How to promote regional collaboration in aligning climate change, air pollution, and sustainable development policies in Asia?

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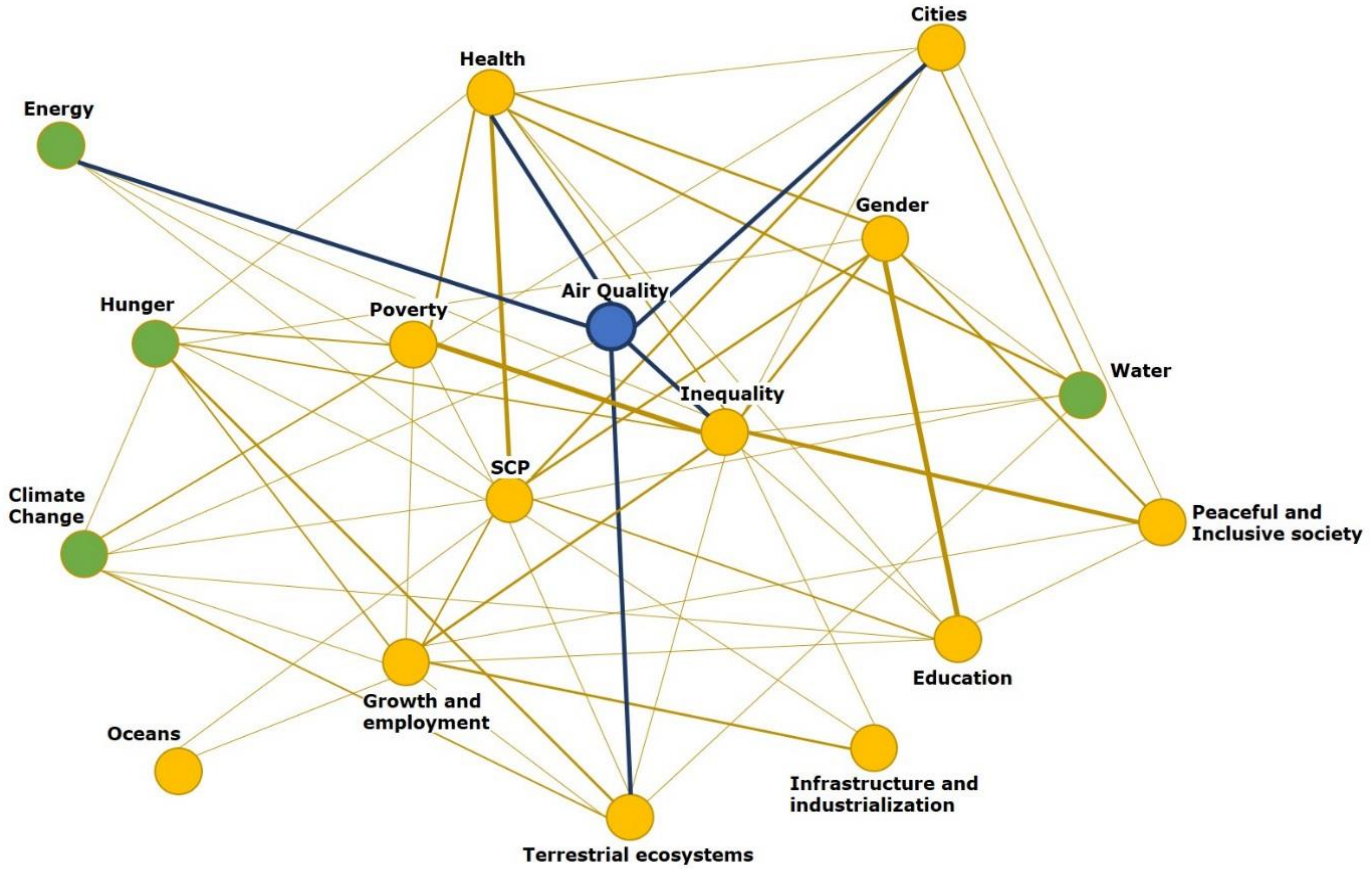
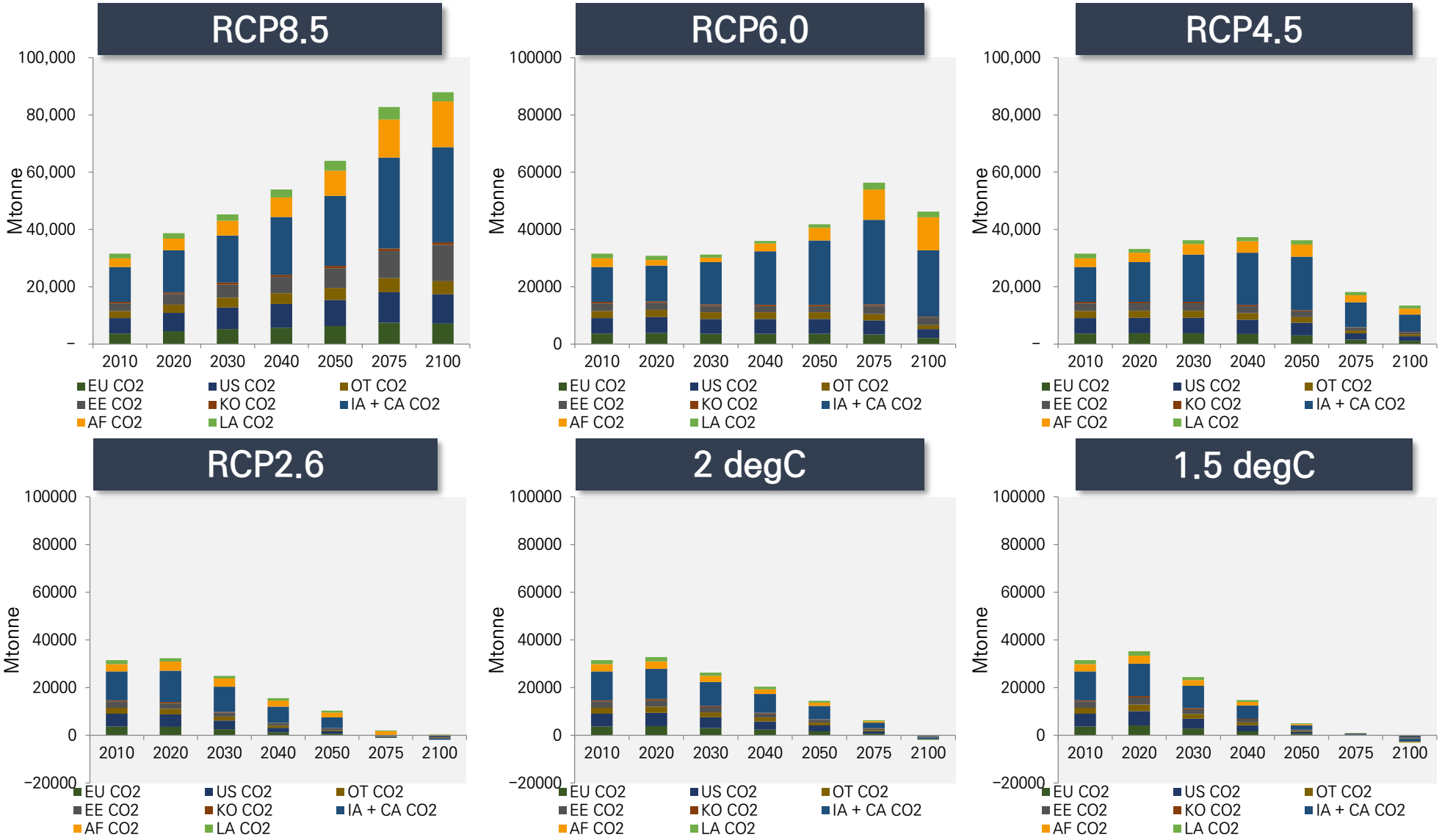
Climate change, air quality, and SDGs



Source: modified from David Le Blanc (2015)

Future: Emission Scenarios

- Northeast Asia RCP scenarios



Source: RCP DB, UNEP (2016)

Climate Change Damage

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▪ Climate Change Damage in NEA by scenario

〈 Annual National Damage Costs with and without Adaptation 2010–2050 in NEA〉

Scenario	Country	With Adaptation			Without Adaptation		
		Land Loss	Forced Migration	Flood damage	Land Loss	Forced Migration	Flood damage
High (with cyclones)	PRC	1	53	83	4	3,819	48,944
	Japan	2	102	0	3	196	922
	Republic of Korea	0	7	26	0	14	1,091
High	PRC	1	53	14	4	3,819	37,769
	Japan	2	102	0	3	196	601
	Republic of Korea	0	7	0	0	14	681
Medium	PRC	1	38	16	3	2,152	33,523
	Japan	2	86	0	2	166	489
	Republic of Korea	0	5	0	0	9	610
Low	PRC	0	22	109	2	180	29,151
	Japan	1	66	0	2	134	310
	Republic of Korea	0	2	4	0	4	495
No change	PRC	0	13	480	1	90	23,245
	Japan	1	48	12	1	102	31
	Republic of Korea	0	0	141	0	0	440

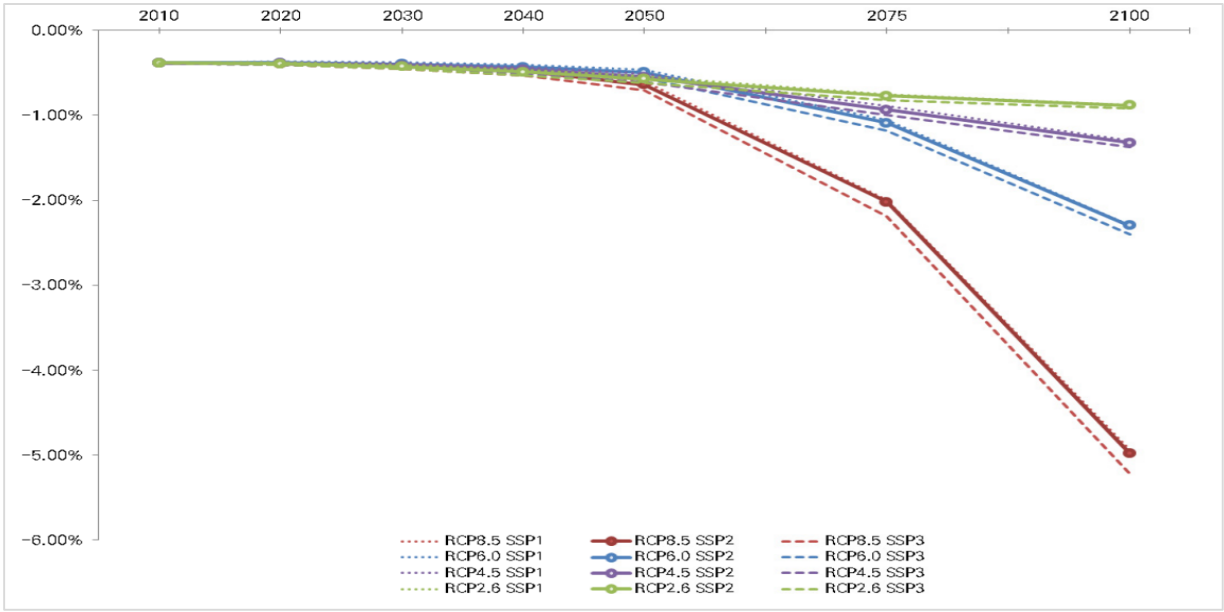
〈 Scenarios for the damage cost estimation〉

Scenario Name	Sea-Level Scenario	Vertical Land Movement	Increased Storminess of Cyclones	Population and GDP Growth
No change	No change	Yes	No	Yes
Low	Low	Yes	No	Yes
Medium	Medium	Yes	No	Yes
High	High	Yes	No	Yes
High (with cyclones)	High	Yes	Yes	Yes

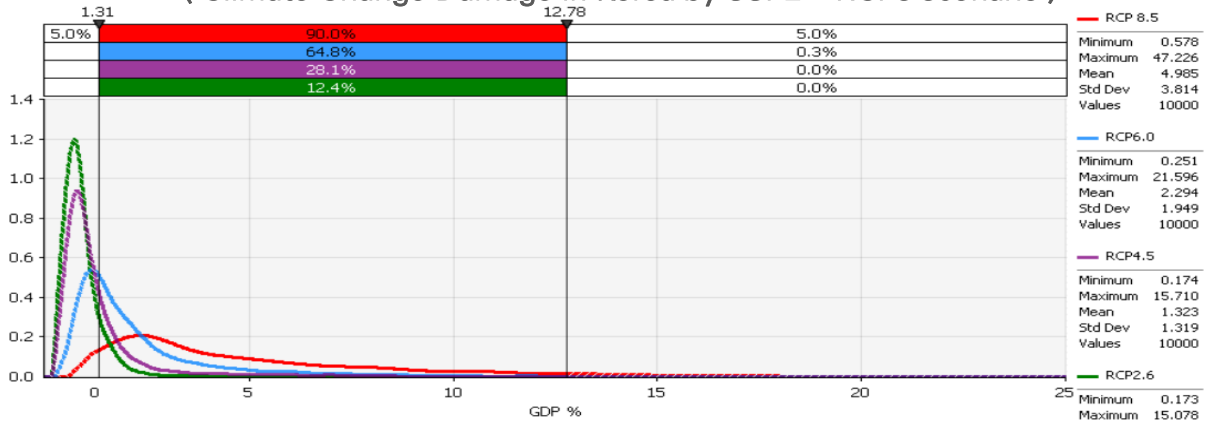
Source: ADB, 2013

▪ Climate Change Damage in Korea by scenario

〈 Climate Change Damage in Korea by RCP–SSP matrix 〉



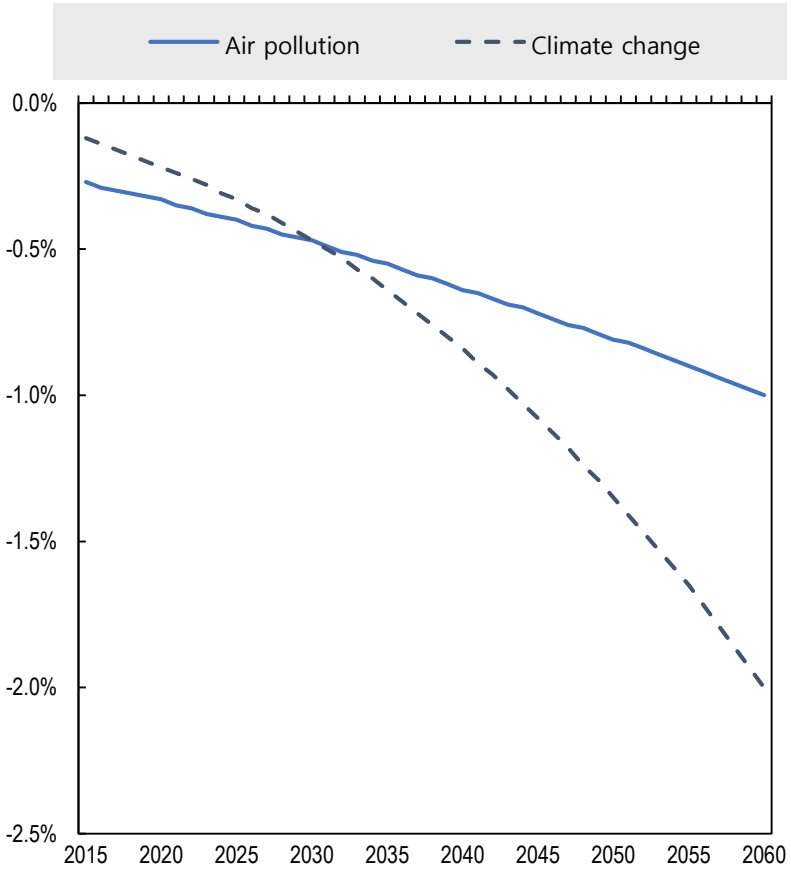
〈 Climate Change Damage in Korea by SSP2 – RCPs scenario 〉



Source: Chae et al., 2014

Air pollution and climate change impacts

Evolution of global GDP changes over time



Source: ENV-Linkages model, OECD(2016)

Regional composition of GDP changes, 2060

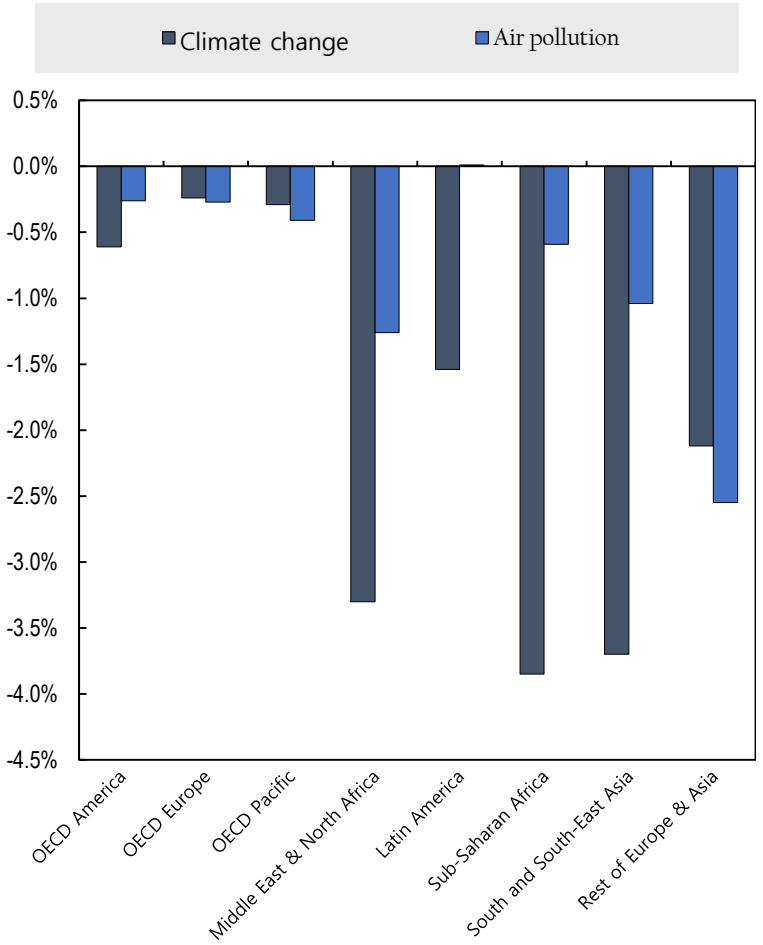


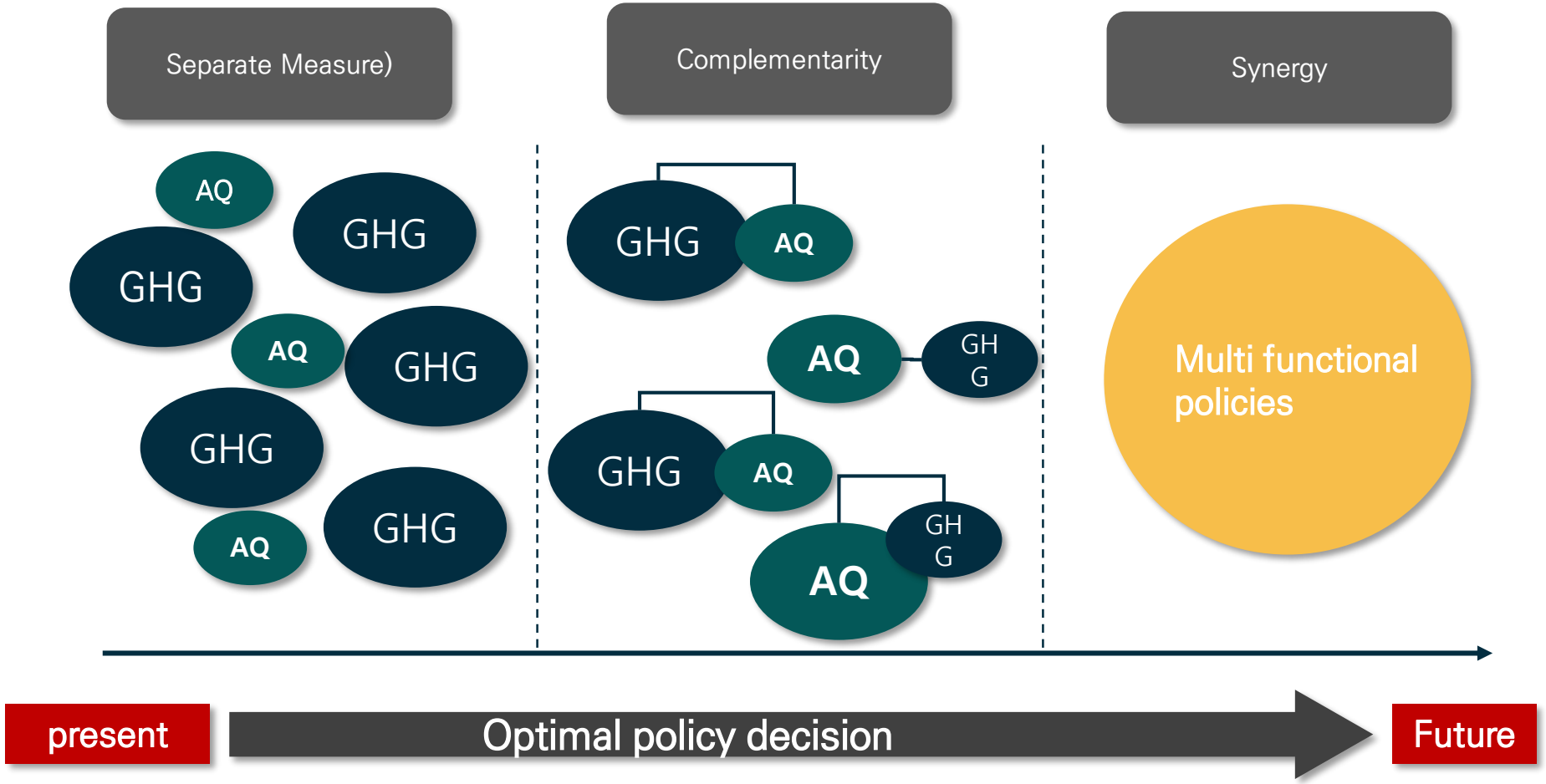
Table 4.3 calculates the value of co-benefits of climate mitigation in 2050 using this analytical apparatus and assuming a CRF that is log-linear in form. This is therefore an extension of the values reported in West et al., who use a linear CRF and report correspondingly larger co-benefits.

Table 4.3. Regional co-benefits of climate mitigation versus CO_2 price in 2050, RCP 4.5

	Deaths avoided (log-linear CRF)	CO_2 abated (million t)	Value of a statistical life (US$ m)	Co-benefit (US$/t$CO_2$)	CO_2 price (US$/t CO_2)
Africa	48,600	1,920	1.9	47	22
Australia and NZ	402	151	14.3	38	22
Canada	14,100	439	9.5	307	22
China	337,000	5,210	5.3	342	22
Eastern Europe	12,600	356	5.9	210	22
Former USSR	65,600	934	3.6	250	22
India	77,000	2,290	3.0	102	22
Japan	12,700	285	12.3	547	22
Latin America	48,300	1,220	4.7	185	22
Middle East	2,270	678	4.6	15	22
South Korea	3,320	121	7.4	203	22
Southeast Asia	99,900	2,390	4.2	175	22
United States	70,000	1,720	12.4	503	22
Western Europe	41,800	1,160	9.1	327	22
Global	834,000	18,900	4.6	205	22

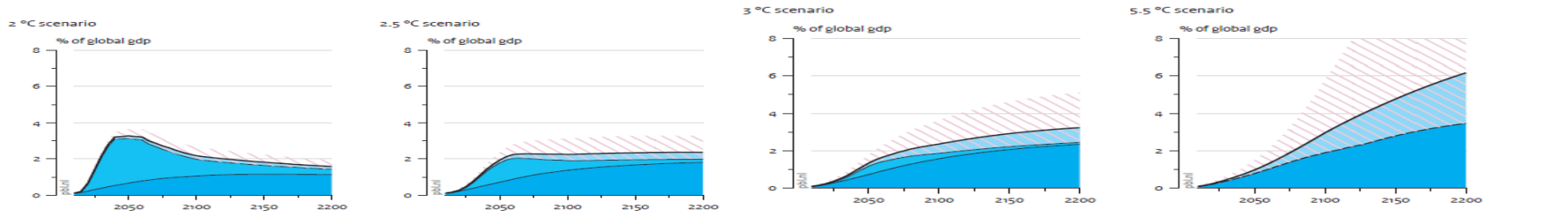
Sources: Authors' calculations based on West et al. (2013) and supplementary online material

Towards multifunctional policies

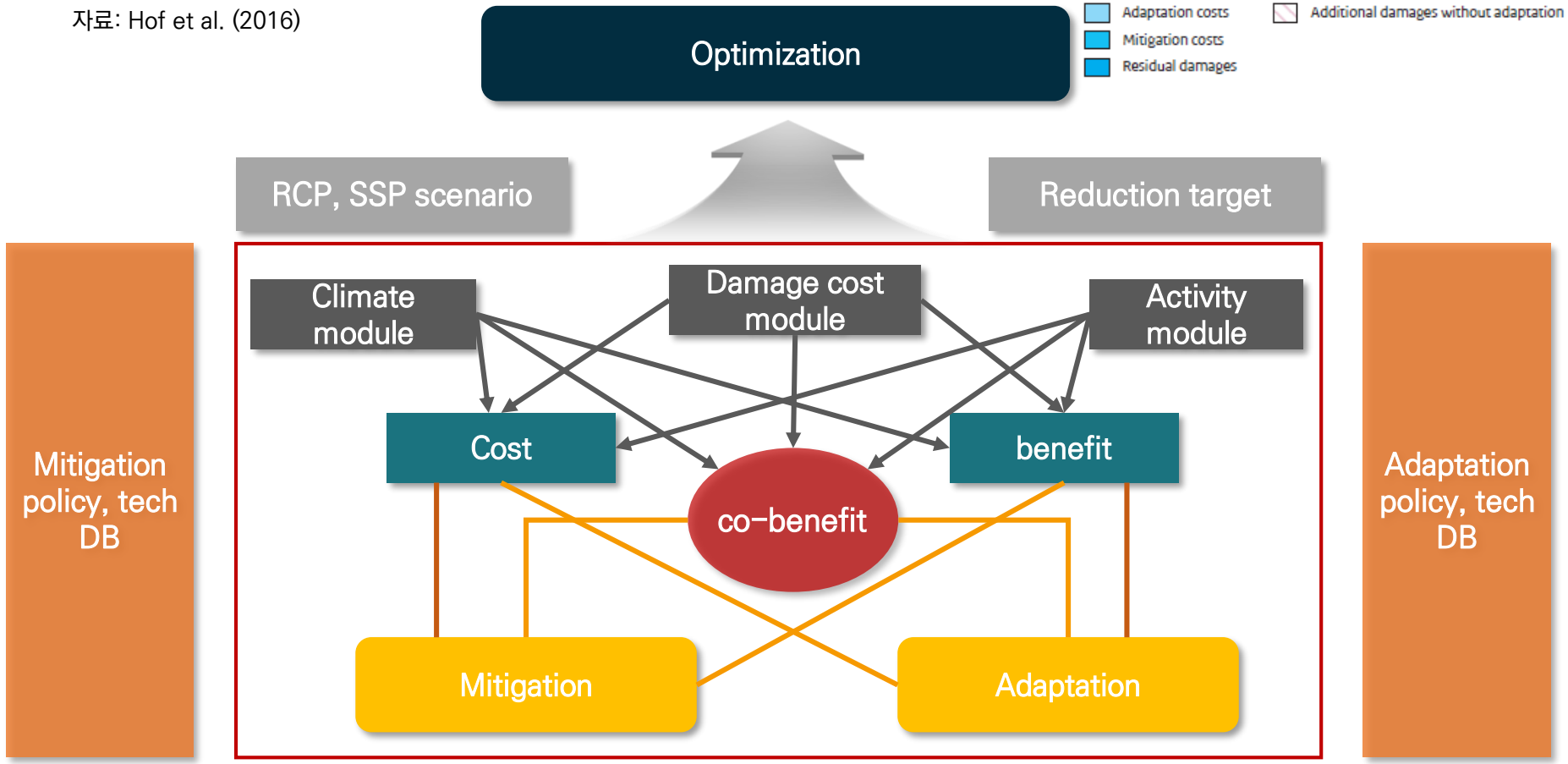


Optimal policy for GHG, Air quality, and Sustainable development

- To develop optimal policy paths under constraints(maximize benefits, minimize the costs) for RCP, SSP scenario matrix



자료: Hof et al. (2016)



- Health Co-benefits by reducing GHG emissions (Nam, 2013)

		Mean	Median
Health Co-benefits per 1t CO_2 reduction (2008 US$)	$2 ~ $128		
Developed Countries		$44/t$CO_2$	$31/t$CO_2$
Developing Countries		$81/t$CO_2$	$43/t$CO_2$

- CO2 reduction Co-benefits by reducing air pollutans

	City or Country	Sectors	Pollutants	Policy Considered	Ancillary CO2 Benefits (%CO2/%Pollution)
Morgenstern et al. (2004)	Taiyuan (China)	Electric	SO2	Shut down small boilers, switch to low sulfur fuels	0.76-0.97
Xu and Masui (2009)	China	All	SO2	Emission caps, energy efficiency, sulfur tax	0.90-0.97
Chae (2010)	Seoul (Korea)	Transportation (public buses)	NOx, PM10	Switch to low sulfur fuels	0.14-0.88
Agee et al. (2012)	U.S.	Electric	NOx, SO2	Cap and trade	n/a
Cao et al. (2012)	China	All	SO2	Emission caps	0.23
Nam et al. (2013)	China	All	NOx, SO2	Emission caps	0.41-0.99

Fuel change: Coal & LNG -> Solar Energy

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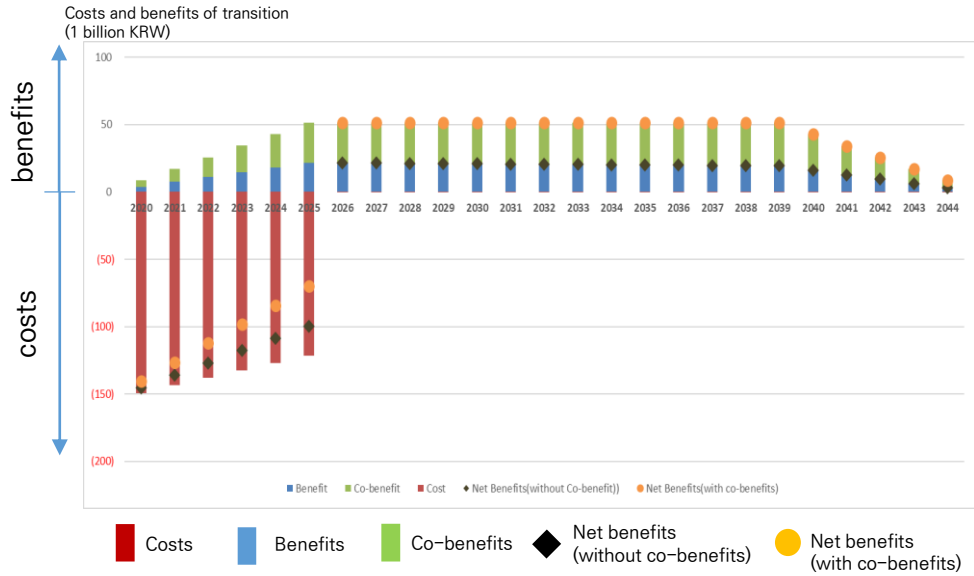
- **Co-benefit Analysis**
  - Coal & LNG to solar energy
    - ✓ Replace 600MW coal and LNG power plants to solar panel from 2020 to 2025
    - ✓ Assumption: Lifespan of a Solar Panel 20 years
    - ✓ Definition
      - Benefit: Social benefits by CO_2 mitigation
      - Co-benefit: Social benefits by NOx, SOx, PM2.5 mitigation
      - Costs: Solar panel installation and maintenance costs
    - ✓ Social costs of pollutants

Pollutant	CO2	SOx	NOx	PM2.5
Social Cost (1,000 KRW/ton)	43.354	12,956	11,553	188,794

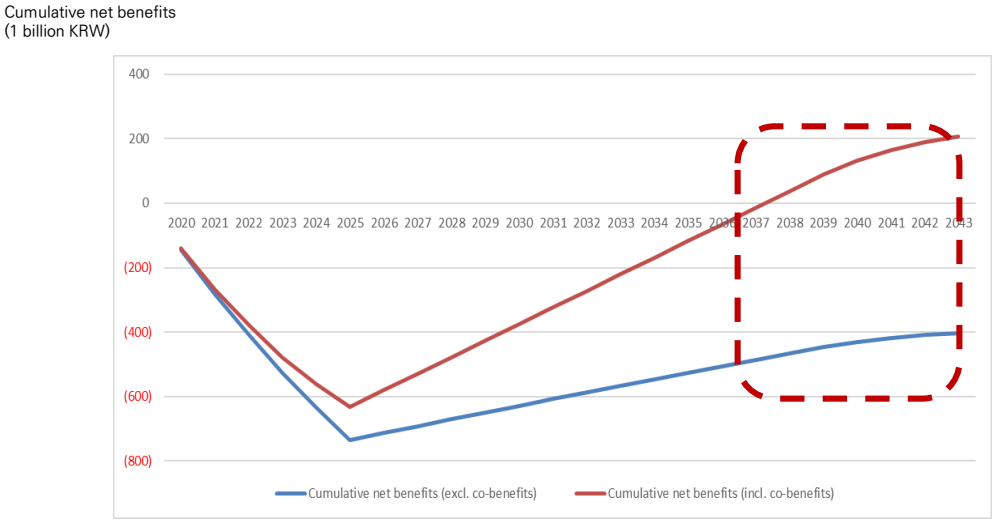
Source: Ahn et al. (2019)

    - ✓ Results
      - Without co-benefits, cumulative net benefits are always negative
      - With co-benefits, cumulative net benefits become positive from 2038
      - Co-benefits are critical determinants of effectiveness in transition policies

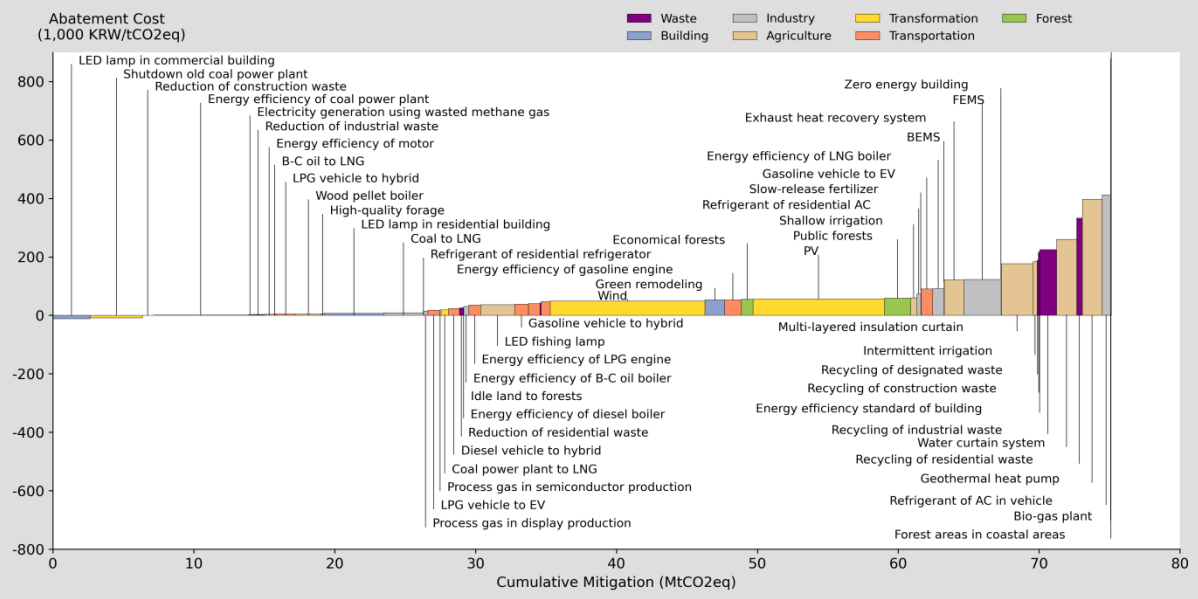
〈Annual costs, benefits, and co-benefits〉



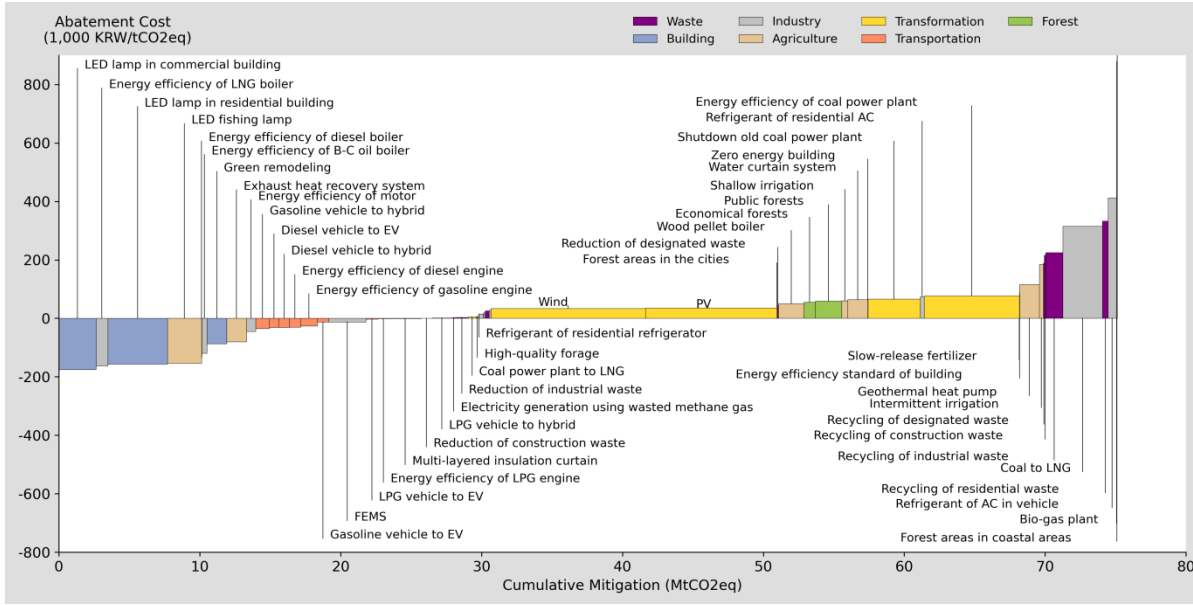
〈Cumulative net benefits with and without co-benefits〉



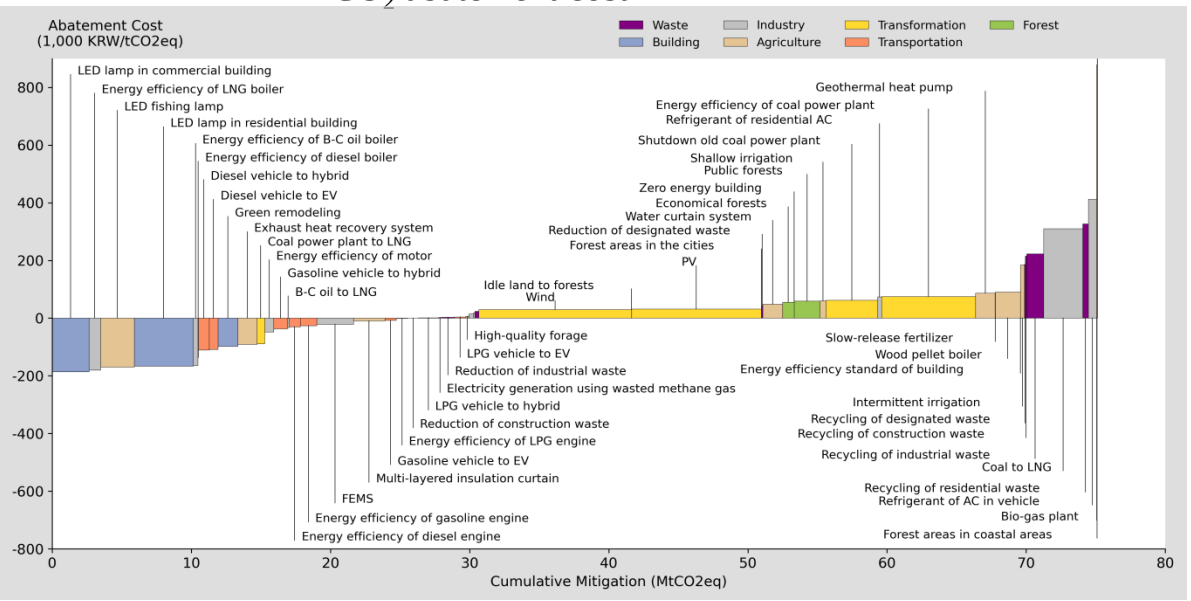
Importance of co-benefits: Energy savings, Air quality, Adaptation



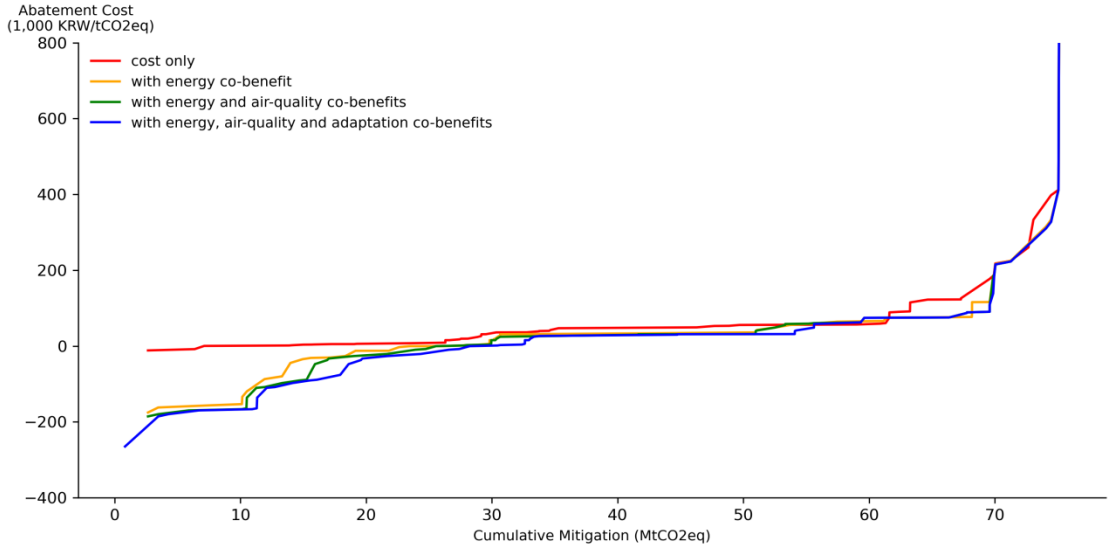
CO_2 abatement cost



CO_2 abatement cost with energy saving co-benefits



CO_2 abatement cost with energy savings and air-quality-improvement co-benefits



Need for integrated assessment of the GHG and AQ policies in NEA

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- Benefits of the emission mitigations of particulate matters and GHGs in Northeast Asia
  - Countries in Northeast Asia are closely connected economically and environmentally
  - Emissions of GHGs and particulate matters are dependent on socio-economic conditions
  - Analysis of the structure of emissions and policies considering the socioeconomic conditions of neighboring countries is needed

- Co-benefits of both policies between particulate matter mitigation and GHG mitigation
  - Co-benefits: More efficient policy can be established by co-reducing particulate matters and GHGs
  - Integrated analysis considering impacts on/from neighboring countries is needed while estimating the benefits of mitigation

- Platform for integrated analysis of policies in Korea, China, and Japan is needed in order to reduce particulate matters and tackle climate change in Northeast Asia
  - National experiences of integrated management of air quality policy and GHG mitigation policy are required
  - Method to propose optimal policy to create inter-countries co-benefits in Northeast Asia is required
  - Impacts of national air quality policy and climate policy + Impacts on neighboring countries = Maximization of regional co-benefits in Northeast Asia

Policy Library

- Quantification of co-benefit is important for policy decision
  - To share information on best co-benefit policies

〈Policy Library〉

Policy	Policy	Transition from Coal and LNG to Solar Energy
	Policy introduction	"Transition to solar energy" policy is included in "Renewable Energy 3020 Implementation Plan" and "Greenhouse Gas Mitigation Target of the 2030 Reduction Roadmap of Korea". "Renewable Energy 3020 Implementation Plan" suggests installing 10GW solar panels in rural areas until 2030. In addition, it suggests installing 7.5 GW by small community-based funds until 2030.
Costs	Construction cost (thousand won/kW)	**1,659**
	Maintenance cost (thousand won/kW-month)	**24.9**
Benefits	Unit GHG reduction (kg/Mwh)	**823.0**
	Unit AP reduction (kg/Mwh)	**NOx: 0.276, SOx: 0.241 PM2.5: 0.012, TSP: 0.012**
Barriers		Capital costs, Siting and transmission, Market entry, Reliability misconception

Thank you