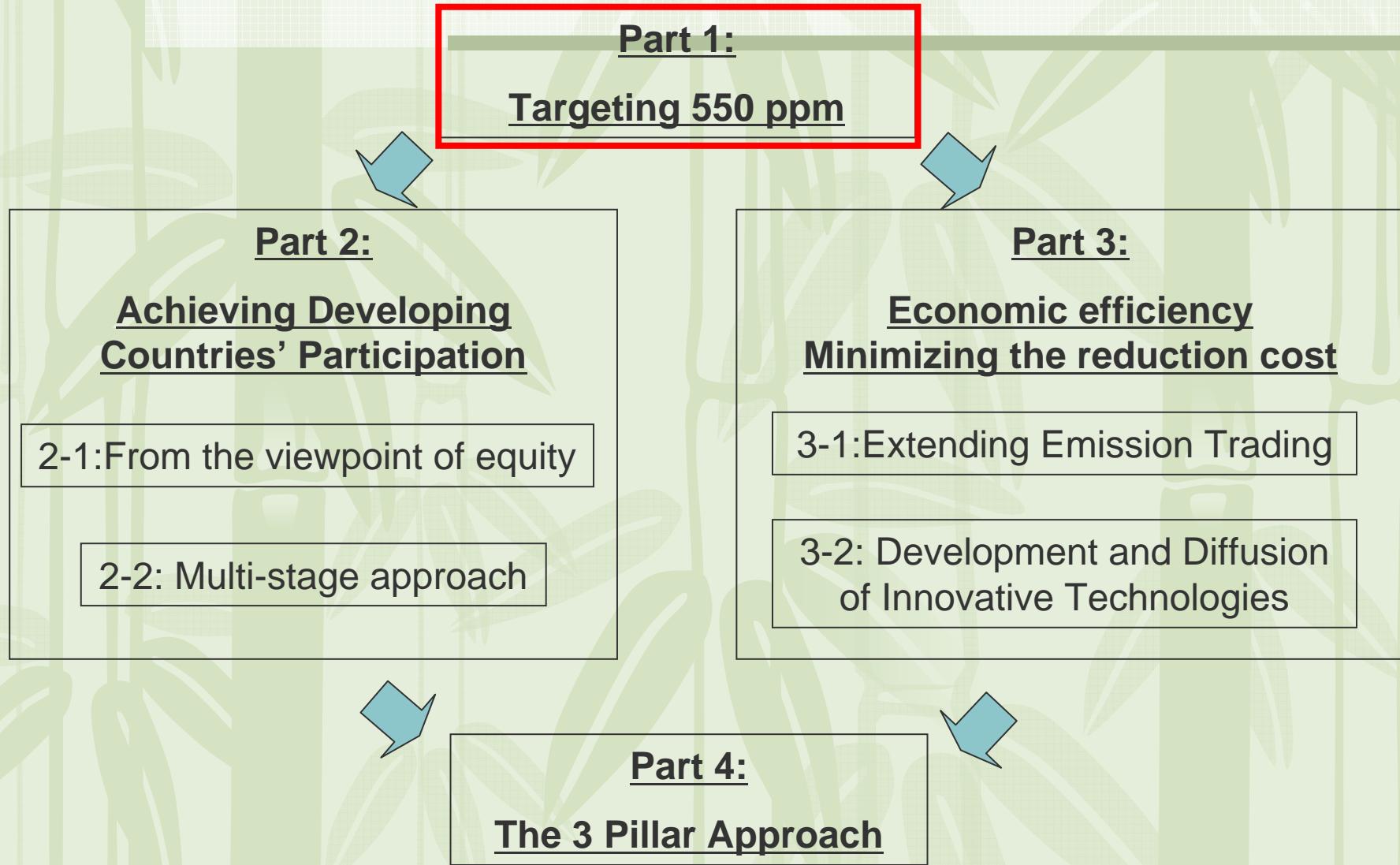


The 3 Pillar Approach

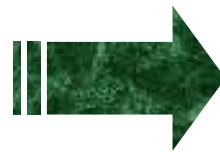
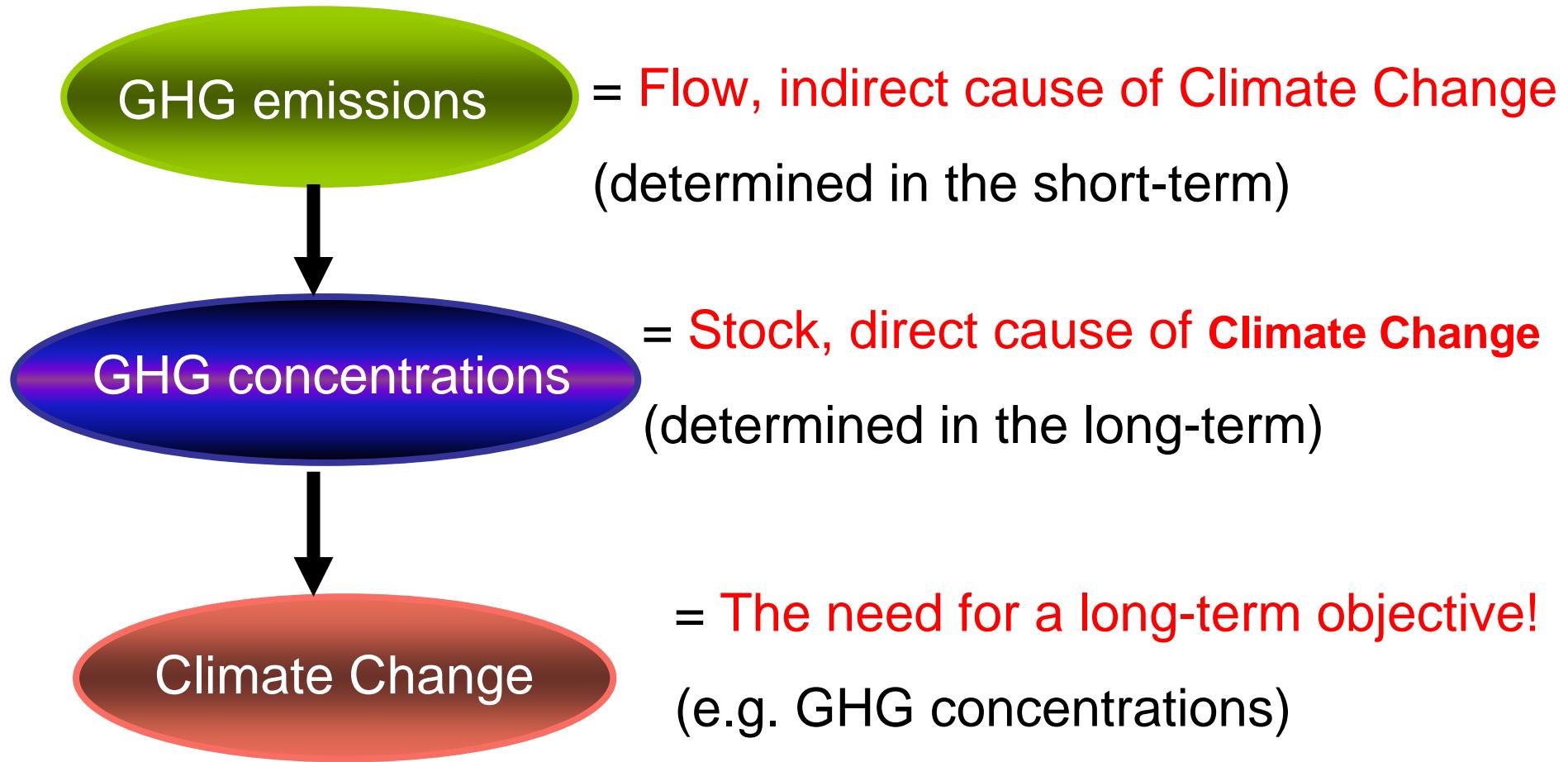
The Future Framework
for Climate Change after Kyoto

Issei Yoshida
Daisuke Miyamoto
Maico Miyasato
Shuzo Shirota
Tomoya Sasaki
Yosuke Arino

Flowchart of our presentation



Climate Change is a long-term issue

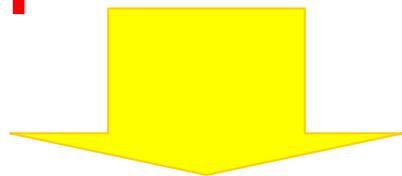


**Setting a long-term objective is important
to tackle with Climate Change !**

Setting the long-term objective

- UNFCCC Article 2.1

“stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system”



But at what level?

Targeting 550ppm

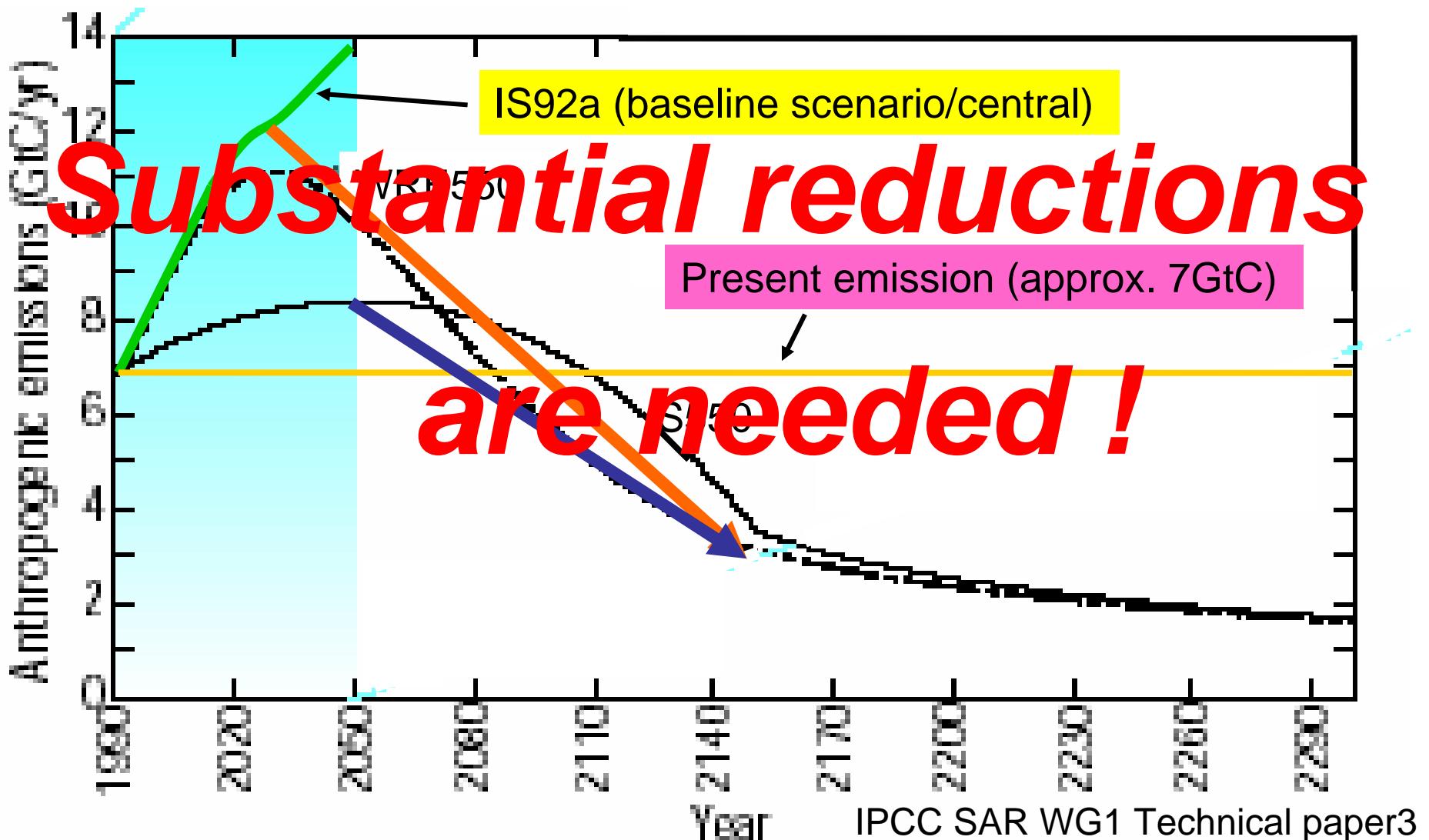
Why targeting 550ppm? (Currently 370ppm)

Because...

1. Given the current state of knowledge and technologies, it is considered to be **the lowest possible GHG concentration level to be achieved.**
2. Targeting such a level now allows future generations to have **more options for GHG concentration levels** than otherwise.

➤ Resolving the uncertainty about the desirable level of GHG concentrations

Projections of GHG emissions paths leading to 550ppm



Essential elements for the future framework

To achieve 550ppm

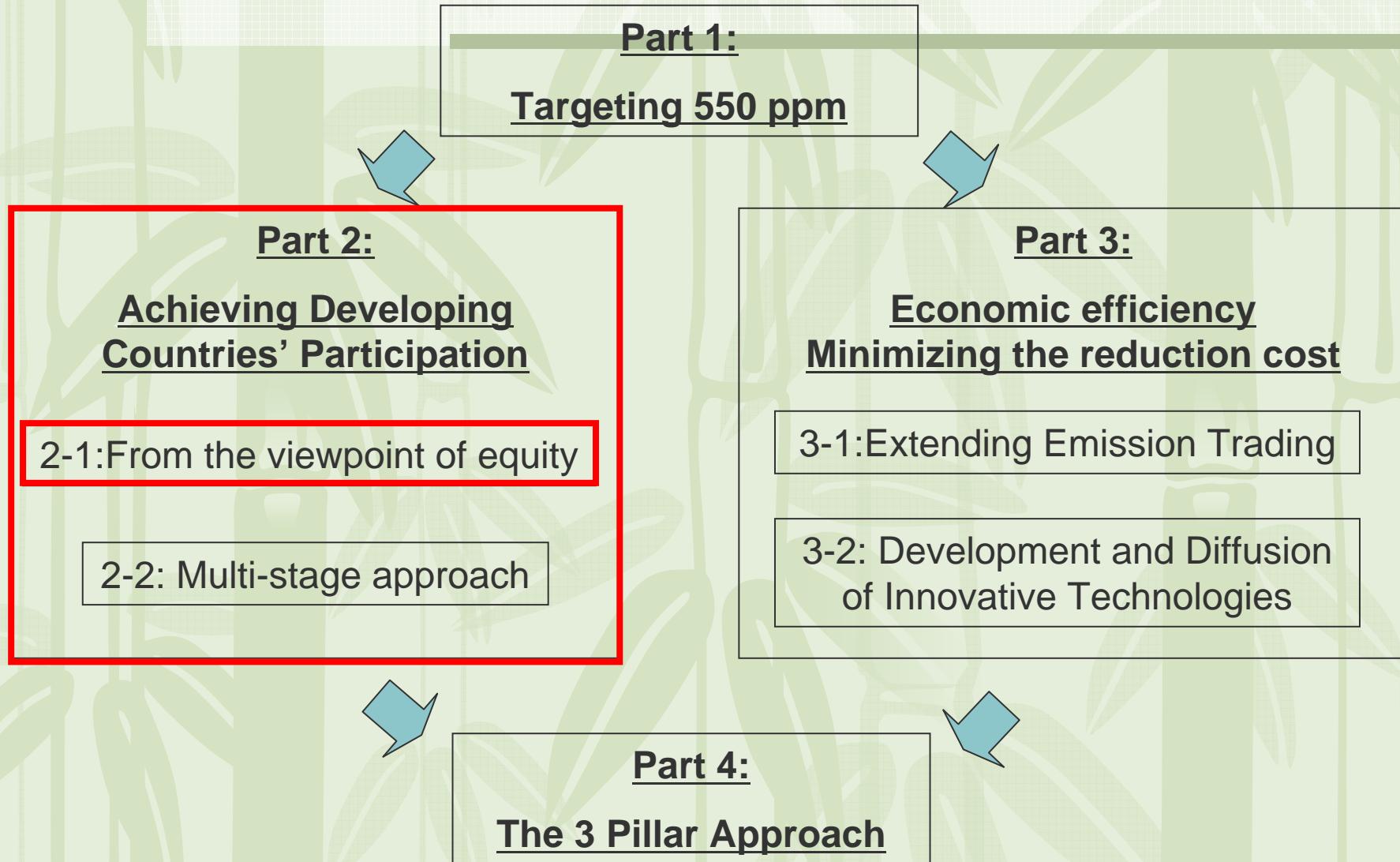
① **Global participation**

⇒ Developing countries in particular

<KP covers only 1/3 of total global emissions>

② **The minimization of reduction cost**

Flowchart of our presentation



What is equity?

The definition:

- Equity is a situation in which **all people or nations are treated equally** and no one has an unfair advantage.

Source : Dictionary “Longman”

Why is equity important?

- If the new framework meets equity, it would be acceptable for developing countries.
- For **developing countries' participation**, equity should be taken into consideration.

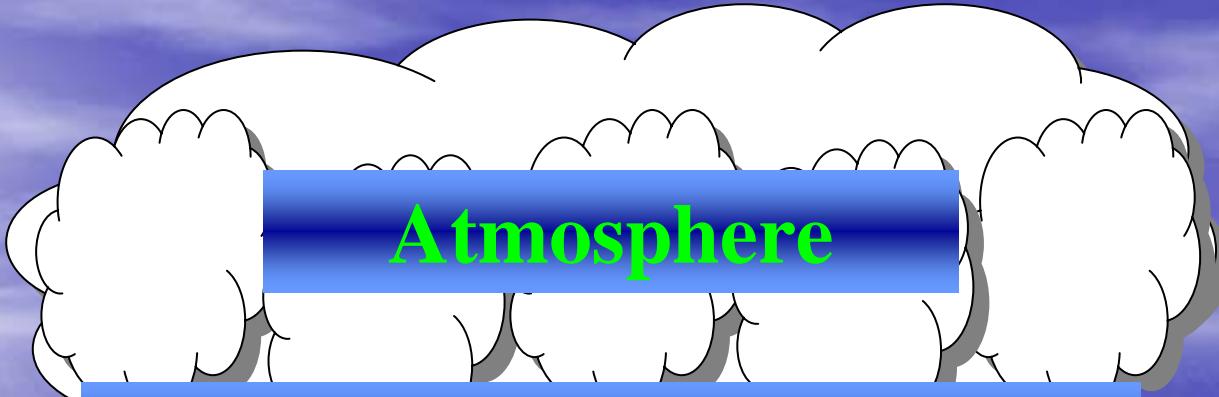
5 basic principles of equity

1. Equal Entitlements
2. Responsibility
3. Capability
4. Basic Needs
5. Comparable Effort

Source: Xueman Wang et al.(2003)

1. Equal Entitlements

- Atmosphere can be considered as the sort of limited resource that we can use to emit GHG into.
- This particular resource is limited and should be **equally distributed among individuals living** on this planet.



Atmosphere



Satisfy equal entitlements !

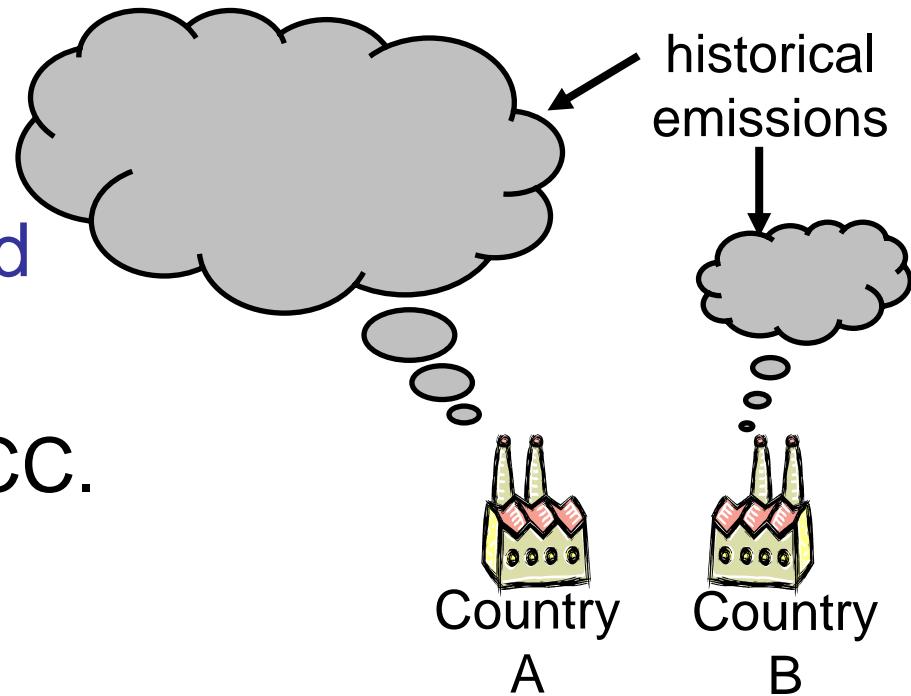


GHG emissions



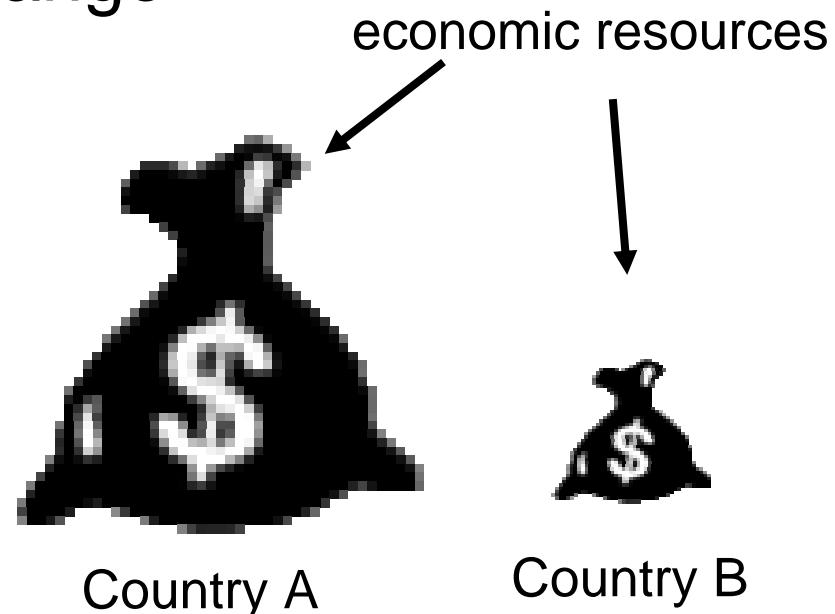
2. Responsibility

- The countries that have more **historical GHG emissions** should assume larger responsibilities and act first in tackling with Climate Change.
- Compatible with “common but differentiated responsibility” specified in the Article 3.1 of UNFCCC.



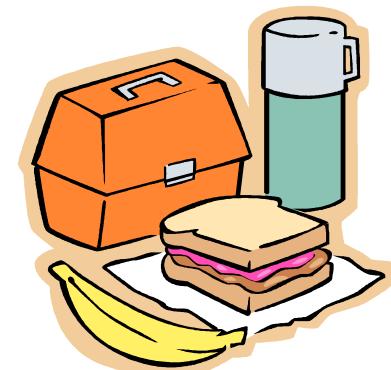
3. Capability

- The countries that have more **economic resources** and more **technologies** should assume larger responsibilities and act first in tackling with Climate Change
- Compatible with “**respective capabilities**” specified in the Article 3.1 of UNFCCC.



4. Basic Needs

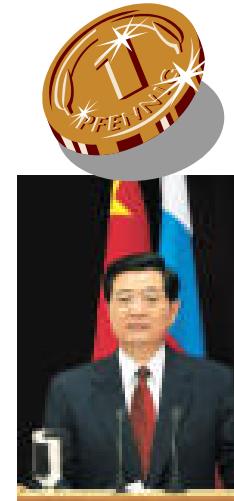
- The countries that lack **basic needs such as food and water** should be exempted from taking actions to mitigate Climate Change.
- E.g. Sub-Saharan African countries



5. Comparable Effort

A unit of GHG reductions

=



Implications for the future agreement

Equal Entitlement

- **Convergence of per capita emissions across countries**

...①

Responsibility

Capability

Basic Need

- **Differentiation of participation timing and the degrees of commitments across countries**

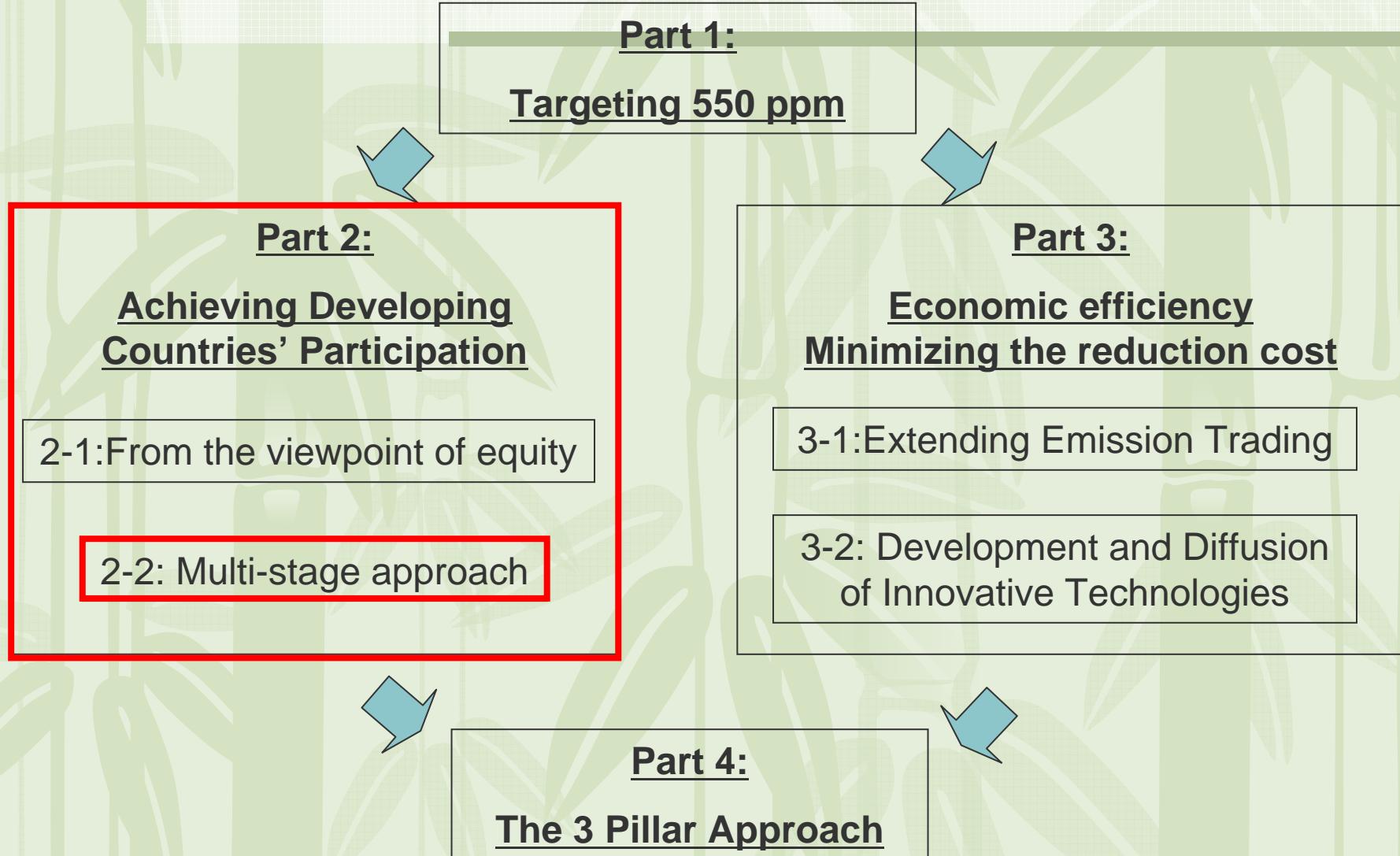
...②

Comparable Effort

- **Emission trading**

...③

Flowchart of our presentation



Multi-stage approach

- Originally proposed by den Elzen (RIVM)
- **Aims** :the stabilization of GHG concentration(**550ppm**) by 2150

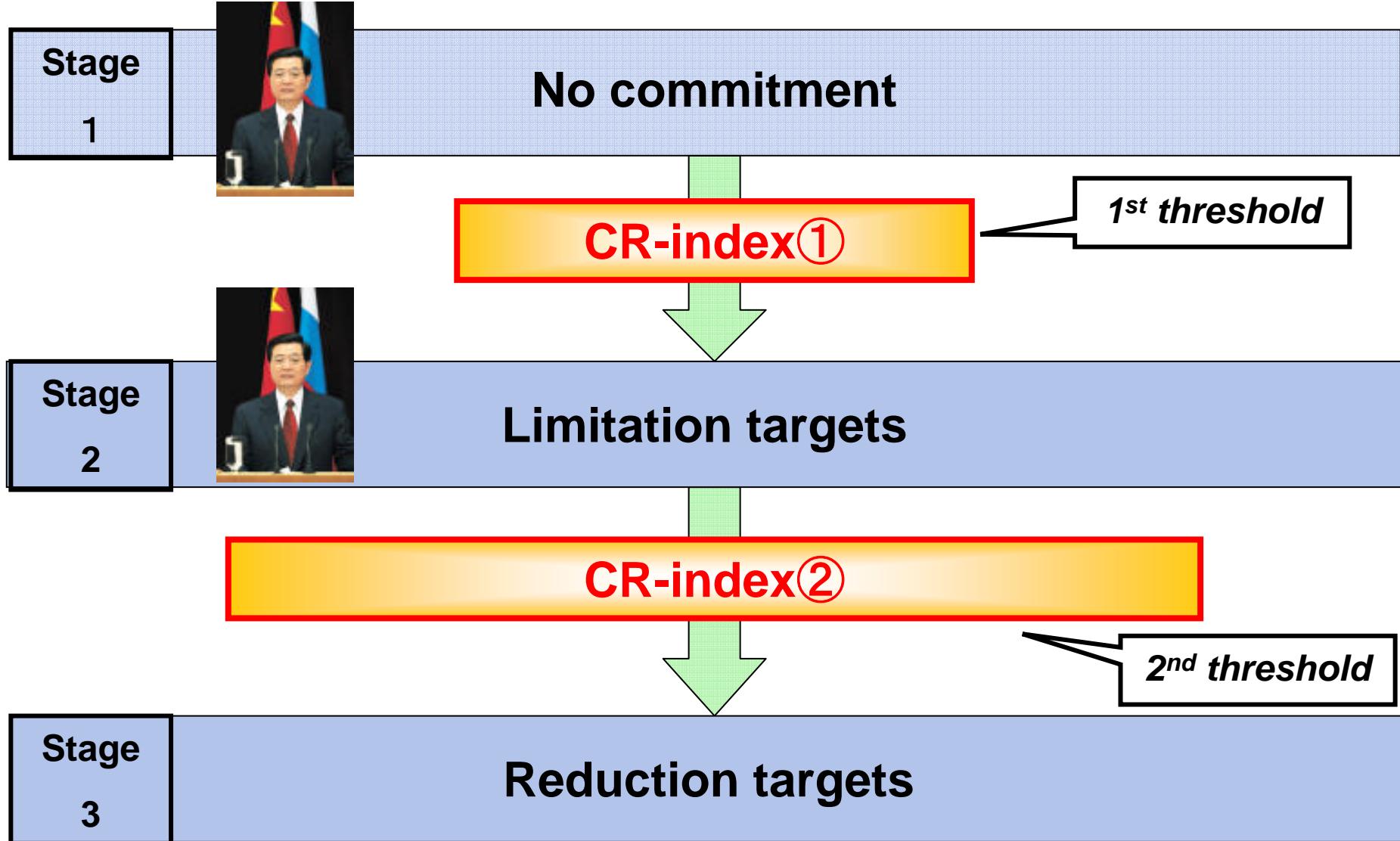
:Convergence of per capita emissions across countries over time
⇒satisfying equal entitlement

Multi-stage approach

Non-Annex I

- Stage1 **No commitment**
E.g. Sub-Saharan countries
- Stage2 **Limitation targets (e.g. intensity targets)**
E.g. China, Brazil etc.
- Stage3 **Reduction targets (per capita emissions)**
E.g. Japan, EU, US etc.
- Per capita emissions will eventually converge across countries over time.

How to move to the next stage



CR-index

Capability + Responsibility

- “Common but differentiated Responsibilities and respective Capabilities”

(Article3.1 of UNFCCC)

$$\text{CR-index} = \frac{\text{Per capita GDP}}{\text{Per capita Emission}} + \frac{\text{Per capita Emission}}{\text{Per capita GDP}}$$

Elzen's model indices

- **550ppm**

1st threshold·CR-index①=5

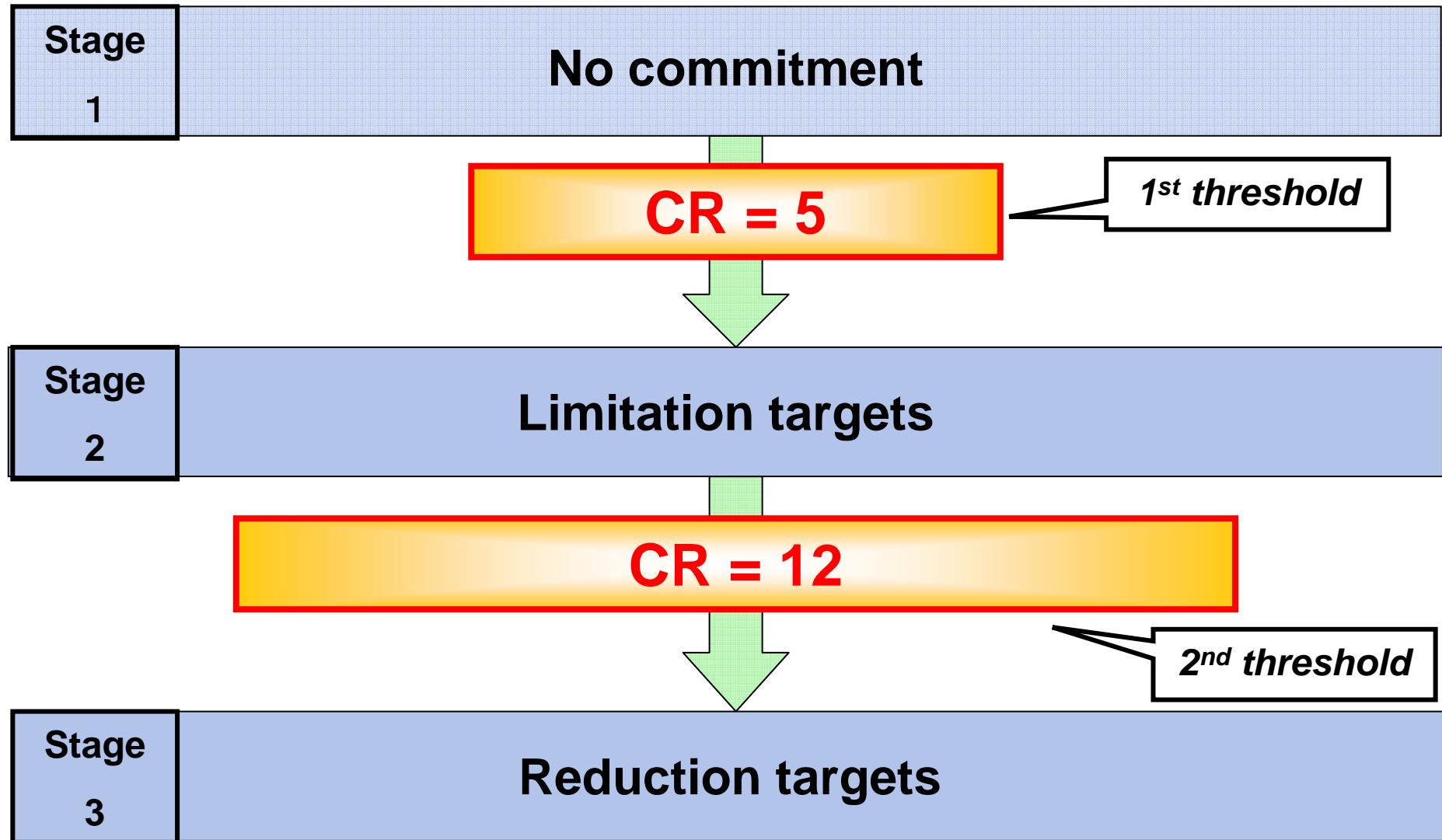
2nd threshold·CR-index②=12

Cf.650ppm

1st threshold·CR-index①=12

2nd threshold·CR-index②=20

How to move to the next stage

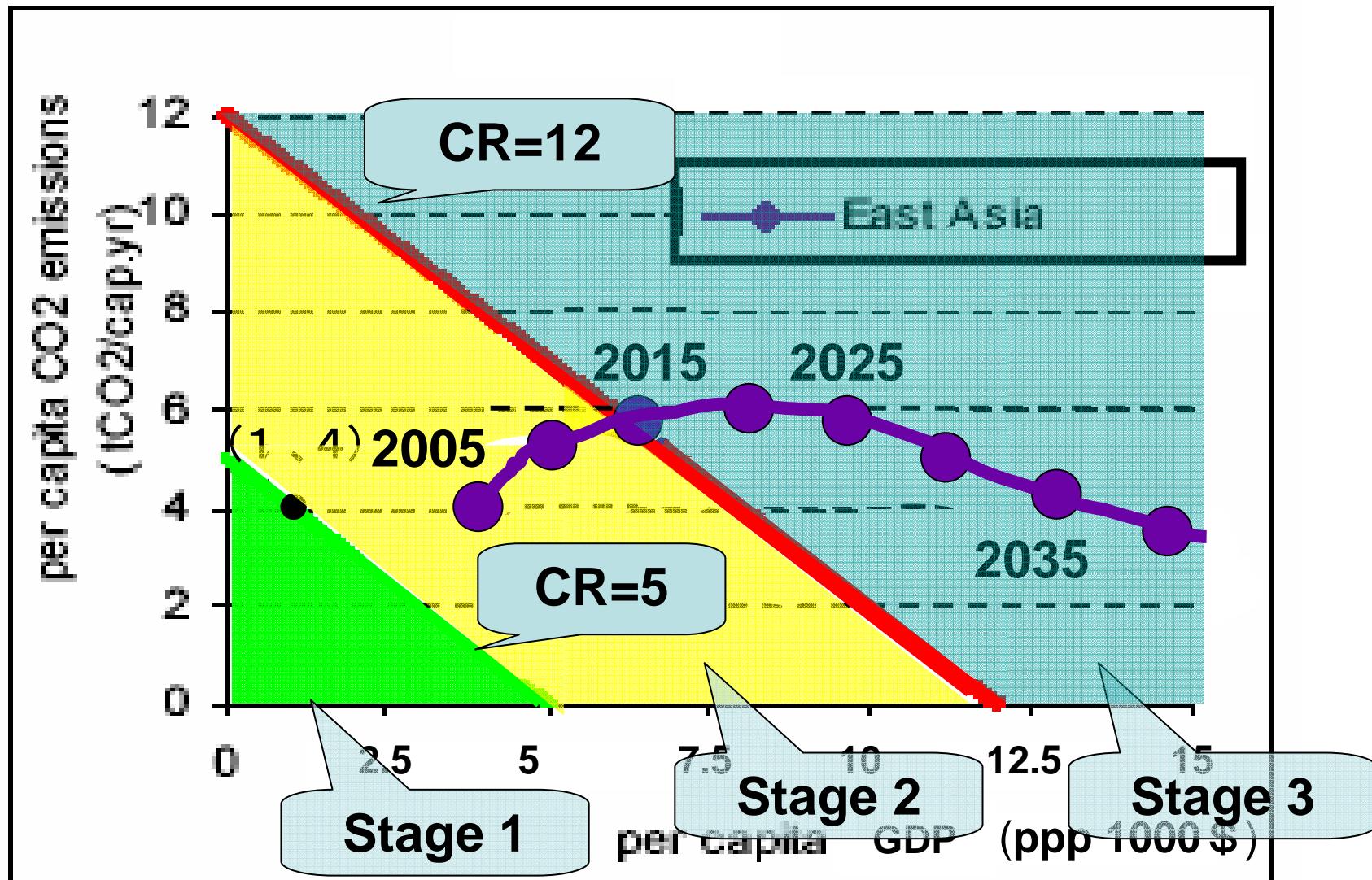


CR-index in 1995

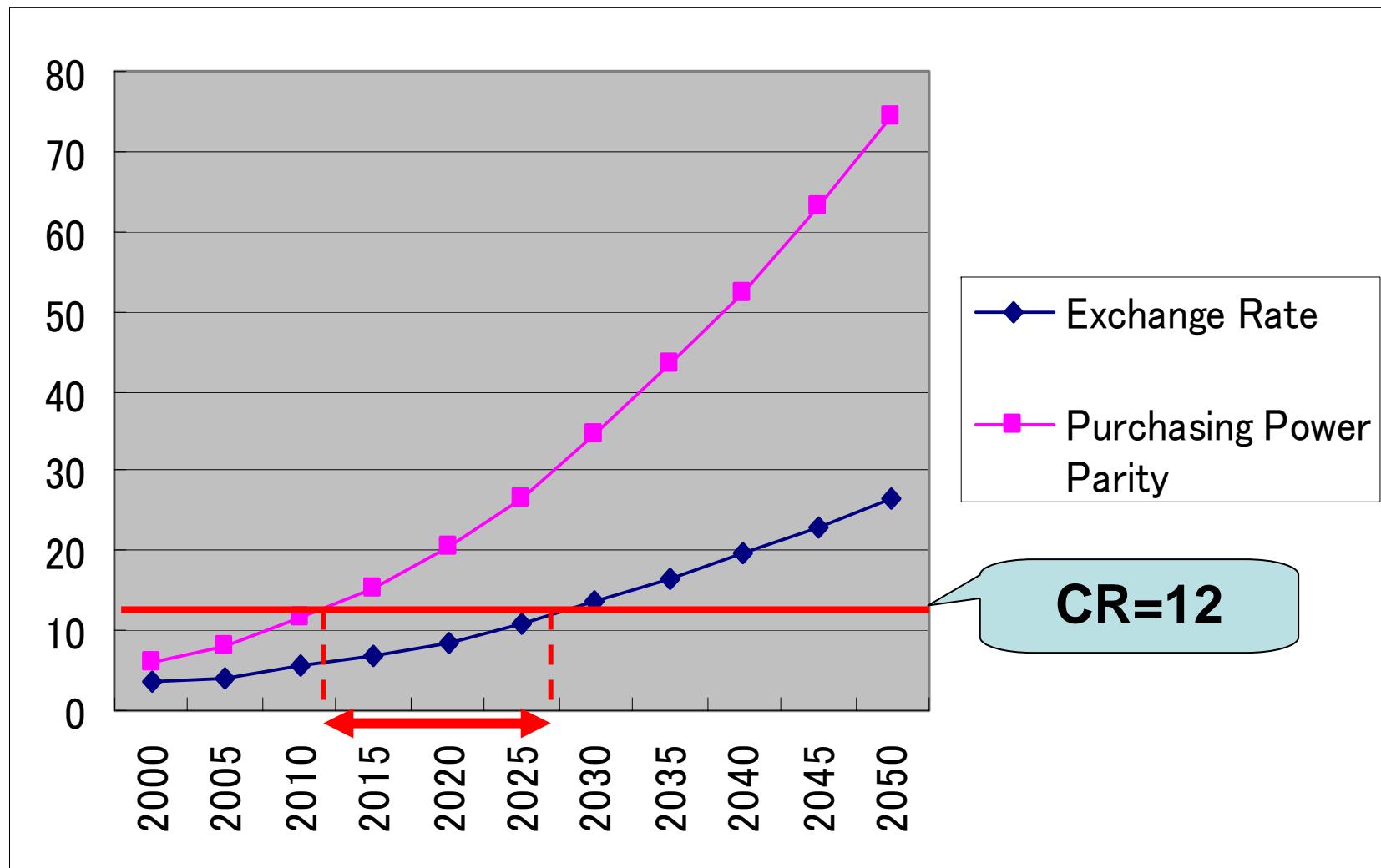
	1995		
	Per capita GDP 1000 PPP\$	Per capita emissions tCO2-eq	CR-index
USA	28	26	54
Canada	24	21	45
Oceania	17	19	36
Japan	24	11	35
OECD Europe	20	11	31
Former USSR	5	12	18
Eastern Europe	7	9	15
Middle East	5	7	12
South America	7	5	12
Central America	5	5	10
Southern Africa	2	4	7
East Asia (China)	3	4	7
Northern Africa	3	3	6
South East Asia	3	3	6
South Asia (India)	2	2	4
Western Africa	1	1	2
Eastern Africa	1	1	2

Source: den Elzen (2004)

CR-index in East Asia



China's Participation in Stage 3



Source: den Elzen (2004) adapted by post-kyoto group

Allocation in the Stage3

550ppm

Proportional to
Absolute Emission (n) \times Per Capita Emission (n)

Share of each nation
 $NR(n) = TR \times S(n)$
Mathematically determined

- TR = Total Reduction
- NR (n) = National Reduction of country n
- S (n) = Share of country n within TR

Japan

China

US.A

National

Share of each nation

Precisely speaking...

Let us assume that...

- $X(n) = \text{Absolute Emission (n)} + \text{Per Capita Emission (n)}$

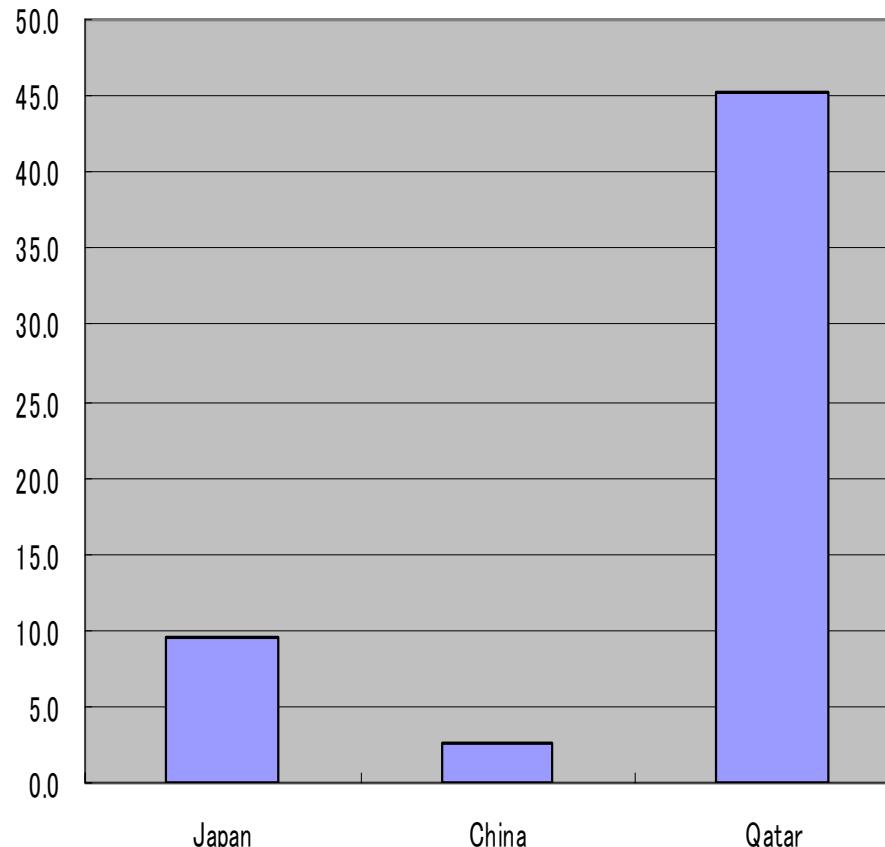
Then...

$$S(1) = \frac{X(1)}{\sum_{n=1}^m X(n)}$$

Share of each nation

in 2002 (for instance)

Per capita CO2 Emission (t)



Absolute CO2 Emission (t)

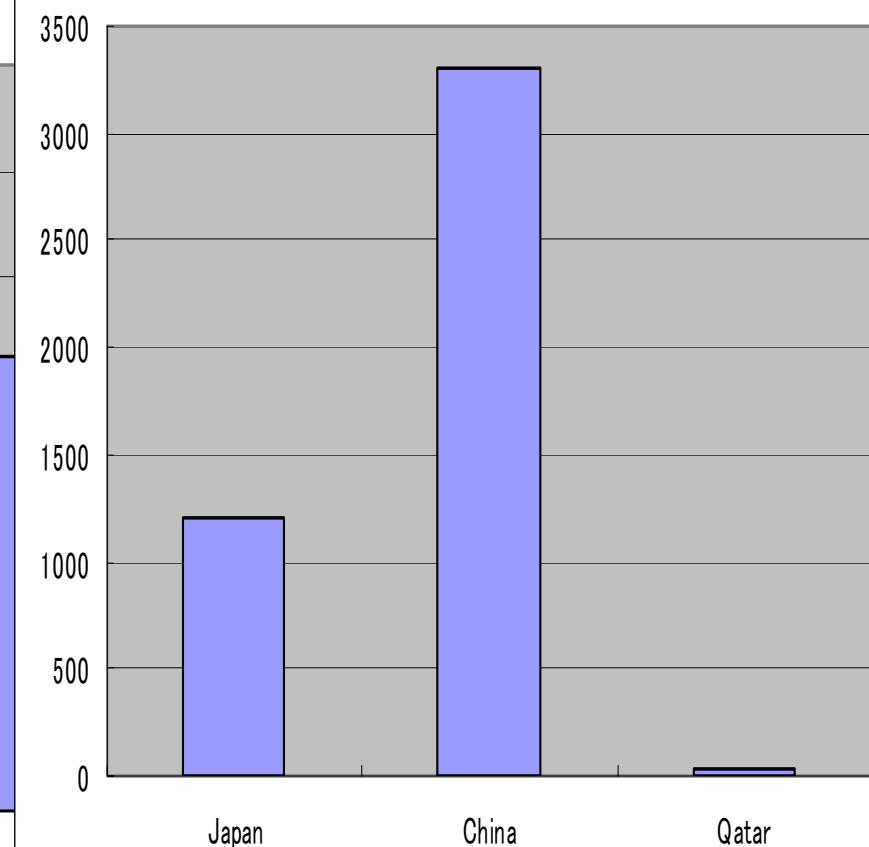
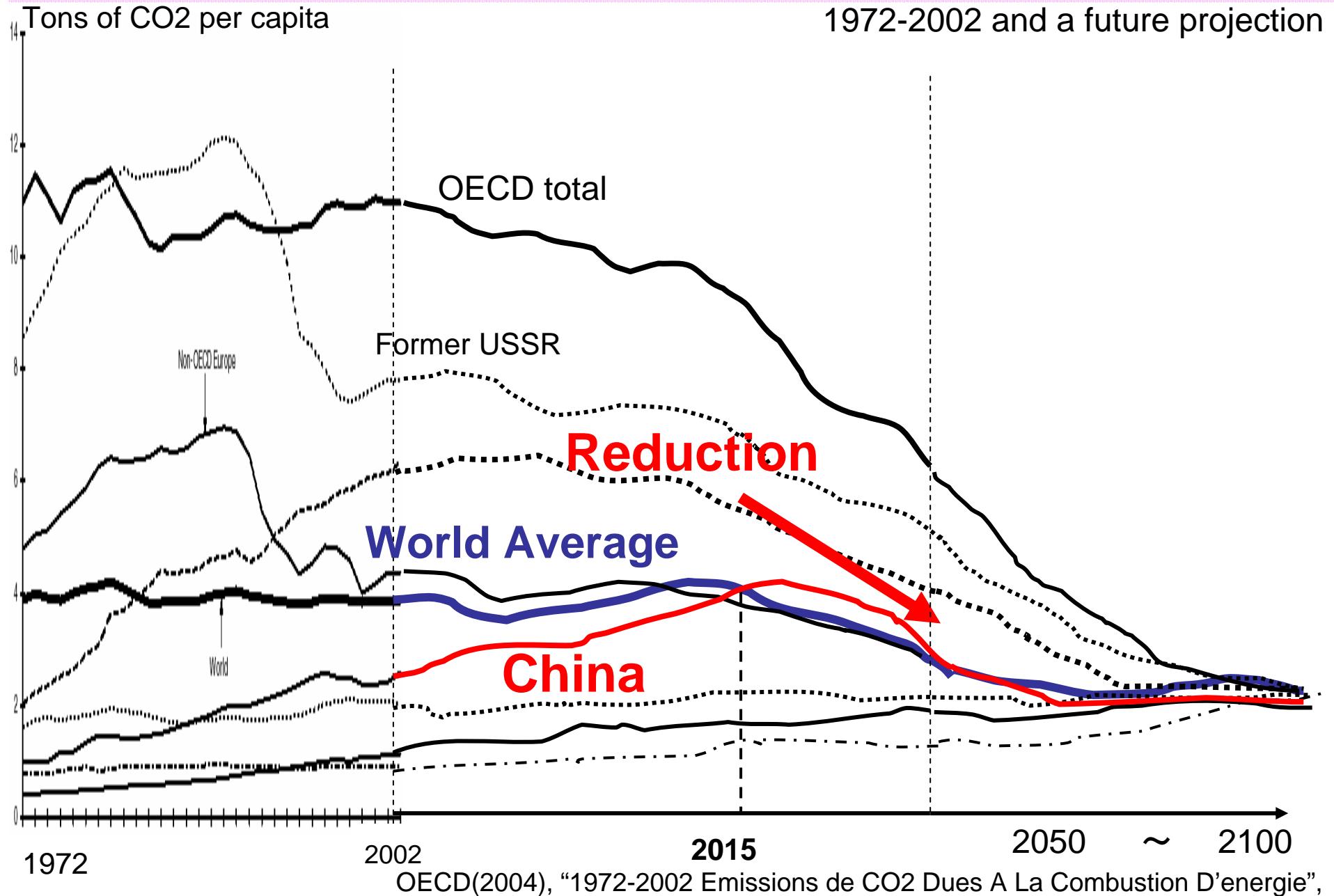
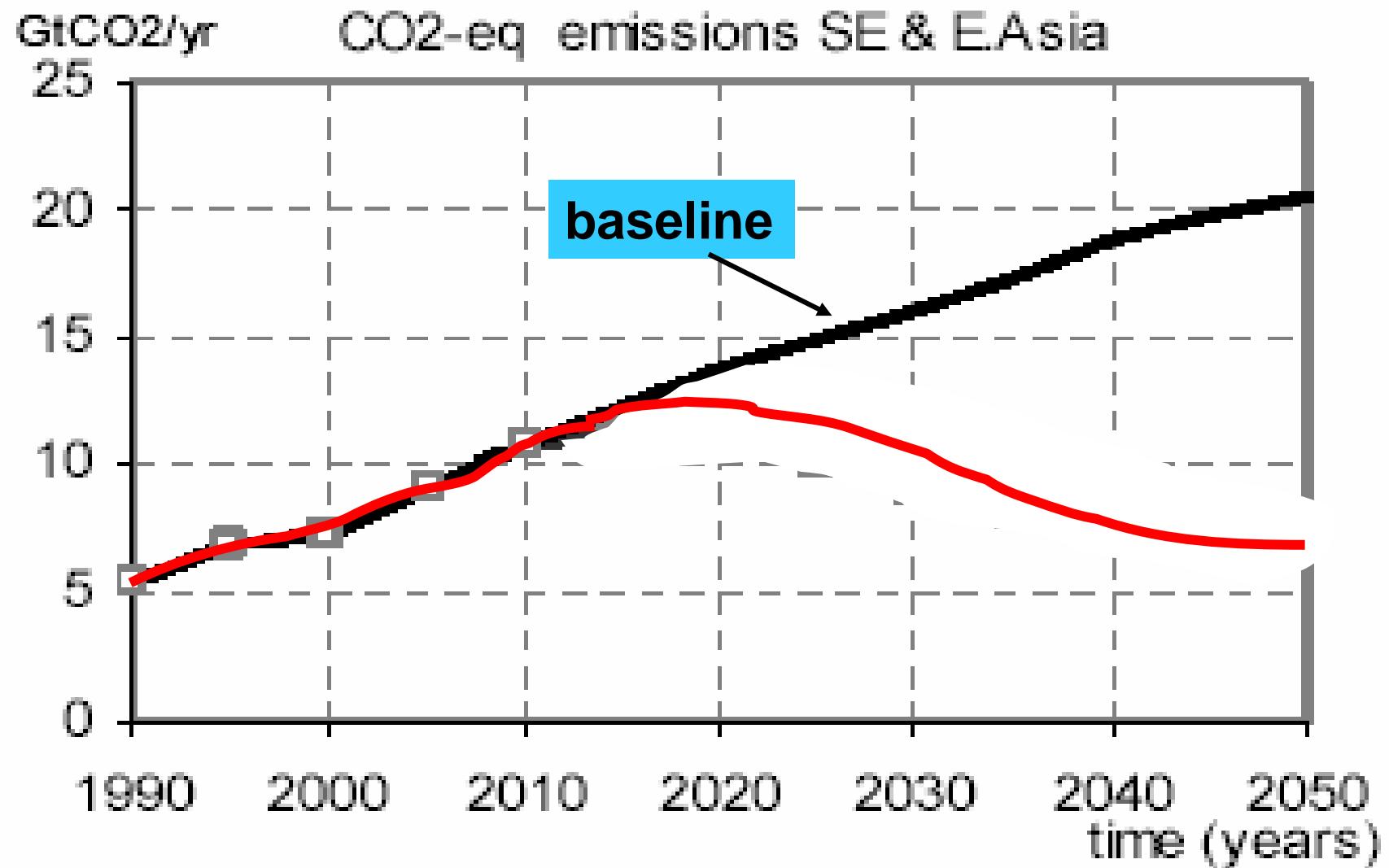


Image of convergence in the future

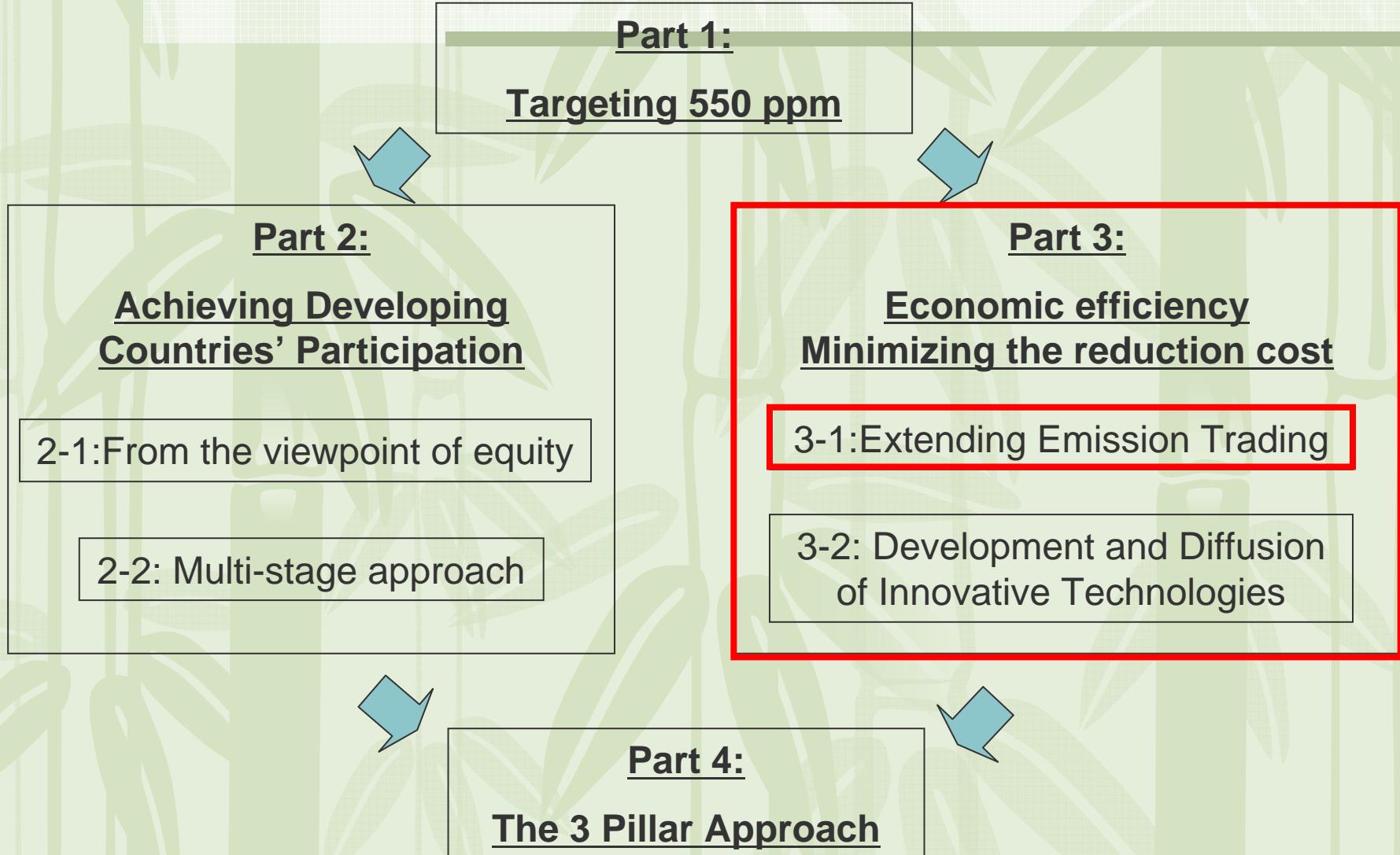


Emission Trajectory of South East and East Asia



Source: den Elzen (2004)

Flowchart of our presentation



Cost Reduction by Emission Trading in the Stage 3

<Macro (social) aspect>

I . Minimize social abatement cost

⇒Equalize marginal abatement cost
across borders

<Micro aspect>

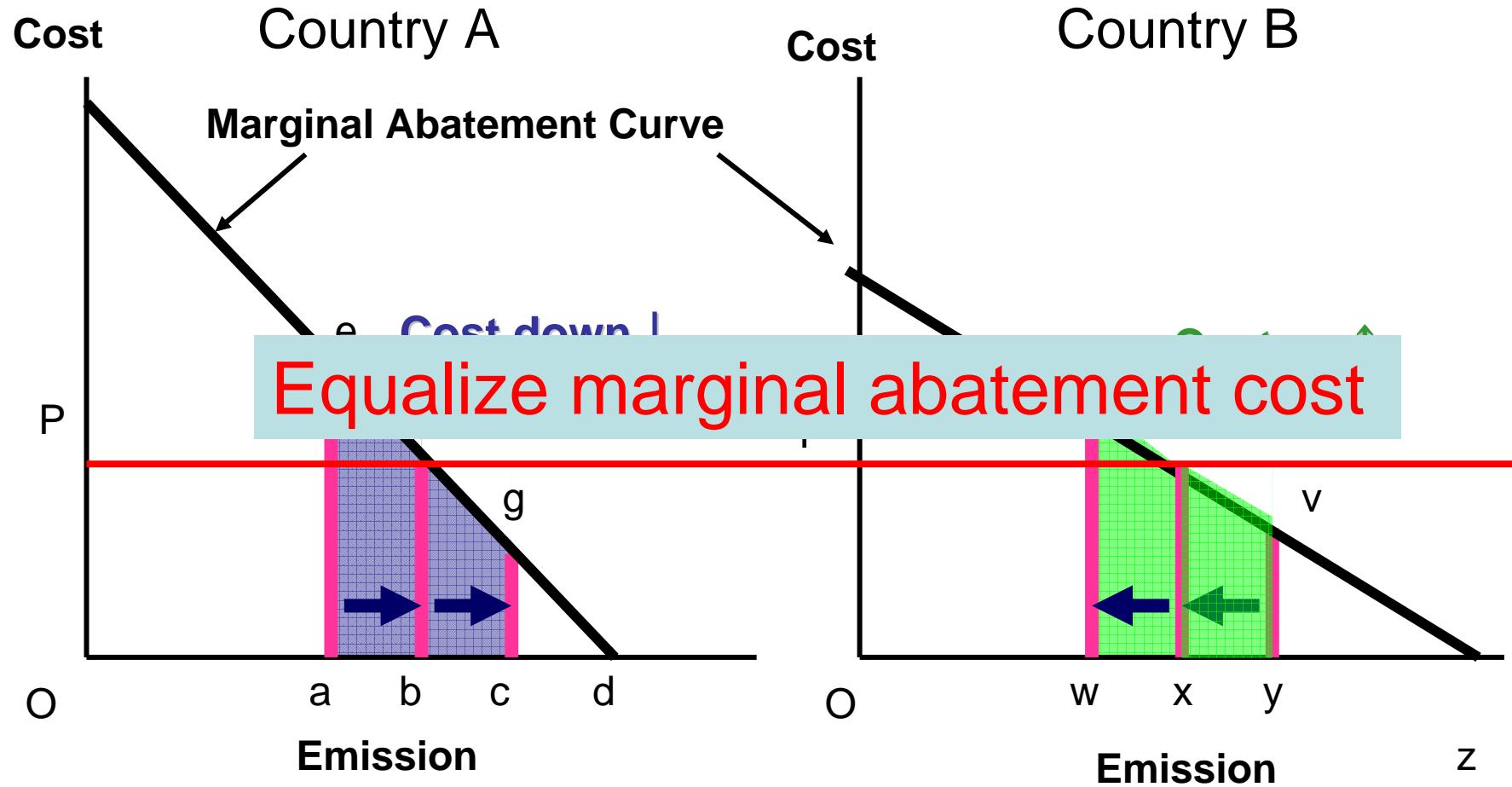
II . Lower abatement cost for each country

Reduction

VS

Reduction + Purchasing permits
Reduction + Selling permits

Emission Trading



Minimize social abatement cost

ET of Kyoto Protocol (Article17)

➤ Among developed countries (Annex B countries)

Annex B countries: OECD, EIT, Russia, Ukraine, The Baltic

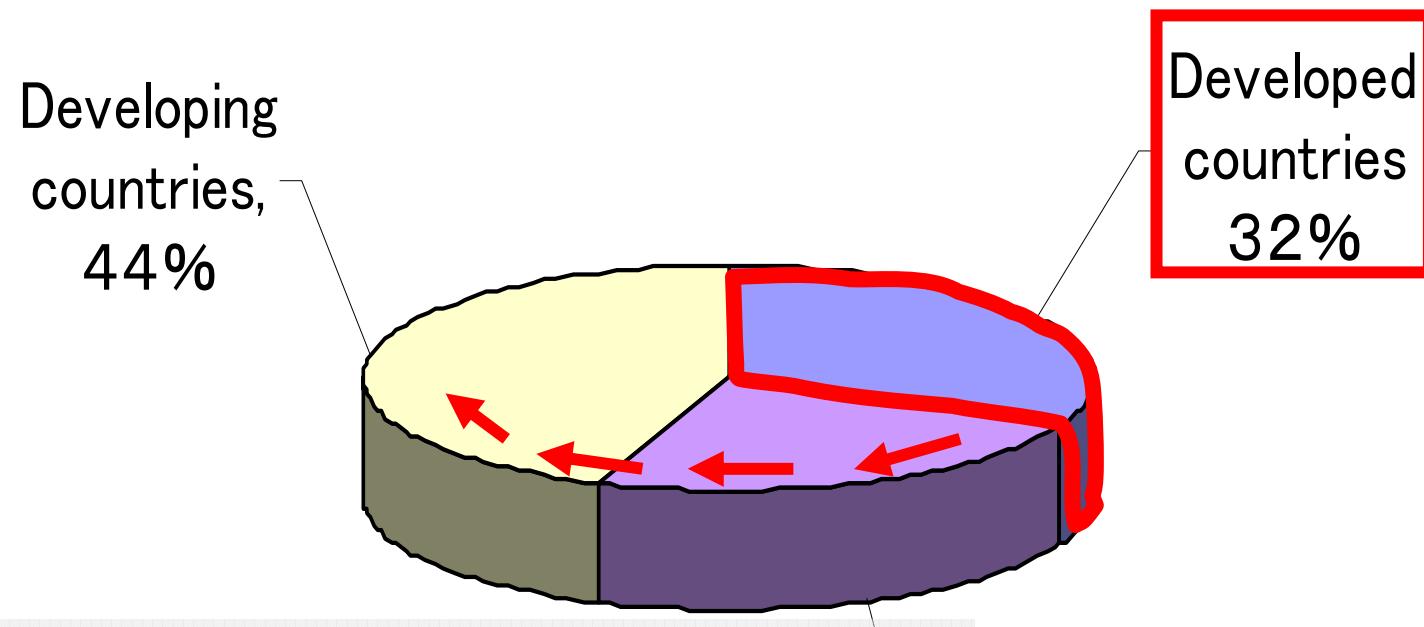
➤ Covering 1/3 of global CO2 emissions

Without US and Australia, and developing countries

➤ Period: 5 years (2008~2012)

Projection of Global CO2 Emission in 2010

Unit: Million Carbon t



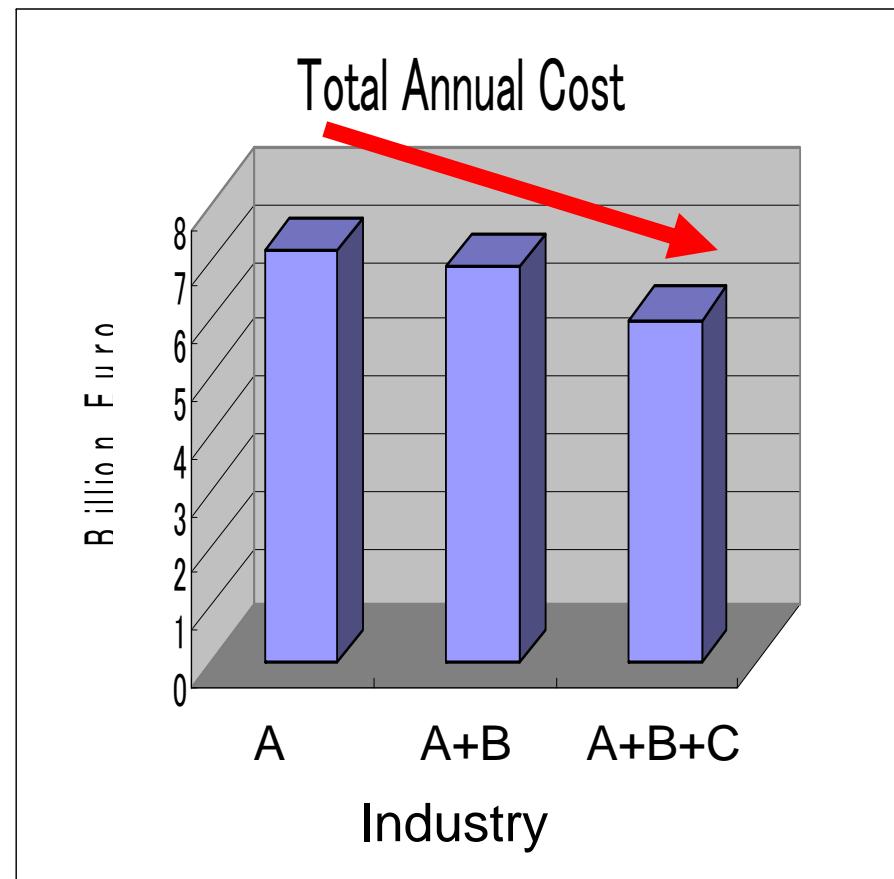
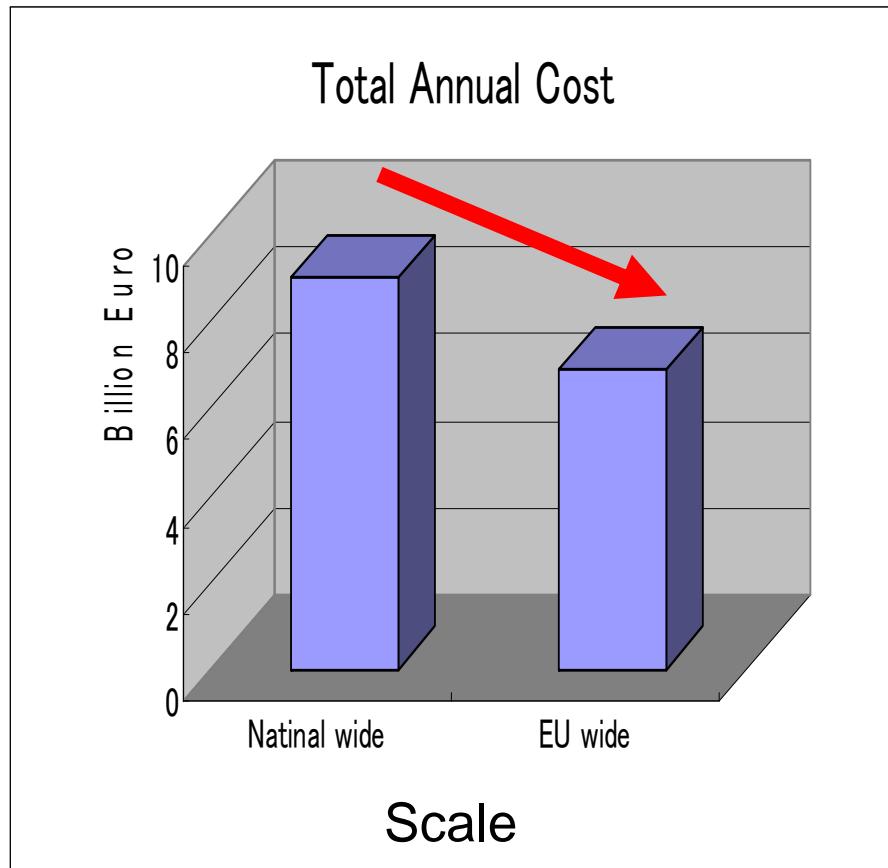
In the future, a number of countries participating in ET is expected to increase!

EU, Australia
24%

Source: IPCC TAR

Cost Reduction by extending trading scale

Ex. EUETS (begins in 2005)



A: Energy supply (Power) B: Energy Intensive sector (Steel, Cement)

C: Others (Agriculture, Transport, Manufacturer, etc.)

Source: OECD (2002) "Environmental Protection and ET"

Marginal Cost of CO₂ Abatement

(\$ of the year 2000/tCO₂)

Model	Annex B Trading	Global Trading
SGM	22	8
MERGE	34	24
G-Cubed	11	4
POLES	33	10
GREEN	20	7
AIM	19	13
Average	24	8

Source: OECD (2001) "Emission Trading"

Extending ET scale helps reduce ...

1. Total abatement cost

=Minimization of social abatement cost

2. Marginal abatement cost

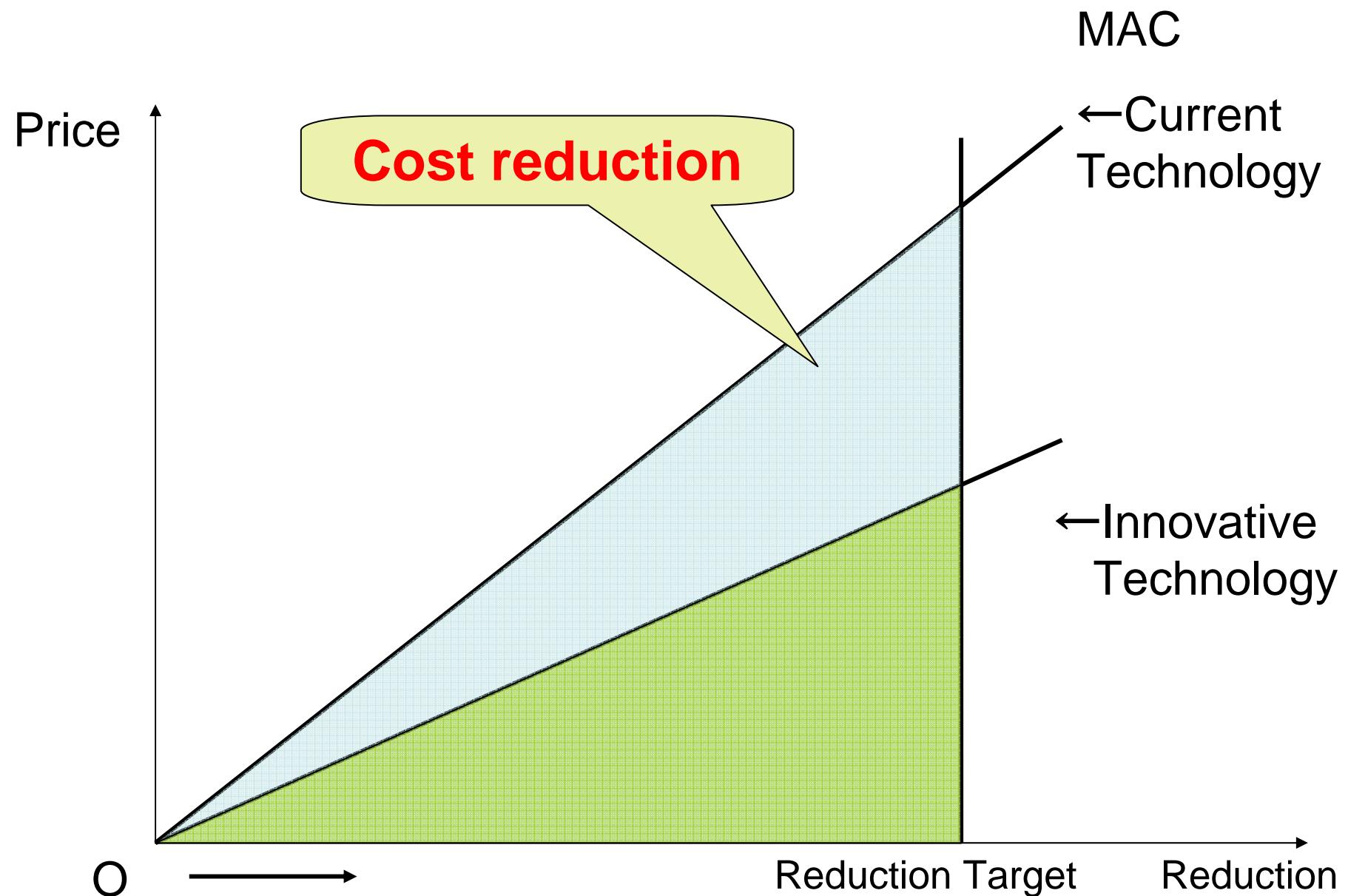
⇒Due to relatively low MAC of DCs.

But

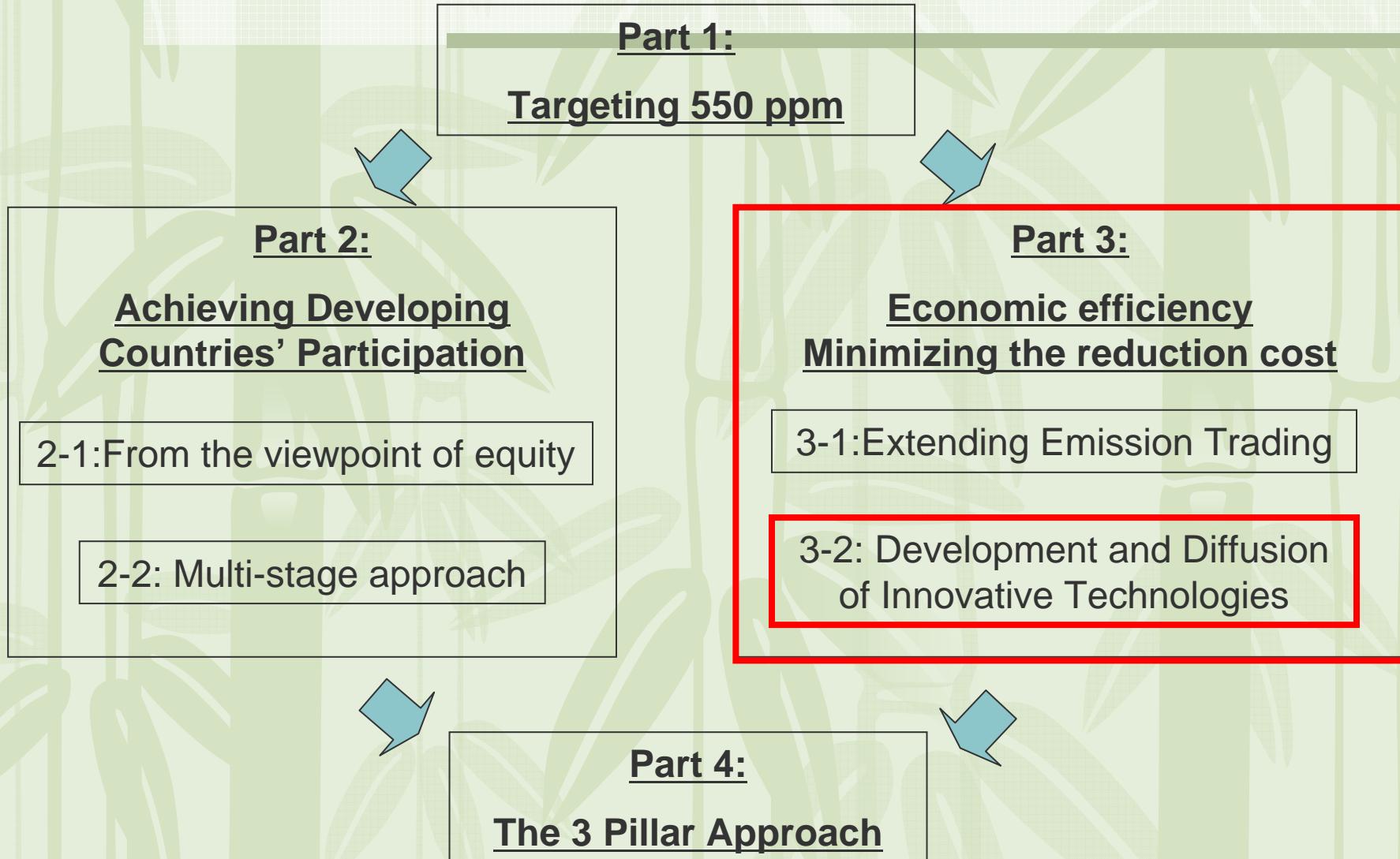
Looking at the long-term horizon, economic instruments are not enough to reduce GHGs drastically.

Technology innovation is essential.

Technology Innovation

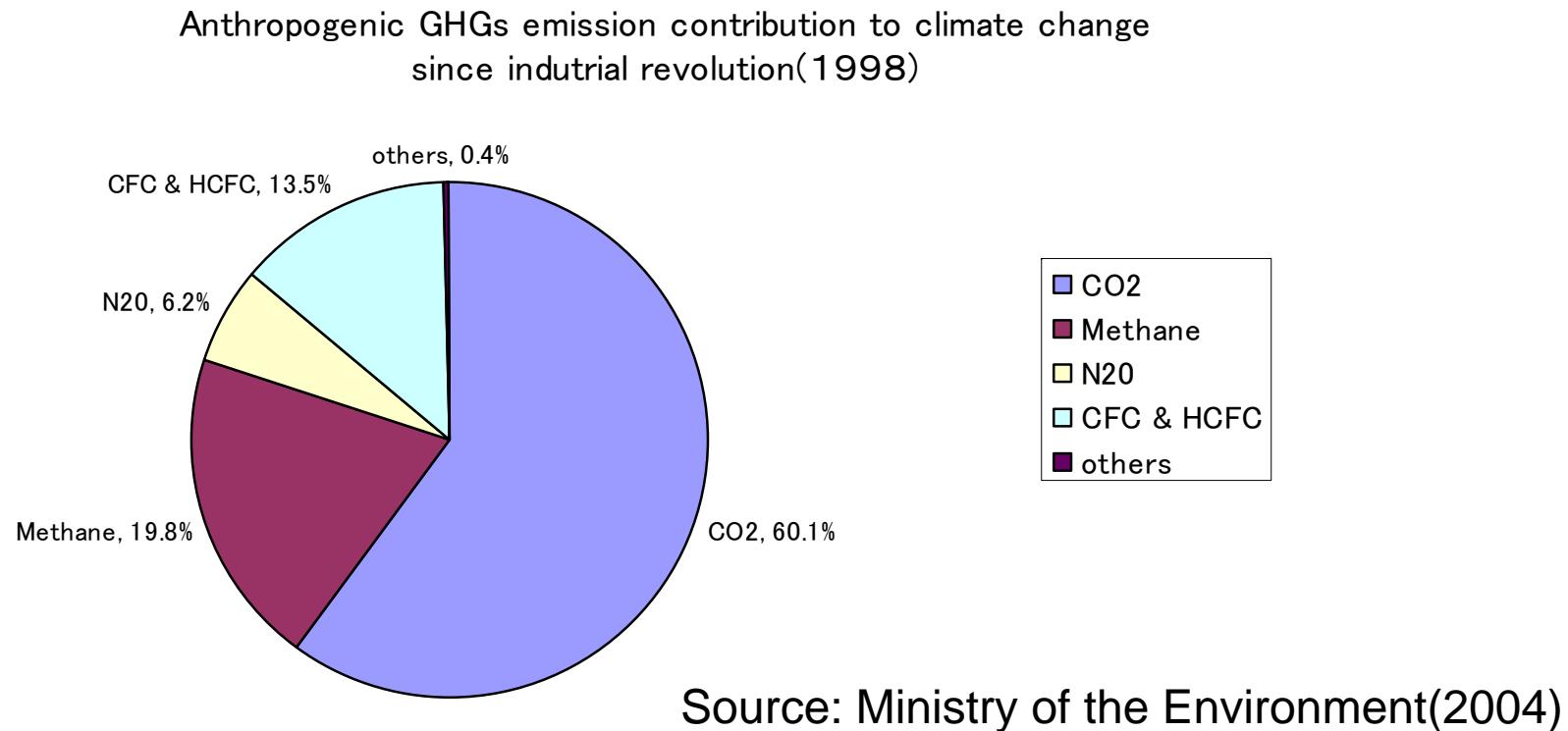


Flowchart of our presentation



- Emphasis on the **energy sector** (definition)
- The role of the market (**learning by doing**)
- The role of **the government** (support R&D and diffusion)
- **Technology mix**

The Breakdown of the contributions of different GHG to Climate Change



•CO₂ is the single dominant contributor to Climate Change.

Four major factors to determine the amount of CO₂ emission

$$\text{CO}_2 \text{ emission} = \text{De-carbonization} \times \text{energy efficiency improvement} \times \frac{\text{GDP}}{\text{population}} \times \text{population}$$

Energy efficiency improvement may bring about “rebound effect”



We focus on “energy conversion”



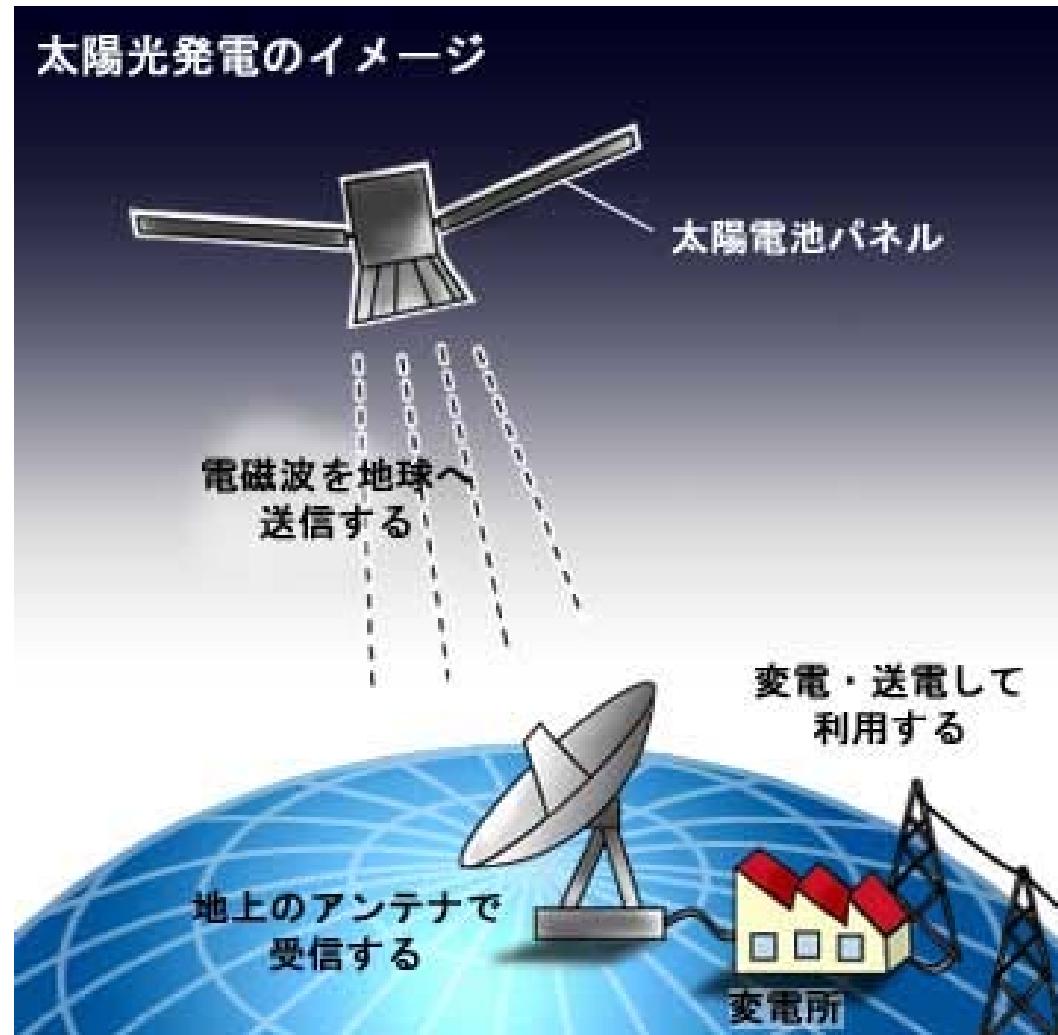
We define innovative technologies as :

1. Technologies that **promote de-carbonization of the energy sector.**
2. Technologies that exists now but **can only diffuse in the long-term.**

Examples :

- ✓ Large scale of wind/solar power
- ✓ Production of hydrogen fuel from renewables
- ✓ Production of hydrogen fuel from fossil fuel with *carbon sequestration*
- ✓ Satellite solar power system

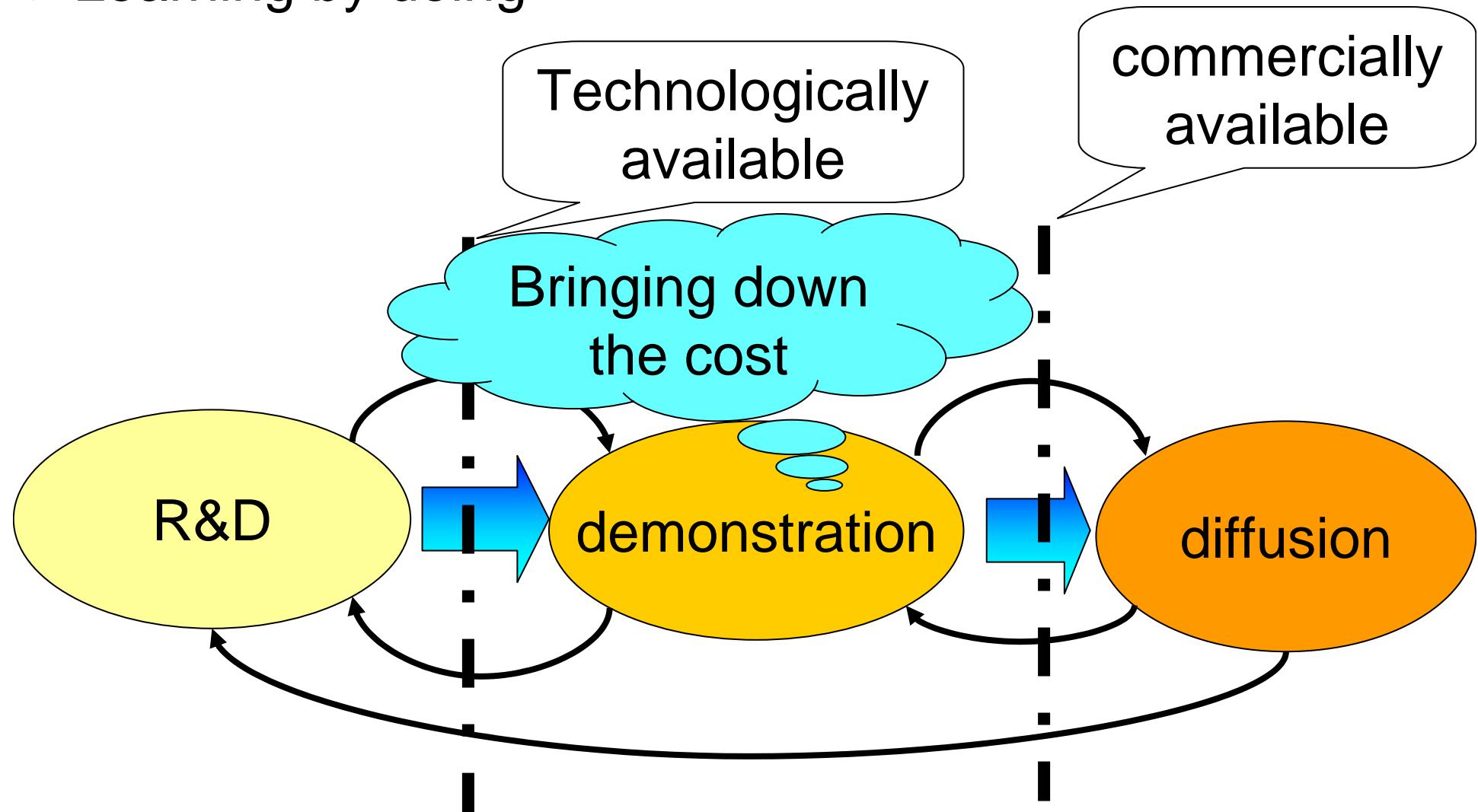
Satellite solar power



Source: JAXA

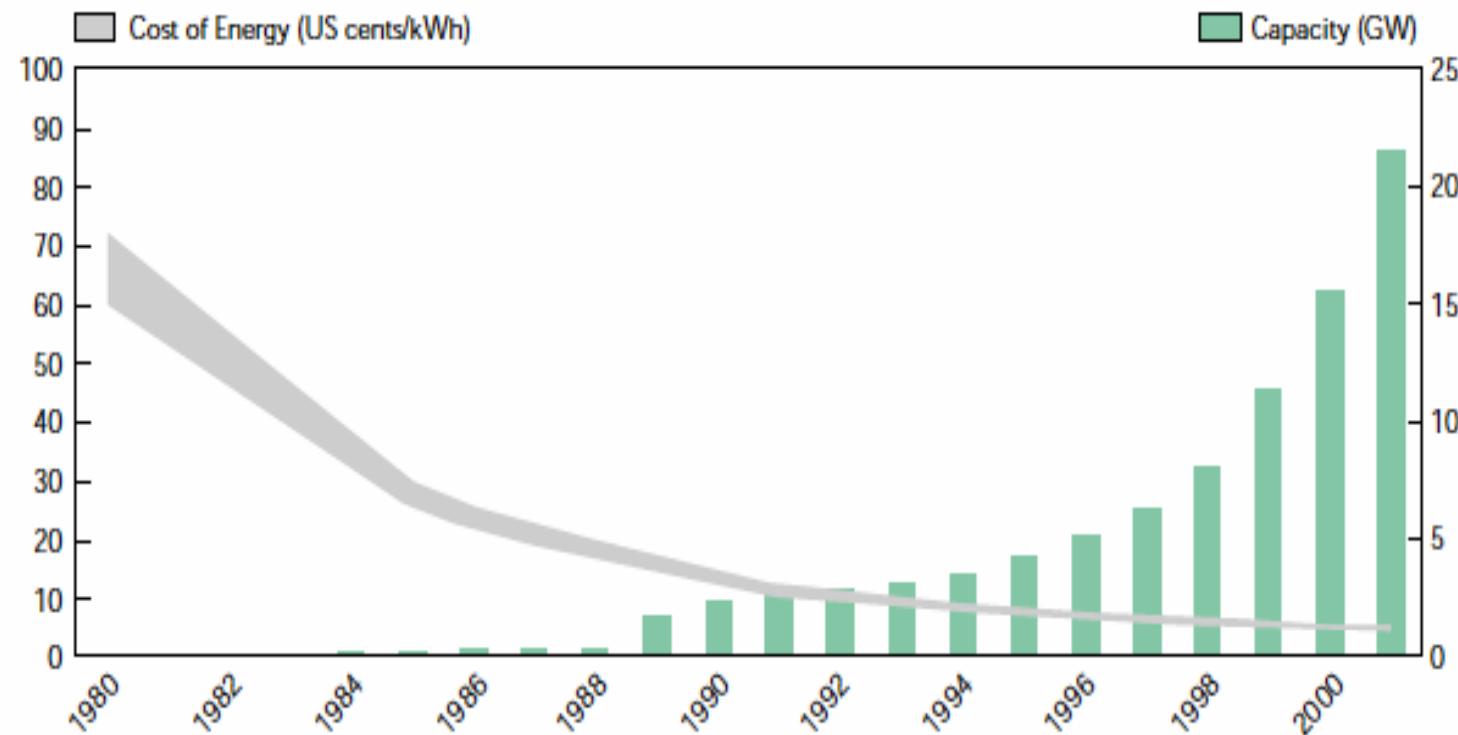
The role of the market

➤ Learning by doing



The relationship between cost and volume

Figure 3-18. Cost and Capacity Trends in Wind Power, 1980-2001



Source: USDOE and IEA Statistics

source: IEA(2004)

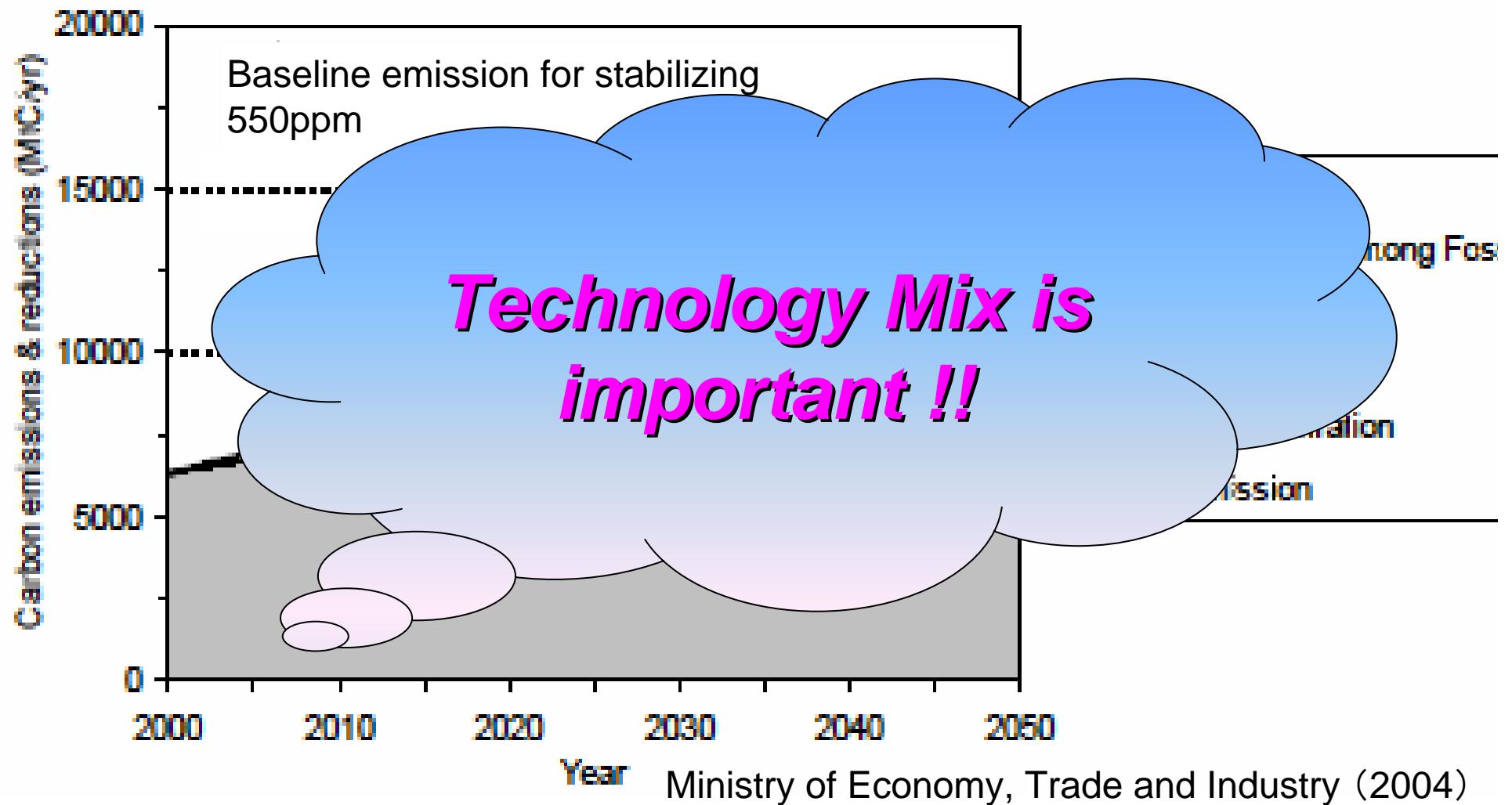
The Role of the Government

✓ Appropriate policies in each stage promote an innovative technology development

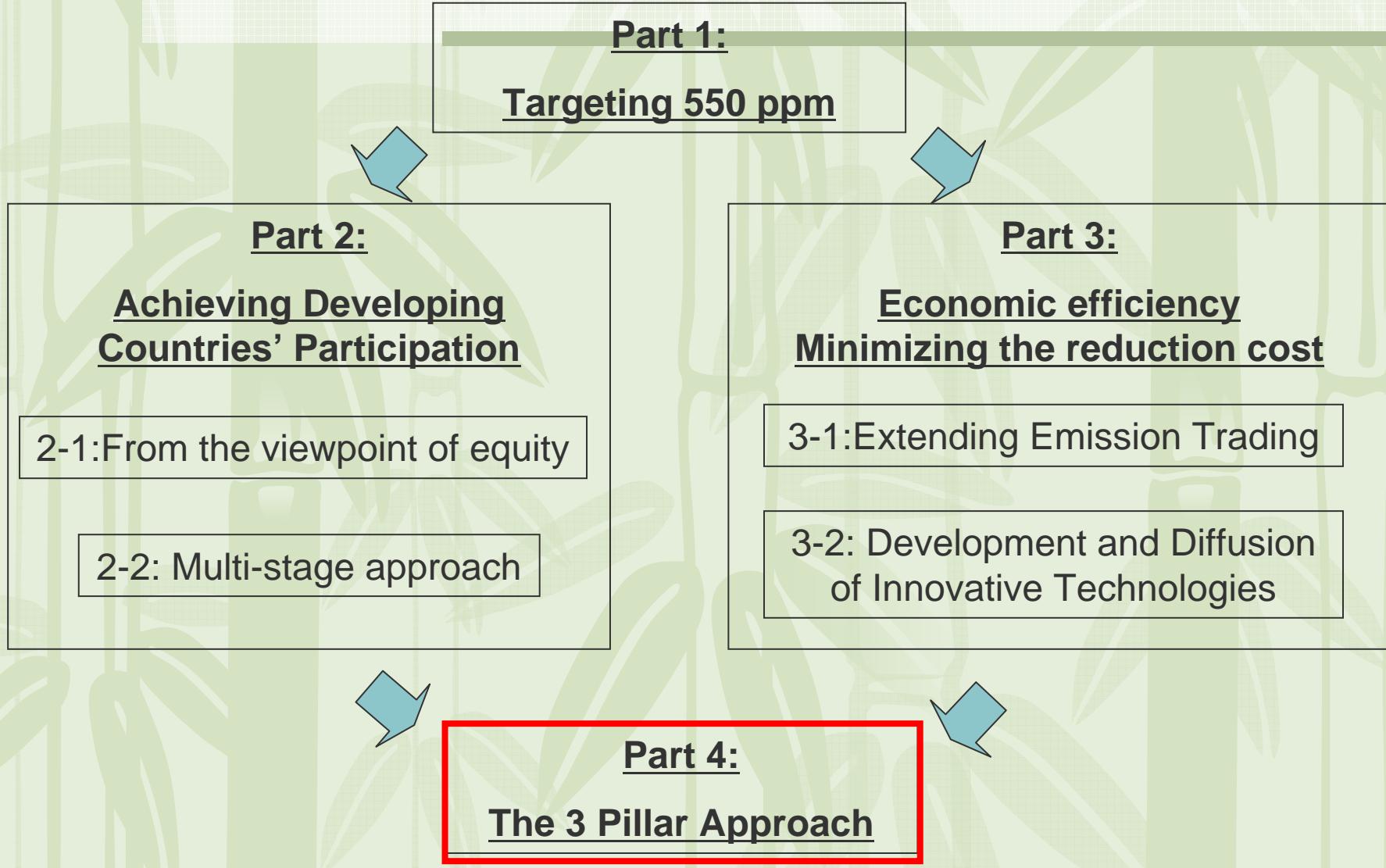
- R&D stage (Research & Development)
- ✓ Government R&D subsidy

- Demonstration
- ✓ Regulation
E.g. Renewable Portfolio Standard (quota system)
- ✓ Economic Instrument
E.g. Emission trading & tax

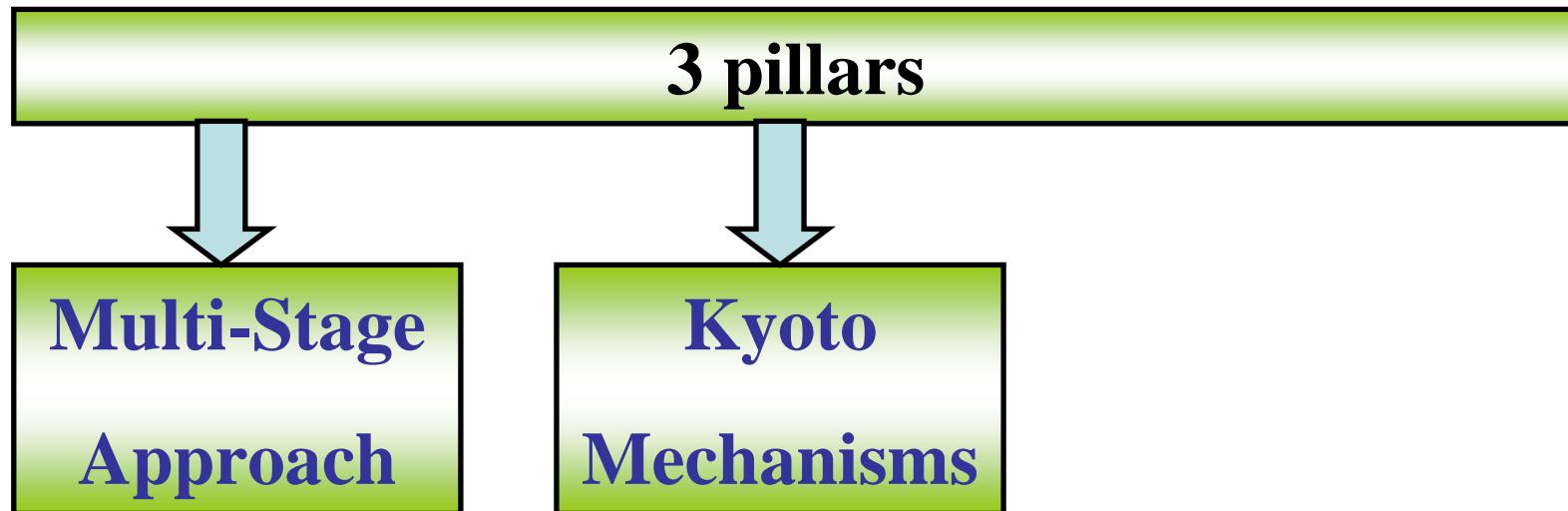
Technology Mix



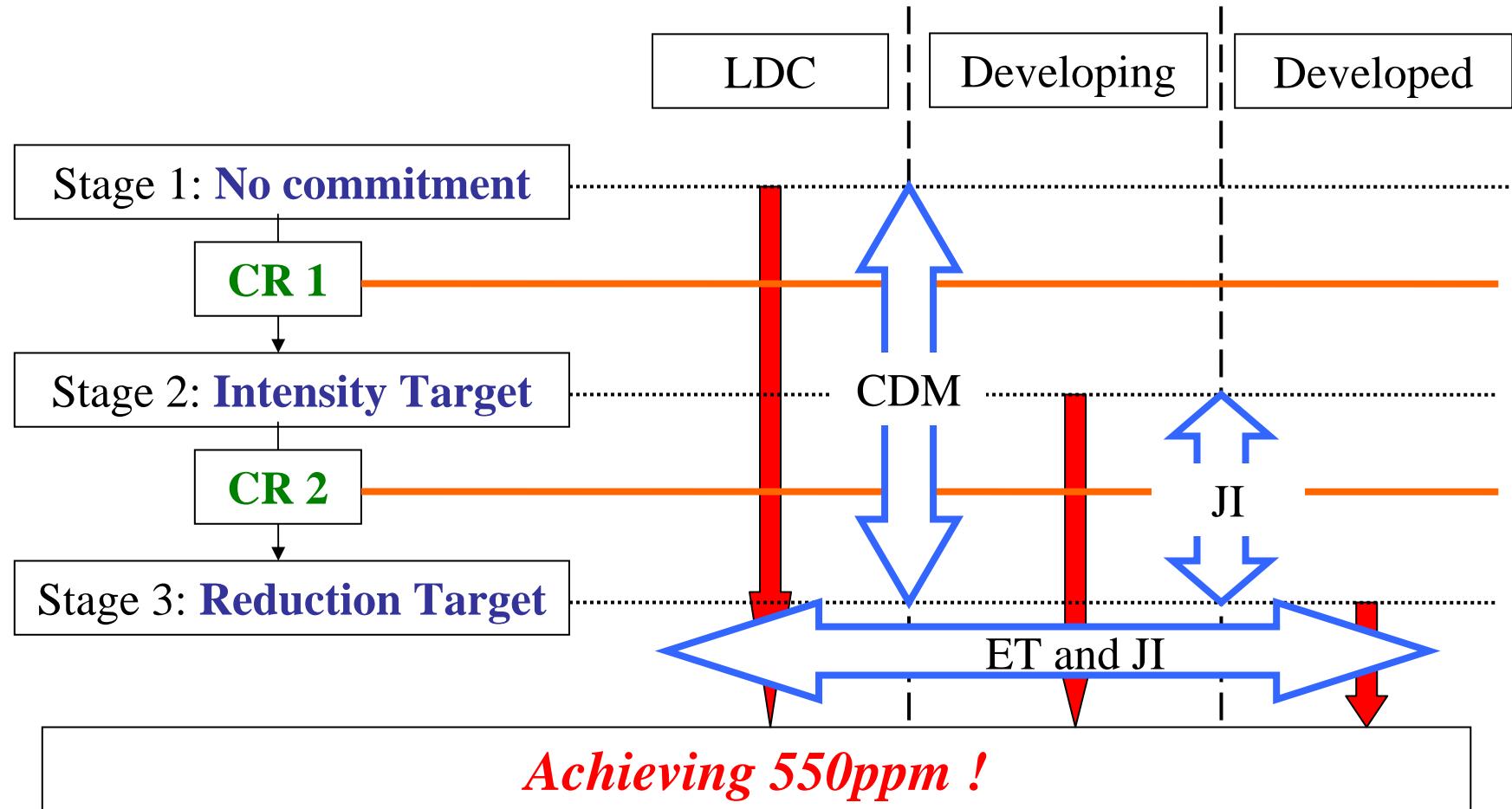
Flowchart of our presentation



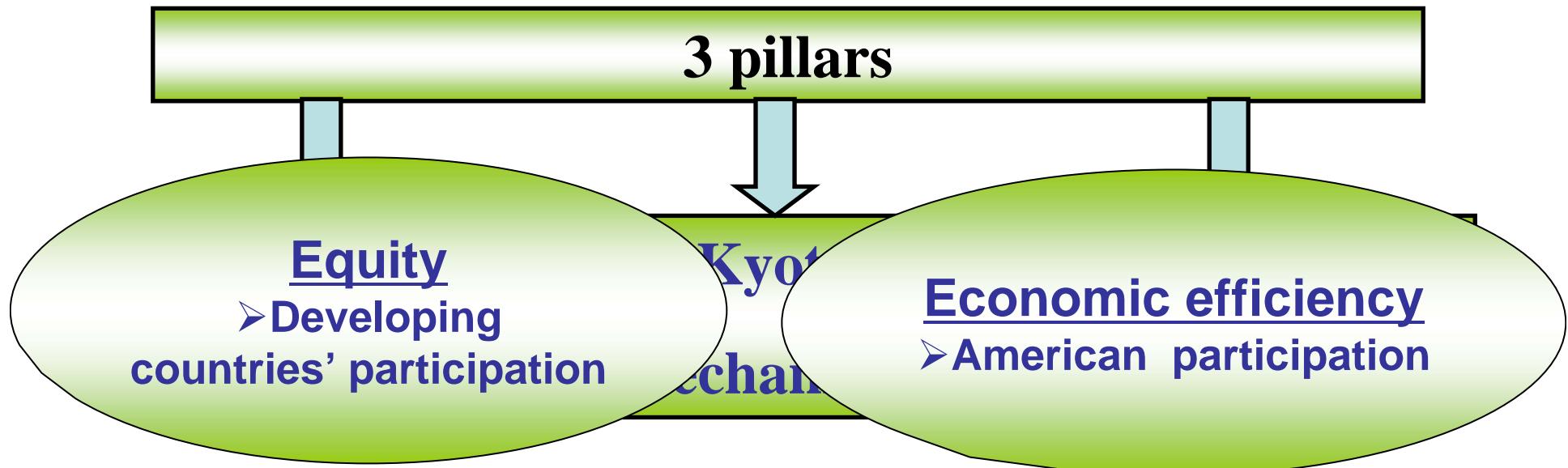
Our Proposal: 3-Pillar Approach



Multi-stage approach and Kyoto Mechanisms



Our Proposal: 3-Pillar Approach



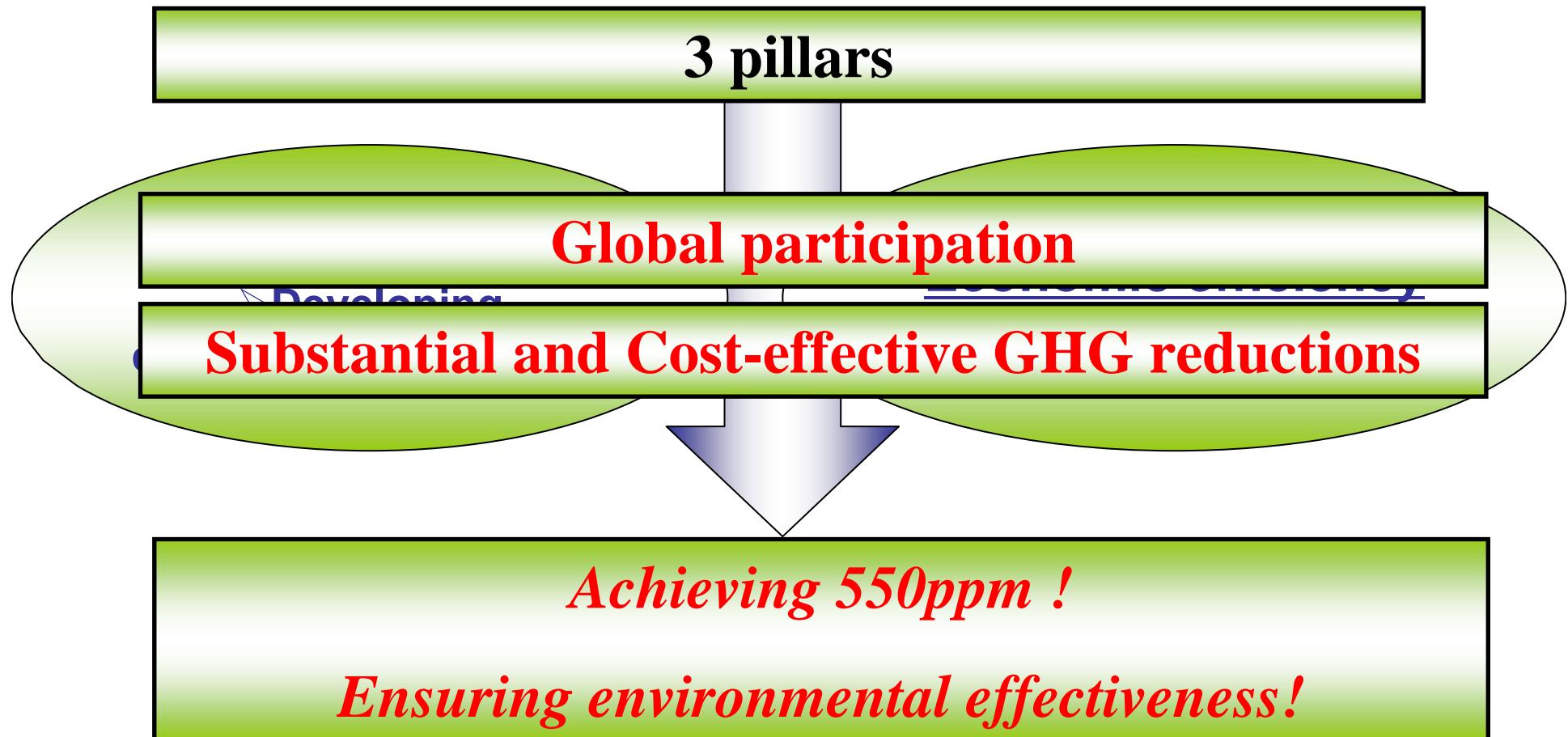
American Concerns

- Economic efficiency of the future framework does matter to US participation because...

Americans are concerned that...

- The future framework might have **a negative impact on its economy**.
- It might be **more cost-effective to wait until innovative technologies emerge** rather than taking actions against Climate Change now.

Our Proposal: 3-Pillar Approach



謝謝 *very much!*



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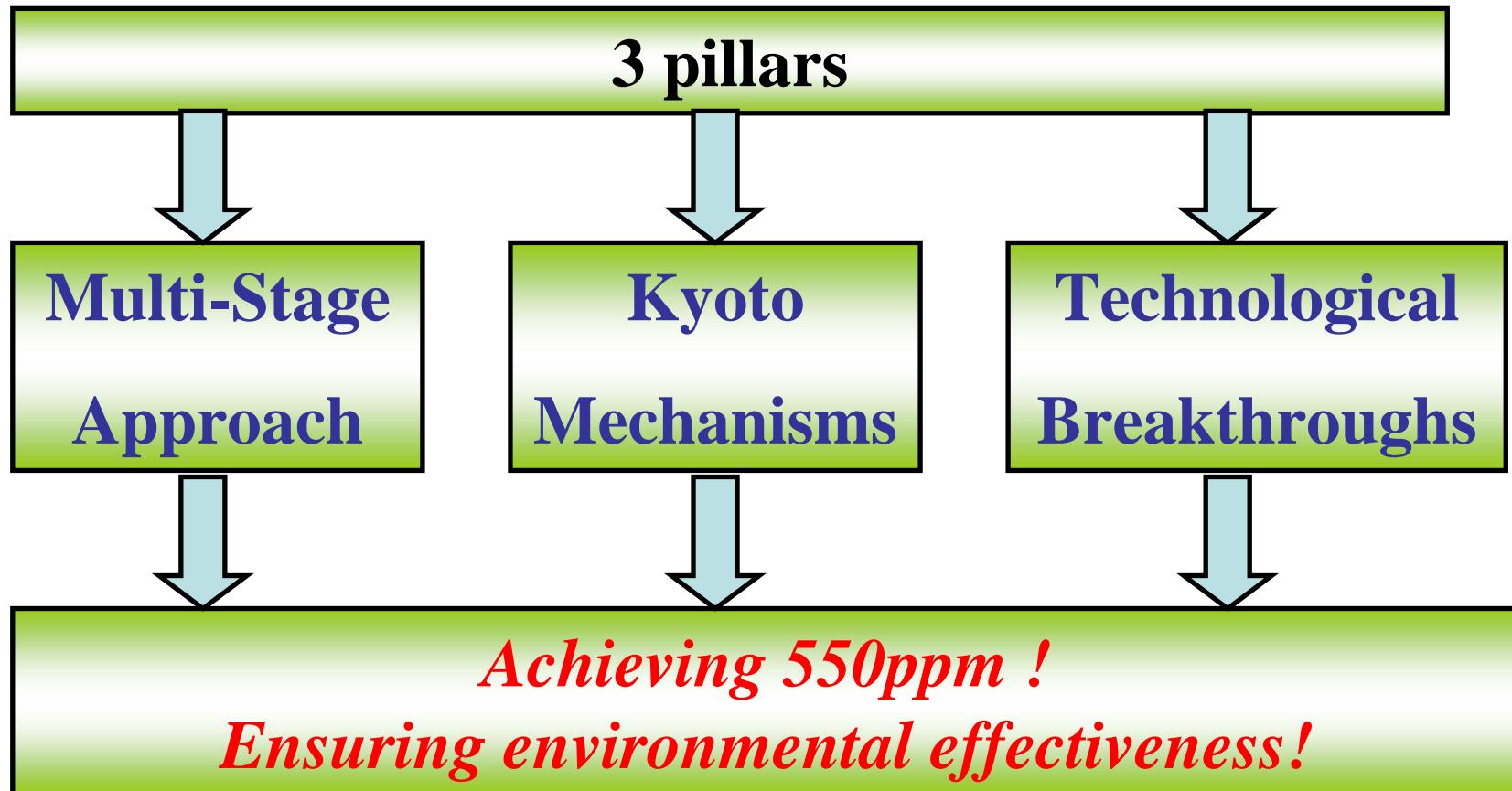
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《Internet resources》

- 環境省 : <http://www.env.go.jp/>
- 経済産業省 : <http://www.meti.go.jp/>
- 全国地球温暖化防止活動推進センター (JCCCA) : <http://www.jccca.org/>
- 資源エネルギー庁 : <http://www.enecho.meti.go.jp/>
- IPCC (Intergovernmental Panel on Climate Change) : <http://www.ipcc.ch/>
- Quality of the Environment in Japan 2004 (White Paper)
- <http://www.env.go.jp/>
- Special Committee on a Future Framework for Addressing Climate Change
- Global Environment Subcommittee, Environment Committee
- Industrial Structure Council
- Global Environment Affairs Office
- Industrial Science and Technology
- Policy and Environment Bureau
- <http://www.meti.go.jp/>
- Research Institute of Innovative Technology for the Earth (RITE)
- <http://www.rite.or.jp/>
- The Institute of Energy Economics, Japan
- <http://eneken.ieej.or.jp/>
- New Energy and Industrial Technology Development Organization
- <http://www.nedo.go.jp/index.html>
- the Institute for Global Environmental Strategies (IGES)
- <http://www.iges.or.jp/index.html>

Our Proposal: 3-Pillar Approach







太陽光発電のイメージ



Stage 1 ⇒ Stage 2

No Commitment ⇒ Limitation Target

- threshold

550ppm

region	CAM	SAM	NAF	WAF	EAF
	2013	2013	2013	2055	2065
region	SAF	ME	SAS	EAS	SEAS
	2013	2013	2015	2013	2013

Source: den Elzen (2004)

Stage 2 ⇒ Stage 3

Limitation Target ⇒ Reduction Target

- threshold

550ppm

region	CAM	SAM	NAF	WAF	EAF
	2015	2013	2050	2100	2100
region	SAF	ME	SAS	EAS	SEAS
	2060	2013	2050	2015	2030

Source: den Elzen (2004)

Convergence

