



## Reduction Emissions from Transport Sector ——EU Action against Climate Change

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### Abstract

There is a consensus among the majority of the world's scientists that our planet is experiencing man-made climate change, which will bring great social, economic and environmental threats to human being (Europa, 2008). The increase amount of atmospheric CO<sub>2</sub> concentration impacts climate changes has become a major concern to the public. Transportation is accounted for 26% of global CO<sub>2</sub> emissions and is one of the few industrial sectors where emissions are still growing (Chapman, 2007). In the European Union (EU), the road transport sector is one of the main sources of CO<sub>2</sub> emissions. Therefore, reducing CO<sub>2</sub> emissions and fuel consumption from road transportation is an important strategy for EU to implement the Kyoto Protocol and to develop a sustainable transport system (Fontaras and Samaras, 2007). This paper explores and discusses the initiation and development of the EU's policies and strategies against climate change and the share experiences in the EU transport sector to reduce CO<sub>2</sub> emission. Basing on the research, it can be concluded that the EU has acted as a front-runner in the battle of combat against climate change.

**Keywords:** European Union (EU), Transport sector, Reduction emissions

### 1. Introduction

There is a consensus among the majority of the world's scientists that our planet is experiencing climate change. The warming trend can be observed from the increasing global temperatures, the widespread melting ice, and the rising global ocean level (IPCC, 2007). According to IPCC (2007)'s report, since 1850, the average surface temperature of the Earth has risen 0.76° C. It is predicted that the global average surface temperature is likely to rise a further 1.8-4.0°C this century if no further action taken to decrease greenhouse gas emissions.

Although human-induced climate change is still questioned in US, the majority of UK senior scientists believe that man-made climate change is a significant threat and that action should not be delayed (Leaf, Verolme et al. 2003). IPCC (2007) claims that most of the warming observed over the last 50 years is caused by human activities such as burning of fossil fuels, deforestation and desertification, which lead to CO<sub>2</sub> emissions, the most important greenhouse gas emissions responsible for climate change. In order to halt the warming trend, CO<sub>2</sub> emissions must be reduced significantly.

According to IEA (2000), transportation is accounted for 26% of global CO<sub>2</sub> emissions and is one of the few industrial sectors where emissions are still growing(Chapman, 2007). In the European Union, transport emits 21% of the EU's greenhouse gas emissions. More severely, there is a 22% rising in emissions between 1990 and 2002(ECCP, 2007). Therefore, reducing CO<sub>2</sub> emissions and fuel consumption from road transportation is an important strategy for the European Union to fight against climate change(Fontaras and Samaras, 2007).

This paper attempts to review the EU's main policies and strategies against climate change, which include the United Nations Framework Convention on Climate Change (UNFCCC), the Kyoto Protocol, the European Climate Change Programme (ECCP) and the European Union Emissions Trading Scheme (EU ETS). The paper also explores the share experiences in the EU transport sector to reduce CO<sub>2</sub> emission, which include reducing CO<sub>2</sub> from new cars (Zachariadis, 2006); dieselization (Zachariadis, 2006; Zervas, 2006; Zervas, Pouloupoulos et al., 2006; Fontaras and Samaras, 2007) and technology improvement such as reducing vehicle mass, enhancing engine efficiency(Zachariadis, 2006) and development of alternative fuel(Chapman, 2007).

## 2. Methodologies

Through plenty of researches on the policies and strategies issued on European Union official portal site: the Europa, this report chronologically discusses the initiation and development of the EU's main policies and strategies against climate change, which include UNFCCC, Kyoto Protocol, ECCP and ETS. On the other hand, through the exploration to many academic journals report on the EU and Member State's experiences on cutting CO<sub>2</sub>, this report qualitatively analyses and summarizes the successful experiences and reasonable recommendation to reduce CO<sub>2</sub> in the EU's transport sector. Since the sample size of journals reports is not sufficient and some of the journal reports have different perspectives, the methodology used in this report may have some limitation and may be further developed.

## 3. EU Policies and Strategies against Climate Change

### 3.1 *The EU's Role on Climate Change*

Christiansen and Wettestad (2003) argue that basing on empirical evidence, the EU's position on climate change has a remarkable change. The EU has change from the role of "a sceptic to become a frontrunner". Similarly, Leaf et al (2003) state that the EU has been acting in many aspects as a key player in the global efforts to reduce greenhouse gases emissions. As one of the largest emitters, the EU owed about 25% of emissions of greenhouse gases in the group of "Annex I countries" addressed in Kyoto Protocol. Moreover, the EU is generally recognised to have played a significant strategic role in the climate negotiations under the UNFCCC, those policies and strategies adopted at the EU level are important not only for emissions eliminating in its Member States, but also for the evolution of the international climate regime. To give an example, EU's emission standards have been adopted by China.

### 3.2 *The United Nations Framework Convention on Climate Change*

Marmo (2008) claims that the EU has greatly contributed to the shaping of the UNFCCC. In 1990, when the UN Intergovernmental Panel on Climate Change (IPCC) sent out the warning that greenhouse gases emissions have caused increasing global temperatures in its first assessment report, the EU committed itself at the same year to keep its CO<sub>2</sub> emissions at the 1990 level by 2000 (EUROPA, 2008). In 1991, the European Commission issued the first Community strategy to improve energy efficiency and limit CO<sub>2</sub> emissions (Marmo, 2008). In 1992, the EU signed the UNFCCC with an ultimate objective "to prevent dangerous anthropogenic interference with the climate system" (Marmo 2008). Since that, the EU has smoothly strengthened and progressed its actions to reduce CO<sub>2</sub> emissions, as well as other greenhouse gases. These efforts were further emphasized after the Kyoto Protocol was agreed.

### 3.3 *The Kyoto Protocol*

It is no doubt that the Kyoto Protocol is a remarkable step for the European Community in its efforts to address climate change. The Kyoto Protocol is a treaty made under the UNFCCC with the aim of reducing greenhouse gases. The Protocol was agreed on December 11th, 1997 when UNFCCC members met in Kyoto. It then entered into force on February 16th, 2005. According to the Kyoto Protocol, developed countries listed in "Annex I countries" must reduce a integrative average 5% of their greenhouse gas emissions by 2008-2012 compare to 1990 level (Wikipedia, 2008).

Under the Kyoto Protocol, the EU committed to achieve a combined reduction of 8% in CO<sub>2</sub> emissions. As for the 15 Member States, under the so-called "burden-sharing mechanism" principle, have been contributed specific percentages of reduction of CO<sub>2</sub> (Council Decision 2002/358/CE). These percentages vary largely from one Member State to the other. For example while Greece and Portugal are allowed to increase 25% and 27%, Denmark and Germany have committed themselves to a reduction of 21%. At the same time, the European Community is also a unit that signed the Kyoto Protocol to the UNFCCC, which means that it must demonstrate itself that it is able to achieve the 8% reduction target as an entity. Thus, it is important to set policies at the community level to help in achieving this objective and to support the more ambitious goal set by the European Council of the global annual mean surface temperature should not exceed 2 °C above pre-industrial levels (European Council, 2005).

### 3.4 *the European Climate Change Programme (ECCP)*

Although many "climate-related initiatives" have been undertaken by the European Commission since 1991 (Marmo 2008), in order to achieved the 8% target by 2008-2012, it is vital that both the European Community and Member States need to reinforce their actions. Consequently, in 2000 the European Commission launched the first ECCP (ECCP I), whose goal was "to identify and develop the EU level's most environmentally and cost-effective policies and measure to implement the Kyoto Protocol" (ECCP, 2007). ECCP I was developed on comprehensive teamwork that has involved the European Community, the Member State and other stakeholders such as industries and national experts. ECCP II was launched in October 2005 through considerable stakeholders discussions to explore further cost-effective options for cutting greenhouse gases emissions. Subsequent working groups covering "impact and adaption, carbon capture and geological storage, CO<sub>2</sub> emissions from aviation and light-duty vehicles" were set up for specific issues (ECCP, 2007). Under the ECCP programme to date, some 40 cross-cutting and sectoral policies and measures have been identified, most of which are already being implemented. They include the "ground-breaking" European Union

Emissions Trading Scheme (EU ETS).

### 3.5 EU ETS (Emission Trading Scheme)

The EU ETS, launched in January 2005, is the world's biggest company level 'cap-and-trade' system for trading in emissions of CO<sub>2</sub> (Egenhofer 2007). Its establishment was through binding legislation put forward by the European Commission and approved by the EU Member States and the European Parliament. Since its implementation, global carbon market has expanded rapidly. This is mostly because that the EU ETS enable companies to utilize credits from the Kyoto Protocol's "project-based mechanisms - the CDM and JI" - to support them to meet their obligations within the system (ETS, 2005). This means the EU ETS not only provide "cost-effective means" for EU-based industries to reduce their emissions. But is also channelling considerable business trading emissions to cut costs and reduce emissions worldwide investment into "emission-reduction projects" in developing countries such as India and China and economies in transition. Through this particular trading, the EU ETS promotes the transfer of advanced, environmentally sound technologies to these countries to support them to achieve sustainable development (ETS, 2005).

### 3.6 Future Development

According to the European Commission's annual report released on, 27 November 2007 (EC Press, 2007), the latest projections from Member States indicate that it is predicted that EU-15 emissions will be able to cut CO<sub>2</sub> to 7.4% of 1990 in 2010, which just short distance of 8% reduction target of 2012. Through measures already taken and additional initiatives adopted and implemented swiftly, the EU is moving closer and closer to achieving its Kyoto Protocol targets.

However, in order to limit global annual mean surface temperature should not rise exceed 2 °C, ambitious action is needed to succeed the Kyoto Protocol after 2012 when the Kyoto Protocol will expire. Since early of 2007, the European Commission has launched several meetings to discuss "the way ahead for 2020 and beyond" and has proposed to reduce its overall emissions to at least 20% below 1990 levels by 2020 (Figure 1). On 23 January 2008, in their proposal "Climate action and renewable energy package", the European Commission even committed that the EU is ready to reduce 30% if other developed countries make comparable efforts (Europa, 2008).

## 4. Reduction CO<sub>2</sub> Emission from Transport Sector

### 4.1 CO<sub>2</sub> Emissions in Transport Sector

The transport sector is a main source of CO<sub>2</sub> in many countries. According to IEA (2000) reports, the transport sector accounts for 26% of global CO<sub>2</sub> emissions, of which about two-thirds generates in the wealthier 10% of countries (Chapman 2007). Transport was one of the key sectors highlighted to be tackled by the Kyoto Protocol with an aim to reduce worldwide greenhouse gas emissions by 5.2% of 1990 levels by year 2012 (Chapman 2007). Therefore, since 1997, the 38 developed countries who signed the agreement have heavily added transport in their political agendas. In the European Union, transport was responsible for 21% of the EU's greenhouse gas emissions, with a 22% increase during the period of 1990 to 2002 (ECCP, 2007). Meanwhile, road transport is the greatest resource of greenhouse gases in the transport sector, reducing CO<sub>2</sub> emissions and fuel consumption from road transportation has become an important strategy for the European Union to against climate change (Fontaras and Samaras, 2007). Experiences and recommendations of reducing CO<sub>2</sub> from road transportation adopted by EU and Member State include reducing CO<sub>2</sub> emission from new cars (Europa, 2006), dieselization and technology improvement etc.

### 4.2 Reducing CO<sub>2</sub> Emissions from New Cars

Reducing CO<sub>2</sub> emissions from new cars is a key priority of EU climate change policy (EUROPA, 2006). The ultimate aim is to limit average CO<sub>2</sub> emissions from new cars sold in the EU to 120g/km by 2012. To achieve this, "three-pronged" strategy is undertaken by the EU and Member States.

Firstly, car producers' commitment to the European Commission to limit average CO<sub>2</sub> emissions from new cars is up to date the most important initiative to limit CO<sub>2</sub> emissions originated by transport and especially emissions from road transportation (Fontaras and Samaras, 2007). In 1999, driven by the trend of increasing CO<sub>2</sub> in the transportation sector, the European Automobile Manufacturers Association (ACEA) signed a voluntary commitment with the European Commission on reducing the average CO<sub>2</sub> emissions from new cars (EC, 1999). One year later, the Japanese and Korean manufacturers signed the similar agreement with the European Commission. In the agreement, it was agreed that the target emission for the average ACEA vehicle should not exceed 140 g CO<sub>2</sub>/km in 2008. This represents a reduction of around 25% compared with the mid-1990s. By implementing this voluntary agreement, since 1995, fuel economy measured in the official driving cycle has improved considerably. According to progress reports published by the EC and ACEA each year, from 1995 to 2002, European new cars CO<sub>2</sub> emissions of per kilometre dropped by 12% with a 1.7% annual improvement. In year 2006, carmakers were almost half-way towards meeting this target (Zachariadis 2006).

Secondly, enable consumers to choose the most fuel-efficient cars is another effective way to reduce CO<sub>2</sub> emission from new cars. To help consumers identify the most fuel-efficient models in a range of products, EU legislation requires that

car makers should demonstrate mandatory labelling and provision of consumer information at the sale point about each car's fuel economy and CO<sub>2</sub> emissions (Europa, 2006)

The third element of the strategy is fiscal support. The Commission has proposed legislation that would require Member States levying car registration taxes and/or circulation taxes to relate at least 50% of the tax to the level of a vehicle's CO<sub>2</sub> emissions (Europa, 2006).

#### *4.3 Reducing CO<sub>2</sub> Emissions by Dieselization*

The increase in the passenger cars (PCs) fleet is a main reason to the increase CO<sub>2</sub> emissions in the EU transport sector (Zervas 2006). Replacement of gasoline passenger cars by diesel passenger cars, also called dieselization, to decrease CO<sub>2</sub> emissions has achieved more awareness among EU experts (Zachariadis, 2006; Zervas, 2006; Zervas, Pouloupoulos et al., 2006; Fontaras and Samaras, 2007). Zervas (2006) argued that from technical aspect, diesel passenger cars have greater thermodynamic efficiency, which provides improved fuel economy and emits less CO<sub>2</sub>. Moreover, the study on the benefit on CO<sub>2</sub> emitted from new passenger cars in the case of an increased diesel penetration in Ireland (Zervas, 2006) and Greece (Zervas, Pouloupoulos et al., 2006) shows the result as table 2.

The results show that with increasing diesel penetration, CO<sub>2</sub> emission reduction increases dramatically. From the experimental study, experts suggest that future total CO<sub>2</sub> emissions from new PCs can be partially controlled by the introduction of diesel passenger cars.

However, other experts argue that continuous increase of the diesel share in passenger cars is still a controversial practice for reducing fuel consumption (Jensen, 2003; Hugrel and Joumard, 2001). More specifically, Kavalov and Peteves (2004) and Jensen (2003) express concern for its impact. They argue that continuous dieselization has been shown can affect "the whole fuel chain and result in increased overall CO<sub>2</sub> emissions due to fuel production, refining and economical factors". Similarly, (Zachariadis 2006) maintains that since diesel vehicles have a lower power/mass ratio, dieselization will cause increases in engine size and vehicle mass. The European Commission indicated that dieselization is an acceptable first measure but states that "the associations would not meet the 140 g/km by a simple increase in the diesel share only, dieselization should also combine with other strategy" (EC, 2004b).

#### *4.4 Reducing CO<sub>2</sub> Emissions by Technology Improvement*

Technological improvement will play an increasing role in the reduction of CO<sub>2</sub> from transport (Chapman, 2007). A car manufactured today emits less CO<sub>2</sub> and pollutants than a decade ago (DfT, 2004a). This is because cars are being designed and manufactured differently today. Recently, cars are being designed much lighter, which can reduce power requirements. As Zachariadis (2006) and Zervas and Lazarou (2008) suggest that increase in weight of future EU new passenger cars would have a negative effect on CO<sub>2</sub> emissions. Therefore, there should be an "upper limit" to the weight of passenger cars. If each new passenger car's weight does not exceed an upper limit, a significant CO<sub>2</sub> benefit can be achieved, especially when this limit is low. The benefit obtained by limitations of weight is also higher than the benefit obtained from the decreased future fuel consumption. To give another example, engine efficiency is enhancing to enable cars to consume less fuel than the past. Today, "improved engines with up to 4 valves per cylinder, better combustion properties and less friction losses, enhanced automatic and manual transmission systems, tyres with lower rolling resistance and lighter automotive bodies with lower aerodynamic resistance" are now commonplace in automobiles, and continue improvements are undertaking in car makers (Zachariadis, 2006). Besides benefit from reducing weight and enhancing engine efficiency, further energy can be saved by "ecological driving", which includes measures such as "avoiding harsh acceleration and braking, using higher gears, observing speed limits and keeping the car regularly serviced with the correct tyre pressures" (SDC, 2006).

Ultimately, the most challenge for technological improvement is the development of alternative fuel such as bio fuels, natural gas, hydrogen and electric motors to replace petroleum fuels which contribute to greenhouse gas emissions (Chapman 2007). Alternative fuel, along with their advantages and disadvantages, however, governments should increasingly fund research and development of alternative fuels whilst using taxation policies to enable the switch to fuels with a low carbon content viable (DfT, 2006). Indeed, without new technologies, such emission reduction targets may be considered impossible to meet in a long term (Sandan and Azar, 2005). Fortunately, the EU realized the importance of alternative fuel development. The EU has set itself an indicative target of achieving a 5.75% share for bio fuels in the petrol and diesel market by 2010. Consequently, most Member States have introduced fuel tax exemptions in favour of bio fuels. The market share of bio fuels grew from 0.2% in 2000 to 0.8% in 2004 (Europa, 2006).

## **5. Conclusions**

This report reviews EU's most important policies and strategies against climate change. These policies and strategies include two major treaties and two big programmes. The two main treaties are the UNFCCC, which the EU helps its shaping, and the Kyoto Protocol, a significant step taken by the European Community in its efforts to address climate change. The two big programmes undertaken by EU to reduce its own greenhouse gas emissions are the European

Climate Change Programme (ECCP) and the EU Emissions Trading Scheme (EU ETS). ECCP has helped the EU establish series of environmental and cost effective policies and measure. While EU ETS is the world's biggest company level 'cap-and-trade' system for trading in emissions of CO<sub>2</sub>. The most worth mentioning is that, to achieve the ultimate target of limit global warming to 2°C, the EU has set up new commitment of reduce 20% greenhouse gas emission by 2020 to succeed the Kyoto Protocol.

In order to implement the Kyoto Protocol and to develop a sustainable transport system, reduction CO<sub>2</sub> from transport sector is the key. This report also reviews some share experiences and recommendations in the EU transport sector to reduce CO<sub>2</sub> emissions. Among these experiences, reducing CO<sub>2</sub> from new cars is a key priority of EU climate change policy. Along with the three-pronged strategy, ACEA's commitment to the European Commission to limit average CO<sub>2</sub> emissions from new cars is up to now the most important initiative to limit CO<sub>2</sub> emissions originated by transport. Although dieselization can significantly reduce CO<sub>2</sub> emissions, it is still a controversial practice that needs further consideration. Technological improvement will play an increasing role in the reduction of CO<sub>2</sub> from transport.

However, climate change and global warming is not only one country or one community's business, it is a global issue. At the same time, it is also a moral issue. Human beings should defend the planet together. We should defend it state-by-state, city-by-city, family-by-family and person-by-person. Reducing emissions is one of the ways. Governments can reduce most emissions by legislations and establishment of strict policies. Industries can contribute by strict implementation of Code of Conduct. For every individual can contribute by using a bicycle instead of a car or even by saving water and electricity in daily life. Fortunately, there were growing public awareness of global warming and energy efficiency issues recently. More and more countries and communities have shown their concerns and have started regulated their policies. Among these countries and communities, it is no doubt that the EU is a front-runner. If all of the other countries make comparable efforts, it can be believed that human being would have the capability to conquer the climate change crises as we have conquered other crises in the past.

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Table 1. Diesel penetration and CO<sub>2</sub> benefit in Ireland and Greece

Percentage of Diesel PC		Diesel Penetration	CO <sub>2</sub> Benefit	
Ireland	Greece		Ireland	Greece
<17%	<1%	30%	>2.9%	>5.4%
		50%	>7.4%	>10.2%

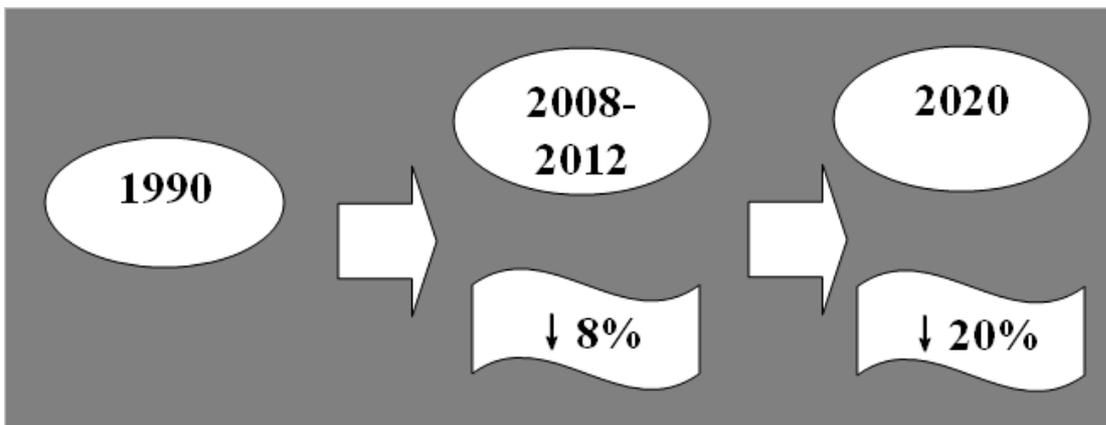


Figure 1. the EU's CO<sub>2</sub> Reduction Target