A Desirable Framework for Creating a Carbon-Neutral Society

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I. Some Debates on Climate Change

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I. Some Debates on Climate Change

1. Definition and Cause of Climate Change

(1) Definition of Climate Change

- 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

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

- Category of climate: tropical, temperate, humid climate, etc.
1. Definition and Cause of Climate Change

(1) Definition of Climate Change

- 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?

- Realism (mainstream): 97%
  - Global warming: observed/measured scientifically
  - Temperature/Sea level rise, etc.: true

- 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

- Natural factors
  - biotic process, variation in solar radiation, etc → global warming
  - interglacial period (evidenced from ruins in glacial period)

- Human-induced factors (UNFCCC: United Nations Framework Convention on Climate Change)
  - emission of greenhouse gases
  - Kyoto Protocol in 1997 (UNFCCC)
    - 6 global warming substances
      - CO2, CH4, N2O, HFCs, PFCs, SF6
## I. Some Debates on Climate Change

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

<table>
<thead>
<tr>
<th>Country (10)</th>
<th>Emission by Year (billion ton)</th>
<th>Ranking</th>
<th>Emission per Person (ton/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>2.51</td>
<td>7.79</td>
<td>9.70</td>
</tr>
<tr>
<td>USA</td>
<td>4.99</td>
<td>5.47</td>
<td>5.42</td>
</tr>
<tr>
<td>India</td>
<td>0.66</td>
<td>1.56</td>
<td>1.97</td>
</tr>
<tr>
<td>Russia</td>
<td>2.44</td>
<td>1.80</td>
<td>1.83</td>
</tr>
<tr>
<td>Japan</td>
<td>1.16</td>
<td>1.25</td>
<td>1.24</td>
</tr>
<tr>
<td>Germany</td>
<td>1.02</td>
<td>0.86</td>
<td>0.81</td>
</tr>
<tr>
<td>S. Korea</td>
<td>0.25</td>
<td>0.54</td>
<td>0.61</td>
</tr>
<tr>
<td>Canada</td>
<td>0.45</td>
<td>0.57</td>
<td>0.56</td>
</tr>
<tr>
<td>Indonesia</td>
<td>0.16</td>
<td>0.41</td>
<td>0.49</td>
</tr>
<tr>
<td>UK</td>
<td>0.59</td>
<td>0.53</td>
<td>0.47</td>
</tr>
<tr>
<td><strong>Total in the world</strong></td>
<td><strong>22.7</strong></td>
<td><strong>31.7</strong></td>
<td><strong>33.9</strong></td>
</tr>
</tbody>
</table>

I. Some Debates on Climate Change

3. United Nations’ Point of View on Climate Change

- **Cause**
  - Natural factor: 20%
  - Human-induced factor: 80%

- **Impact of greenhouse gas by greenhouse gas substance**
  - Different by
    - emission per unit
    - total quantity being emitted
  - Impact of CO2 (total quantity being emitted)
    - scholars: 66% - 98%
    - UNFCCC: 80%

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

```
Winter: lower than 5°C
Summer: higher than 20°C
Spring and Autumn: 5°C ~ 19°C
annual average temperature of the earth
```
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)

- Change in habitat of plants and animals
- 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)

- Water supply
- Food production
- Human health
- Economic structure and development
- Population
- World trading system
- Land-use
- 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

- Has its roots in the UNFCCC adopted in Rio in 1992
- 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 (e.g. below 20%, to the way to zero emission, etc.)
- Also include provisions to reduce vulnerability to the impact of climate change
- Effectiveness: climate change continues, but its acceleration will be reduced
Ⅲ. The Concept and Implications of Carbon Neutrality

2. Carbon Neutrality

- Removing as much carbon from the atmosphere as we put in → net-zero carbon emission
- The overall goal is to achieve a zero carbon footprint
- 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
- Effectiveness: climate change continues, but does not get more serious
Ⅲ. The Concept and Implications of Carbon Neutrality

3. Carbon-zero (Carbon-free)

- Removal more than we emit
- But, ‘actual carbon-zero’ is not possible
- 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.)
- True carbon-zero is
  - removing carbon more than we emit
  - through (virtual zero carbon) + (some negative carbon)
- Effectiveness: climate change is gradually reduced, and moves toward climate neutrality
4. Climate Neutrality

- Net change to atmosphere 0 ton through low carbon, carbon neutralith and carbon-zero
- The state of climate before industrialization in the 18th century
- 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)
1. Low Carbon Strategy: 1997 - 2012 (Kyoto Protocol)

(1) Category of Country

- Annex I
  - Most developed
  - Compulsory reduction

- Non-Annex I
  - Developed/Developing
  - Recommended to reduce

- 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

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

(3) Reduction Cost (per ton)

- Different by
  - Country (available technology, etc)
  - Sector to be reduced (industry, transport, waste, etc.)

- 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)

- 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)

- 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)

- 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

- South Korea: 10% → 3%
- 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

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

- Other name of Paris Agreement: Post-2020 New Climate Regime
- 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)

- 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
  - 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

![Diagram showing the relationship between Societal System, Climate Change Impact, and Response Strategy.]

- Societal System: Industrialization, Urbanization, Consumerism, Globalization
- Climate Change Impact: Nature, Humans/Society
- Reducing driving-force
- Improvement of the status of CC
- Response Strategy
V. A Desirable Direction and Contents for Achieving Carbon Neutrality

2. Approaches to Achievement of Carbon Neutrality (Policy)

(1) Nature-based Approach (Example)
   - Creating the sources of carbon sink
     - Planting tree
     - Expanding grassland
   - Expanding urban green space
   - Expanding blue carbon (carbon sink + restoring ecosystems)

(2) Technology-based Approach (Example)
   - Improvement of energy efficient
   - Supply of new and renewable energy
   - Carbon capture/storage/sequestration
   - 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

- 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

- The sectors to be transformed (Example)
  - Land-use - Transportation - Green space - Building
  - Ecosystem - Energy - Living environment - Water
  - Wind - Waste

- 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

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

- Participants in governance system
  - Experts
  - Civil organizations
  - Residents
  - Stakeholders

- 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

- Definition: reduction quantity of greenhouse gas emission compared to financial investment

- Examples (Jeju Province, South Korea)

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

- 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

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

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

(2) The Status of Carrying Capacity
   - At a global level: exceeded by 2.50 times (2000)
   - South Korea: exceeded by 9.5 times (2003)
   - Exceeding countries: USA (1.8 times), Japan (6.0 times), etc.
   - 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

- 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)
- Expanding the size of the Earth 2.5 times bigger (not possible)
- Reducing one-third of current production (not possible)
- 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

- 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

- 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

- 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

- 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

- Availability of finance
- Availability of advanced technologies
- 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)
- 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

- Luxury Titanic to be sunk shortly into the sea?
- 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