Low carbon scenarios in 2050, Korea

- An Application of Energy Snapshot Tool and Backcasting model-

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Contents

Background

Why We Concentrate in Two Sectors

Renewable Energy in Residential Area (Solar Energy)

- Essential Factor for LCS in residential area

- Korean government Request to make roadmap

Transportation Sector

- Lots of Energy wasted on the road

- Construct more roads are not a solution

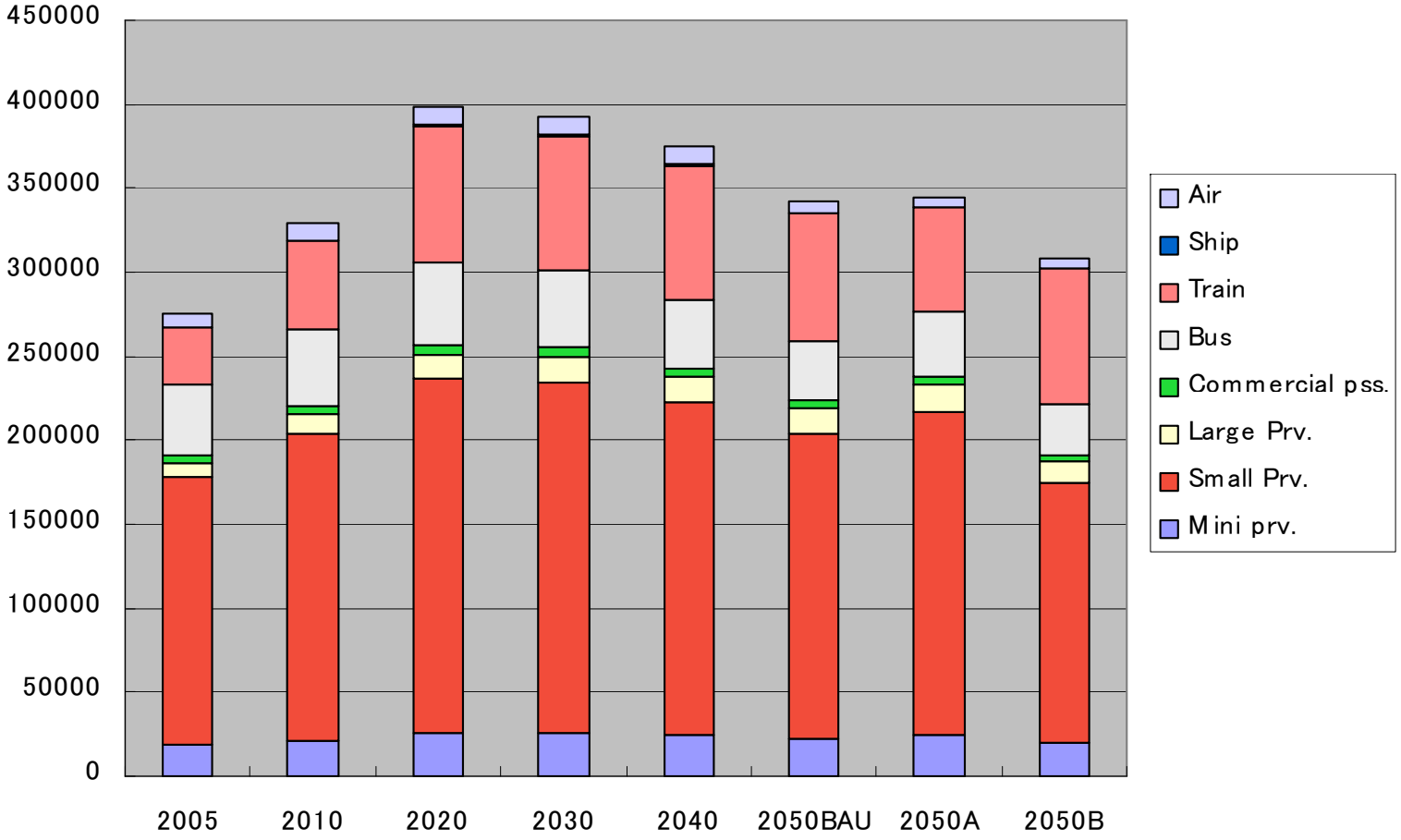
LCS Scenario Outline

	2000	Scenario (2050)
GDP (annual)	4.20%	2.98%
Population('000)	48,183	43,623
Household('000)	15,971	18,252
Average family members	2.89	2.39
Urbanization rate	80.8%	88%
Market	- Regulations	- Adequate rules and regulations
Life style	- Convenient lifestyle	- Reducing the attraction towards apartment complex

Passenger transportation Sector

- Scenario taking demand change into consideration the bike-related policy announced by Ministry of Government Administration and Home Affairs

(Unit : mil-passenger/Km)



Assumption before Start Modeling

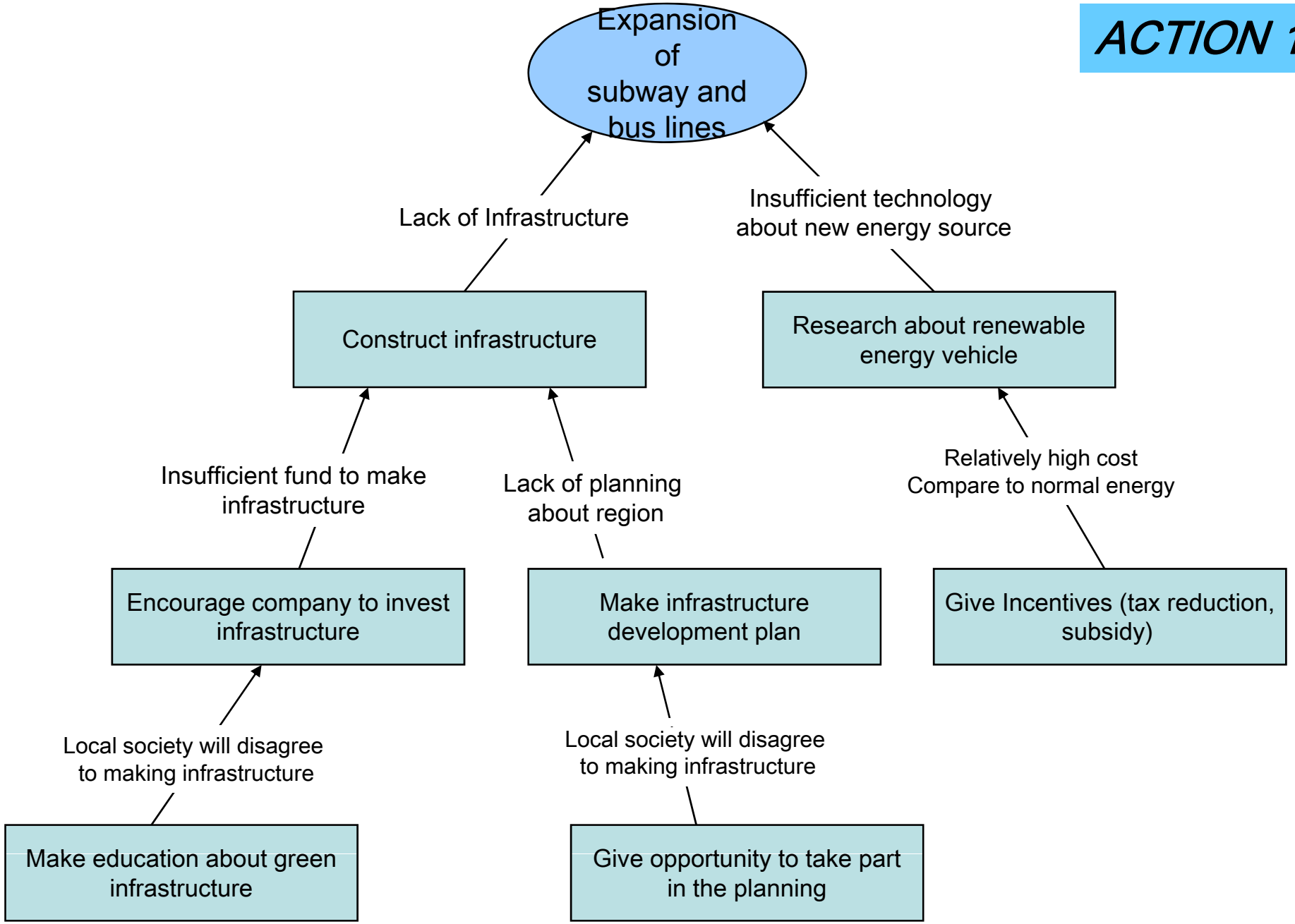
-Demands of each energy source basically follows linear modeling.

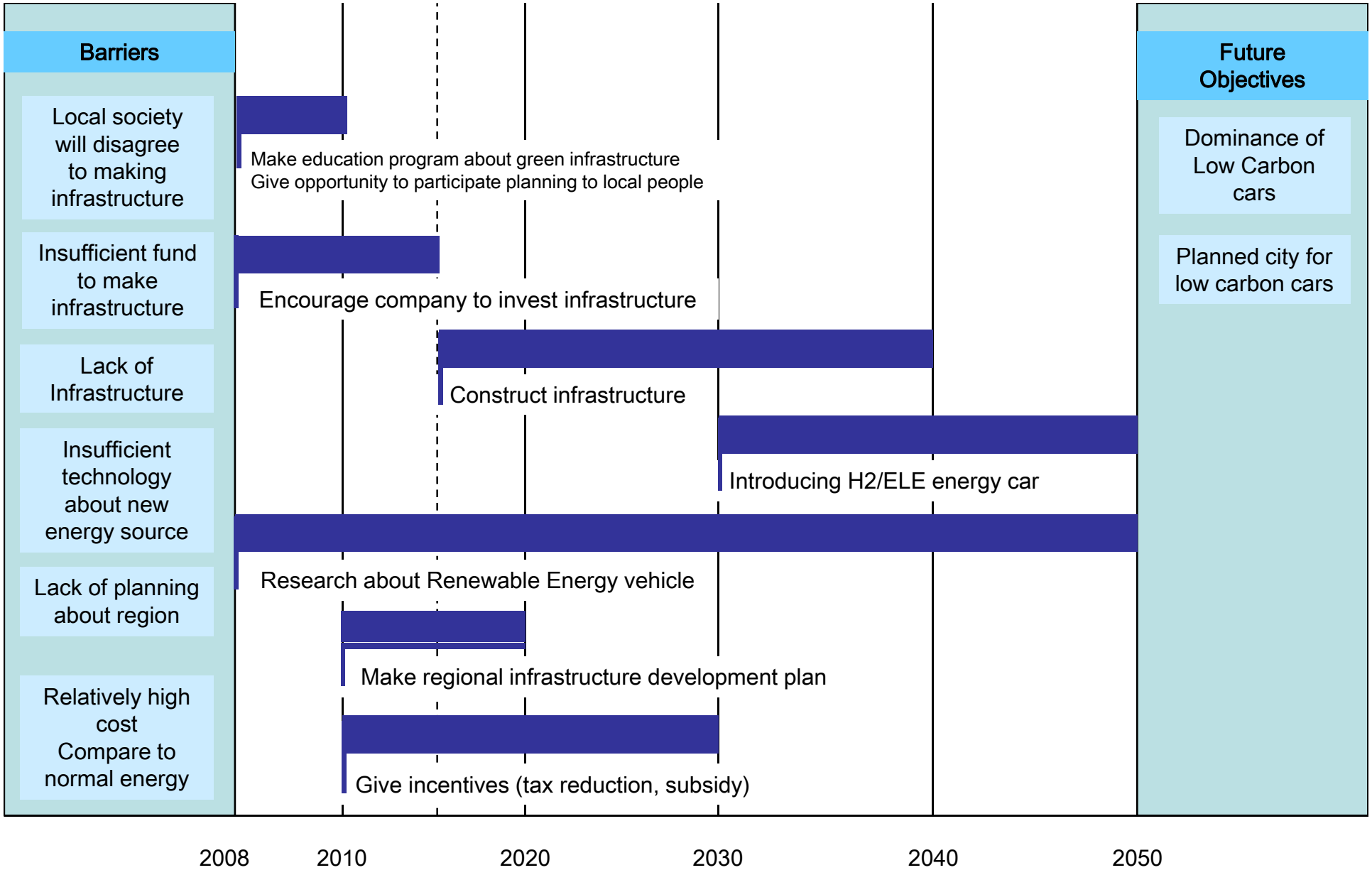
- We merely consider about reducing CO2 in the passenger transportation area and residential area.

WE DID NOT COUNT IN FINANCIAL FACTORS IN OUR MODEL AND OTHER FACTORS

Transportation Sector

ACTION 1


Expansion of subway and bus lines
Lack of Infrastructure
Insufficient technology about new energy source
Construct infrastructure
Research about renewable energy vehicle
Insufficient fund to make infrastructure
Lack of planning about region
Relatively high cost Compare to normal energy
Encourage company to invest infrastructure
Make infrastructure development plan
Give Incentives (tax reduction, subsidy)
Local society will disagree to making infrastructure
Local society will disagree to making infrastructure
Make education about green infrastructure
Give opportunity to take part in the planning


Barriers
Local society will disagree to making infrastructure
Insufficient fund to make infrastructure
Lack of Infrastructure
Insufficient technology about new energy source
Lack of planning about region
Relatively high cost Compare to normal energy
Make education program about green infrastructure
Give opportunity to participate planning to local people
Encourage company to invest infrastructure
Construct infrastructure
Introducing H2/ELE energy car
Research about Renewable Energy vehicle
Make regional infrastructure development plan
Give incentives (tax reduction, subsidy)
Future Objectives
Dominance of Low Carbon cars
Planned city for low carbon cars
2008
2010
2020
2030
2040
2050

Future Objectives

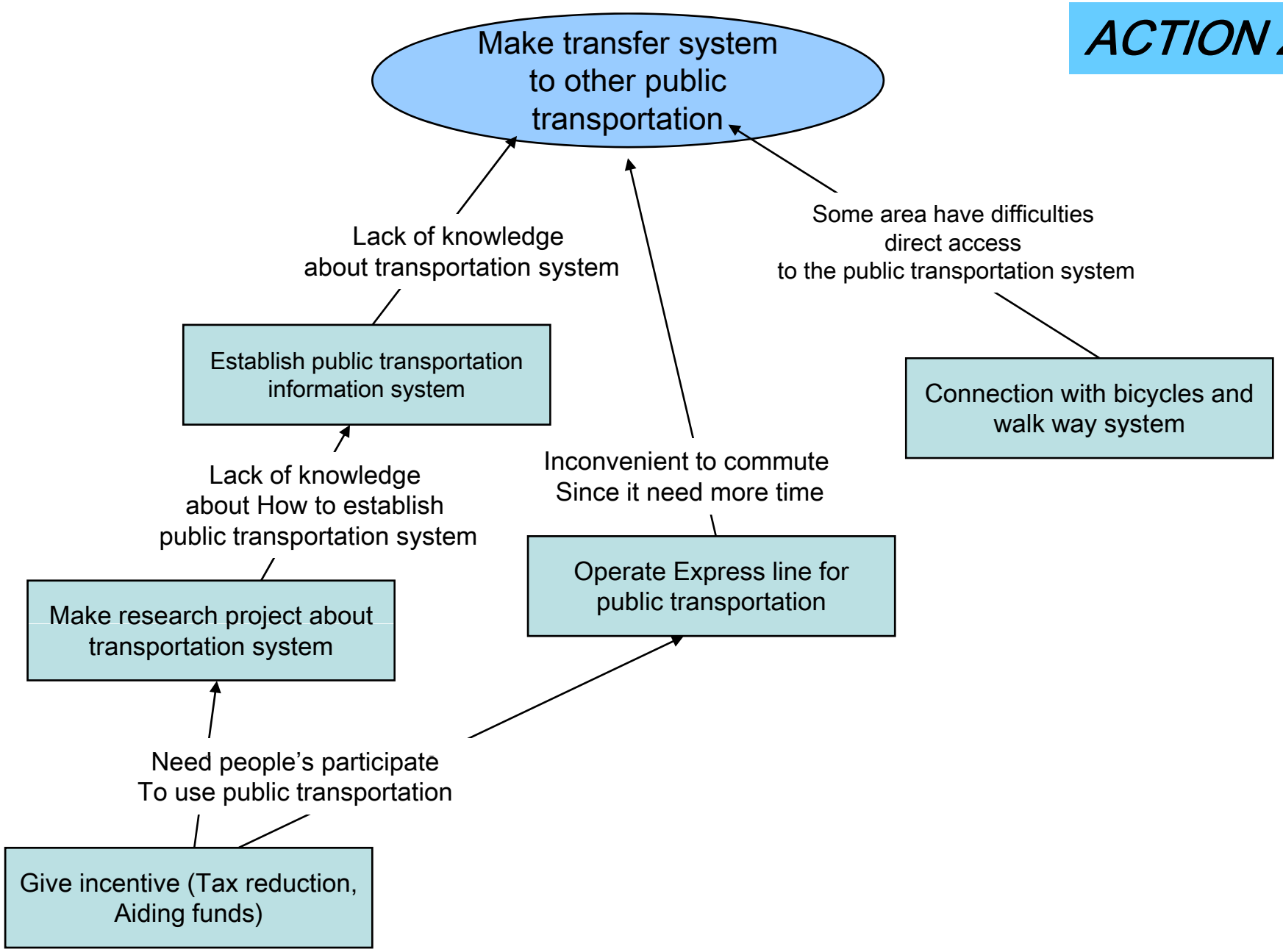
Dominance of Low Carbon cars

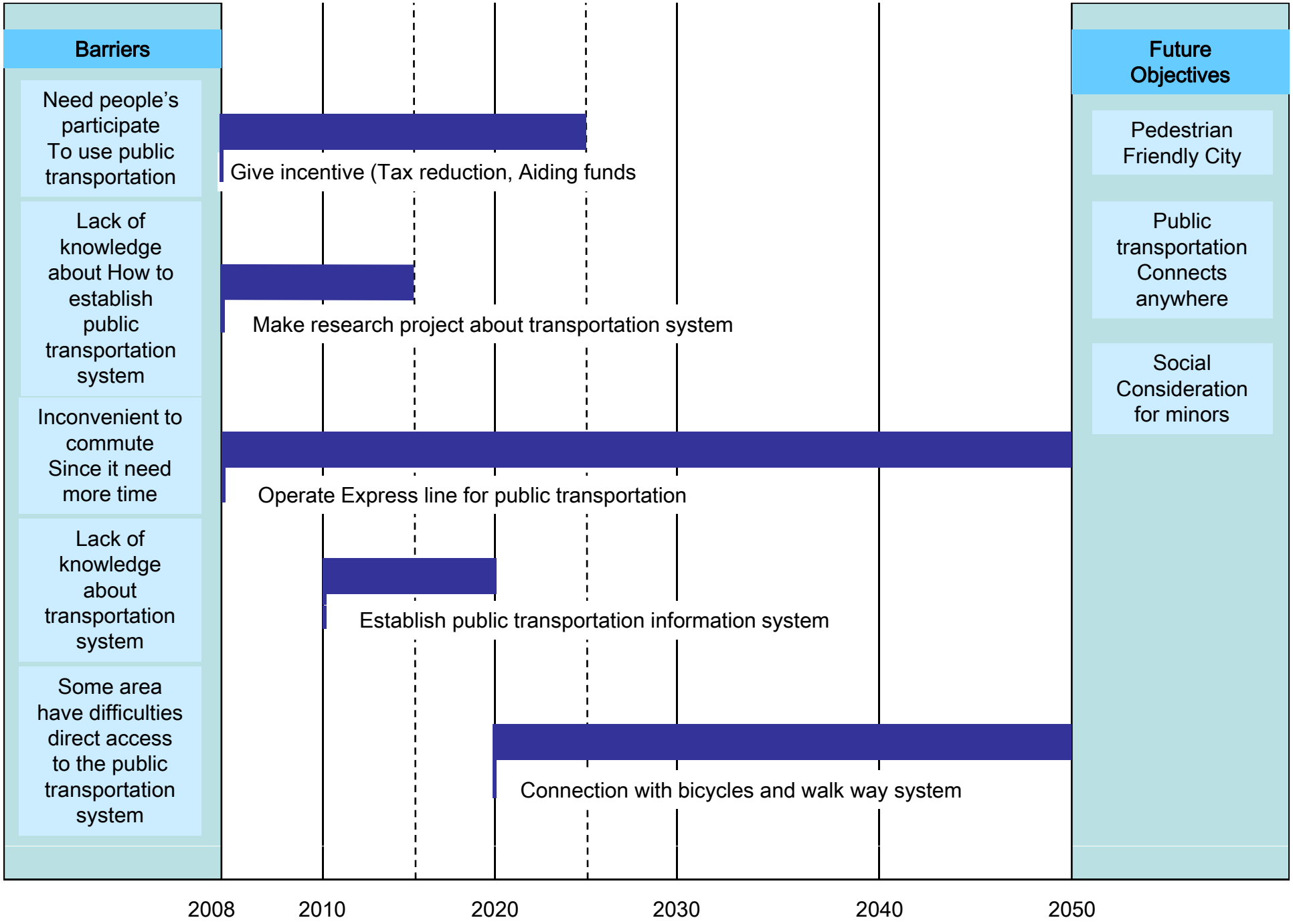
Most of demand for fossil fuel cars will substitute to low carbon car. This causes about 70% reduction of CO2 emission when compared to BAU. Because of changing type of household, it's much reasonable to have smaller car. It could have more CO2 reduction potential

Planned City for Low carbon cars

As low carbon car popular, it would bring many changes. For instance, social infrastructure will be changed that fits to the low carbons cars.

ACTION 2


Make transfer system to other public transportation
Lack of knowledge about transportation system
Some area have difficulties direct access to the public transportation system
Establish public transportation information system
Connection with bicycles and walk way system
Lack of knowledge about How to establish public transportation system
Inconvenient to commute Since it need more time
Make research project about transportation system
Operate Express line for public transportation
Need people's participate To use public transportation
Give incentive (Tax reduction, Aiding funds)


Barriers
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Connection with bicycles and walk way system
Future Objectives
Pedestrian Friendly City
Public transportation Connects anywhere
Social Consideration for minors
2008
2010
2020
2030
2040
2050

Future Objectives

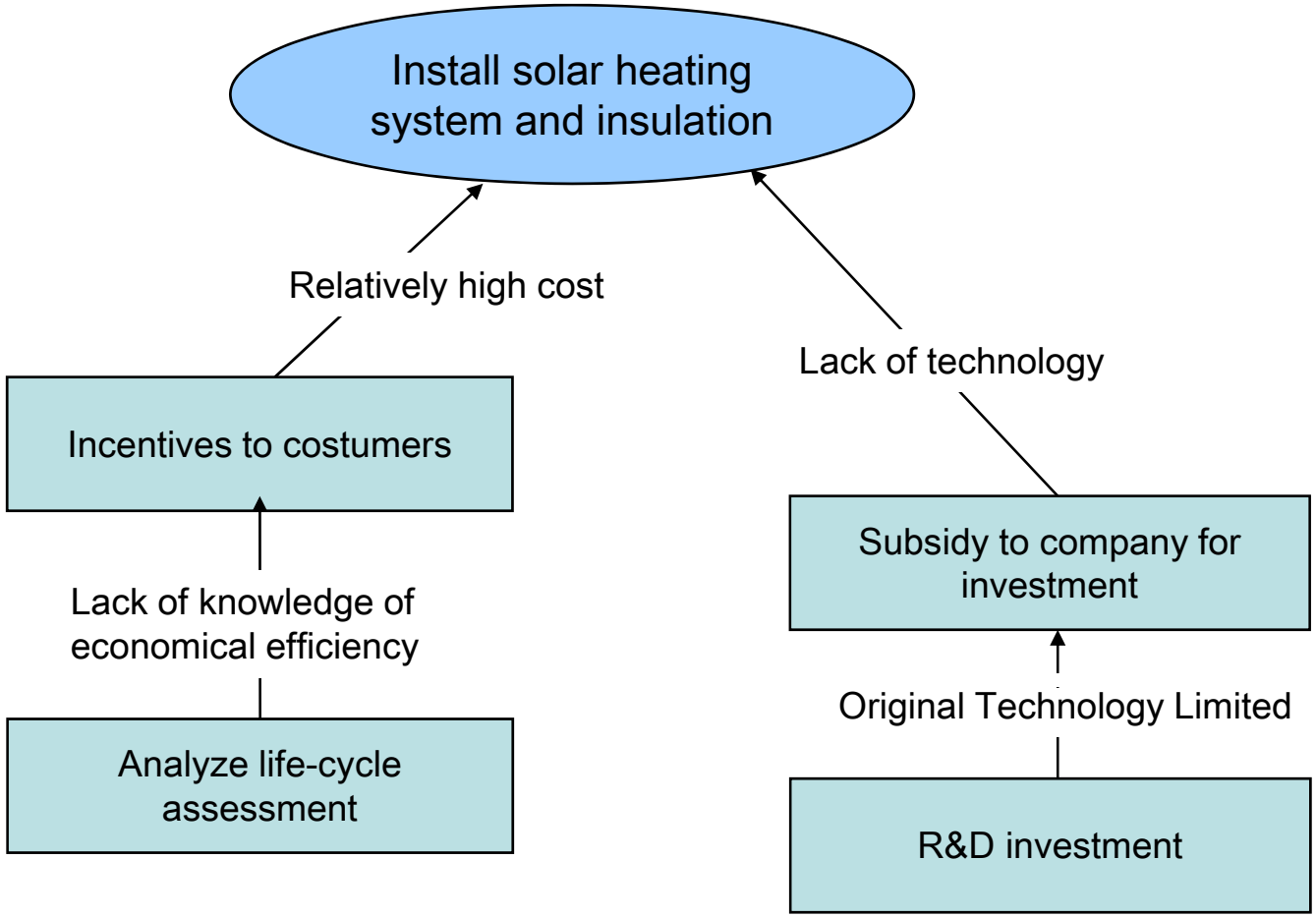
Expansion of subway and bus lines

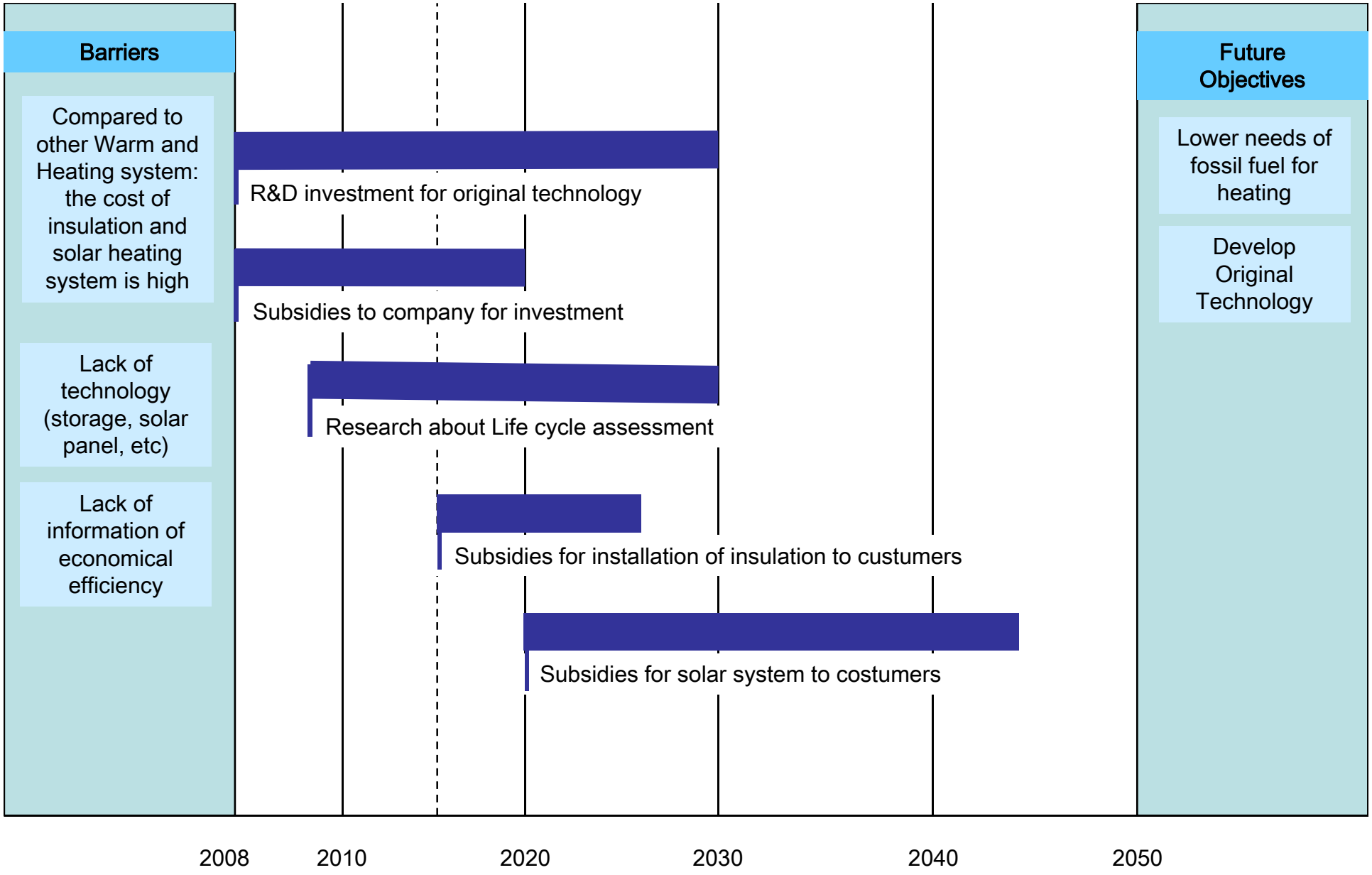
In the center of urban area, traffic will be restricted. In the center area, walkways and Bicycle will used to connect between public transportation stations such as subway station and bus terminal Instead of car, public transportation system will be used to connect people between urban area and suburban area. For public transportation system transfer center will be built in the outskirt of city.

Establish Public Transportation Information System

This System will provide information about public transportation. For example, this will guide to shortest way to get somewhere people would like to go. It also gives exact time when the bus or subway will get to the station or terminal.

Residential Sector


Install solar heating system and insulation
Relatively high cost
Lack of technology
Incentives to costumers
Subsidy to company for investment
Lack of knowledge of economical efficiency
Original Technology Limited
Analyze life-cycle assessment
R&D investment


Barriers
Compared to other Warm and Heating system: the cost of insulation and solar heating system is high
Lack of technology (storage, solar panel, etc)
Lack of information of economical efficiency
R&D investment for original technology
Subsidies to company for investment
Research about Life cycle assessment
Subsidies for installation of insulation to custumers
Subsidies for solar system to costumers
Future Objectives
Lower needs of fossil fuel for heating
Develop Original Technology
2008
2010
2020
2030
2040
2050

Future Objectives

Lower needs of fossil fuel for heating

In the residential sector, Installation solar energy panel and insulation will decrease the heating demands. It is possible to install them on various parts of buildings including the roof or walls. In many cases, photovoltaic are installed in not only residences and buildings but also in fallow lands for the purpose of selling the generated power

Develop Original Technology

By developing original technology, it’s much easier to low prices since we don’t need to pay royalties to use technology. It would cause wide spread of houses which uses solar energy. And Through these technology, we could make built-in buildings that has renewable energy technology in it.

Applying Backcasting model

Input options

1	중형차 감소	TR_P	LARGE		DRV		-26.226	Mtoe/unit	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
2	미니-기름기술	TR_P	MINI		EEF	OIL	200	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
3	미니-가스	TR_P	MINI		EEF	GAS	200	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
4	미니-바이오가스	TR_P	MINI		EEF	BMS	200	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
5	미니-수소	TR_P	MINI		EEF	H2	100	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
6	미니-전기	TR_P	MINI		EEF	ELE	200	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
7	스몰-기름	TR_P	SMALL		EEF	OIL	200	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
8	스몰-가스	TR_P	SMALL		EEF	GAS	200	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
9	스몰-바이오가스	TR_P	SMALL		EEF	BMS	200	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
10	스몰-수소	TR_P	SMALL		EEF	H2	100	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
11	스몰-전기	TR_P	SMALL		EEF	ELE	200	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
12	라지-기름	TR_P	LARGE		EEF	OIL	200	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
13	라지-가스	TR_P	LARGE		EEF	GAS	200	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
14	라지-바이오가스	TR_P	LARGE		EEF	BMS	200	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
15	라지-수소	TR_P	LARGE		EEF	H2	100	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
16	라지-전기	TR_P	LARGE		EEF	ELE	200	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
17	상업-기름	TR_P	COM		EEF	OIL	200	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
18	상업-가스	TR_P	COM		EEF	GAS	200	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
19	상업-바이오가스	TR_P	COM		EEF	BMS	200	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
20	상업-수소	TR_P	COM		EEF	H2	100	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
21	상업-전기	TR_P	COM		EEF	ELE	200	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
22	버스-기름	TR_P	BUS		EEF	OIL	200	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
23	버스-가스	TR_P	BUS		EEF	GAS	200	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
24	버스-바이오가스	TR_P	BUS		EEF	BMS	200	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
25	버스-수소	TR_P	BUS		EEF	H2	100	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
26	버스-전기	TR_P	BUS		EEF	ELE	200	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
27	기차-기름	TR_P	TRAIN		EEF	OIL	50	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
28	기차-가스	TR_P	TRAIN		EEF	GAS	50	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
29	기차-바이오가스	TR_P	TRAIN		EEF	BMS	50	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
30	기차-전기	TR_P	TRAIN		EEF	ELE	100	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
31	배-기름	TR_P	SHIP		EEF	OIL	33	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
32	배-가스	TR_P	SHIP		EEF	GAS	33	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
33	배-바이오가스	TR_P	SHIP		EEF	BMS	33	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
34	배-수소	TR_P	SHIP		EEF	H2	33	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
35	비행기-기름	TR_P	AIR		EEF	OIL	50	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
36	비행기-가스	TR_P	AIR		EEF	GAS	50	Point	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%
37	미니-연료변화	TR_P	MINI		FSH	OIL	-0.457	Mtoe/unit	0	1	Mtoe	2010	0	40	0	0	0	0	B-JPY	0%

Input 50 options for accurate projection

Process of Backcasting Model

Transportation Sector

1 Energy service demand

	Unit	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
PPV_S	B p-km	18	19	19	20	21	21	22	22	23	23	24
PPV_M	B p-km	159	163	166	170	173	176	180	183	186	190	193
PPV_L	B p-km	9	10	10	11	12	12	13	14	14	15	16
CPV	B p-km	4	4	4	5	5	5	5	5	5	5	5
BUS	B p-km	42	42	42	41	41	40	40	39	39	38	38
TRN	B p-km	33	36	39	42	45	48	51	53	56	59	62
SHP	B p-km	1	1	1	1	1	1	1	1	1	1	1
AIR	B p-km	8	8	8	7	7	7	7	7	6	6	6

CM

2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
18	19	19	20	21	21	22	22	23	23	24
159	163	166	170	173	176	180	183	186	190	193
9	10	9	6	3	2	2	2	2	2	2
4	4	4	5	5	5	5	5	5	5	5
42	42	42	41	41	40	40	39	39	38	38
33	36	39	43	46	50	54	57	61	65	68
1	1	1	1	1	1	1	1	1	1	1
8	8	8	7	7	7	7	7	6	6	6

Residential Sector

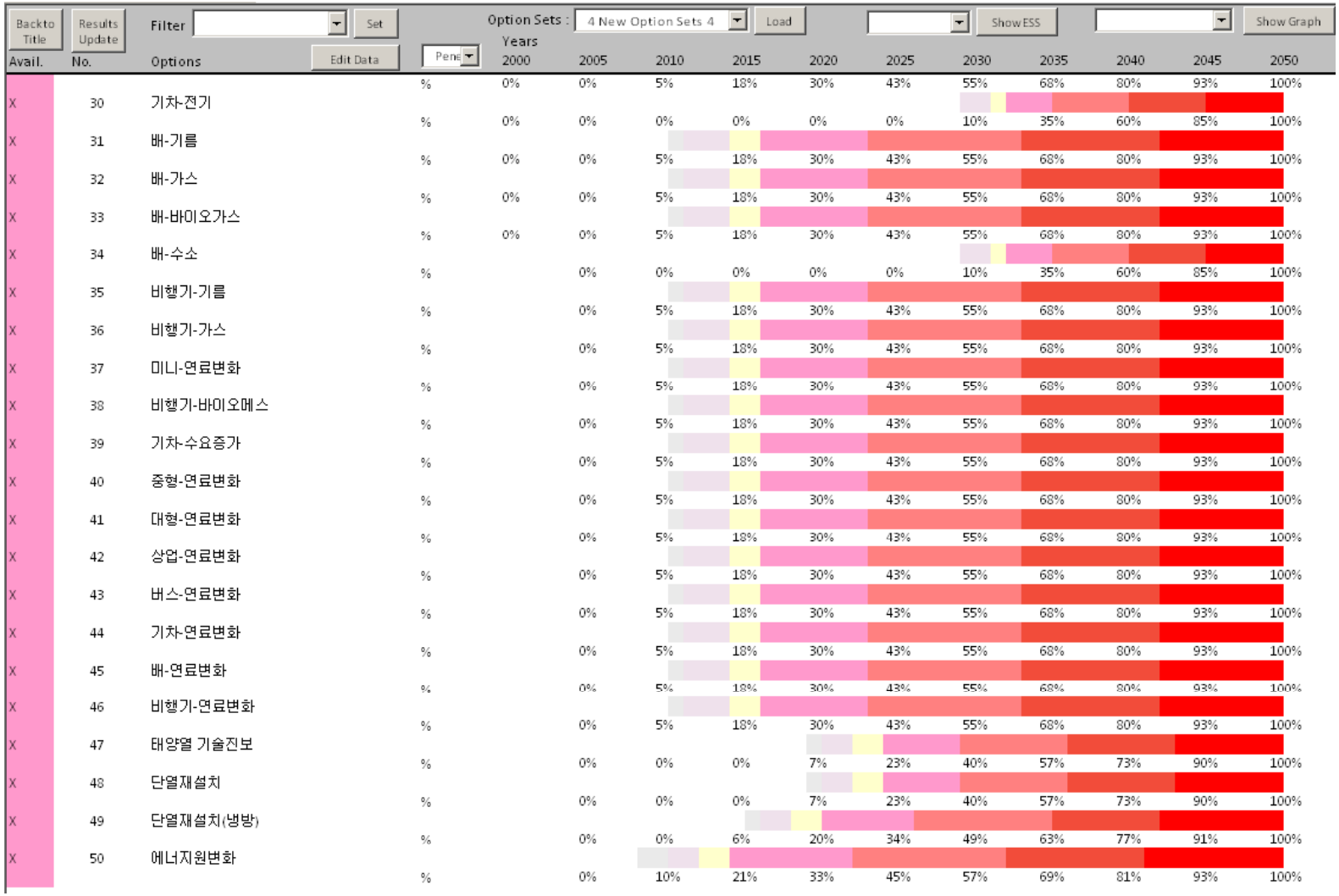
1 Energy service demand

	Unit	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
Space cooling		1.6	2.04	2.46	2.88	3.3	3.72	4.15	4.57	4.99	5.41	5.8
Hot water and heating		10.1	10.7	11.4	12	12.7	13.3	14	14.6	15.3	16	16.6
Cooking		1.6	1.66	1.69	1.71	1.73	1.76	1.78	1.81	1.83	1.86	1.9
Lighting		1.0	1.08	1.15	1.23	1.3	1.38	1.45	1.53	1.6	1.67	1.7
Refrigerators		0.5	0.57	0.62	0.67	0.71	0.76	0.81	0.86	0.9	0.95	1.0
ICT appliance		0.7	0.91	1.1	1.3	1.49	1.69	1.88	2.07	2.27	2.46	2.7
Cloth washers		0.2	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.2
Other Appliance		1.1	1.35	1.62	1.89	2.16	2.42	2.69	2.96	3.23	3.5	3.8

CM

2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
1.6	2.04	2.46	2.83	3.11	3.38	3.64	3.88	4.11	4.33	4.6
10.1	10.7	11.4	12	12.6	12.9	13.3	13.6	13.9	14.3	14.7
1.6	1.66	1.69	1.71	1.73	1.76	1.78	1.81	1.83	1.86	1.9
1.0	1.08	1.15	1.23	1.3	1.38	1.45	1.53	1.6	1.67	1.7
0.5	0.57	0.62	0.67	0.71	0.76	0.81	0.86	0.9	0.95	1.0
0.7	0.91	1.1	1.3	1.49	1.69	1.88	2.07	2.27	2.46	2.7
0.2	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.2
1.1	1.35	1.62	1.89	2.16	2.42	2.69	2.96	3.23	3.5	3.8

Process of Backcasting Model



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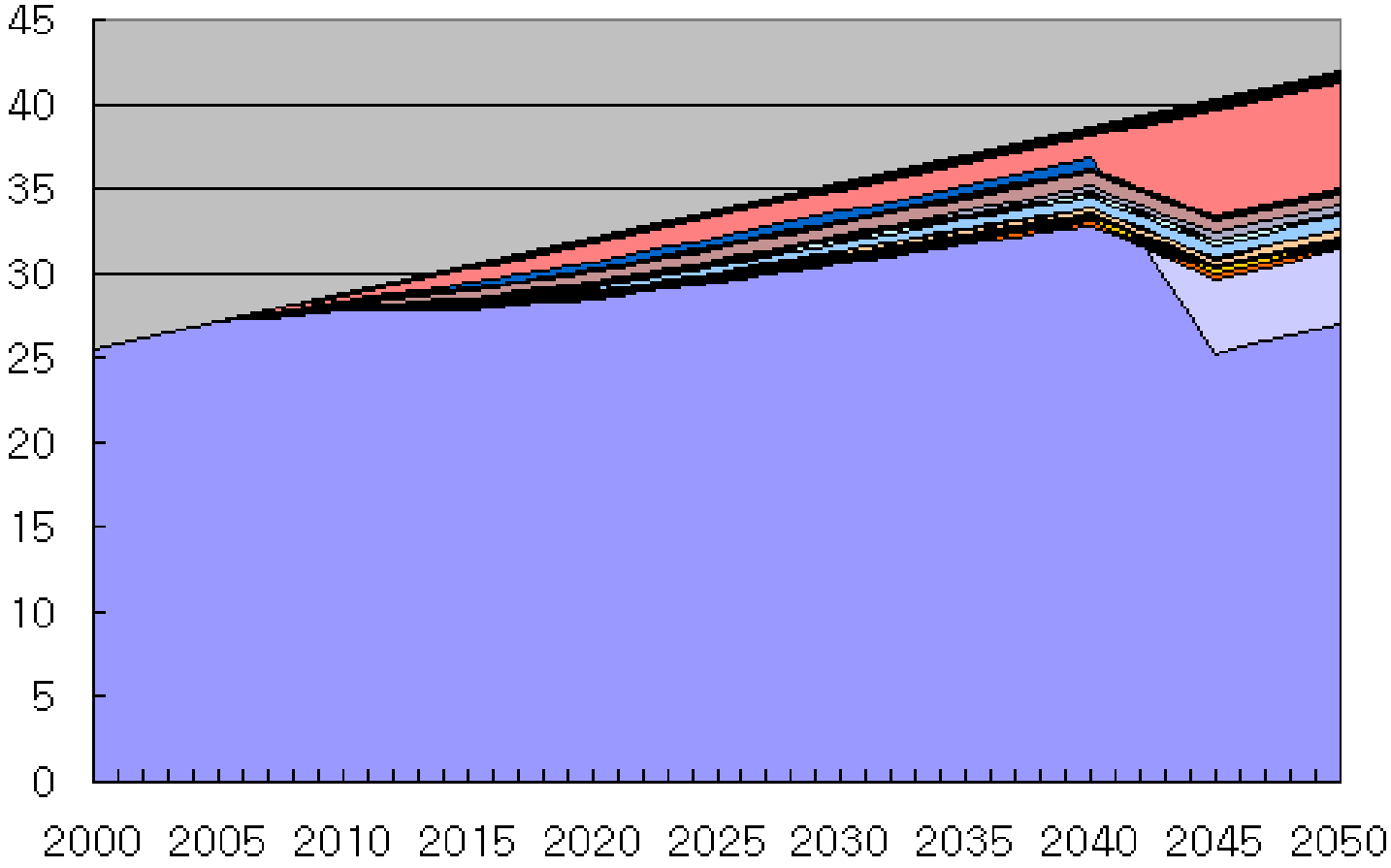

In 2030 after introducing H2 mini and small car causes drastic decrease emission of CO2

Conclusion & Discussion point

Conclusions

- Korea already have potential options for LCS but they are individually working in different sectors in society
- Backcasting model could very useful to make national roadmap
- To achieve LCS, need cooperation among various Field
- Need more options and actions accurate projection of LCS
- During Preparing backcasting model, some error has occurred.
- Financial option should be included.

Thank you for your attention