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Research Collaboration with IIASA: Example (II)
SLCP Co-benefit in East Asia

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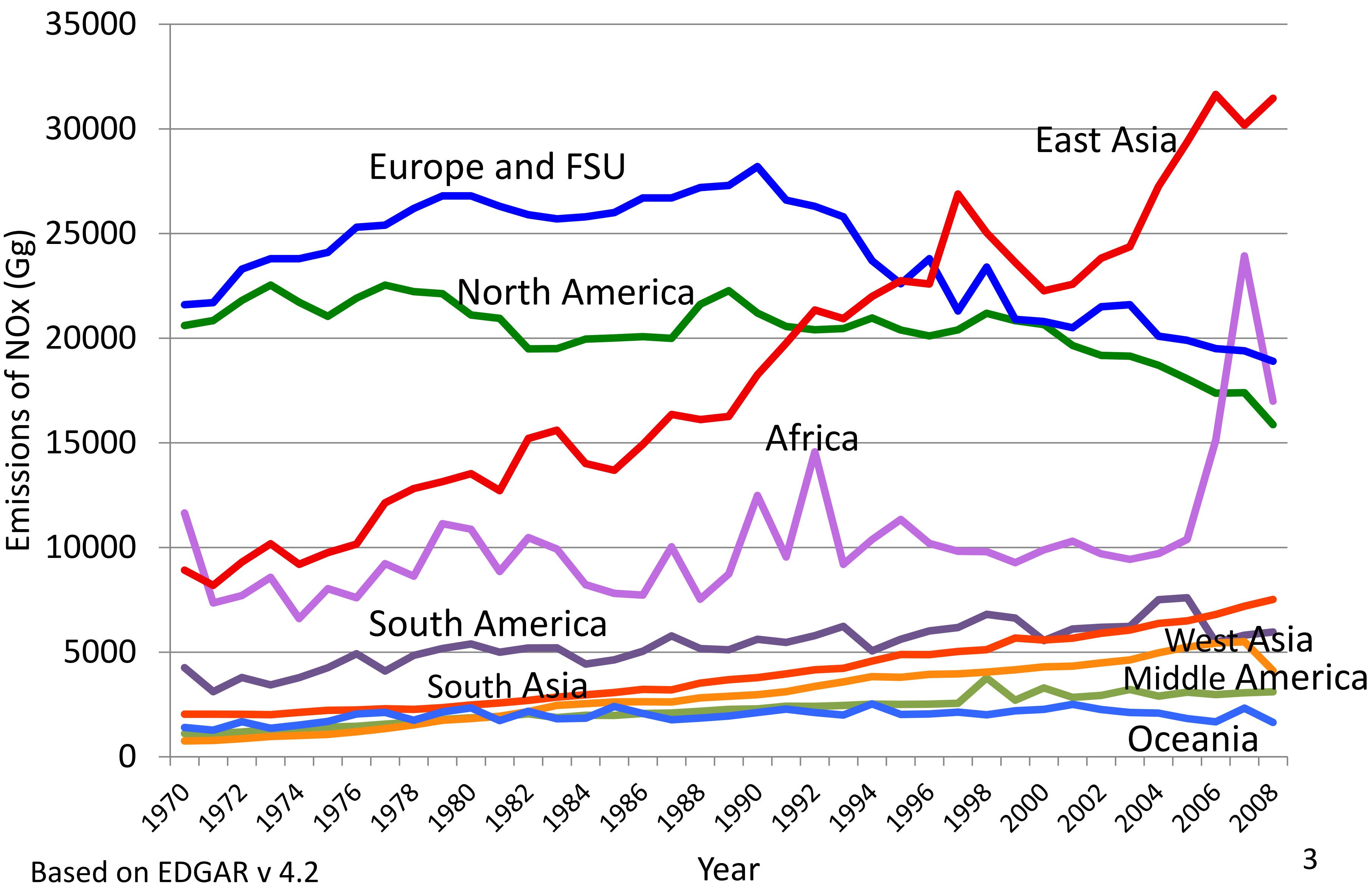
Research Collaboration with IIASA

To Develop Concept Design of
SLCP Co-benefit Approach in East Asia

S-7 Project Funded by MOEJ
(FY2009-2013)

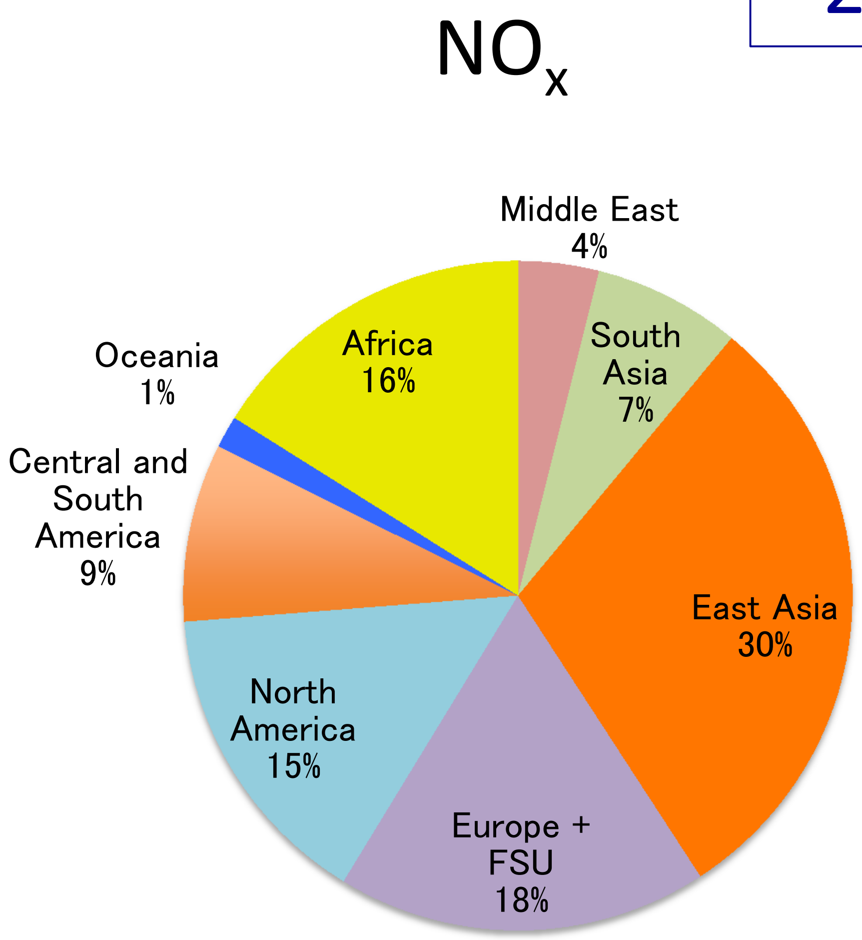
Trends of NO_x Emissions by Continent during 1970-2008



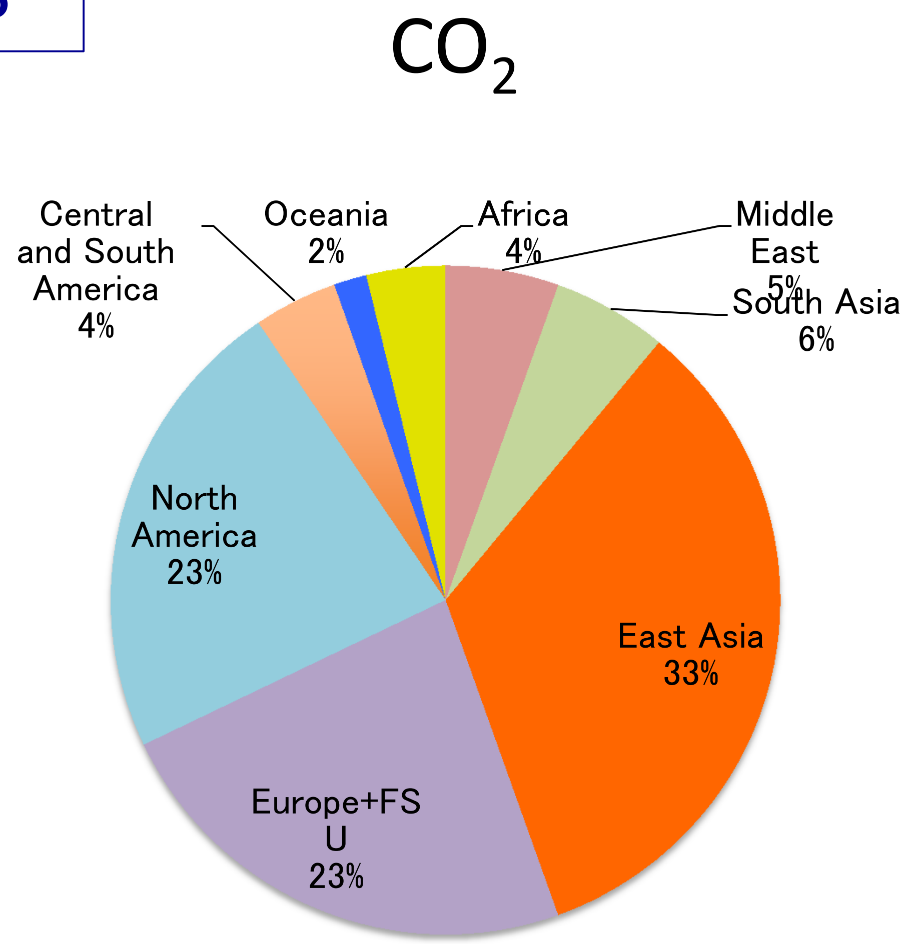
Based on EDGAR v 4.2

Global Share of NO_x and CO_2 Emissions by Continent

2008



Based on EDGAR v 4.2



Based on CDIAC

Climate Change and Hemispherical Air Pollution Issue can never be solved without controlling the emissions of CO_2 and APs in East Asia

"SLCP Co-benefit Approach" provides a logically sound policy to control CO_2 and APs simultaneously

However, SLCP reduction pathways in East Asia should be different from those proposed by EU and US

In EU/US serious air pollution has already been overcome, and social incentive is higher for climate change. Therefore, they proposed SLCP reduction mainly from the view point of climate change mitigation.

- UNEP Report, CCAC (Climate and Clean Air Coallition)

However, in many countries in East Asia air pollution ($PM_{2.5}$ and O_3) is very serious, and social incentive is much stronger for air pollution mitigation rather than climate change measures.

Targeted SLCPs (Short-lived Climate Pollutants) :

BC, Tropospheric O_3, CH_4

Climate Change Side		Air Quality Side
BC		$PM_{2.5}$
OC, NO_3^-, SO_4^{2-} (negative RF)	⟷ Contradiction	(BC, OC, NO_3^-, SO_4^{2-})
Tropospheric O_3 (Global)		Surface O_3 (Urban/Regional)
CH_4		NO_x/NMVOC
NO_x (negative RF)	⟷ Contradiction	CH_4

UNEP Report, CCAC

- CH_4 should be reduced.
- NO_x should not be reduced.

Our Conclusion

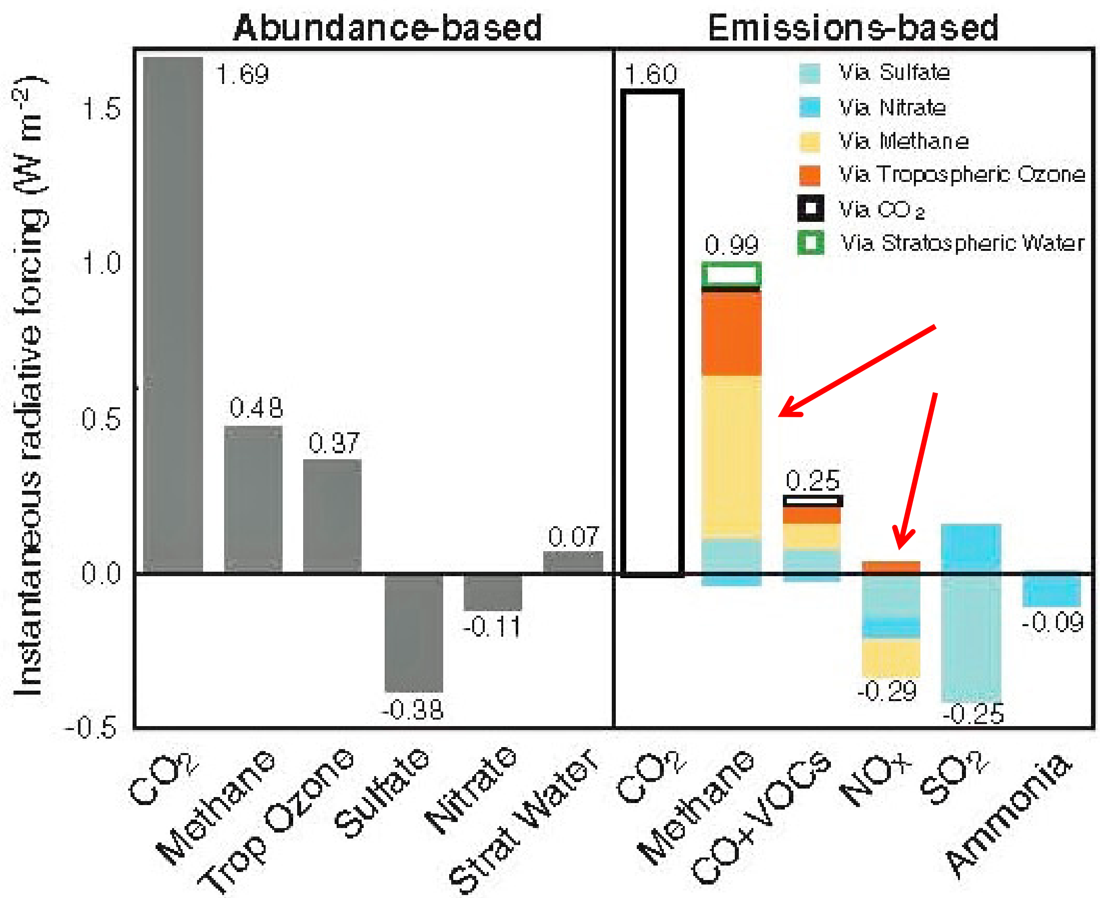
- NO_x/NMVOC should be reduced.
- CH_4 should be reduced simultaneously.

Why only CH_4 and not NO_x Control is targeted In UNEP Reports and CCAC Initiative?

➡ Reduction of NO_x alone will decreases NO_3^-, and OH

The decrease of OH will increase CH_4

Instantaneous radiative forcing due to the abundance-based and emission-based increase of each chemical species



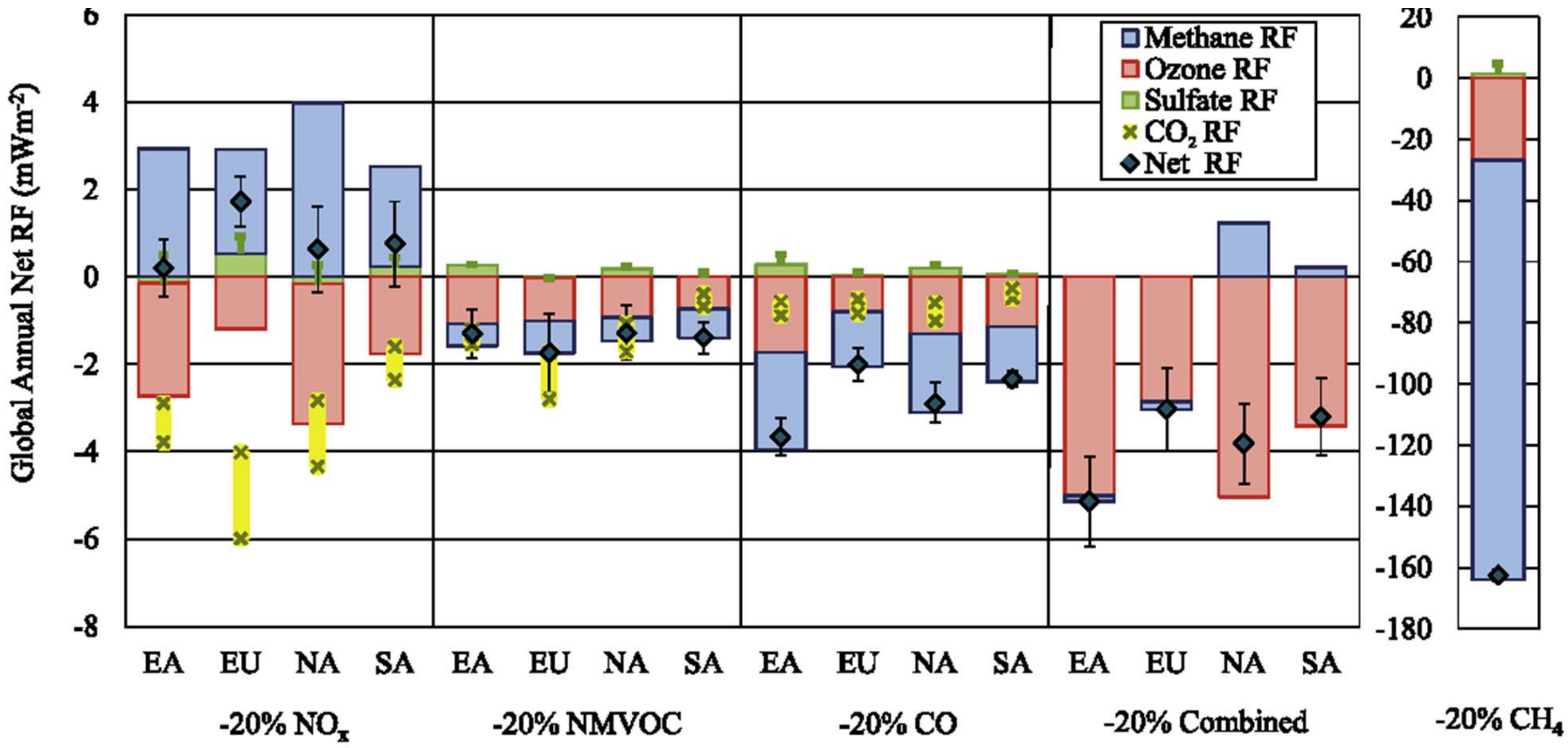
Shindell et al., Science, 2009

Simultaneous reduction of NO_x together with NMVOC

OH does not decrease and CH_4 does not increase.

The decrease of O_3 contribute to the decrease of RF.

Global annual average RF (mW m-2) for the HTAP ensemble of multiple models



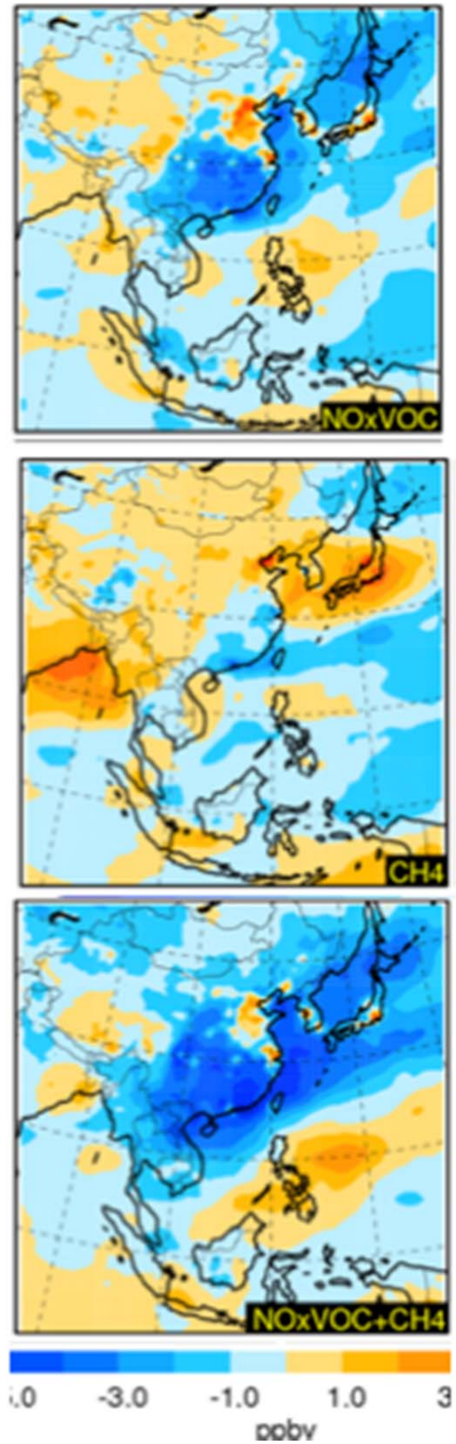
Fry et al. J. Geophys. Res., 2012.

Sensitivity analysis of 50% emission reduction of NO_x/NMVOC and CH_4 in Northeast Asia on surface O_3
(China, Korea, Japan, Mongolia)
(Referenced to the 2005 GAINS Emission)

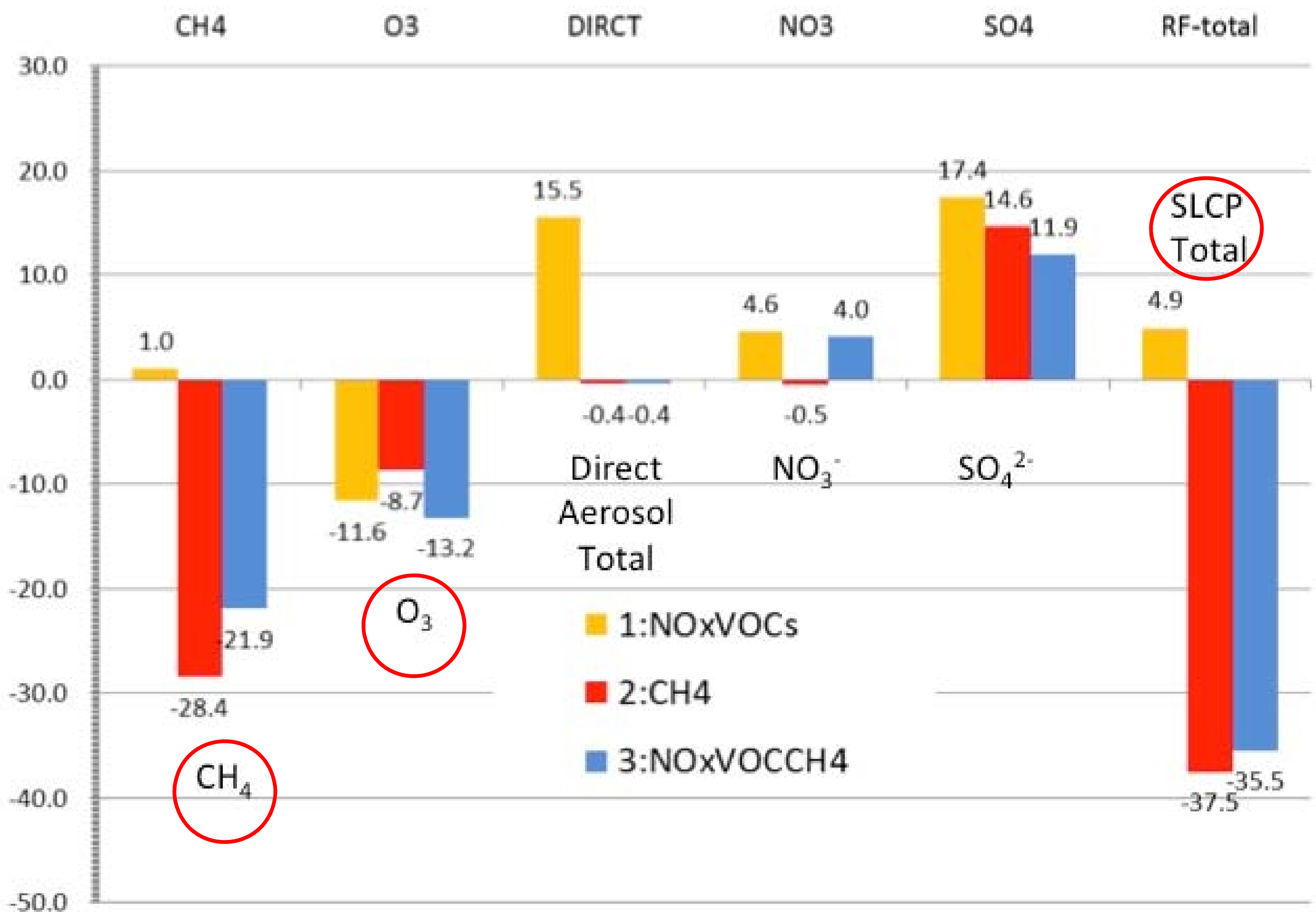
50% Reduction of NOx/VOC

50% Reduction of CH_4 Emission
(ca. 4% reduction of mixing ratio)

50% Simultaneous Reduction of NOx/VOC and CH_4



Change in Global Averaged Radiative Forcing at the tropopause for 50% Reduction of Emissions in Northeast Asia (Referenced to the 2005 GAINS Emission)

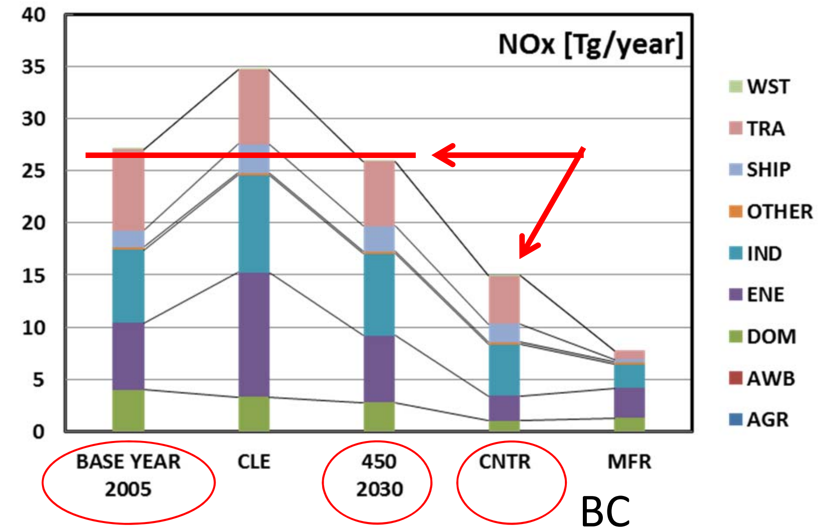


IIASA Emissions for East Asia in 2005 & 2030（CLE, 450ppm, MFR Scenarios)

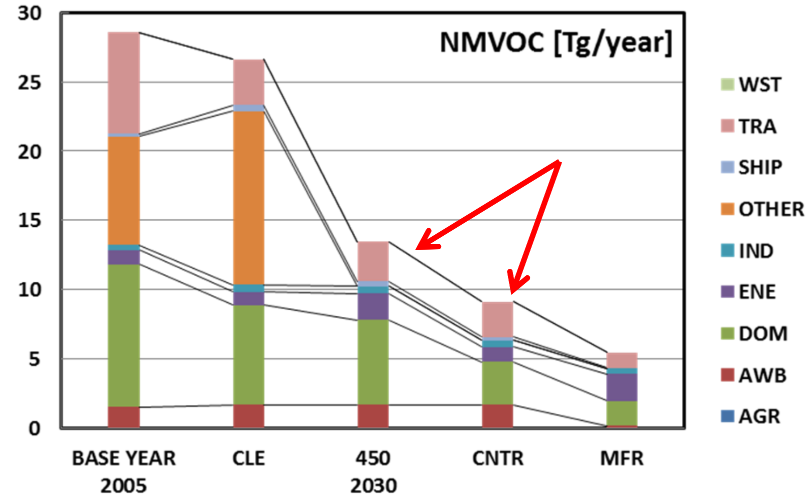
“450 ppm-cntr” Scenario

NOx: about 50% reduction, VOC and BC: about 30% reduction for East Asia in 2030 Compared to” 450 ppm” scenario (no change for CH_4 and SO_2)

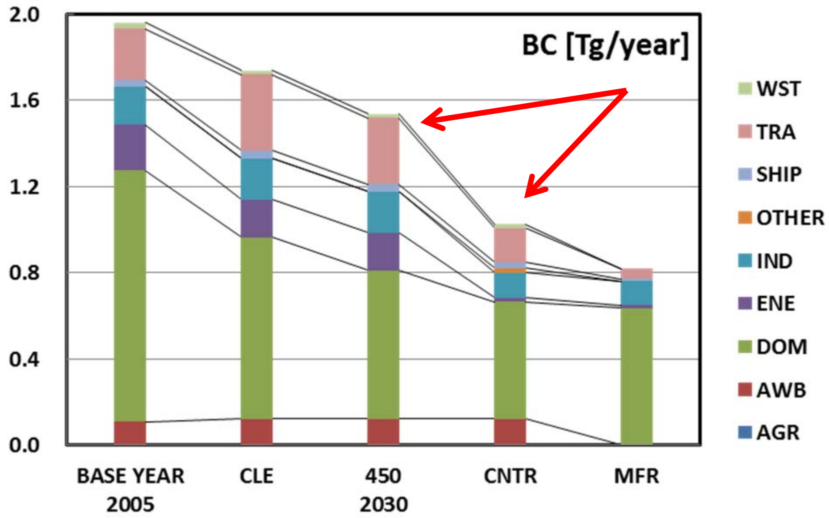
NOx



NMVOC

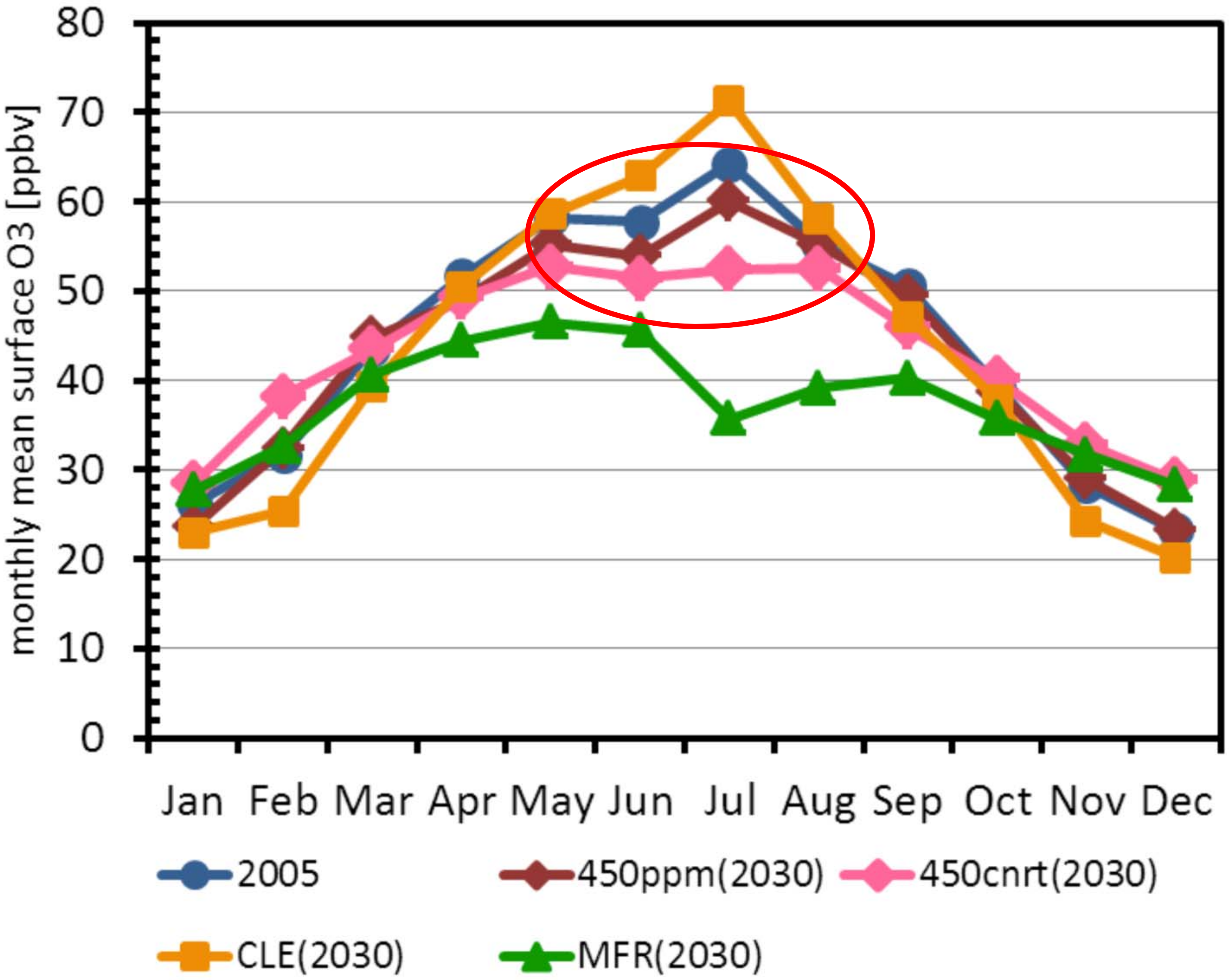


BC



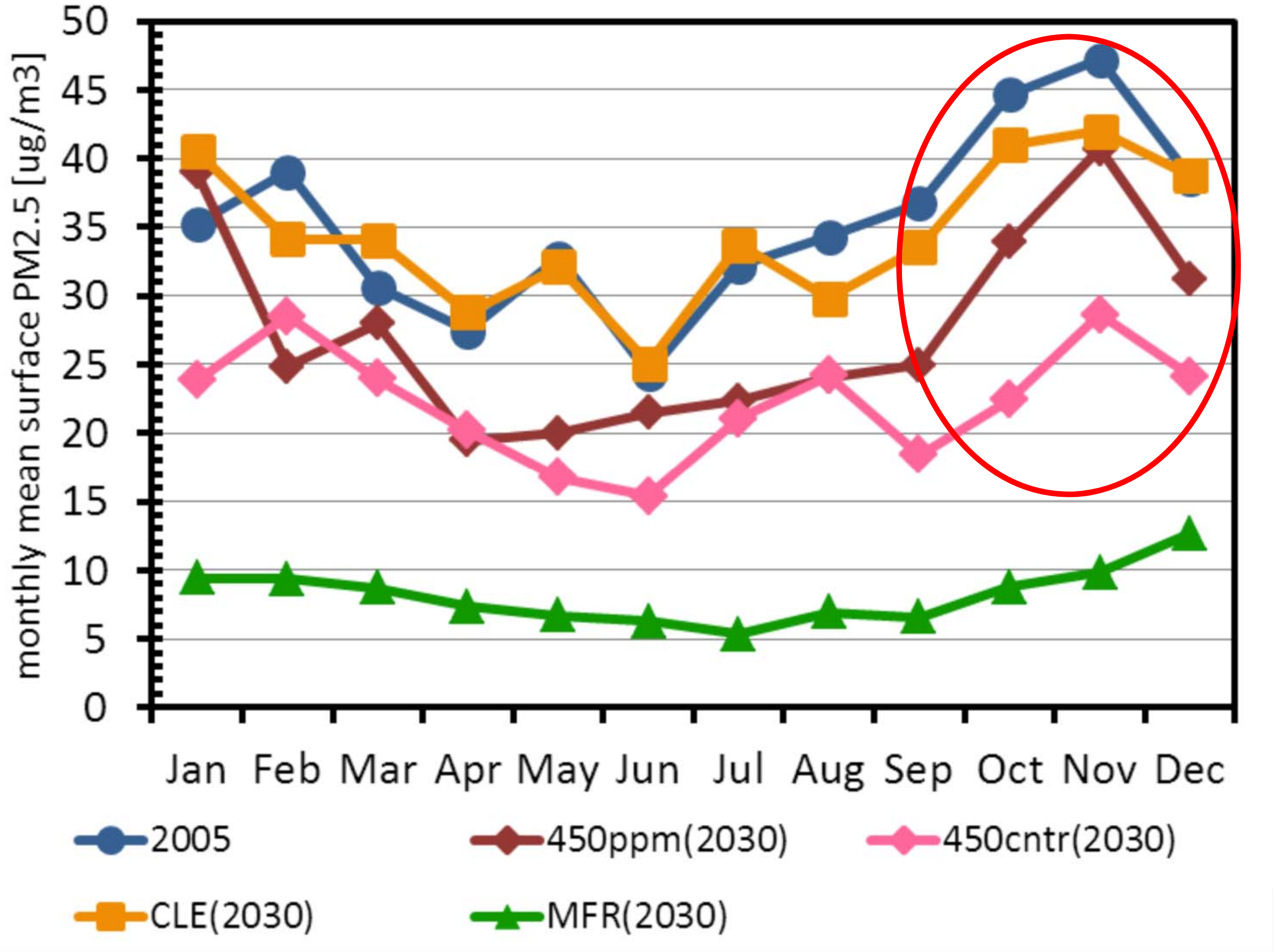
Seasonal Variation of Surface O_3 Concentration In Central East China according to the IIASA Scenarios

O_3



Seasonal Variation of Surface $PM_{2.5}$ Concentration In Central East China according to the IIASA Scenarios

$PM_{2.5}$



Summary

1. Strengthening NOx/VOC (and BC) reduction in East Asia reduces surface O_3 in summer time and reduces $PM_{2.5}$ in autumn/winter time in this region.
2. Strengthening NOx/VOC and BC reduction together with CH_4 reduction reduces radiative forcing distinctly.
3. Therefore, money should be spent for the simultaneous reduction of NOx/VOC/BC and CH4 in East Asia.
4. Policy for the SLCP co-benefit approach should be region-specific reflecting the societal concern in each region.