Preliminary Research on
Low Carbon Society Scenario for Semarang

2 November, 2017

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We are here
ประเทศไทย
Thailand
Laos
Việt Nam
Vietnam
กรุงเทพมหานคร
Bangkok
กัมพูชา
Cambodia
Hồ Chí Minh
Andaman Sea
Gulf of Thailand
Luzon
Pilipinas
Philippines
Pulo ng Leyte
Negros
Palawan
Mindanao
Basilan
Malaysia
Kuala Lumpur
Singapore
Celebes Sea
BANDA ARC
Indonesia
Java Sea
Jakarta
Semarang City
Banda Sea
Arafura Sea

Semarang in 100RC program

100RC is initiated by the Rockefeller Foundation aim to helping **cities** around the world become more resilient

Semarang is the first city in Indonesia who join in 100RC network with the other 99 cities

100RC program adopts a comprehensive definition of urban resilience in the face of shocks and stresses in various fields

Semarang has a City Resilience Strategy in the context of climate change in 2010, need to be updated with more comprehensive and inclusive approach in the making.

The City Resilience Strategy is in parallel with the Semarang Mid Term Development Plan 2016-2021 who is also in the making

Support from 100 rc program

Providing support to the city of Semarang through a CRO who will lead the preparation of city resilience strategy (CRS / City Resilient Strategy)

Provide assistance and advisory support to the city of Semarang through Mercy Corps Indonesia as strategy partner

Providing access to the platform partners, a resource for the development and implementation of future strategies

Membership in the international 100RC network for knowledge sharing and collaboration.

100 RESILIENT CITIES

Phase 1

(December 2014- October 2015)

Preliminary Resilience Assessment (PRA) + Discovery Resilience Areas

Phase 2

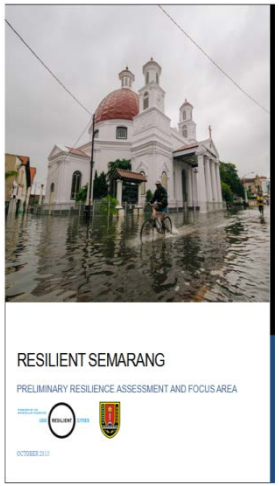
(November 2015- May 2016)

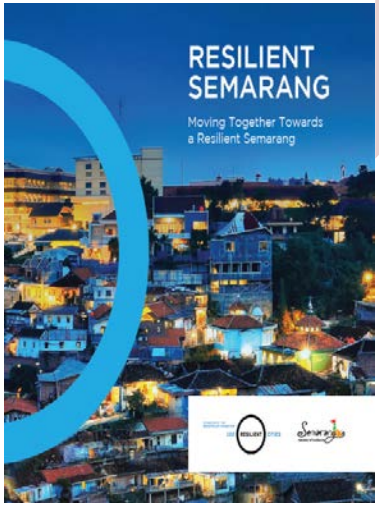
City Resilience Strategy

Phase 3

Implementation

(on going)





100RC Semarang team

LCS : Part of Initial action toward Semarang City resilience

Collaborative work of Semarang and Japan

Objective

- Support developing and accelerating a climate change action plan in Semarang by quantitative analysis with integrated modeling approach
- Capacity building and knowledge transfer of Low Carbon Society (LCS) scenario development and implementation

Research Team

Semarang City

Local Government

Development Planning Agency (Bappeda)

University

Diponegoro University

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AIM team, Japan

Ministry of Environment Japan

Institute for Global Environmental Strategies

National Institute for Environmental Studies, Japan

Consulting firm

E-Konzal Co. Ltd.

Mizuho Information and Research Institute, Inc.

Before Joint with

LCS team

Simple modeling of green house effect #9

If we take the value:

Fs = 341.5 W m-²
A = 0.3
Tvis = 0.8
T_{IR} = 0.1

$$TE = \left(Fs \frac{(1-A)(1+Tvis)}{\sigma(1+TIR)} \right)^{1/4}$$

T_E = 288.2 K (+ 15.2⁰C)

Component
Nitrogen (N2)
Oxygen (02)
Argon (Ar)
Carbon dioxide (CO2)
Neon (Ne)
Helium (He)
Methane (CH4)
Crypton (Kr)

Earth
0.03 % of Co_2 in the atmosphere
Average temperature : + 15⁰C

Simple modeling of green house effect #1

If we take the value:

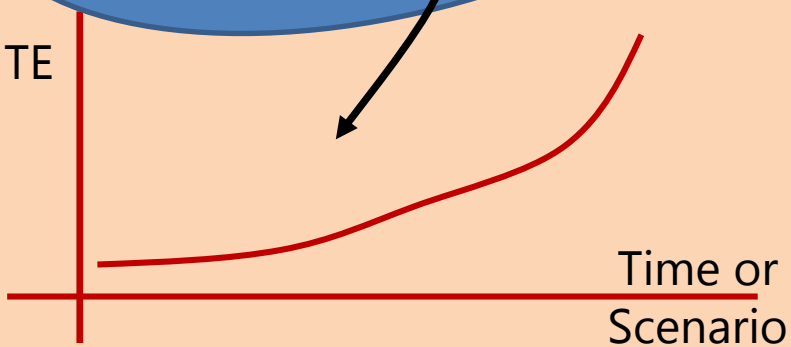
Fs = 341.5 W m-²
A = 0.3
Tvis = 0.8
T_{IR} = 0.1

$$TE = \left(Fs \frac{(1-A)(1+Tvis}{\sigma(1+TIR)} \right.$$

Scenario	1	2	3	4	5	6	7	8
Fs	1366							
A	0.3							
Tvis	0.8							
T_{IR}	0.1							
T_E(K)	288.2							

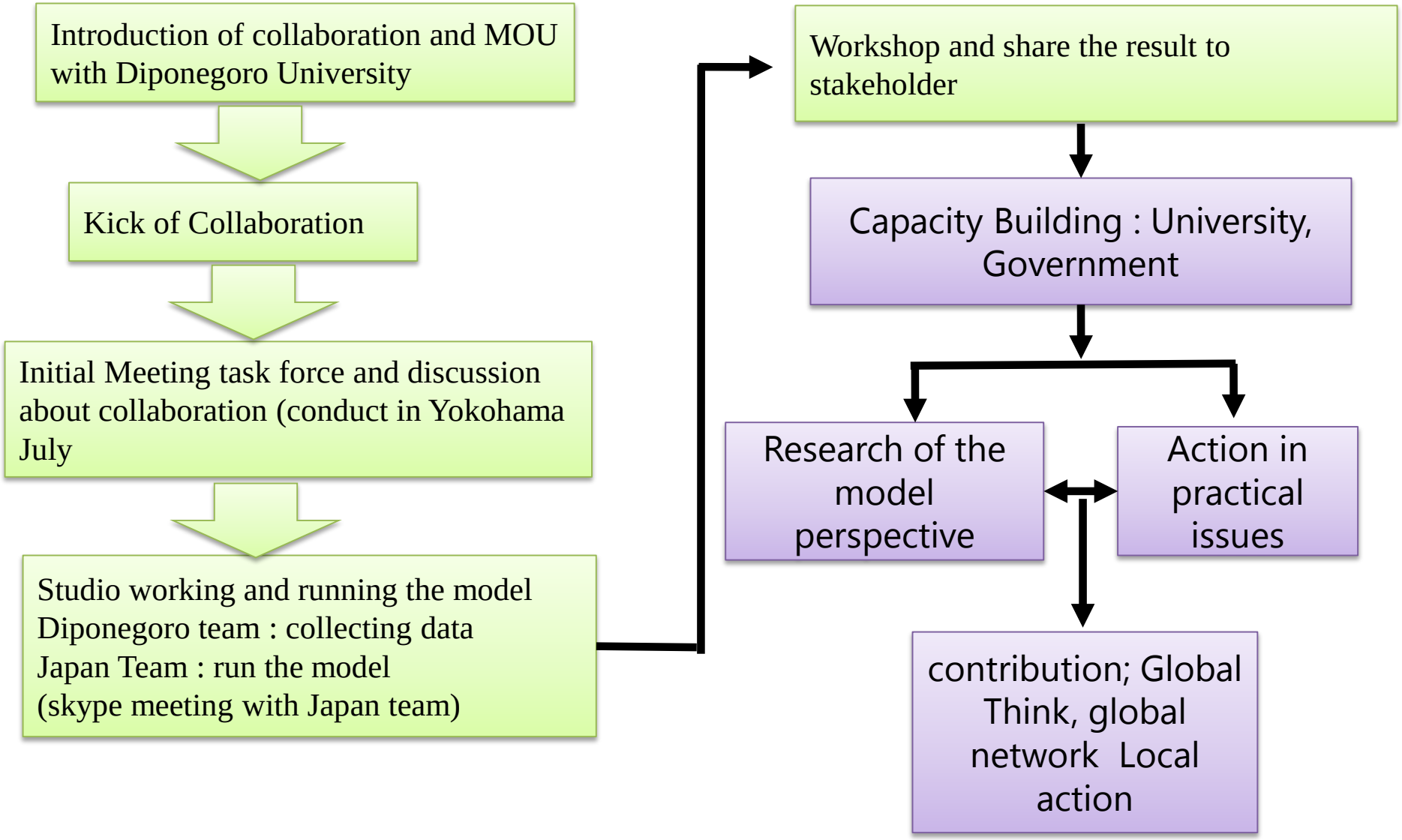
Scenario for 100 or 1000 years ?

My Student and Government Officer with zero understanding of climate change is very impression when the can calculate by them self and look the result grafic on excel



Joint with LCS team

2. Collaboration with IGES (Japan Team) : Step in Collaboration



Discussion in ISAP-yokohama,
July 23, 2017

Kick of Collaboration
August 15, 2017

Internal Workshop, 18 August
2017 Diponegoro team

Studio team in
Diponegoro University

What is Low Carbon Society Scenario?

A kind of guides to show how to realize an attractive society with low/no GHG emission in future.

LCS Scenario

Current Status

Grasp the current situation

- Population
- Economy
- Transport
- Energy
- CO_2

Identify how to achieve the vision

- LCS target
- LCS Action
- LCS Project/Measure

Future Vision

Design and analyze desirable future

- Population
- Economy
- Transport
- Energy
- CO_2

Methodology

1. Start of the Story
1.1 Formulation of the region's top initiative
1.2 Resource allocation

- Authorize task force
- Human resource, budget plan of research

2. Framework Setting
2.1 Background research
2.2 Framework setting

- Existing policies, plans, and studies, national and regional circumstances etc.
- Timeframe, scope and boundary

3. Data Preparation
3.1 Collection of statistical data and future plan
3.2 Estimation of necessary data in base year
3.3 Assumption of future change of the society

- Related statistics, reports and preliminary surveys
- Demography, macro economy, industrial structure etc.

4. Design of LCS Projects and Projection of Future Scenario
4.1 Projection of BaU scenario by quantification tools, ExSS
4.2 Listing of LCS projects
4.3 Calculation of emission reduction by project
4.4 Projection of LCS policy scenario by quantification tools
4.5 Adjustment of project-based emission reduction

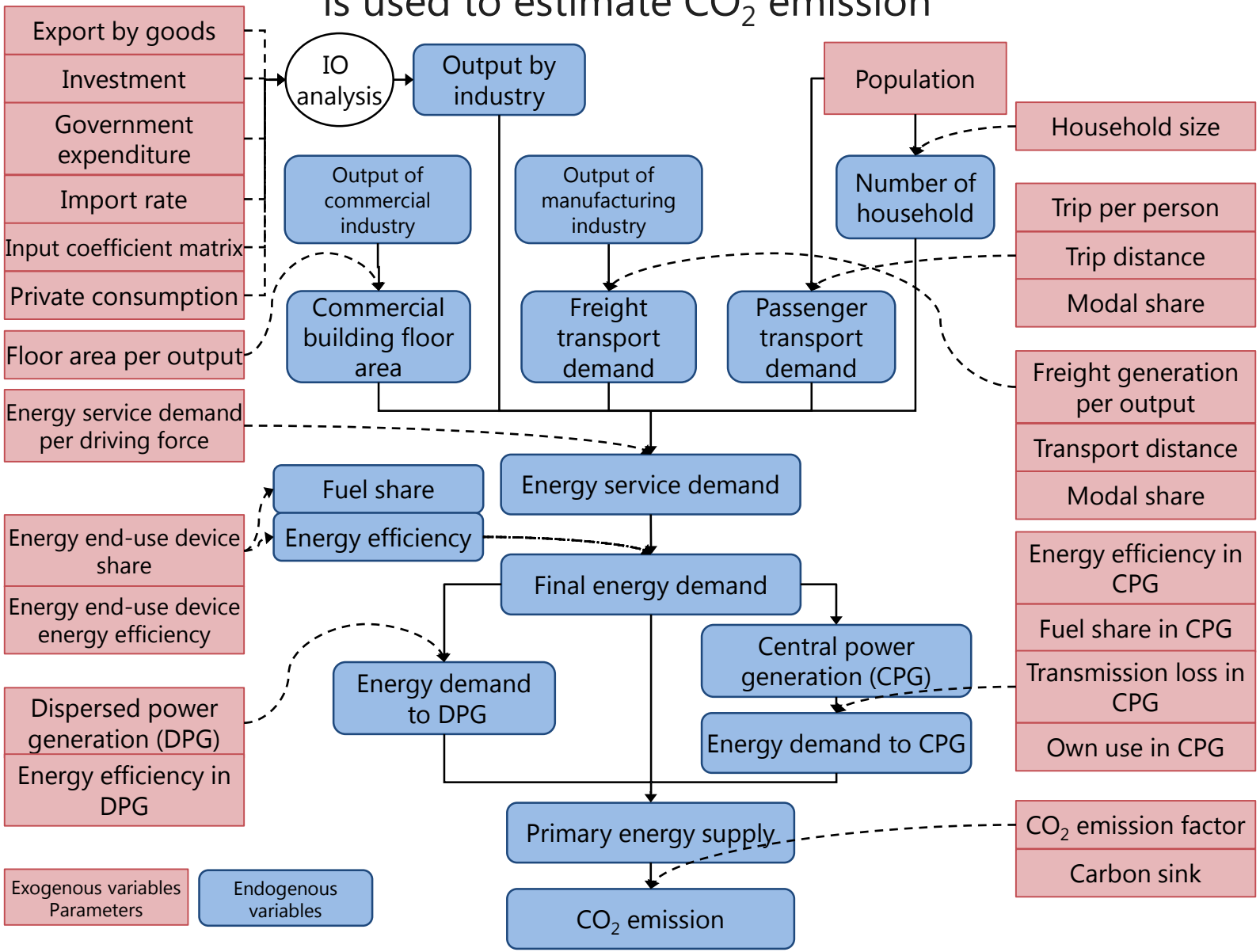
- Adjusting of methodologies, tools and software
- Existing projects and projects
- Identify parameters and indicators on GHG and non-GHG effects

5. Bridging the Output to Real World
5.1 Formulation of Actions and projects for implementation
5.2 Reporting the result to policy makers

- Make priority list of actions and projects based on the analysis
- Construct ABS for realizing LCS
- Summarize the whole outputs to a brochure/report

Model Structure of Extended Snapshot Tool

Extended Snapshot Tool (ExSS), developed by AIM team, is used to estimate CO_2 emission



Framework of the research

Framework

Base year	2015
Target year	2030
Types of GHG	CO_2

Target activities	Fuel combustion • Industry sector • Commercial sector • Residential sector • Transport sector
Types of scenarios	• BaU scenario • CM scenario

Scenarios

BaU (Business as Usual) Scenario

- Social and economic development based on future plan of the region
- Without implementation of LCS policy in future

LCS Scenario / CM (Countermeasure) Scenario

- Same assumption as BaU scenario about social and economic development
- With implementation of LCS policy

Data Preparation

A variety of data and information of Semarang, Central Jawa and Indonesia were collected to prepare input data for ExSS

	Source
Population and household	■ Badan Pusat Statistik, Kota Semarang (2016): Kota Semarang dalam Angka Tahun 2016. ■ Demographia (2010): Demographia World Urban Areas Population Projections (From 6th Edition of World Urban Areas).
Macro economy	■ Badan Pusat Statistik, Kota Semarang (Website): [2010 Version] GRDP At Current Market Prices by Industrial Origin Per Sector-Sub Sector in Semarang Municipality, 2008 - 2016. ■ Badan Pusat Statistik, Kota Semarang (Website): [2010 Version] GRDP of Semarang Municipality at Current Market Prices [2010] by Type of Expenditure (Million Rupiahs), 2010 - 2016. ■ Bappeda, Provinsi Jawa Tengah and Badan Pusat Statistik, Provinsi Jawa Tengah (2015): Table Input Output Jawa Tengah 2013. ■ Kota Semarang (2004): Rencana Detail Tata Ruang Kota - Kota Semarang Tahun 2000 - 2010 (Bagian Wilayah Kota I - X). ■ Coordinating Ministry for Economic Affairs, Indonesia (2011): Masterplan for Acceleration and Expansion of Indonesia's Economic Development 2011-2025.
Transport	■ Kecamatan Dalam Angka Kota Semarang Tahun 2016 dan. ■ Badan Pusat Statistik, Kota Semarang (Website): Kind of Vehicles in Semarang City, 2005-2014. ■ Sugiono, A (2012): Prakiraan Kebutuhan Energi Untuk Kendaraan Bermotor di Perkotaan: Aspek Permodelan. Jurnal Sains dan Teknologi Indonesia Vol. 14, No. 2, Agustus 2012, Hlm. 104-109. ■ Badan Pusat Statistik, Indonesia (2017): Statistik Indonesia 2017. ■ Indonesia 2050 Pathway Calculator – Panduan Pengguna untuk Sektor Transportasi –.
Energy	■ Pemerintah Kota Semarang (2012): Profil emisi GRK Kota Semarang Tahun 2010 - 2020. ■ Pemerintah Kota Semarang (2014): Inventarisasi Emisi Gas Rumah Kaca Kota Semarang Tahun 2009-2014. ■ Ministry of Energy and Mineral Resources, Indonesia (2017): Handbook of Energy & Economic Statistics of Indonesia 2017. ■ International Energy Agency (2017): World Energy Balance 2017. ■ Bandung Institute of Technology & Kyoto University (2013): Technical Report of Low Carbon Society Scenarios Indonesia 2020 and 2050. ■ Ministry of Energy and Mineral Resources, Indonesia (2015): Power Policy and National Development Plan in Indonesia

Socioeconomic indicators

- Population will amount to 2 million in 2030.
- GRDP per capita will be increased by about 5 times compared to 2015.

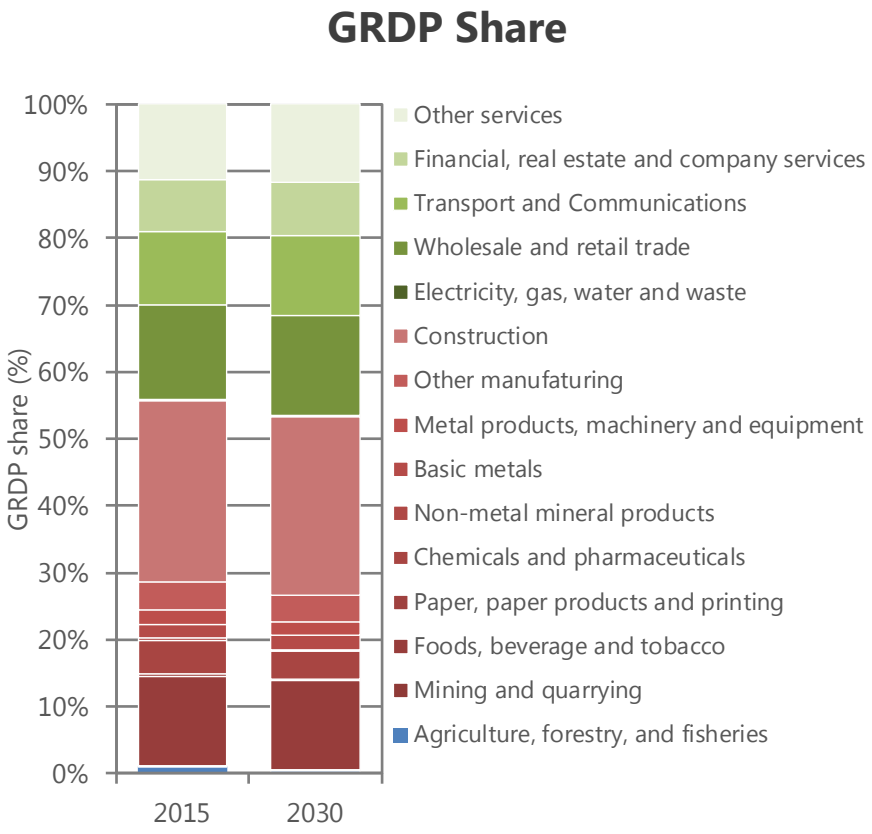
	Unit	2015	2030	2030/2015	CAGR
Population	persons	1,595,267	2,060,000	1.29	1.52%
No. of households	households	471,327	686,667	1.46	2.24%
GRDP per capita	mil. Rp	84	405	4.81	9.68%
GRDP	bil. Rp	134,207	834,197	6.22	11.35%
Primary		1,373	3,590	2.61	5.82%
Secondary		73,340	440,906	6.01	11.13%
Tertiary		59,493	389,701	6.55	11.69%
Outputs	bil. Rp	50,252	330,043	6.57	11.71%
Gross fixed capital formation	bil. Rp	99,697	607,179	6.09	11.21%
Export	bil. Rp	37,563	228,772	6.09	11.21%
Import	bil. Rp	114,672	690,811	6.02	11.14%
Commercial floor area	thous m^2	50,252	330,043	6.57	11.71%
Passenger transport demand	mil. pass-km	18,342	28,422	1.55	2.61%
Freight transport demand	mil. ton-km	3,391	20,307	5.99	11.10%

GRDP

- GRDP in 2030 will become 6 time as large as that in 2015.
- Secondary sector will still be main industry, though remarkable growth of tertiary sector.

GRDP by sector (bil. Rp)

	2015	2030	2030 /2015
Primary	1,373	3,590	2.61
Secondary	73,340	440,906	6.01
Mining and quarrying	261	1,414	5.41
Foods, beverage & tobacco	17,885	110,507	6.18
Paper, paper products & printing	408	2,165	5.30
Chemicals & pharmaceuticals	6,785	35,783	5.27
Non-metal mineral products	459	1,490	3.24
Basic metals	2,840	17,264	6.08
Metal products, machinery & equipment	2,804	17,162	6.12
Other manufacturing	5,695	32,959	5.79
Construction	36,201	222,162	6.14
Tertiary	59,493	389,701	6.55
Electricity, gas, water & waste	250	1,658	6.62
Wholesale & retail trade	18,966	124,395	6.56
Transport & Communications	14,669	99,352	6.77
Financial, real estate & company services	10,452	67,700	6.48
Other services	15,157	96,597	6.37
Total	**134,207**	**834,197**	**6.22**

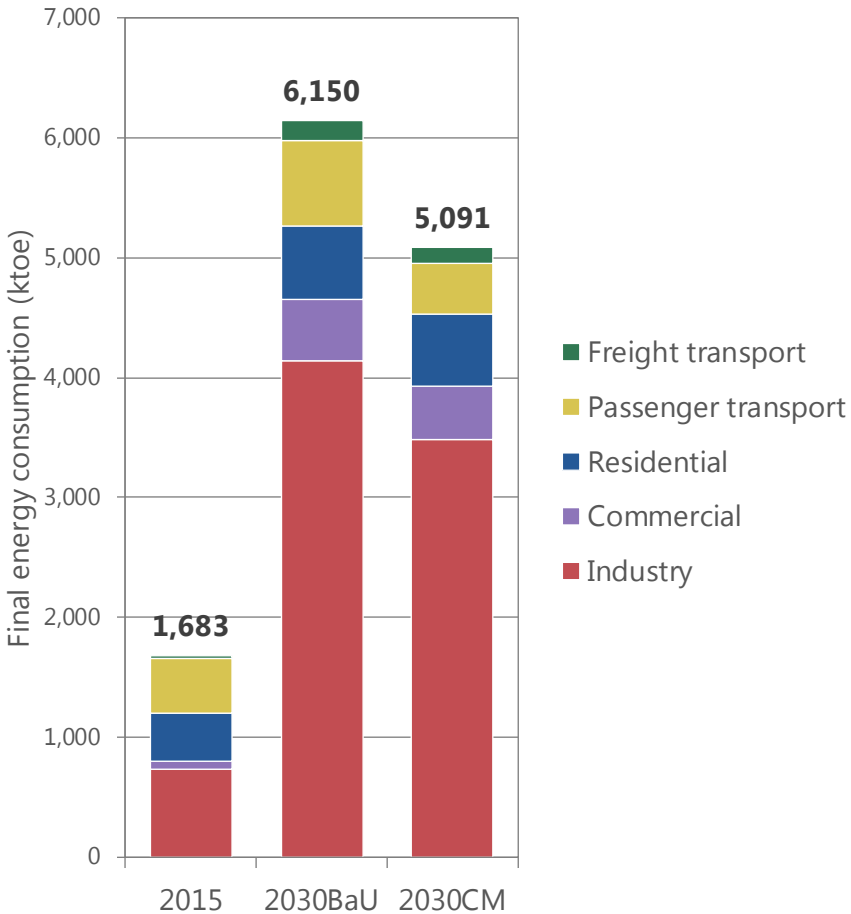


Energy consumption

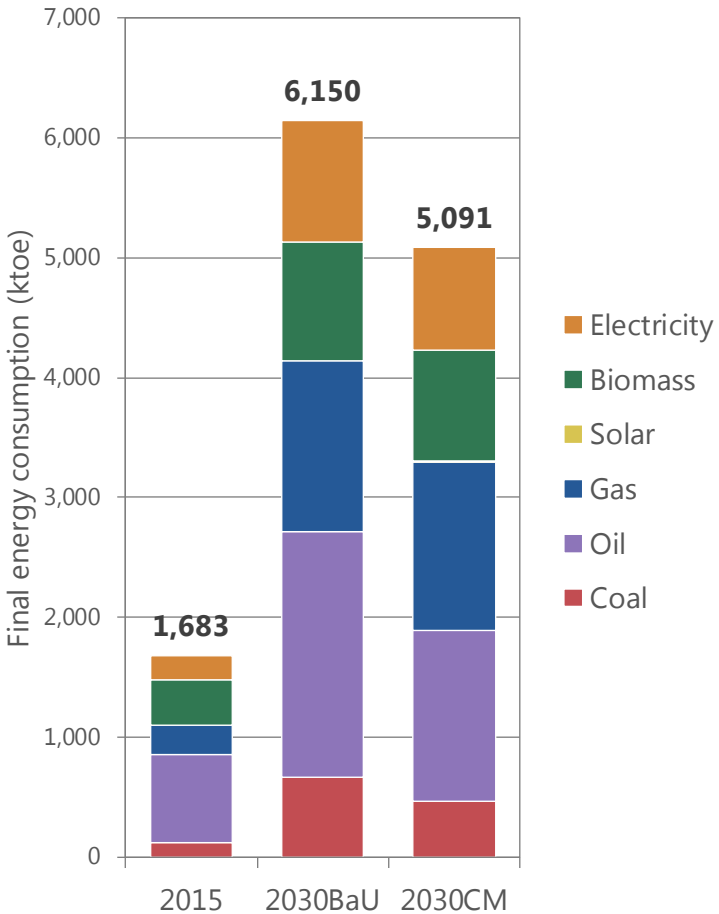
- Energy consumption in BaU scenario will increase by 3.7 times as much as 2015.
- In CM scenario, Energy consumption can be reduced by 27%.
- Share of natural gas and electricity is increased in CM scenario.

Final energy consumption

<by Sector>



<by Fuel type>

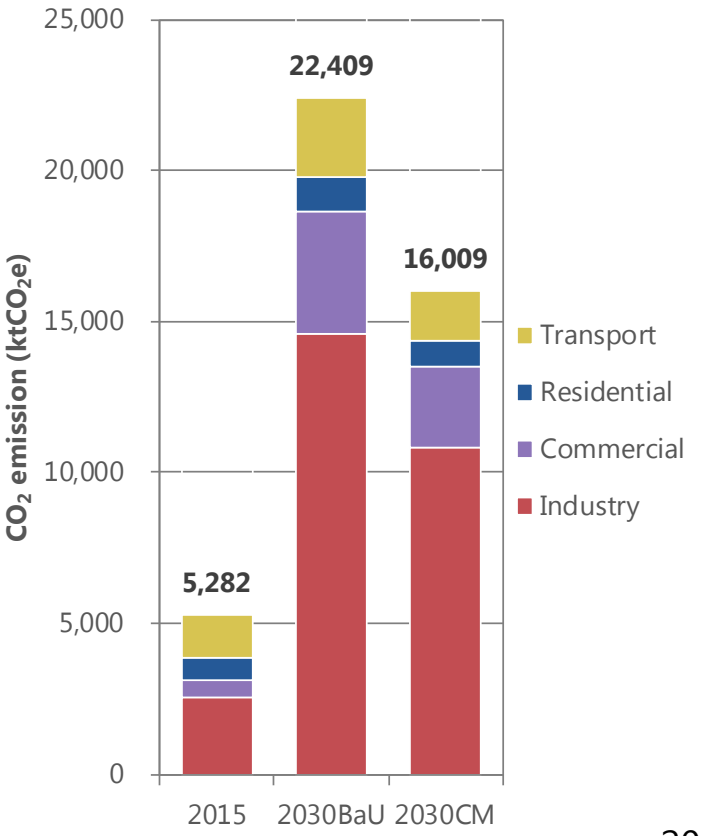


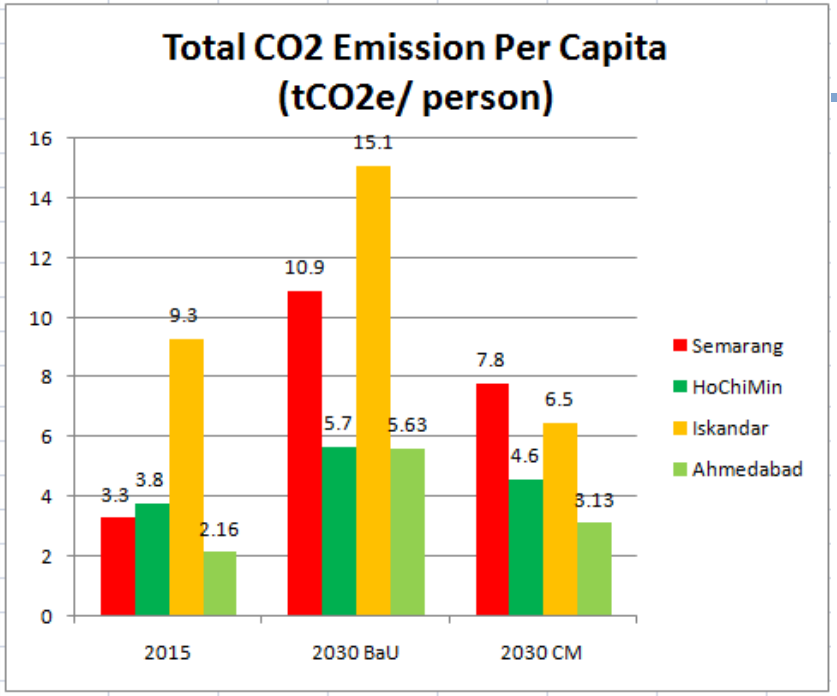
Carbon emission

- CO_2 emission in BaU scenario will amount to 4.2 times as much as 2015.
- In CM scenario, CO_2 emission can be reduced by 29%.
- The passenger transport sector and the commercial sector will lead emission reduction.
- Semarang City has a potential to reduce CO_2 emission corresponding to INDC of Indonesia

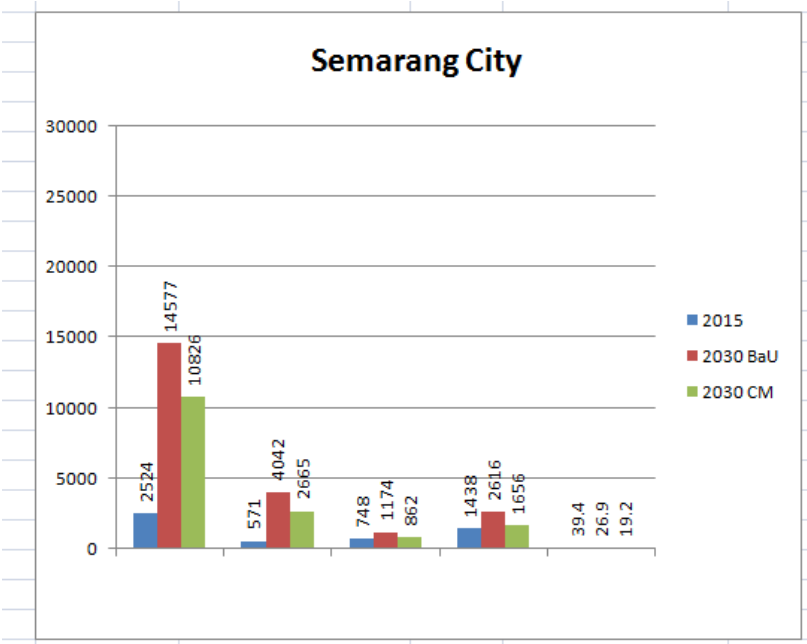
CO_2 emission by sector

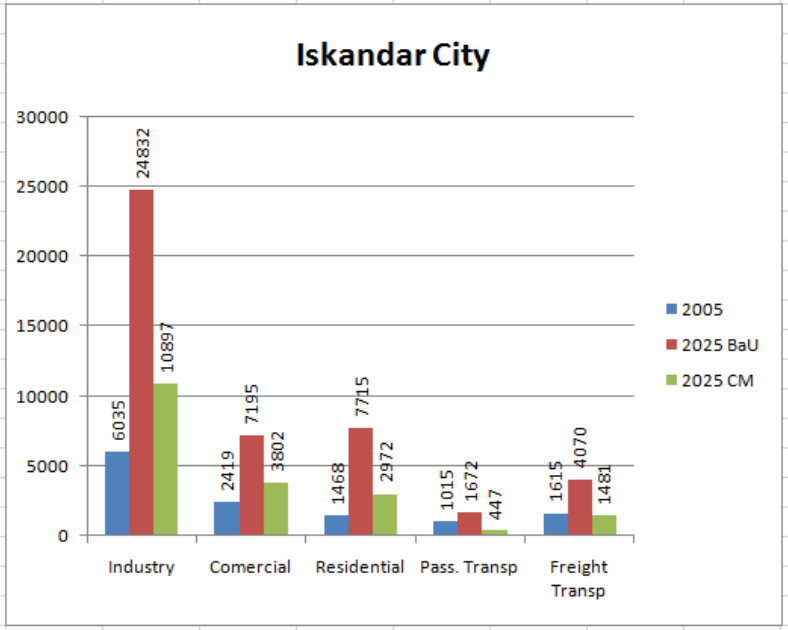
	2015	2030 BaU	2030 CM	BaU /2015	CM /BaU
CO_2 emission ($ktCO_2e$)	**5,282**	**22,409**	**16,009**	**4.24**	**0.71**
Industry	2,524	14,577	10,826	5.77	0.74
Commercial	571	4,042	2,665	7.08	0.66
Residential	748	1,174	862	1.57	0.73
Passenger transport	1,438	2,616	1,656	1.82	0.63
CO_2 emission per GDP (tCO_2e/bil.Rp)	**39.4**	**26.9**	**19.2**	**0.68**	**0.71**
CO_2 emission per capita (tCO_2e/person)	**3.3**	**10.9**	**7.8**	**3.29**	**0.71**





Comparing the result with previous research





CO_2 reduction by action/project

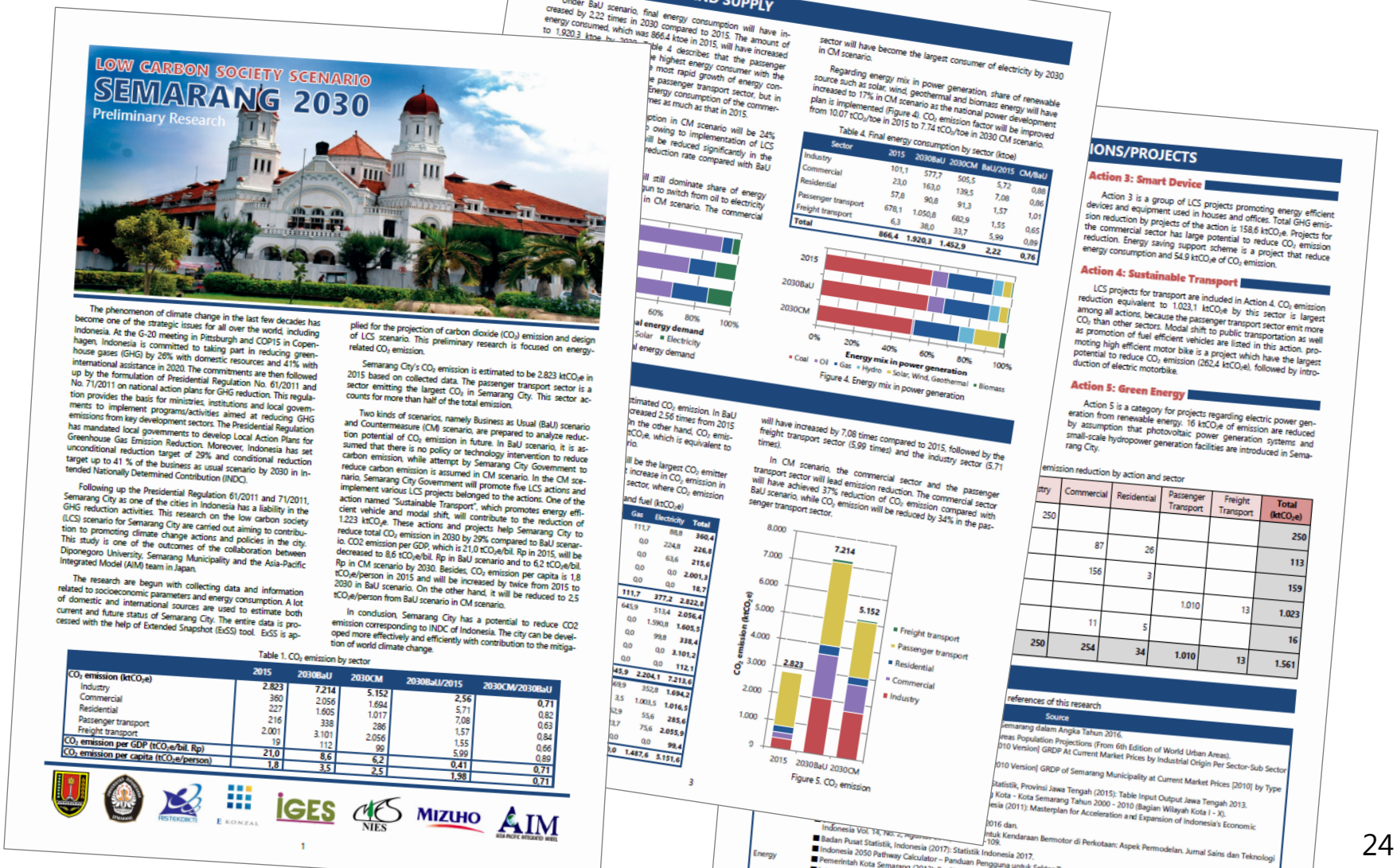
Action		Project	Sector	Emission reduction ($ktCO_2eq$)
1 Green Industry	1-01	Energy saving support scheme such as ESCO (Energy Saving COmpany) project for industries	Industry	964.6
	1-02	Installation high energy efficiency facilities	Industry	346.6
	1-03	Regional energy supply system	Industry	489.7
	1-04	Improvement of kiln and furnace technology	Industry	692.3
	1-05	Promotion of fuel shift of furnaces and boilers from coal to natural gas	Industry	58.8
		Total		**2,552.0**
2 Smart Building	2-01	Installation of insulated glasses to commercial buildings	Commercial	84.1
	2-02	Installation of insulated glasses to households	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 commercial 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 such as ESCO (Energy Saving COmpany) project for commercial 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 (such as air conditioners with inverter controllers) in commercial buildings	Commercial	137.3
	3-05	High efficiency air conditioners (such as air conditioners with inverter controllers) in households	Residential	33.7
	3-06	Promotion of energy-efficient appliances	Residential	23.1
		Total		**434.1**

CO_2 reduction by action/project

Action		Project	Sector	Emission reduction ($ktCO_2eq$)
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 transportation	Transport	96.2
	4-04	Development of public transportation like railway and 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 vehicles (cars for passenger)	Transport	452.3
	4-08	Promotion of energy-efficient vehicles (motorbikes)	Transport	86.7
	4-09	Promotion of energy-efficient vehicles (trucks)	Transport	112.8
		Total		**950.1**
5 Green Energy	5-01	Introduction of photovoltaic power generation to commercial buildings	Commercial	24.3
	5-02	Introduction of photovoltaic power generation to households	Residential	9.7
	5-03	Introduction of small-scale hydropower generation (at water distribution stations)	Commercial	1.7
		Total		**35.7**
Improvement of CO2 emission factor of electricity				**2,179.1**
Total				**6,399.5**

Summarize output to the brochure

- Output of this preliminary research is summarized into the brochure. (Now printing)
- We will launch it in COP23.



Next step

- Re-Analysis of the Model structure
- Re check -Data Need Investigation and Assessment
- Re check availability of Data
- Re-Running the model and discussing the scenario
- Discussion with student and other academic view point
- Discussion with stakeholder concerning to practical utilization
- Considering local action concerning to local condition
- Fostering collaboration in local, national, Regional and global action in any possibility of situation

Thanks you so much for attention