Climate Change Policy and its Indication to Supply Chain Decision-Making

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Companies are facing challenges from how to reduce their environmental impacts (especially greenhouse gas emissions) and how to fulfill their social responsibilities. Supply chain serves as the main cost driver in the company; it is also one of the main sources (mainly form transportation) of greenhouse gas emissions. In this paper, we explore climate change policies and focus on the policies that mitigate climate change and specifically relate to supply chain decisions such as transportation and distribution. Environmental taxes and tradable emission permits are the most prominent new climate change policies adopted over the past 10 to 20 years. We conduct an analysis based on the public data and general information of the fuel taxes and the cap-and-trade programs in the United States and European Union. From the analysis, we find (1) cost certainty of the fuel tax in both United States and European Union is verified; (2) compared to European Union, the rate of the current U.S. fuel tax shows larger benefit uncertainty; (3) cap and trade in both U.S. and European Union shows benefit certainty; and (4) cost certainty/uncertainty is difficult to assess without detailed information about trading in a cap-and-trade program. The contribution of this paper includes (1) a comprehensive literature review of climate change/environmental policies and a classification of all policy options; (2) a preliminary quantitative analysis of fuel tax and carbon cap-and-trade program and their impact to the transportation aspect in supply chains.

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I. INTRODUCTION

There is increasing global awareness of the threat posed by climate change in the 21st century. Global warming is one of the most serious climate change threat the human beings are facing. The development of global warming is primarily caused by the increasing concentration of greenhouse gases (GHGs) produced by human activities such as burning of fossil fuels, cement production, and land use changes. GHG emissions have grown 70% between 1970 and 2004; and the largest growth comes from energy supply, transportation and industry (IPCC, 2007).

As a consequence, many companies are facing challenges from how to reduce their environmental impacts (especially GHG emissions) and how to fulfill their social responsibilities. Before the recent climate change threat, most companies used to focus on how to reduce costs from their logistics and supply chain management such as procurement, production, inventory, and distribution.

The recent trend is that decision makers in a company are taking the consequences of their decisions for climate change into account. Their priority is not merely to reduce costs anymore but also to reduce GHG emissions. Additionally, there are a growing number of policies that are particularly relevant and explicitly targeted at corporate GHG emissions reduction. Therefore, it is critical for companies to react to these policies and mitigate GHG emissions in a timely manner.

As discussed, the role of supply chain management is important to the company decision makers. Supply chain decision-making determines whether the company can produce the products and ship to its customer at the least cost. From the cost's perspective, transportation and distribution are critical functions in a supply chain. From the environmental impact's perspective, transportation and distribution produce a significant amount of GHG emissions. To reduce the GHG emissions in a company, decision makers should investigate its supply chain especially the transportation and distribution functions.

In this paper, we explore climate change policies and identify the policies that have close relationship to supply chain decision-making. We use publicly accessible data to test how effective these policies are. The rest of the paper is organized as follows. We first conduce a comprehensive literature review of climate change policy. Then we discuss how effective these policies are and how they affect supply chain decision-making. At the end, we provide some concluding remarks and point out future directions.

II. CLIMATE CHANGE POLICY LITERATURE REVIEW

In the literature, there are many existing taxonomies of climate change policies that are particularly relevant and explicitly targeted at greenhouse gas (GHG) emissions reduction (e.g., Dessler and Parson, 2010). In this paper, we focus on the policies that mitigate climate change and specifically relate to supply chain decisions such as transportation and distribution. As a result, we propose a new taxonomy of climate change policies that have direct and indirect impacts to the supply chains. Three types of policies are identified in this taxonomy, which include market-based regulatory mechanisms, conventional regulations, and voluntary approaches.

2.1. Market-Based Regulatory Mechanisms

Market-based regulatory mechanisms are the most prominent new climate change policies adopted over the past 10 to 20 years (Dessler and Parson, 2010). These policies pursue environmental goals by providing emission reduction options through the market. And individuals have the flexibility to choose their response to the market. The two most commonly discussed market-based regulatory mechanisms are environmental taxes and tradable emission permits.

An environmental tax is defined as a tax or fee charged from firms or consumers to compensate their caused environmental damages. When applied to GHG emissions (mainly CO_2 emissions), it is generally called a carbon tax. The carbon tax measures the market price attached to the right to emit every ton of carbon through fuel combustion or other activities. There are various environmental taxes designed to regulate the harmful emissions and to reduce the environmental damage. Other than a carbon tax, some examples of environmental taxes designed to mitigate the GHG emissions mainly from the transportation sector include vehicle miles traveled (VMT) tax, road tax, and vehicle tax.

In theory, the rate of an environmental tax should be equal to the marginal harm from the regulated parties, which are referred to as emitters. In reality, the setting of a tax rate is undoubtedly challenging because it is difficult to obtain the accurate information over time about the costs and benefits of reducing emissions or mitigating climate change (Metcalf and Weisbach, 2009).

Regarding a carbon tax, it makes GHG emissions costly but grants the flexibility to emitters about how they respond. Under a carbon tax, emitters need to reduce their emissions cost efficiently; otherwise, they have to pay the tax if they realize the cost of reducing emissions is more expensive. Harper (2007) pointed out that there are two types of carbon tax – direct tax on emissions and indirect tax on inputs or final products. A direct tax may be applied when there are few large emitters and the calculation of direct emissions is easy and cost-feasible, or when there is no correspondence between inputs or final products and emissions. Alternatively, an indirect tax can be applied relatively easily on inputs or final products. A fuel tax is a common type of indirect taxes charged on the input (fuel) that results in harmful emissions to the environment.

Tradable emission permits in climate change and environmental policies are often referred to as cap-and-trade programs or simply cap and trade. The cap-and-trade programs regulate both large and small emitters based on the total emission allowance ("cap") permitted among those emitters. Under cap and trade, an overall cap on the amount of emissions permitted in the economy is determined. Initially, the emission allowances are distributed for free or through an auction. The emitters who reduce their emissions cheaply can sell the excessive permits to the ones who cannot reduce emissions cheaply and would rather pay for a permit. The price of the permit is set by the trades among emitters in the market place. Although the total emissions are fixed, normally it is difficult to predict how much it costs to reduce to that amount.

A cap-and-trade program can be implemented at various points in the system, from initial fuel extraction to the point of emission. When a cap-and-trade program is implemented at the point that extracts or imports a unit of fossil fuel, it is called "upstream" cap and trade; when it is implemented at the point where the fuel is burned and the carbon emission is generated, it is called "downstream" cap and trade (Dessler and Parson, 2010). In an upstream cap-and-trade program, the cost of an emission permit will follow the fuel through the entire economy, which will cause the raise of the price of carbon-related goods and services. For a downstream cap-and-trade program, it is difficult to manage a large number of regulated entities; therefore it is often limited to some particular sectors or industries.

An example of a downstream cap-and-trade program is the European Union Emissions Trading System (EU ETS). EU ETS was launched in 2005, and is the first international scheme for the trading of GHG emission allowances. Currently it covers 11,000 power stations and industrial plants in 30 countries (EU-27 plus Iceland, Liechtenstein and Norway). The target of EU ETS is to reduce GHG emissions to 21% below 2005 levels by 2020. EU ETS started covering CO_2 emissions from aviation in 2012.

Currently, there is no federal-level cap-and-trade program in the United States. The Regional Greenhouse Gas Initiative (RGGI) is the first CO_2 emissions trading program in the United States that started in 2009. There are ten participating states in the northeastern and mid-Atlantic region, which include Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont. In the participating states, RGGI covers 209 fossil fuel fired power plants (25 megawatts or greater in size). The target of RGGI is to reduce CO_2 emissions to 10% below 2009 levels by 2018.

In the western United States, the Western Climate Initiative (WCI) is developed as a regional effort to reduce GHG emissions to 15% below 2005 levels by 2020. It will be fully implemented in 2015. WCI will cover emissions of seven greenhouse gases (CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, and NF_3) from electricity generation, industrial fuel combustion, industrial processes transportation fuel use, as well as residential and commercial fuel use. There are seven US states (Arizona, California, Montana, New Mexico, Oregon, Utah, and Washington) and four Canadian provinces (British Columbia, Manitoba, Ontario, and Quebec) participating in the WCI.

A cap-and-trade program is inherently more complicated than an environmental tax. In the design of a cap-and-trade program, policymakers have to determine several elements within the program. First of all, policymakers need to decide the scope/coverage of the program (e.g., regulated sectors/industries/points, types of GHG emissions, geographical regions). The scope/coverage also determines the total cap set initially in the program. Then the policymakers need to decide how to allocate the total emission allowances among regulated entities (for free or through an auction) and how many allowances to be allocated to each entity. Finally, policymakers must decide on emissions monitoring, reporting, and enforcement provisions. A cap-and-trade program also requires the setting of a baseline to establish the emission cap. The value of a baseline is calculated from either past or projected emissions or consumption data and is used to determine the number of allowances available as well the level of reductions achieved. Once the "cap" is determined, no matter how the allowances will be distributed, either for free or through an auction, a cap-and-trade program still has the complexity. Free distribution need to decide which industries receive allowances for free, while auction need to build a monitoring system to prevent cheating. The auction associated with a cap-and-trade program also needs to take into account the borrowing and banking of the emission permits. If a cap and trade involves trading with external (both national and international) cap-and-trade programs, it requires building an even complicated monitoring platform. Last but not least, it is necessary to establish an "offset" program in most of the cap-and-trade programs, which allows regulated emitters to purchase measurable and verifiable emission reduction credits from sources outside the scope of the cap (offsets could be international too). Ideally, an offset should be environmentally additional, verifiable, permanent, measurable and enforceable. However, it remains issues to draw the boundary and decide the quality of an offset.

2.2. Conventional Regulations

Under conventional regulations (such as energy efficiency and emission performance standards), public authorities mandate the environmental performance to be achieved, or the technologies to be used, by firms. Over the past 30 years, conventional regulations have brought large environmental improvements (Dessler and Parson, 2010). However, the costs of conventional regulations are often invisible. Therefore, they are often criticized for costing more than needed to achieve a particular environmental target. Moreover, the effectiveness of conventional regulations in achieving national wide emission reduction targets is vague, since they may not cover all the emission sources in the nation. Since 1990, conventional regulations have largely been eclipsed by market-based mechanisms (Dessler and Parson, 2010).

2.3. Voluntary Approaches

The voluntary approaches allow firms make commitments to improve their environmental performance beyond what the law restricts. They require less preparation than regulatory approaches, and are considered as alternatives or supplements to traditional regulations. Compared to "command-and-control" regulations, voluntary approaches offer increased flexibility in terms of how a given target is to be achieved. The policymakers have realized the flexible, effective and less costly nature of the voluntary approaches and attempted to encourage firms to take the voluntary action (Arimura, Hibikid, and Katayama, 2008).

Many companies chose to get involved in voluntary approaches expect some strategic benefits from their participation, such as operational improvement, anticipating and influencing climate change regulations, accessing new sources of capital, improving risk management, elevating corporate reputation, indentifying new market opportunities, as well as enhancing human resource management (Hoffman, 2005).

There are many innovative voluntary approaches that have already established, such as the U.S. Environmental Protection Agency (EPA)'s SmartWay Transport Partnership program. The SmartWay Transport Partnership program started in 2004 is collaboration between the EPA and the freight industry to improve energy efficiency and reduce GHG emissions. The EPA was interested in reducing emissions from diesel engines and improving energy security in the freight industry; and the freight industry was interested in improving its public image, recognizing for its efforts and fuel savings to help companies in an extremely competitive industry (Tan, 2009). The program was designed as an innovative public-private partnership policy that targets at mitigating carbon emissions from the freight transportation sector. Participating carriers of the SmartWay Transport Partnership are committed to integrate cost saving, fuel efficient technology and strategies to improve environmental performance of their fleet operations. Shippers are committed to implement facility measures that improve efficiency and reduce emissions; they are also committed to ship the majority of their goods with SmartWay Transport carriers (EPA, 2011). Companies that meet SmartWay Transport Partnership requirements will benefit from reduced operating costs and enhanced visibility, moreover, those can demonstrate their superior performance will earn the right to display the SmartWay Transport logo. The SmartWay Transport Partnership program participants will benefit from cost savings, business-to-business advantage, environment achievement, and public and peer recognition (EPA, 2011).

Information disclosures are also voluntary approaches to make companies be responsible to their environmental impacts by evaluating and publishing the results of their environmental performance. Announcing the environmental performance to their investors and customers can motivate companies to decrease their environmental impacts or develop innovative approaches to reduce emissions. The participants of information disclosure are required to reveal their emission levels to their investors and customers; so all the relevant information of emissions is public and transparent. The information disclosure program encourages companies to disclose by framing the disclosures as an opportunity to distinguish a company as being positioned to mitigate the risks of climate change and to take advantage of the opportunities being created. The participating companies include companies that have high levels of emissions, but also include many low-emission companies that disclose information about estimated future physical and regulatory risks from climate change (Stanny and Ely, 2008).

One of the largest efforts of climate change in public filings has been the Carbon Disclosure Project (CDP). CDP is a United Kingdom based nonprofit organization that works with investors and companies to disclose the GHG emissions of major companies and their action plans concerning climate change. CDP has two major objectives – to inform managers about investors' concerns about climate change and to inform investors about companies' risks associated with climate change (Stanny and Ely, 2008). CDP publishes its reports that are independent from companies' annual reports or other sustainability reports, which makes it easy to isolate the impact of the information regarding climate change. The number of companies reporting their emissions to CDP has increased from 687 in 2007 to 1525 in 2010 (CDP, 2011).

III. DELIVERING CLIMATE CHANGE POLICIES TO SUPPLY CHAINS

All climate change policy options discussed in the previous chapter have brought significant environmental improvement in the past. In our paper, we mainly talk about the most prominent new climate change policies adopted over the past 10 to 20 years: market-based regulatory mechanisms which include environmental taxes and tradable emission permits.

As discussed, a tax instrument and a cap-and-trade program differ from many dimensions, even though they are both market-based mechanisms with the same goal to reduce GHG emissions. One of the most important differences is that a tax offers cost certainty and cap and trade offers benefit certainty (Avi-Yonah and Uhlmann, 2009). A fuel tax, for example, is set in advance as an exact amount despite the fluctuating price of the fuel. This shows the precise cost derived from reducing carbon emissions (cost certainty). But the effect of imposing a fuel tax on carbon emissions is not known in advance, the fuel tax does not guarantee benefit certainty. Cap and trade, on the other hand, sets an overall cap on the total emissions permitted in the economy, offers certainty of the environmental benefit from its implementation – benefit certainty. However, the overall cap in a cap-and-trade program is set without the consideration of the imposing cost to the economy at large or to individual polluters of achieving that cap. Thus cap and trade is lack of cost certainty.

In the literature, there are a lot of arguments between the policy options of the tax and a cap-and-trade program. But it is not clear whether cost certainty or benefit certainty is more important in climate change policies. In fact, both a tax and a cap-and-trade program can be adjusted to increase cost certainty and benefit certainty. In other words, since the costs and benefits of reducing emissions are uncertain, which policy option is preferable depends on whether the total quantity reduced or the total marginal cost of reduction is more important.

We conduct an analysis based on the public data and general information of the fuel taxes and the cap-and-trade programs in the U.S. and EU. From the analysis, we understand the status of these two policy options, and their imposed cost certainty and benefit certainty (if any) in supply chains (mainly in transportation).

3.1. Fuel Tax in Transportation

The U.S. federal motor fuel tax is \$0.184 per gallon, the diesel fuel tax is \$0.244 per gallon, and the aviation gasoline tax is \$0.194 per gallon (Defense Logistics Agency, 2011).

Table 1 shows the fuel consumption in the U.S. by mode of transportation in physical units (National Transportation Statistics, 2010). We multiply the fuel consumption by its associated fuel tax to get the total fuel tax in the transportation sector, which is 39,479.82 million dollars.

From Table 1, the total fuel consumed in the U.S. was 205,112 million gallons in 2007. GDP of the U.S. in 2007 was 14,061.8 billion dollars, and the population was 301,621,157. Therefore we calculate the percentage of the total fuel tax (in transportation sector) in GDP, the transportation fuel consumption per capita and per GDP dollar (Table 2).

TABLE 1. U.S. FUEL CONSUMPTION BY MODE OF TRANSPORTATION IN PHYSICAL UNITS

	2007	Fuel Tax (dollar/gallon)	Total Fuel Tax (million dollars)
Air			
Certificated carriers			
Jet fuel (million gallons)	12,999	0.194	2,521.81
General aviation			
Aviation gasoline (million gallons)	351	0.184	64.58
Jet fuel (million gallons)	1,544	0.194	299.54
Highway			
Gasoline, diesel and other fuels (million gallons)			
Passenger car and motorcycle	74,377	0.184	13,685.37
Other 2-axle 4-tire vehicle	61,836	0.184	11,377.82
Single-unit 2-axle 6-tire or more truck	10,044	0.244	2,450.74
Combination truck	28,545	0.244	6,964.98
Bus	1,145	0.244	279.38
Transit			
Electricity (million kWh)	6,216		
Motor fuel (million gallons)			
Diesel	515	0.244	125.66
Gasoline and other nondiesel fuels	51	0.184	9.38
Compressed natural gas	108		
Rail, Class I (in freight service)			
Distillate/diesel fuel (million gallons)	4,062	0.244	991.13
Amtrak			
Electricity (million kWh)	578		
Distillate/diesel fuel (million gallons)	62	0.244	15.13
Water			
Residual fuel oil (million gallons)	6,327		
Distillate/diesel fuel oil (million gallons)	1,924	0.244	469.46
Gasoline (million gallons)	1,222	0.184	224.85
Pipeline			
Natural gas (million cubic feet)	621,364		

TABLE 2. FUEL TAX/GDP, TRANSPORTATION FUEL CONSUMPTION/CAPITA, AND TRANSPORTATION FUEL CONSUMPTION/GDP IN THE U.S. (BASED ON 2007 DATA)

Fuel Tax/GDP (percentage)	Fuel Consumption/Capita (gallon/capita)	Fuel Consumption/GDP (gallon/dollar)
0.281%	680.032	0.015

TABLE 3. FINAL ENERGY CONSUMPTION IN TRANSPORTATION, BY FUEL, EU-27 (MTOE)

Motor spirit	106
Gas/diesel oil	196
Kerosenes	53
Biofuels	8
Other	13
Total	**377**

TABLE 4. FUEL TAX/GDP, TRANSPORTATION FUEL CONSUMPTION/CAPITA, AND TRANSPORTATION FUEL CONSUMPTION/GDP IN EU-27 (BASED ON 2007 DATA)

Fuel Tax/GDP (percentage)	Fuel Consumption/Capita (gallon/capita)	Fuel Consumption/GDP (gallon/dollar)
1.400%	205.284	0.006

Due to data unavailability, we calculate the same statistics of the European data in a different way. From Eurostat database, the transportation fuel tax of all 27 EU members is 1.4% of the GDP (European Commission, 2007). Table 3 shows the final energy consumption in transportation by fuel of EU-27 in 2007 (European Commission, 2010).

The sum of the taxable fuel (motor spirit, gas/diesel oil, and kerosenes) is 384.88 million m3 or 101,675.52 million gallons (based on unit conversion). The GDP of EU-27 in 2007 was 17,377.6 billion dollars (or 12,049.4 billion euros), and the population was 495,292,925. Table 4 shows the percentage of the total transportation fuel tax in GDP, the transportation fuel consumption per capita, and the transportation fuel consumption per GDP dollar in EU-27.

From Tables 2 and 4, the U.S. transportation fuel tax in GDP is 5 times less than that in EU-27. The average transportation fuel consumption in the U.S. is 3.3 times more than that in EU-27, but the transportation fuel consumption in every one-dollar market value in the U.S. is 2.5 times more than that in EU-27.

In both U.S. and EU-27, certain amount of fuel tax is charged in order to reduce carbon emissions and battle climate change. Cost certainty of the fuel tax is verified. However, the cost of transportation fuel tax differs in the U.S. and EU-27. Compared to EU-27 (transportation fuel tax is 1.4% in GDP), the U.S. fuel tax in transportation is very limited to affect the use of the fuel and the reduction of carbon emissions. With the lack of information regarding the optimal setting of a fuel tax, at least we can learn that the rate of the current U.S. fuel tax shows larger benefit uncertainty (compared to EU-27).

TABLE 5. U.S. CARBON DIOXIDE EMISSIONS FROM ENERGY USE BY SECTOR

	2005	2008
Total US CO_2 Emissions from energy use by sector (million metric tons)	**1,629.2**	**1,585.6**
Transportation	**542.3**	**526.3**
Natural gas	9	9.8
Electricity	1.3	1.3
Petroleum	532	515.2
Motor gasoline	322.9	309.5
Liquid petroleum gas	0.5	0.3
Jet fuel	67.2	61.7
Distillate fuel	121.2	121.5
Residual fuel	18	20.2
Lubricants	1.5	1.4
Aviation gas	0.7	0.5
Industrial	**455.8**	**433.4**
Residential	**342.1**	**332.7**
Commercial	**289**	**293.2**

TABLE 6. STATISTICS OF THE EMISSION REDUCTION OF RGGI AND WCI IN THE TRANSPORTATION SECTOR

Emission Reduction	Total (million metric tons)	Yearly (million metric tons)	Per capita (tons/capita)	Per GDP (kg/$)
RGGI	473.67	52.63	1.57	0.034
WCI	460.96	30.73	1.53	0.033

TABLE 7. STATISTICS OF THE EMISSION REDUCTION OF EU ETS IN THE TRANSPORTATION SECTOR

Emission Reduction	Total (million metric tons)	Yearly (million metric tons)	Per capita (tons/capita)	Per GDP (kg/$)
EU ETS	754.69	50.31	1.52	0.043

3.2. Carbon Cap-and-Trade Program in Transportation

The carbon dioxide emissions from energy use by sector in the U.S. (National Transportation Statistics, 2010) are shown in Table 5.

We assume both RGGI and WCI will cover national emissions from the transportation sector in the U.S. Based on the emission reduction targets of RGGI and WCI, we calculate the total and yearly emission reduction, emission reduction per capita and per GDP value in the transportation sector (Table 6).

In Europe, the total CO2 emissions from the transportation sector in 2005 were 955.3 million tons (European Commission, 2010). We also assume EU ETS will cover emissions from the transportation sector in EU-27. Thus the total and yearly emission reduction, emission reduction per capita and per GDP value in transportation sector are calculated based on the emission reduction target of EU ETS (Table 7).

Both cap-and-trade programs in the U.S. and in EU-27 show certainty of the environmental benefit that results from the implementation (benefit certainty). Tables 6 and 7 show that RGGI and EU ETS impose a similar yearly carbon emission reduction, emission reduction per capita and per GDP value. But since cap and trade allows the emitters to trade emission permits among themselves in the "market place", it is difficult to assess the overall cost to achieve the benefit without detailed information about trading (cost uncertainty).

IV. CONCLUDING REMARKS AND FUTURE DIRECTIONS

Human beings are facing the threat posted by climate change and global warming. Human activities (burning of fossil fuels, cement production, and land use changes) are responsible for the increasing concentration of greenhouse gases that is the main cause of global warming. Companies are facing challenges from how to reduce their environmental impacts (especially greenhouse gas emissions) and how to fulfill their social responsibilities. Supply chain serves as the main cost driver in the company; it is also one of the main sources of greenhouse gas emissions. In this paper, we explore climate change policies that are particularly relevant and explicitly targeted at greenhouse gas emissions reduction. We focus on the policies that mitigate climate change and specifically relate to supply chain decisions such as transportation and distribution. Environmental taxes and tradable emission permits are the most prominent new climate change policies adopted over the past 10 to 20 years.

We conduct an analysis based on the public data and general information of the fuel taxes and the cap-and-trade programs in the United States and European Union. From the analysis, we find that (1) Cost certainty of the fuel tax in both U.S. and EU is verified; (2) Compared to EU, the rate of the current U.S. fuel tax shows larger benefit uncertainty; (3) Cap and trade in both U.S. and EU shows benefit certainty; and (4) Cost certainty/uncertainty is difficult to assess without detailed information about trading in a cap-and-trade program.

Evaluating climate change policies using quantitative approach is difficult. This is a very preliminary comparison and evaluation of the current environmental taxes and tradable emission permits related to the transportation in supply chains. Although we used the data from both U.S. and EU, the data is highly aggregated and is lack of useful information. For future research, we should collect data with more details. The national level data may be impossible to get therefore we may collect data from one sector or selected states. Another future direction of our research is to explore other policy options including conventional regulations and voluntary approaches, especially voluntary approaches. Because they offer increased flexibility in terms of how a given emission reduction target is to be achieved. Also, the policymakers have realized the flexible, effective and less costly nature of the voluntary approaches.

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