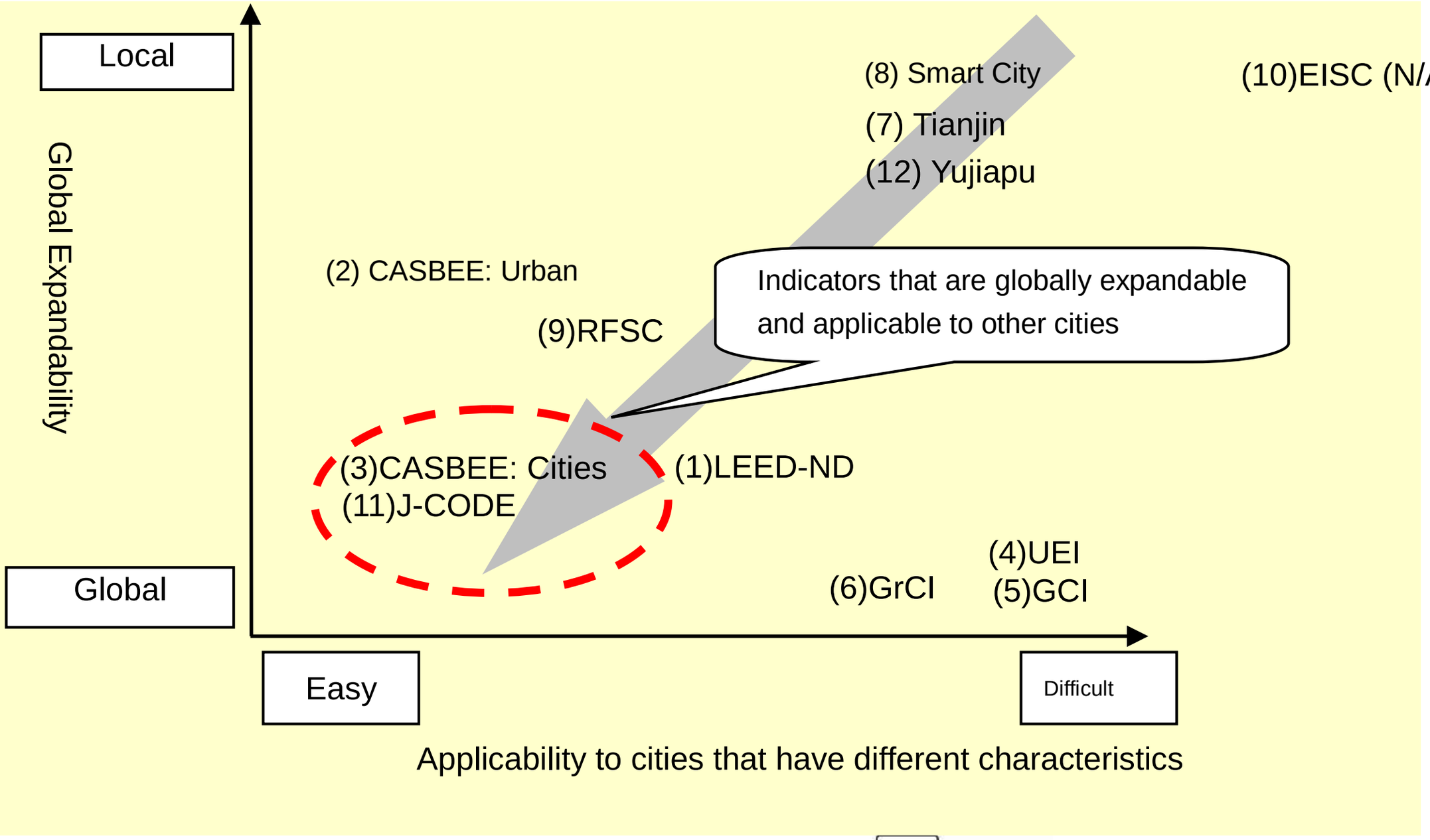
Categorization of existing indicators by applicable phase

key goal indicators* to manage a situational change between the beginning and the end of a project
key performance indicators* that monitor progress in the planning and implementation of countermeasures during the intermediary stages of the project, that is, in the planning, construction, and operational phases.

Applicability of Existing Indicators

Ex) How: How should the assessment be approached?

The assessment process should be simple and easy to understand and should reflect the circumstances of each economy, project characteristics, and international trends.



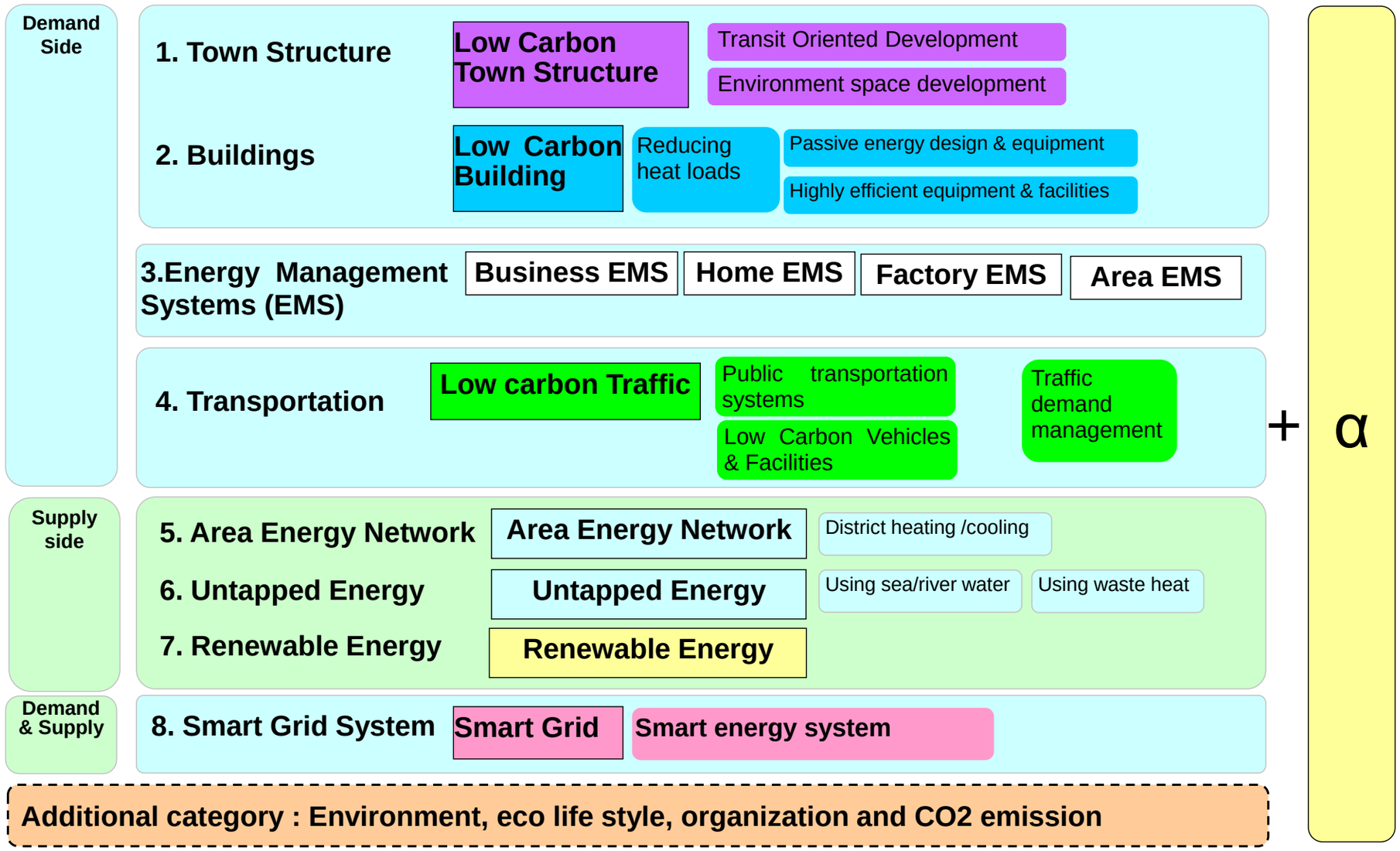
Applicability of Existing Indicators

Key Requirements										
	Desired LCT-I Form									
1. WHY Assessment Purpose	Self-assessment and growth management by cities	C External Certification	C Business Operator	C	A	A	C	C Project Area	C
2. WHO Assessment Body	Can be assessed by municipal senior management	C External Certification	C Business Operator	C	A	A	C	C Project Area	C
3. WHEN Assessment Timing	Capability of diagnosing the actual conditions	A	A	A	C	C	A	A	A
	Assessable in design and planning phases	C	C	A	C	C	A	A	A
	Assessable in construction phase	C	C	A	C	C	A	A	A
	Assessable in operational phase	C	C	A	C	C	A	A	A
4. WHERE Scope of Assessment	Administrative districts under the jurisdiction of local governments in the APEC region	C Project Area	A	A	A	A	A	C Metropolitan Area	A
5. WHAT Assessment Area	KGIs should be considered.	C	A	A	A	A	A	A	A
	1	LEED-ND	C External Certification	C Business Operator	C	A	A	C	C Project Area	B
	2	CASBEE: Urban [illegible]	C External Certification	C Business Operator	C	A	A	C	C Project Area	B
	3	CASBEE: Cities	A	A	A	C	C	A	A	A
	4	Urban Environmental [illegible]	C External Assessment	C International Organization	A	C	C	A	C Metropolitan Area	A
	5	Global City Indicators	C External Assessment	C International Organization	A	C	C	A	A	A
	6	[illegible]	C External Assessment	C International Organization	A	C	C	A	A	B
	7	Tianjin Eco City	C Top-down management	C Central Government	C	A	A	C	A	B
	8	Smart City Indicator	C Top-down management	C Central Government	C	A	A	C	A	B
	9	Reference Framework [illegible]	B Guidelines for administrators	C International Organization	C	A	A	C	A	A
	10	European Initiative on [illegible]	C Technological development	C International Organization	C	C	C	C	C Industry	C
	11	J-CODE	C Top-down management	C Central Government	C	A	A	C	A	B
	12	Tianjin Yujiapu CBD	A	A	C	A	A	C	A	B

LCT-I Development Principles

Assessment Areas

- Not only the areas that have a direct impact on low-carbonization, but also those that indirectly impact it (areas that contribute to the enhancement of appeal for and sustainability of LCT) should be targeted.
- While the APEC LCMT CONCEPT states measures to achieve low-carbonization as one of areas, the APEC LCT should assess the results (output) of using such measures.
- The assessment areas shall include nine basic categories (Qualitative Assessment: 8 areas, Quantitative Assessment: CO2) and each economy shall be allowed to add extra categories on an as-needed basis.



[Reference] The Concept of the Low-Carbon town in the APEC Region

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Evaluation Structure of APEC LCT-I

Partial List of Evaluation Categories

Category	Evaluation Item	Evaluation Index	Town Classification				Evaluation Score		
			① U-1 CBD	② U-2 Commercial	③ U-3 Residential	④ Rural	★	★★	★★★
②Architecture	Energy-saving Buildings	Ratio of number of energy efficient buildings in the area	●	●					
	Building Insulation	PAL 1)	●	●	●	●			
	Energy Efficiency of Building Equipment	ERB 2)	●	●	●	●			
③EMS	Building and Area Energy Management	Existence of building EMS implementation plan	●	●					
		Existence of home EMS implementation plan			●	●			
		Existence of factory EMS implementation plan		●	●				
		Existence of area EMS implementation plan	●	●	●	●			
④Transportation	Promotion of Public Transportation	Public transportation mode share	●	●					
	Formation of Transport Hub	Existence of more than 2 types of transport hubs	●	●					
	Low-carbon Public Transportation	Existence of BRT or LRT implementation plan	●	●					
		Existence of electric bus or natural gas vehicle implementation plan			●	●			
	Low-carbon Vehicles	Diffusion rate of EV and PHV	●	●	●	●			
	Transportation Demand Management	Existence of car sharing or rental bike system implementation plan	●	●	●	●			
⑤Energy	District Heating and Cooling System (DHC)	Ratio over total energy consumption	●	●					
	Renewable Energy	Ratio over total energy consumption	●	●	●	●			
	Untapped Energy	Ratio over total energy consumption	●	●	●	●			
	Smart Grid	Existence of smart grid implementation plan	●	●					

1) PAL: Perimeter Annual Load
2) ERB: Energy Reduction Rate of Building Equipment

Evaluation Structure of APEC LCT-I

[Structure of Evaluation]

- Assessments are performed on individual categories and overall performance.
- Assessment results are expressed in 3-scale rating systems, i.e., ★/★★/★★★ (overall) and 1-3 point (category).
- Evaluation criteria for each category can be set by individual economies
- Score of individual category is calculated based on the aggregate performance of sub-items; overall score of the LCT is the average score of individual categories.

★★☆

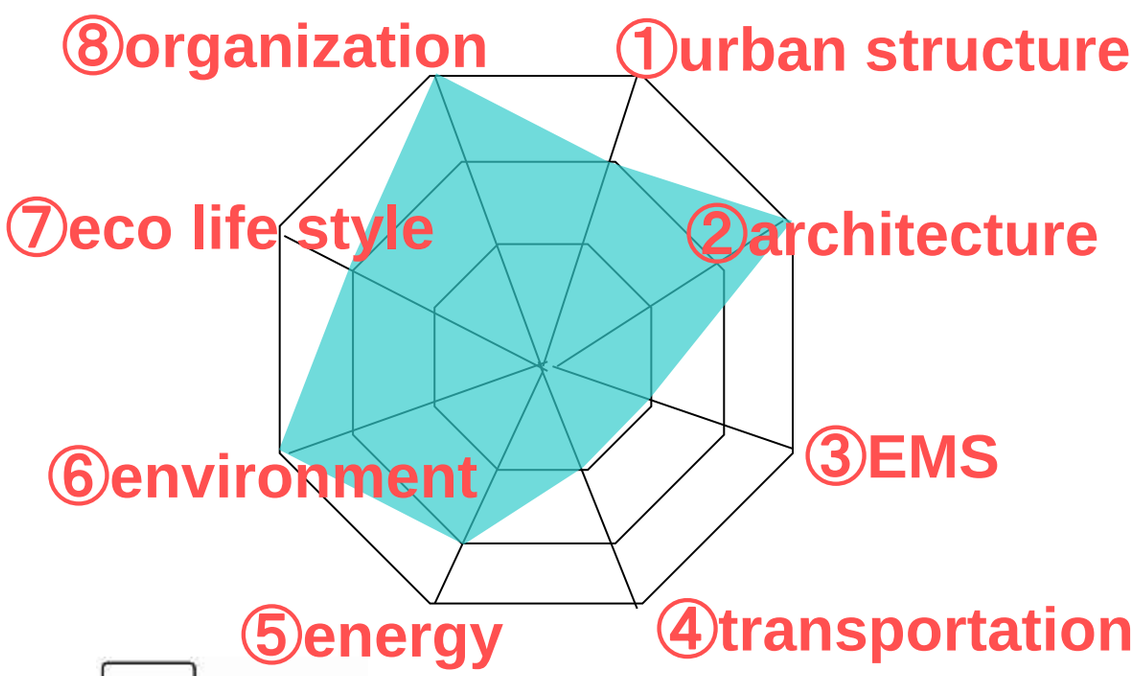
Overall Score
1.7

CO2 reduction
470 t-co2/year

★☆☆ Minimum level for economy

★★☆ Standard level for economy

★★★ Ideal level for economy



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