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# Feasibility of 50% global GHG emission reduction

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# Research questions

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- Reduction targets of regions by 3 burden-sharing schemes
  - (1) Emission per capita (pCAP)
  - (2) Emission per GDP (pGDP)
  - (3) Cumulative emission per capita (pCUM)
  
- Feasibility of 50% global GHG emission reduction in 2050 compared with 1990
  
- Feasibility of reduction target of each region
  
- Differences of reduction targets by
  - GHG total vs GHG excluding LULUCF
  - Target year: 2050 vs 2075
  - *etc*

# Three burden-sharing schemes

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**Target Year: 2050**

◆ Emission per Capita (pCAP)

◆ Emission per GDP (pGDP)

◆ Cumulative emission per capita (pCUM)

Cumulative emission per capita =

cumulative emission from 2020 / cumulative population from 2020

If target year is set before 2020, it is impossible to equalize cumulative emission per capita.

**Emission path:**

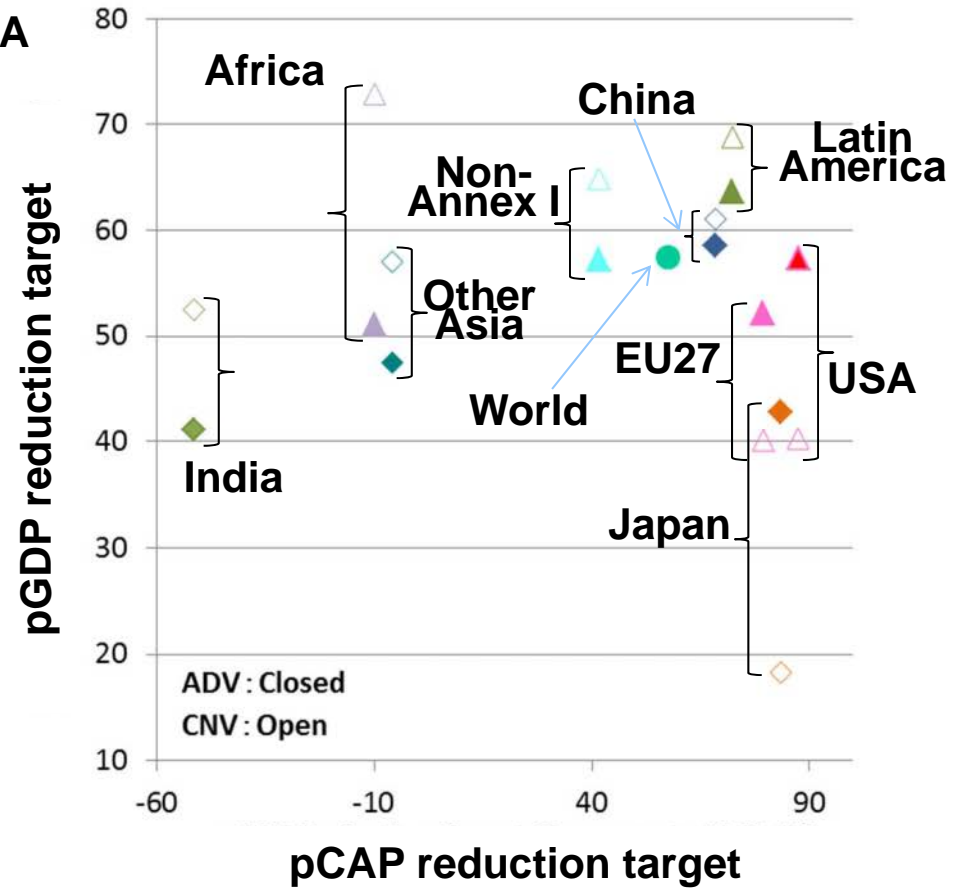
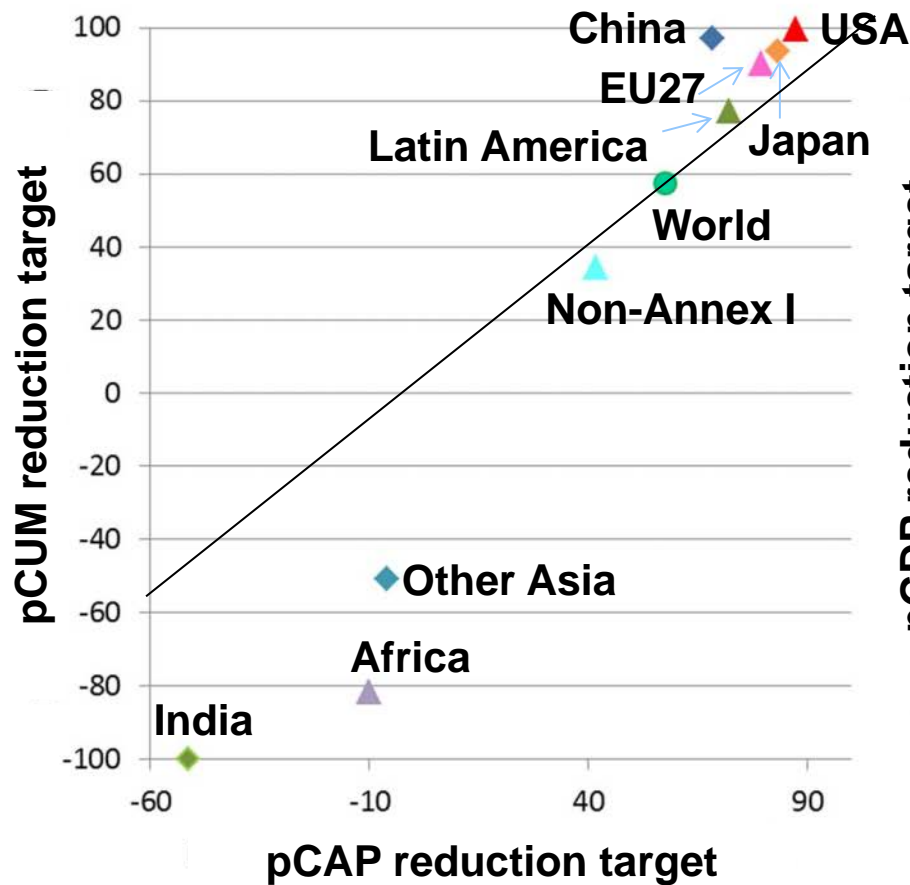
constant change rate of GHG/GDP

pass the pledges in 2020

## Reduction target in 2050 (compared with 2005, %)

Region	pCAP	pGDP		pCUM	Region	pCAP	pGDP		pCUM
		ADV	CNV				ADV	CNV	
Japan	83	43	18	94	Middle East	58	48	56	77
China	68	59	61	97	Australia	89	68	58	99
Indonesia	69	88	88	81	New Zealand	78	46	40	87
India	-51	41	53	-100	Central Asia	71	82	90	81
Korea	85	57	49	99	Canada	89	68	58	100
Malaysia	-116	-163	-181	51	USA	87	57	40	99
Taiwan	87	54	39	99	EU-15	80	48	33	89
Thailand	61	54	65	85	EU-10	80	68	71	96
Vietnam	12	60	74	32	EU-2	74	74	83	95
Singapore	75	14	-16	92	Turkey	32	20	24	56
Philippines	-104	39	33	-376	Oth. WE in Annex I	67	-30	-87	69
Oth. East Asia	66	89	95	81	Oth. EE in Annex I	80	87	92	97
Oth. South Asia	-120	4	52	-371	Other Europe	59	62	77	74
Oth. Southeast Asia	74	92	96	87	Russia	85	84	90	100
Oth. Oceania	33	45	65	43	Mexico	56	29	36	74
Asia	46	57	59	47	Argentina	69	32	28	92
Asia excl. JPN	42	58	63	43	Brazil	83	79	80	88
Annex I	83	58	46	95	Oth. Latin America	52	43	57	52
Non-Annex I	42	57	65	34	South Africa	76	66	74	93
World	58	58	58	58	Other Africa	-22	49	73	-105

# Relationship among three burden-sharing schemes

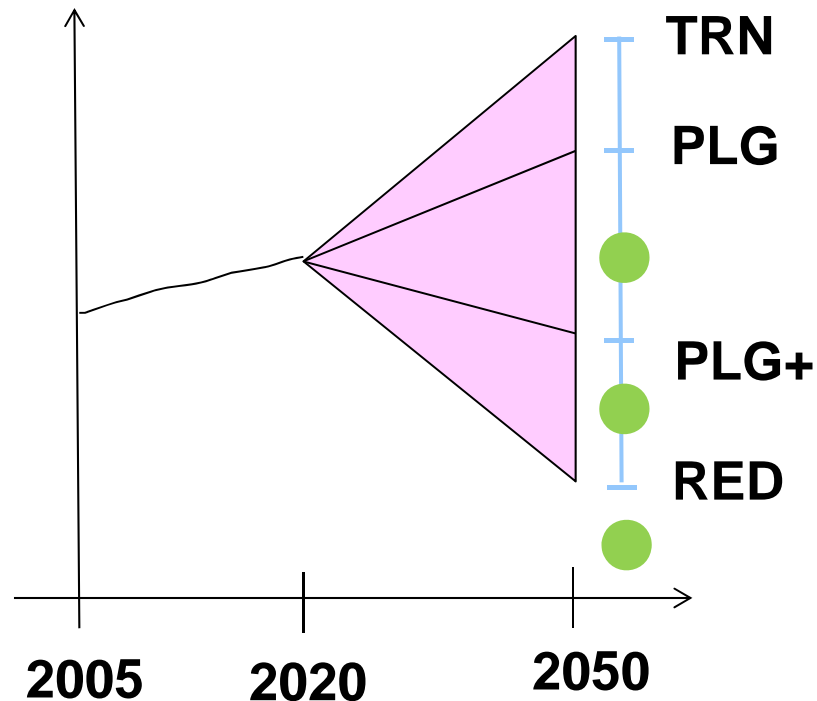


The pCAP and pCUM schemes have roughly a linear relationship.

pGDP; ADV scenario---developed countries: high reduction targets.

CNV scenario---developing countries: high reduction targets

# How to check "feasibility"



GHG emission =  
Energy related + Other source

$$\begin{aligned} \text{Energy related emission} &= \frac{\text{GHG}}{\text{Energy}} \times \frac{\text{Energy}}{\text{GDP}} \times \text{GDP} \\ &= \text{CI} \times \text{EI} \times \text{GDP} \end{aligned}$$

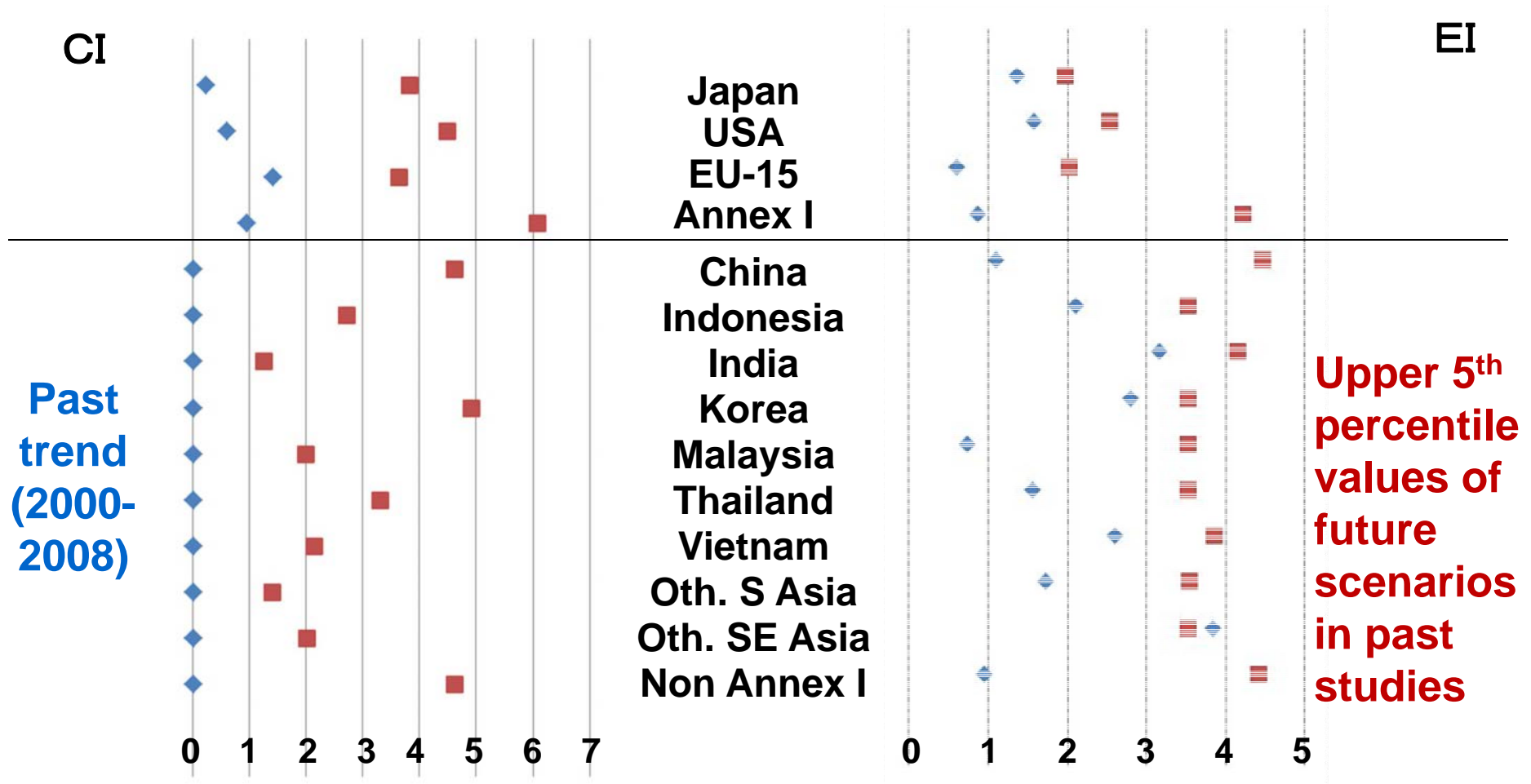
◆ **GDP:** world growth rate : ADV (3.39%/yr), CNV (2.23%/yr)

◆ **EI, CI:** 1) past trend ( 2000–2008)

2) assume for future emissions scenarios in past studies

(Asia LCS report, SRES, WEO, Asia/World EO, ER )

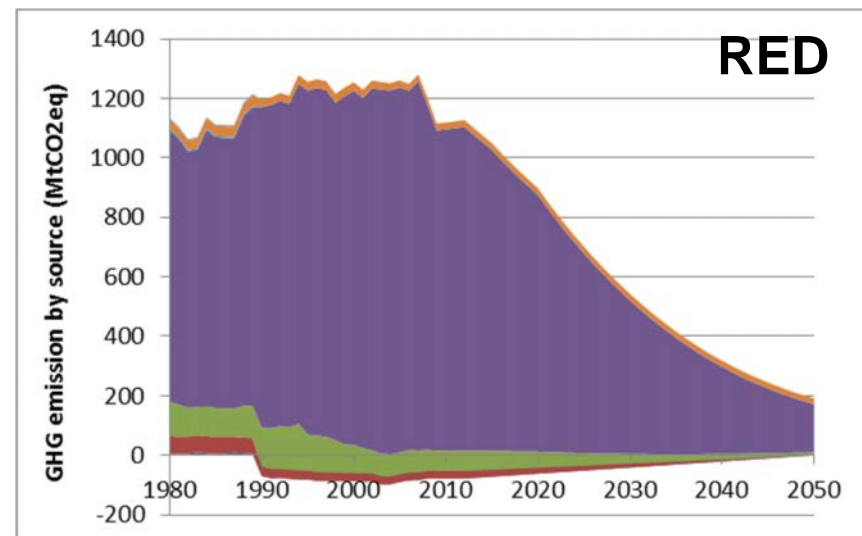
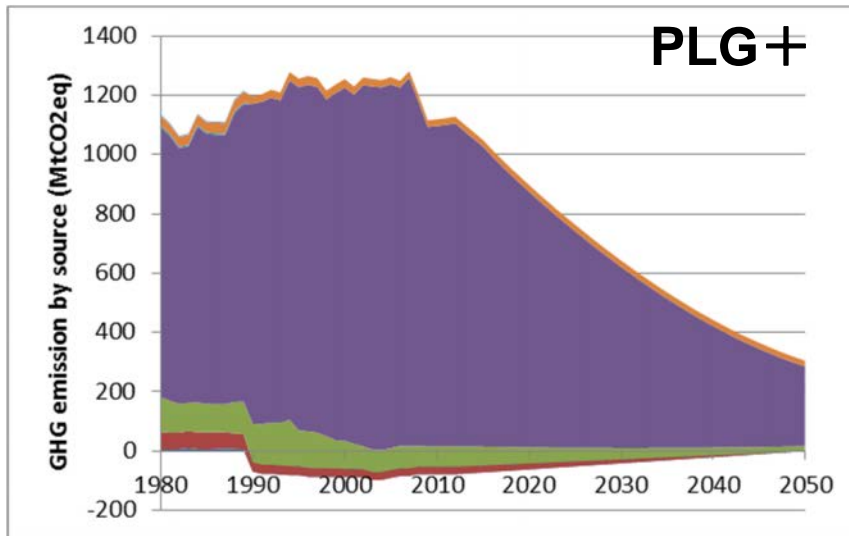
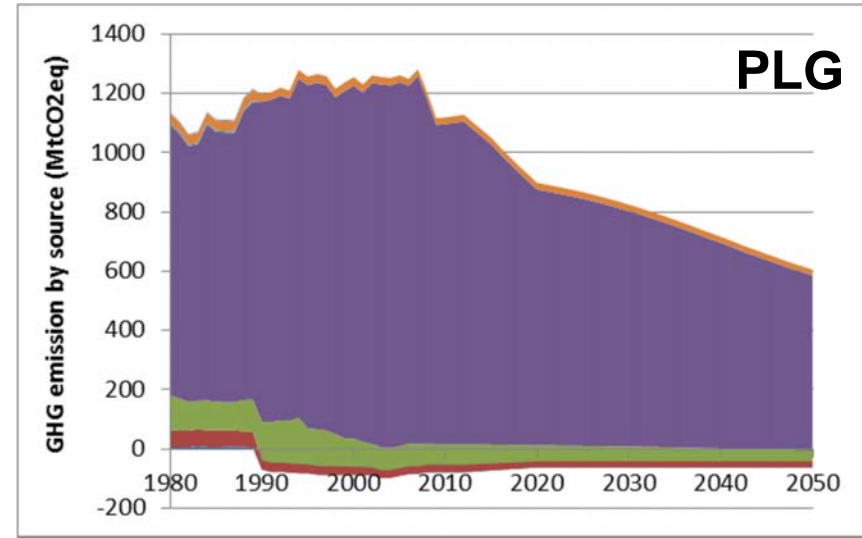
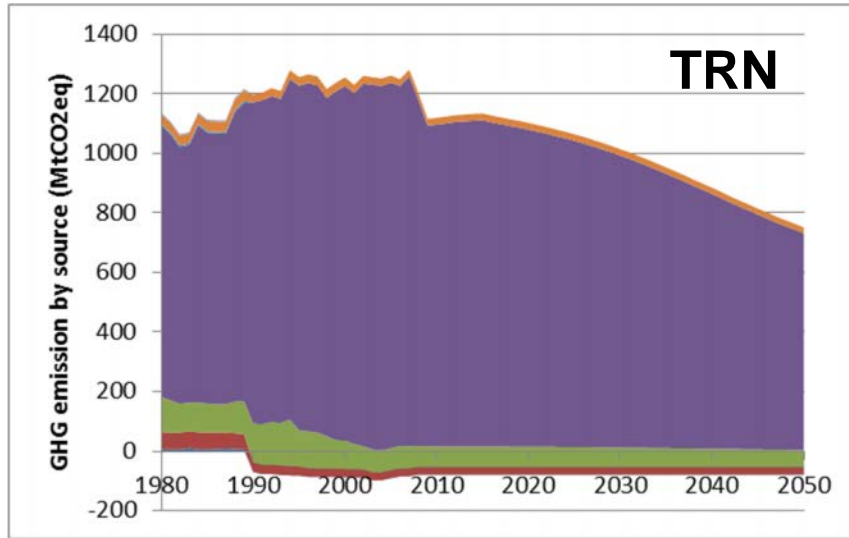
# Improvement rate of EI and CI (%/yr)



If improvement rates are minus (deterioration), improvement rates of EI and CI are set as zero for GHG projection.

# 4 reduction case (ex. Japan)

4 reduction case: TRN, PLG, PLG+, RED





# Emission scenarios of sources by 4 cases

Period	Source	Reduction case					
		TRN	PLG		PLG+		RED
			Without pledge	With pledge	Without pledge	With pledge	
2008 ~ 2012	Energy	For both EI and CI, the speed of improvement from 2000 to 2008 continues					
	Industry, Solvent, Other	Assume the same speed of improvement as energy related emission					
	F-gas	Keep 2008 emission level					
	AFOLU						
2013 ~ 2020	Energy	For both EI and CI, the speed of improvement from 2000 to 2008 continues	Improve towards meeting pledge while keeping a constant speed of change in GHG/GDP	For both EI and CI, the speed of improvement from 2000 to 2008 continues	Improve towards meeting pledge while keeping a constant speed of change in GHG/GDP	Both EI and CI change at a high speed of improvement	
	Industry, Solvent, Other	Assume the same speed of improvement as energy related emission	Assume the same speed of improvement as energy related emission	Assume the same speed of improvement as energy related emission	Assume the same speed of improvement as energy related emission	Assume the same speed of improvement as energy related emission	
	F-gas	Keep 2008 emission level	Linear reduction in emissions to 0 in 2050	Keep 2008 emission level	Linear reduction in emissions to 0 in 2050		
	AFOLU						
2021 ~ 2050	Energy	For both EI and CI, the speed of improvement from 2000 to 2008 continues	For both EI and CI, the speed of improvement from 2000 to 2008 continues		For both EI and CI, the speed of improvement between 2013 to 2020 continues	Both EI and CI change at a high speed of improvement	
	Industry, Solvent, Other	Assume the same speed of improvement as energy related emission	Assume the same speed of improvement as energy related emission	Assume the same speed of improvement as energy related emission	Linear reduction in emissions to 0 in 2050		
	F-gas	Keep 2008 emission level	Keep 2020 emission level	Keep 2008 emission level			
	AFOLU						

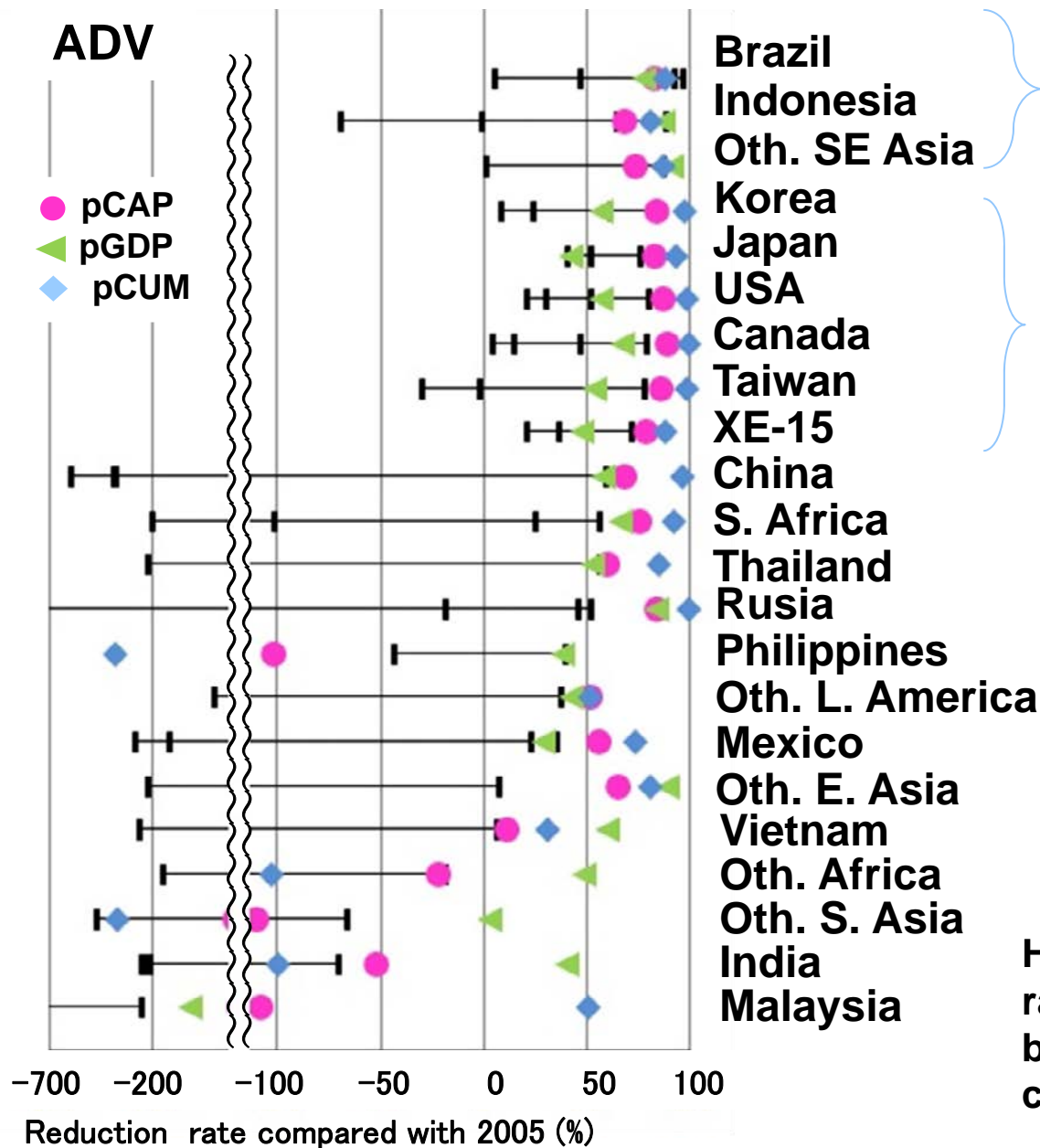
## Result 1: Feasibility of 50% global GHG emission reduction in 2050 compared with 1990

Reducion	Economic Scenario			
	ADV		CNV	
case	GHG Emission (GtCO <sub>2</sub> eq)	Reduction from 1990 (%)	GHG Emission (GtCO <sub>2</sub> eq)	Reduction from 1990 (%)
1990	35.7		35.7	
2005	42.1	-17.7	42.1	-17.7
TRN	112.9	-216.1	70.3	-96.8
PLG	92.5	-158.8	57.1	-59.7
PLG+	109.0	-205.2	70.5	-97.2
RED	21.5	39.9	12.1	66.1

achieve  
50%

The GHG emissions in the world increase compared to 1990 under all cases except RED case.

# Result 2: Feasibility of reduction target of each region



**Large share of AFOLU**

**Developed countries**

Both reduction projections and reduction targets are large.

\* small GDP growth rate

\* large CI improvement

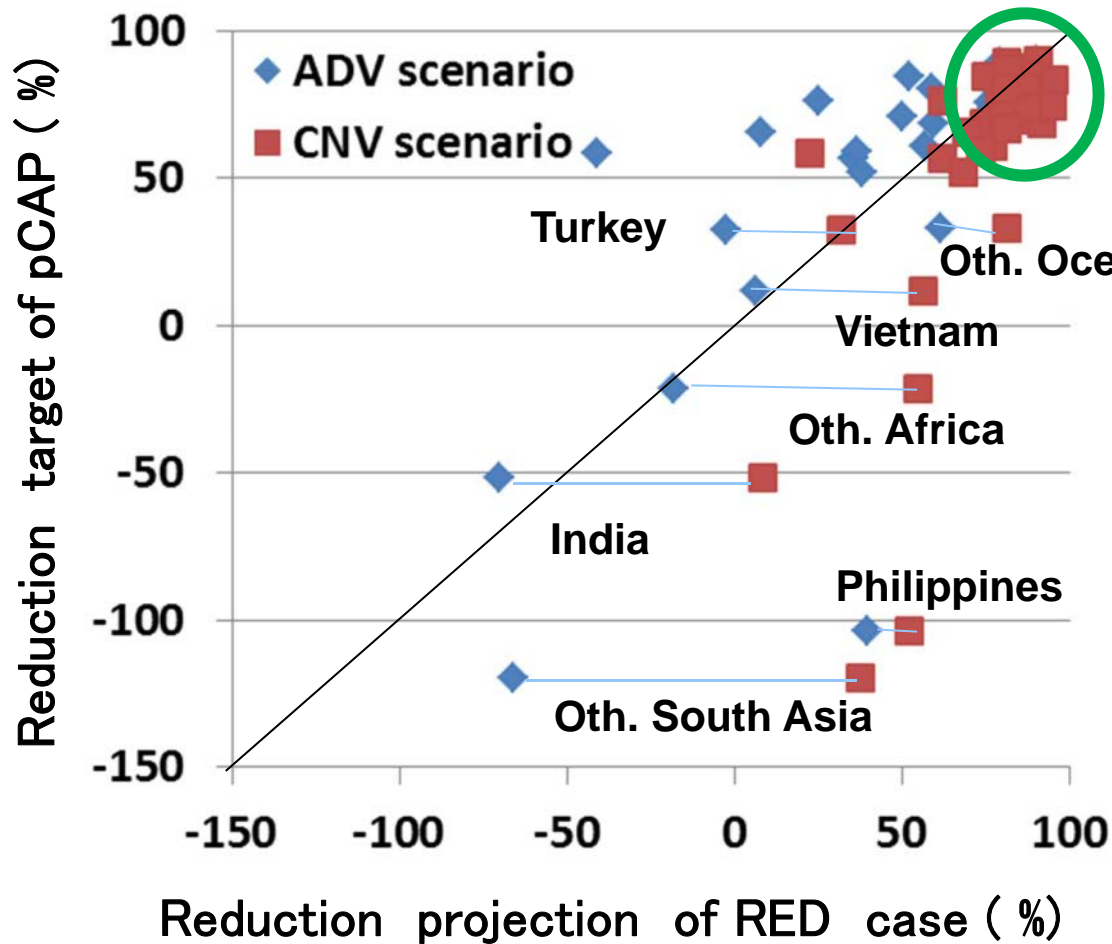
**Developing countries**

Reduction projections: small

Some can't achieve all the reduction targets

Horizontal line shows feasible ranges of GHG emission reductions based on TRN, PLG, PLG+, and RED cases.

## Result 3: Effect of economic scenario



Economic scenario doesn't effect reduction projection.

Effect for reduction target achievement;

CHN, IND, MEX, THA, VNM, XEA, XCS, XEEI, WENI, XLM

## Result 4: Target year and LULUCF

Regions	GHG emission (MtCO <sub>2</sub> eq)			pCAP Reduction target (%)		
	1990	2005	2005LU	2050		2075
				GHG total	GHGexLU	GHG total
Japan	1197	1261	-90	83	85	73
China	3931	7946	69	68	68	21
Indonesia	1165	1791	1126	69	15	46
India	1387	2145	33	-51	54	-100
Korea	301	590	-35	85	86	65
Malaysia	199	39	-215	-116	67	-368
Taiwan	137	290	0	87	87	67
Thailand	208	349	13	61	59	18
Vietnam	99	226	9	12	6	-55
Singapore	33	48	0	75	75	55
Philippines	96	146	1	-104	-106	-84
Oth. East Asia	221	171	46	66	53	38
Oth. South Asia	357	539	9	-120	-123	-168
Oth. Southeast Asia	944	647	495	74	-9	46
Oth. Oceania	42	52	36	33	-116	-36
USA	5320	6157	-1028	87	89	70
EU-15	4044	3932	-255	80	81	66
World	35732	42061	3264	58	54	25

Thank you



# Works in FY 2012

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## **Burden Sharing (MEM\_BS)**

- 3 burden-sharing schemes
  - (1) Emission per capita (pCAP), (2) Emission per GDP (pGDP), and (3) Cumulative emission per capita (pCUM)
- Description
  - 230 countries
  - GDP: ADV scenario and CNV scenario

## **Material Stock Flow Model (MSFM)**

- Finalize world model
- Separate country model