Sectoral Approaches in Global Warming Measures♦ -Expectations, Expected Roles and its Challenges-

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Summary

The term "Sectoral Approaches" has recently come to be frequently used in forums for global warming negotiations, particularly those on a future framework. However, the term has no established clear definition as of yet and has been used in many different contexts. This paper therefore seeks to outline the concept of sectoral approaches by going throughboth domestic and overseas papers and material in order to identify in what context the term "sectoral approaches" have appeared and what definitions are implied and to study the concerns lying behind its usage.

The Kyoto Protocol had great significance in the sense that it aroused awareness about global warming issues and accelerated national and business efforts. However, being centered on "national" efforts, it has posed some challenges. Because the targets were determined on ambiguous grounds, there remains a sense of unfairness regarding burden-sharing. Also, it draws a line between Annex I countries and non-Annex I countries based on the principle of "common but differentiated responsibilities", distorting competitive circumstances among companies exposed to international competition. Sectoral approaches try to overcome these challenges by focusing on "sectors," such as the industrial sector, transport sector and residential/commercial sector, on the axis of efforts.

Sectoral approaches can be largely divided into "sectoral approaches for target-setting" and "sectoral approaches for institutional design." "Sectoral approaches for target-setting" are used to calculate the values to serve as a basis in negotiations on national emission targets. They divide the domestic GHG emission structure into sectors and aggregate sectoral emissions from a bottom-up approach in order to establish more equitable targets. "Sectoral approaches for institutional design" aim to achieve substantial environmental effects through detailed policies and measures based on sector-specific technologies and best practices. They also seek to involve developing countries and to address concerns for leakage and competitiveness.

Sectoral approaches, the development of which Japan has lead, have the potential of encompassing a wider range of countries than the Kyoto Protocol, thus establishing a more equitable and rational framework. The EU and the US have expressed some understanding for Japan's proposal, but their expectations for sectoral approaches are focused on different aspects. EU centers its global warming measures on the EU-ETS and considers sectoral approaches as a solution for carbon leakage from energy-intensive industries. On the other hand, the US has promoted voluntary sectoral approaches through the Asia Pacific Partnership for Clean Development and Climate, involving developing countries. However, resenting interference with its policy from other countries, it could promptly change its attitude should a binding framework such as internationally coordinated policy be considered. Japan is expected to exercise its leadership with due consideration for the power balance in the international politics for global warming negotiations.

♦This report has been based on a report conducted under the Global Environment Projects to Promote International Collaboration "A Study on a Future Framework for Global Warming based on Sectoral Approaches" commissioned by New Energy and Industrial Technology Development Organization (NEDO) in FY 2007. Additions and alterations have been made to the original paper. This paper was made available to the public thanks to NEDO's support and the kind and cooperation of all parties involved..

1. Introduction

The term "sectoral approaches" has recently come to be frequently used in forums for global warming negotiations, particularly on a future framework. In the intensified debate on a post-Kyoto framework, the establishment of an equitable framework embracing major greenhouse gas (GHG) emitters is sought and sectoral approaches have been discussed as a possible solution.

The Kyoto Protocol had great significance in the sense that it aroused awareness about global warming issues and accelerated national and business efforts, but it contained institutional shortcomings as well. For example, 1) it falls behind in achieving its ultimate goal to "stabilize atmospheric concentrations of greenhouse gases at a level that would prevent "dangerous" anthropogenic interference with the climate system; 2) it leaves a strong sense of unfairness among countries because it does not reflect country-specific GHG emission structures or the differences in the accumulated efforts of each country; and 3) it categorizes Parties into two groups, namely, countries committed to emission reductions (Annex I countries) and those not subject to such commitments (non-Annex I countries), thus posing growing concerns over the transfer of production bases to regions where regulations are more relaxed. Furthermore, the world situation has changed drastically from when the Protocol was being drafted 10-15 years ago, and therefore the simple furtherance of developments made to date is not sufficient enough to shape a post-2012 framework.

"Sectoral approaches," which take a bottom-up approach for defining sector-specific policies and targets in detail, are expected to mitigate and resolve these challenges. However, a clear definition of the term has yet to be established. Also, in some aspects, it is still not fully understood why sectoral approaches need to be taken to begin with.

This paper therefore seeks to study the background for the current call for sectoral approaches and to analyze the different stances taken by Japan, the US and EU towards them, thus identifying the features of various types of sectoral approaches and how they can actually function.

2. Why the Call for Sectoral Approaches?

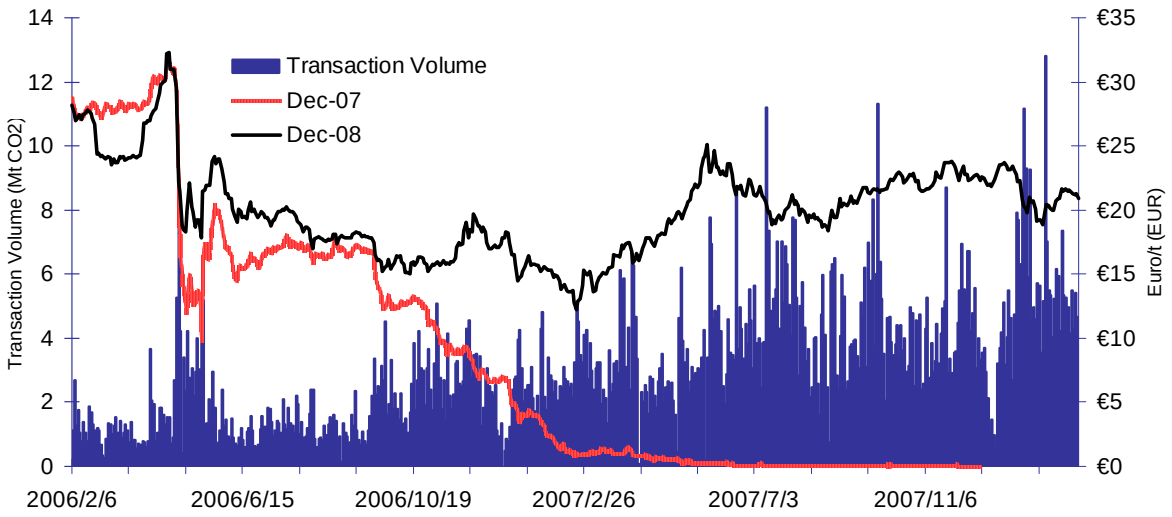
Sectoral approaches are literally approaches focused on sectors (or industries). They can be referred to as approaches centered on efforts led by sectors, such as industrial, transportation and residential/commercial sectors, to complement or overcome the issues and limits of the current country-based Kyoto Protocol. This paper will discuss the background against which the concept of sectoral approaches has been brought under the spotlight: recent changes in world situation, namely, the "formulation of carbon prices," the "borderless business activities," the "enhanced presence of developing countries;" "policy priorities" and "limits of the Kyoto Protocol"

2.1. Formulation of Carbon Prices

The world carbon market has been expanding significantly since 2005, when Kyoto mechanism transactions gained momentum as the Kyoto Protocol came into effect and the EU Emissions Trading Scheme (EU-ETS) was launched. According to a World Bank report, the carbon market became a 64 billion US dollar (47 billion Euro) market in 2007. Although CDM credits constitute a greater part (87% of transaction volume, 91% of transaction value) of CDM/JI project credits, the transaction volume and value of JI credits increased approximately twofold and threefold, respectively, compared to 2006 levels. Carbon had previously been priced in the form of environmental taxes, but with the launch of emissions trading markets in various regions, a carbon market was developed at a global level and carbon prices have become subject to daily fluctuation.

The iron and steel, aluminum and cement industries, emitting large amounts of GHGs and exposed to international competition, have become very tense over this situation. A company that has just been through EU-ETS Phase I says, “With the introduction of EU-ETS, companies have come to seriously address the issue of reducing CO2 as top priority management agenda. However, despite diverse efforts, CO2 emissions have been successfully reduced only by an average of 5% and further improvements cannot be expected. Downsizing manufacturing operations (in Europe) is the only solution left.” This past decade, China, free of carbon restrictions, has expanded production drastically, whereas developed countries have been under the increased pressure of carbon restrictions; therefore, the development of a fair competitive environment where competitive conditions are not distorted is strongly called for.

Figure 2.1-1 Transaction Price and Volume in EU-ETS



Source: ECX

2.2. Borderless Business Activities

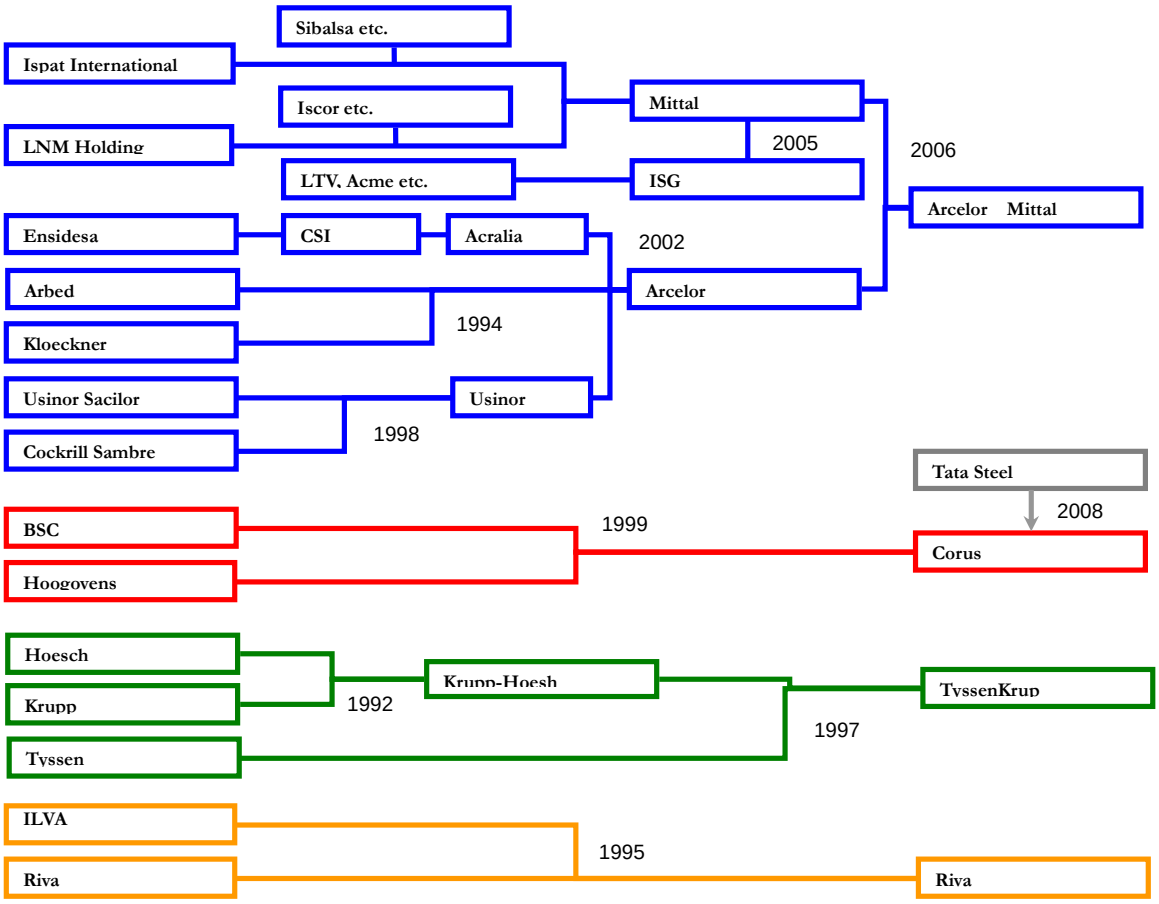
Significant developments were made in the globalization[1] of corporate activities in the 1990s. Increased international transactions of capital, including direct investment, reduced communication costs due to advancements in information technology and developments in distribution networks, including air and marine transport, together have furthered the integration and collaboration of world economy. The ratio of imported goods and services against world GDP fell short of 20% in 1990, but exceeded 27% in 2005[2]; increased trade transactions have served to create closer ties in the global economy.

Combined with these developments, business reorganization has become a global trend. The transition to a market economy in the former Soviet Union and East European countries and economic development in China and India have led to an oversupply in the market and intensified price competition. Struggling for survival, companies have pursued cross-border M&As, thus accelerating the further augmentation and increased market power of already large companies.

[1] “Internationalization” is a concept generated between countries whereas “globalization” regards the world to comprise one single system and is not premised on the idea of individual nations.
[2] OECD (2007)

Figure 2.2-1 presents the developments in the reorganization of major iron and steel groups. With increased demand for steel products in China and India, companies were confronted with calls for businesses expansion. However, direct investment in production capacity could lead to oversupply and increase risks of decreased profitability; and therefore, acquisition was the preferred means of corporate growth. Large mergers were observed particularly in Europe, where the industry reorganization after the 1990s aggregated what had been 22 blast furnace steelmakers in the 1980s into four major groups. Also, in June 2006, Mittal Steel, which had rapidly expanded through the successive acquisition of Asian and East European steelmakers, took over Arcelor, then the world's second largest steel manufacturer, and was reborn as Arcelor Mittal, becoming approximately three times the size of Nippon Steel Corporation.

Figure 2-2-1 M&As in the Iron and Steel Sector



Data provided by: Japan Iron and Steel Foundation

In the cement and aluminum industries as well, corporate reorganization and oligopoly have become a global trend. The three European cement majors, Holcim. La Farge and Heidelberg Cement have actively expanded overseas. Securing productive bases outside Europe has become a crucial task in the business strategy for these companies. They have made capital investments and

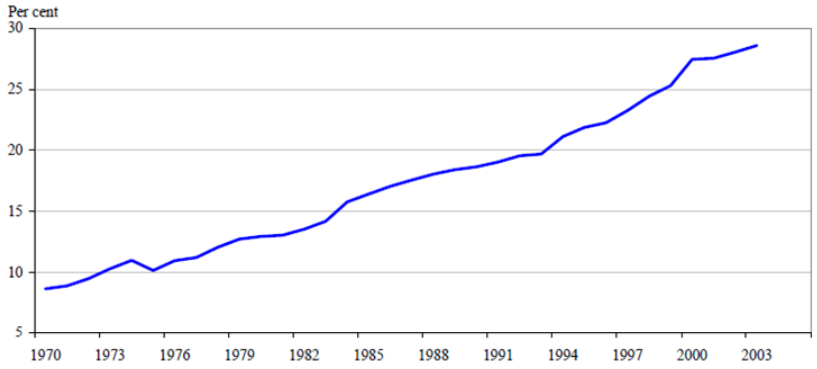
have gradually increased their market share, thereby securing production bases especially in emerging markets, including China, India, Eastern Europe and Russia, where more significant growth in demand is expected.

In the aluminum industry, as well, Australian Rio Tinto purchased Canadian Alkan for 38.1 billion US dollars, dethroning Russian UC Rusal to become the world's largest aluminum producer, Rio Tinto Alkan (5 million tons). The second largest producer, UC Rusal (3.8 millison tons) had just been reborn in 2006 in the three-way merger of Rusal (Russia), Sual (Russia) and the aluminum assets of Glencore (Switzerland). Alcoa (3.5 million tons), the third largest aluminum producer, had also competed for the acquisition of Alkan, but lost to Rio Tinto. The aluminum industry has also become a competitive M&A market.

Mergers and acquisitions and intense market competition also brought in a wave of corporate downsizing and streamlining. In order to survive price-cutting competition, companies needed to make drastic cost reductions; thus, developments were made in supply chain management, optimizing procurement and sales at a global level Therefore, a great portion of trade has come to be done within a sector or company. Figure 2.2-2 presents the ratio of imported input in the global manufacturing industry. What was 17-18% in the 1990s increased to nearly 30% in 2003, indicating that more intermediate input is being procured from overseas.

In this manner, intensified competition makes companies sensitive to the slightest price changes. With carbon regulations varying among countries on the one hand and companies beginning to make decisions from a global perspective on the other, the risk of carbon leakage is seriously concerned.

Figure 2.2-2 Ratio of Imported Input in Manufacturing Industry



Source: OECD (2007)

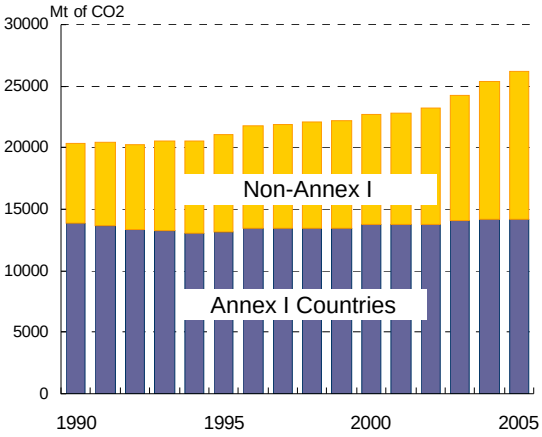
2.3. Enhanced Presence of Developing Countries

Figure 2.3-1 exhibits the trend of energy-derived CO2 emissions from 1990 through 2005. In 1990, the baseline year of the Kyoto Protocol, Annex I countries accounted for 68% of total emissions, but gradually reduced their share to 54% in 2005. In the past 15 years, emissions from Annex I countries increased only by 2%, whereas those from developing countries increased by 85%.

CO2 emissions are projected to increase further in developing countries due to population growth, improved living standards, increased motorization and developments in the industrial sector. Figure 2.3-2 presents the emissions outlook by country and by region to 2030 compiled by the US Department of Energy. Global CO2 emissions, marking 28.1 billion tons (carbon dioxide

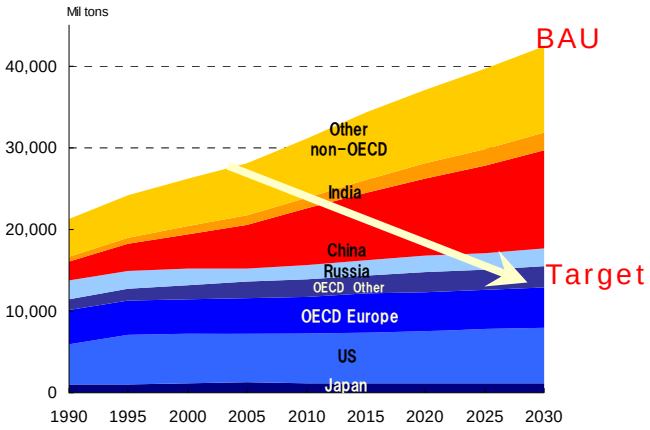
equivalent) in 2005, are projected to increase more than 1.5 times in 15 years in the baseline case, with 2030 emissions marking 42.3 billion tons, the larger part of which is believed to originate in developing countries. As of 2005, emissions from non-OECD accounted amounted to 7% more than that from OECD countries, but is projected to exceed the latter by over 70% in 2030.

Figure 2.3-1 Emissions from Annex I and non-Annex I Countries



Source: IEA

Figure 2.3-2 CO2 Emissions Outlook by Country/Region



Source: EIA

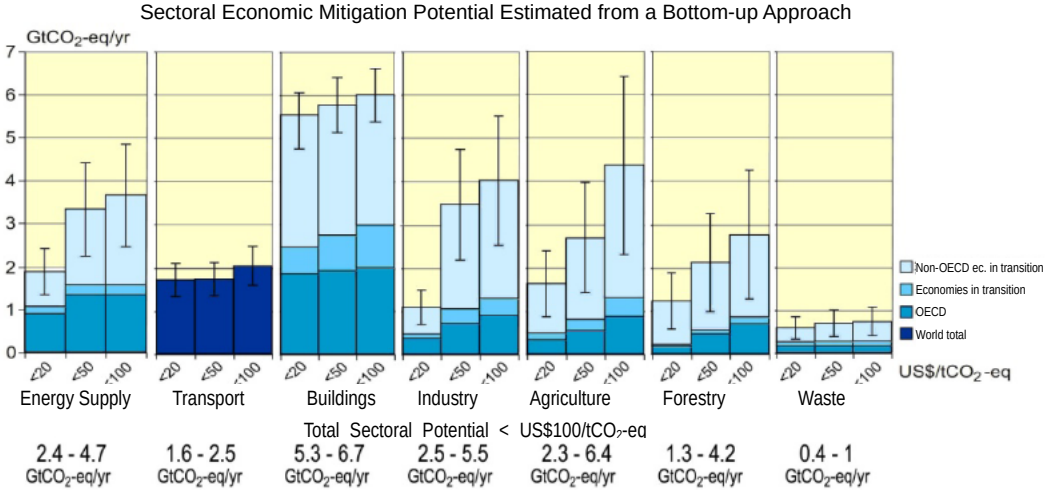
The IEA forecasts for the baseline scenario are similar. However, the IEA holds that additional policy measures[3] can restrain CO2 emissions by over 6 billion tons in 2030 (alternative scenario). The additional measures are greatly reliant on improved energy efficiency; two-thirds of total reduction lies in the two countries. Thus, we are shown that energy efficiency measures have high potential in terms of policy measures and that China and India are marked by high reduction potential in terms of region, implying that how we can engage developing countries in reduction efforts will be a key issue in the post-2012 framework.

2.4. Policy Priorities

Reduction potential for GHG emissions and its costs vary among sectors and technologies. Figure 2.4-1 presents economic mitigation potentials by sector. Mitigation potentials are estimated in seven sectors, namely energy supply, transport, buildings, industry, agriculture, forestry and waste for the cases in which CO_2 prices are under 20 US dollars, under 50 US dollars and under 100 US dollars per ton. The estimations indicate that there is much potential in the buildings sector and that non-OECD countries embrace much potential particularly in the industry and agriculture sectors. Also, the industry sector holds little potential when CO2 prices are relatively low (under 20 US dollars), implying that effective measures entail a certain amount of costs.

[3] The breakdown of the measures is: improved vehicle fuel efficiency and improved efficiency in the industry sector (36%), energy saving by efficiency improvements in household appliances (29%): fuel conversion in power generation sector (13%); increased use of renewable resources and bio fuels (12%); increased share of nuclear power generation (10%) (IEA WEP 2006)

Figure 2.4-1 Estimated sectoral economic potential for global mitigation for different regions as a function of carbon price in 2030

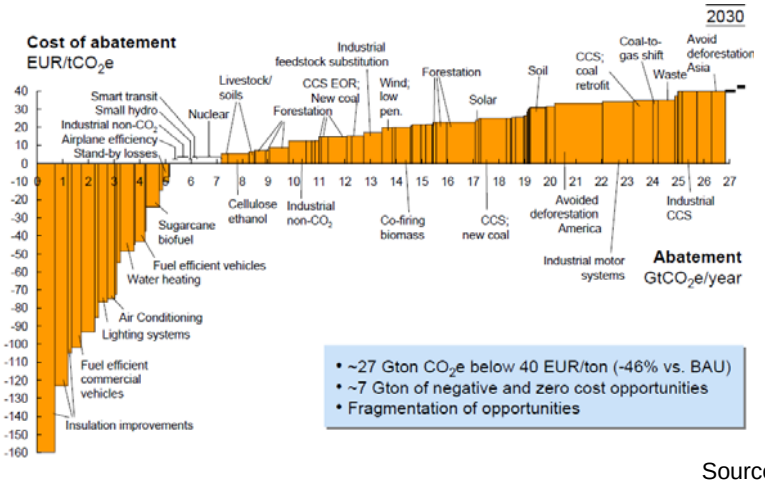


Source: IPCC AR4 WG3

This conclusion matches an analysis conducted by McKinsey. Figure 2.4-2 presents marginal emission reduction costs and reduction potentials in 2030 by measure / technology. The vertical scale represents costs per ton CO2 and the horizontal scale, annual emission reductions; the farther left the bar, the smaller the costs incurred (if costs are less than 0, benefits exceed costs.) The measure to the far left is “insulation improvements” (buildings sector), followed by fuel efficiency improvements, energy saving efforts in lighting and air conditioning. Measures that generate more benefits than costs are estimated to collectively have a reduction potential of approximately 7 billion tons. On the other hand, we learn that although CCS and renewable energies are marked by relatively high reduction potential (wider bars), they are expensive measures.

Because the larger part of Japan’s GHG emissions is coming from CO2, the priority tends to be laid on CO2 emission abatement measures. However, a study of global GHG reduction potentials by sector or by gas shows that non-CO2 gases also have large reduction potential.

Figure 2.4-2 Marginal Abatement Costs by Measure

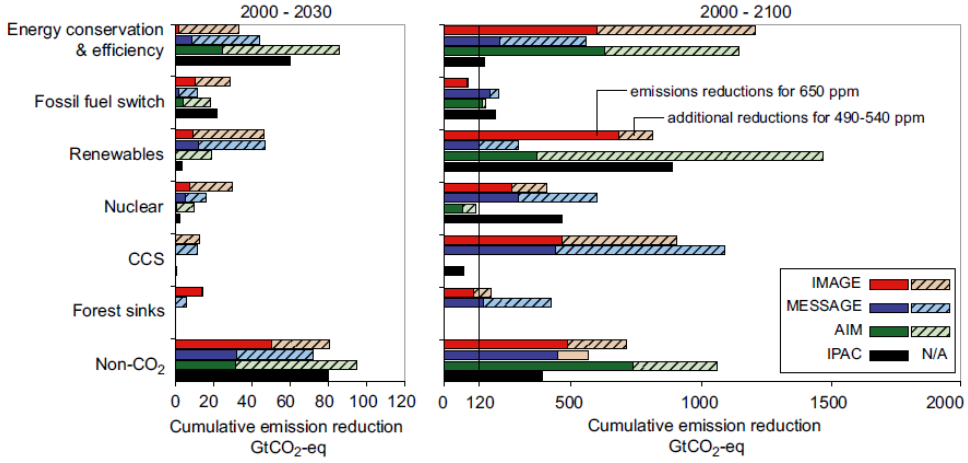


Source: McKinsey

Figure 2.4-3 is a compilation of estimated global accumulated emissions reductions from 2000 to 2100 based on 4 different models. The left-hand graph presents the cumulative emission reductions in the midterm as of 2030 and the graph to the right shows the cumulative reductions in the long-term as of 2100. As Sugiyama (2007) has pointed out, the gases with the largest reduction potential to 2030 are non-CO2 gases, including methane and N2O, which can make larger contributions than energy saving measures.

The current framework tends to focus on national emissions, but a shift of perspectives to an approach based on sector-specific emissions will provide a relatively clear understanding of technologies, costs and potentials, therefore enabling more detailed and constructive debate. A rational sequence of measures to address could be determined by giving priority to less costly and high potential measures.

Figure 2.4-3 Cumulative Emission Reductions in 2030 and 2100



Source: IPCC

2.5. Common but Differentiated Responsibilities

The ultimate goal of the Framework Convention on Climate Change is to "stabilize atmospheric concentrations of greenhouse gases at a level that would prevent "dangerous" anthropogenic interference with the climate system." However, even if Annex I countries (including the US) successfully achieved their emission targets, it would only amount to a global 5.2% reduction compared to 1990 level. CDM/JI projects have made relatively good progress, with over 3,000 projects reducing approximately 2.5 billions tons of emissions developed in 68 countries, but in annual terms they amount to only 0.5 billion tons of reductions, calling for further efforts in order to achieve the ultimate target. IPCC stated in its Fourth Assessment Report that" global emissions must peak in 10 to 15 years and decline to well below half of 2000 levels by 2050;" and hence the growing importance of effective measures that can eliminate GHGs globally.

Therefore, a focal point in the debate on the next framework is how to engage developing countries in committing to mitigating actions. However, developing countries are persistent with the principle of "common but differentiated responsibilities," thus obstructing constructive discussion among developed and developing countries and rather escalating confrontations. Their basic stance is that forcing emissions reductions upon developing countries will limit their opportunities for economic development and that developed countries, responsible for historical emissions, should assume the costs and provide the technologies for reduction. Furthermore, China, India and Brazil

house many CDM projects, promising them the benefits of the current framework which have been developing into vested rights; and thus, there is little incentive to develop a new scheme for these countries.

In terms of living standards and economic development, a large gap remains between developed and developing countries, but from industrial perspectives, developed and developing countries generally share the same technologies, material, production processes and policies. However, there are differences in the resources available, the introduction rate of energy efficient equipment, energy usage, policy barriers and other factors that produce disparities in energy efficiency. Identifying the technologies and best practices, including policy measures by sector, to analyze the gaps with those with the highest efficiency and the reasons for them should help derive policy suggestions for GHG reduction.

2.6. Conclusion

Carbon pricing will lead to increased costs for energy-intensive industries, in particular. Under differentiated carbon controls for Annex I countries and non-Annex I countries, international competition circumstances will be distorted. The global M&A and the development of global supply chains have created circumstances likely to cause carbon leakage. The Kyoto Protocol basically calls for national efforts to reduce emissions, but leaves CO2 emitted from aviation and maritime transport (international bunker oil) to be dealt with by the International Maritime Organization (IMO) and the International Civil Aviation Organization (ICAO), respectively, because it would be difficult to allocate emissions to each country. This is a form of sectoral approach, which could become necessary for cases other than international bunker oil, with accelerated cross-border trade of goods.

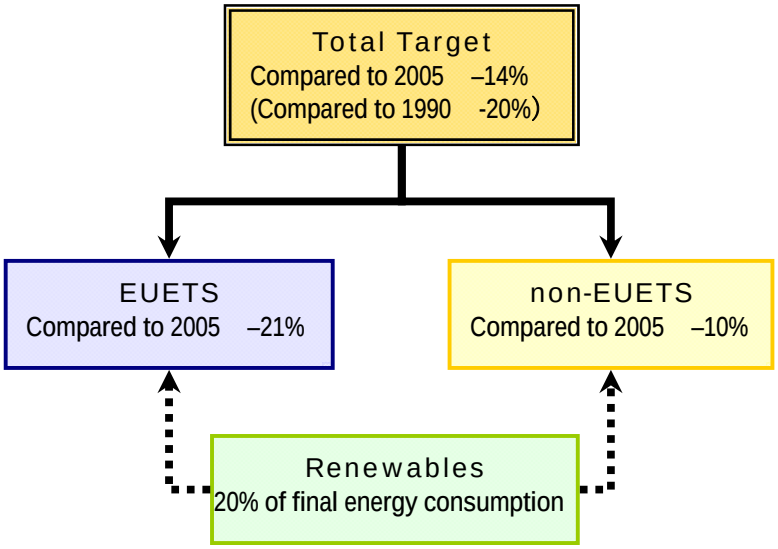
Furthermore, with projections of the increased presence of developing countries, global efforts are required in order to achieve the ultimate goal of stabilizing atmospheric concentrations of GHGs. Generally, developing countries are marked by low energy efficiency and have much room for improvements. Energy conservation usually creates more benefits than the costs entailed and are thus advantageous for developing countries. It should therefore be a priority issue, but the principle of “common and differentiated responsibilities” has stood in the way of constructive debate on global warming countermeasures in current climate change negotiations. Now that the post-2012 framework is being debated, it is appropriate timing to return to the basics to consider which efforts are the most efficient and should be treated with priority.

3. Mixed Expectations of Japan, US and Europe

3.1. Trends in Europe

The EU’s GHG emissions reduction efforts are centered on its emissions trade scheme (EU-ETS), for which sectoral approaches are believed to be a complementary tool. EU has set a minimum target of reducing GHGS by 20% and increasing the renewables share in energy supply to 20% by 2020. On January 23, 2008, the European Commission announced a detailed policy proposal to achieve its targets. The policy package consists of three key proposals, namely: 1) a proposal of amending the EU-ETS; 2) a proposal of numerical targets for Member countries in the sectors not covered by the EU-ETS (transport, buildings, services, smaller industrial installations, agriculture and waste); 3) a proposal of targets for the introduction of renewables.

Figure 3.1-1 Outline of EU's New Policy Package



Source: compiled by author

Emission allocations under the EUETS have originally been grandfathered, but will be auctioned from 2013. Although preferential measures will be installed for sectors exposed to international competition, many energy-intensive industries in Europe are most concerned that the application and enhancement of EUETS will distort their international competitiveness, that they will be jeopardized by imports from developing countries such as China.

Therefore, industries, including iron and steel, cement and aluminum, have been discussing the conclusion of global sector-specific agreements encompassing developing countries and the development of globally fair competitive circumstances with the European Commission's Directorate General for Enterprise and Industry and its Directorate General for Competition. Although they have not yet made any proposals for concrete frameworks and measures, they are expected to consider detailed schemes within the EU with regard to developments in international negotiations.

The European Commission Directorate General for Enterprise and Industry launched the High Level Group on competitiveness, energy and the environment, comprising a membership of European Commissioners, including Commissioner Verheugen for Enterprise and Industry and Commissioner Dimas for Environment, and top executives from Europe's leading companies, such as La Farge and BP, and non-governmental organizations, including WRI and WWF. The Group has met 6 times from February 2006 to November 2007. The meetings have covered a wide range of themes, including the need for new energy infrastructure, the weaknesses of the EU electricity and gas markets and the EUETS' impact on corporate international competitiveness. A report[4] issued at the end of the meetings stated that "a successful 2012 agreement will therefore demand a common approach from developed nations that focuses on achieving economy wide reductions in emissions and will encourage commitments from emerging economies consistent with their differentiated responsibilities."

Seeking to enhance and expand the EUETS, the EU is ultimately interested in keeping companies in the region safe from being placed under disadvantageous circumstances, and therefore

[4] http://ec.europa.eu/enterprise/environment/hlg/doc_07/hlg-fifth-08-11-07.pdf

considers sectoral approaches a tool to secure fair international competition while engaging emerging economies (in particular their carbon-intensive sectors) to further their climate mitigation measures. However, the degree of interest towards sectoral approaches varies among sectors in the EU. The four energy-intensive sectors, iron and steel, cement, aluminum and chemical, show great enthusiasm, while the more domestic sectors, electricity and transport, do not present as strong an interest.

3.2. Trends in the US

The United States' basic policy for climate change issues to present can be summarized into five main concepts: "the participation of developing countries"; "measures combined with solutions for economic development, poverty alleviation and other environmental issues;" and tools for the simultaneous resolution of these challenges, namely "the significance of technology," "cooperative, not standoff efforts" and "collaboration with the private sector."[5]

In July 1997, the US Senate unanimously adopted the Byrd-Hagel Resolution which said that the United States should not be a signatory to any protocol that did not include binding targets and timetables for developing countries. Although under the Clinton Administration the US signed the Kyoto Protocol at the COP3 meeting in December the same year, the President Bush withdrew the US from the Protocol when he took office in 2001 on the grounds of scientific uncertainty, adverse impact on the US economy and the absence of developing countries. Subsequently, the climate change policy of the Bush Administration has been to resolve urgent issues by making intensity improvements through voluntary measures, thus hindering GHG emissions and in the long-term shifting to a low-carbon society as a result of innovative technology development. The US has launched a diversity of non-binding partnerships and forums in order to establish constructive debate and relationships with emerging economies.

In June 2003, it hosted the Carbon Sequestration Leadership Forum (CSLF), which involved the 21 partner countries and the European Commission. It has approved 19 carbon sequestration / storage projects and technology roadmaps to serve as guidelines for international cooperation in carbon sequestration to date. Then, in November the same year, it hosted an International Partnership for the Hydrogen Society meeting, at which 16 countries including the US and developing countries and the EU agreed to promote basic and pre-competition international cooperation and the international harmonization of codes and standards. Subsequently, in 2004, it announced its vision for the Methane to Markets Partnership (M2M) and in 2006, that for the Global Nuclear Energy Partnership (GNEP), seeking to promote the expansion of nuclear energy use for peaceful purposes as well as nuclear non-proliferation.[6]

The Asia Pacific Partnership on Clean Development and Climate (APP) was also established under the initiative of the US. In January 2006, six ministers from Japan, the US, Australia, China, India and Korea gathered in Sydney, Australia and agreed on a Charter to guide partnership activities. Eight sectoral Task Forces were also established with the approach to seek sustainable solutions through substantial action based on public-private partnerships.

These activities of the United States have been founded on the five principles provided above, with a strong emphasis on international cooperation encompassing China, India and other developing countries. Another feature of these efforts is that although they are not clearly described to be sectoral approaches, they are technology-oriented, therefore requisitely based on sectors which share the same practices and sectors.

In January 2008, at a post-meeting press briefing of the Second Major Economies Meeting on

[5] Sugiyama 2006
[6] cf. United States Department of State website (http://www.state.gov/g/oes/climate/)

Energy Security and Climate Change held in Honolulu, Chairman Connaughton of the White House Council on Envrronmental Quality was asked, "As we can see in the Asia Pacific Partnership, the Bush Administration is supportive of sectoral approaches. How are sectoral approaches linked with national plans? Will sectoral approaches have a special role in the post-Kyoto framework?" and answered, "Sectoral approaches are relevant in both national plans and the post-Kyoto framework. National plans are already generally sector-oriented, so sectoral strategies should internationally expand very rapidly."[7] As this statement implies, in one aspect the US considers sectoral approaches to be approaches that coordinates domestic policy with international frameworks.

3.3. Trends in Japan

Serious discussions on sectoral approaches in Japan were initiated in October 2005, at the Tenth Meeting of the Special Committee on a Future Framework for Addressing Climate Change, Global Environmental Subcommittee, Environmental Committee, Industrial Structure Commission, with the debate on "Sectoral Approaches for the Deployment of Existing Technologies."

Sectoral approaches were originally studied in Japan as a countermeasure against emissions in major developing countries. With emissions increasing drastically in China and India, concerns that once industrial infrastructure was established, it would be used for a long period of 40-50 years, and thus countermeasures needed to be implemented promptly. The overall tone of the Special Committee is that concrete sectoral cooperation efforts should be considered. On that basis, the Committee concludes that sectoral approaches are effective from the perspectives of: 1) promoting concrete technology transfer; 2) securing equity; 3) preventing leakage; 4) the scale of reduction potential; 5) simplifying CDM procedures; 6) the appropriateness as indicators for emissions reduction efforts by developing countries; and 7) preventing hot-air.

It was also around the same time that, given the adoption of the Gleneagles Plan of Action on climate change at the Gleneagles G8 Summit in July 2005, the IEA began benchmarking, comparing energy consumption intensities and efficiency standards and identifying best practices for each sector, including industry, construction, transport and household appliances. Also in July the same year, against the backdrop of new visions for the Asia Pacific Partnership on Clean Development and Climate (APP), a road map for advancing cooperation with China and India based on Japan's outstanding energy-saving technologies was presented. Working in sectors, the APP, in particular, has activated cross-sectoral dialogue, has searched for possibilities of cooperation within the private sector, including concrete technology transfer, and has promoted activities to engage developing countries as well.

The Japanese industrial sector is also supportive of these technology-specific sectoral approaches. In April 2007, the Japan Business Federation (Nippon Keidanren) stated that "Sectoral approaches like the Asia-Pacific Partnership on Clean Development and Climate (APP) are effective mechanisms for efficiently sharing and disseminating industry's knowledge and information. It is important to steadily promote bottom-up strategies to ensure that effective measures are put into concrete practice." in a position paper titled "Toward the Post-2012 International Framework on Climate Change."

Japan strongly supports sectoral approaches not only because it is interested in engaging developing countries but also because it seeks more equitable and convincing targets in the framework to come. However, it must be noted that the term "sectoral approaches" used here does not refer to concrete efforts like those described above but to a methodology to estimate quantified targets.[8] Having had experienced two oil shocks, Japan had developed and introduced energy

[7] http://www.nedodcweb.org/report/2007-11-7.html

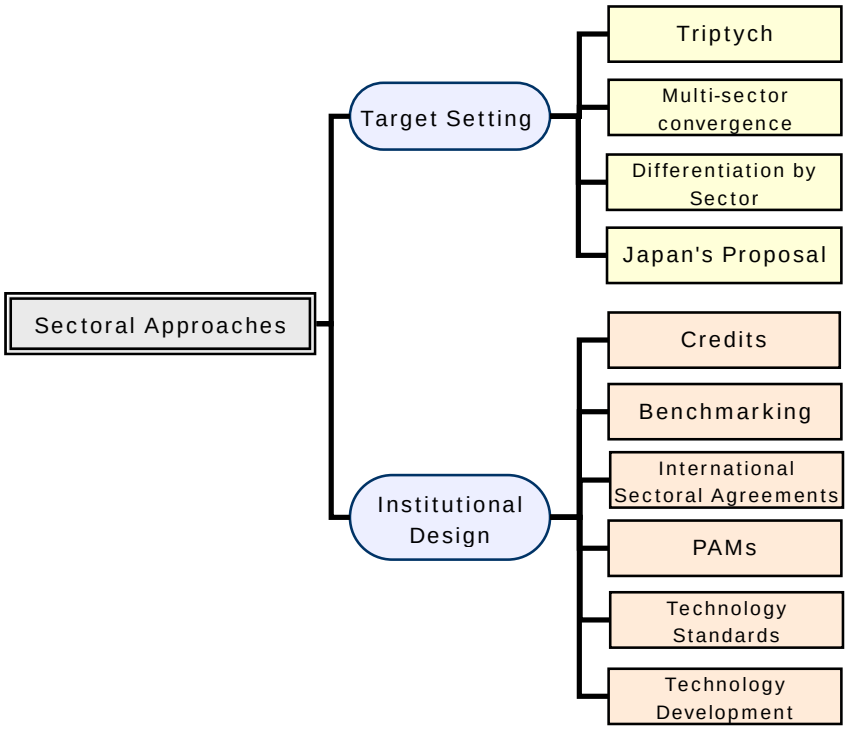
[8] The term "sectoral approaches" is actually often used not clearly defined and thus frequently causes confusion. Details

conserving technologies long before other developed countries did. Nevertheless, the Kyoto Protocol imposed large national reduction targets, second only to the EU (EU: 8%, Japan 6%), causing the deep-seated frustration that its historical reduction efforts had not been justly acknowledged. Against this background, Japan advocates the adoption of a sectoral approach to determine national emission target for greenhouse gases by a bottom-up aggregation of estimated sectoral reductions. This approach will give regard to past efforts, thus leaving countries such as Japan marked by high levels of energy efficiency with relatively low emission targets.

Japan has reflected its views in its "Submission to the Ad Hoc Working Group on Long-Term Cooperative Action under the Convention," submitted to the UN Secretariat in March 2008. It proposed an approach to determine national emission targets by aggregating sectoral reductions for mid-term target setting (measurable, reportable and verifiable method) and a cooperative sectoral approach as a method for mitigation-related domestic / international action and technology development and transfer

4. Types and Functions of Sectoral Approaches

Figure 4-1 Categorization of Sectoral Approaches



Source: compiled by author

Although definitions for sectoral approaches are diversified, they can be largely divided into two groups, namely, "sectoral approaches for target-setting" and "sectoral approaches for

elaborated in Jusen Asuka (2008).

institutional design". Of the proposals made in Japan's submission to the UNFCCC, it can be said approaches for mid-term target setting fall under the former group, and cooperative sectoral approaches, under the latter.

"Sectoral approaches for target-setting" are methods to calculate figures to serve as a basis in negotiations on national reduction targets and include the Triptych, Multi-Sector Convergence, Differentiation by Sector and Japan's Proposal. These methods are based on the idea that given the differences in national economic structure and economic development levels and the availability of resources, a sector-specific bottom-up approach will enable more equitable target-setting.

The other set of approaches, "sectoral approaches for institutional design," encompasses sector-specific credits, sectoral benchmarks, international sectoral agreements, policies and measures and Technology Standards and technology development agreements. Proposals from this group have often originated in the interest in increasing the involvement of developing countries and addressing leakage and competitiveness issues. These approaches are focused on how to establish an effective scheme. This section will discuss what role is expected of sectoral approaches in addressing leakage and developing country issues.

4.1. Sectoral Approaches for Target-Setting

The Kyoto Protocol imposes reduction targets on developed countries, referred to as Annex I countries, more specifically, -6% on Japan and Canada, -7% on the US and -8% on the EU compared to 1990 levels. These targets have not been determined on scientific grounds but are rather outcomes of political compromise. Industrial structure, availability of domestic resources, potential of CCS and renewable resources, access to domestic and imported energy and climate conditions vary among countries, and thus, the viability of GHG emissions abatement measures and their costs are also naturally diverse. Approaches that analyze these circumstantial differences in detail and divide domestic emissions into several sectors, each for which emissions levels are determined so that analyzed differences may be reflected in target-setting are referred to as "sectoral approaches for target-setting." Presenting clear calculation methods and having more consideration for equitableness, they should be relatively acceptable approaches for different countries. There are some variations depending on the ways of distinguishing sectors or ways of determining emission levels for each sector. The features of four types of approaches, Triptych, Multi-Sector Convergence, Differentiation by Sector and Japan's Proposal, will be discussed here.

4.1.1. Triptych

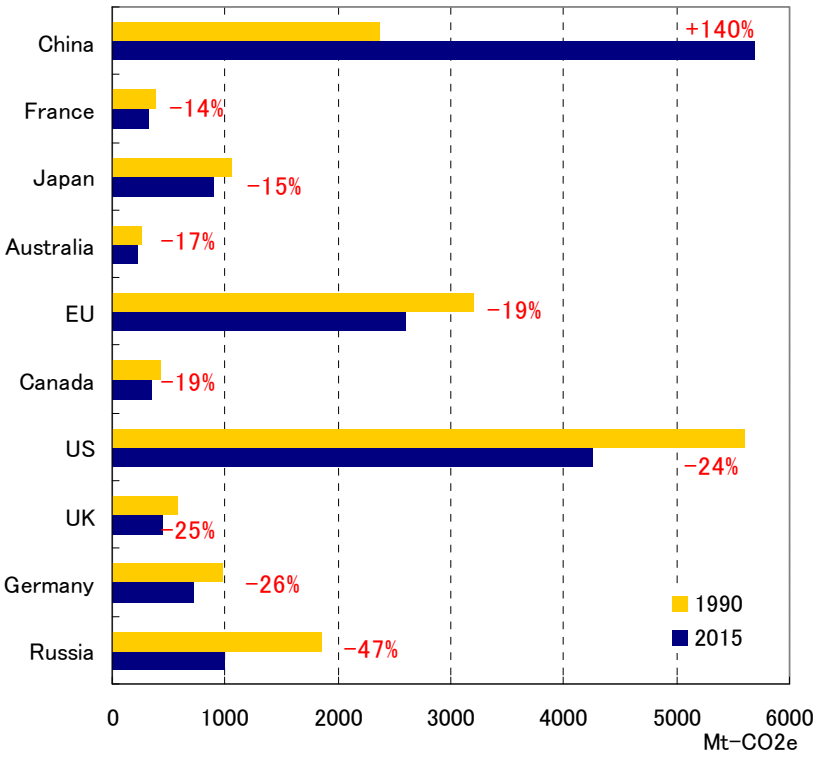
The Triptych Approach was originally developed at the University of Utrecht by Professor Blok and his assistant Phylipsenby et al. at the request of the Dutch government as a tool to determine emission reduction targets within the EU. The basis concept of the approach is to maintain the equitability of the strictness of emissions reduction measures differentiates targets depending on national circumstances.

The Triptych Approach categorizes a country's emissions sources into three sectors, namely, the energy-intensive industry, the power producing sector and the domestic sector, each for which emissions target levels were calculated[9] to be later aggregated to determine the national allowance. Considering the population, economic growth, industrial structure, living standards and power mixture, varying among countries, it is a well-balanced approach with high political acceptability and therefore served the basis for negotiation to determine burden-sharing within the EU in 1997.

[9] Sectoral emission levels are estimated only for the calculation of national allowances. This is because determining domestic targets and commitments for each sector will inhibit the promotion of the most cost-effective emission reduction measures in each country.

Since its employment in the EU, this approach has continued to be studied for wider application at the global level.

Figure 4.1-1 Triptych Approach Calculations



Source: Gloenenberg and Phylipsen (2001)

The greatest challenge faced by this approach is the difficulty of acquiring reliable data, the quality of which is a problem especially for East European and former Soviet countries and developing countries (power producing sector, in particular). Improvements required include incorporating considerations for factors such as the potential of renewables in the power production sector, domestic resources and climatic conditions.

4.1.2. Multi-Sector Convergence

The Triptych Approach had originally been developed to determine emission levels assigned among EU countries with similar economic levels. A global application of the approach would involve large national discrepancies, and would therefore require a more careful arrangement. The Multi-Sector Divergence Approach is based on a concept close to that of the Triptych Approach in the sense that it aggregates target levels for each sector, but it comprises seven sectors (power, household, transport, industry, services, agriculture and waste), thus more accurately reflecting national circumstances. The approach was jointly developed by Norway's Center for International Climate and Environmental Research (CICERO) and The Netherland Energy Research Foundation

(ECN). However, because it requires more detailed data than the Triptych Approach, it also faces the serious problem of not having access to reliable data. Developing a formula to determine sectoral emissions abatement standards, allowance factors and an empirical study of potentials for the introduction of renewables are also called for.

4.1.3. Differentiation by Sector

The Differentiation by Sector approach is based on the Triptych Approach developed by Sugiyama et al. at the Central Research Institute of Electric Power Industry to enhance its advantages and to overcome its shortcomings.

The Triptych Approach has several disadvantages, including 1) the arbitrariness in its parameters, such as energy efficiency improvement ratios and energy power mix; 2) inadequate consideration of the energy supply-demand balance; 3) the lack of consideration of country-specific sectoral technological potential regarding renewables and CO2 storage. Therefore, it was disadvantageous for Japan with limited renewable resources and small CO2 storage potential. The Differentiation by Sector Approach aims to determine fair and viable numerical targets through explicit consideration of these issues.

4.1.4. Japan's Proposal

Japan presented its views regarding sectoral approaches for mid-term target-setting in its "Submission to the Ad Hoc Working Group on Long-Term Cooperative Action under the Convention" of April 2008. Under this approach, national GHG emissions will be segmented by sector, namely, power generation, energy-intensive industries (iron and steel, chemical, cement, pulp and paper, aluminum), other industries, consumer (commercial / household), transport (cargo / passenger), agriculture, land use, land use change and forestry (LULUCF) and waste, for each of which reduction potentials will be aggregated to determine the total national emissions. Compared to the Triptych and Multi-Sector Convergence Approaches, it is divided into more specific sectors and its sectoral targets are not per capita consumption but aggregated reduction potentials estimated based on energy efficiency. However, with more detailed sectoral division, it faces a larger problem of accessibility to reliable data.

4.2. Sectoral Approaches for Institutional Design

Judging from negotiations to date, it is unthinkable that non-Annex I countries would accept the same national emission targets as Annex I countries. It is essential for developing countries to make some kind of commitment, national emission target or not, and promote measures. At present, a diversified and flexible framework that can encompass all countries is being sought. Sectoral approaches as an institutional framework and as a tool for its implementation is one of the solutions. Here we will call this "sectoral approaches for institutional design." Organizations such as the OECD/IEA, the WRI, the Pew Center and the CCAP have made various proposals for the details of institutional design. In this report, they will be classified into six groups, namely, Sectoral Credits, Sectoral Benchmarks, International Sectoral Agreements, PAMs (including SD-PAM), Technology Standards, Technology Development Agreements, to discuss their features and strong and weak points.

4.2.1. Sectoral Credits

A sector-based CDM is an extended version of the conventional project-based CDM that covers a whole sector all efforts in an entire region. The advantages[10] of this type of CDM are that:

[10] M.G.J den Elzen & M.M. Berk (2004)

1) built upon an existing scheme, it would be highly compatible with the current framework; 2) it provides incentive for developing countries to convert entire sectors; 3) it is more acceptable for developing countries; 4) it is more cost-effective due to lower transaction costs and thus economies of scale. On the other hand, its shortcomings are that: 1) developing countries lack the capacity for appropriate implementation and monitoring; 2) it is difficult to establish reliable baseline projections; 3) it entails risks of deceptive emission reductions and excessive sales.

There are largely three types of credit allocation mechanisms: "policy-based credits" generated with the introduction and implementation of climate change measures addressing specific sectors, "sectoral emission caps," which generate credits worth of the reductions achieved from a set emissions cap and "intensity-based credits" generated when emissions become less than a certain intensity level.

The "No Lose Target" scheme proposed by the CCAP is a version of sectoral emission caps where major sectors in developing countries establish voluntary targets. If they successfully achieve the target, they are granted credits equivalent to the difference with actual emissions but there is no penalty for nonfulfillment.

Sectoral Credits will be allocated to rivals in non-Annex I countries without reduction commitments and thus are also subject to the criticism that it does not solve competitiveness issues. It has been pointed out that it could be adopted as a transitory measure before developing countries take on commitments but that in the end a road map imposing national targets on developing countries will need to be designed.

4.2.2. Sectoral Benchmarking

Benchmarking is a methodology for systematic improvement originally developed as a management tool that compares best practices inside and outside the sector with one's own processes, analyzing the gaps and improving the prevailing operating processes. Sectoral Benchmarking is an adoption of this methodology in energy conservation efforts. Technologies and practices are basically unique to the sector; therefore, if the best practices providing each sector with foothold can be defined, rational emission mitigation measures can be implemented for their dissemination.

Such procedures would involve visualizing energy conservation measures by using energy efficiency indicators, etc., then measuring and determining the gap between the benchmark. Then the reasons for the disparity in efficiency are analyzed. If factors such as production efficiency, introduced technology, available resources or institutional impediments are identified, then detailed policy implications and effective measures can be derived.

"Cooperative Sectoral Approaches" proposed in Japan's Submission to the Ad Hoc Working Group on Long-Term Cooperative Action under the Convention submitted to the UNFCCC Secretariat is based on this approach. In more specific terms, it proposed that sector-specific best practices should be studied, at the same time identifying the technologies that have already been introduced and the technologies and policies that could be installed in developing countries. Seeking to ensure that developing countries set ambitious goals and engage in substantial reductions and to establish a system that promotes technology transfer on a commercial basis with due consideration to the protection of intellectual property, it follows the efforts currently made through the Asia Pacific Partnership.

Benchmarking can be employed for the appropriate evaluation and treatment of businesses that have already made progress in energy conservation efforts. For example, the Dutch government and its provincial governments concluded a "Benchmarking Agreement" with industry groups representing the power generation, chemical, iron and steel, non-ferrous metals, pulp and paper industries in 1999. Under the agreement, companies are committed to become listed among the top

energy efficient companies of the world by 2012 in exchange for assurance from the government that they will not be subject to any additional measures regarding energy conservation or CO2 emissions, including special energy taxes and mandatory emission caps.

4.2.3. International Sectoral Agreements

Sectoral Agreements are agreements of particular sectors, such as civil aviation, steel production and automobile manufacturing, at a global level on sectoral emission reduction targets and manufacturing process or product-related targets (regulations on minimum performance standards or low-emission technology use). A pioneering example is an agreement between the EU and the European Automobile Manufacturers' Association (ACEA). It has set the voluntary targets of achieving fuel efficiency of 140g-CO2/km by 2008 and 120g, by 2012. However, a challenge faced by sectoral agreements is that although international agreements are comparatively easy to apply in the industrial and transport sectors, they are difficult to introduce in the energy generation (conversion), agriculture, sevices and household sectors that are strongly dependent on circumstances unique to the region and unexposed to international competition.

These agreements can be applied in a scheme to expand commitments by developing countries. In more concrete terms, when it is considered too early for developing countries to commit to national targets, particular sectors can commit to sector-wide intensity-based or quantity-based reduction targets for GHG emissions or energy use and efficiency. Because particular sectors instead of entire countries can make the commitments, these agreements are relatively acceptable for developing nations, consequently enabling them to participate in international emissions trading at an early stage. The involvement of developing countries will reduce leakage risks and mitigate the distortion of competitiveness. On the other hand, the shortcomings of these agreements is that they are difficult to monitor and that if a sector independently sets its own targets it becomes difficult for countries and companies to implement cross-sectoral measures and that when a product is replaceable with another product made in another sector, there are leakage risks between products or materials.

4.2.4. PAMS

Policies and measures (PAMs) are a framework to implement policies and measures for GHG reduction based on international evaluation and cooperation. Those focused on the sustainable development (SD) of developing countries, in particular, are called SD-PAM.

The concept of international policy cooperation is to have a number of countries cooperate in implementing policies in order to generate a larger policy effect than would be created were the policy implemented in just one country. For example, if carbon taxes and emission caps in the EU-ETS were implemented in just one country or region, the price of products from that one country or region would rise, undermining its competitiveness Thus, it would be more effective to implement them under international cooperation instead of solely in one country.

However, internationally coordinated policies can limit a country's policy options; thus, this kind of approach tends to be unwelcomed by the United States and other countries which resent interference with national policy. In At COP 1, held in Berlin in 1995, Parties adopted the Berlin Mandate, which provided that developed countries would set numerical targets for greenhouse gas emissions and that a Protocol stipulating the policies and measures to be taken by each countries for their achievement would be adopted at COP3. Against this backdrop, the EU proposed measures including the harmonization of the minimum tariff of fuel taxes, preparatory work for the establishment of a common framework for environmental taxes, the abolishment of subsidies for fossil fuels, energy efficiency improvements including the application of standards and labels, fuel conversion to energy sources with low carbon content and measures addressing international

aviation and ships. These proposals listed a significant wide range of measures addressing the energy, transport, industry, agriculture, forestry, waste and fluorocarbons sectors, thus fully covering all major GHG reduction policies. However, the United States opposed the policy adjustment on the grounds that policies and measures should be self-initiated and based on national circumstances. Therefore, PAMs could not be implemented based on the cooperation of all developed countries.

SD-PAMs are different from the PAMs discussed by developed countries in climate change abatement because they are focused on the sustainable growth of developing counties. The procedures proposed for the development of these measures are to first prioritize measures, then identify how to integrate sustainable development with climate change measures and finally quantify emissions reductions. Providing developing countries with incentive, sectoral CDMs granting developing countries credits are said to promise high compatibility with SD-PAMs. However, Ellis et al. (2007) have pointed out that integrating SD-PAM into the future framework would need to overcome the difficulties of assessing SD-PAM (submission, approval, registration, monitoring , verification) and defining policy effects.

Some PAMs can also be linked with financial support measures. The Multilateral Fund designed under the Montreal Protocol[11] provides an example of financial support through funds. Support from the Multilateral Fund had initially been project-based but even if a facility was closed in one area, another would be newly built in another, not leading to emission reductions at the national level. Therefore, in 1997, a "sectoral approach" in which the Multilateral Fund and the Chinese government would have to agree on a sector's Phase-Out Plan for funds to be later provided according to the progress made, was introduced. Transaction costs were reduced significantly under the new scheme, which grants governments funds for sector-wide performance and does not require the examination of the qualifications of each project. This advantage has contributed to the drastic reduction of CFCs since the adoption of this approach.

4.2.5. Technology Standards

Technology Standards are agreements under which parties are committed not to reduce GHG emissions but to adopt internationally common technology standards, such as those for the energy efficiency of appliances, insulation level of housing and the use of zero-carbon technology (minimum share of renewables). Edmonds (1999) has proposed that CCS technology should be installed in every new thermal or combined power plant built in developed countries.

An agreement on technological standards that is often introduced as a successful example is the MARPOL Convention[12] It comprises a convention and protocol designed with the objective of preventing marine pollution due to the sailing and accidents of ships and stipulates the prohibition of dumping and exhausting regulated substances, reporting requirements, procedures and technological standards.

In 1972, the US enacted a domestic law with the objective of preventing marine pollution caused by oil tankers and set a level of pollution prevention technology which ships would have to clear in order to be admitted entrance into its ports The US urged other countries to establish similar laws and MARPOL was adopted in 1973 as a result its campaign. However, because the ratification process in each country was delayed, the US implemented measures to refuse the entry of

[11] Protocol with the objective of identifying substances that deplete the ozone layer and control the production, consumption and trade of such substances (adopted 1987, entered into force 1989). A Multilateral Fund was established to provide developing countries with financial support for its implementation.

[12] The formal name is "International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978." MARPOL is the abbreviation of MARine POLlution. Detailed descriptions can be found in Ueno, Sugiyama (2006).

nonqualified ships into its ports, triggering the amendment and enhancement of MARPOL in 1978, after which major countries inlcuding the US adopted technology standards which would limit the ports where international ships could make a port call. Thus, shipping companies also adopted the standards in order to secure ports of call[13]. This example implies that if a certain number of countries can cooperate, the network effect can synergistically generate wider effects.

The RoHS[14], WEEE[15] and REACH[16] recently adopted by the EU also have had similar effects. When an adequate number of countries adopt a technology standard and the standard is developed as a benchmark, other countries and industries will tend to act in conformity with that common standard in order to secure market access, thereby driving economies of scale in and network effects in production and enhanced self-enhancement mechanisms.

The application of technology / performance standards such as Minimum Energy Performance Standards (MEPS) for household appliances and insulation standards for buildings effectively encourage consumers to use efficient technologies and products but has been debated in terms of the industrial sector. Opposing arguments include concerns over 1) technological lock-in, or that future technological development may be avoided, thus stagnating efficiency improvements in the long-term, 2) the susceptibility of regulations regarding specific technologies to political pressure from stakeholder organizations and 3) trade frictions resulting from standards with a similar character to trade regulations, despite WTO rules acknowledging non-preferential product standards.

4.2.6. Technology Development Agreement

It is often pointed out that because the Kyoto Protocol's main focus is on cost-effective reduction measures for the short-term, its current system has not provided enough incentive to convert the economic or social structure. In order to achieve the long-term climate change target to stabilize GHG concentrations, emissions must be reduced globally and rapidly and thus requires large investments in technology and the application of new innovative technology.

Technology agreements are international agreements with the objective of promoting research and development and demonstration of technology and can be classified into several different types, including knowledge sharing, technology development and technology transfer. Barrett proposes that in order to promote technological research and development, countries could commit to providing financial support for such research and development programs and share outcomes of research and development among parties through exemption from patent and license fees. The introduction of relatively costly new technologies into the market involves policy measures, including technological regulations such as MEPS, market share requirement for new technologies (renewable energy or carbon free vehicles) and market creation through government procurement programs. Technology agreements aim to cooperatively implement such efforts to give further impetus to technology development.

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[13] Refer to Ueno, Sugiyama (2006) for details.

[14] Restriction of Hazardous Substances (RoHS): Directive of the European Parliament and of the Council on the restriction of the use of certain hazardous substances in electrical and electronic equipment. Issued in February 2003 with WEEE Directive and implemented in July 2006.

[15] Directive of the European Parliament and of the Council on Waste Electrical and Electronic Equipment (WEEE Directive)

[16] Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) Adopted on December 13, 2006; implemented on June 1, 2007. Requires manufacturers and importers to study the impact of all chemical substances (1 ton/year or more) on humans and the environment and apply for authorization of and register substances at the European Chemicals Agency .

Table 4.2-1 Types of Technology Agreements

Agreement Type	Outline	Examples
Knowledge Sharing	Meetings, plans, information exchange	Carbon Sequestration Leadership Forum, coordination & harmonization of research agenda and standards
RD&D	Joint RD&D, establishment of funds	ITER fusion project, mutual agreement of domestic RD&D policy
Technology Transfer	Provision of funds for technologies & projects	GEF, flow from developed countries to developing countries, international licenses, promotion of protection of patents
Mandatory technology introduction, standards, incentives	Promotion of particular technologies or technology groups	RPS, automobile fuel efficiency, efficiency standards for household appliances, subsidies for renewables

Source: Coninck et al. (2007)

However, overall emission targets are difficult to establish and enormous investments in new technologies may not lead to GHG emissions reductions. There is also concern that least developed countries lacking the capacity to participate will end up having no substantive part in reductions.

5. Challenges for Sectoral Approaches

Sectoral approaches are as varied in their challenges and issues as they are in their features and functions. They are also often challenged with the questions: "Are sectoral approaches really effective?" "Which actors should assume responsibility?" "Are aggregated sectoral targets really appropriate?" This section will discuss the challenges faced by sectoral approaches from the aspect of effectiveness, legal issues and data collection.

5.1. Effectiveness

M.GJ. den Elzen, M.M.Berk (2004) has noted that although bottom-up approaches could become an important factor of a future framework, they lack certainty regarding environmental impacts and cannot replace the climate change regime with quantitative emission reduction targets. As suggested, even if agreement can be reached on sectoral efficiency targets or standards, their overall environmental impact is uncertain. Even if efficiency targets are achieved, the economy could be activated, resulting in expanded activity and thus increased final emissions, in which case an efficiency improvement target exceeding the economic growth rate must be introduced for the reduction of total emissions. Also, since negotiations are conducted within each sector in sectoral approaches, negotiation processes may become complicated. Furthermore, sectoral or partial optimization may not always lead to total optimization.

5.2. Legal issues

In the event that international sectoral agreements are adopted, the legal status of the parties to the agreement will become an issue. Assuming that sectoral GHG emission reductions will be agreed upon within the world's major sectors, non-state actors such as the International Aluminium Institute (IAI) and the International Iron and Steel Institute (IISI) would have to become involved. Under current international law, only states and international organizations have legal status and can become parties to international treaties. A new legal regime will be necessary if other actors are to become parties to an international agreement.

GHGs emitted from international aviation and international shipping are under the control of ICAO and IMO, respectively. ICAO and IMO are both specialized agencies to the UN and

international agreements, rules and regulations are negotiated and approved by member states within the frameworks of these organizations. IMO and ICAO can formulate guidelines towards reduction or conclude legally binding agreements, which would require the approval of member state representatives. Furthermore, the ratification of the agreement would usually call for the approval of the member state's national legislature.

However, although the IISI and the IAI are international industry organizations, they are governed by the laws of the nation in which their head office is located and thus it is not within their power to conclude or implement any international agreement. Kati Kulovesi and Katja Keinanen (2006) suggest that a new international law regime is necessary.

5.3. Data Collection

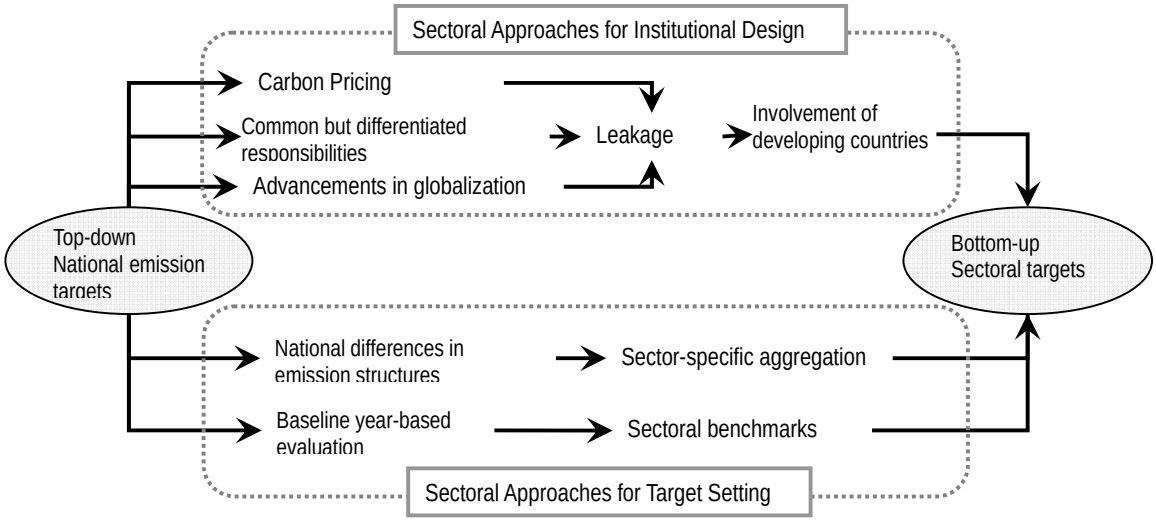
In many cases when data become necessary for target-setting or as assessment indicators such as sectoral benchmarks, the relevant data is unavailable, or even in instances that such data do exist, they are unreliable. Groenenberg (2001), who developed the Triptych Approach, notes that data for former Soviet and East European countries and those for developing countries (power generation sector data, in particular) have especially poor quality, that IEA data is incomplete, that UNFCCC data (national reports) consist of only those for Annex I countries and that the data has not been sorted into specific categories. Also, it is unlikely that existing energy statistics can be valid for sectoral benchmarking, in which case assessment boundaries must first be set and detailed data collected in that context. In addition, CO2 emissions per kWh are dependent on the country-specific power mix and it is not rare that the emission factor for electricity is disputed. Data quality must be carefully considered because deriving policy implications based on inappropriate data can invite misleading results.

6. Conclusion

The essence of sectoral approaches is taking a bottom-up approach to carefully implement policies and measures based on sector-specific circumstances, best practices and technologies. One of its advantages is that it can be used to identify technologies and experiences with high potential requiring little cost and promote rational measures founded on technological grounds. Also, domestic emissions can be divided into several sectors, for each of which target levels can be calculated and by aggregating the sectoral target levels from a bottom-up approach, national emission structures and industrial structures, living standards, power mix, competitiveness of internationally competitive industries can be compared, thus enabling the establishment of more equitable and objective targets.

Sectoral approaches are highly expected as a powerful alternative to expand the commitment of developing countries to GHG emission abatement. This is because by considering sectors to be actors, countries can overcome their differences based on "common but differentiated responsibilities" and implement more technologically appropriate global warming countermeasures. If cross-border sectoral targets can be set, then competitive circumstances are unlikely to be diversified among the companies of the same sector. Also, if targets can be represented by energy efficiency or emission intensity, hot air issues can be prevented.

Figure 6-1 Conceptual Diagram of Sectoral Approaches



Source: compiled by author

However, there have been many proposals for sectoral approaches and reactions have also varied among countries. The EU has been considering sectoral approaches from concerns for the competitiveness of energy-intensive industries. Therefore, the iron and steel, cement and aluminum sectors have shown great interest, whereas the electricity and transport and other domestic sectors are indifferent. On the other hand, the US is focused on the involvement of developing countries and technology and addressing a wider range of sectors, thus launching the APP, IPHE, GNEP and CSLF. Although the US strongly supports the bottom-up approach at present, it could change its position as soon it becomes accompanied by legal binding force. It must be noted that the US, resenting to interference from other countries, could choose to leave room for domestic discretionary policy instruments.

The sectoral approaches currently advocated by Japan have the potential of encompassing a wider range of countries than the Kyoto Protocol, thus establishing a more equitable and rational framework. However, global warming negotiations are also susceptible to the power balance in international politics. Japan is expected to exercise its leadership with consideration for trends in the EU, with its main focus on the EU-ETS and on the effort of energy-intensive industries, and for the behavior of the US, which is currently promoting measures in line with sectoral approaches but could promptly change its attitude should its domestic policy be affected.

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