

Theme: International Conference on Blue Carbon Ecosystems for Sustainable  
Development with Special Emphasis to Mangrove Ecosystems

Organizers

- Yokohama National University, Japan
- UNESCO New Delhi Office, India
- International Society for Mangrove Ecosystems (ISME)

Venue: Yokohama National University, Japan

Date: January 10 - 13, 2023

## **A Desirable Framework for Creating a Carbon-Neutral Society**

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January 12, 2023



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# **I . Some Debates on Climate Change**

- 1. Definition and Cause of Climate Change**
- 2. Emission of Human-induced Greenhouse Gas (CO<sub>2</sub>-eq)**
- 3. United Nations' Point of View on Climate Change**

# I . Some Debates on Climate Change

## 1. Definition and Cause of Climate Change

### (1) Definition of Climate Change

#### o Weather

- The state of the atmosphere at a given time and place,
- With respect to variables such as temperature, moisture, wind velocity, and barometric pressure, etc.
- Conceptual unit: day-to-day

#### o Climate

- The long-term prevalent weather conditions (at least 10 years)
- In other words
  - the average weather conditions through long time
  - in a region

#### o Category of climate: tropical, temperate, humid climate, etc.

# I . Some Debates on Climate Change

## 1. Definition and Cause of Climate Change

### (1) Definition of Climate Change

- o Climate change is the change
  - in the average weather conditions and/or
  - in the distribution of weather events (extreme drought/heavy rain, etc.)
  - in a region during at least the past 10 years (empirically 30 years)

# I . Some Debates on Climate Change

## 1. Definition and Cause of Climate Change

### (2) Climate Change, Is It a Real Reality?

- o Realism (mainstream): 97%
  - Global warming: observed/measured scientifically
  - Temperature/Sea level rise, etc.: true
- o Skepticism (anti-mainstream): 3%
  - Global warming: uncertainty
  - A result from
    - Uncertainty of climate science
    - Not perfectly scientific analysis/measurement
  - Exaggerated information is being provided to people

# I . Some Debates on Climate Change

## 1. Definition and Cause of Climate Change

### (3) Cause of Climate Change

- o Natural factors
  - biotic process, variation in solar radiation, etc → global warming
  - interglacial period (evidenced from ruins in glacial period)
- o Human-induced factors (UNFCCC: United Nations Framework Convention on Climate Change)
  - emission of greenhouse gases
  - Kyoto Protocol in 1997 (UNFCCC)
    - 6 global warming substances
    - CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFCs, PFCs, SF<sub>6</sub>



# I . Some Debates on Climate Change

## 2. Emission of Human-induced Greenhouse Gas (CO2-eq)

Country (10)	Emission by Year (billion ton)				Ranking		Emission per Person (ton/year)
	1990	2008	2011	2019	1990	2019	2019
China	2.51	7.79	9.70	10.18	2	1	7.28
USA	4.99	5.47	5.42	5.29	1	2	16.10
India	0.66	1.56	1.97	2.62	6	3	1.92
Russia	2.44	1.80	1.83	1.68	3	4	11.62
Japan	1.16	1.25	1.24	1.17	4	5	8.76
Germany	1.02	0.86	0.81	0.72	5	6	8.46
S. Korea	0.25	0.54	0.61	0.61	9	8	11.82
Canada	0.45	0.57	0.56	0.58	8	9	16.07
Indonesia	0.16	0.41	0.49	0.62	10	7	2.29
UK	0.59	0.53	0.47	0.37	7	10	5.55
<b>Total in the world</b>	<b>22.7</b>	<b>31.7</b>	<b>33.9</b>	<b>37.7</b>			<b>4.89</b> <b>(7.71 billion)</b>

# I . Some Debates on Climate Change

## 3. United Nations' Point of View on Climate Change

- o Cause
  - Natural factor: 20%
  - Human-induced factor: 80%
- o Impact of greenhouse gas by greenhouse gas substance
  - Different by
    - emission per unit
    - total quantity being emitted
  - Impact of CO<sub>2</sub> (total quantity being emitted)
    - scholars: 66% - 98%
    - UNFCCC: 80%
- o Responsibility
  - Most developed countries: 70%
  - Developed/developing countries: 30%

# **II. The Current Status, Future Prospect and Impact of Climate Change at a Global Level**

## **1. The Current Status and Future Prospect of Climate Change**

## **2. The Impact of Climate Change**

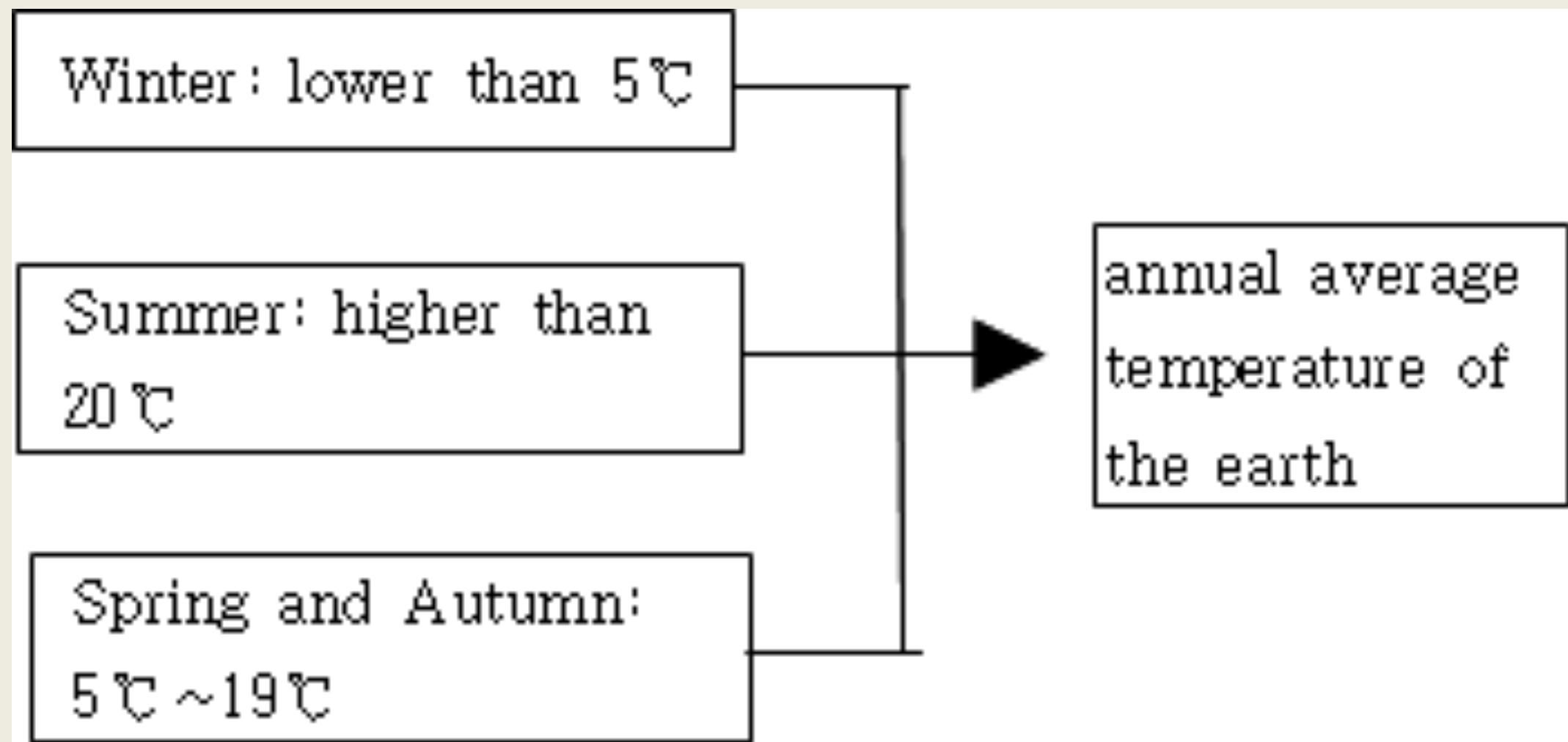
(1) On Nature

(2) On Humans/Society

## II. The Current Status, Future Prospect and Impact of Climate Change at a Global Level

### 1. The Current Status and Future Prospect of Climate Change

- o Average temperature of the earth: having been constant for hundreds of millions of years (average daily temperature)



# II. The Current Status, Future Prospect and Impact of Climate Change at a Global Level

## 1. The Current Status and Future Prospect of Climate Change

- o Current Evidences of global warming (IPPC)
  - Temperature rise: 1.07°C over the past 100 years
  - Change in season: winter was reduced (30 days)
  - Sea level rise: 1.88mm every year since 1961
  - Precipitation intensity: having increased
- o Prediction (IPPC)
  - Species: 20-30% extinction by 2200
  - Global temperature rise: 1.1°C - 6.4°C by 2100
  - Sea level rise: 1.00m (submergence of current land: 1.2%)
  - Climate refuge: 2.3 billion (about 30% of current world population)

# II. The Current Status, Future Prospect and Impact of Climate Change at a Global Level

## 2. The Impact of Climate Change

### (1) On Nature (Example)

- o Change in habitat of plants and animals
- o Loss of/Decrease in biodiversity

\* change in the original status of nature

→ environmental problems

→ crisis of nature → crisis of human existence

# II. The Current Status, Future Prospect and Impact of Climate Change at a Global Level

## 2. The Impact of Climate Change

### (2) On Humans/Society (Example)

- o Water supply
- o Human health
- o Population
- o Land-use
- o Food production
- o Economic structure and development
- o world trading system
- o Citizens' lifestyle

# III. The Concept and Implications of Carbon Neutrality

- 1. Low Carbon**
- 2. Carbon Neutrality**
- 3. Carbon-zero (Carbon-free)**
- 4. Climate Neutrality**



# III. The Concept and Implications of Carbon Neutrality

## 1. Low Carbon

- o Has its roots in the UNFCCC adopted in Rio in 1992
- o Is generally used to describe forward-looking national economic development plans or strategies that encompass low emission and/or climate-resilient economic growth, but no absolute level of reduction  
(eg. below 20%, to the way to zero emission, etc.)
- o Also include provisions to reduce vulnerability to the impact of climate change
- o Effectiveness: climate change continues, but its acceleration will be reduced

# III. The Concept and Implications of Carbon Neutrality

## 2. Carbon Neutrality

- o Removing as much carbon from the atmosphere as we put in → net-zero carbon emission
- o The overall goal is to achieve a zero carbon footprint
- o Approach to zero carbon footprint
  - carbon offset: ex. wind farm, solar park
  - buying enough carbon credits to make up the difference
  - industrial process such as production of carbon-neutral fuel
  - reducing and/or avoiding carbon emission
  - unavoidable emissions are offset
- o Effectiveness: climate change continues, but does not get more serious

# III. The Concept and Implications of Carbon Neutrality

## 3. Carbon-zero (Carbon-free)

- o Removal more than we emit
- o But, 'actual carbon-zero' is not possible
- o The best that we can achieve is
  - 'virtual zero emission' (at least a 90% reduction)
  - 'negative carbon emission' (artificial carbon sink by tree planting, carbon capture and storage, etc.)
- o True carbon-zero is
  - removing carbon more than we emit
  - through (virtual zero carbon) + (some negative carbon)
- o Effectiveness: climate change is gradually reduced, and moves toward climate neutrality

# III. The Concept and Implications of Carbon Neutrality

## 4. Climate Neutrality

- o Net change to atmosphere 0 ton through low carbon, carbon neutralith and carbon-zero
- o The state of climate before industrialization in the 18th century
- o It takes about 100 years to reach climate neutrality from the year we start reducing 10% of CO2 emission (4 billion ton at a global level)

## **IV. United Nations' Strategy on Carbon Neutrality**

- 1. Low Carbon Strategy: 1997 - 2012 (Kyoto Protocol)**
- 2. Negotiation for New Strategy: 2013 - 2014 (Post Kyoto Protocol)**
- 3. Carbon Neutrality Strategy: 2015 (Paris Agreement)**

# IV. United Nations' Strategy on Carbon Neutrality

## 1. Low Carbon Strategy: 1997 - 2012 (Kyoto Protocol)

### (1) Category of Country

- o Annex I
  - Most developed
  - Compulsory reduction
- o Non-Annex I
  - Developed/Developing
  - Recommended to reduce
- o Annex II
  - Least developed
  - Benefit of free financial/technology transfer from Annex I

# IV. United Nations' Strategy on Carbon Neutrality

## 1. Low Carbon Strategy: 1997 - 2012 (Kyoto Protocol)

### (2) Goal of Reduction by 2012

- o Different allocation by Annex I country (5%, etc.: Up to 10%)
- o Average: 5.2% compared to 1990 emission (22.7 billion ton)

### (3) Reduction Cost (per ton)

- o Different by
  - Country (available technology, etc)
  - Sector to be reduced (industry, transport, waste, etc.)
- o By industry
  - Textile industry: US\$20
  - Steel industry: US\$700

# IV. United Nations' Strategy on Carbon Neutrality

## 1. Low Carbon Strategy: 1997 - 2012 (Kyoto Protocol)

### (4) Three Compensation Strategies for Reduction Cost

#### (Applied to Annex I Country)

- o Joint Implementation (JI)

- Annex 1 can invest in an emission reduction project in any other Annex 1 where reducing emission may be cheaper as an alternative to reducing emissions domestically
- using the resulting Emission Reduction Units (ERU) towards their commitment goal



# IV. United Nations' Strategy on Carbon Neutrality

## 1. Low Carbon Strategy: 1997 - 2012 (Kyoto Protocol)

### (4) Three Compensation Strategies for Reduction Cost

#### (Applied to Annex I Country)

##### o Clean Development Mechanism (CDM)

- Annex 1 can implement emission-reduction projects in Non-Annex 1 and Annex 2 as an alternative to reducing emissions domestically
- for Annex 1 to achieve their commitment goal
- for Non-Annex 1 and Annex 2 to achieve domestic socio-economic development through the investment in capital and technology by Annex 1
- CDM awards these projects Certified Emission Reductions (CERs)

# IV. United Nations' Strategy on Carbon Neutrality

## 1. Low Carbon Strategy: 1997 - 2012 (Kyoto Protocol)

### (4) Three Compensation Strategies for Reduction Cost

#### (Applied to Annex I Country)

- o Emission Trading Scheme (ETS)

- a market-based approach to reduction of emission
- in case that Annex 1 reduces emission more than commitment goal, they can sell the surplus in market
- in case that Annex 1 do not achieve commitment goal, they should buy the amount of emission they do not achieve commitment goal

# IV. United Nations' Strategy on Carbon Neutrality

## 1. Low Carbon Strategy: 1997 - 2012 (Kyoto Protocol)

### (5) A Gunless War on Reduction

- o South Korea: 10% → 3%
- o Others (examples)
  - China: equity
  - USA: excessive social cost against uncertainty
  - Kenya (lean crops): Requesting OECD countries
    - free financial support
    - to purchase insurance against lean crops

# IV. United Nations' Strategy on Carbon Neutrality

## 2. Negotiation for New Strategy: 2013 - 2014 (Post Kyoto Protocol)

- o Negotiation for establishing a new strategy
- o Not successful for drawing consensus among member countries

## IV. United Nations' Strategy on Carbon Neutrality

### 3. Carbon Neutrality Strategy: 2015 (Paris Agreement)

- o Other name of Paris Agreement: Post-2020 New Climate Regime
- o Background of carbon neutrality strategy having been adopted
  - Marginal temperature for self-recovery of the earth: 2.0°C
  - By 2100: Lower than 2.0°C (real target: lower than 1.50°C)

# IV. United Nations' Strategy on Carbon Neutrality

## 3. Carbon Neutrality Strategy: 2015 (Paris Agreement)

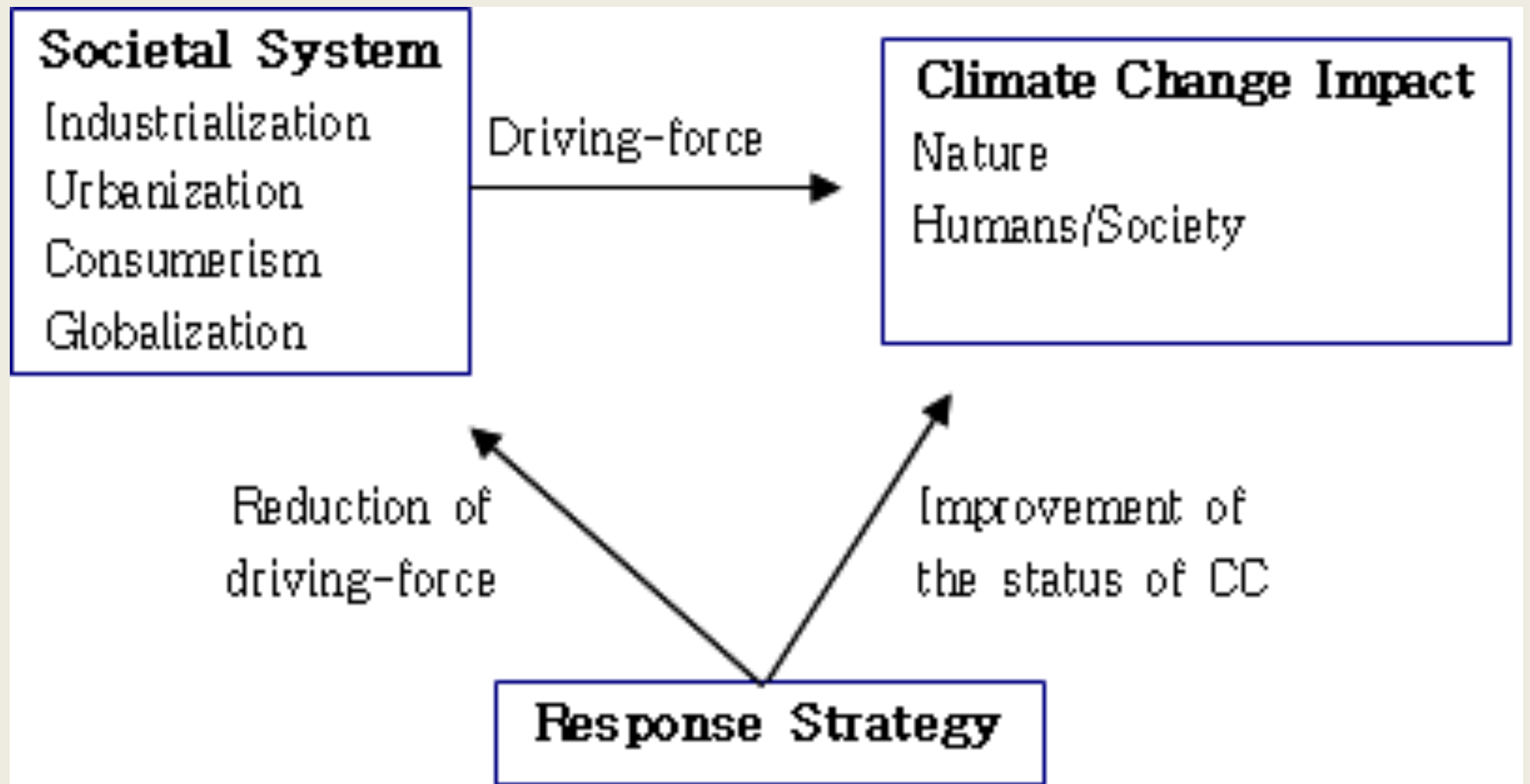
- o Goal: achievement of carbon neutrality before 2050
  - All countries
    - are obligated to reduce carbon emission
    - should set up reduction target by themselves, and submit it to UNFCCC
    - should inspect implementation of carbon reduction every 5 years from 2030, and report it to UNFCCC
- o Most developed countries
  - should provide developing countries with least \$100 billion a year
  - for climate change response from 2020

# **V. A Desirable Direction and Contents for Achieving Carbon Neutrality**

- 1. A Framework to Approach Carbon Neutrality**
- 2. Approaches to Achievement of Carbon Neutrality (Policy)**
  - (1) Nature-based Approach
  - (2) Technology-based Approach
  - (3) Societal System-based Approach
- 3. Introduction of Governance to Policy-Making Process**
- 4. Policy Effect Analysis**

# V. A Desirable Direction and Contents for Achieving Carbon Neutrality

## 1. A Framework to Approach Carbon Neutrality





# V. A Desirable Direction and Contents for Achieving Carbon Neutrality

## 2. Approaches to Achievement of Carbon Neutrality (Policy)

### (1) Nature-based Approach (Example)

- o Creating the sources of carbon sink
  - Planting tree
  - Expanding grassland
- o Expanding urban green space
- o Expanding blue carbon (carbon sink + restoring ecosystems)

### (2) Technology-based Approach (Example)

- o Improvement of energy efficient
- o Supply of new and renewable energy
- o Carbon capture/storage/sequestration
- o Carbon utilization

# V. A Desirable Direction and Contents for Achieving Carbon Neutrality

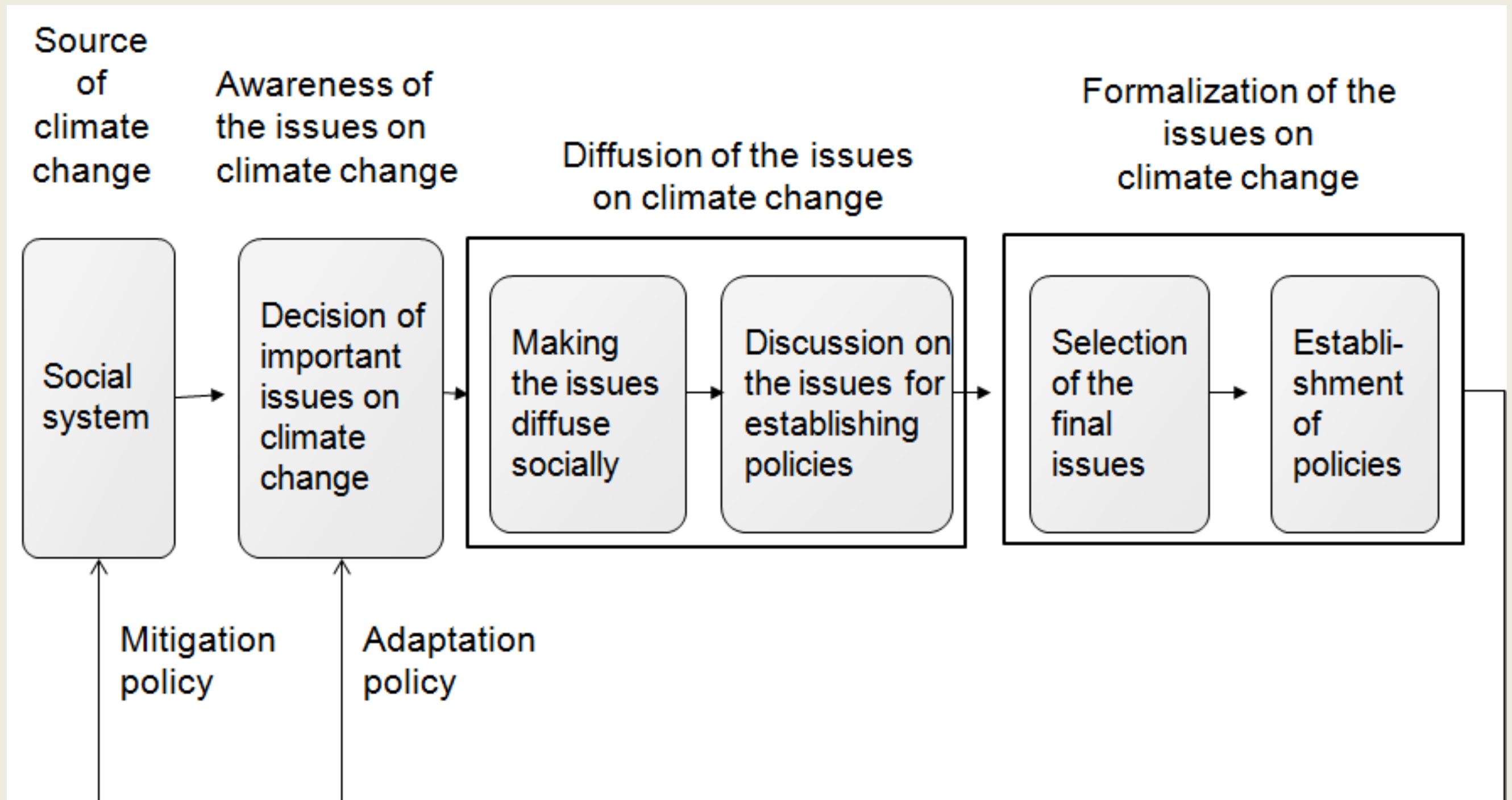
## 2. Approaches to Achievement of Carbon Neutrality (Policy)

### (3) Societal System-based Approach

- o Transforming to a low carbon socio-economic system
  - Economic: Maximizing profit + Minimizing ecological cost
  - Social (lifestyle): Eco-friendly behavior (resource and energy saving)
  - Cultural ethos: Consumerism → Environmentalism
- o The sectors to be transformed (Example)
  - Land-use      - Transportation      - Green space      - Building
  - Ecosystem    - Energy                      - Living environment    - Water
  - Wind              - Waste
- o Nature-based/Technology-based approach
  - a means
  - necessary for societal system-based approach

# V. A Desirable Direction and Contents for Achieving Carbon Neutrality

## 3. Introduction of Governance to Policy-Making Process



# V. A Desirable Direction and Contents for Achieving Carbon Neutrality

## 3. Introduction of Governance to Policy-Making Process

### o Purpose

- Less social conflict in the process of implementing policies
- Through internalization of social conflict in advance (social consensus)

### o Participants in governance system

- Experts
- Civil organizations
- Residents
- Stakeholders

### o Decision of what stage of decision-making process to invite the participants

- Decision of important issues on climate change
- Discussion on the issues for establishing policies
- Selection of the final issues
- Establishment of policies

# V. A Desirable Direction and Contents for Achieving Carbon Neutrality

## 4. Policy Effect Analysis

### (1) Investment Efficiency Analysis by Policy

- o Definition: reduction quantity of greenhouse gas emission compared to financial investment
- o Examples (Jeju Province, South Korea)

Policy to Be Implemented	Budget (million in US\$)	Reduction Quantity (ton)	Budget for Reducing 1 ton (US\$)
Afforestation(6,500ha)	93	38,350	2,430
Supply of Clean Energy	104	227,372	460
Substitute of Traffic Signal with LED	3	9,735	310

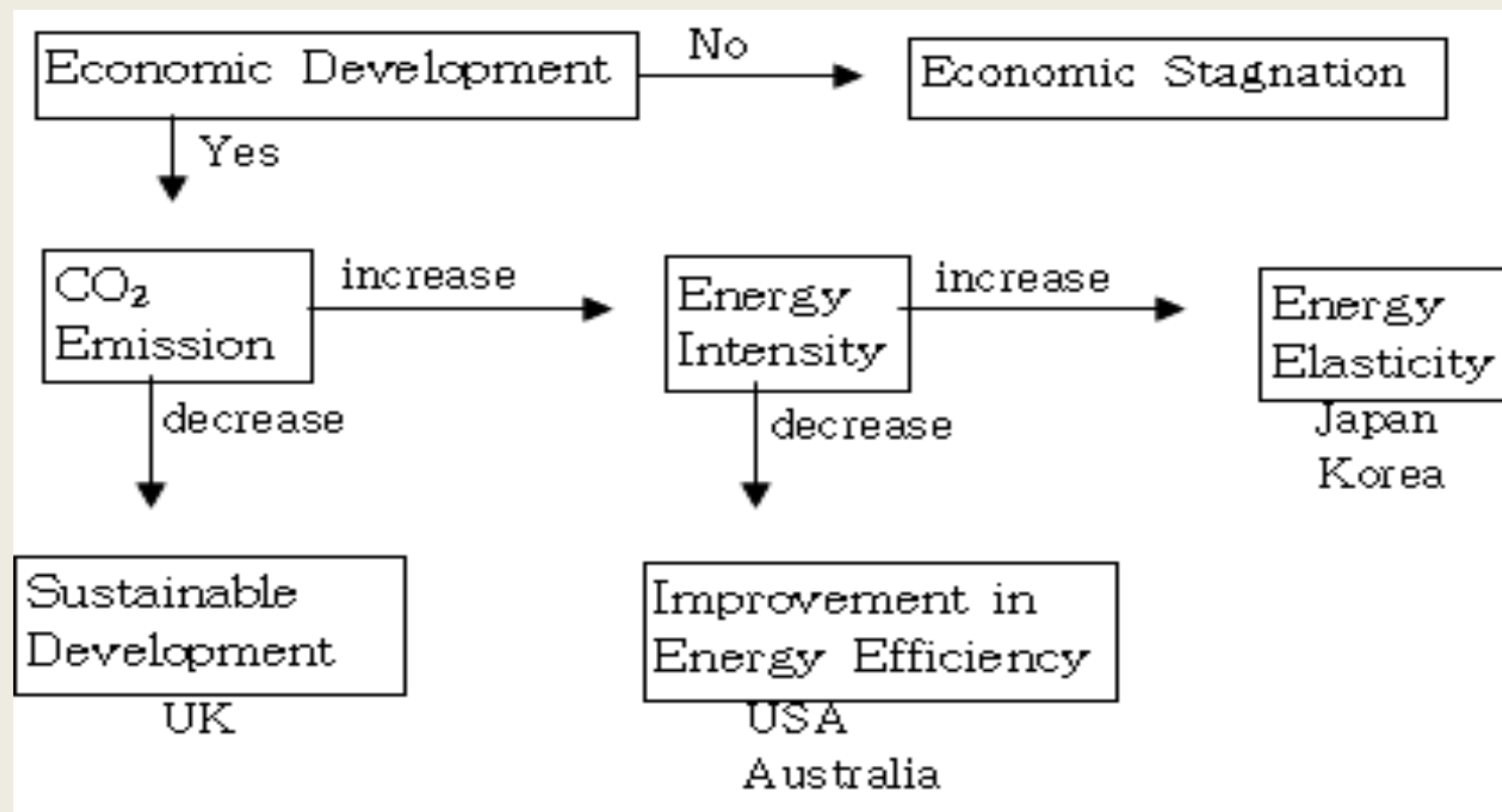
- o Function: a guide for the decision of policy priority

# V. A Desirable Direction and Contents for Achieving Carbon Neutrality

## 4. Policy Effect Analysis

### (2) Effect Analysis of All Policies as a Whole

- o Need to examine whether the policies launched are effective or not on a regular-period base
- o An analytic framework



- o Function: A guide for identifying what way the policies launched should be
  - modified and/or
  - supplemented

# VI. Concluding Remarks

- 1. Carrying Capacity of the Earth - A Synthetic Indicator**
- 2. Implications of Industrialization**
- 3. Capacity Building**

# VI. Concluding Remarks

## 1. Carrying Capacity of the Earth - A Synthetic Indicator

### (1) Concept of Carrying Capacity: Two Capacities as a Reality

- o Capacity to provide humans with resources
- o Capacity to absorb and treat wastes discharged by humans

### (2) The Status of Carrying Capacity

- o At a global level: exceeded by 2.50 times (2000)
- o South Korea: exceeded by 9.5 times (2003)
- o Exceeding countries: USA (1.8 times), Japan (6.0 times), etc.
- o Not exceeding countries: Canada, Australia, Brazil, Philippines, etc.



# VI. Concluding Remarks

## 1. Carrying Capacity of the Earth - A Synthetic Indicator

### (3) How to Solve the Exceeded Carrying Capacity

- o Find a planet
  - that all conditions are the same as the Earth and size is 2.5 times bigger than the Earth,
  - and 7.7 billion population immigrate to the planet (not possible)
- o Expanding the size of the Earth 2.5 times bigger (not possible)
- o Reducing one-third of current production (not possible)
- o Killing 2 billion population (not possible)

# VI. Concluding Remarks

## 1. Carrying Capacity of the Earth - A Synthetic Indicator

### (3) How to Solve the Exceeded Carrying Capacity

- o The Earth continues voyage with 2.5 times more passengers than carrying capacity → will be sunk into the sea in 200 years
  - Extinction of about 20 - 30% species
  - Human: Their bad luck is all of their own doing
  - Other species: innocent, but buried alive with humans due to having met bad neighbors

# VI. Concluding Remarks

## 2. Implications of Industrialization

### o Industrialization

- Improvement of material affluence/convenience in life
  - Increase in extraction of natural resource
  - Increase in emission of gaseous/liquid/solid waste
  - Excess of carrying capacity (nature)
  - Pollution/destruction of original quality of nature
  - Crisis of nature → Crisis of human existence

# VI. Concluding Remarks

## 2. Implications of Industrialization

- o Examining the implications of industrialization
  - Humans: Beneficiary/victim of industrialization →  
Committed a self-contradiction
  - Having resulted in making a fire of my house
  - Strategy responding to the crisis of nature →  
Action for solving the self-contradiction
- o The limitations inherent in sustainable development having been having been promoted from the 1990s
  - Horizontal perspective → Conflict among the three goals
  - Evidence
    - Still lots of challenges covering wide range of sectors
    - The challenges are being deteriorated

# VI. Concluding Remarks

## 3. Capacity Building

- o Availability of finance
- o Availability of advanced technologies
- o Establishment of cooperative network (social consensus)
  - Industry: green management
  - Civil organization: environmental movement
  - Mass media: providing information/discussion venue/publicity, etc.
  - Citizen: environmentally friendly behavior in everyday life
  - Cultural ethos: Quality of life (consumerism → environmentalism)
- o Establishing cooperation network with domestic/foreign governments and institutes for (ex.)
  - Exchanging information and data on climate change
  - Joint activities responding to climate change

# Our Choice

- o Luxury Titanic to be sunk shortly into the sea?
- o Poor and small Noah's ark?



# Our Choice

If we continue enjoying Titanic, our near future in everyday life



**Thanks a lot for your attention**