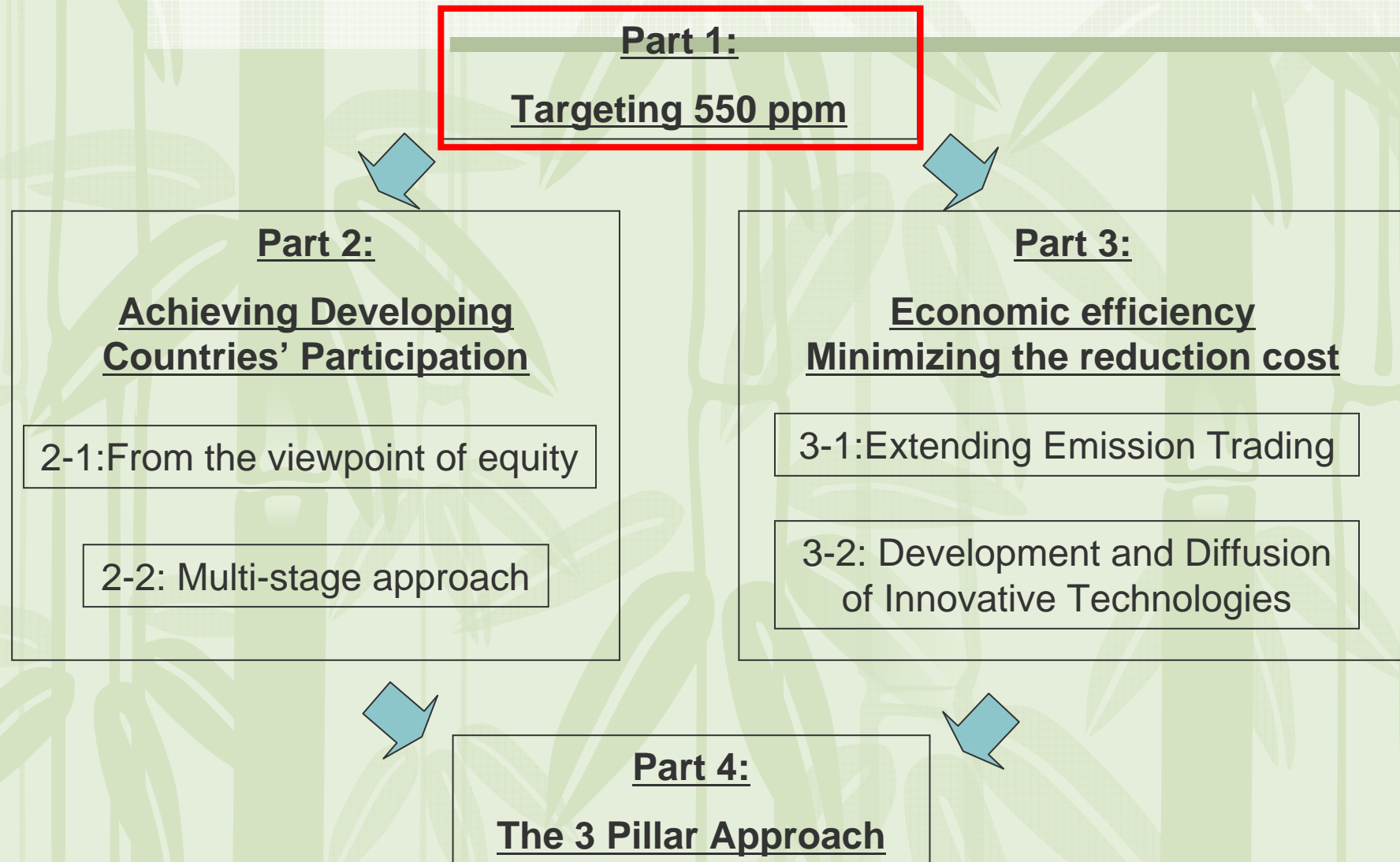


The 3 Pillar Approach

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

GHG emissions

= **Flow, indirect cause of Climate Change**
(determined in the short-term)

GHG concentrations

= **Stock, direct cause of Climate Change**
(determined in the long-term)

Climate Change

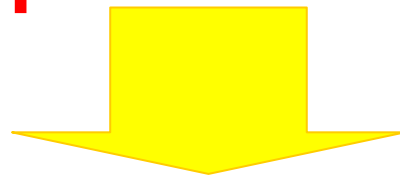
= **The need for a long-term objective!**
(e.g. GHG concentrations)



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)

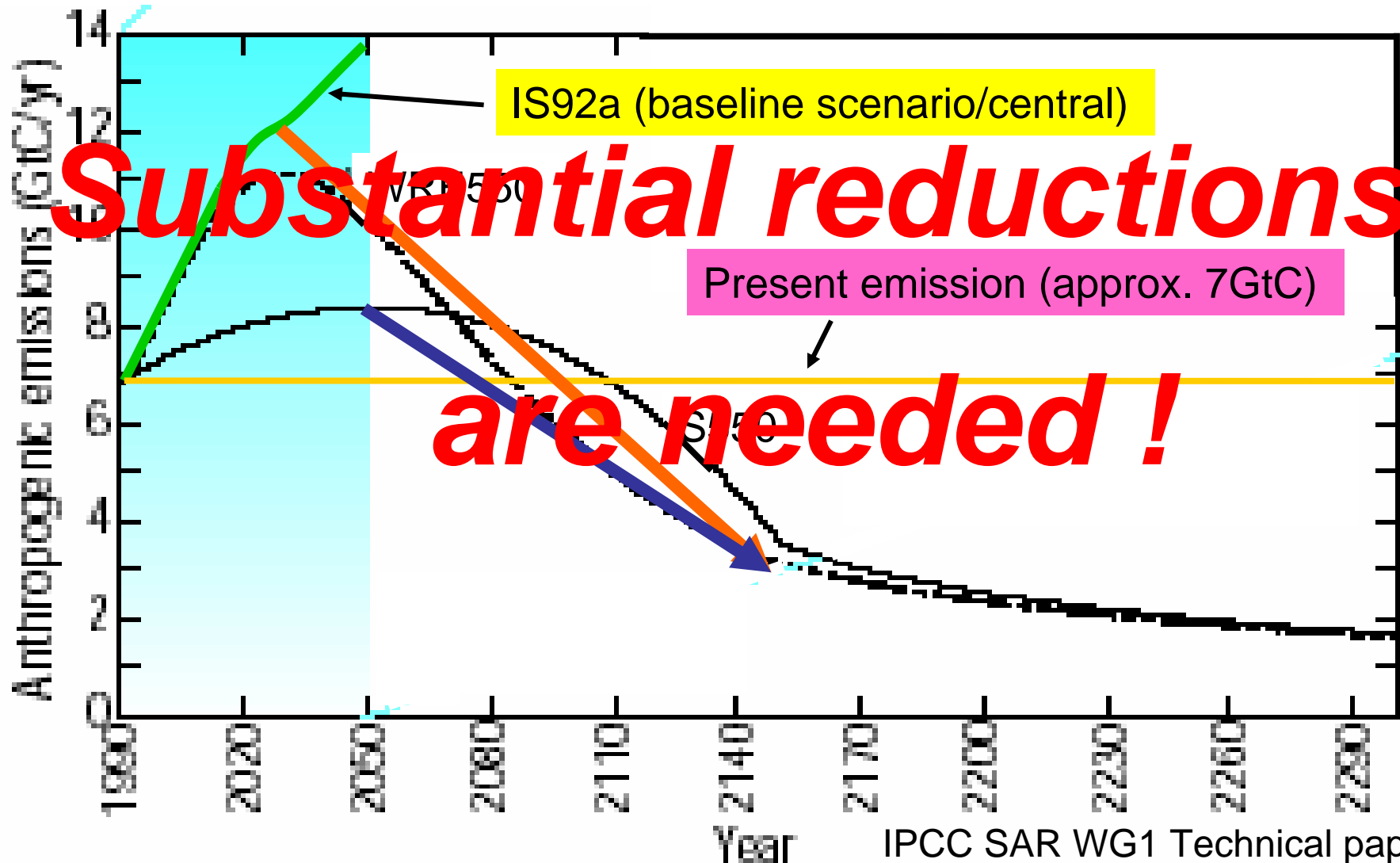
Because...

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

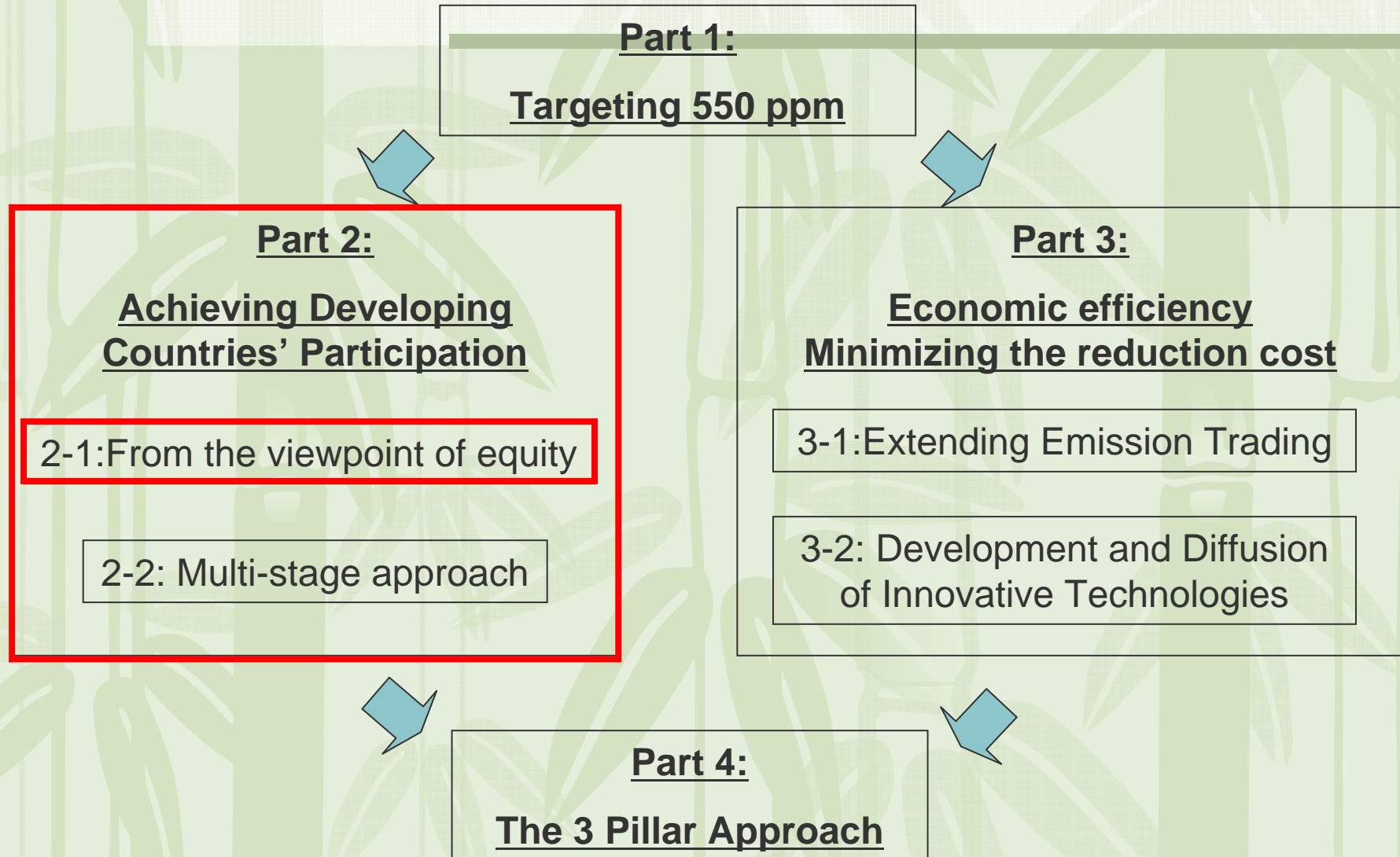
① **Global participation**

⇒ 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.

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 !

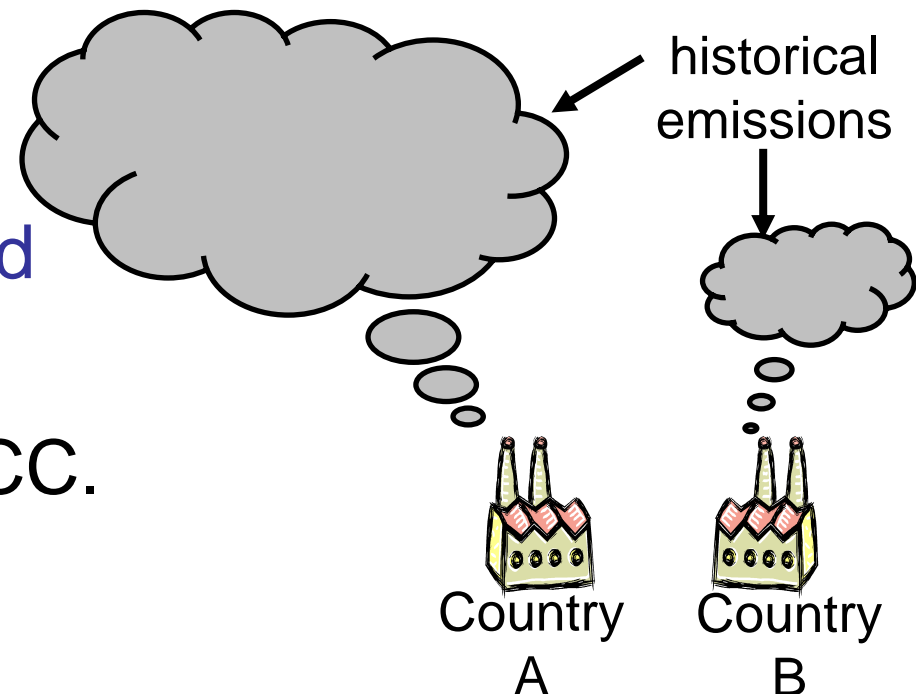
GHG emissions



2. Responsibility

- The countries that have more **historical GHG emissions** should assume larger responsibilities and act first in tackling with Climate Change.

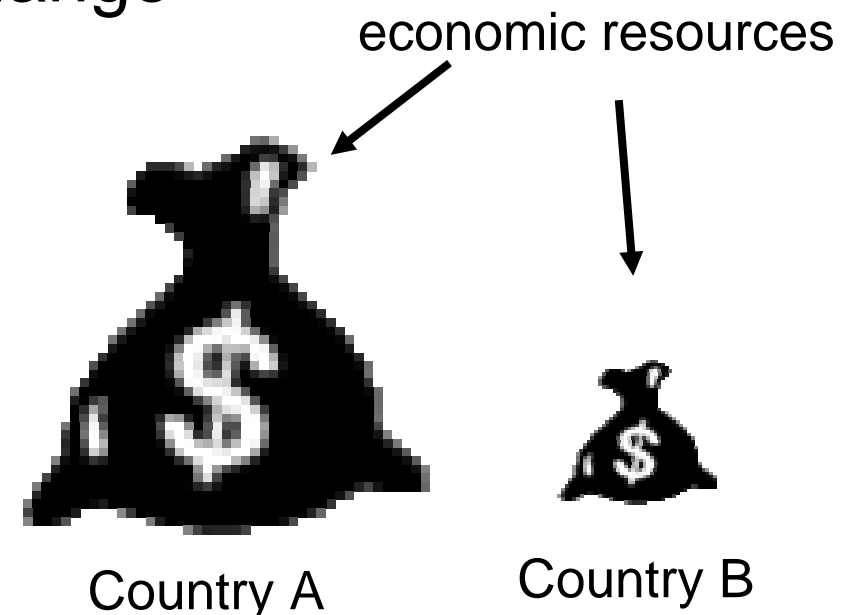
- Compatible with “common but differentiated responsibility” specified in the Article 3.1 of UNFCCC.



3. Capability

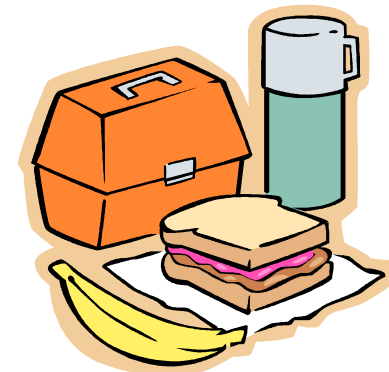
- The countries that have more **economic resources** and more **technologies** should assume larger responsibilities and act first in tackling with Climate Change

- 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

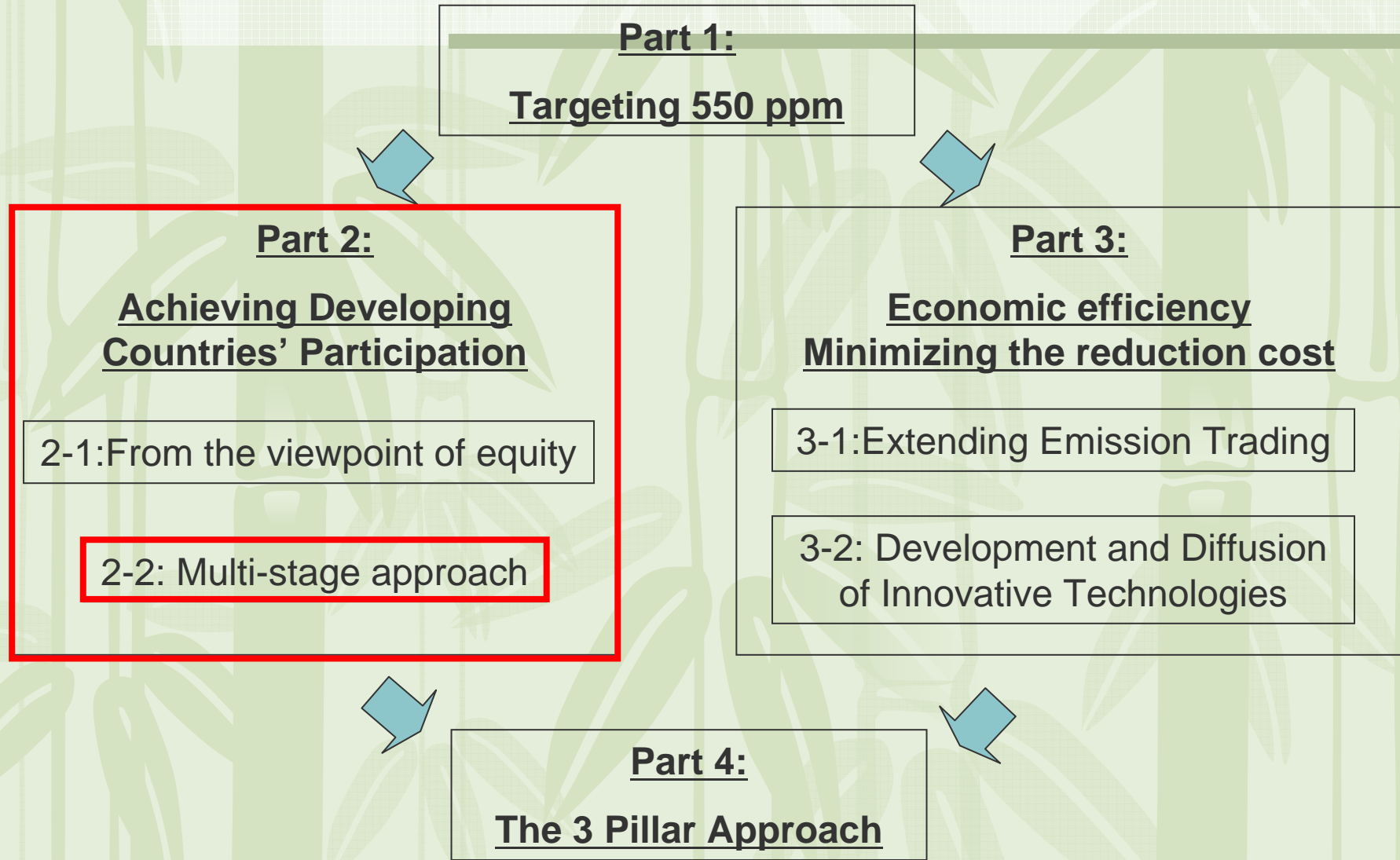
Basic Need

- **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

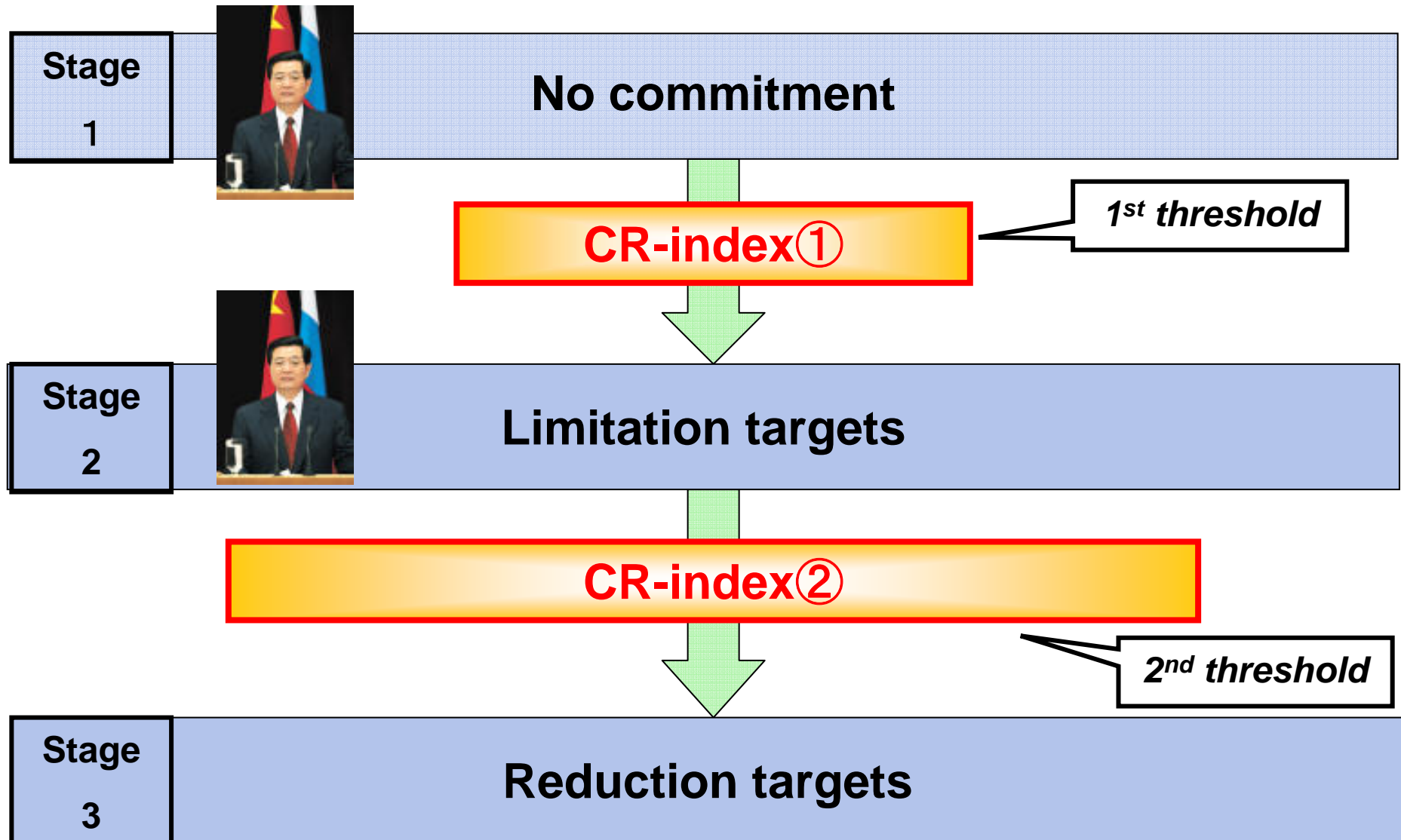
⇒ satisfying equal entitlement

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”
(Article 3.1 of UNFCCC)

CR-index = **Per capita GDP** + **Per capita Emission**
(unit: ppp1000\$) (unit: tCO₂-eq)



Elzen's model indices

- 550ppm

$$\text{1st threshold} \cdot \text{CR-index} \textcircled{1} = 5$$

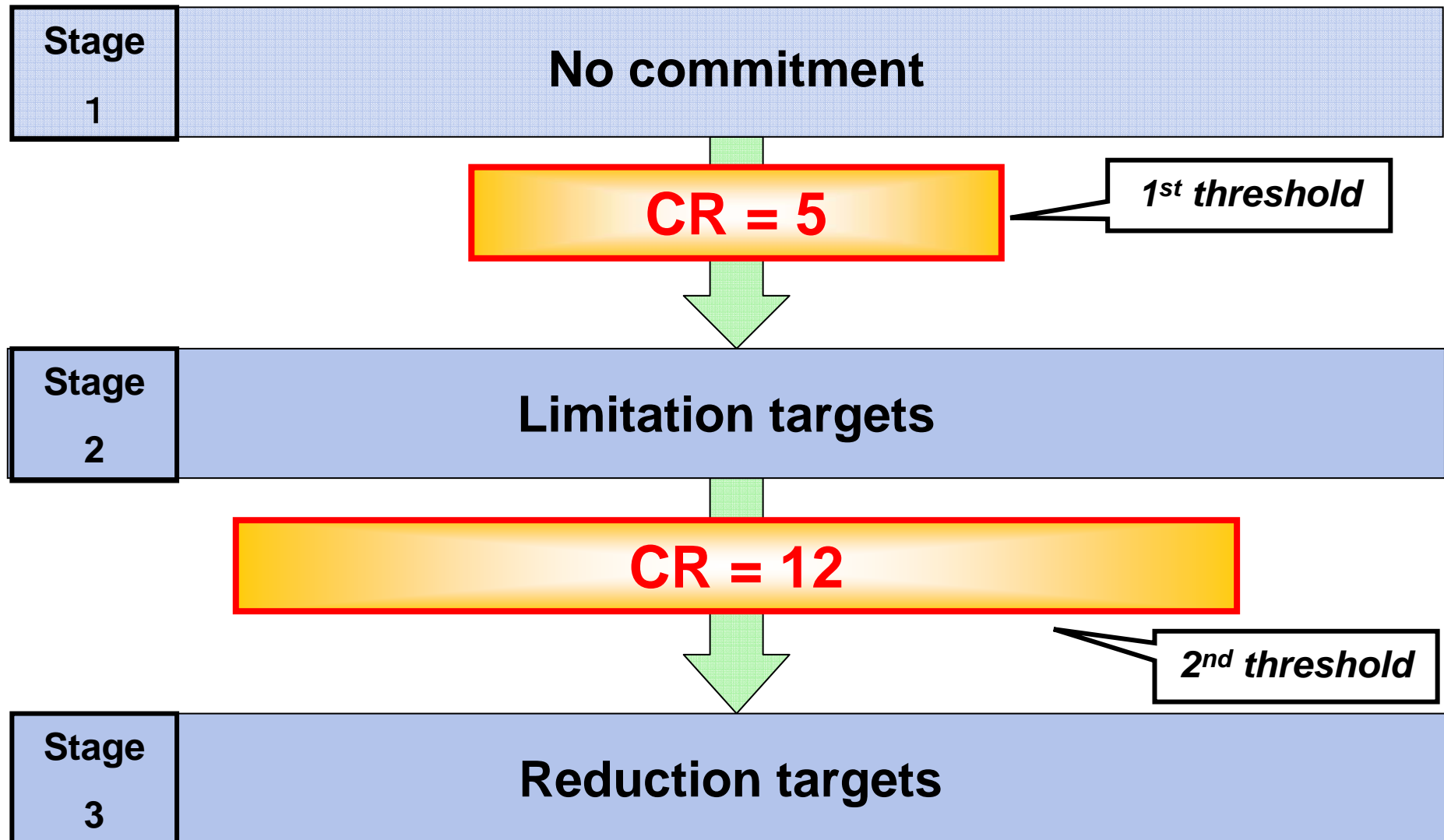
$$\text{2}^{\text{nd}} \text{ threshold} \cdot \text{CR-index} \textcircled{2} = 12$$

Cf. 650ppm

$$\text{1st threshold} \cdot \text{CR-index} \textcircled{1} = 12$$

$$\text{2}^{\text{nd}} \text{ threshold} \cdot \text{CR-index} \textcircled{2} = 20$$

How to move to the next stage

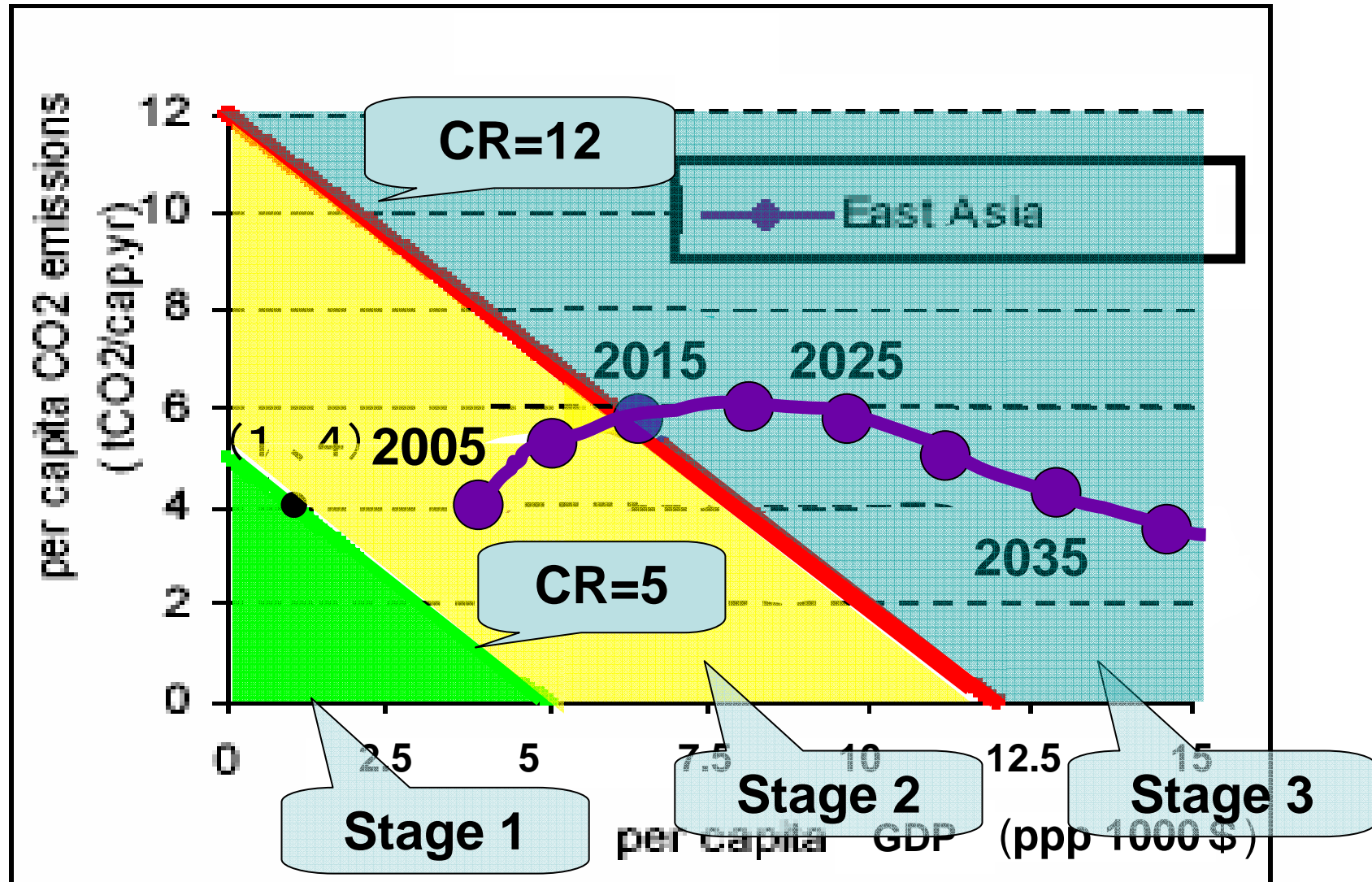


CR-index in 1995

	1995		
	Per capita GDP	Per capita emissions	CR-index
	1000 PPP\$	tCO ₂ -eq	
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

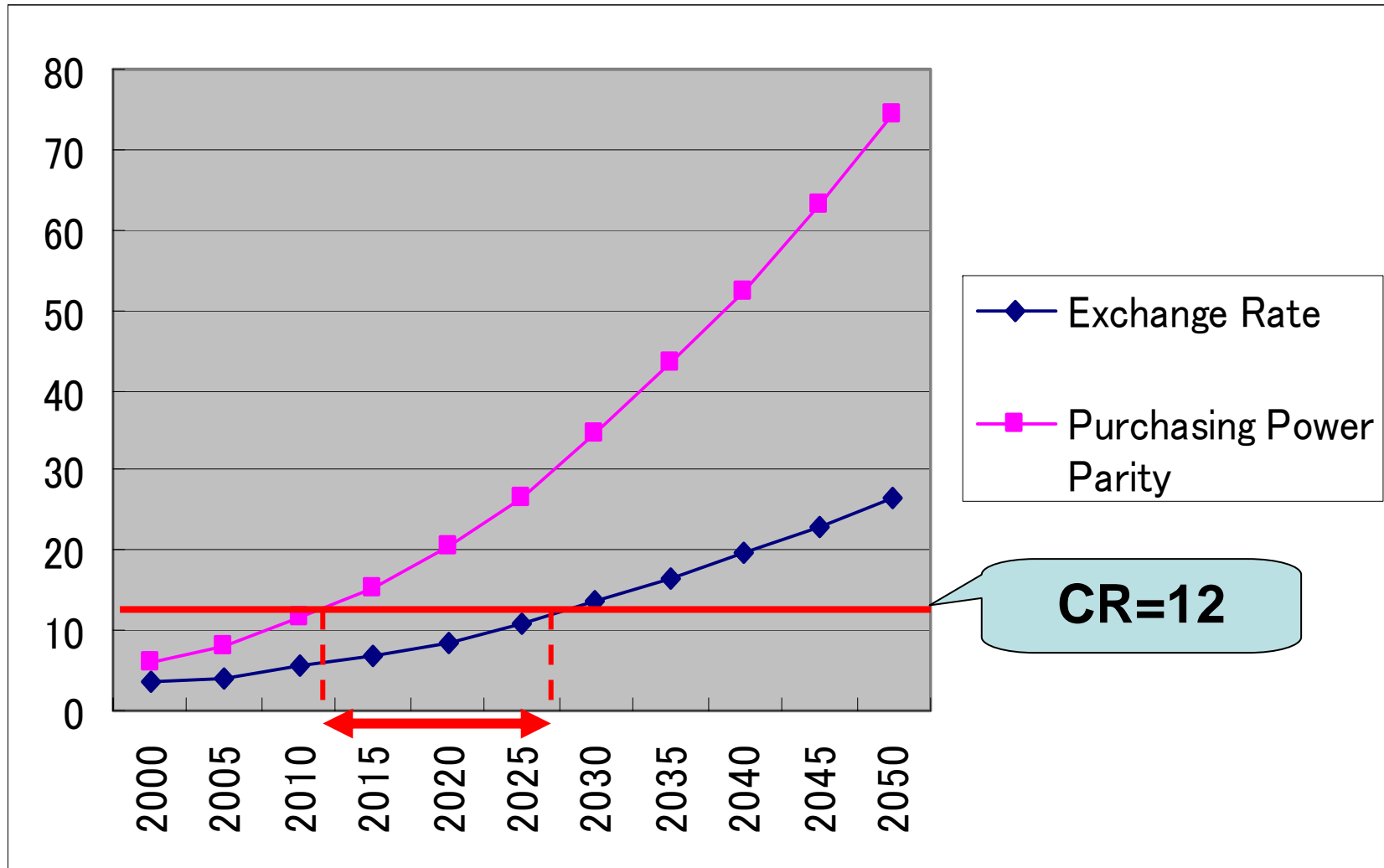
Source: den Elzen (2004)

CR-index in East Asia



Source: den Elzen (2004)

China's Participation in Stage 3



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

Allocation in the Stage3

550ppm

Proportional to
Total Reduction = 100
Absolute Emission (n) × Per Capita Emission (n)

Global

×

×

×

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

National

Japan

China

US.A

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)

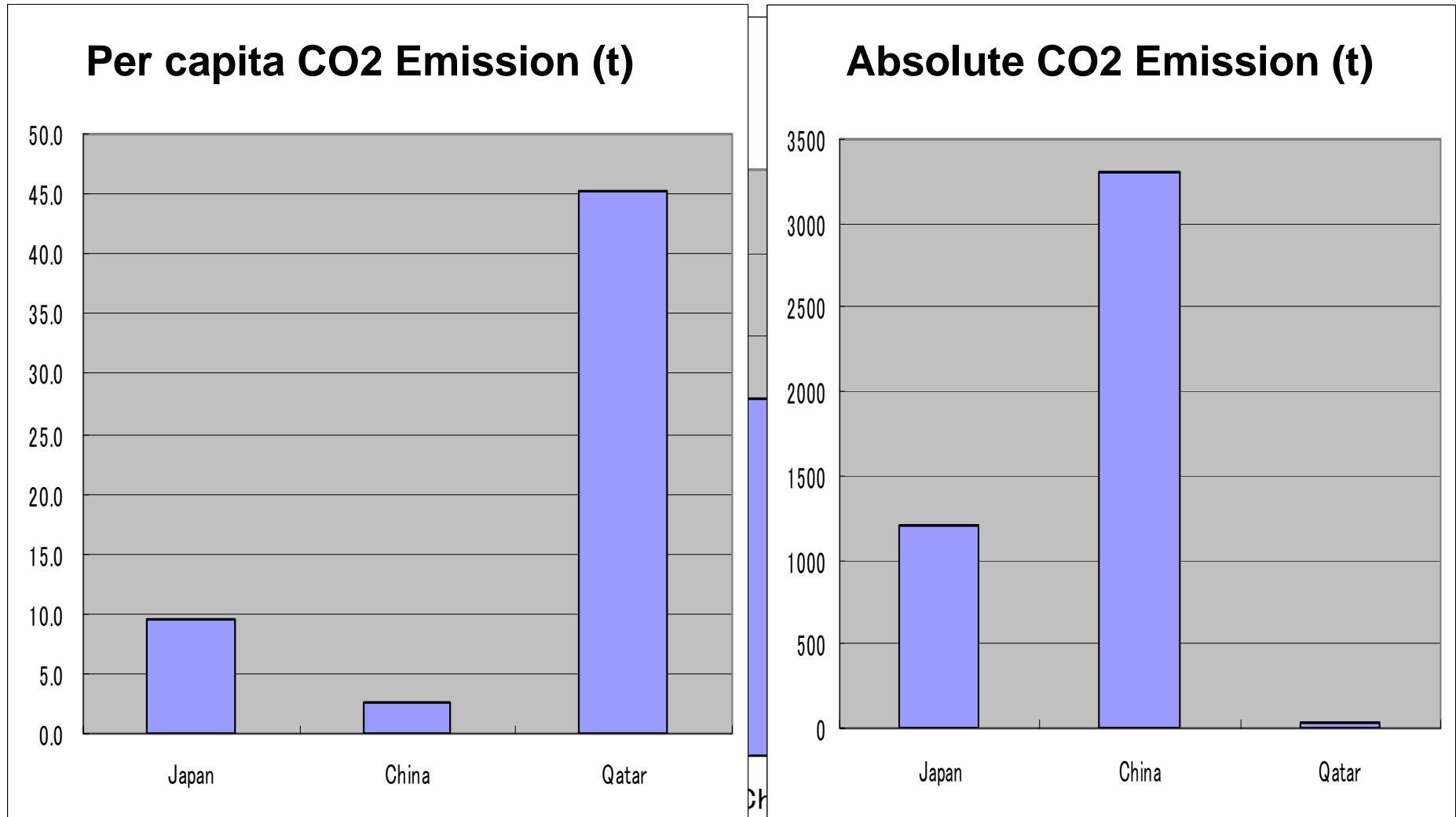
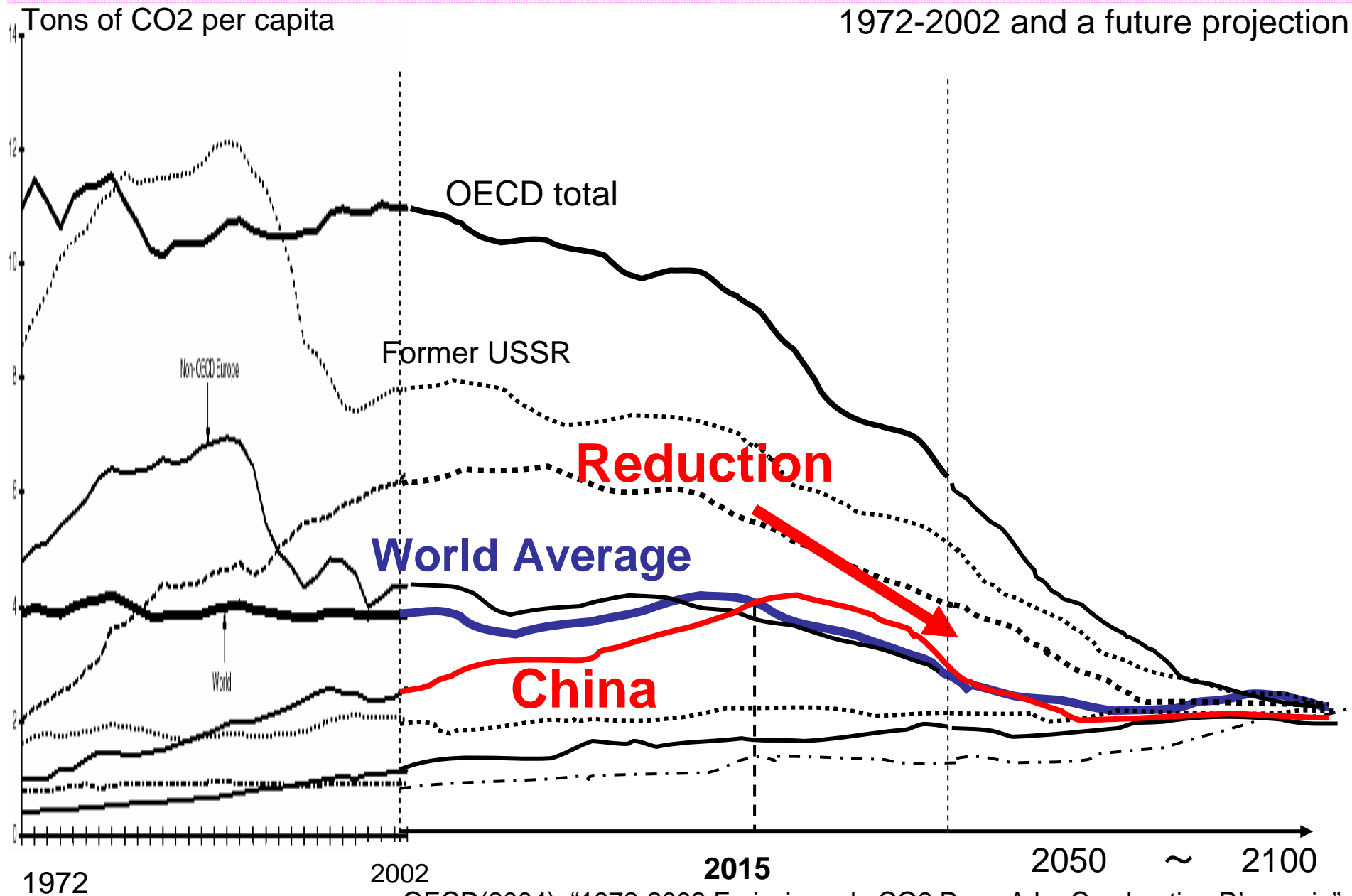
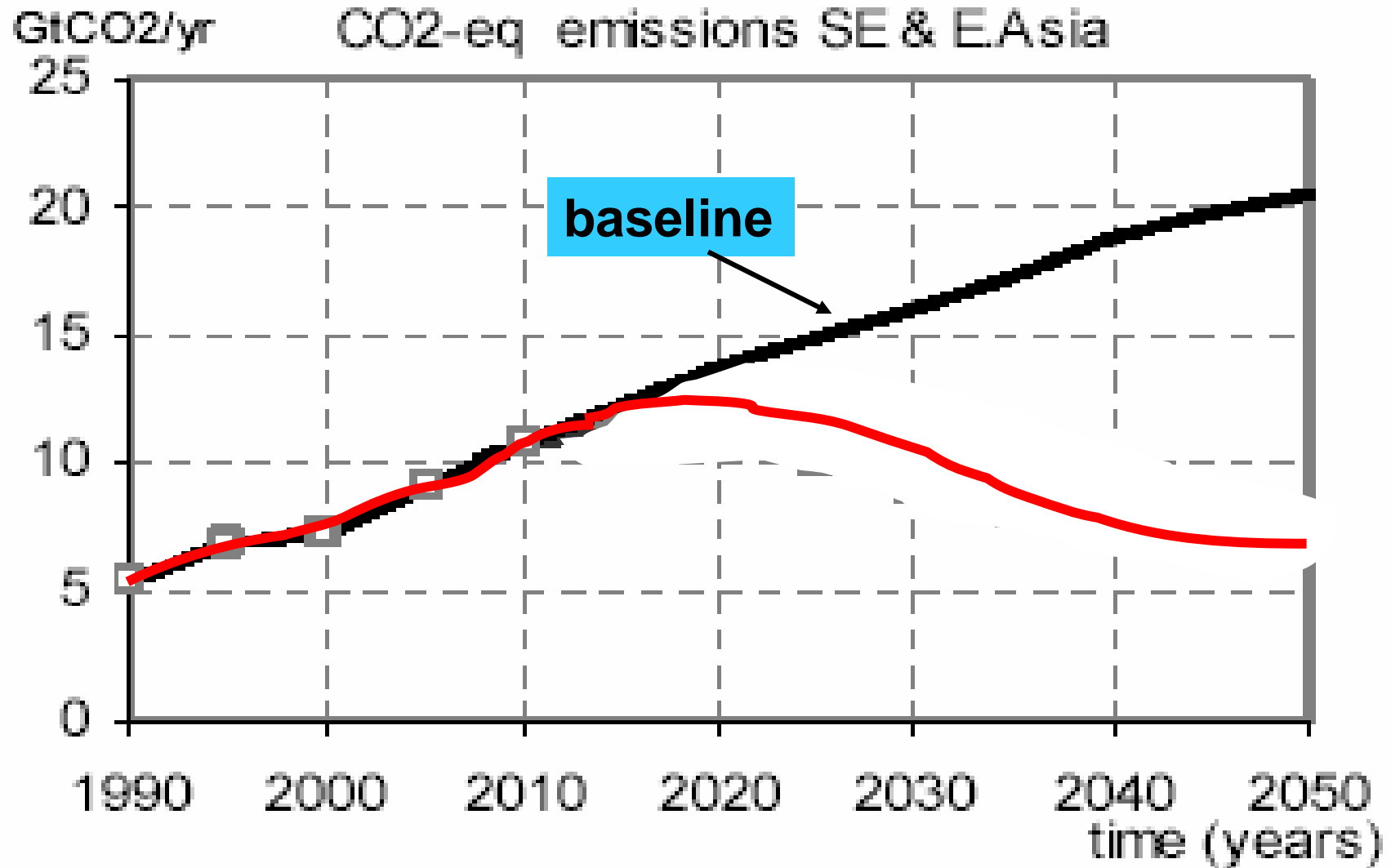


Image of convergence in the future



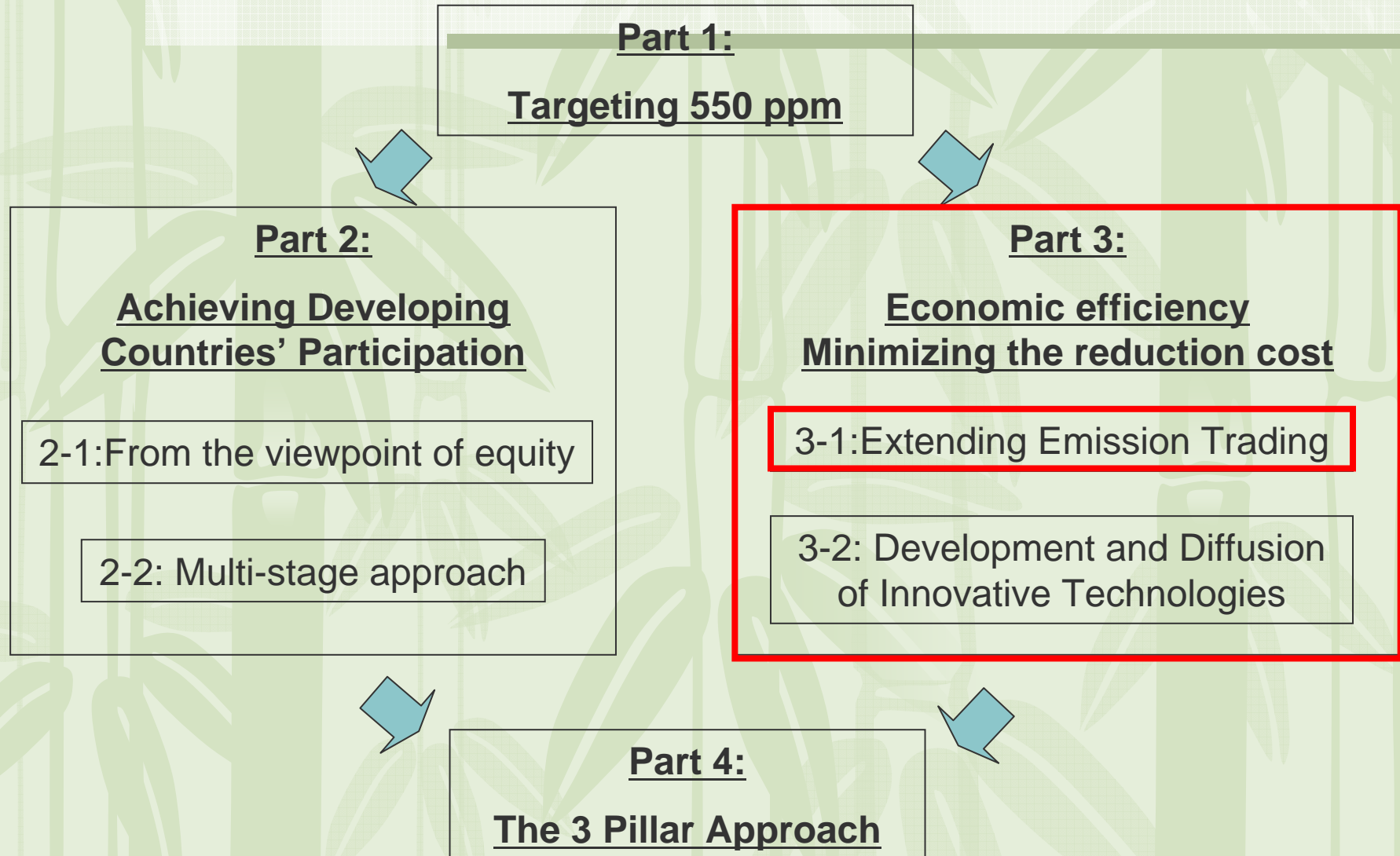
OECD(2004), "1972-2002 Emissions de CO2 Dues A La Combustion D'energie",

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

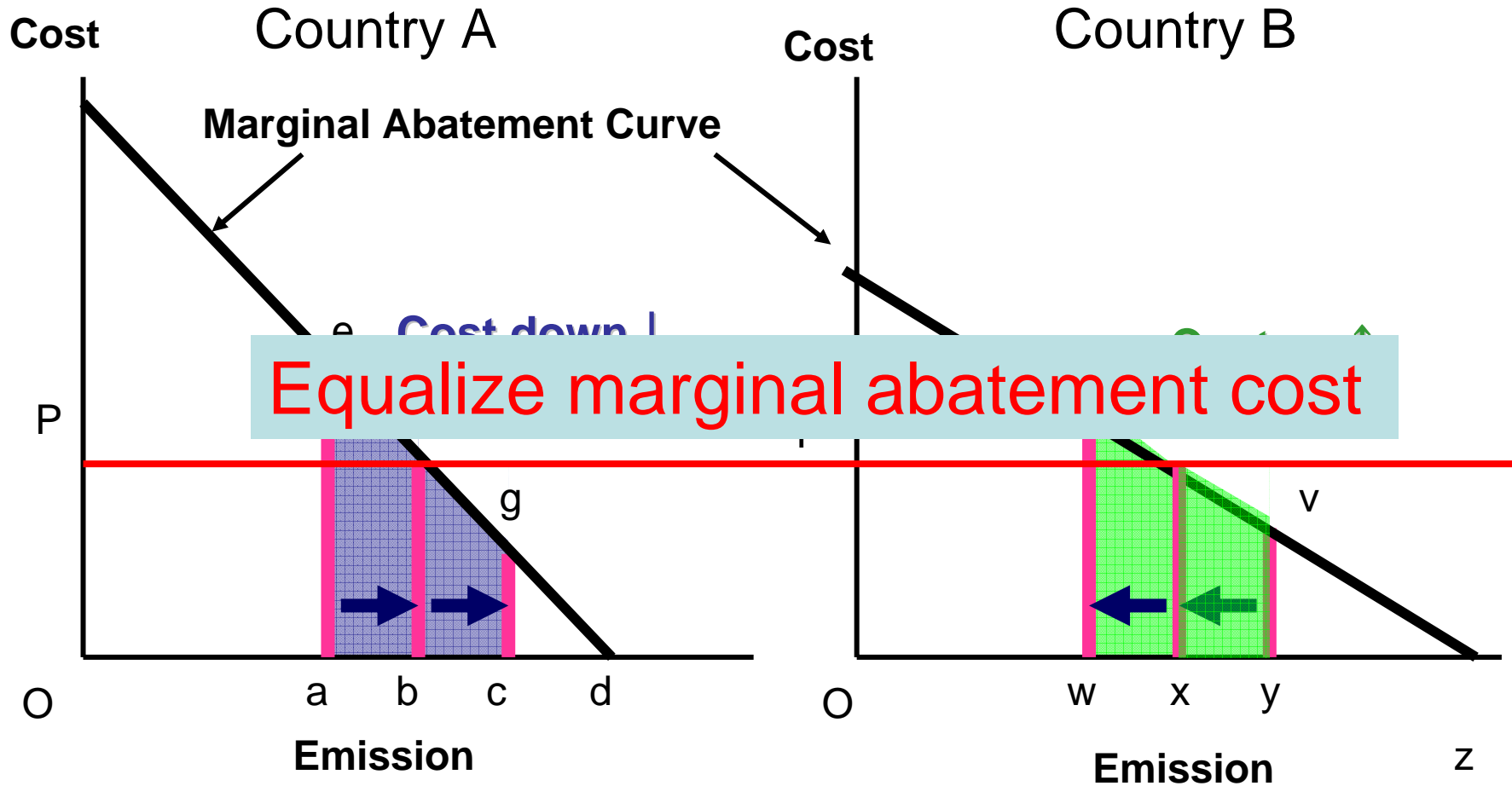
Reduction

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

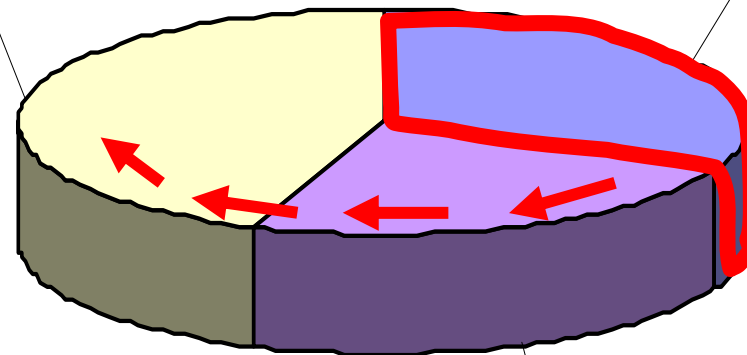
Without US and Australia, and developing countries

- **Period: 5 years (2008~2012)**

Projection of Global CO2 Emission in 2010

Unit: Million Carbon t

Developing countries,
44%



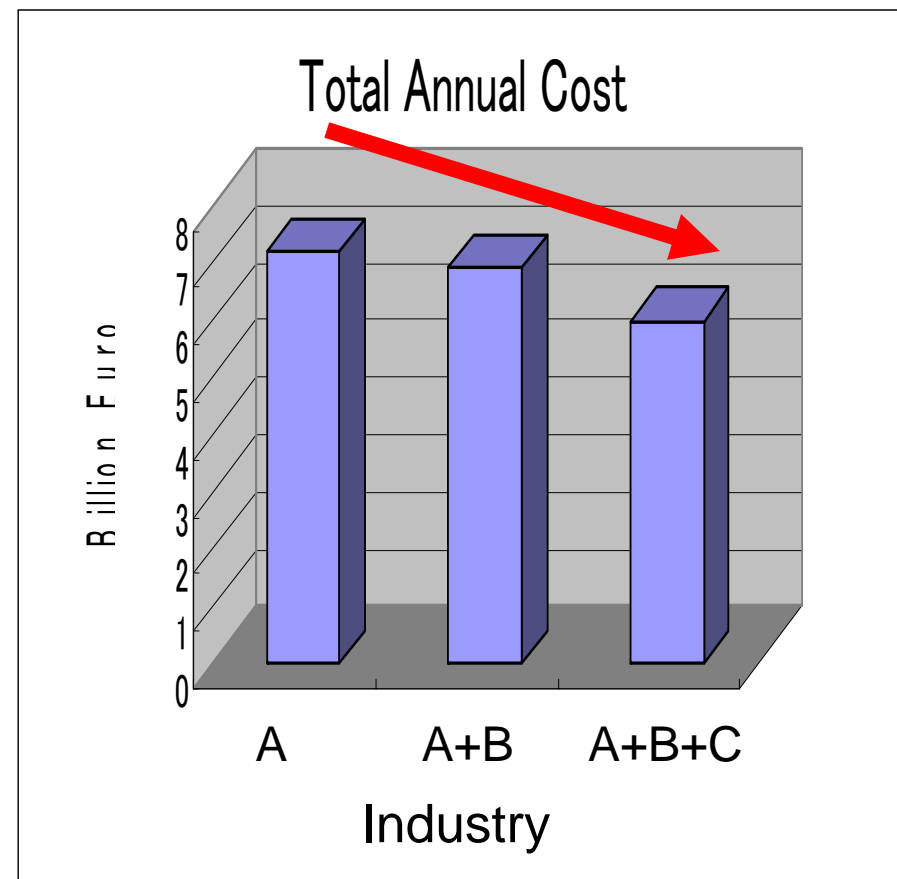
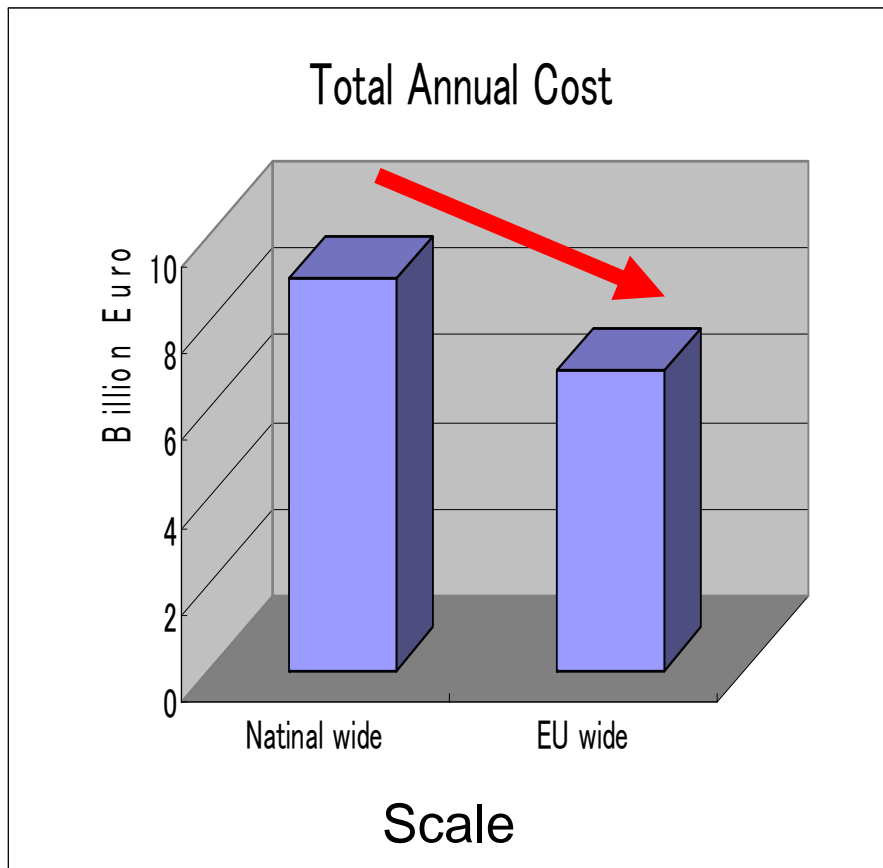
Developed countries
32%

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

U.S., Australia
24%

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"

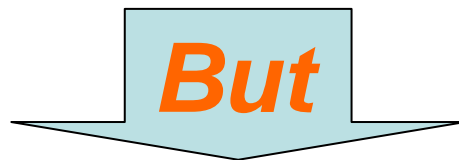
Extending ET scale helps reduce ...

1. Total abatement cost

=Minimization of social abatement cost

2. Marginal abatement cost

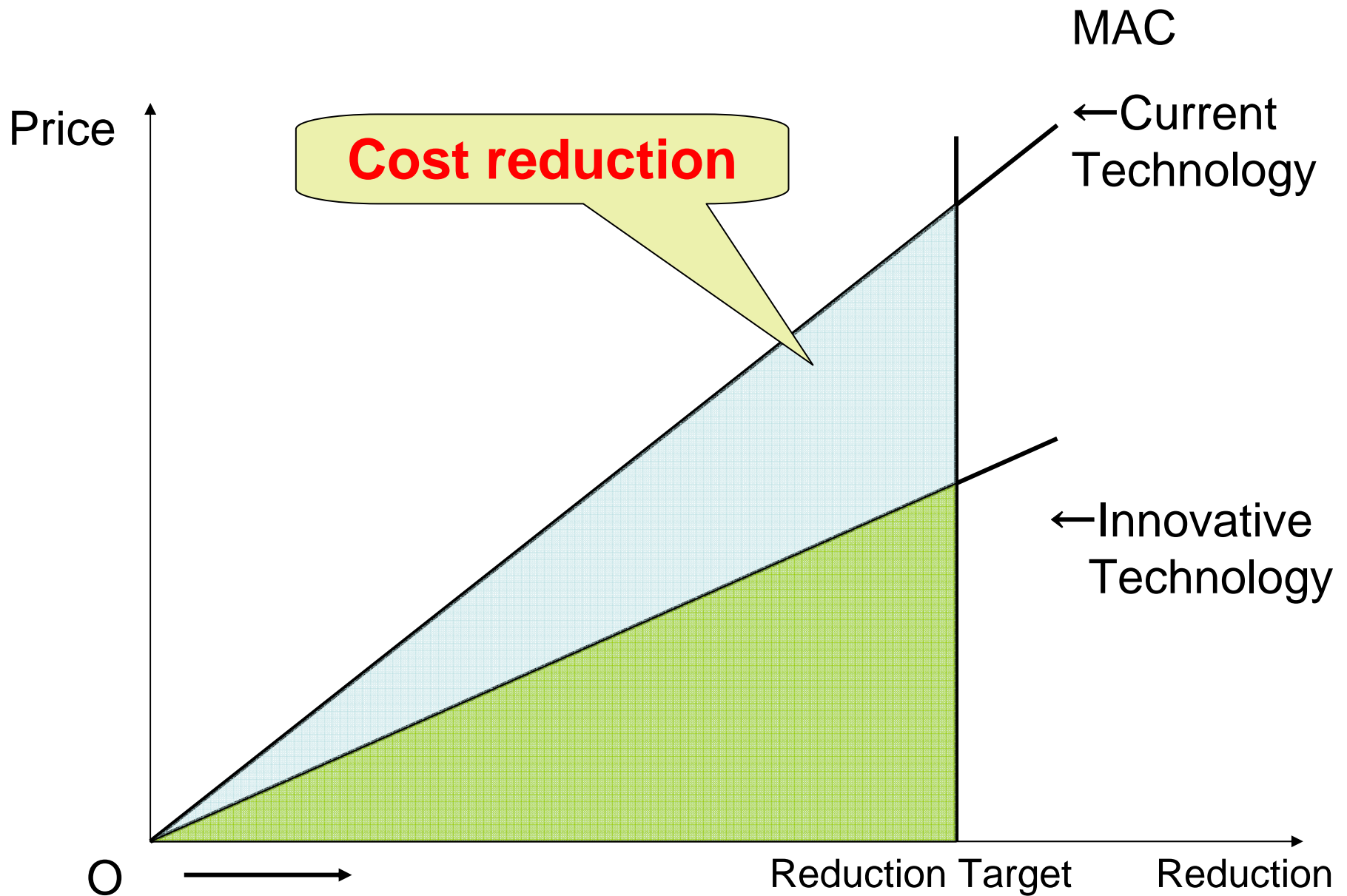
⇒ Due to relatively low MAC of DCs.



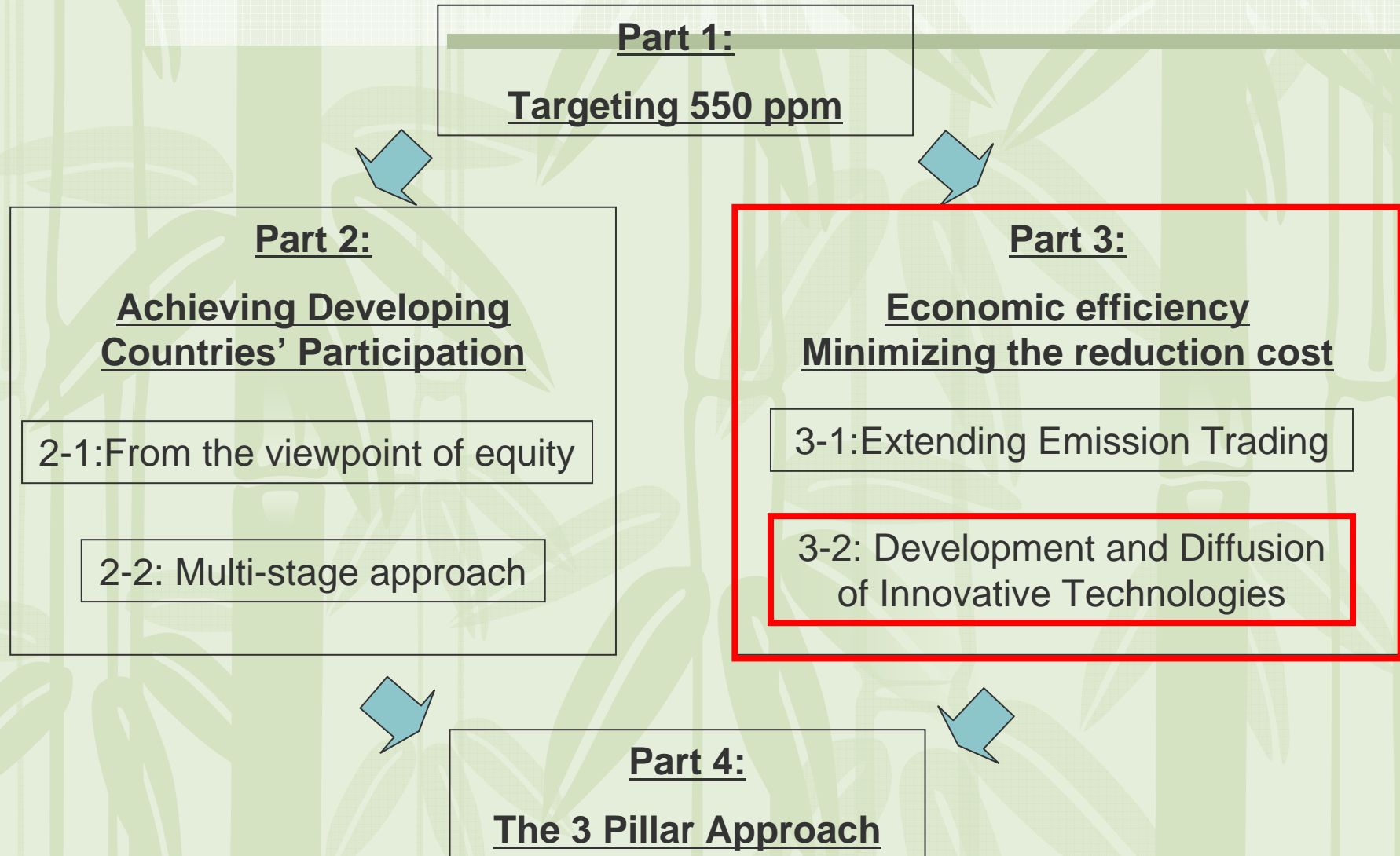
Looking at the long-term horizon, economic instruments are not enough to reduce GHGs drastically.


Technology innovation is essential.

Technology Innovation



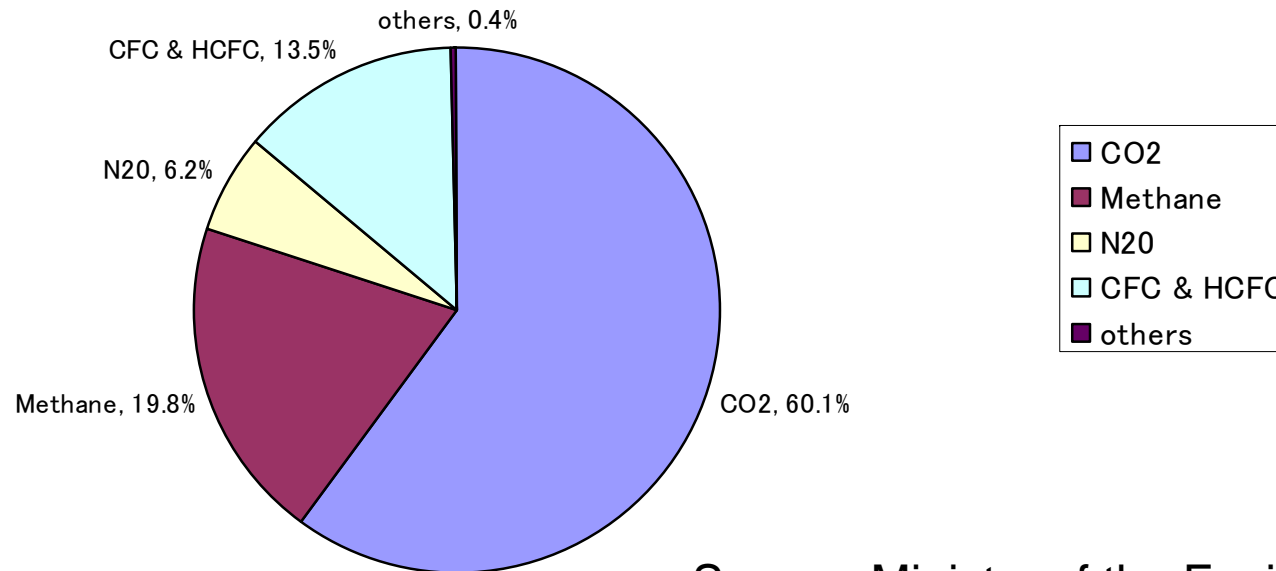
Flowchart of our presentation



- 
- 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

Anthropogenic GHGs emission contribution to climate change since industrial revolution(1998)



Source: Ministry of the Environment(2004)

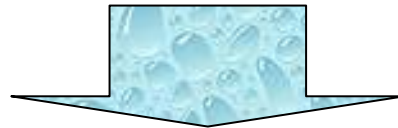
•CO₂ is the single dominant contributor to Climate Change.

Four major factors to determine the amount of CO2 emission

$$\text{CO2 emission} = \text{De-carbonization} \times \text{energy efficiency improvement} \times \frac{\text{GDP}}{\text{population}} \times \text{population}$$

① ② ③ ④

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

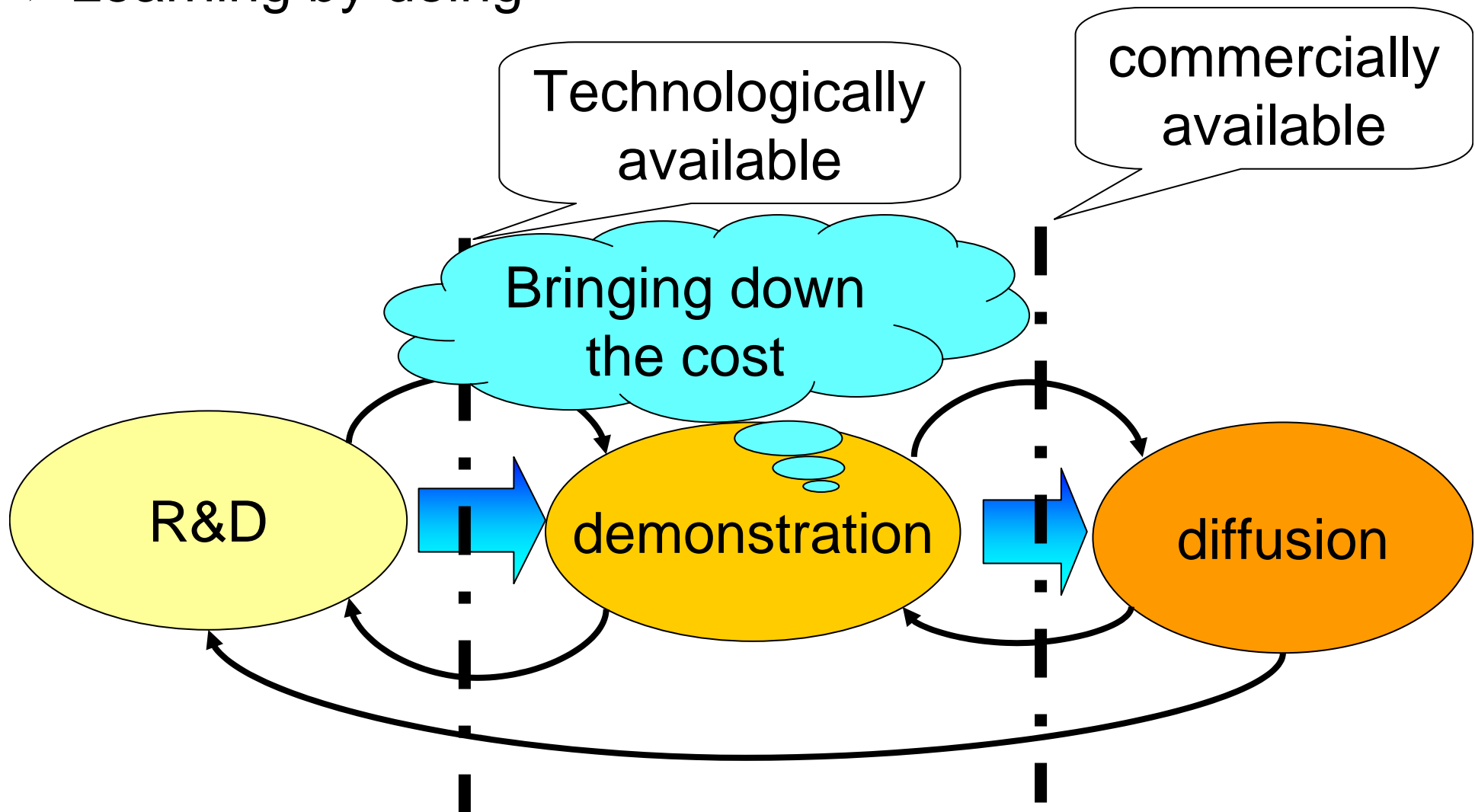
Satellite solar power



Source: JAXA

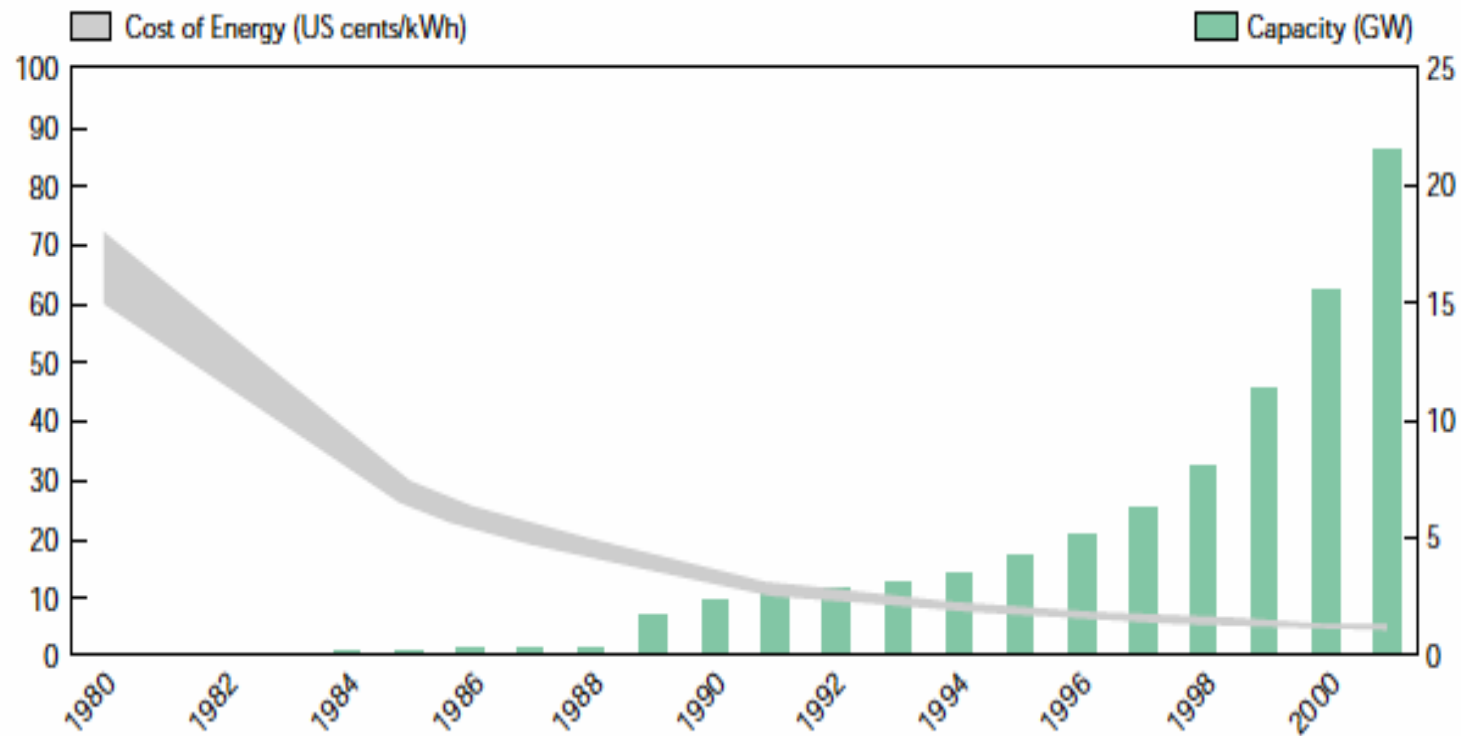
The role of the market

➤ 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)

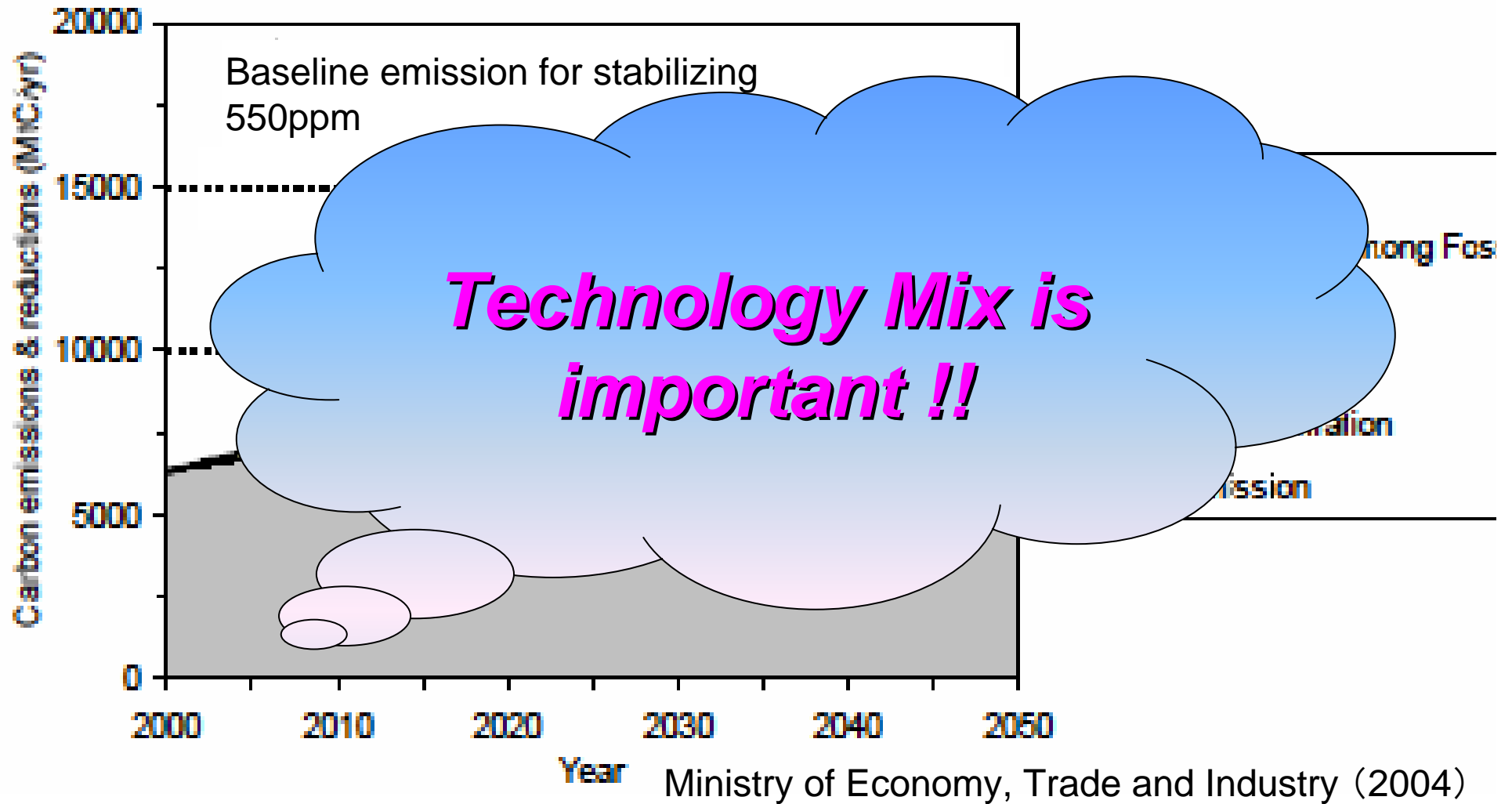
The Role of the Government

- ✓ Appropriate policies in each stage promote an innovative technology development

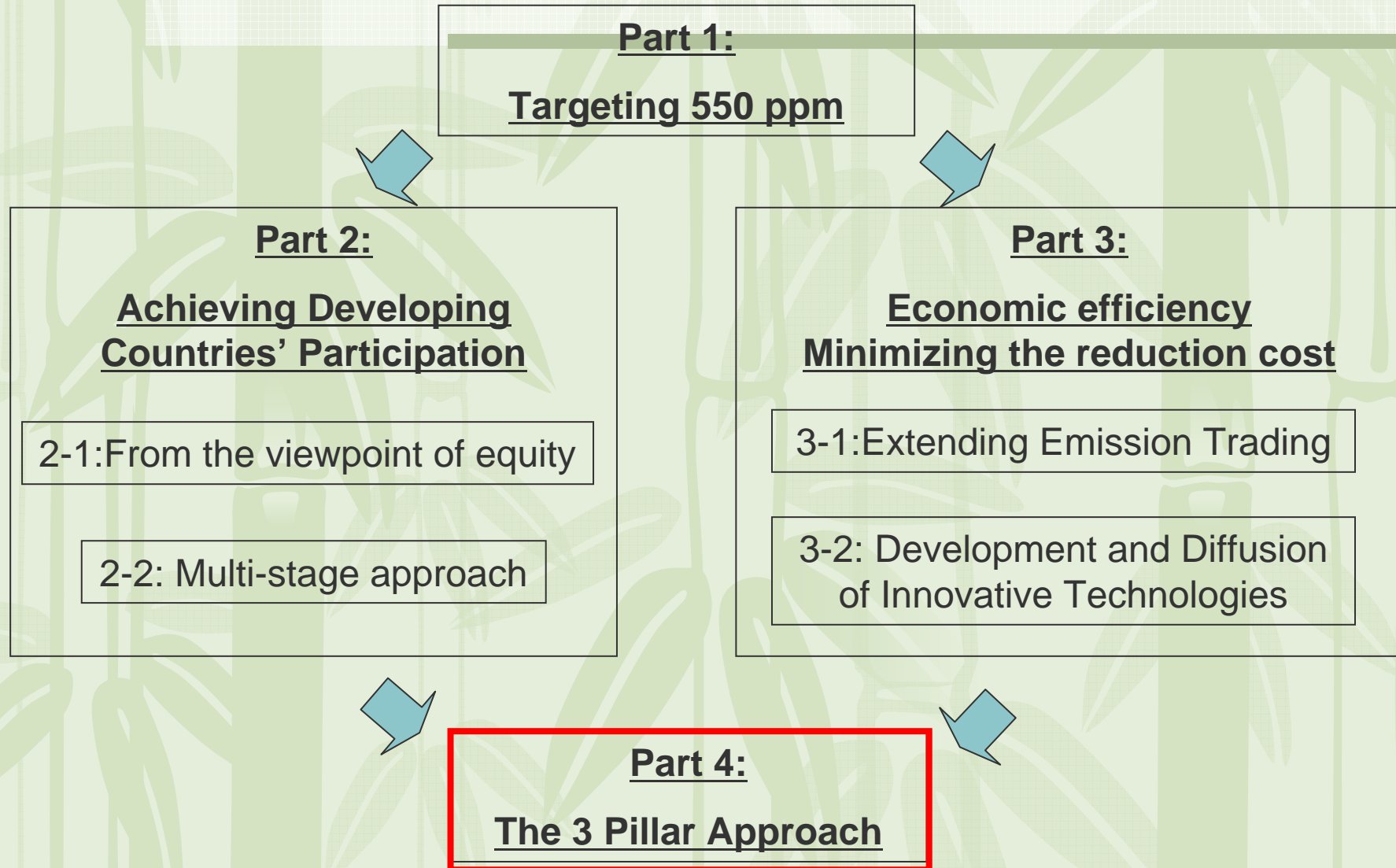
- R&D stage
(Research & Development)
- ✓ Government R&D subsidy

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

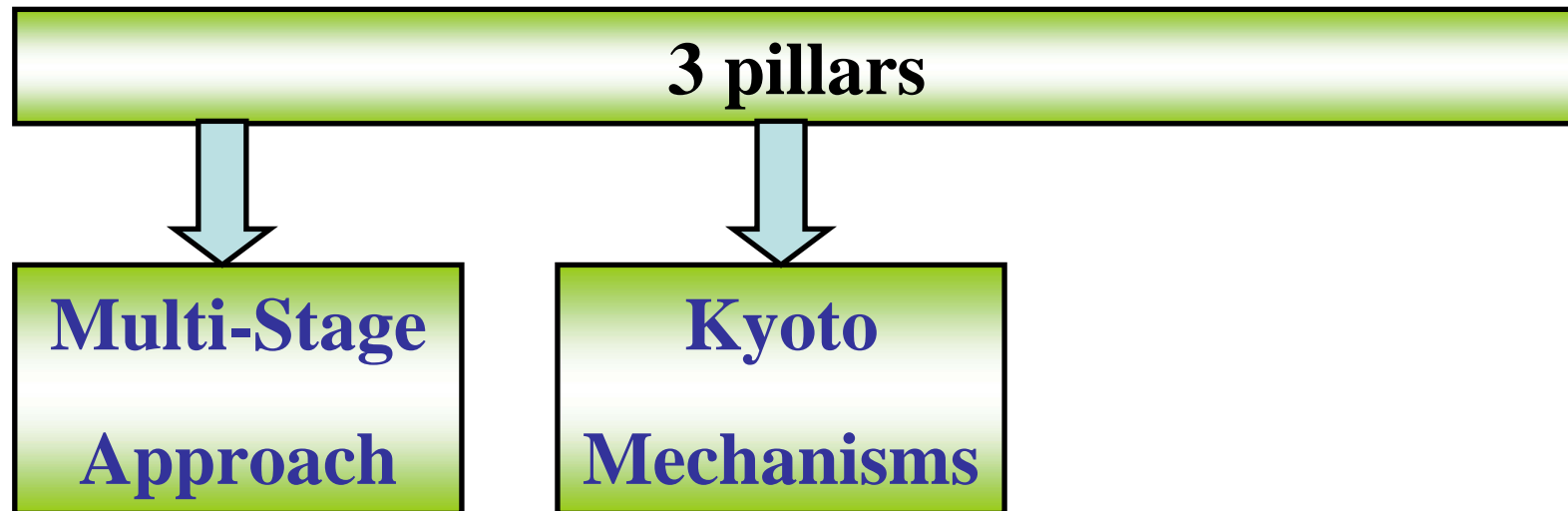
Technology Mix



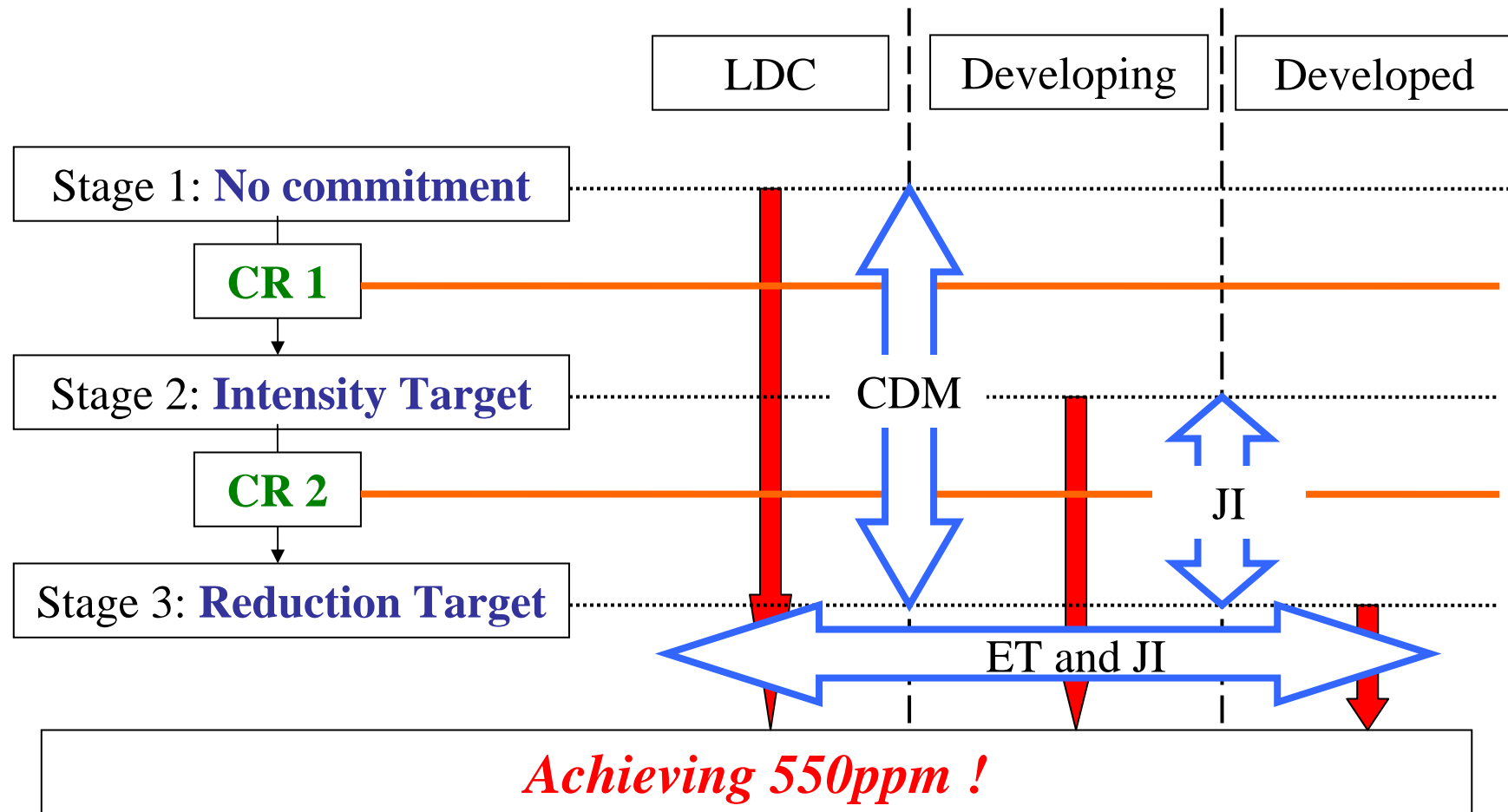
Flowchart of our presentation



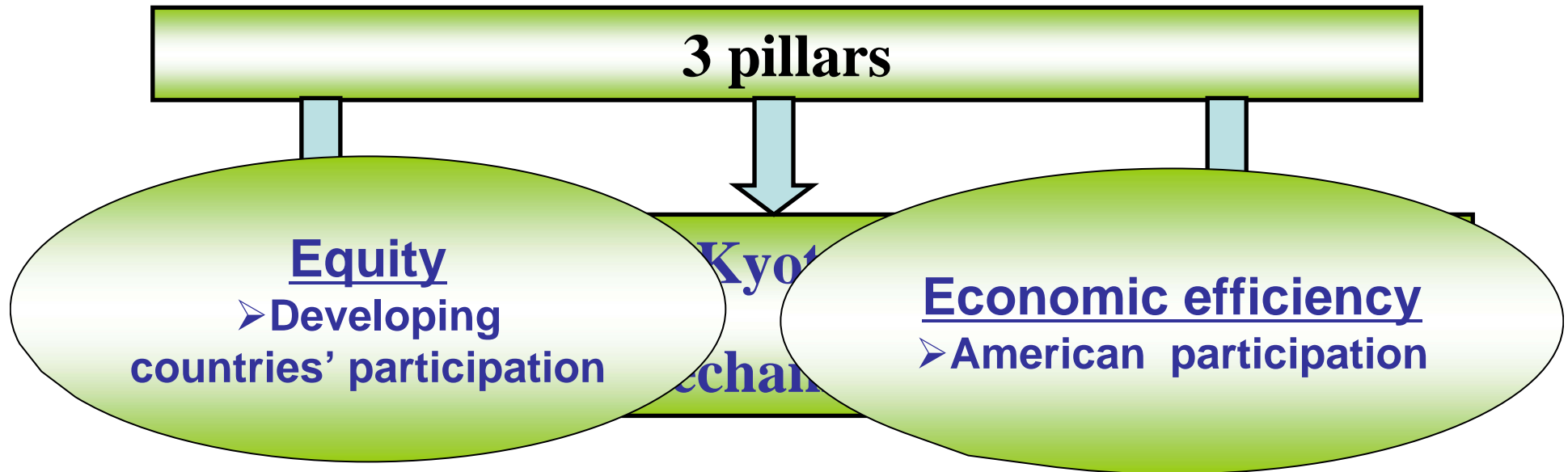
Our Proposal: 3-Pillar Approach



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

3 pillars

Global participation

Substantial and Cost-effective GHG reductions

Achieving 550ppm !

Ensuring environmental effectiveness!

謝謝 *very much!*



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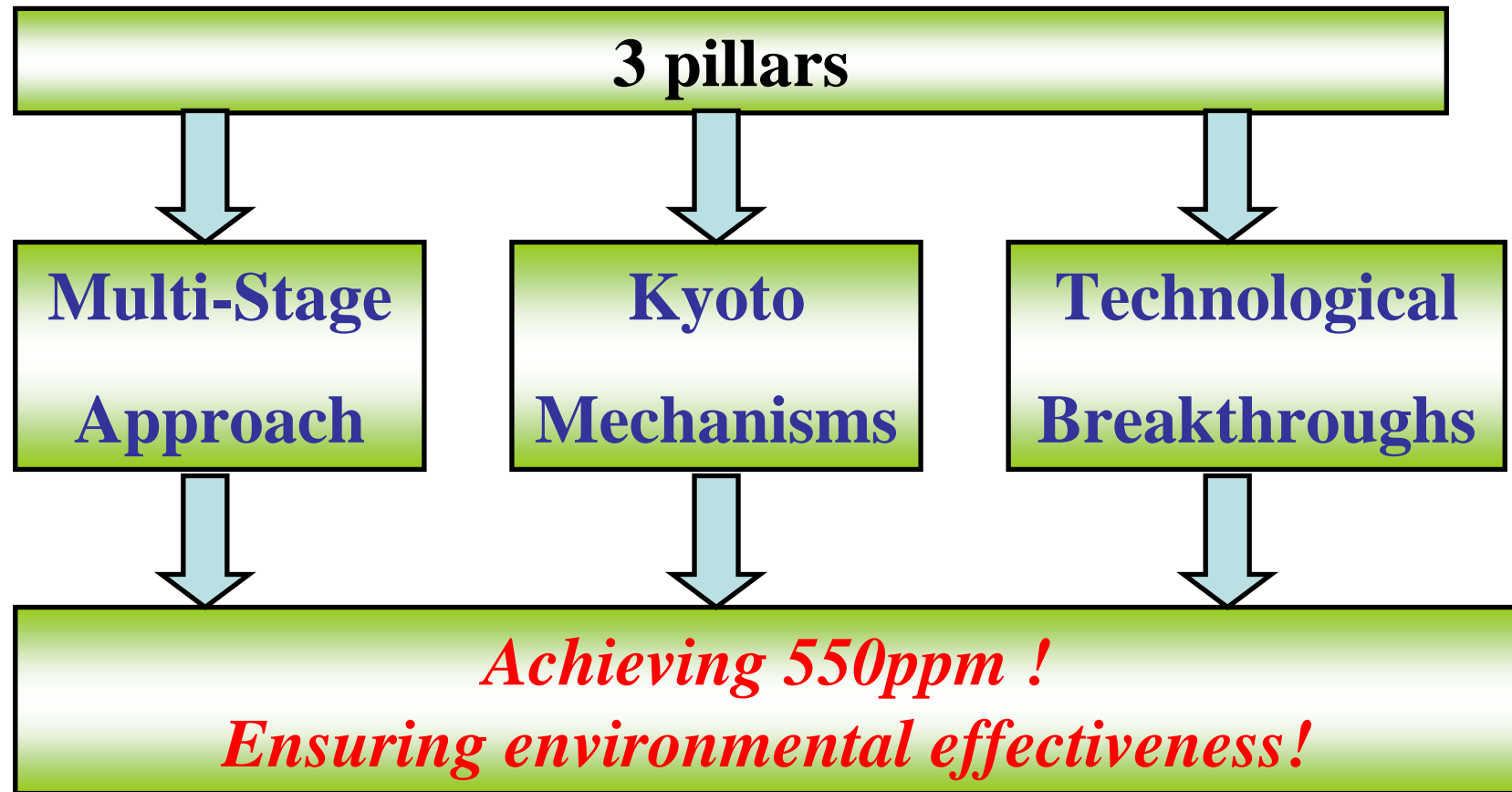
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- Industrial Science and Technology
- Policy and Environment Bureau
- <http://www.meti.go.jp/>
- Research Institute of Innovative Technology for the Earth (RITE)
- <http://www.rite.or.jp/>
- The Institute of Energy Economics, Japan
- <http://eneken.ieej.or.jp/>
- 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



太陽電池パネル

電磁波を地球へ
送信する



変電・送電して
利用する

地上のアンテナで
受信する



変電所

Stage 1 \Rightarrow Stage 2

No Commitment \Rightarrow 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 \Rightarrow Stage 3

Limitation Target \Rightarrow 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

