# *ERI's Research Activities in 2014*

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Energy Research Institute

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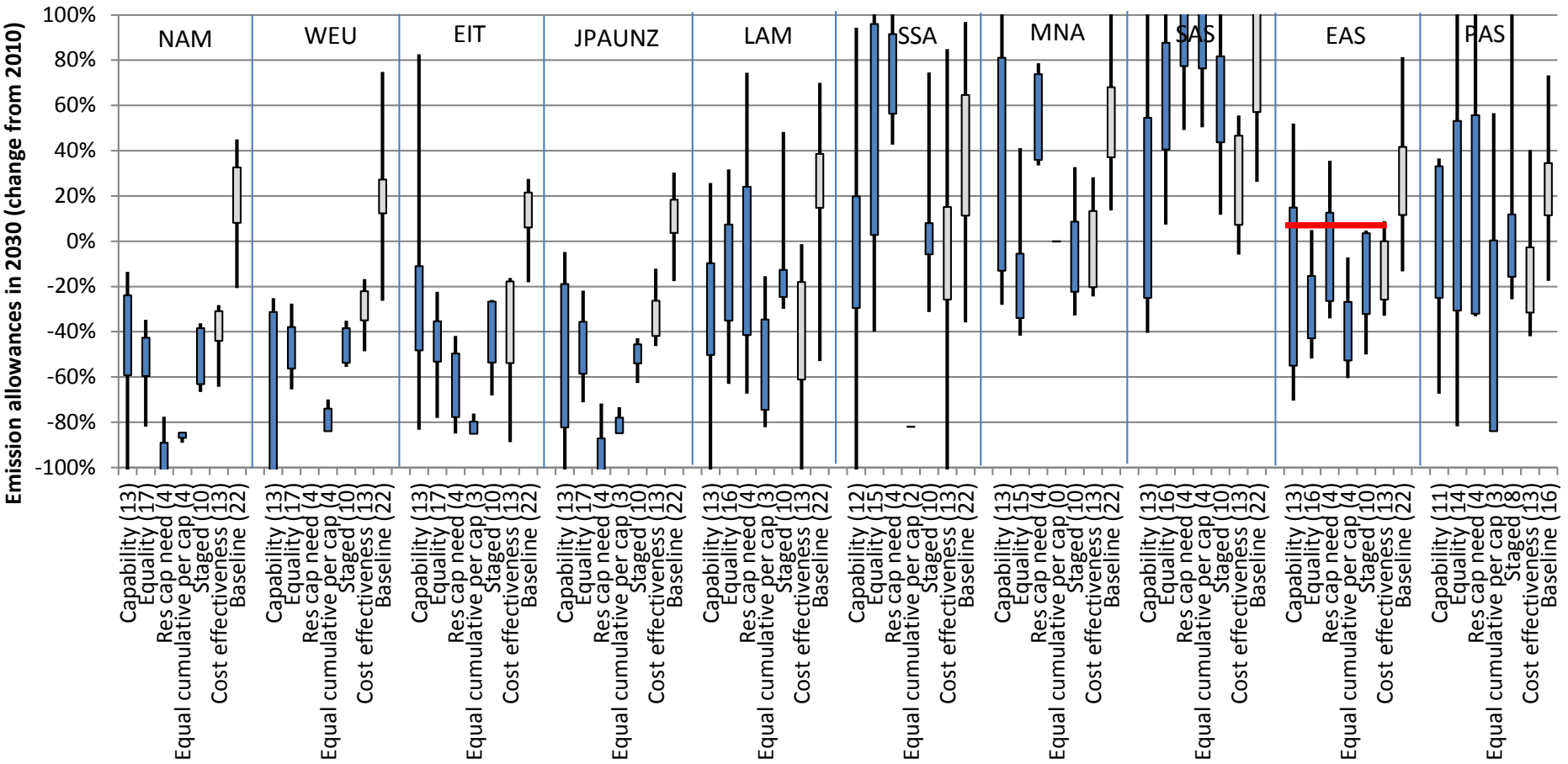
Tsukuba

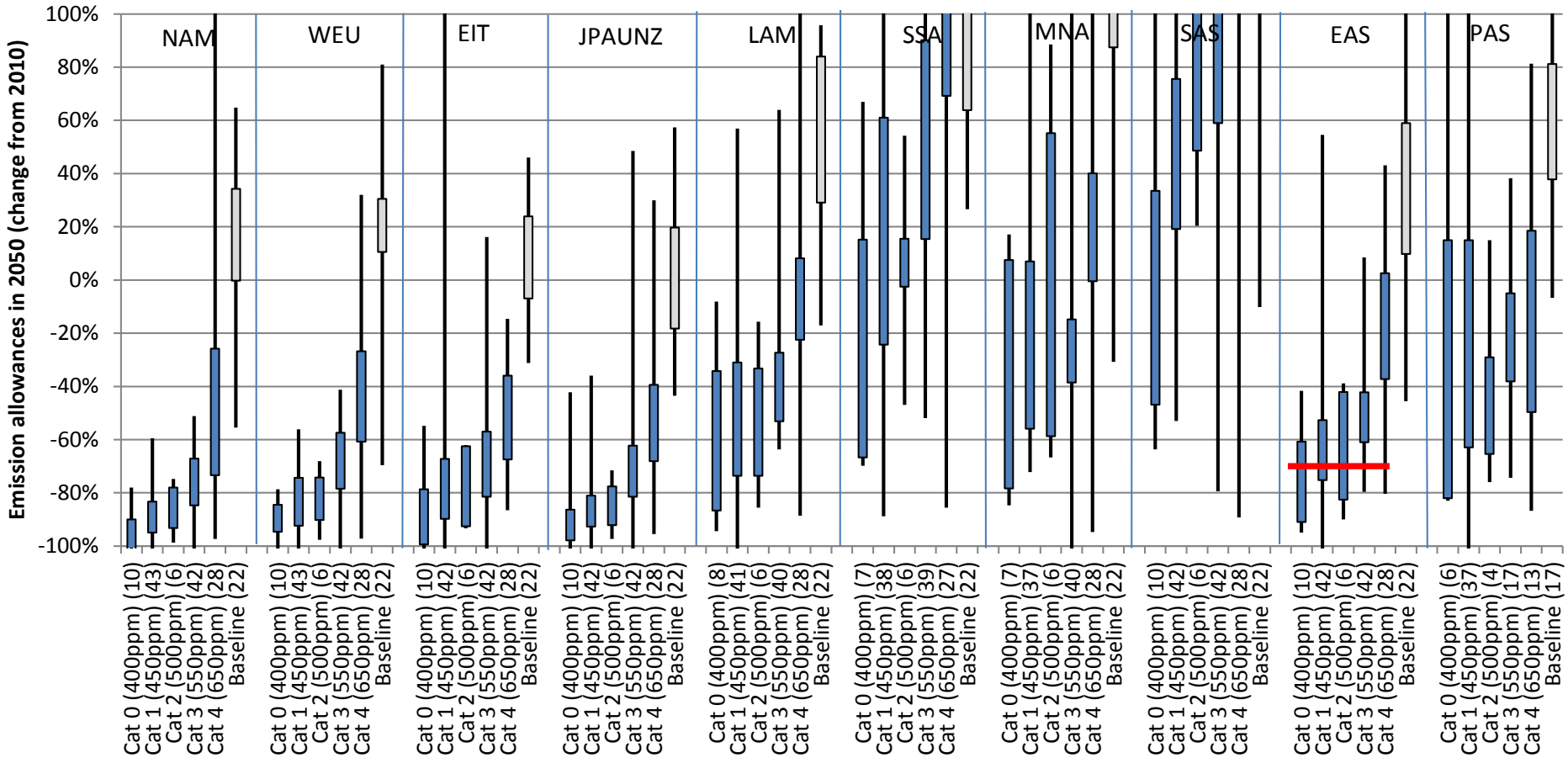
# Modeling activities in 2014

- feasibility for 2 degree scenario: multiply 2 degree scenarios
- air pollution control policies assessment, co-benefit with GHG emission
- carbon pricing assessment: carbon tax, emission trading
- Provincial/City studies: Beijing Low Carbon Development Strategy, Guiyang Energy Planning
- Coal peaking study
- Rapid Energy Transition Scenario for China
- Energy Solution in rural area
- CD-LINK, LIMIT, IAMC, EMF30, MILES
- 2 degree Asia



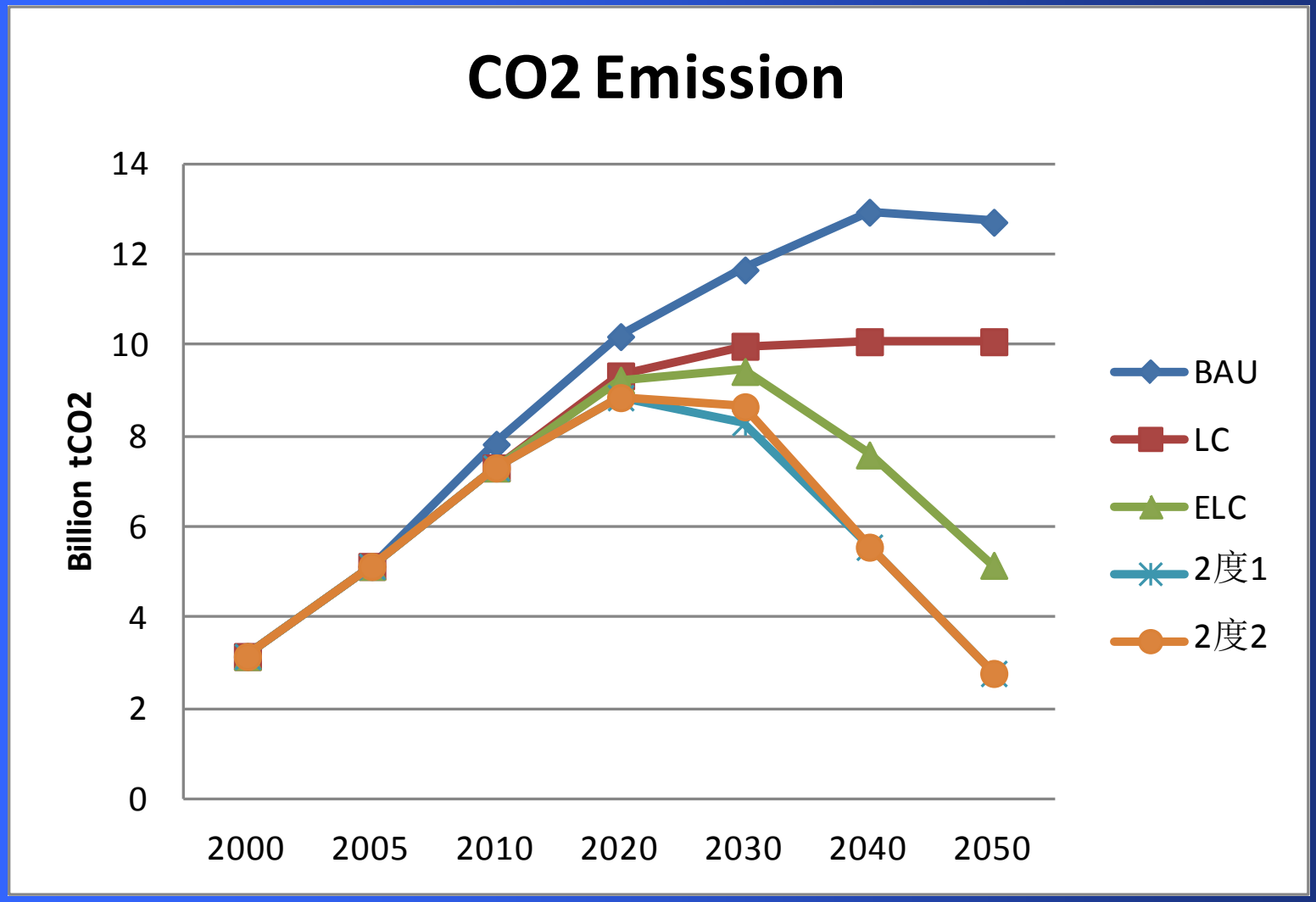

**排放分担，2030和2010年相比，十个地区**

**Figure 2. Emission allowances by allocation category for Cat 1, i.e. 425-475 ppmCO2e, in 2030 relative to 2010 emissions (min, 20th percentile, 80th percentile, max). Number of studies in brackets. GHG emissions (all gases and sectors) in $GtCO_2e$ in 1990 and 2010 were OECD90 13.4, 14.2, EIT 8.4, 5.6, ASIA 10.7, 19.9, MAF 3.0, 6.2, LAM 3.3, 3.8 .**

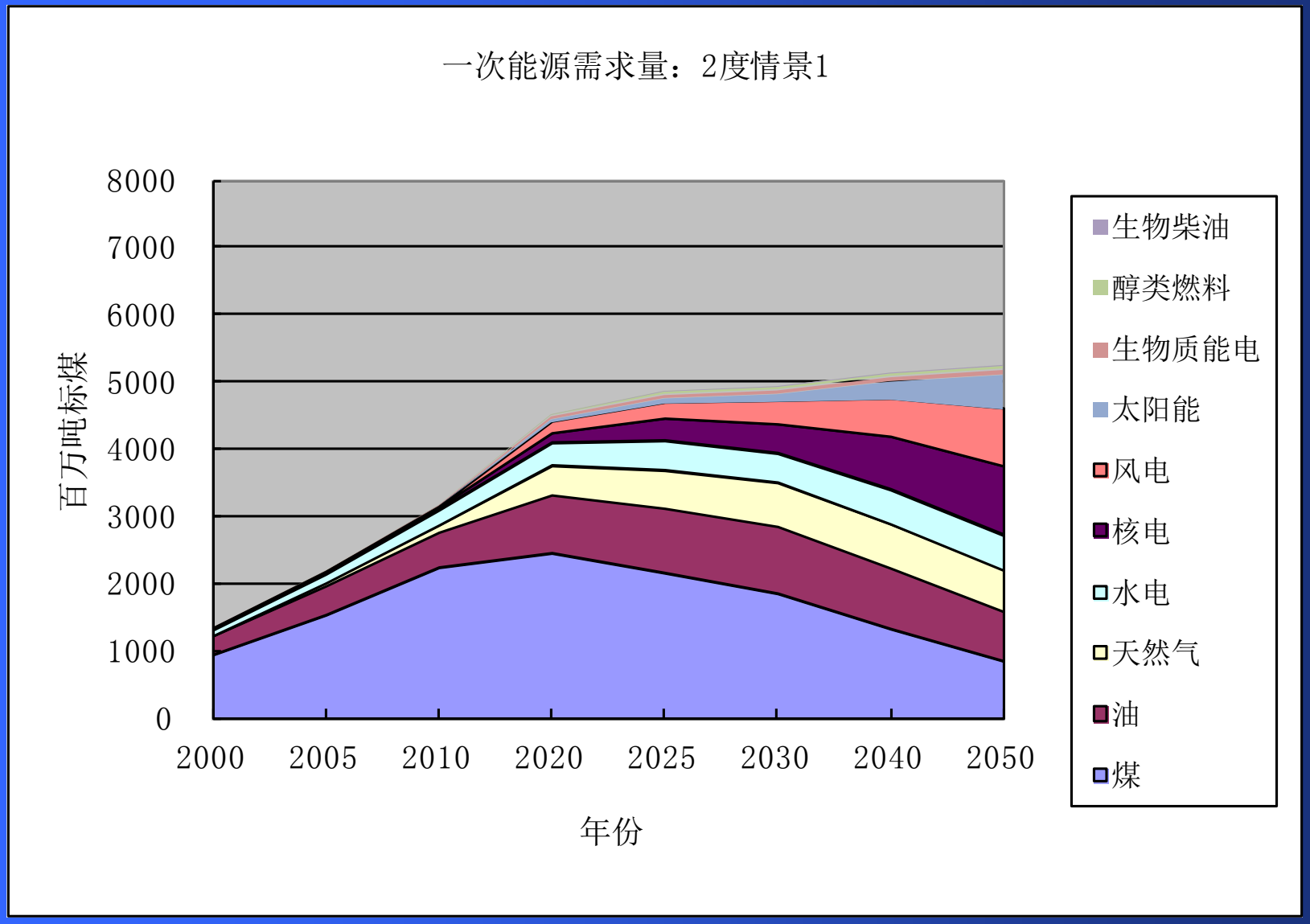



**排放分担，2050和2010年相比，十个地区**

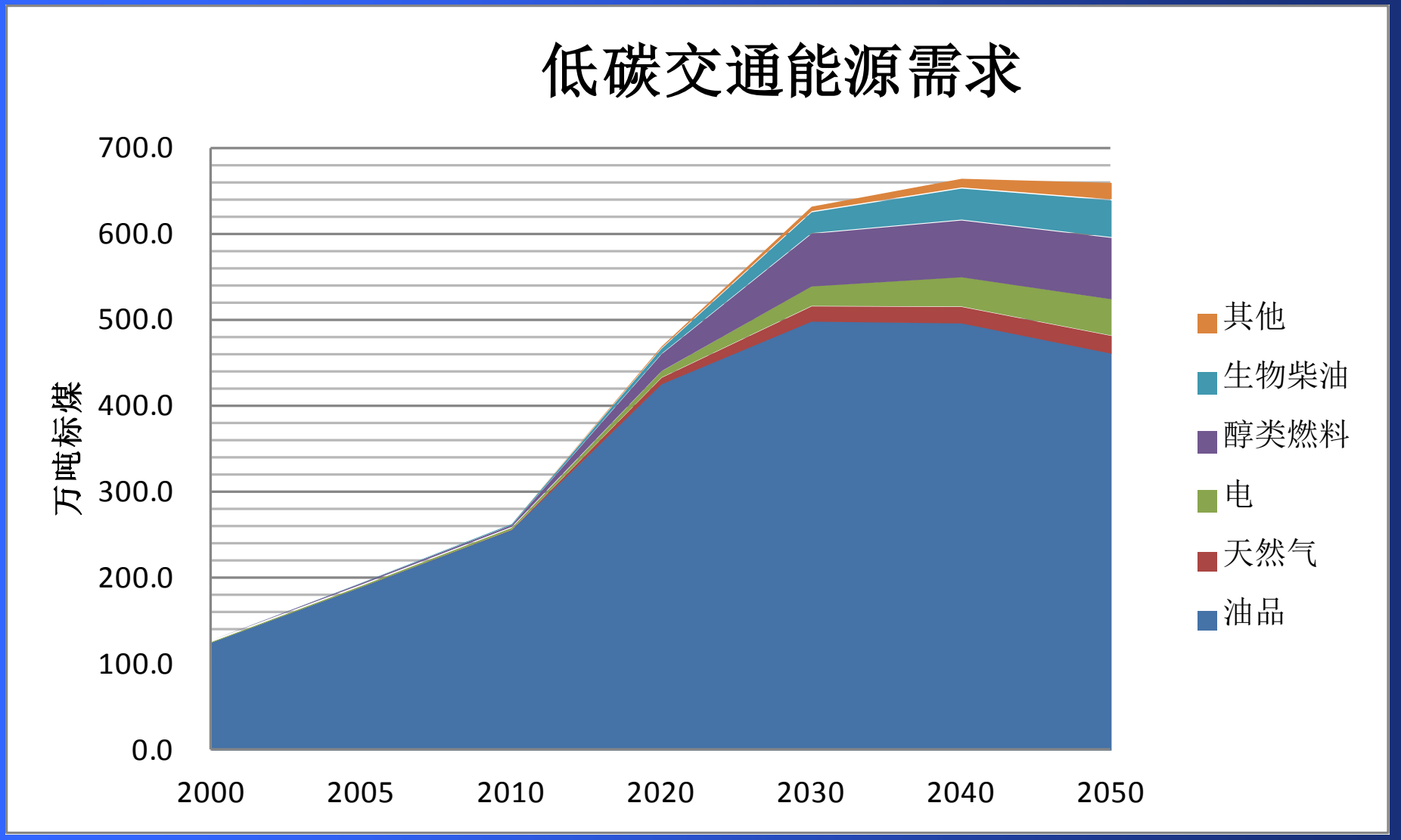
**Figure 3. Emission allowances for various concentration levels in 2050 relative to 2010 emissions (min, 20th percentile, 80th percentile, max). Number of studies in brackets. GHG emissions (all gases and sectors) in $GtCO_2e$ in 1990 and 2010 were OECD90 13.4, 14.2, EIT 8.4, 5.6, ASIA 10.7, 19.9, MAF 3.0, 6.2, LAM 3.3, 3.8**


CO2 Emission
Billion tCO2
14
12
10
8
6
4
2
0
2000
2005
2010
2020
2030
2040
2050
BAU
LC
ELC
2度1
2度2

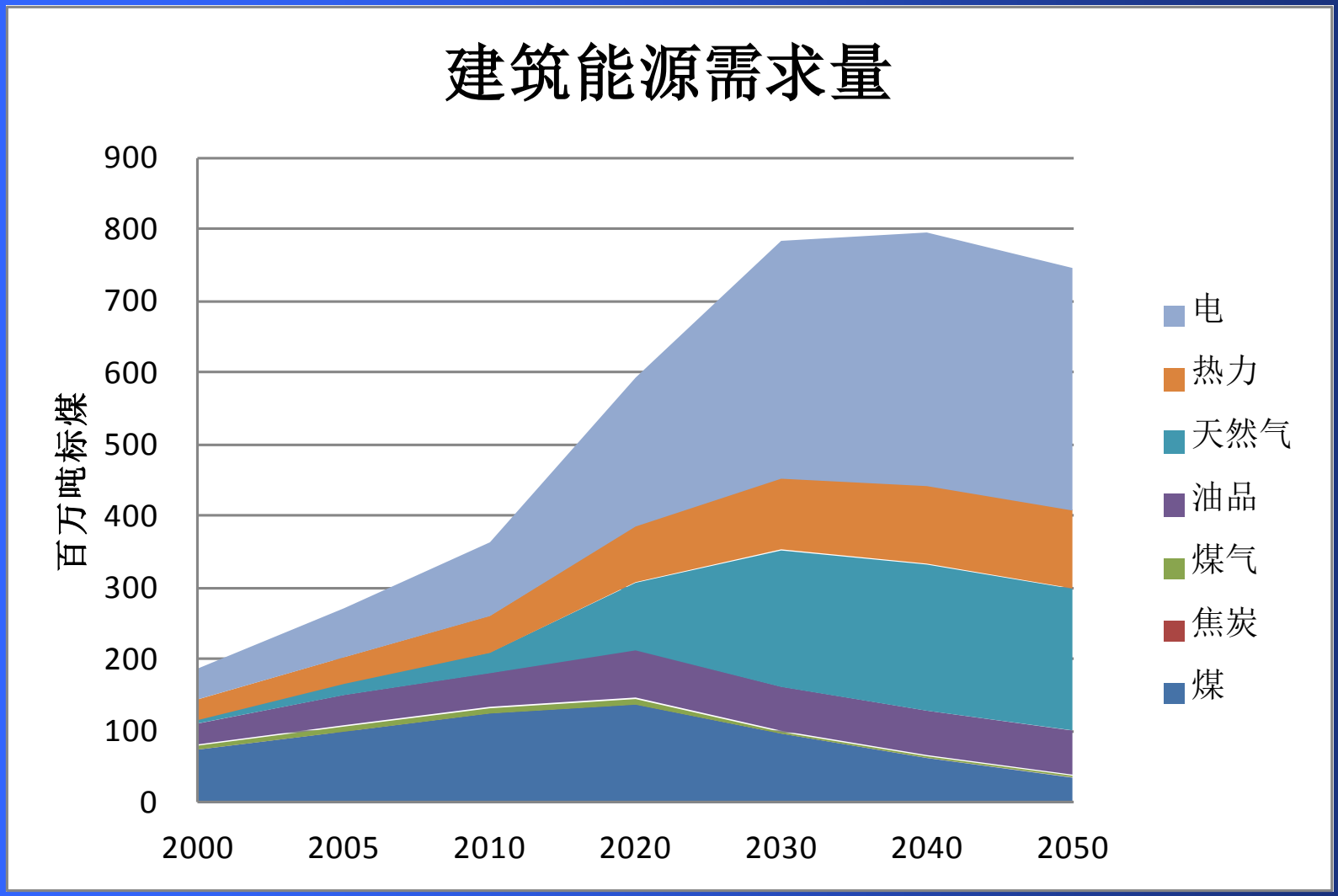
# Primary Energy Demand: 2 degree scenario 1



# Energy Demand in Transport under the 2 degree scenario



# Energy Demand in Building under the 2 degree scenario



# Power Generation

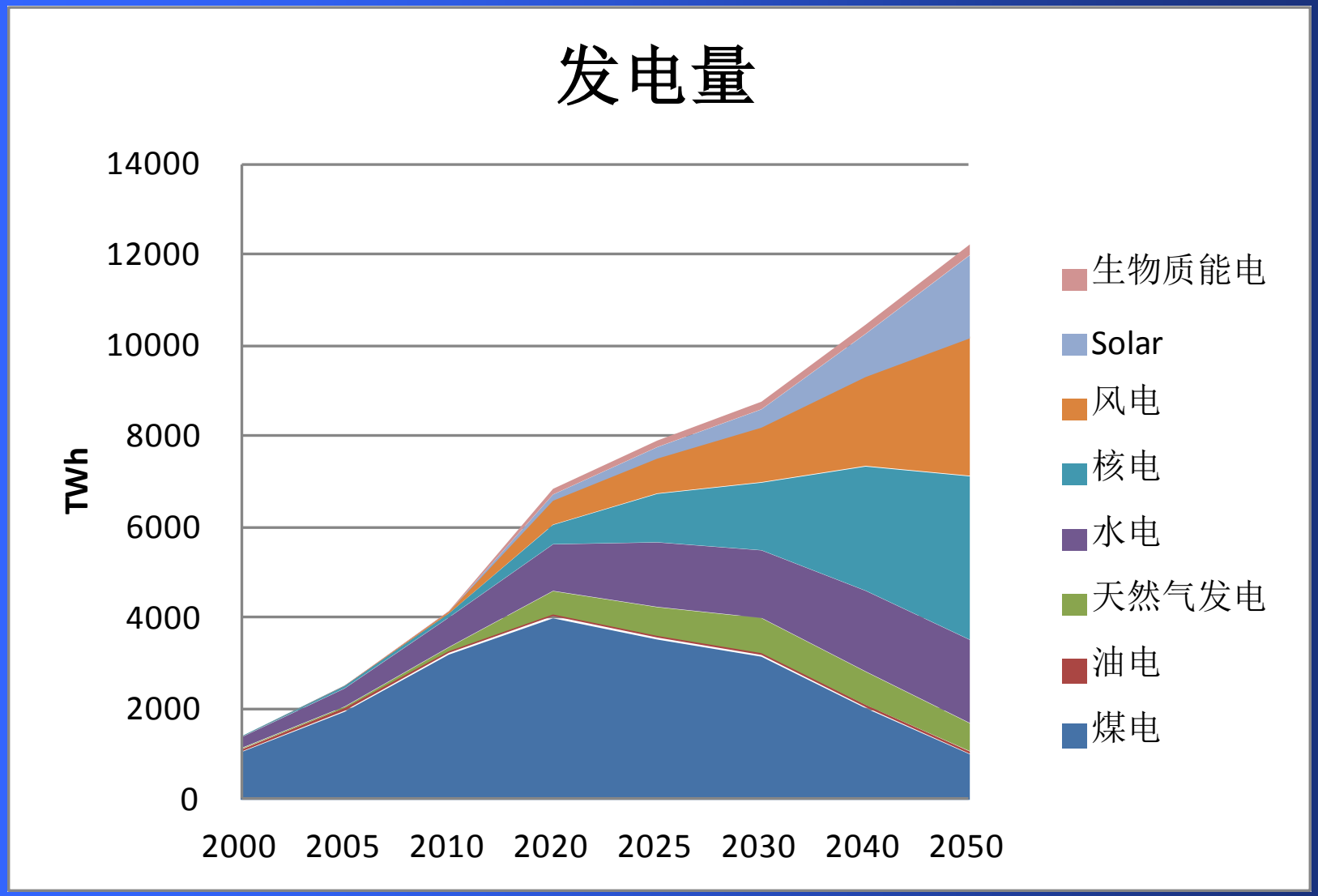
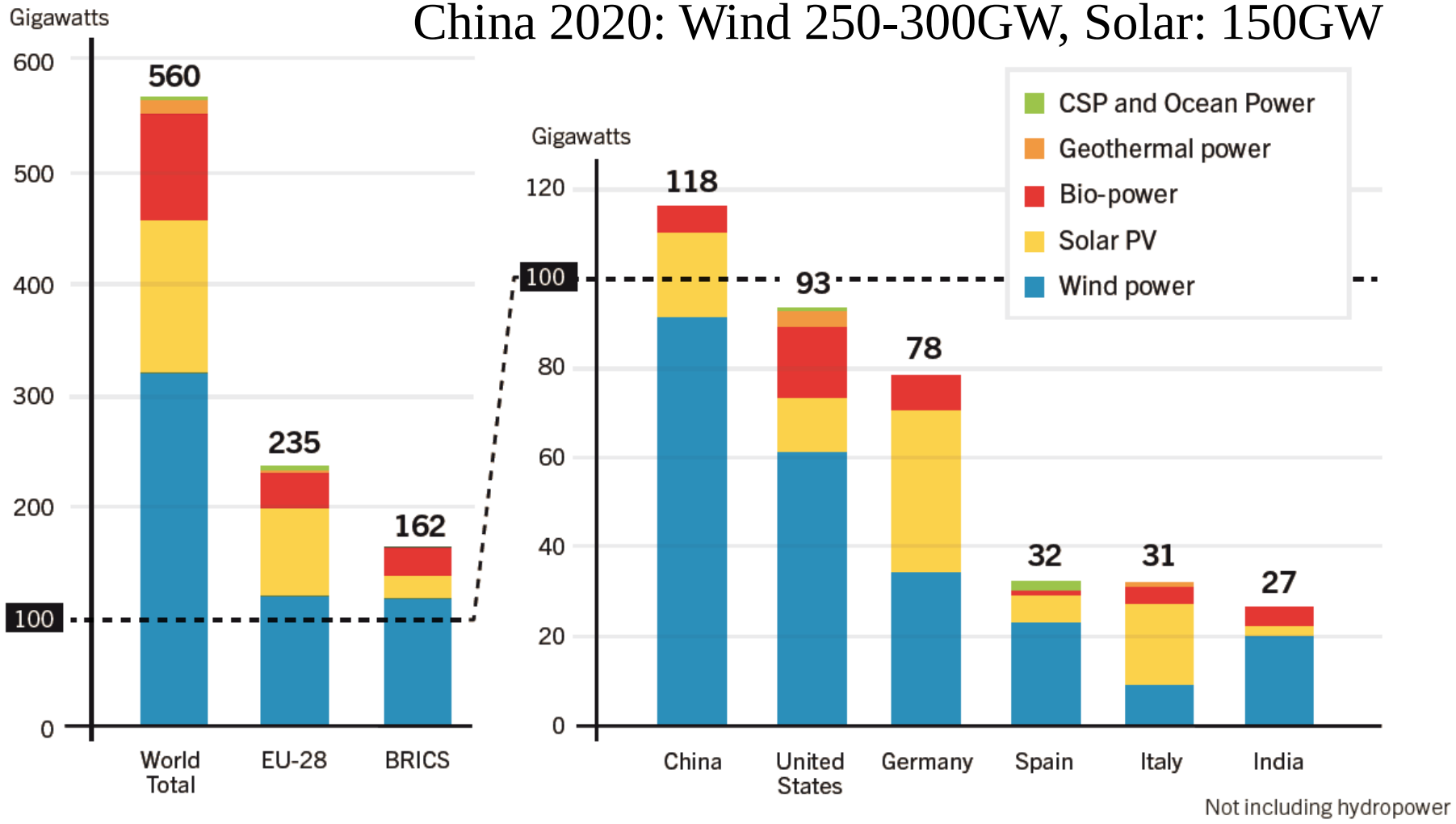


**Figure 4.** Renewable Power Capacities in World, EU-28, BRICS, and Top Six Countries, 2013

China 2020: Wind 250-300GW, Solar: 150GW



# 2014

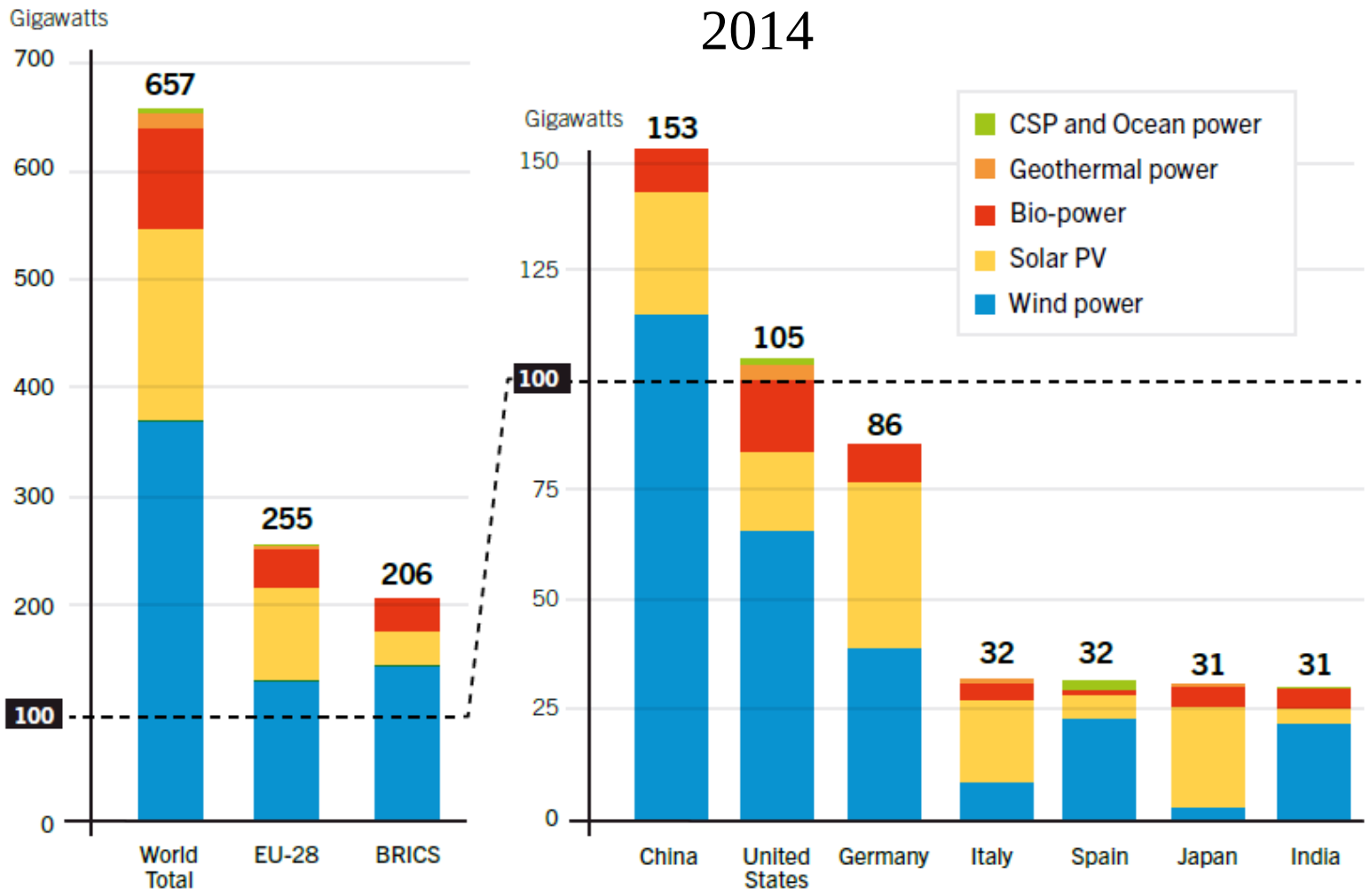
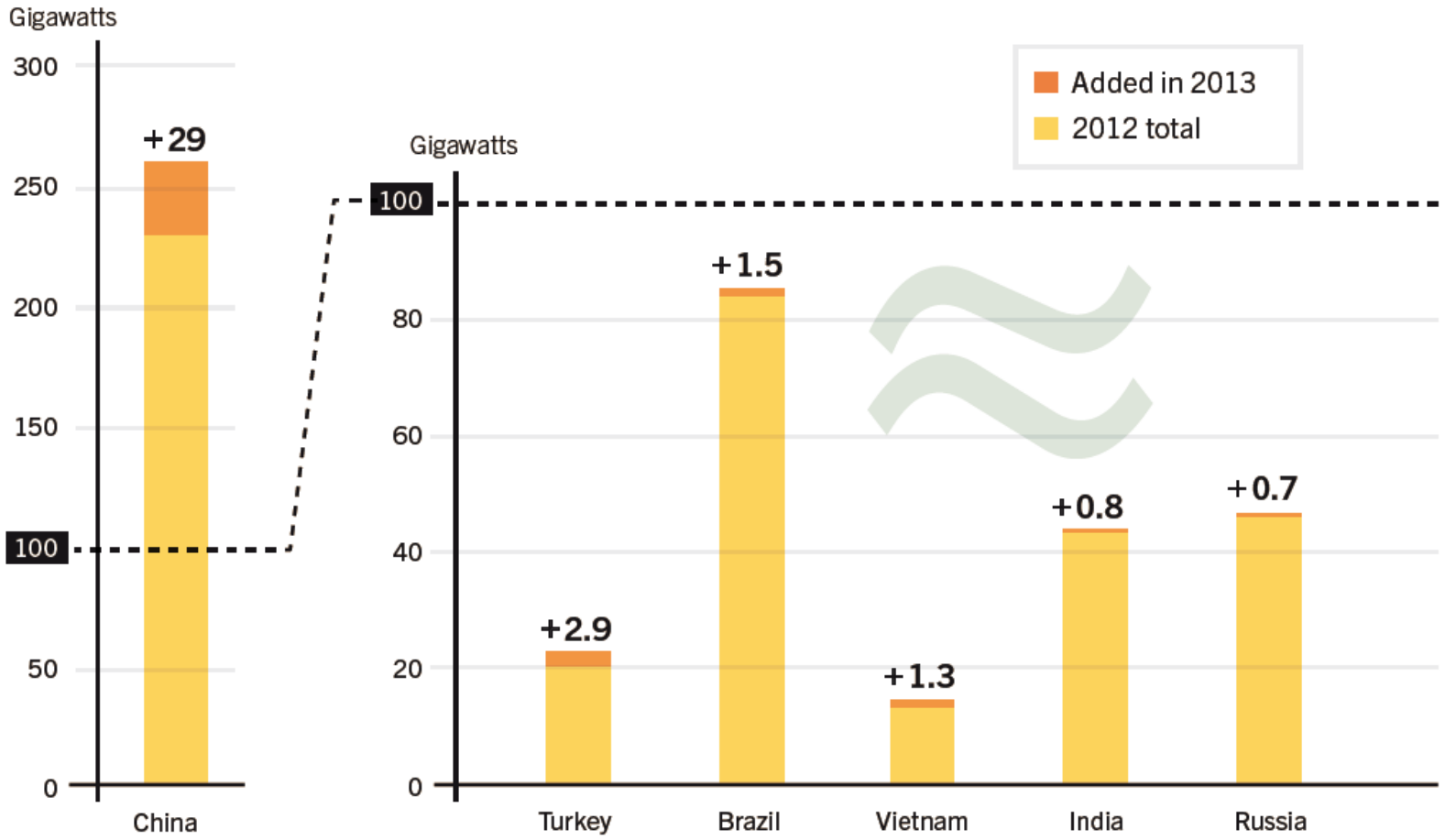
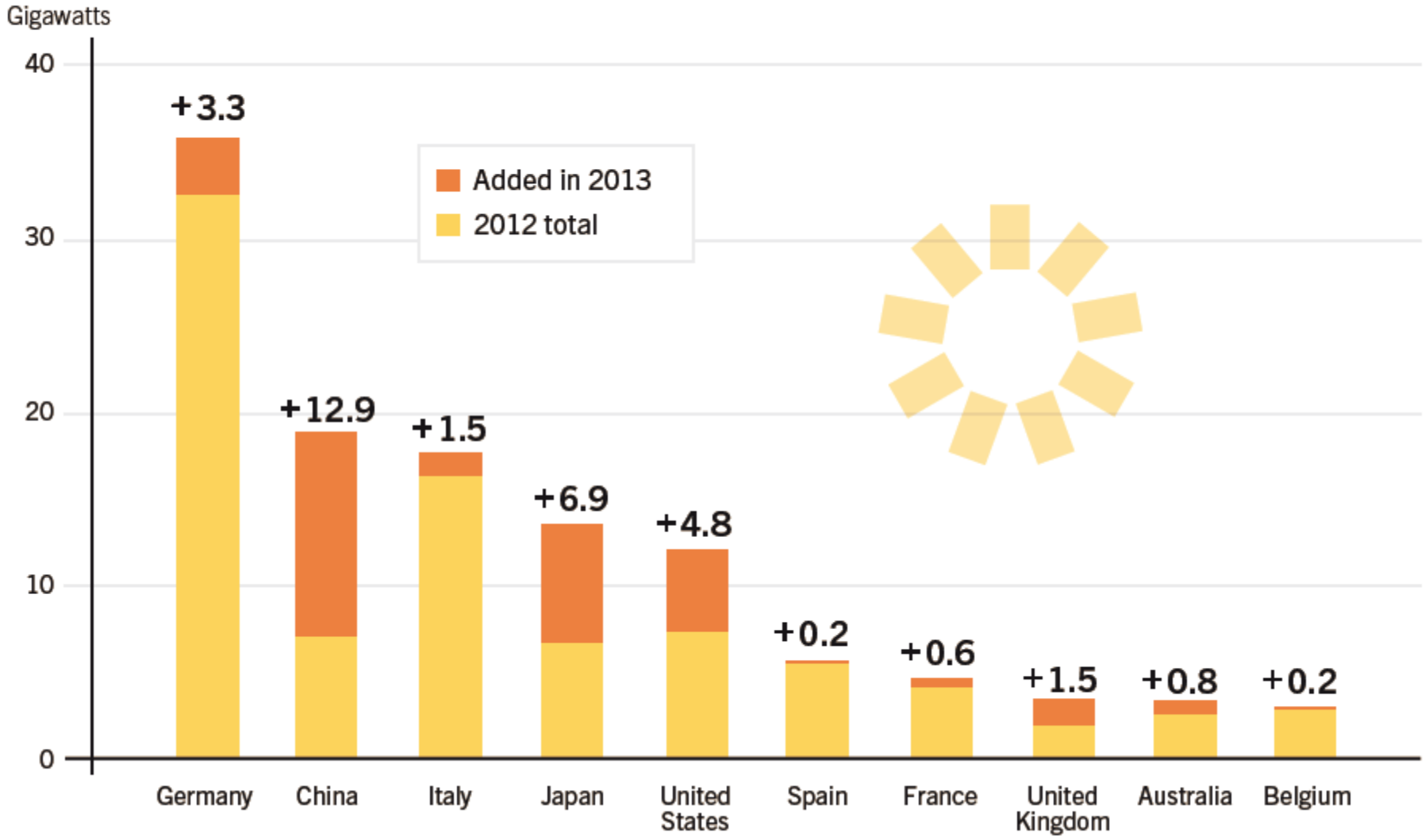

Gigawatts
700
600
500
400
300
200
100
0
657
255
206
World Total
EU-28
BRICS
Gigawatts
150
125
100
75
50
25
0
153
105
86
32
32
31
31
China
United States
Germany
Italy
Spain
Japan
India
CSP and Ocean power
Geothermal power
Bio-power
Solar PV
Wind power

**Figure 11.** Hydropower Capacity and Additions, Top Six Countries for Capacity Added, 2013




Additions are net of repowering and retirements.

**Figure 13.** Solar PV Capacity and Additions, Top 10 Countries, 2013



***2014***

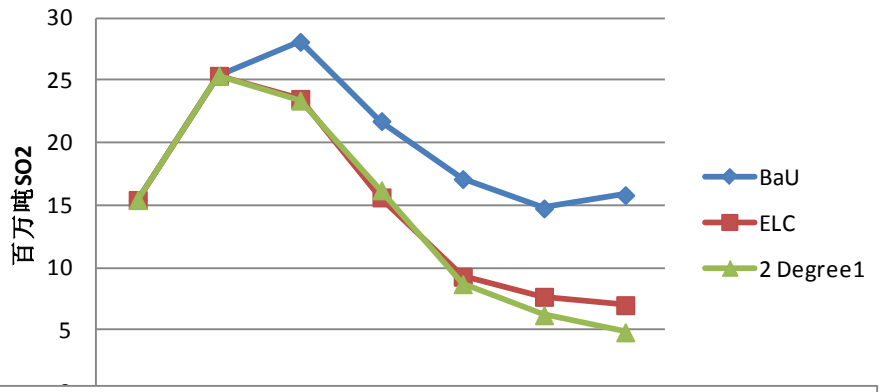
Newly Installed Renewable Energy Power

World: 134GW
China:  57GW

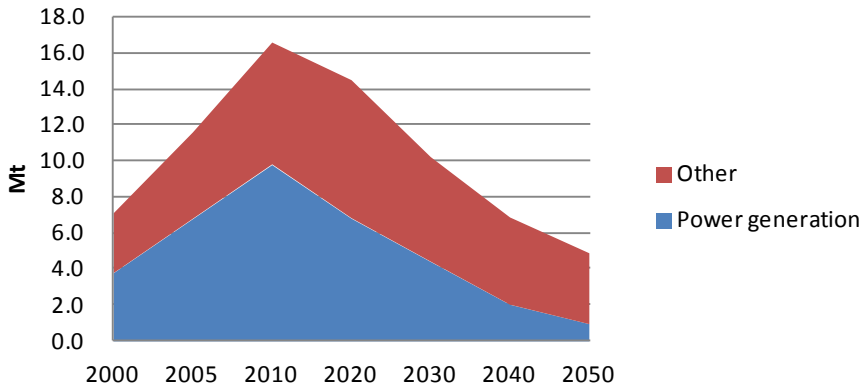
Newly Installed Nuclear Power

World: 3.7GW
China:  3GW

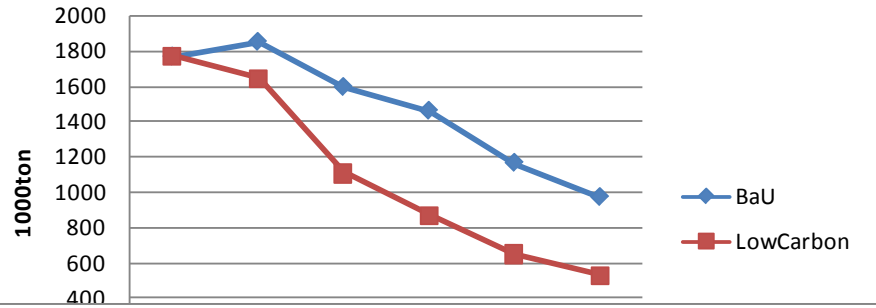
## SO2排放



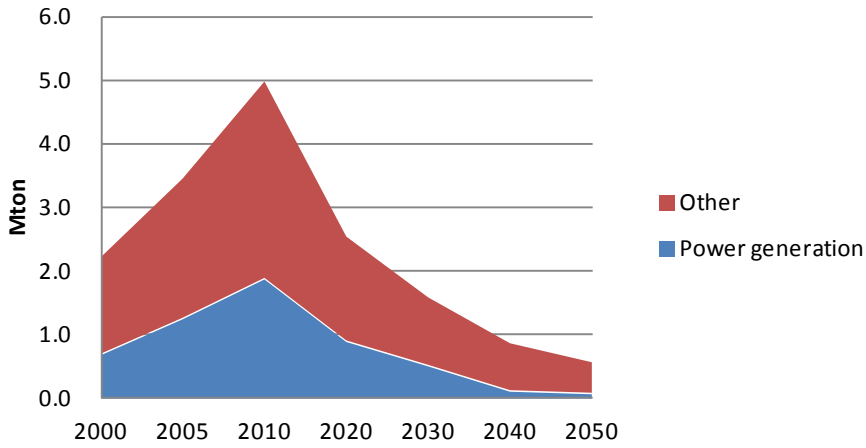

## NOx Emission in China, 2 degree scenario



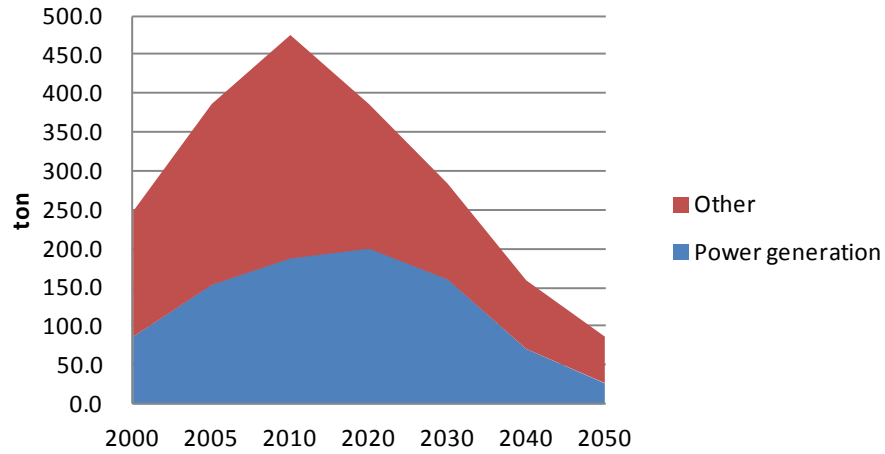

## Black Carbon Emission in China



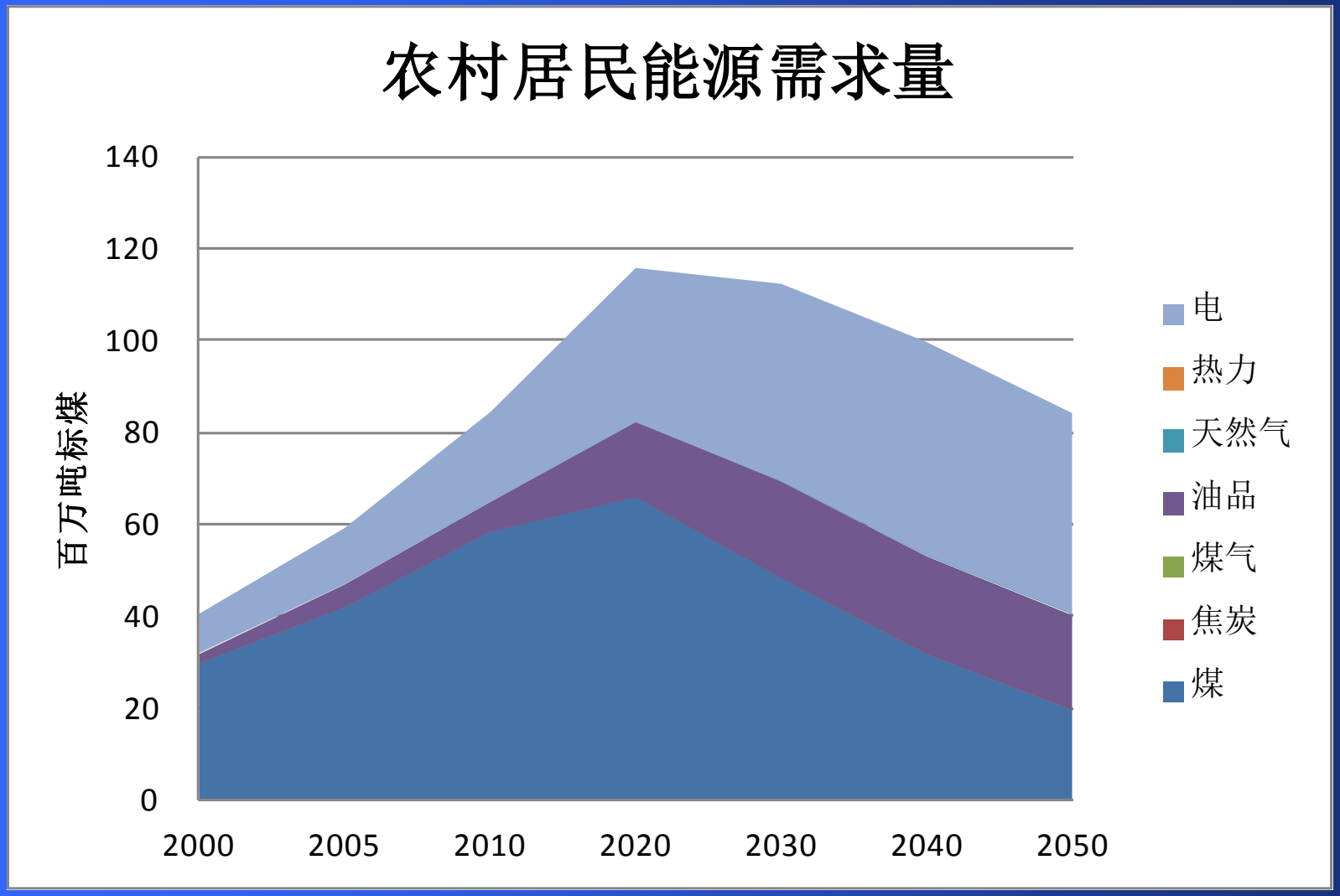

## PM2.5 Emission



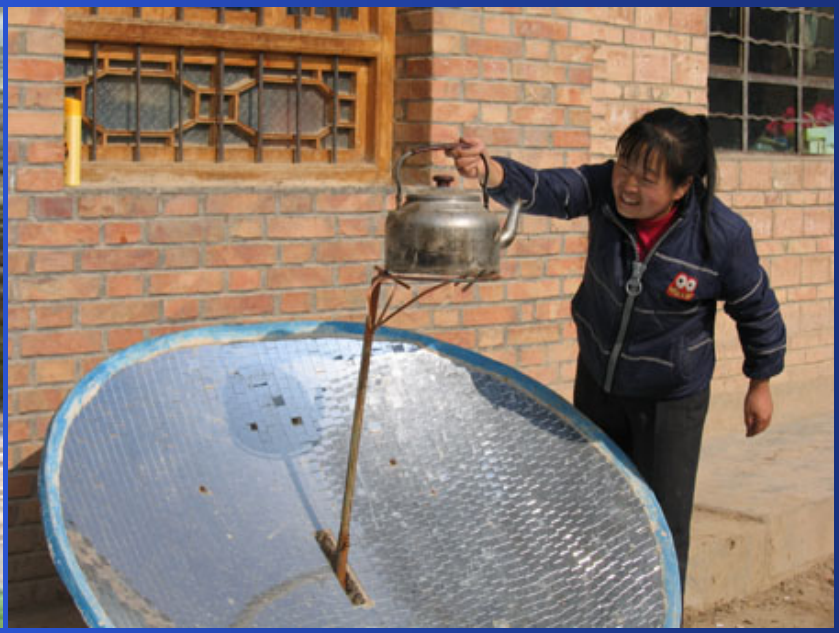

## Mercury Emission



# Rural Energy Demand in China




储气罐

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# A 2 degree Asia: A good way to understand the global target


***Scenario Analysis:***

Japan
Korea
China
India
Thailand
Malaysia
Indonesia
Nepal
Vietnam

# Required GHG reduction ratios in 2050 compared with year 2005, to meet the global 50% reduction are:

| Burden share sheme | Required GHG reduction ratios (%) compared with year 2005 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | World | Annex-I | Non-Annex I | Asia except Japan | China | India | Indonesia | Japan | Korea | Malaysia | Thailand | Vietnam |
| pCAP | 58 | 83 | 42 | 42 | 68 | -51 | 15 | 83 | 85 | 67 | 61 | 12 |
| pGDP | 58 | 46-58 | 57-65 | 58-63 | 59-61 | 41-53 | 67 | 18-43 | 49-57 | 57-60 | 54-65 | 60-74 |
| pCUM | 58 | 95 | 34 | 43 | 97 | -100 | 49 | 94 | 99 | 93 | 85 | 32 |

Minus is an increase of allowable emission compared with year 2005
Values of Indnesia and Malaysia are excluding emission/sink of LULC sectors
Ranges of pGDP are corresponding with ranges of GDP projections in references
pCAP: Equal per capita emission
pGDP: Equal per GDP emission
pCUM: Converge to equal cumulative emission per capita, after 2075

Matsuoka, et al., 2013, How to approach Asian Low-Carbon Societies?
Global Environmental Research, 17(1), 3-10

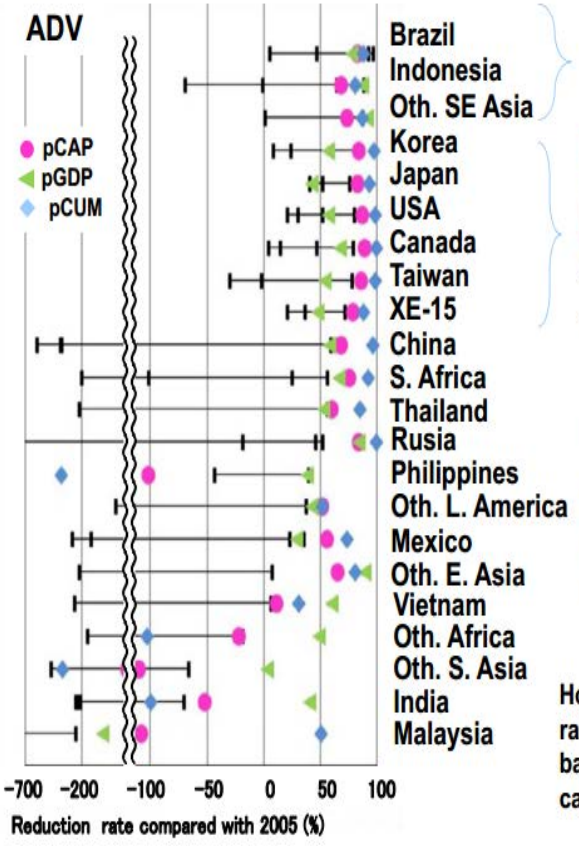
# Feasibility of 50% global GHG emission reduction source:18th AIM workshop

## 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 | Argentine | 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 |



## 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

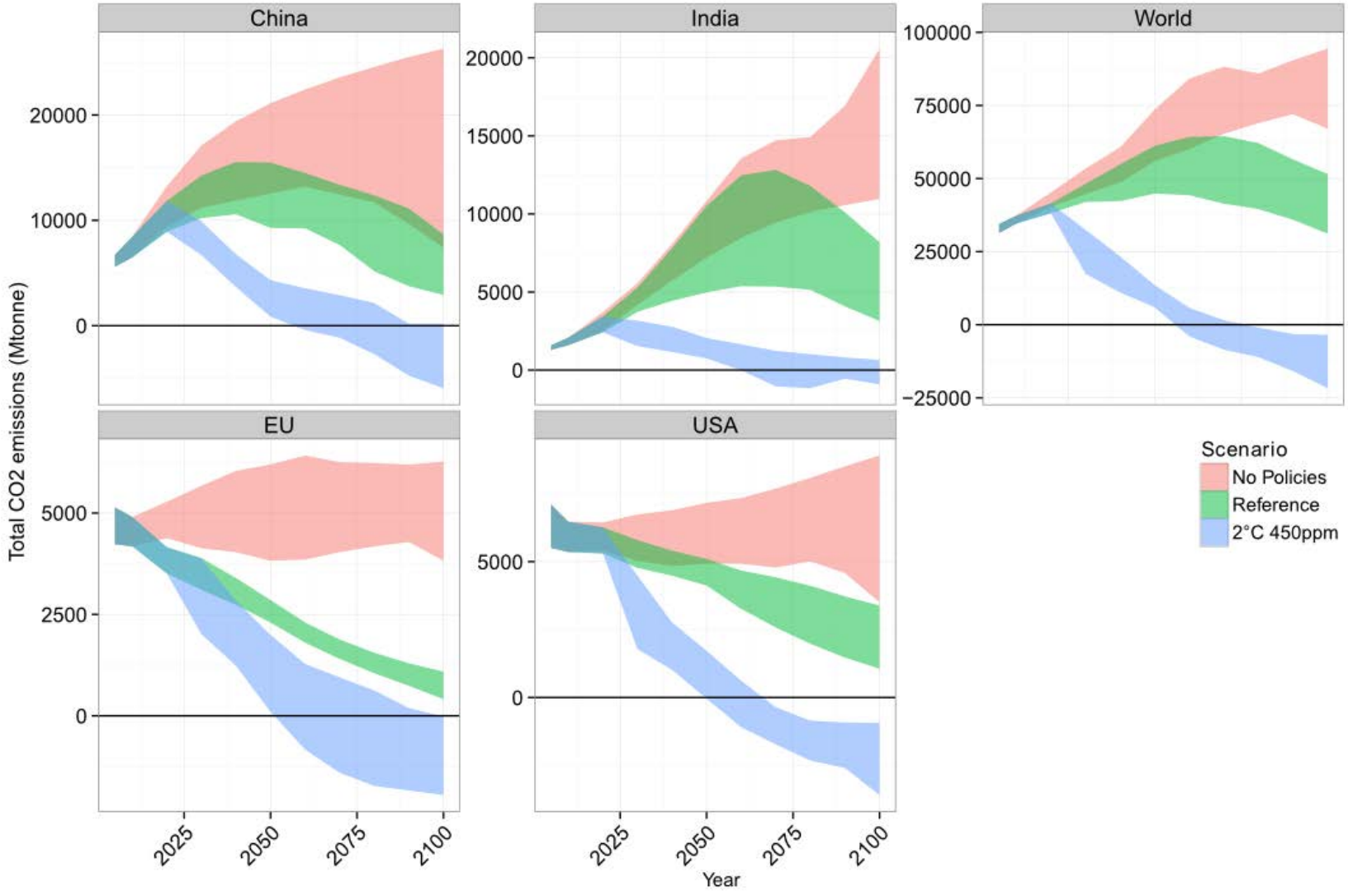
**Developing countries**

Reduction projections: small

Some can't achieve all the reduction targets

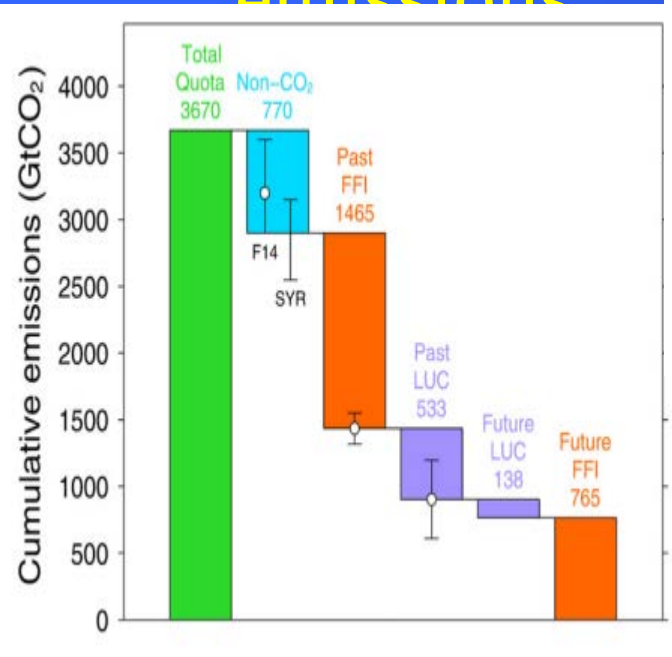
Horizontal line shows feasible ranges of GHG emission reductions based on TRN, PLG, PLG+, and RED cases.

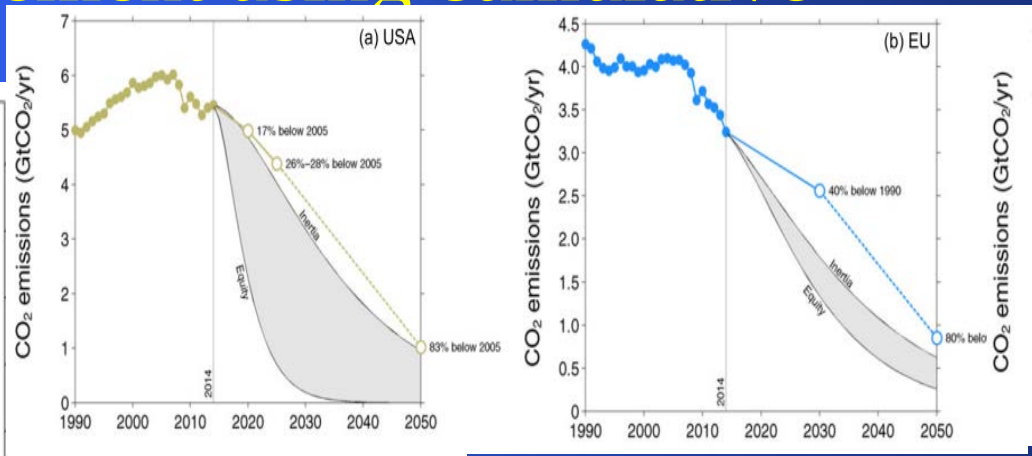
# LIMIT Project finding

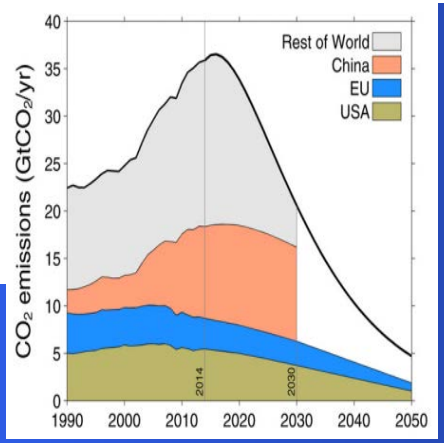


# Top Level

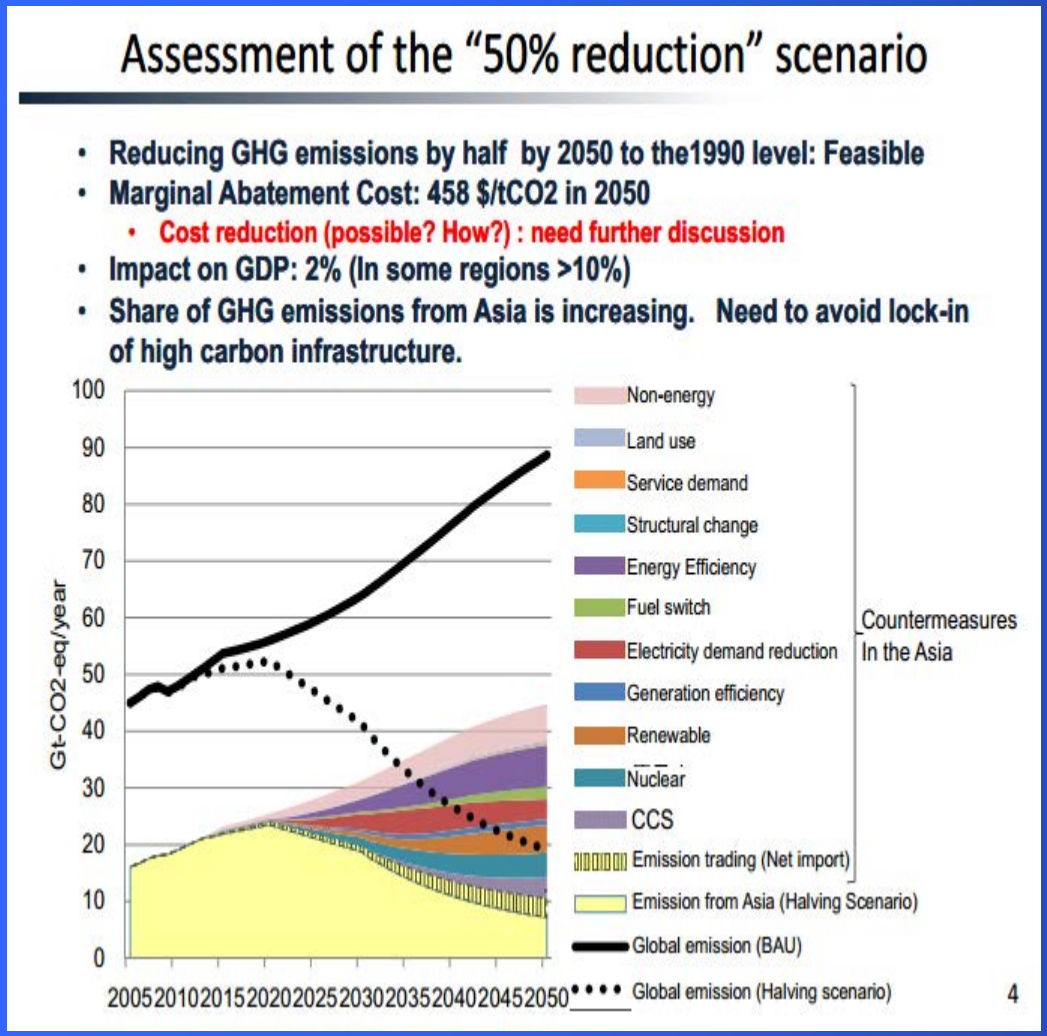
- Source: Measuring a fair and ambitious climate agreement using cumulative emissions



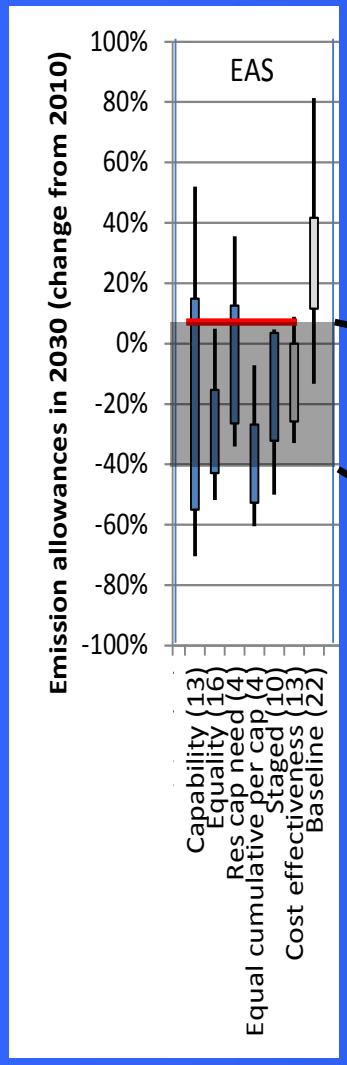



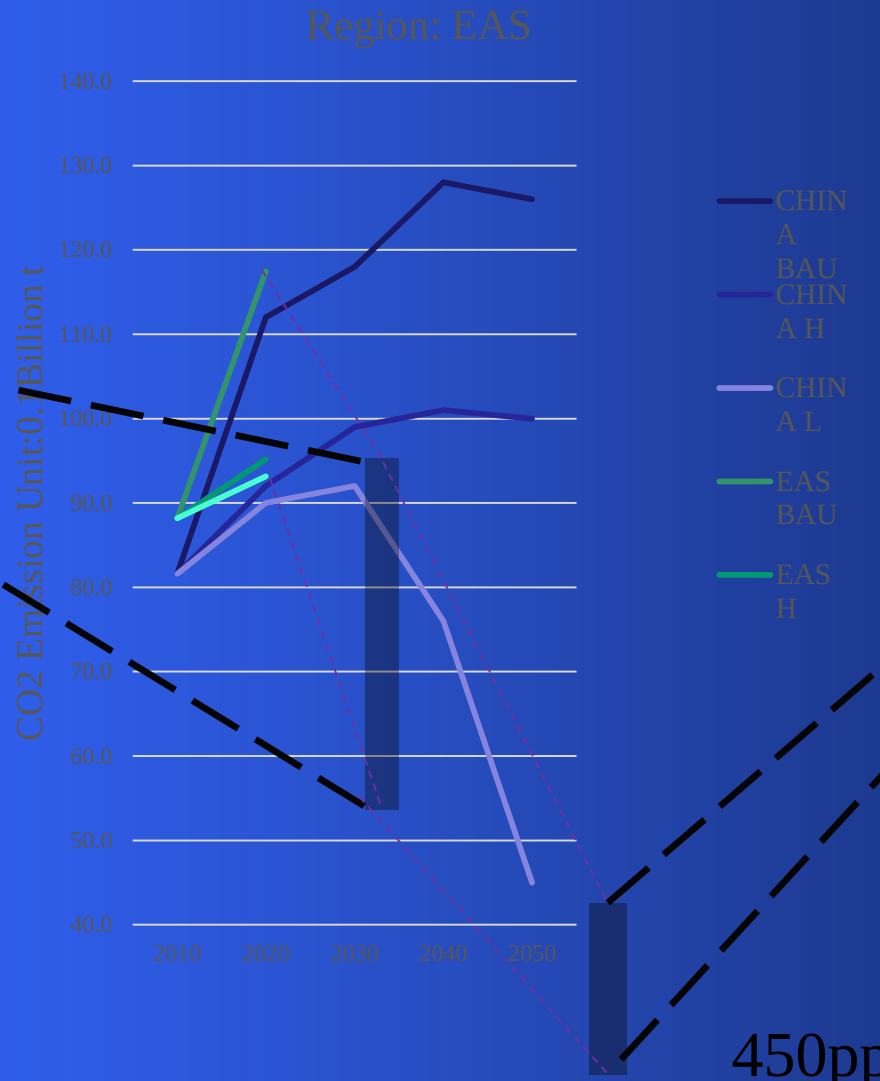
# 来自各国的情景分析：亚洲整体

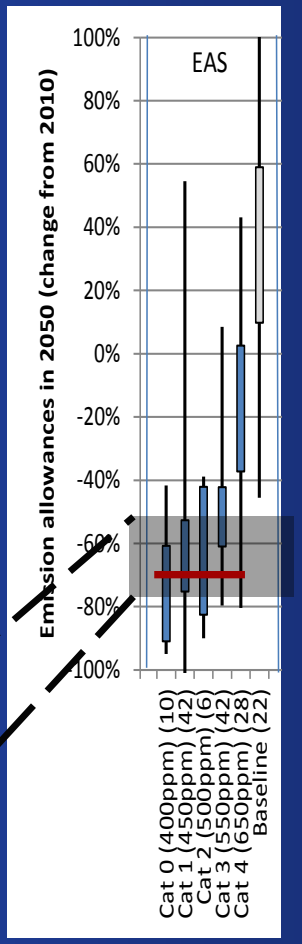



- 2050相比1990减半：可行，整个亚洲tCO2
- 1990:160亿；
- 2010:180亿；2030:180亿；
- 2050:80亿，相比2010减少55%
- Source:The 17th AIM International Workshop,Research Activities for Low‐Carbon Asia
- http://www-iam.nies.go.jp/aim/aim_workshop/aimws_17/presentation/s02_fujino_ppt.pdf

# EAS region(China, Korea, Mongolia)
# GAS: CO2 Excl. LUCF

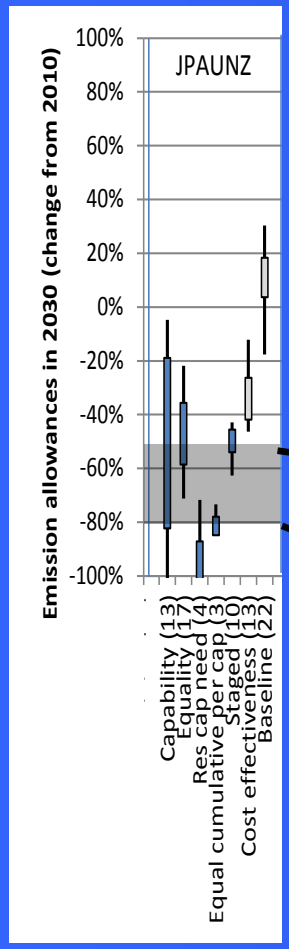


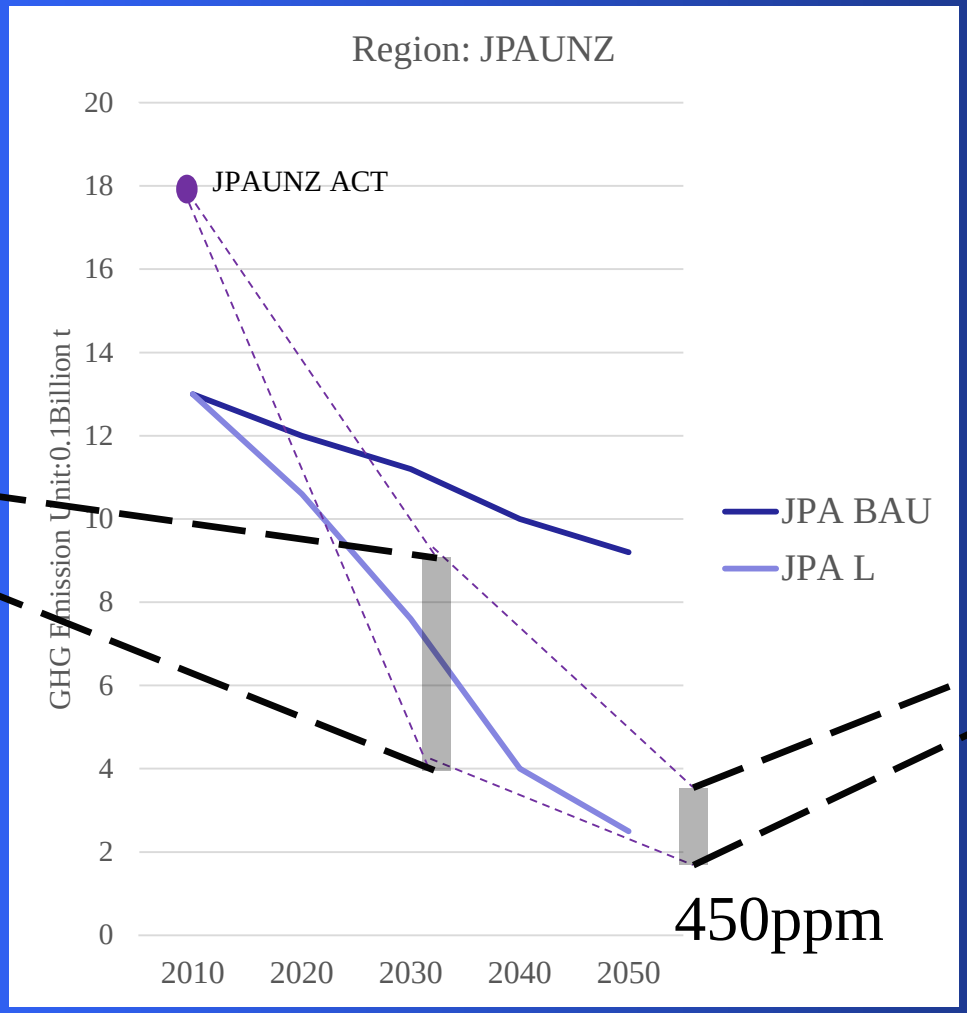



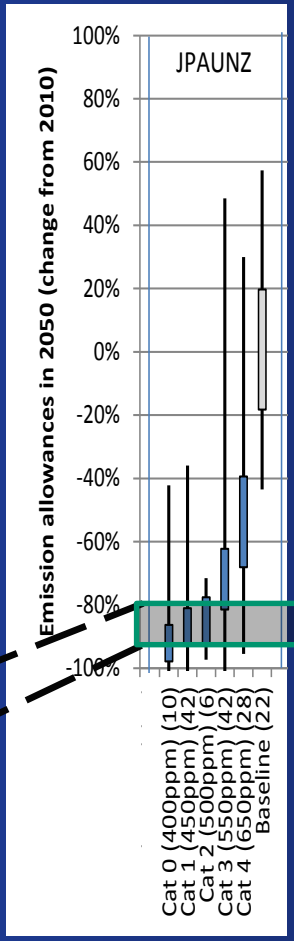




450ppm

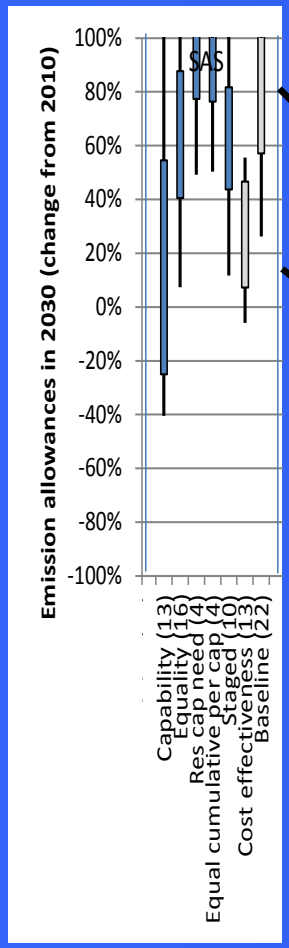
# Region: JPAUNZ(Japan, Australia, New Zealand)
# Gas: GHG Excl. LUCF

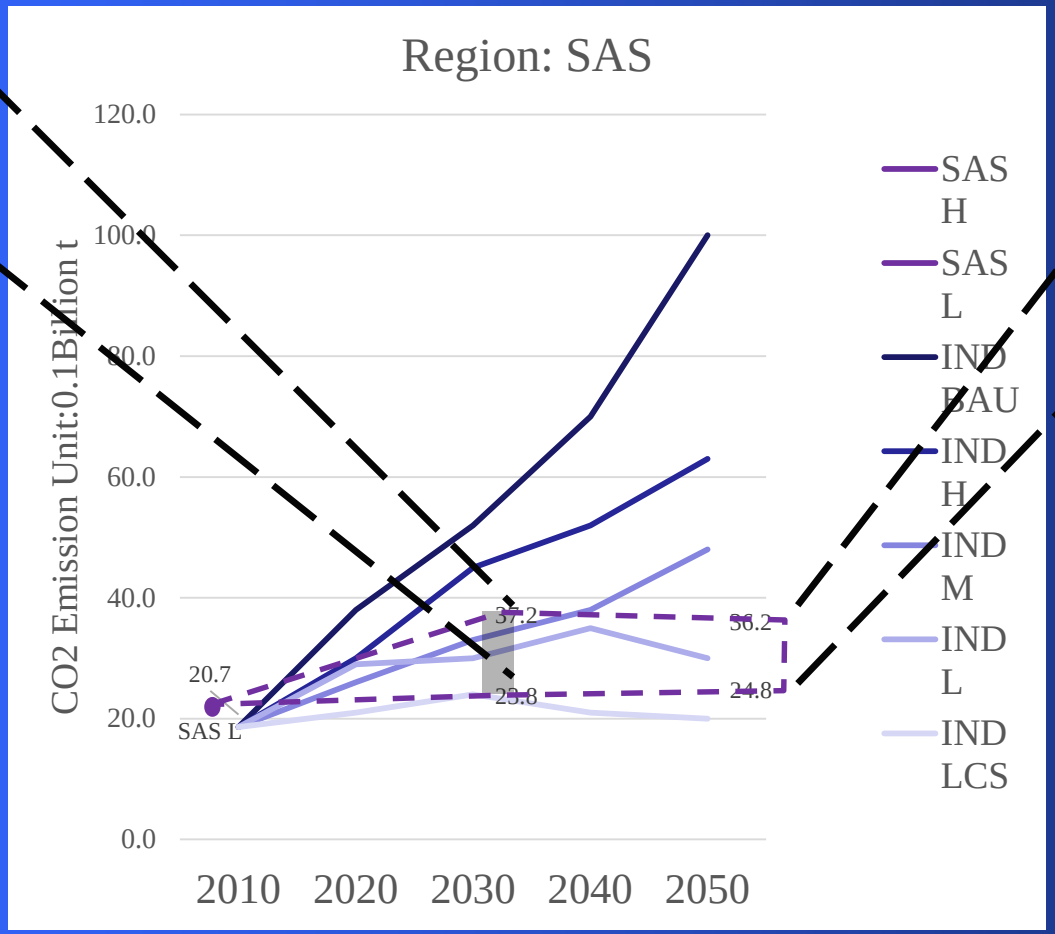


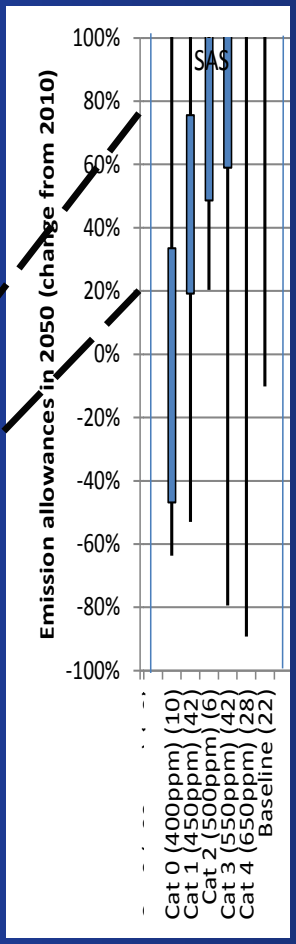



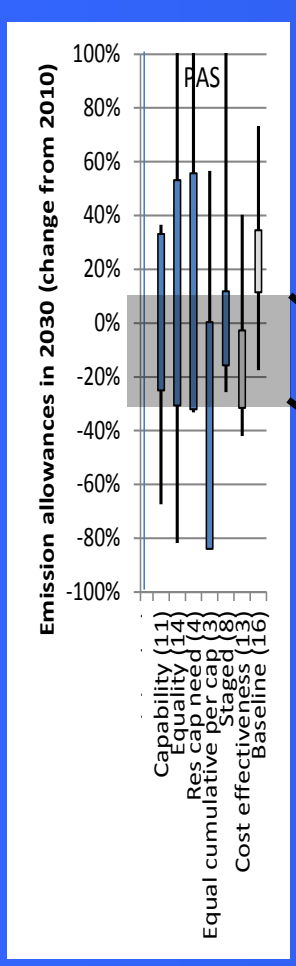
# Region: SAS (Bangladesh, India, Pakistan)
# Gas: CO2 Excl. LUCF

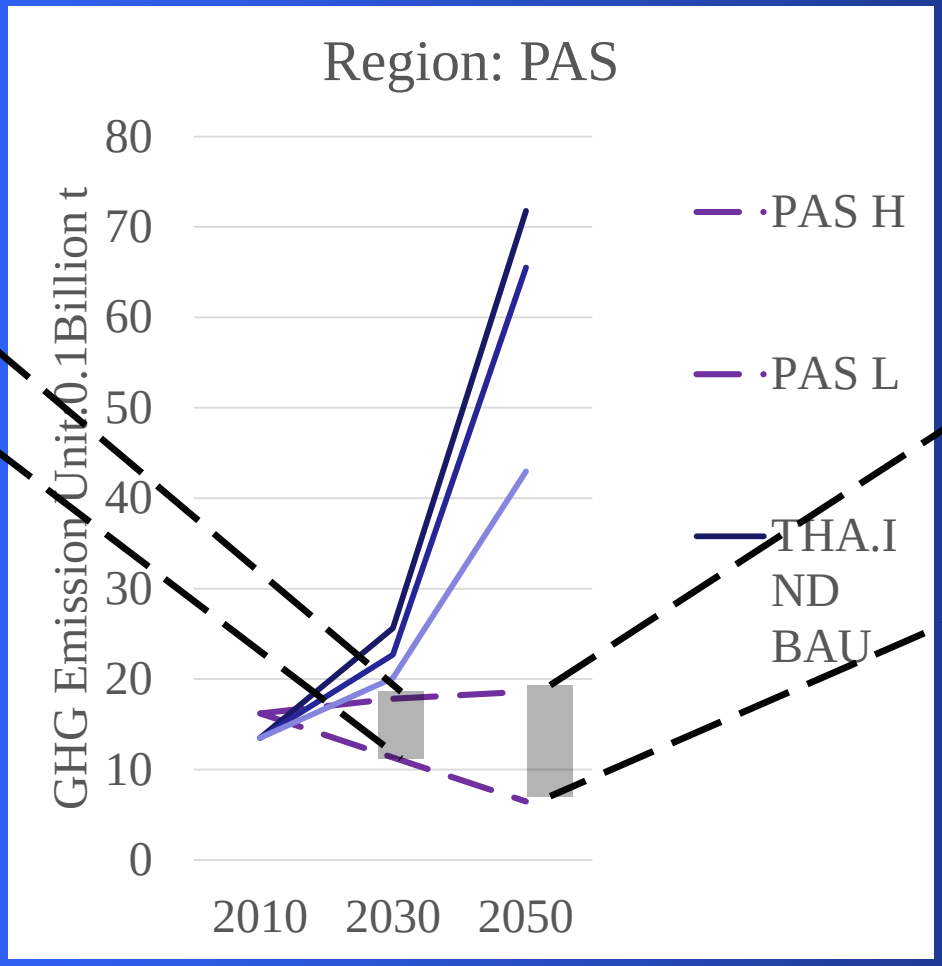


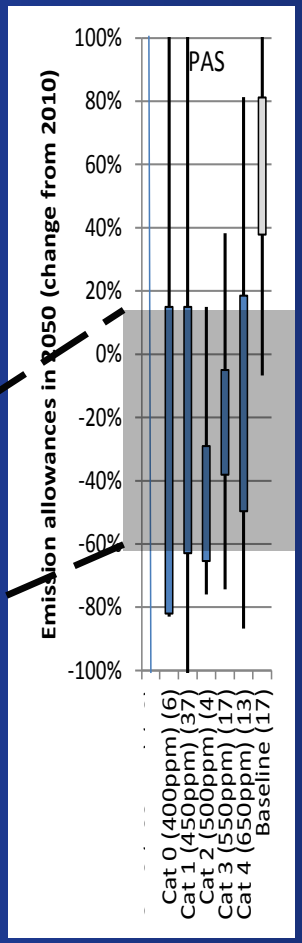



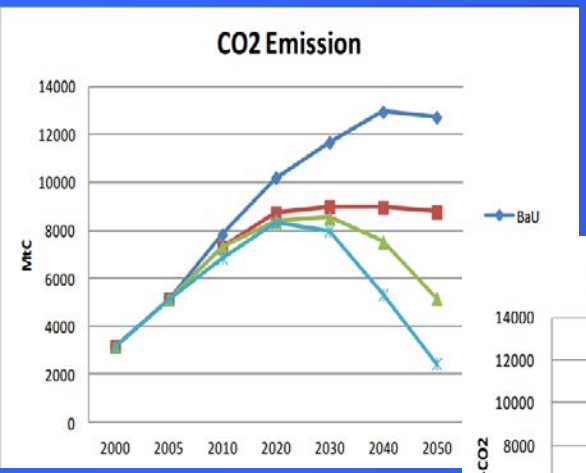
# Region: PAS (Cambodia, Indonesia, Malaysia, Thailand, Vietnam)
# GAS: GHG Excl. LUCF

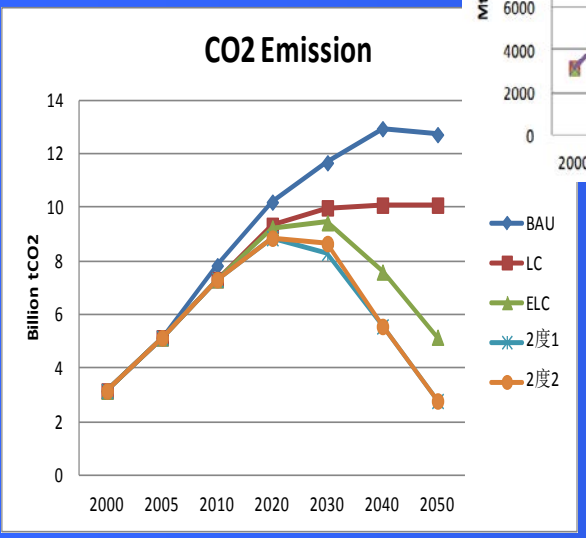


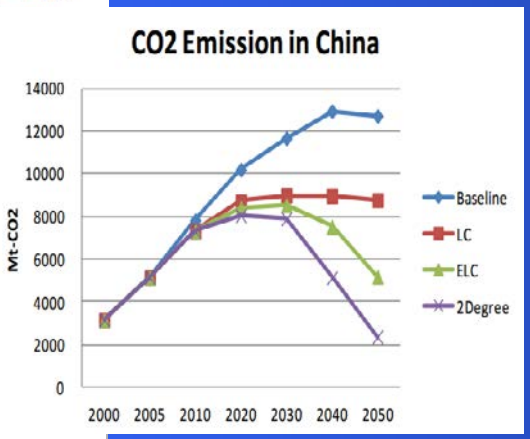



# China

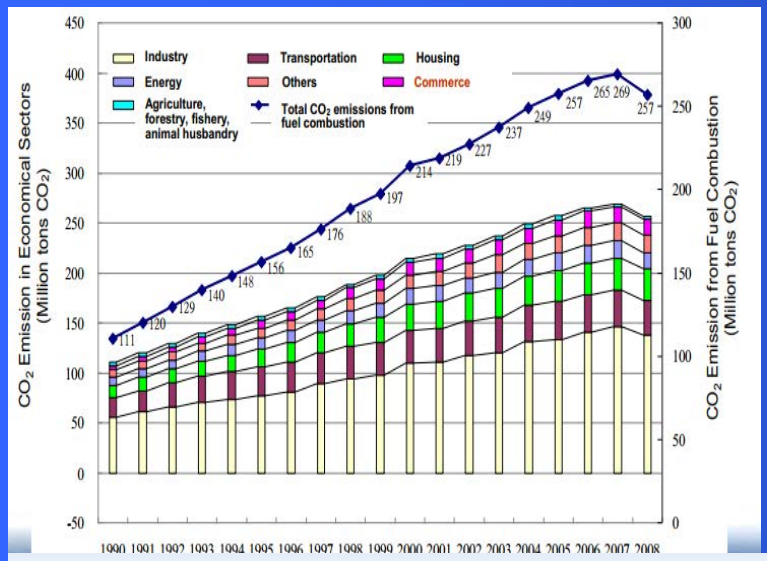


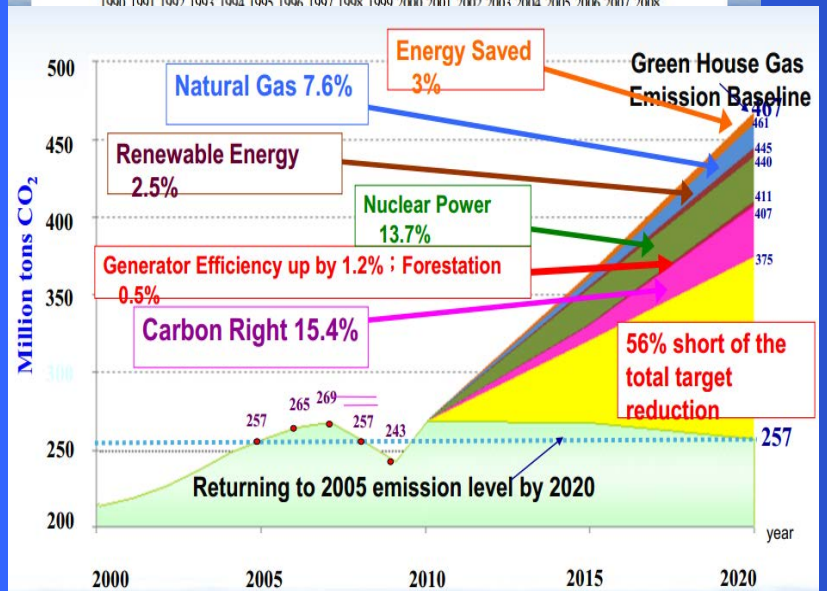




- 中国tCO2
- 2010:80亿；
- 2030:约90亿（80-120）
- 2050:30亿（25-125）
- Source:The 17th AIM International Workshop, http://www-iam.nies.go.jp/aim/aim_workshop/aimws_17/presentation/s02_jiang_ppt.pdf
- 2nd Source: 18th AIM workshop
- 3rd Source:Prof. Jiang ppt

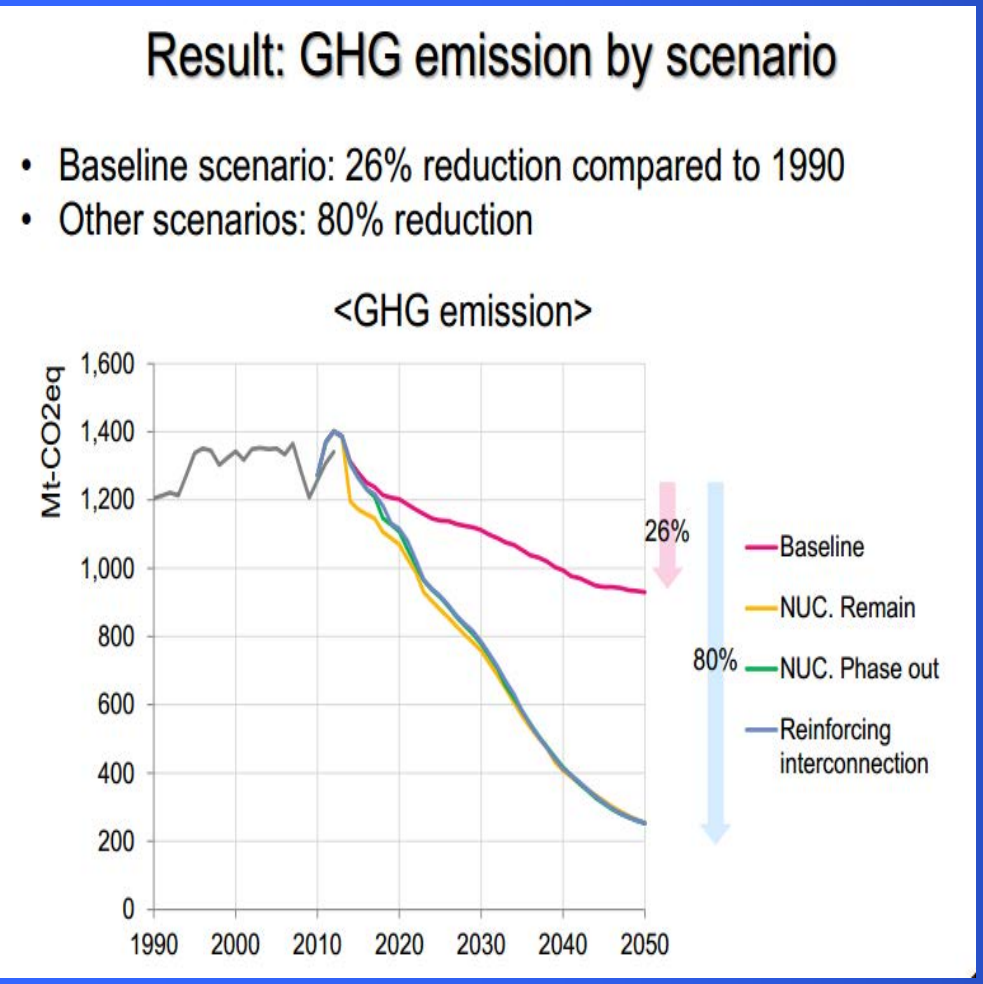
# Taiwan, China



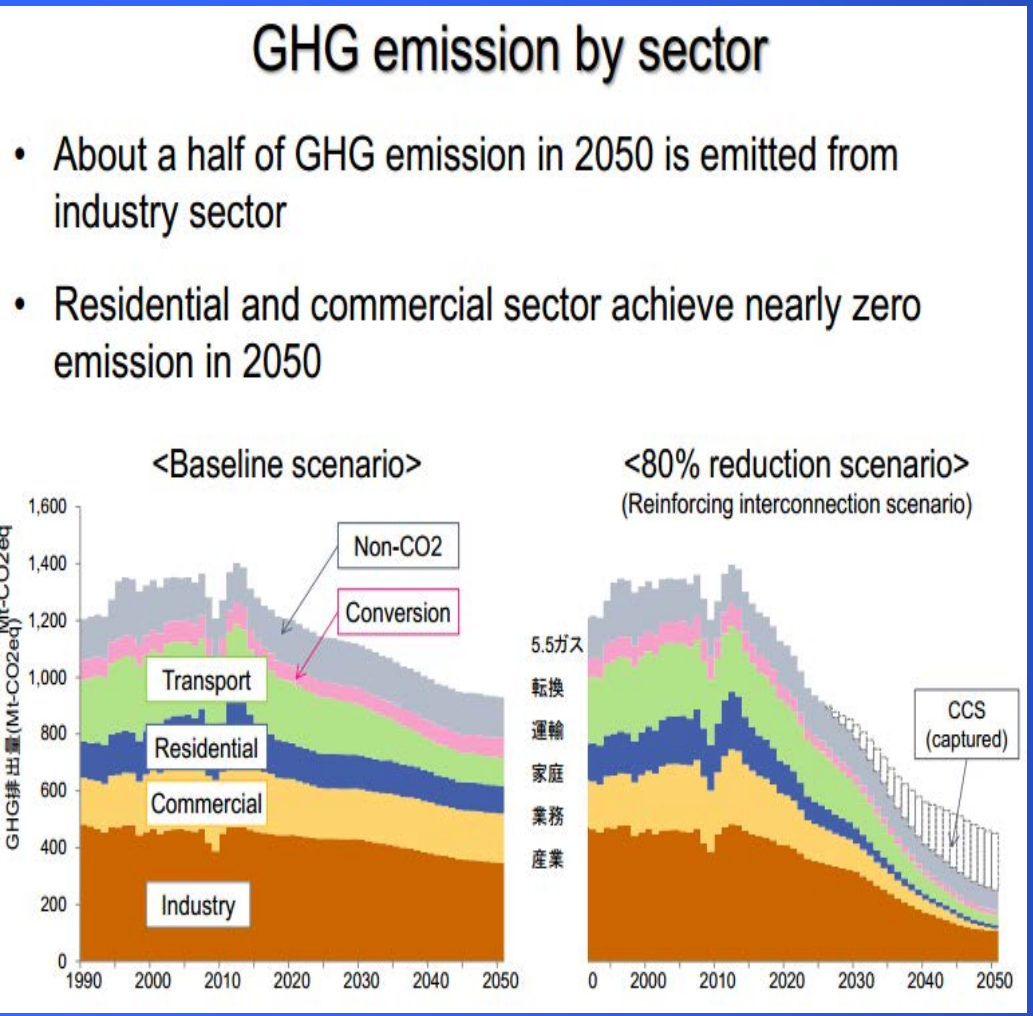

- 1990:1.11亿tCO2
- 2020回到2005水平，2.57亿tCO2
- Source:The 17th AIM International Workshop, Taiwan’s Energy Conservation and Carbon Reduction
- http://www-iam.nies.go.jp/aim/aim_workshop/aimws_17/presentation/s04_kuo_ppt.pdf

# Japan



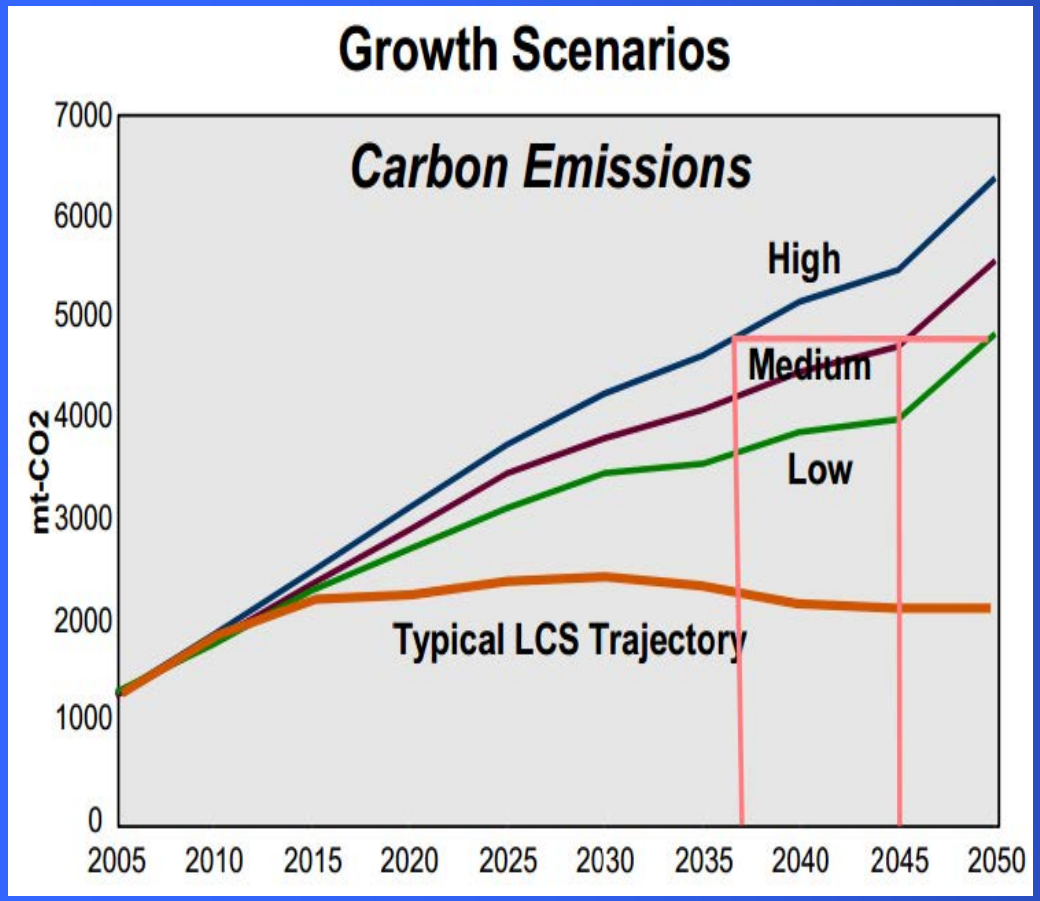

- 2010-13億tCO2eq
- 2030-8 or 11 億tCO2eq
- 2050-2.6 or 9.2億tCO2
- Source: The 19th AIM International Workshop, Regional model Feasibility of 80% emission reduction in Japan
- http://www-iam.nies.go.jp/aim/aim_workshop/aimws_19/presentation/s09_oshiro_hibino_ppt.pdf

# Japan



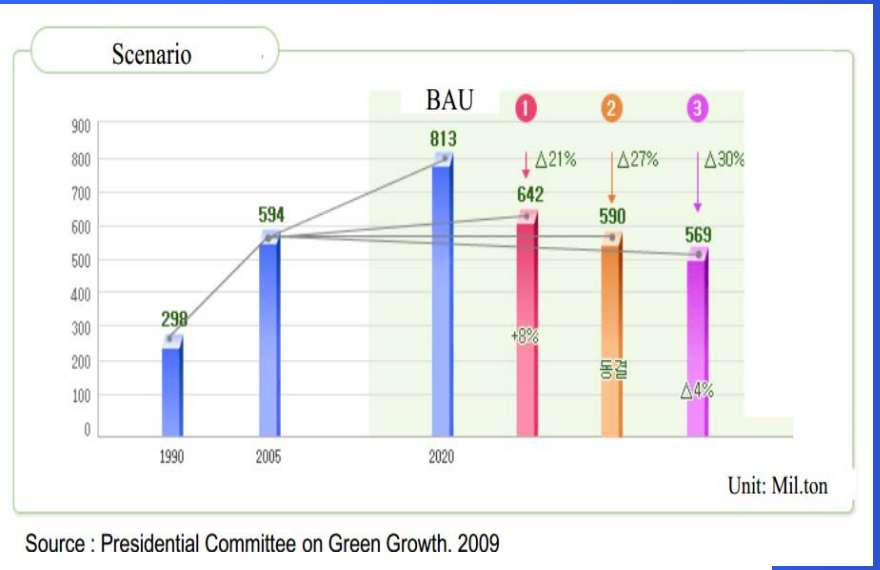

- 2010-13亿tCO2eq
- 2030-8 or 11 亿tCO2eq
- 2050-2.6 or 9.2亿tCO2
- Source: The 19th AIM International Workshop, Regional model Feasibility of 80% emission reduction in Japan
- http://www-iam.nies.go.jp/aim/aim_workshop/aimws_19/presentation/s09_oshiro_hibino_ppt.pdf

# India



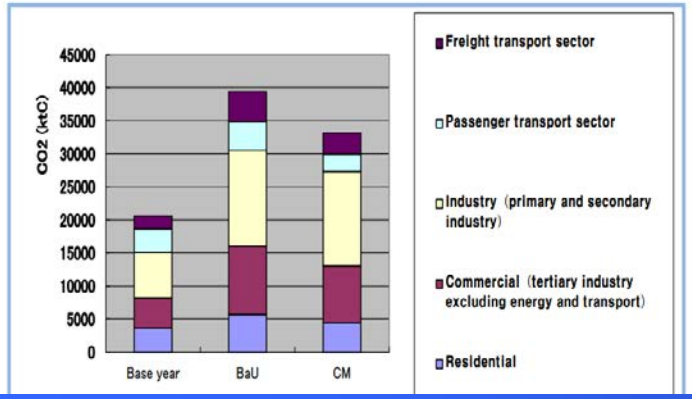

- 印度（tCO2）:
- 2010：20亿
- 2030：22-40亿
- 2050：20-60+亿
- Source:The 17th AIM International Workshop, Low Carbon Society in Asia: Activities in India
- http://www-iam.nies.go.jp/aim/aim_workshop/aimws_17/presentation/s02_shukla_ppt.pdf

# Korea



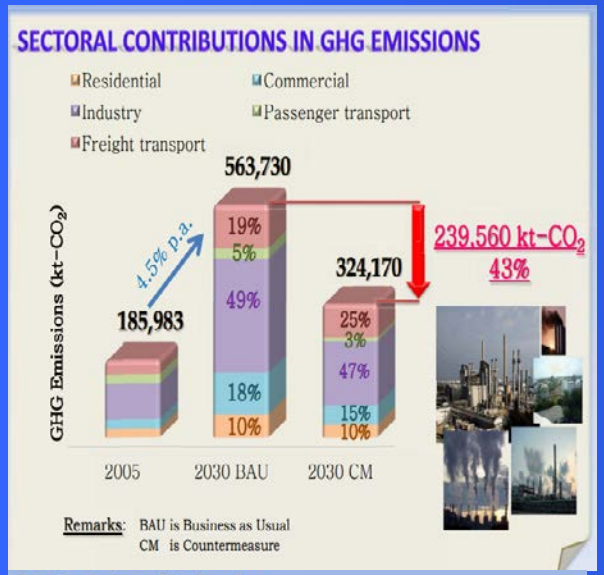

Source : Presidential Committee on Green Growth. 2009

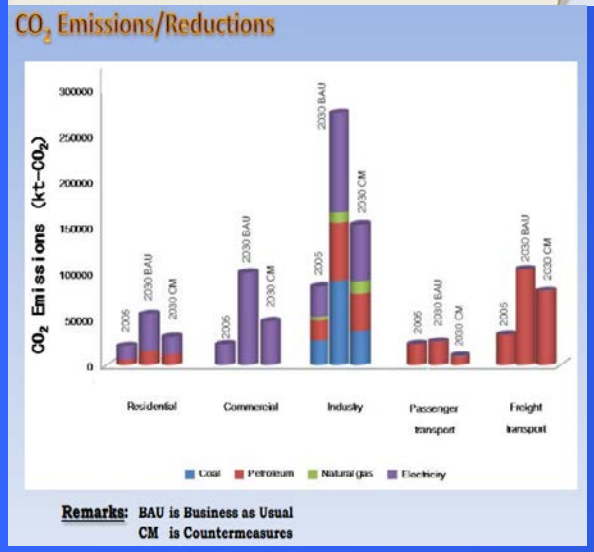
- According to BAU(Business as usual) emissions analysis, indicates 80% increase in comparison to 2005.
- Via improvement in efficiency and lifestyle changes (which reduces demand for energy services) a 16% reduction is shown in comparison to BAU.




- 政策：2005到2020：0.59亿t到0.569-0.813亿t（单位及统计口径不明）
- 2005到2030:0.21亿tC到0.34亿tC
- Source: The 17th AIM International Workshop, The Integrated Assessment of Korea’s response to climate change
- http://www-iam.nies.go.jp/aim/aim_workshop/aimws_17/presentation/s07_lee_ppt.pdf

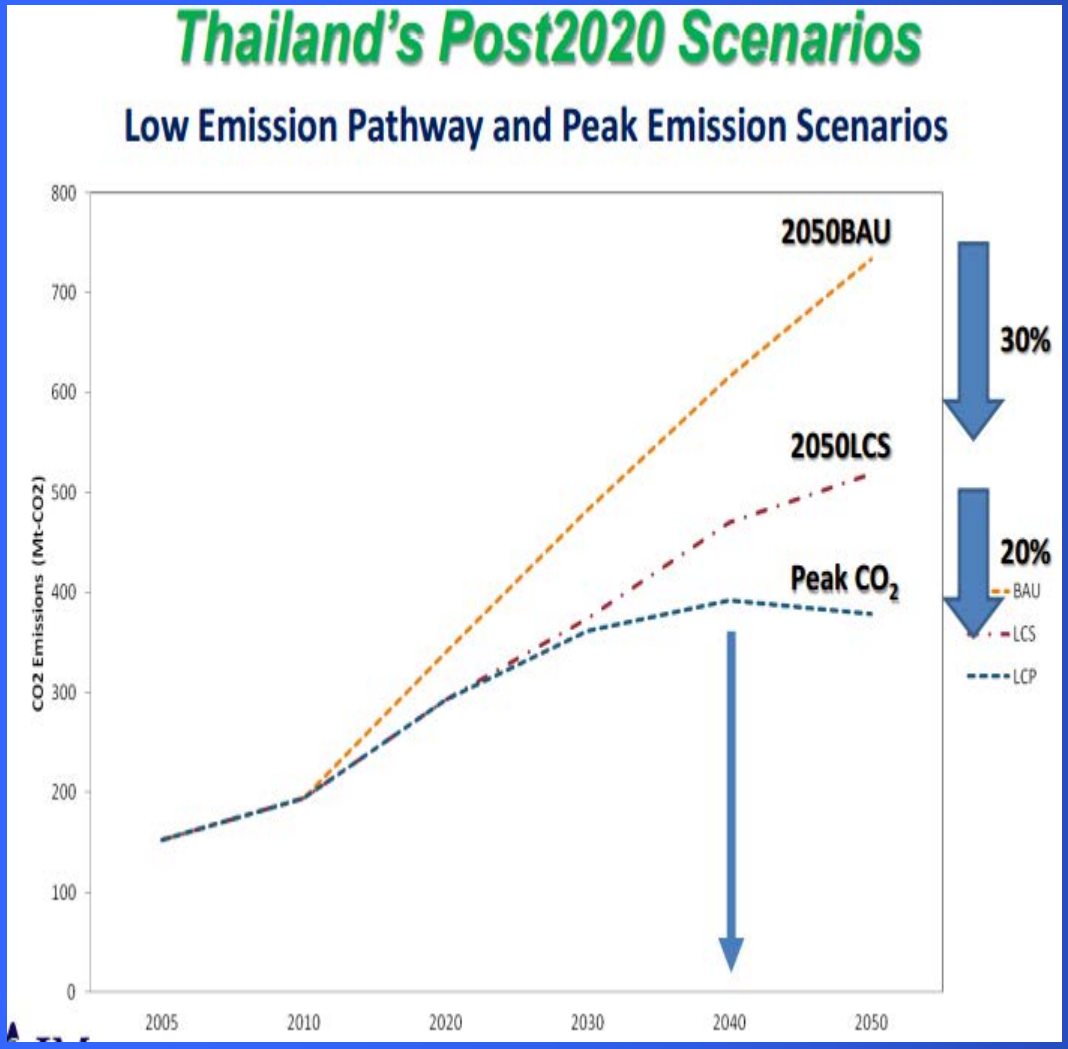
# Thailand



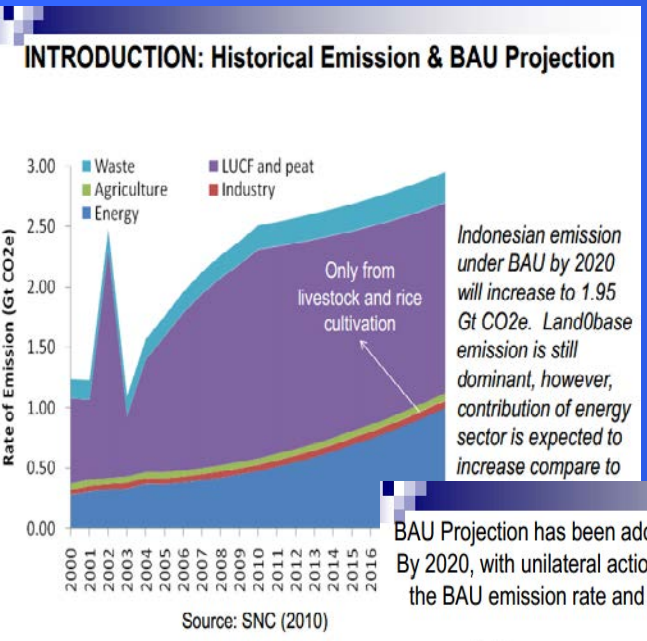

- 2030相比2005：政策情景增加75%
- 2005：1.86亿tCO2
- 2030：3.24亿tCO2
- Source: The 17th AIM International Workshop, Low-Carbon Society in Asia: LCS Activities in Thailand
- http://www-iam.nies.go.jp/aim/aim_workshop/aimws_17/presentation/s03_bundit_ppt.pdf

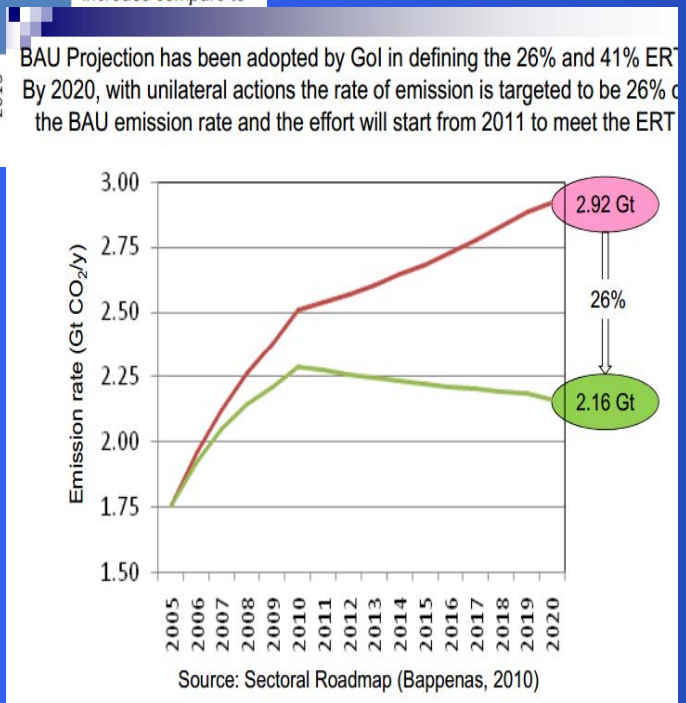
# Thailand




- Source: The 20th AIM International Workshop, Thailand NAMA Roadmap, INDC and Peak CO2 Scenarios in 2050
- http://www-iam.nies.go.jp/aim/aim_workshop/aimws_20/presentation/s04_03_bundit_ppt.pdf

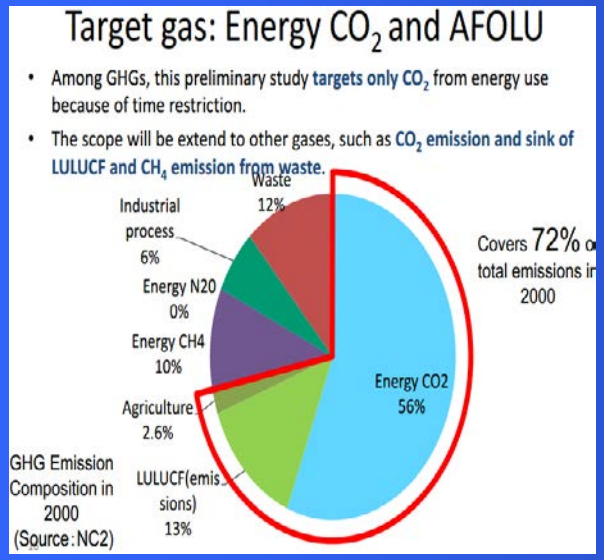
# Indonesia

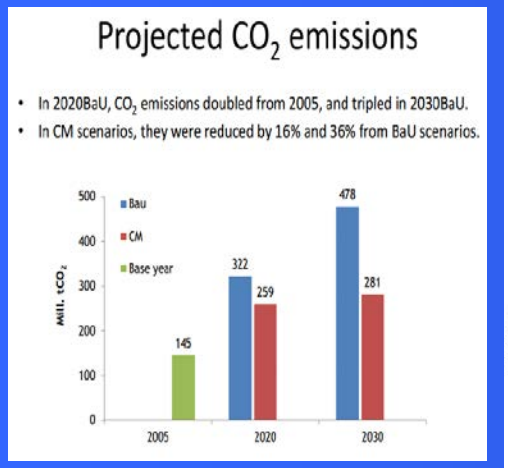


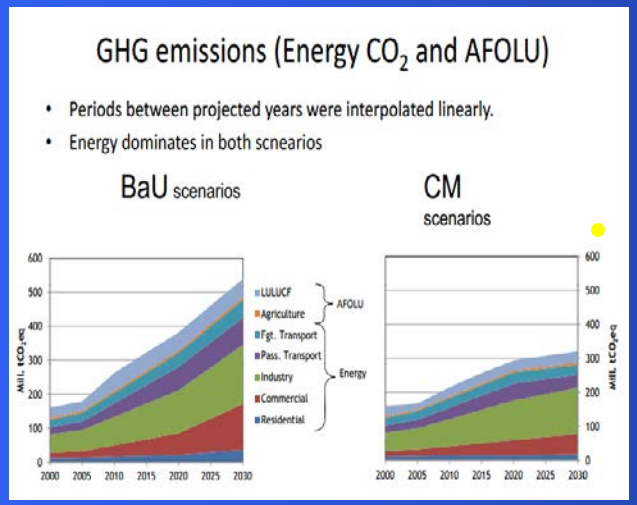




- 政策情景下，总GHG排放2020相比2010: 从22.8亿到21.6亿，减少5%
- Source: The 17th AIM International Workshop, Activities in Indonesia
- http://www-iam.nies.go.jp/aim/aim_workshop/aimws_17/presentation/s03_rizaldi_ppt.pdf

# Malaysia



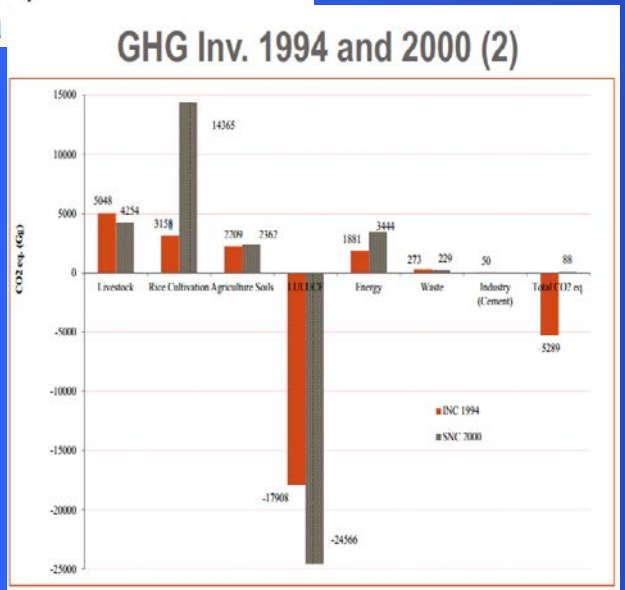




- 研究气体：仅包括能源、农业和土地利用变化，占总GHG的72%
- 政策情景下，2030相比2005：从1.45亿tCO2到2.81亿tCO2，增长94%
- Source: The 17th AIM International Workshop, Malaysian Low Carbon Societies: The way forward
- http://www-iam.nies.go.jp/aim/aim_workshop/aimws_17/presentation/s03_ho_ppt.pdf

# Cambodia

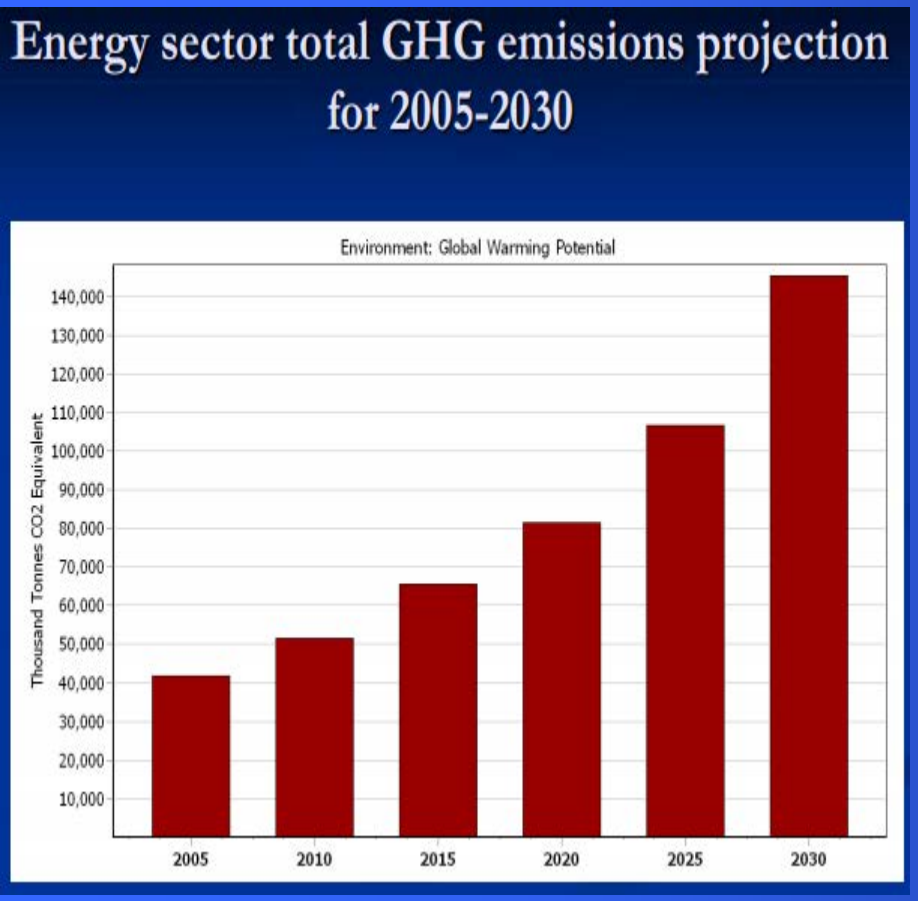
## III. Energy Circumstance in Cambodia

- Demand for Electricity
  - 70% Rural population lack access to electricity
  - Kerosene is predominantly used for domestic lighting
  - Some use car batteries for lighting and TV
- Grid electricity will not be available for many years to come
- Need alternatives to supply electricity
- Solar Photovoltaics (PV) is a mature technology with a range of possible applications in Cambodia




- 柬埔寨排放量较小，能源情况来说70%的农村人口缺乏电力，煤油是照明的主要能源，一些人使用汽车电池照明以及观看电视
- 未来一段时间电网供电跟不上，需要替代电力，太阳能是可选成熟技术
- Source: The 17th AIM International Workshop, Low Carbon Development in Cambodia
- http://www-iam.nies.go.jp/aim/aim_workshop/aimws_17/presentation/s04_hak_ppt.pdf

# Bangladesh




- 更关注适应，六个支柱
- 能源部门GHG排放：2005-2030，从0.4亿tCO2到1.45亿tCO2，增长262%
- Source: The 17th AIM International Workshop, Low Carbon Development –Bangladesh Perspective
- http://www-iam.nies.go.jp/aim/aim_workshop/aimws_17/presentation/s04_mirza_ppt.pdf

# Vietnam

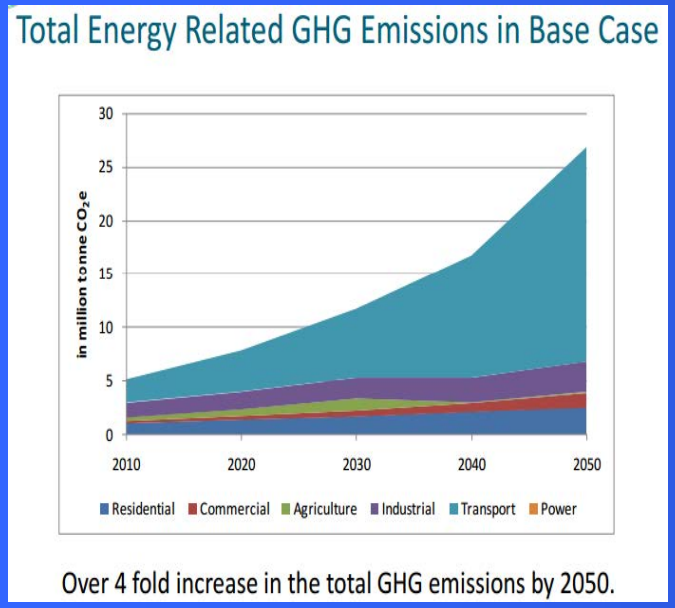
**1. GHG inventory**: Inventory for the year of 2005 just finalized in May 2013. There have been three official inventories up to now.

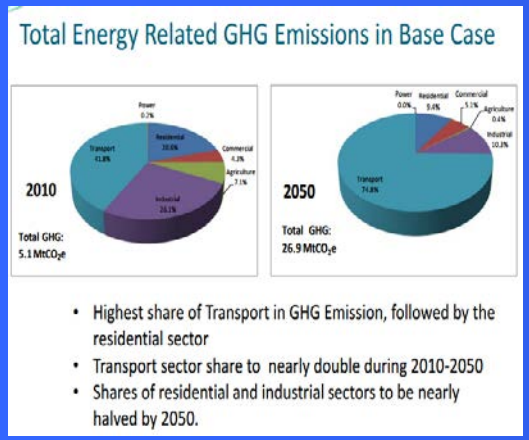
- In the inventory of 2005, LULUCF appears to be a big sink, Then, the total emission seems to be almost the same as the inventory of 2000! (*need more elaborate in this issues*)

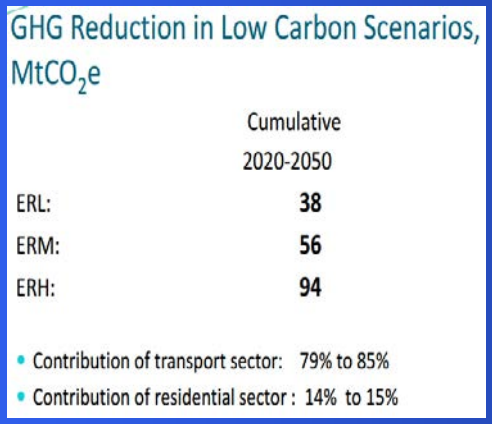
| Sectors | 1994 | 2000 | 2005 |
|---|---|---|---|
| 1. Energy | 25,637 | 52,773 | 101,564 |
| 2. Industrial Processes | 3,807 | 10,006 | 14,591 |
| 3. Agriculture | 52,450 | 65,091 | 80,583 |
| 4. LULUCF | 19,380 | 15,105 | -49,755 |
| 5. Waste | 2,565 | 7,925 | 8,118 |
| Total (mill tons of CO2 eq) | 103,839 | 150,900 | 155,101 |

- 没有未来的情景分析及结果
- Source: The 19th AIM International Workshop, Current status of LCS and AIM studies in Vietnam
- http://www-iam.nies.go.jp/aim/aim_workshop/aimws_19/presentation/s04_lanh_ppt.pdf

# Nepal

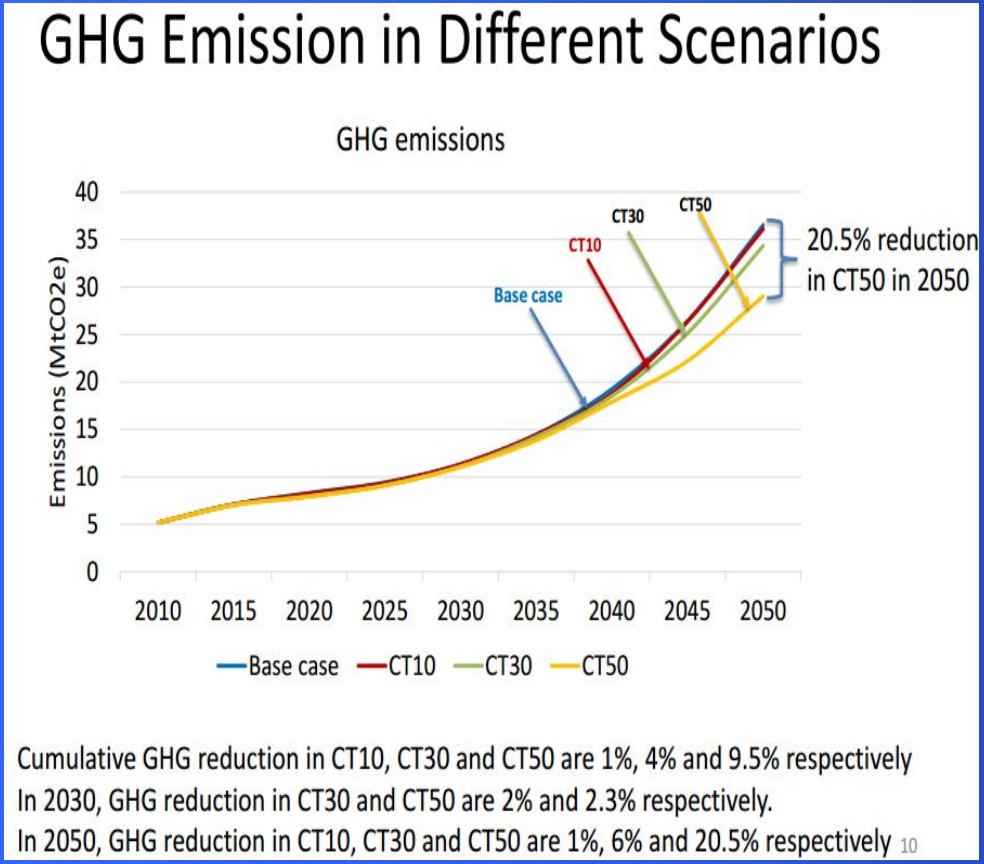



- Source: The 19th AIM International Workshop, Developing low carbon strategies for Nepal: Preliminary results from AIM/Enduse model analysis
- http://www-iam.nies.go.jp/aim/aim_workshop/aimws_19/presentation/s04_shrestha_ppt.pdf

# Nepal




- Source: The 20th AIM International Workshop, Analyses of Some Low Carbon Scenarios: Case of Nepal
- http://www-iam.nies.go.jp/aim/aim_workshop/aimws_20/presentation/s04_04_ram_ppt.pdf