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# Marginal Abatement Cost of CO<sub>2</sub> Mitigation Options for the Residential Sector in Korea

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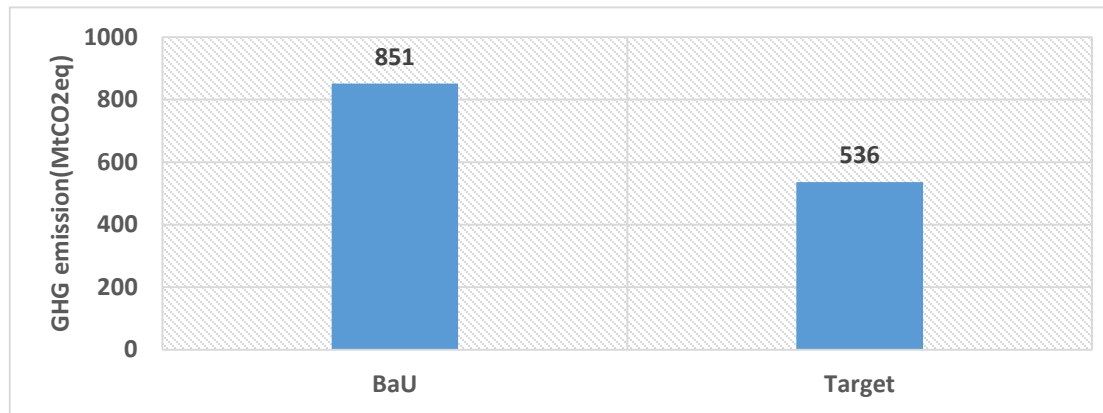
# Introduce Korea's NDC plan

[http://www.motie.go.kr/motie/ne/presse/press2/bbs/bbsView.do?bbs\\_seq\\_n=158865&bbs\\_cd\\_n=81&currentPage=1&search\\_key\\_n=&search\\_val\\_v=&cate\\_n=&dept\\_v=&from\\_brf=brf&brf\\_code\\_v=3](http://www.motie.go.kr/motie/ne/presse/press2/bbs/bbsView.do?bbs_seq_n=158865&bbs_cd_n=81&currentPage=1&search_key_n=&search_val_v=&cate_n=&dept_v=&from_brf=brf&brf_code_v=3)

# 01 NDC

## Background

- Korea plans to reduce its greenhouse gas emissions by 37% from the business-as-usual (BAU, 850.6 MtCO<sub>2</sub>eq) level by 2030



- Government approved the 1<sup>st</sup> National Climate Change Response Plan on state council (2016.12.06)
- Coordination role: MOE -> Office for Government Policy Coordination (2016.06)
- Responsibility of emission reduction management: Each ministry of sector(2016.06)

# 01 NDC

## Sectoral plan

- The mitigation target is finalized by sector

Sector	2030 BAU (MtCO <sub>2</sub> eq)	Reduction amounts (MtCO <sub>2</sub> eq)	Ratio(%)	
			Bysector	ByTotal
Power generation	333	64.5	(19.4)	7.6
Secondary industries	481	56.4	11.7	6.6
Buildings	197.2	35.8	18.1	4.2
Green industries	-	28.2	-	3.3
Transportation	105.2	25.9	24.6	3.0
Public and others	21	3.6	17.3	0.4
Waste	15.5	3.6	23.0	0.4
Primary Industries	20.7	1	4.8	0.1
Domestic reduction	851	219	25.7%	
Emission trading*		96	11.3%	

\*Through the international market mechanism (Detailed plan will be prepared by 2020)

# 01 NDC

## Paradigm shift

### 1. Low carbon energy policy

- Ramping up renewables(A renewable portfolio standard (RPS) increase, Renewable Fuel Standard increase, incentives): ('20) 5.0% → ('25) 7.7% → ('30) 9.7% → ('35) 11%
- Energy mix change in power sector (Withdrawal or shift energy source: 10 coal fired plant), Deploying high efficiency plant equipment
- Energy demand management (Negawatt Market project, Electronic price change, Deploying high efficiency devices)
- Building energy(BEMS, Zero emission building, etc), Vehicle (hybrid: 4million, Electronic: 1mil, H2: 0.6mil), low emission Infrastructure (BRT: 29.0 km → 928.8 km, Rail: ('16) 3,729.3km → ('25) 5,363.5km, ICT, ...), improve its vehicles' average fuel efficiency
- Deploying high efficiency equipment in industry sector

### 2. Low carbon energy policy

- Local emission trading(Incentive for BM(BenchMark) allocation, CDM, Improving MRV system, tax incentive, Reducing Information access gap)
- International market mechanism (Bilateral cooperation, ODA, SDM, Governance building)

### 3. Investment for green industries

- CCS and CCU(Steel industry), Microgrid, Smart grid, Energy Storage System, and so on)
- Climate Technology Roadmap(2016.06)

# 01 NDC

## Paradigm shift

### **4. Climate proof cities**

- Climate change monitoring system
- Climate adaptation (Vulnerable groups, infrastructure, and so on)
- Managing biodiversity and ecosystem service

### **5. LULUCF and others**

- REDD+ (Urban forest: ('15) 38,513ha → ('30) 60,160ha, and so on)
- Initiate Bio-energy use
- Recycle & Reuse of waste

### **6. International cooperation**

- Improve transparency
- Bilateral cooperation, and so on

### **7. Citizen participation**

# 01 NDC

## Paradigm shift

New strategy towards 2030 low carbonized society

Category	Current strategy
Response	Mitigation only
Mitigation method	Regulation
Corresponding	Individual response
Governance	Government oriented
Evaluation	-
International reporting program	-



Mid-long term strategy
Mitigation/ Adaptation/ Transparency
Market / Technology
Integrated response
Public-private partnership
MRV/Feedback
Implementation and evaluation reports (Every 5 years)

# **Marginal Abatement Cost of CO2 Mitigation Options for the Residential Sector in Korea**



## 02 MAC

### Background

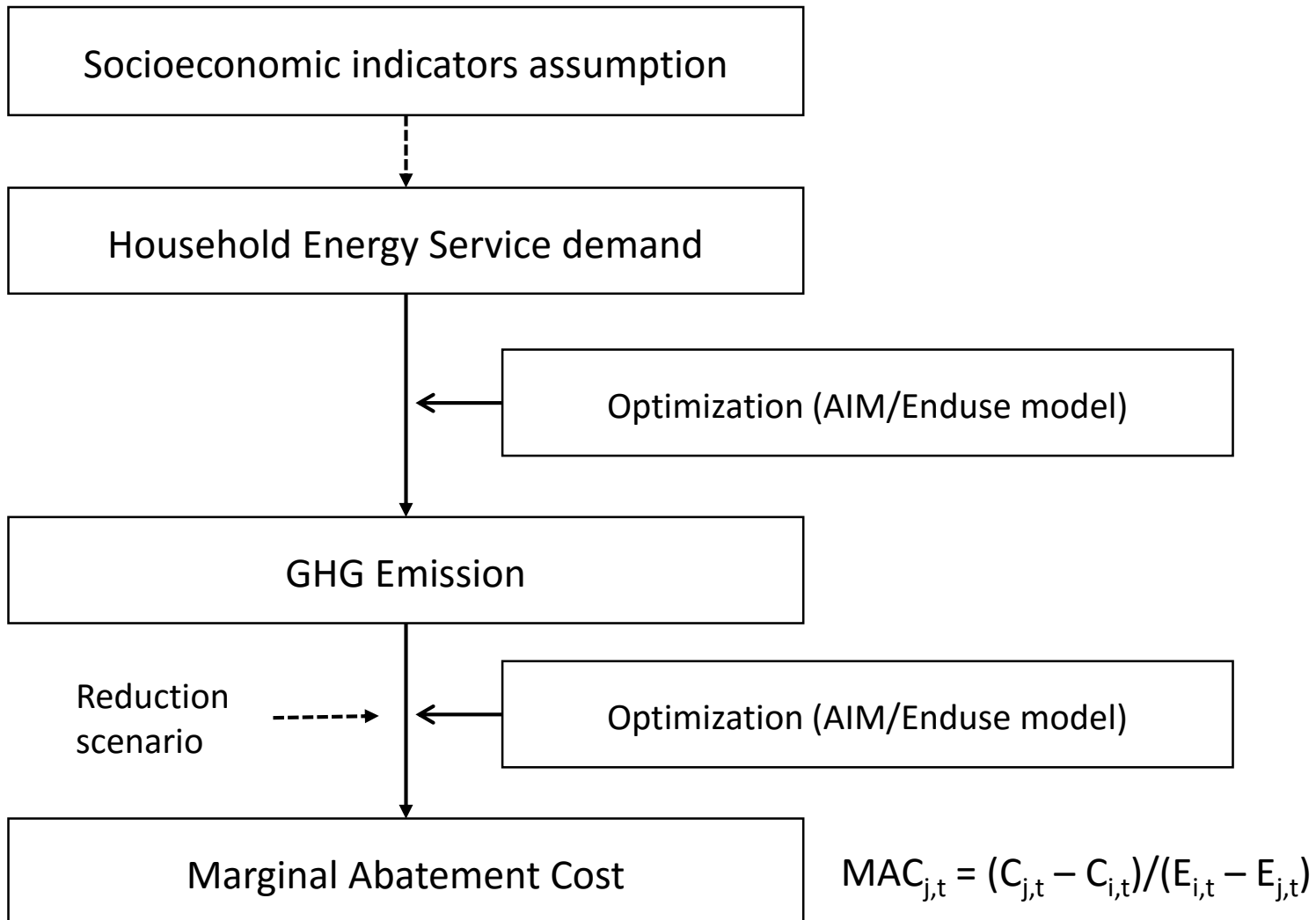
- South Korea have to invest in energy efficiency in residential, and other sectors to meet mitigation target.
- Residential sector in South Korea doesn't use much energy than other countries due to energy price in current situation. But, in the long, South Korea also use large energy in the residential sector due to lifestyle change caused by income change, climate change, and others.
- It is important to examine the amount of energy consumption, reduction potential, reduction cost by each sector with the long-term sight.

### Contribution

- This study elaborates the service demands of the residential sector in 2050 and offers marginal abatement cost in residential sector with detailed technologies.

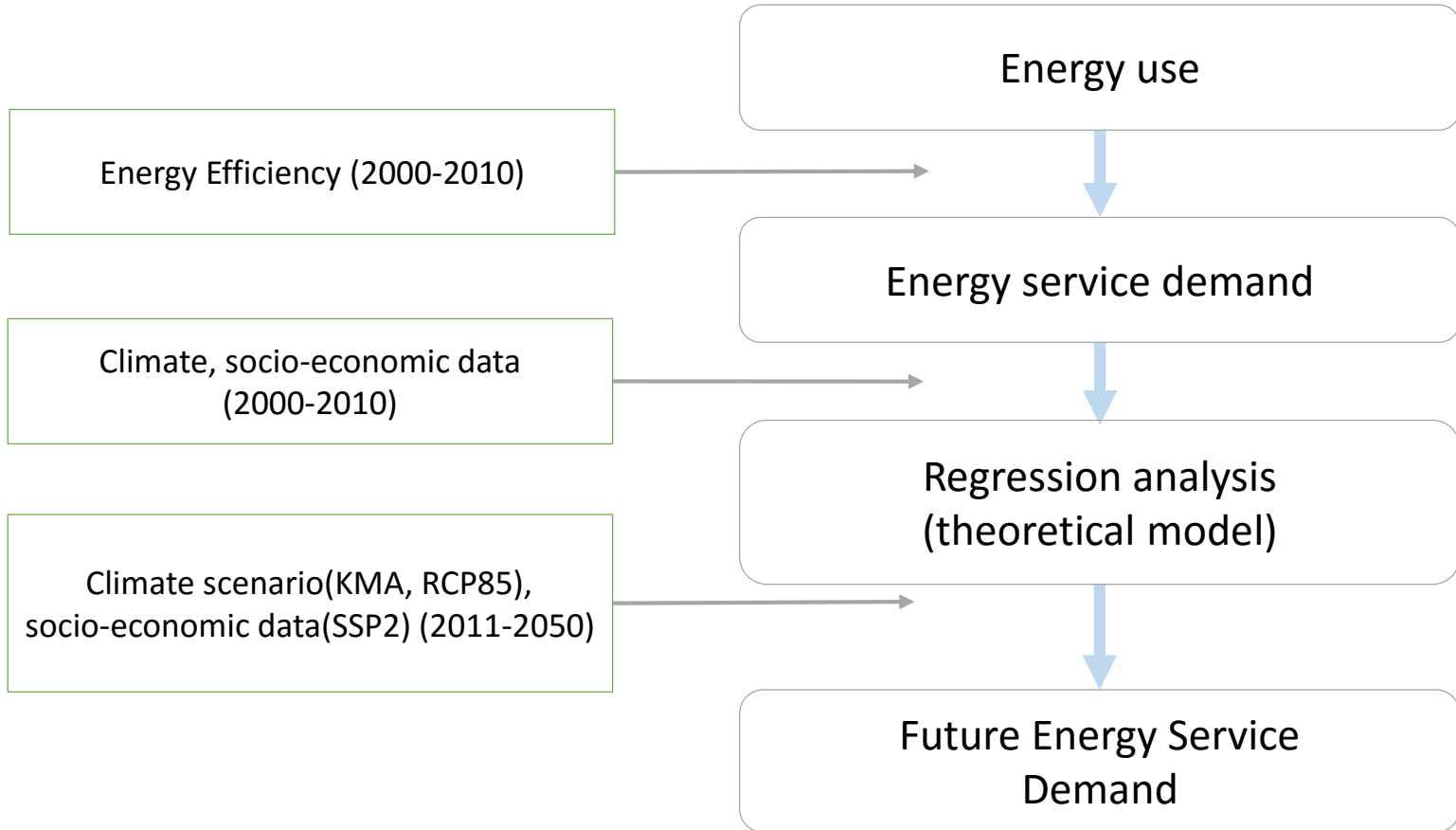
# 02 MAC

## Methods



# 02 MAC

## Methods (Energy service demand)



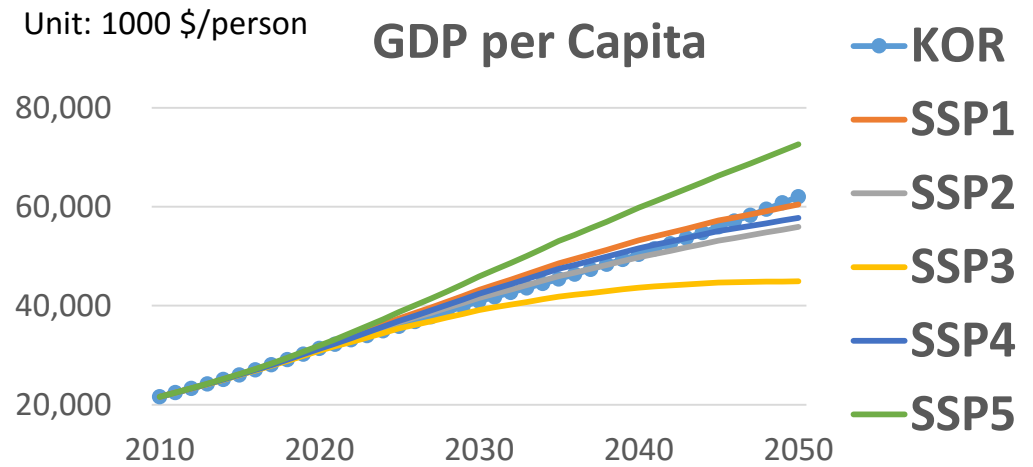
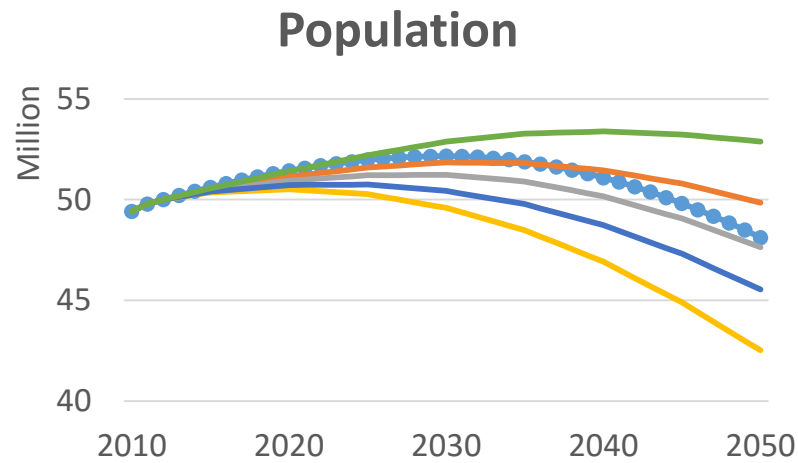
## 02 MAC

### Scenario

Scenario	Abbreviation	Definition
Business as Usual	BAU	Efficiency improvements are included to some extent as a consequence of technological progress and current policy implementation
		No emissions cap, no emissions tax
Reduction	RD	Emissions cap: 30% reduction in 2050 compared to the BAU level in the target year
		Efficient technologies are introduced into the market in order to meet the pre-set emissions cap

# 02 MAC

## Socio-economic assumptions



# 02 MAC

## Results(Equation of energy service demand per capita)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	HEATING	HOTWATER	COOLING	LIGHTING	COOKING	REF	ICT	OTHERS	AIR
HDD	0.125*** (0.0194)	0.026* (0.00993)							
CDD			0.005* (0.00288)						
AIR			2.783*** (0.663)						
GDPPC				0.528*** (0.046)	-5.240*** (0.636)	1.091*** (0.0892)	0.714*** (0.060)	0.436*** (0.039)	0.027*** (0.005)
_cons	-118.3* (46.19)	26.280 (23.64)	2.653*** (0.491)	1.893* (0.850)	177.000*** (12.13)	3.253 (1.701)	2.651* (1.146)	1.578* (0.746)	-0.013 (0.101)
N	64	64	64	64	64	64	64	64	64
R-sq	0.739	0.665	0.872	0.848	0.822	0.865	0.829	0.903	0.569
adj. R-sq	0.650	0.551	0.825	0.796	0.761	0.820	0.771	0.870	0.422

(rsme)

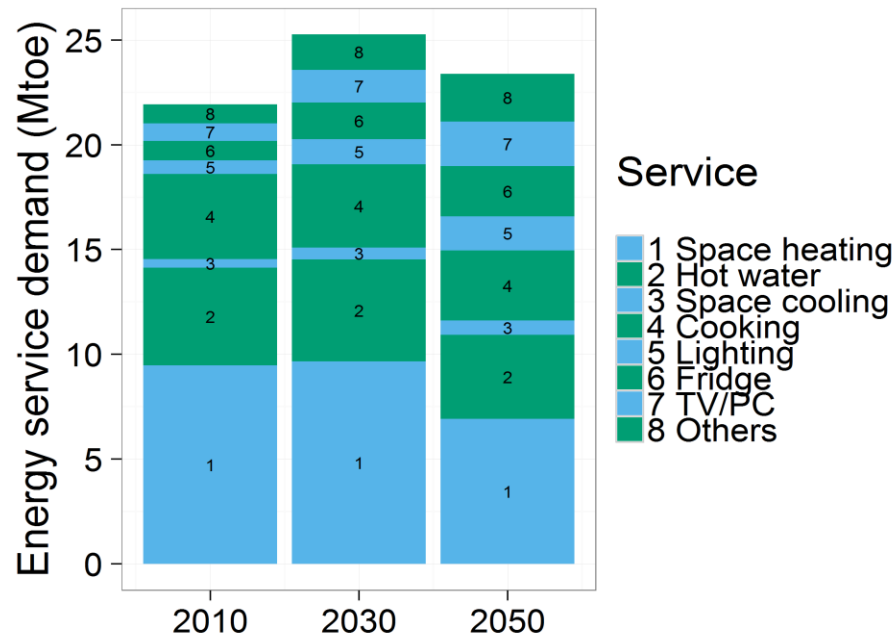
Standard errors in parentheses

\* p<0.10 \*\* p<0.05 \*\*\* p<0.01

## 02 MAC

### Results(Energy service demand)

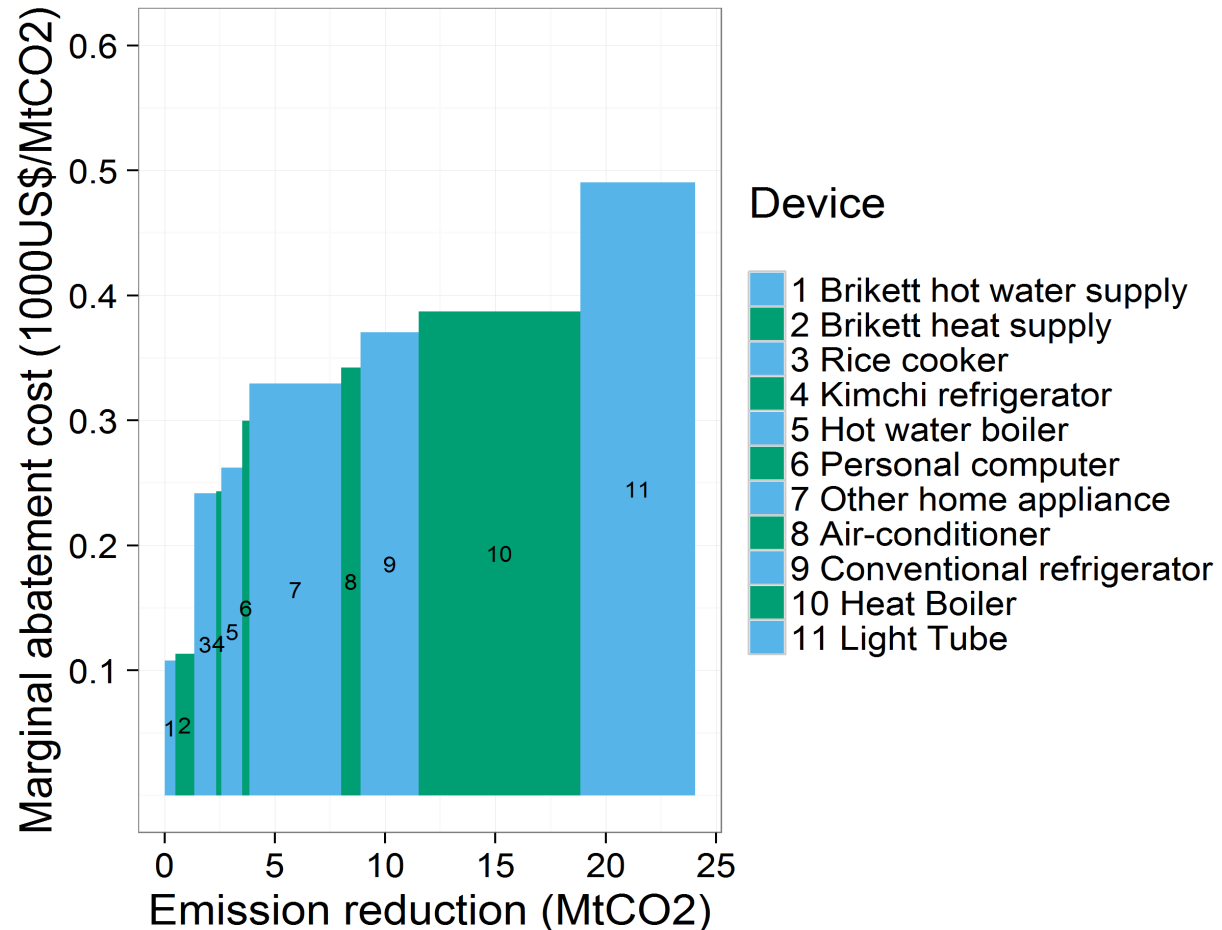
- Energy service demand in the residential sector increases to 1.15 times in 2030 and 1.08 times in 2050 compared to 2010 level
- It is also shown that heat and the hot water energy service demand is decreasing due to the climate change, cooling service is appeared to be increased slightly.
- Other services using electricity are expected to increase their service demand because of population increase and higher income levels



## 02 MAC

### Results(MAC)

- It can be reduced by 24 MtCO<sub>2</sub>-eq compare to the BaU in the entire residential sector and it would cost with the range of 100 to 500 dollar in US.
- 8.8 billion dollars are needed in whole residential sector (187\$ per person)
- The positive value par of MAC indicates necessary information for the installation of deployment policies and research policies with the goal to foster innovation.





## 02 MAC

### Results(MAC)

	Total (billion\$)	Per capita (\$)	Note(year)
Cost of residential sector for 30% Reduction in 2050	9	170	2050
Income tax of labor (Average)		4,160	2015
Subsidy for high efficiency device purchasing (All sector)	1	21	2010
SOC	22	468	2017
Welfare Budget	130	2,766	2017
Total government budget	400	8,511	2017

Any comments or questions?