Development of Assessment tools to support climate change mitigation and adaptation actions of local governments

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E-Konzal Co. Ltd. is a research and consulting company especially for energy and environmental issues. Our mission is to contribute to a sustainable future especially from energy and environmental perspectives. We have developed assessment tools to support local governments which intend to take action for climate change mitigation and adaptation.

MITIGATION

Quantification Tool for Designing Low Carbon City Scenarios

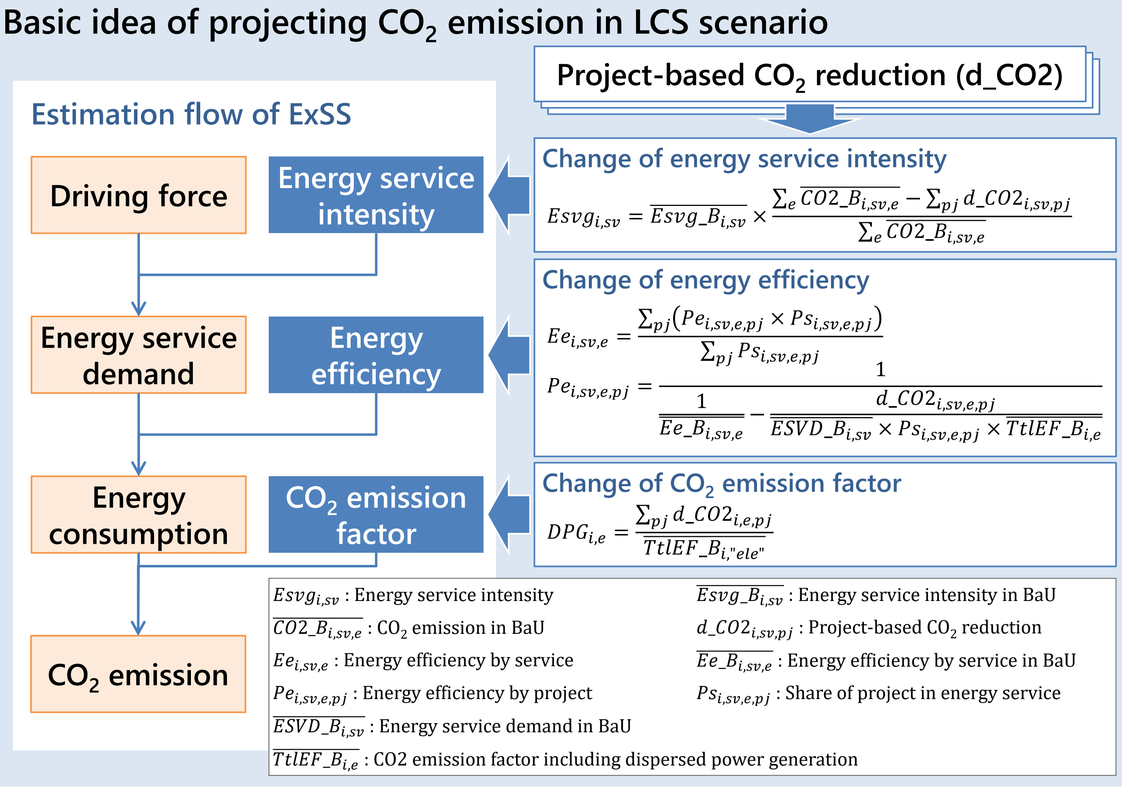
Background

It is desirable to reduce GHG emission harmonized with economic growth and quality of life. However it is not easy for cities to take actions for it. A low carbon society (LCS) scenario is a kind of guides to show how to realize an attractive society with low/no GHG emission in future. We developed a quantification tool to assess LCS scenario for cities.

Methodology

Future scenarios are assessed by integration of top-down method using Extended Snapshot tool (ExSS) and bottom-up project-based method. First, LCS projects are listed and CO_2 reduction by each project is calculated. Concrete projects are easy to imagine. Then the reductions by project are converted to input parameters of ExSS. ExSS estimates CO_2 emissions and reductions inclusively without duplication among projects.

Basic idea of projecting CO_2 emission in LCS scenario

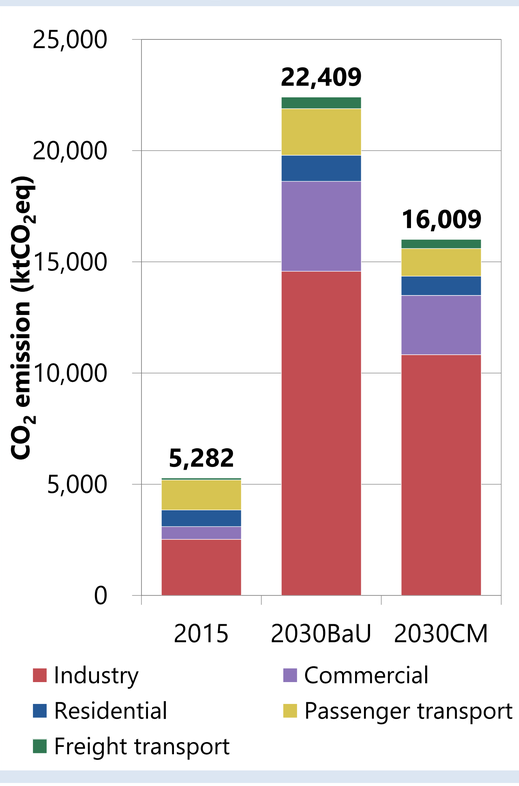


$Esvg_{i,sv}$: Energy service intensity
$\overline{Esvg\_B_{i,sv}}$: Energy service intensity in BaU
$\overline{CO2\_B_{i,sv,e}}$: CO_2 emission in BaU
$d\_CO2_{i,sv,pj}$: Project-based CO_2 reduction
$Ee_{i,sv,e}$: Energy efficiency by service
$\overline{Ee\_B_{i,sv,e}}$: Energy efficiency by service in BaU
$Pe_{i,sv,e,pj}$: Energy efficiency by project
$Ps_{i,sv,e,pj}$: Share of project in energy service
$\overline{ESVD\_B_{i,sv}}$: Energy service demand in BaU
$\overline{TtlEF\_B_{i,e}}$: CO2 emission factor including dispersed power generation

Case study in Semarang, Indonesia

We applied this methodology to Semarang city in Indonesia. CO_2 emission in two scenarios, which are Business as Usual (BaU) and Countermeasure (CM) scenario, were estimated. In addition, CO_2 emission reduction by project in CM scenario are identified.

Estimated CO_2 emission and reduction by project in Semarang



Action		Project	Sector	Emission reduction ($ktCO_2eq$)
1 Green Industry	1-01	Energy saving support scheme like ESCO for industries	Industry	964.6
	1-02	Installation high energy efficiency facilities	Industry	346.6
	1-03	Regional energy supply system	Industry	489.7
	1-04	Improvement of kiln and furnace technology	Industry	692.3
	1-05	Fuel shift of furnaces and boilers to natural gas	Industry	58.8
		Total		**2,552.0**
2 Smart Building	2-01	Installation of insulated glasses to buildings	Commercial	84.1
	2-02	Installation of insulated glasses to houses	Residential	12.2
	2-03	Introduction of incentive to low energy buildings	Commercial	15.9
	2-04	Introduction of insulating material to houses	Residential	7.0
	2-05	Energy efficiency technology applied to buildings	Commercial	35.8
	2-06	Shift to natural gas in buildings	Commercial	17.1
	2-07	Introduction of solar water heater to buildings	Commercial	52.3
	2-08	Introduction of solar water heater to households	Residential	23.9
		Total		**248.4**
3 Smart Device	3-01	Energy saving support scheme like ESCO for buildings	Commercial	150.6
	3-02	High efficiency lighting in commercial buildings	Commercial	66.5
	3-03	High efficiency lighting in households	Residential	22.8
	3-04	High efficiency air conditioners in commercial buildings	Commercial	137.3
	3-05	High efficiency air conditioners in households	Residential	33.7
	3-06	Promotion of energy-efficient appliances	Residential	23.1
		Total		**434.1**
4 Sustainable Transport	4-01	Promotion of eco-driving with digital tachographs	Transport	7.2
	4-02	Wide-range traffic control	Transport	28.8
	4-03	Expansion of frequencies and routes of bus and BRT	Transport	96.2
	4-04	Development of public transportation (railway/MRT)	Transport	98.6
	4-05	Shift to CNG bus	Transport	6.1
	4-06	Introduction of electric motorbikes	Transport	61.5
	4-07	Promotion of energy-efficient passenger cars	Transport	452.3
	4-08	Promotion of energy-efficient motorbikes	Transport	86.7
	4-09	Promotion of energy-efficient trucks	Transport	112.8
		Total		**950.1**
5 Green Energy	5-01	Introduction of PV to commercial buildings	Commercial	24.3
	5-02	Introduction of PV to households	Residential	9.7
	5-03	Introduction of small-scale hydropower generation	Commercial	1.7
		Total		**35.7**
Improvement of CO_2 emission factor of electricity				**2,179.1**
Total				**6,399.5**

This LCS study for Semarang is done by Municipality of Semarang, Diponegoro University, Institute for Global Environmental Strategies (IGES), National Institute for Environmental Studies, Japan (NIES), Mizuho Information and Research Institute, Inc. and E-Konzal Co. Ltd.
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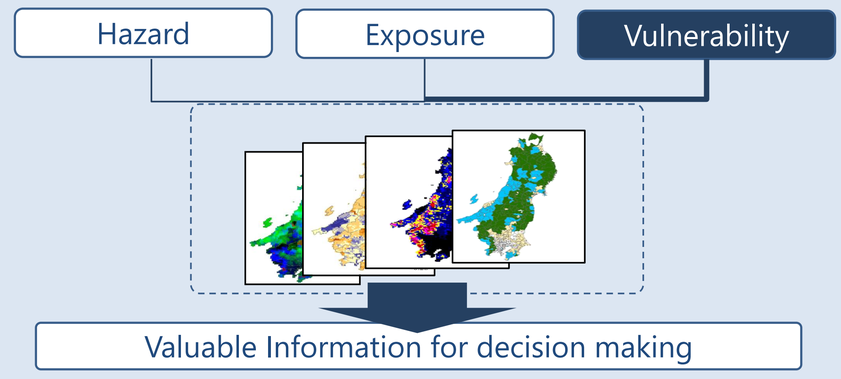
ADAPTATION

Assessment Method of Regional Vulnerability Regarding to Impact of Climate Change

Background

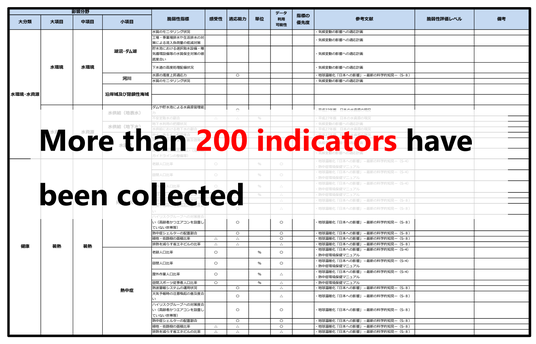
In Japan, many research projects have been conducted and knowledge regarding to impact of climate change and adaptation measures have been accumulated. Although those knowledge are created by experts on several sectors, it is said the problem is that those research projects mainly have focused on "Hazard" and "Exposure", and that regional "Vulnerability" have not been taken into account sufficiently.
With the basis of existing research, this research firstly structures the concept of vulnerability, and secondly identifies the relationship between regional vulnerability and impact of climate change and then develops the assessment method of regional vulnerability. Finally, using the result of vulnerability assessment with the data of hazard and exposure, this research evaluates regional risk on impact of climate change and creates information for decision making regarding to adaptation.

Concept of the method



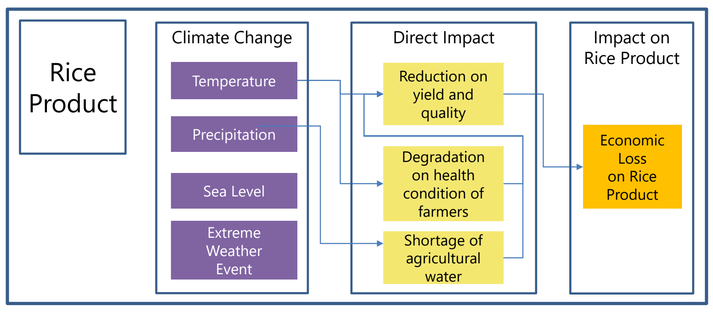
Methodology

Toward vulnerability assessment, it is needed to identify indicators of regional vulnerability. In this research we have two approach. Firstly, this research has conducted literature research about vulnerability in Japan and all over the world broadly and collected the indicators suggested by those research and more than 200 indicators have been assembled. Secondly, this research have selected and allocated indicators collected by approach 1 with specific logic mentioned later.



Current State and Direction

As the logic of selecting and allocating mentioned, this research employs Impact Chain(giz(2014): The Vulnerability Sourcebook). Firstly with Impact Chain, we identifies the direct impact of climate change in each sector as the image of Impact chain. Secondly we gets the exposures which would suffer from those impact, thirdly decides indicators of reginal vulnerability as the charts of vulnerability indicators.
As the next step, we will identify the indicators in other sectors, for example disaster and water resource, and collect regarding data, then try to order the priorities of indicators with some measure including expert judge.



＜Impact Chain (Rice Product)＞

Impact	Direct Impact	Exposure	Vulnerability	Vulnerability Indicators	Priority (Example)
Economic loss on rice product	Reduction on yield and quality	Rice itself	Sensitivity	Percentage of area which cropped by the rice of high-temperature-tolerant	100
			Adaptive Capasity	Condition of recognision by rice farmers on impact of climate change and adaptation measures	–
				Condition of development about the rice with high-temperature-tolerant	50
				Condition of implementation of adaptation measures	50
	Degradation on health condition of farmers	Farmers of rice	Sensitivity	Percentage of aged person in rice farmers	100
				Mutual condition of farmers	50
			Adaptive Capasity	Condition of recognition on countermeasures on heat-related illness for rice farmers	–
				Condition of implementation of adaptation measures on heat-related illness for rice farmers	50
	Shortage of agricultural water	Agricultural water of rice	Sensitivity	Percentage of water for rice product on all agricultural water	50
			Adaptive Capasity	Condition of recognision by rice farmers on impact of climate change and adaptation measures	–
				Condition of development about efficient management method of agricultural water	50
				Condition of implementation of adaptation measures on efficient management method of agricultural water	50

＜ Vulnerability Indicators (Rice Product)＞

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