# From Global Public Good to Regional Economic Services: A Comparative Study on the Development of Climate Change as Economic Goods in China and the EU

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# From Global Public Good to Regional Economic Services

## A Comparative Study on the Development of Climate Change as Economic Goods in China and the EU*

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### Summary:

Economics is an important perspective of growing interest to analyze the climate change issues, especially, when we concentrate on the development of market-based instruments at the regional level. Starting from the fundamental characteristics of economic goods, the research put forwards a definition of climate change goods and, furthermore, builds a model of climate change policies in three transitional phases: from global public goods to regional private goods. Based on this model, the paper analyzes the development of climate change strategies in China and the EU, specifically considering the climate policies in Central and Eastern European economies in transition. While international climate negotiations remain important, the development of market-based instruments at the regional development is an important issue of transformation and social learning. From our comparative study, the transitional phase will last long period for all regions. Furthermore, the phase of a mature, perfectly functioning market, will never be reached because some public good elements of climate change will remain. There are many common issues faced by the EU and China, from a transitional perspective such as national harmonisation versus regional differentiation, and integration of top-down versus bottom-up strategies, and so on. Mutual learning on capacity development in China and the EU will be beneficial even if linking of climate change goods' markets in China and the EU will only be possible after 2020 due to divergent backgrounds.

### Zusammenfassung:

Wirtschaftswissenschaftliche Perspektiven werden zunehmend bedeutsamer für die Klimapolitik, besonders wenn es um die Entwicklung von dezentralen marktbasierten Instrumenten geht. Ausgehend von der grundlegenden Typologie ökonomischer Güter wird ein konzeptioneller Rahmen für die Entwicklung von „Klimagütern" in drei Phasen skizziert. Auf dieser Grundlage werden die historischen und aktuellen Klimastrategien in China und der EU analysiert. Besondere Berücksichtigung finden dabei die Transformationsprozesse in der Klimapoltik der neuen Beitrittsländer in Mittel- und Osteuropa. Auch wenn eine weltweite Klimapolitik (Top down) unverzichtbar ist, müssen – parallel – regionale Transformations- und Lernprozesse stattfinden, deren Entwicklung lange Zeit braucht und am Ende immer Elemente staatlicher Regulierung und öffentlicher Gutsbereitstellung beinhalten. Eine „reine" Marktlösung ist nicht möglich. Aus dieser Transformationsperspektive entstehen zahlreiche gemeinsame Themen für die wissenschaftliche Zusammenarbeit zwischen China und der EU, z.B. die Frage der (inter)nationalen Harmonisierung versus regionalen Differenzierung und die Verbindung von Top-down und

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Bottom-Up Strategien. Die Perspektive der Verknüpfung von „Klimagütermärkten“ zwischen der EU und China ist wegen der Ungleichzeitigkeit der Entwicklung und anhaltender Systemunterschiede allerdings nicht vor 2020 möglich.

**Key words:** Climate Change Goods; Sustainable Development; Economies in Transition; Market-based Instrument; Comparative Study; China; EU

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| | |
|---|---|
| CCTV | China Central Television |
| CDM | Clean Development Mechanism |
| CEE | Central Eastern European Countries |
| CITL | Community Independent Transaction Log |
| CMA | China Meteorological Administration |
| CO2 | Carbon Dioxide |
| EC | European Commission |
| ECCP | European Climate Change Program |
| ECX | European Climate Exchange |
| EMS | Environmental Management System |
| ETS | Emissions Trading System |
| EU | European Union |
| EU-15 | European Union with 15 members |
| EU-27 | European Union with 27 members |
| EUA | European Union Allowance |
| EU ETS | European Union Emissions Trading Scheme |
| FYP | Five Year Plan |
| GHG | Greenhouse Gas |
| GDP | Gross Domestic Product |
| IET | International Emissions Trading |
| IPCC | Intergovernmental Panel on Climate Change |
| LDC | Least Developed Countries |
| MRV | Monitoring, Reporting and Verification |
| MOST | Ministry of Science and Technology |
| NAP | National Allocation Plan |
| NBS | National Bureau of Statistics |
| NDRC | National Development and Reform Commission |
| NEA | National Energy Administration |
| NGO | Non-Governmental Organization |
| OECD | Organization for Economic Co-operation and Development |
| PPP | Public-Private Partnership |
| UN | United Nations |
| UNFCCC | United Nations Framework Convention on Climate Change |

# 1 Introduction

Following the path-breaking report of Stern (2006) economics has become a leading discipline in the field of climate policy. There are since many studies in the field of 'climate change economics', (as indicated in new journals and forums[1]) addressing economic questions of mitigation *of* climate change and adaptation *to* climate change. This research include, for example, the analysis of costs and benefits of climate change mitigation to establish economically justified global 'mitigation corridors', and the economic choice of different instruments such as regulatory instruments, market mechanisms and other measures. Sometimes they also include a study of 'preconditions' of the usage of these instruments, e.g. barriers of application (Stavins 2001, Fuessel 2007, Butzengeiger et al. 2011), but mostly they focus on the economic assessment of the instruments, e.g. with regard to their efficiency, flexibility and robustness to incoming knowledge on climate change, and political acceptability to different stakeholder groups and so on. In other words, the focus of existing study is economic targets and instruments without considering of development in the context of economies in transition such as China and the enlarged EU-27.

While these studies sometimes point the necessary 'framework conditions' of applying these tools, there is not enough consideration of the 'preconditions' at different stages of development to make an economic climate change policy successful, and how to meet these 'preconditions' through a process of transformation, going through different stages with a corresponding governance regimes: from a global public good (climate change) with a corresponding international governance regime (international policy) to private economic goods (climate services) applying market mechanisms for scarce goods. Viewed from this angle, we have to make clear which kind of preconditions have to be created to allow the application of economic tools, i.e. economically derived targets and instruments for climate change. Some preconditions can be 'created' by means of economic policies such as establishing 'property rights' (Tietenberg 2006) or other ways to make climate change goods economically 'scarce'. But some preconditions of economic tools cannot be easily 'created' such as environmental awareness or institutional capacity for price stabilization in emissions markets and for the resolution of distributional conflicts, especially if fundamental human development are attached as is most always the case in developing economics and economies in transition.

Climate goods, products and services, will be analyzed in this paper from a perspective comparing developments in China and the enlarged EU-27, focusing especially on new member states in Central and Eastern Europe (CEE). Basically we learn that three economic preconditions must be met to make climate change an economic goods, i.e. scarcity, rational stakeholders, and a 'functioning market'. Based on these essential or 'preconditions', the article will propose 'strategies', i.e. bundles of policies and measures to establish institutional capacity on the national, regional and local level, which, through ´stages of development`, will result in climate change becoming an economic good. This is at the same time the underlying theory of this comparative study. The different stages of development of climate goods in China and the EU-27 should be able to explain the tools and instruments applied. Furthermore, the paper will try to elaborate the difficulties to 'link' these 'markets' at different stages.

The paper is structured as follows. In chapter 2 will firstly we define climate change goods - and explain our theoretical framework of 'preconditions' and their dynamic evolution through different phases of development (chapter 3). Utilizing the case studies of emissions trading in China (in chapter 4) and the EU with a special focus on countries in Central Eastern Europe (chapter 5 and 6), we analyze transitory learning processes needed for climate change to become economic goods (chapter 7).

[1] http://www.worldscientific.com/worldscinet/cce, www.climatechangeecon.net.

# 2 Pre-conditions of climate change as economic goods

## 2.1 Defining climate change goods

This section attempts to provide a clear and general definition of "climate change goods", which encompass local measures to increase resilience to the physical impacts of climate change (e.g. early warning to natural disasters) to global policies of mitigation and adaptation and to climate financing at the UNFCCC level. This general definition of climate change goods is the core of this report. Some of definitions related to climate change goods and climate services include the mitigation of climate change, adaptation to climate change, and the bearing of the unavoidable impacts of climate change, which can be neither mitigated nor adapted to. These definitions explain the policies or actions taken at different levels to deal with climate change. Heuson et al. (2012), based on a comprehensive survey, state "there are two basic climate policy options with which to respond to the problems and challenges of human-induced climate change. First, climate change can be curbed or halted by reducing greenhouse gas emissions (mitigation). Secondly, measures can be taken to adapt society and ecological systems to the changed climatic conditions (adaptation)". The IPCC (2007a) defines adaptation as "the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities".

It is difficult to distinguish mitigation and adaptation in many cases. Take afforestation as an example, forests are an important carbon sink, consequently a target sector to mitigate climate change. It is also a target sector for adaptation to regional climate change, influencing micro-climate and local water availability. Another example is in the energy sector where a switch towards large shares of power produced from renewables is seen as a step towards the mitigation of climate change while it can be seen as an 'adaptation to climate change' triggered by regulation of power production and the energy system. The same situation can be found in 'urban greening' where growing trees in urban environments serve as the mitigation of climate change and the adaptation to a changing climate. In general, policy responses to climate change involve some combination of reducing emissions, adapting to most of the remaining impacts, and also bearing the cost of the unavoidable residual damage (Parry, 2009). In particular, the latter will necessarily involve some concern for equity issues, because the cost of residual damages will affect poor countries and poor people more than rich countries and rich populations. This is where economic concepts need to be enriched by ethical and political considerations, which are beyond the realm of this report.

In this report, climate change goods are defined as "the products or services alleviating the negative effect of climate change. In economic terms, climate change goods can be a pure 'private good' (e.g. protecting a clearly delimited real estate property against flooding), a 'club good' (e.g. an improved irrigation system protecting agricultural yields), or a 'public good' (e.g. the breeding of highly drought-resistant cultivars, or mitigating emissions)". Depending on the economic characteristics of climate change goods, different governance regimes of climate change goods may evolve. These governance regimes share some 'pre-conditions' to evolve in a dynamic evolutionary process of different stages.

## 2.2 Scarcity of climate change goods

Scarcity, in a traditional economic framework, is the economic prerequisite for treating climate change as "economic goods". Although by definition, scarcity relates to both sides of the market i.e. demand and supply, we will restrict our analysis to the development of demand in this study because demand drives supply.

The most immediate question relating to the demand side is: which sectors, industry or social governance bodies (e.g. water authorities) are most exposed to climate change, i.e. economically impacted, and thus, 'constrained' by climate change. The "exposure to climate risks, including also the 'exposure' to future economic opportunities from climate change, directly translate into a need for products and climate change goods and services.

Generally, the more serious the effects of climate change become constraining factors, the more the number of firms and individuals become 'demanders' for climate change goods. Exposure to climate change economic risk, in the dual sense of economic threats and opportunities, can be measured, for example, in total energy consumption. In an international comparison, we will see that different policies responding to climate change can be explained by the relative importance of "demand side" (for example, measured in terms of their percentage of GDP).

As public goods, the basic theory of externalities is the starting point for analyzing climate change goods. Those who produce greenhouse gas emissions do not have to compensate those who lost out because of the negative effects of climate change. Thus, the scarcity of climate change goods depends on the internalization of external negative effects to give economic incentives to reduce the emission. Furthermore, climate change has four special features (Stern, 2006): it is an externality that is global in both it is a cause and a consequence; the impacts of climate change are persistent and develop over time; the uncertainties are considerable; and the impacts are likely to have a significant effect on the global economy. In this sense, climate change goods should be corrected through policy intervenes.

## 2.3 Rational stakeholders and climate change goods

From an economic point of view, all relevant stakeholders are assumed to act rational, i.e. take welfare-maximizing decisions. For the choice of climate change goods, this means that the stakeholders would evaluate the profit of responding, mitigation and/or adaptation, to climate change. There are three factors underlying a stakeholder's choice of climate goods:

First is the rate of discount. That means to evaluate the importance of current versus future generations. The crucial role of discounting has come to the forefront of public interest ever since Stern (2007) has applied a near to zero discount rate in his cost-benefit analysis of global mitigation of climate change. The benefits of responding to climate change, both for adaptation and mitigation, stretch over an extended time horizon. A lower discount rate makes the benefit relatively larger in its present value, while a higher rate creates the opposite effect (Scrieciu et al. 2013). Economic tools of climate change goods should take a long term view, i.e. increase the importance of future benefits. Developing insurance models for future risks or funds to cover future loss and damages from climate change can help to stimulate a long-term view by means of economic instruments.

Second is improving the awareness of stakeholders to respond to climate change. Lack of information and low awareness of risks and loss of climate change are serious barriers for any response effort to climate change. Cultural and social background are important preconditions which will influence the understanding and acting upon climate change.

The third is cooperation between relevant stakeholders. For example, the policy process will change from an idea-based discourse to a series of conflicts over distribution in the context of a zero-sum-game (Boecher 2012). However, if climate change is perceived as a positive-sum game with win-win solutions, chances to cooperate will increase. The Clean Development Mechanism (CDM) is a typical economic instrument developed to increase cooperation throughout the world. Cooperation can also be achieved at the regional level or industrial level by means of emissions trading (in the case of mitigation) or market mechanisms for adaptation.

## 2.4 Functioning market for climate change goods

In terms of stages, there are two crucial and progressive questions to be addressed in the development of climate change goods: "Is there a market and is the market functioning?" Often, 'functioning' is defined in traditional economics 'perfect functioning", to be understood as "a large number of suppliers meeting a large number of demanders, where both sides cannot exert supply or purchasing power on the respective other side." However, for

purposes of comparison, this "ideal" market condition can be restricted to the second best condition of non-distortion where supply and demand forces work out reasonably well.

There may cases where the market of some climate change goods will never be developed, which is common in fields related to poverty reduction. An example would be education for underprivileged areas where few or no companies are willing to invest in although education policies is widely believed to be one of the most important policies for adaption to the impacts of climate change. Distributional consideration (the incidence or distributional consequences of a policy, which includes dimensions such as fairness and equity, among others) is one of four principal criteria for evaluating environmental policy (IPCC 2007b).

The same situation can occur with relevant spillovers of climate change related innovations. Leaders of climate change innovations are faced with lacking property rights on knowledge, which will inhibit sufficient knowledge production and innovation in responding to climate change. Another important factor is the unavoidable uncertainty. Insufficient knowledge of climate change seriously affect predictability and measurability of adaptive capacity, which then, severely hampers market-based mechanisms. The development of market-based mechanisms for adaptation needs a high degree of certainty in predicting and measuring adaptation achievements (Butzengeiger et al. 2011). In the development of climate goods from public to private goods, some goods can take the transitory form of 'collective' or 'club' goods. An example would be the administration of water management by 'water associations'. In this transitory phase, the government should bear the transition cost of restructuring. After that, the focus should be on the construction of a functioning market. According to the measurement indicator of market-oriented mechanisms, governments should focus on improving the mechanisms for the monitoring, reporting and verification of climate services, reducing transaction cost, and preventing monopoly or other market distortions.

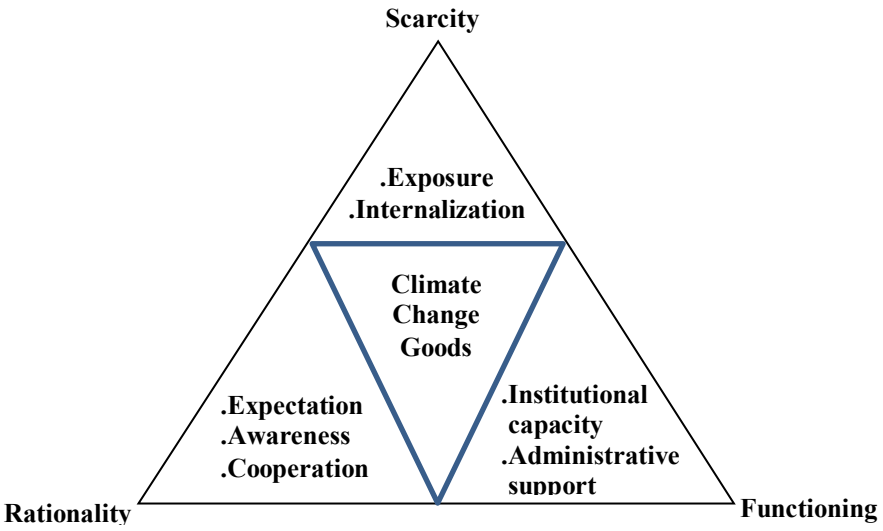


**Fig 2 - 1 Pre-Conditions of climate change goods**

# 3 Three phases of climate change policy

The debate of climate change has moved from "do we need to act now" to "how do we act now in order to best mitigate and adapt to climate change" (Scrieciu, et al.2013). Every nation (or region) should take steps according to national (or regional) development stages and regional climate change characteristics. Finding measures to deal with climate change issues from an economic perspective has become an urgent need. This section will explain the corresponding strategy to climate change for different national (or regional) contexts. Based on these background characteristics, we will put forward a strategy to combat climate change in three phases.

Figure 3-1 shows two parallel oblique lines, which represent climate change goods set with different characteristics and response measures. The shift of character in climate goods is accompanied by a shift in the response strategy. As for climate change goods set, it can be a few climate goods, e.g. on the national level. It can refer to a kind of climate change good, e.g. on the level of industry. According the different climate change goods set, there will be responding strategy.

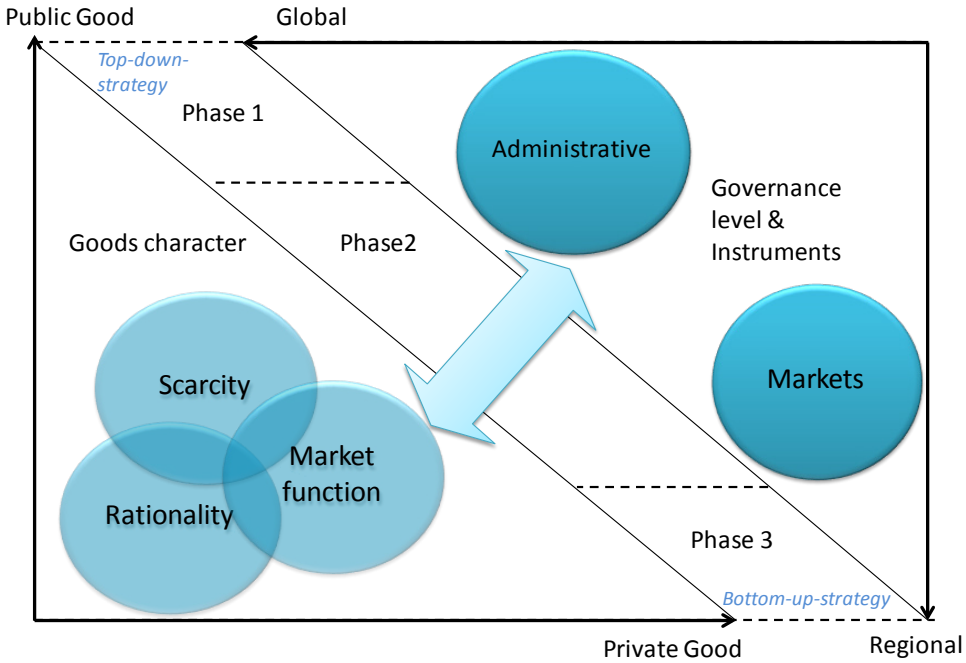


**Fig 3 - 1 Phases of climate change goods development**

Two aspects should be first explained for the different phases. First, the character of climate change goods will be clearly defined and explained in its gradual change from public goods into private goods throughout the three phases. Second, the corresponding strategy and instrument of the different phases will include different governance levels (global or regional), and policy instruments (command and control, direct regulatory system or market instrument). The analysis of the preconditions, advantages and disadvantages of special strategy or instrument may be conducted in some fields.

Comparable and measureable economic indicators (for example, the share of climate change services in GDP, per capita income and etc.) would seem to be a clear measure for studying and analyzing the development of climate change responding strategies in the EU and China. As these economic indicators are not available in this early and partly 'experimental stage' of climate change development, we will limit our discussion to potential and feasible economic indicators to certain stages of climate change strategy development in order to clarify our approach.

### 3.1 Phase 1

In this phase, climate change goods are global public goods. Scarcity is experienced at the global level. The main drivers behind each government's adaptation strategy to climate change are international environmental negotiations. At this stage, the scientific understanding of the climate change problem is crucial to convey the message that every country should take action in responding to climate change. At this stage, no markets exist, which means that governments make up both demand and supply side of the equilibrium.

In the first phase, the state will analyze the background of economic development and the structure of industries to predict how climate change will affect the economic development of the country. As a pillar industry, any small change will have an impact on the whole economy, which means more uncertainty. The policy of climate change will involve systemic changes, e.g. the industry of steel and coal in China. Climate policy will incur a series of change, which includes new institutional and mechanism setting, legislative framework, environmental regulations, labor skills for new technologies and social attitudes. In order to avoid uncertainty, the government would prefer some direct measures, which are mostly control and demand or top-down measures.

In some sectors, climate change goods already take on the characteristics described in the first phase. The transport and food supply sectors are clear examples where the demand is price inelastic, thus the corresponding response strategy to climate change may be better achieved by top-down measures, or a combination of regulatory changes, command and control instruments and market-incentives. Anyway, the acceptability of market mechanisms cannot be taken for granted. Discussion of adaptation funding is heavily interrelated with international equity issues (Butzengeiger, et al. 2011).

### 3.2 Phase 2

The most distinguishing feature of the second phase is transition, which will last a long time. Now, the global public goods have become scarce at the sub-global (regional or national) level. This means that the maximum allocation efficiency of climate change goods will be at the regional or national scale. At the beginning of this transition period, governments should create conditions for a more efficient response to climate change. Creating a market for the public good is one of the optimal choices for the sustainable provision of public goods (Tompkins, 2012). The most important task for a region, from the first phase to the second phase, is to support the activities for the demand and supply of climate change goods, which include the following tasks: supporting the technical innovation of suppliers, improving the market transaction environment of climate change goods, implementation of pilot projects, and awareness raising of climate change responses.

Firms, as main economic body, will become relevant stakeholders. However, because of path dependence, not many firms are aware of the scarcity of climate change goods. Furthermore, the return cycle of investment is short due to uncertainty of the future. In this phase, innovation is one of the most important and decisive factor for the transition. According to the framework of Clarke et al.(2008), if the effects of research and development are combined with learning-by-doing and spillover effects from other sectors, a transformed energy system could eventually be more cost effective than a fossil-fuel-based system. At this phase, the market needs government support and steering as it will be unable to provide sufficient innovation incentives because the social returns to innovation are much higher than the private returns at this stage. In other words, private firms cannot capture all the benefits of innovation from market returns.

Due to the limitations and imperfections of the market, public authorities should adopt a "strategic niche management" approach, which is larger than simple niche promotion in that niches are managed and the broader context in which niches evolve are taken into account (Maréchal, 2007). In this respect, the government should support the leader of the market, which is not necessarily characterized by the biggest market shareholder. Instead,

the market leader is identified in terms of transitional capacity e.g. knowledge or new technology. A small or medium sized company is often the market leader in this phase.

In phase two, the strategy of responding to climate change should combine top-down and bottom-up approaches. Some pilot programs will be implemented top down. Bottom-up participatory action should be highlighted, besides government effort of setting up the foundation of an information database and creating mechanisms for monitoring, reporting and verification (MRV). Measures for coping with climate change may benefit from a polycentric approach at multiple local, regional and national levels involving different stakeholders rather than focusing on single top-down policies (Ostrom, 2009).

At this stage, the response strategies will be a portfolio of administrative instrument, which are command and control instrument, and market instruments, which includes regulation, tax, subsidy, trading system, and so on. Several instruments are often used simultaneously especially in transition stage or for pilot areas.

### 3.3 Phase 3

The third phase should be economic efficiency where the market mechanism can work well in the domain of general climate change goods, while the government plays important role in the public domain of public climate change goods.

As general goods, climate change goods have become scarce at the firm level. More and more firms become suppliers, and firms and individuals become demanders for climate change goods. Markets are an efficient measure to allocate climate change goods because the market system is established with timely information, a perfect monitoring network, and objective reporting. Stakeholders can make rational decisions according to the climate change goods price. Markets are “active” and “functioning”.

Unlike the second phrase, uncertainties of the future have been reduced. Investments undertaken to reduce environment impacts may trigger productivity gains following the hypothesis of Porter (Porter and Van der Linde, 1995). In this scenario, innovations responding to climate change can gain an economic benefit and not just incur additional costs. Green investment is one of the important factors for the future sustainable growth of firms, industries or other economic sectors. “Green growth” has proven to be possible and beneficial in cities and companies (Climate Group, 2004) and at the macroeconomic scale (The Allen Consulting Group, 2004).

This does not mean that the private sector can provide enough climate change goods or that the market mechanism can work well on its own in response to climate change. In this phase, the connection and integration between the top-down measures and market mechanism is important. To establish a market mechanism for adaptation we would, for example, need to define an “adaptation unit” by means of top-down regulation and monitoring in order for the most vulnerable to benefit from the existing adaptation funds, e.g. by earmarking a certain share of adaptation funding for the most vulnerable, while allocating the rest through market mechanisms” (Butzengeiger, et al. 2011). As with many infrastructure projects, public-private partnerships (PPP) would be the most efficient relationship for government and private sectors in many fields, such as green infrastructure finance. A World Bank report pointed out that many green technologies require subsidy support. Such hybrid financing schemes are more common as projects become more complex and are not viable on purely private financing structures. Green technologies must develop an equitable risk allocation framework that can provide a compelling argument for different stakeholders to support these investments through subsidized financing to the extent that such financing is justifiable from a climate change perspective (Baietti, 2013).

In view of this, a few issues have to be addressed during the progression from the second phase to the third phase. The first concerns the resource sharing of relevant agencies. To supplying climate change goods is the integration of different knowledge and needs the supporting of many kinds of science date. It is impossible for any supplier alone. Cooperation is the best way to gain economic efficiency in the climate goods market. The second issue is the

balance between public and private climate goods, which includes the capacity building of vulnerable populations and the quality control of climate change goods. The third issue relates to the communication to end users. A customer-orientated approach is important for the third phase. Climate change goods must be designed for the specific customer, which includes an understanding of the user's needs, the user's uncertainties, and identifying climate sensitivities.

As mentioned before, the three phases are not strictly divided and all kinds of policy instruments are not mutually exclusive. For example, with the German ecological tax reform of 1999, the government gradually implemented market based environment policy instruments but did not substantially abandon the dominant regulatory approach (Boecher, 2012). Given China's circumstances, regulatory instruments are urgently necessary but they have to be complemented by a wide range of market-based policy instruments.

# 4 China's strategy for addressing climate change

According to the model established in chapter 3, this part describes the development of response strategies to climate change in China which provides the background for understanding the proposed model.

## 4.1 Background and development of climate change response strategies in China

### 4.1.1 Responding climate change at international and national level

In 1992, China signed and ratified the United Nations Framework Convention on Climate Change (UNFCCC). After that, China started responding to climate change at the national level. During that period, participation in international conferences was the main driver for climate change response in China. This classified climate change as an issue for international relations and international politics and was tackled as a public issue at the national level until 2005 when the 11th Five Year Plan (FYP) was implemented.

From a climate change goods development angle, the government and the national scientists formed the sole demand for climate change goods and services. The focus was on knowledge generation, i.e. learning about climate change and climate change impacts, specifically the exploration and prediction of the relationship between climate change and national development in a rapidly growing economy. At that time, few stakeholders of the private sector were concerned about the environment and climate change goods in their production and consumption planning. This lack of awareness and narrow economic rationality of the relevant stakeholders were characteristic for this phase.

Little knowledge of climate change was available and disseminated to the Chinese public. The (inherent) uncertainties of climate change obstructed the development of climate goods and services in many fields. For example, the impact of climate change on agriculture was perceived as unpredictable and too complicated because it depend on too many factors such as scale, location and the vulnerability of the people and activities involved (Aydinalp and Cresser 2008). The effects of those factors depend on complex feedback cycles that are still poorly understood. Furthermore, uncertainty was increased by the complexity of an integrated biophysical and socio-economic system. (IPCC 2007a; Kalaugher et al. 2013).

In this truly Knightian sense of uncertainty (Knight 1921), there is no market possible for climate change goods and services. Within this period, climate change goods are purely public goods: non-excludable and non- rivalrous (Kennedy 2012). Most are scientific projects financed by necessity on public budgets since the results of climate change research are also non-rivalrous (everybody can benefit without narrowing the benefits of others). This also has also implications on the structure of governance whereby, prominent agencies such as the Ministry of Environment was a level lower in administration within China's government system until 2008.

At that time, the response to climate change was set against three developing contexts: **First,** economic growth was the most important focus for China in that period. To illustrate, in 2010, the per capita GDP was just US$4,433 in China, compared to US$34,892 in the EU in 2010 and US$48,112 in USA. Hundreds of millions of people lived below the UN poverty line (UN 2013). **Second**, the economic structure shaped the current situation of China where the development of industry relied heavily on the supply of energy and raw materials (as shown in Figure 4-1). **Third,** the technology of low carbon production, in which the growth of production is de-coupled from the growth of energy and resource usage, was lacking. Consequently, the only way for China to decrease the CO2 emission was to decrease production activities, which sharply contradicts its national plans for economic growth, explained in fist context.

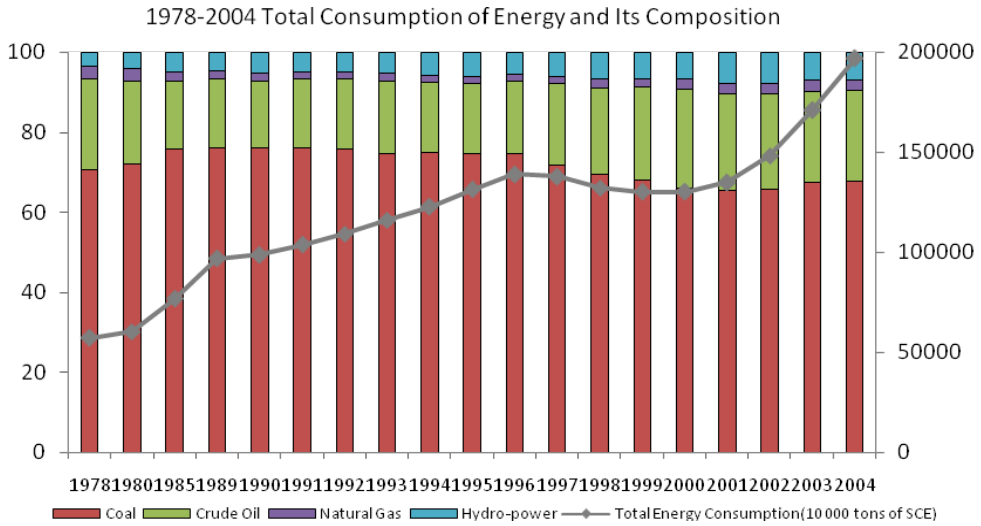


**Fig 4 - 1 1978-2004 Total consumption of Energy and its composition**

In order to resolve this lock-in situation, the Chinese government tried to find measures leading out of this 'economic dilemma' of developing the country amidst international pressure. The turning point appeared with the Kyoto Protocol in 1997. In the following year (1998), the coordination office of climate change policy in China was transferred from the politically lower ranking Meteorological Bureau of China (now, the China Meteorological Administration (CMA) to the National Development and Reform Commission (NRDC), which is the most important change in governance when studying the development of climate change goods in China. In the late 90s, very little research was available on the economic effects of limiting carbon emissions at the macroeconomic and sectorial level. Also, there was little research on the potential and efficiency of relevant mitigation and adaptation policies, in particular, studies on the economic assessment of climate change policies (Chen, 2002)**.** This condition continued until 2005, the beginning of the 11$^{th}$ FYP.

### 4.1.2 Transition to responding to climate change at the regional level

In 2005, the introduction of the 11$^{th}$ FYP coincided with the change in China's climate change strategy, which marked a long period of transition, a transition from pure public good to a mixed public-private–partnership, and from response at the national level to action at the regional level. In December 2009, responding nationally to climate change became more urgent when China joined the Copenhagen Accord pledge to carry out a domestically binding target to reduce its economy's carbon intensity by 40 to 45 percent in 2020 compared to 2005 levels. To achieve this target, the Chinese government planned to utilize more market-based means and will begin domestic carbon trading programs during the period of 12th Five-Year Plan.

Responding to climate change is a complex project. Each subsystem, including ecology society, and economy, interact with each other. For instance, market-based approaches are difficult to implement even in many developed and leading industrialized countries, exemplified by the many 'failures' of re-adjustments of the European Union Emissions Trading Scheme (EU ETS). Challenges are therefore not particular to China, but common to any emerging emission trading system. For China, one of the most important tasks in the second phase is to experiment with response strategies at the regional level. Pilot projects play an important role of "forging the river by feeling for the stones". In general, two types of pilot projects related to developing market-based approaches are characteristic for China: (1) Low-carbon Pilot Projects in Provinces and Cities and (2) Pilot Projects for Carbon Emissions Trading.

- **Low-carbon Pilot Projects in Provinces and Cities**

In July 2010, China launched the first batch of national "low-carbon province and low-carbon city" experimental project, which included five provinces and eight cities[2]. In November 2012, the second batch of "low-carbon province and low-carbon city", which included 28 cities and one province, was launched[3]. Most of these cities are in eastern China although every province has pilot cities. The main target of these pilot projects is to improve capability building for addressing climate change, which comprises administrative capability and preparation for market-based measures. The pilot projects were designed with five main tasks: i) compiling low-carbon plans, ii) formulating supporting policies, iii) promoting the construction of a low carbon industrial system, iv) establishing data management and statistical system of greenhouse gas emissions (GHG), and v) advocating a low-carbon life style and consumption pattern. The pilot projects were spread broadly with the aim of strengthening and optimizing each pilot city, rather than implementing sharp reforms.

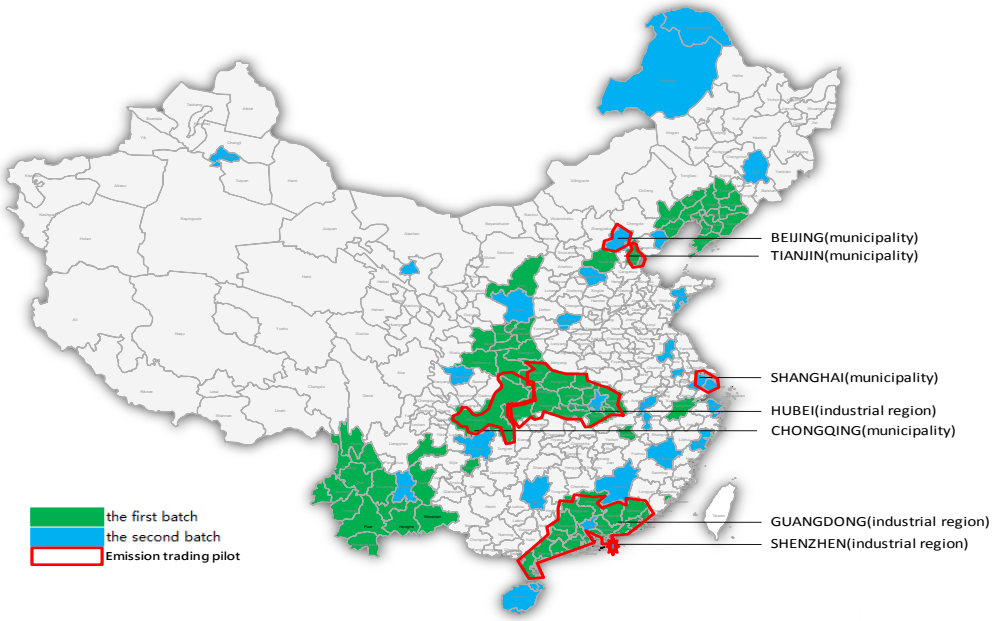


**Fig 4 - 2 Regional distribution of low carbon and carbon emission trading pilots**

- **Pilot Projects for Carbon Emissions Trading**

In November 2011, the NDRC approved carbon emission trading pilot projects in seven provinces and cities, which are Beijing, Tianjin, Shanghai, Chongqing, Hubei, Guangdong and Shenzhen. The main target of the seven pilot projects is to "find the stones", which is a bottom-up approach to uncover valuable insights for designing of a national system in the near future. The main tasks included i) calculating and defining overall caps for GHG emissions in the region, ii) formulating plans for distributing specific emissions targets, iii) developing a support system, which include regulatory as well as national registry and recording systems, for the pilot programs and v) establishing trading platforms as the carrier for carbon trading in each pilot area. These pilot projects are expected to take on and test various modes of trade and different implementation paths and make good progress by the end of the experiment. Their successes or failures will have more implications for market-based measures development in China.

[2] The first batch of selected localities included five provinces, namely, Guangdong, Hubei, Liaoning, Shaanxi and Yunnan, and eight cities, namely, Tianjin, Chongqing, Hangzhou, Xiamen, Shenzhen, Guiyang, Nanchang and Baoding.
[3] Beijing, Shanghai, Shijiazhuang, Qinhuangdao, Jincheng, Hulunbeier, Jilin, DaxingAnling, Suzhou, Huaian, Zhenjiang, Ningbo, Wenzhou, Chizhou, Nanping, Jingdezhen, Ganzhou, Qingdao, Jiyuan, Wuhan, Guangzhou, Guilin, Guangyuan, Zunyi, Kunming, Yanan, Jinchang, Wulumuqi and Hainan.

**Tab 4 - 1 Goals for Energy Efficiency**[4]

| Location | Achieved energy consumption per-unit GDP in 2010 (Standard coal/tone/10,000RMB GDP) | Decreased energy consumption per-unit GDP from the 2005 level (%) | Energy consumption per-unit GDP reduced by 2015 (%) | Carbon dioxide emission per-unit GDP reduced by 2015 (%) |
|---|---|---|---|---|
| **National Total** | 0.810 | 19.1[5] | 16 | 17 |
| **Beijing** | 0.582 | 26.59 | 17 | 18 |
| **Guangdong** | 0.664 | 16.42 | 18 | 19.5 |
| **Tianjin** | 0.826 | 21.00 | 18 | 19 |
| **Shanghai** | 0.712 | 20.00 | 18 | 19 |
| **Hubei** | 1.183 | 21.67 | 16 | 17 |
| **Chongqing** | 1.127 | 20.95 | 16 | 17 |
| **Shenzhen** | 0.513 | 13.39 | 7.84 | 15 |

As shown in Table 4-1, every pilot project has released specific plans for energy efficiency and also steps to establish carbon trading systems. Before a national scheme can be implemented, several obstacles must be overcome. For example, efficient and equity of emission right allocation is a controversial topic even after setting the cap on emissions. Meanwhile, the capability and legislation of MRV is also crucial for the ETS. The contradiction between increased cost and fixed product price, such as electricity, of many state enterprises are some of the barriers to the implementation of an ETS. Although China announced that a national emission trade system will be designed in the near future, it is an ambitious aim.

## 4.2 Analysis of climate change response strategy as economic goods in China

After twenty years, China is now trying to improve climate change strategy systemically. Even though it is still a newcomer and is still in the beginning of the second stage, China is in the transition phase of responding to climate change. At this stage, one of the crucial tasks is the creation of a market, which involves the creation of demand and supply simultaneously. The government should also apply market instruments gradually and maintain a balance between top-down and bottom-up measures as one of the key factors for a smooth and successful transition.

### 4.2.1 Supporting supply

At this stage, the Chinese government tries to encourage profit maximization for individual, private actors in the delivery of climate change goods. Research found that, from the angle of cost saving, greater heterogeneity among producers would gain greater achievements comparing top-down measures only (Jack et al. 2008). On the other hand, private actors should be compensated for the public goods or services provided and associated opportunity costs when they participate in responding to climate change[6].

This objective can be achieved through subsidy or tax incentives, by transfer of property rights, and by the regulation of market mechanisms. Subsidies to technical innovation by forerunners of climate change goods providers is one of the most important strategies adopted in China. Until now, there are a few technologies supplied, such as, remote sensing satellite, natural disasters monitoring and prevention information systems, solar photothermal technology, field film mulching crop cultivation, crop yield-enhancing technology, rainwater collection, storage and utilization technology, and so on[7]. Government support is necessary at this initial stage. Besides the National Scientific and Technological Actions on Climate Change jointly formulated by the Ministry

[4] Data reference to FYP of each regional and State
[5] The target of 11th FYP is 16%
[6] There are also other kind of suppliers which include accidental supplier and altruists' suppliers.
[7] http://www.actc.com.cn/

of Science and Technology (MOST) and the NDRC during the 12th Five-Year Plan Period, China has started to subsidize research and development on clean and efficient utilization of energies, energy-saving technology and equipment in certain key industries, such as in the steel, non-ferrous metals and petrochemical and cement industries. In order to transform and upgrade traditional industries, NDRC released the 2011 edition of the Guideline Catalogue for Industrial Restructuring.

China also established research and advisory institutions, which will become important suppliers of climate change goods, such as:

i) National Strategic Research and International Cooperation Center,
ii) Environment and Climate Change Center and Ecological Protection and Climate Change Response Research Center,
iii) three forest carbon sink metering and monitoring centers in east, central and northwest China,
iv) the Energy Conservation and Emission Reduction Research and Promotion Center which is an industrial research institute specializing in energy conservation[8].

These institutes will play a big role with the intelligence and coordination of climate change goods demanders and suppliers and assessment of the progress in climate change response actions.

### 4.2.2 Encouraging demand

In many cases, especially in the early stages of transition, the actual demand for climate change goods and services is not sufficient to support its provision. Some research has explained that carbon offset markets should be supported and incentivized because not many individuals or enterprises are interested in or have a demand for greenhouse gas mitigation (Bumpus,2008). States should create a demand for climate change goods i.e. by transferring the scarcity of climate change goods from the central government to the relevant regional and sectorial stakeholders.

The market system for climate change goods will be improved and work well when the demand for climate change goods increase. One of the important methods for China is to establish a general responsibility system for meeting energy saving and pollution discharge reduction targets. From 2007, the government started to assess the local government on the energy savings targets. The National Bureau of Statistics (NBS), NDRC and the National Energy Administration (NEA) jointly issued energy consumption indexes for each province, such as energy consumption per unit of GDP. At same time, NDRC assessed and supervised the energy savings target of 1,000 key enterprises. Several key industries took action to respond to climate change, such as the power industries, steel industries, petrochemical industry, nonferrous metals industry, building materials, and so on. Sufficient demand should be created under these policies especially when the government takes measures obligating the need for beneficiaries to "pay" for the generation of climate change goods. This is also good way to address the problem of free-riding (Jack et al. 2008).

Another method to create demand is to improve the level of understanding by increasing public awareness on climate change and engaging civil society. With the aim to educate people on making optimal choices under the constraints of climate change and promote low-carbon development, it is important to raise awareness of the need to address climate change and make climate change an important factor in the decision making process.

The Chinese government has already put in place a few measures to increase "rationality" in the sense of Chap. 2. First, educational institutions are gradually including climate change into the national education and training system. Second, relevant departments and local governments have promoted low-carbon development through campaigns, forums and the distribution of publicity materials. Third, major Chinese news media, including Xinhua News Agency, the People's Daily, CCTV and other mainstream media as well as specialist media, provided varied

[8] These institutions belong to NDRC, MEP, the State Forestry Administration, and the Civil Aviation Administration of China.

and informative coverage of climate change and green and low-carbon development. Forth, industrial associations organized forums and expositions on climate change and low-carbon economics, which played an important role in promoting the development of renewable energy[9]. Fifth, NGOs have taken proactive actions, such as the Climate Citizen Surpassing Action (C+) Plan.

### 4.2.3 Establishing functioning markets

In the stage of transition, one of the important tasks is the creation of conditions for establishing a functioning climate change goods market, which is a regional or national infrastructure where demand is communicated and suppliers are available to meet their needs. It is also a platform for suppliers to find opportunities of profitable service. Most importantly, a mature market system needs two important parts: First are the preconditions for a market operating smoothly. Another is the application of market management tools in an efficient and effective manner. In recent years, China has attempted to set up a perfect competition market environment in its effort to transform climate change goods from public goods to private goods. In 2010, China issued 27 mandatory national standards for energy consumption quotas of high energy-consuming products and 19 mandatory national energy efficiency standards for major terminal energy-using products; formulated 15 national standards for the discharge of major pollutants and promulgated 71 environmental labeling standards. The ISO 14000 series offers a framework to encourage or compel industries to improve environmental performance. Until now, the ISO14000 certification is useful in promoting a good enterprise image and hence, conducive to improve the market competitiveness of enterprises and products.

Furthermore, China has been trying to improve the legal system for addressing climate change. According to China's Policies and Actions for Addressing Climate Change (2012), the NDRC and relevant departments have drafted a legal framework for addressing climate change and the passage of the law is likely by 2015 (Yu and Elsworth, 2012). A project entitled "Studies into Provincial Legislation on Climate Change: a Case Study of Jiangsu Province" was initiated to improve provincial legislation on addressing climate change and to accelerate the passing of national legislation[10].

The government is proactively pushing forward energy management through contract management, power demand side management, voluntary energy conservation agreements and other market mechanisms. For instance, trials for trading energy savings, carbon emission rights, pollution discharge rights and water rights were recommended at the 18th National Congress of the Communist Party of China (CPC) (Hu 2012).

Reliable national statistics and accounting systems are fundamental for a functioning climate change goods market. The transparency and accuracy of China's climate change data needs to be tackled seriously (Marland 2008; Liu,2009). Research pointed that $CO_2$ emissions calculated on the basis of the two publicly available official energy data sets differ by 1.4 gigatonnes for 2010(Guan 2012). The discrepancy of energy data in China reflects inconsistencies in official energy statistics (Marland 2012). Now, China is trying to enhance statistical and accounting capabilities and improve energy and climate change related statistical systems. As of 2011, all provinces, autonomous regions and municipalities directly under the central government have set up energy statistics organizations, and key energy consumption units have boosted their energy statistical and accounting framework. China also reinforced greenhouse gas emission accounting and built a national inventory of greenhouse gases. However, the biggest challenge lies in the change of a top-down statistical system, under which the local data (provincial and county levels) was coordinated by NBS at the central government level (Holz 2004).

[9] Such as China Renewable Energy Industry Association, China National Coal Association, China Nonferrous Metals Association, China Petroleum and Chemical Industry Association, China Building Materials Federation, China Electricity Council and so on.

[10] China's Policies and Actions for Addressing Climate Change (2012)

Actually, establishing a perfect market and implementing market tools are inter-related prerequisites or mutual conditions. Taking environmental liability insurance as example, China would carry out mandatory environment insurance, which uses market tools in the risk management field. In the early stage, a smooth transition and an improving market operating environment are key factors for implementing the insurance. A few points should be highlighted: **First,** a detailed and sophisticated insurance policy system must be provided, which includes a required coverage list and a sustainable price for both insurers and the insured. As a new field, the government should provide support for some aspects, such as financial rewards or subsidies, to facilitate a smooth transition for insurance companies or insured factories. **Second,** the government must put forward a compensation mechanism, which includes compensation standards and procedure, supervision agency, arbitration organization and so on. Under a perfect compensation mechanism, insurance companies would assess the environmental risks and apply pressures on operators to reduce pollution. Otherwise, there would be no incentives for insurance companies to bear the social responsibility during enforcement of pollution reducing events. **Third,** insurance companies should be free to assess and supervise the insured factory i.e. insurers must have the appropriate power with sufficient official support to enforce environmental risk management and supervise insured factories involved, which is important especially for regions where GDP is one of the important government targets.

### 4.2.4 Maintaining a balance between top-down and bottom-up measures

Although some research is available, methods for choosing measures of responding to climate change is still a significant challenge with regards to specific governments, development stages, and different regions (Adger, et al. 2005; Urwin and Jordan 2008). Maintaining a balance between top-down and bottom-up measures is always a tough skill to master for administrative departments. Research shows that top-down measures are effective and gain higher efficiency if the objective is to mitigate climate change, such as emission reduction (Sovacool and Brown 2009), while bottom-up measures have more advantages for adaptive measures to climate change (Hulme 2008). Since mitigation and adaptation strategies are not a black and white question, efficient response measures to climate change need a combination and an interaction of top-down and bottom-up approaches.

In China, emission reduction is an important promise to the international community, which means mitigation strategies are a national challenge. Besides that, adaptation strategies are also an important task. As a member of the UN, China should have a detailed concrete plan and implementation procedures for top-down measures in its participation in international negotiations. Furthermore, the government should fulfill various obligations such as providing climate change information, raising public awareness and implementing programs of climate adaptation ability, which are all prerequisites for efficient bottom-up approaches.

Although top-down measures was the important part of whole government responding system, bottom-up approach is under carrying out in China's Policies and Actions for Addressing Climate Change (2012). Some sectors initiate bottom-up activities according to sectors characters. For example, in 2011, the Ministry of Transport initiated pilot projects for the construction of low-carbon transport systems. The Ministry of Agriculture continued to promote the cultivation of high quality seed varieties with high yield potential and resistance to drought, flooding, high temperature, diseases and pests. Meanwhile, some programs and reforms were initiated also at local (provincial and municipal) levels. Local activities will take on a more prominent role in climate change mitigation in China's future. There may be some disadvantages of both bottom-up and top-down approaches for responding to climate change. The combination of two approaches would be an efficient choice (Schreurs 2008). China is trying to integrate and balance different level policies. That is important to facilitate dialogue and make partnership actions successful. Establishing departments for adaptation in different levels will put forwards the integration. Moreover, inter-level organization can play an important role for communication and providing knowledge to each other.

# 5 EU strategy to climate change

Preventing dangerous climate change is a strategic priority for the European Union. Europe is working hard to substantially reduce its greenhouse gas emissions while encouraging other nations and regions to do likewise. The following are some of the targets:

i) For 2020, the EU has committed to cutting its emissions to 20% below 1990 levels.

ii) EU also offered to increase its emissions reduction to 30% by 2020 if other major emitting countries in the developed and developing worlds commit to undertake serious emissions reduction efforts in similar fashion.

iii) For 2050, EU leaders have endorsed the objective of reducing Europe's greenhouse gas emissions by 80-95% compared to 1990 levels as part of efforts to build a low-carbon and a competitive European economy at the same time.

In the year 1998, the European Union was responsible for 24% of the GHG in the worldwide. When the Kyoto Protocol was signed that year, the EU committed to reduce its emissions by 8% between the years 2008 and 2012. It has since been committed to international efforts to tackle climate change and felt the duty and advantage to be a 'frontrunner' and to set an international example in responding to climate change through domestic robust policy-making. The mainstay of EU's climate change strategy is the European Union's Emissions Trading System (EU-ETS), a comprehensive package of policy measures to reduce GHG emissions, which has been named the European Climate Change program (ECCP). Each EU Member State has also set out to use their own domestic actions that build on the ECCP measures or complement them. The first ECCP (ECCPI) was launched in 2000 to help ensure that the EU meets its target for reducing emissions under the Kyoto Protocol. This requires the countries that were EU members before 2004 to cut their combined emissions of GHG to 8% below the 1990 level by 2012. In October 2005, the Second European Climate Change Programme (ECCP II) was launched, to further explore cost-effective options for reducing GHG emissions, and to achieve synergy with the EU's Lisbon strategy for increasing economic growth and job creation.

## 5.1 EU-ETS as a social learning process

The EU emissions trading system (EU ETS) is the cornerstone of the European Union's policy to combat climate change and its key tool for reducing industrial GHG emissions cost-effectively. The first and the biggest, to date, international system for trading greenhouse gas emission allowances, the EU ETS covers more than 11,000 power stations and industrial plants in 31 countries, as well as airlines. The EU ETS works on the 'cap and trade' principle. A 'cap', or limit, is set on the total amount of certain GHG that can be emitted by the factories, power plants and other installations in the system. The cap is reduced over time so that total emissions fall. In 2020, emissions from sectors covered by the EU ETS will be 21% lower than in 2005. The EU ETS is divided in 3 phases running until 2020 (see Table 5-1).

**Tab 5 - 1 Three phases of EU-ETS**

| Phase 1 | Phase 2 | Phase 3 |
|---|---|---|
| *Pilot Phase*<br>• 25 participants<br>• Allowances allocated for free<br>• Establishment of exchange markets: ECX in London, EEX in Leipzig, BlueNext exchange in Paris<br>• Development of NAPs<br>• Establishment of National Registries and CITL<br>• Penalty á 40€ / ton short EUA<br>• Banking of EUAs not allowed | • 30 participants - Romania and Bulgaria (New-EU Member States); Iceland, Norway, Liechtenstein (Non- EU) join in<br>• Enforces the EU's obligations in the Kyoto Protocol to meet goal of -8% compared to 1990 level<br>• Penalty á 100€ / ton short EUA<br>• Banking of EUAs possible | • Culmination of first two phases<br>• No more NAPs - Commission to centrally assign EUAs<br>• Include new sectors (chemical industry) and additional CO2 emissions<br>• 2013 Cap - 2.04 bil. Allowances to be reduced by 1.74% annually<br>• Allowances to be fully auctioned by stepwise<br>• Aviation (within EU) to be included<br>• Back-Loading and Structural Reform to stabilise EUA prices |

Source: Compiled from European Commission DG Climate: http://ec.europa.eu/clima/policies/ets/index_en.htm.

The **first phase** was set to run from 2005-2007 and to establish the trading of emission rights for GHGs and set incentives for the right use of energy. It regulates the emissions of CO2 for more than 12 000 plants for about 45% of EU total emissions, especially within energy activities, the production and processing of ferrous metals, the mineral industry, and the paper and board activities. A distinguishing feature of this 'learning phase' was that each participating member state submitted a National Allocation Plan (NAP) to quantify the total amount of allowances it would allocate in a year to its companies. These plans were based on past emissions (historical baseline). This plan needed approval by the EU Commission or faced amendments based on EU Commission recommendations, before entering into effect. The Commission also required a separate Community Independent Transaction Log (CITL) to monitor the transactions among accounts and assure that such exchanges were done according to ETS rules. During phase I, an instalment which was found in non-compliance was subject to a fine of 40€ per overage ton and was required to purchase the necessary credits it was short of.

The **second phase** from 2008-2012 was aligned with the 1997 Kyoto Protocol commitments and aimed to produce 'real results'. After the pilot phase, the EU ETS was facing numerous critics and had many problems to deal with. Nonetheless, the EU learned from these mistakes and problems and increased efforts to prevent from over allocation in national allocation plans. The second major amelioration was to prevent the emission trading market from reporting uncertainty and volatility in prices. Also, the fine was increased to 100€ per overage ton to strengthen rule conformity of emission trading for the ETS II. Finally, allocations are now bankable from Phase II into future periods, reducing exposure to short period price variations. Three new non – EU countries joined the scheme (Norway, Iceland, Liechtenstein).

Finally the **third phase**, 2013 - 20, foresees continual quantity restrictions and real progress towards lowering overall emissions below 1990s levels. After a major revision, approved in 2009 in order to strengthen the system, the third phase was based on rules which are far more harmonised than before. The main changes are:

- A single, EU-wide cap on emissions replaces the previous system of national caps;
- Auctioning, not free allocation, is now the default method for allocating allowances. It is estimated that around 60 percent of the allowances are going to be auctioned. The rest of the allowances will be freely allocated according to harmonised EU ETS rules. The free allocations will mainly go to sectors whose competitiveness would fall dramatically as a result of the EU ETS. The European Commission fears that the firms concerned would move to countries outside of the European Union, with laxer regulations which, could encourage an escalation in CO2 emissions. Under the principle of 100 percent of allowance

auctioning, the EU ETS countries will auction ever larger parts of their allowances. The principal has two main objectives: increase transparency and entice firms to invest in low-carbon energies.

- Harmonised allocation rules, which are based on ambitious EU-wide benchmarks of emissions performance, apply to the allowances given away for free;
- More sectors and gases are included and
- At the end of Phase two, the caps will be annually decreased by a linear factor of 1.74 percent and this annual cut will still be valid beyond 2020.

## 5.2 Is EU-ETS a mature market?

Many economists consider the EU ETS to be the most cost-efficient way to reduce emissions in the EU. In fact, it has proven adaptability to broader macroeconomic conditions, for example, by responding to the contracting economic activity in the EU by generating lower EUA prices (fig 5-1). Recent market developments, however, have cast doubt on the EU ETS as a 'mature market' (Phase III of our stages of development). Following the latest financial crises in 2011/2012, more and more financial players have left the EU ETS due to lower price levels. The European Commission has therefore taken the initiative to postpone (or 'back-load') the auctioning of some allowances as an immediate measure, while also launching a debate on structural measures (European Commission 2012). For a short-term intervention, it proposes a delay on the auctioning of 900 million allowances to the later years of phase 3. This proposal is known as "backloading" and would reduce the oversupply in the next few years but not change the overall supply and demand imbalance in the market.

To address the long-term oversupply of EUAs, the EU commission offers several options. One of these includes the cancellation of the "backloaded" allowances, which would result in severe regulatory uncertainty (thus is less probable) while the other proposal foresees strengthening the EU's emission reduction target and including other sectors in the EU ETS (and is most probable as a structural reform). One way to do this is to increase the linear reduction factor of 1.74 to a higher factor that would be in line with the EU's long-term climate target to reduce emissions by at least 80 percent by 2050. These unconfirmed initiatives for a sustainable solution to long term price stability are yet another reason to believe that EU-ETS is still a market in development (or phase II in our terminology) rather than a mature market.

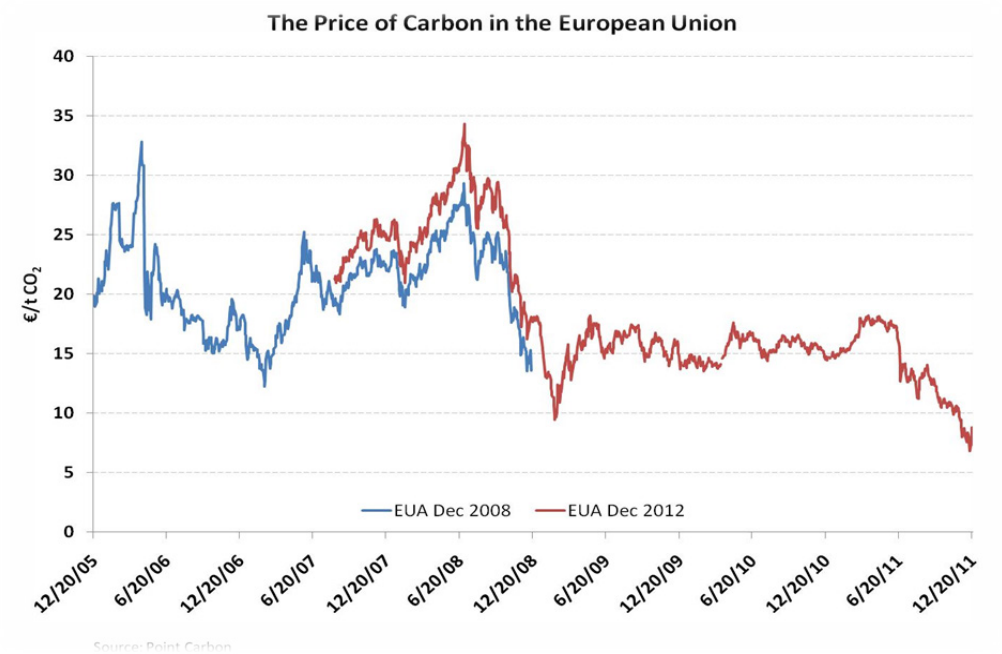


**Fig 5 - 1 The price of carbon in the European Union**

## 5.3 Prospects for linking EU-ETS with international markets

The success of the EU ETS has inspired other countries and regions to launch cap and trade schemes of their own. The EU aims to link up the ETS with compatible systems around the world to form the backbone of an expanded international carbon market. Considering the linking with other markets as a process of maturation, the most probable prospect is the linking EU-ETS with the Australian emissions trading scheme. In August 2012, an agreement has been reached between the EU commission and the government of Australia on establishing a full two-way link by 1 July 2018 at the latest. Under this arrangement, companies will be allowed to use carbon units from the EU ETS or the Australian ETS for compliance under either system. Looking at prospects of linking ETS in the EU and China, Han et al. (2012) find that China's carbon market are still in a research and development phase (Phase I in our terminology). Given the long duration of transition, and the five year planning periods in China this move will only be possible past 2020 (in the 14th FYP).

# 6 Environment in the transition to a market economy: the case of Central and Eastern Europe States

Building on the analysis of the EU ETS, this chapter outlines the environmental developments the CEE states went through leading into the EU ETS. It explains the difficulties for the development of climate change policies in countries with a heavy pollution background i.e. industry dependent on coal. The surprisingly positive trends in GHG reductions will also be explained. This section serves as the basis for exploring the lessons learned by the countries in transition into the EU ETS and discussed before the background of alleged 'hot air trading'.

In 2004 and 2007, the European Union underwent a large eastern-oriented expansion, in which ten Central and Eastern European states (CEE) successively accessed the EU. Within a period of only three years, twelve new member states[11], also known as the EU 12, had joined the standing fifteen EU members (EU 15) as participants in the European Union, bringing the total number of countries in the EU to 27 (EU 27). The starting year of EU-ETS, 2005, immediately followed the accession of EU 12 in 2004. Similarly, the starting of Phase II of EU-ETS in 2008 followed the accession of Romania and Bulgaria in 2007. Focussing on the economic and political situation faced by the Central and Eastern European member states, we will analyse how these nations approached EU-ETS, how they learned the 'new ways' of treating and trading pollution, and also how they unlearned detrimental environmental practices stemming from the previous Soviet economic system.

## 6.1 Transformational background

Before the transition to the post-communist period, the environmental practices in the CEE states followed the Soviet model. A defining characteristic of this model was little consideration for the quality of life and the environment. For instance, environmental damage stemming from government owned industrial complexes was either ignored or covered up. Environmental policy in this period was largely symbolic, proclaiming unrealistic or unachievable goals (Moldan and Hak 2011).

This reality shaped the initial response to the challenge of climate change. The greenhouse gas (GHG) emissions in CEE countries depicted a very favourable development. In the 1980s, it was at around 980 million tons and fell drastically to around 830 million tons after transition to the post-communist period. In 1995, it was less than 700 million tons (depicted in Fig. 6-1), which was reported by CEE states in international climate negotiations as a success of structural reform and environmental policies. Critics feared that it is only 'hot air trading', which did not lead to an overall reduction in emissions (Schwarze 2002; Ellerman and Joskow 2008). As a result of 'hot air debate', the CEE states lost some opportunities in the starting period of EU-ETS and were only able to fully access the market in the second phase. The 'hot air debate' was a long term obstacle for investors of EU15 to purchase the carbon credits of CEE countries (Skjærseth and Wettestad 2007).

[11] Ten CEE states (Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, Slovenia, Bulgaria and Romania) plus Cyprus and Malta accessed the EU in 2004 as group of EU 12, Bulgaria and Romania followed this move in 2007.

*

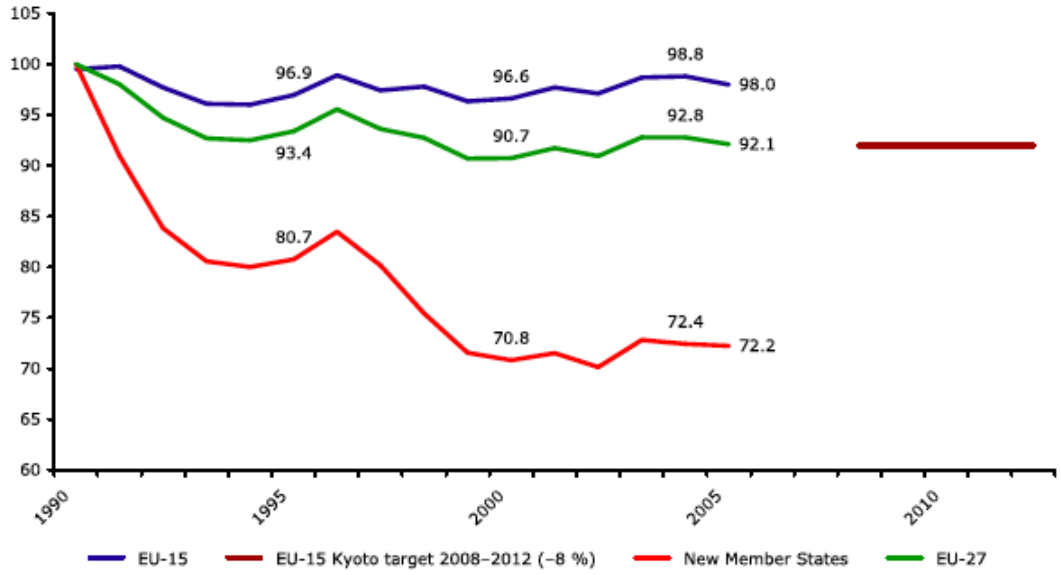


**Fig 6 - 1 GHG emissions in the EU 27, EU 15 and EU 12**

Source: Fazekas (2009), 42, based on EEA (2007). Note: 100 = 1990 levels

While the key driver for this development of GHG emissions has been de-industrialization, following privatisation and market liberalisation, it can also be partially attributed to the growing democratic opposition against the 'environmental blindness' of the Soviet model (Moldan and Hak 2011). Starting already in the 1980s, a concern about the environmental impacts of industry did begin to emerge in some countries[12], which resulted in limited environmental policies. However, implementation of these policies was often diluted and delayed by the 'biggest polluters' in the economies – namely large government owned industrial complexes who were able to directly 'speak to power'. Following the collapse of the Soviet system and the subsequent transitions, the 2000s brought drastic changes in political, economic, social and also environmental terms. EU accession implied for the CEE countries they needed to adhere to the rules of the so-called 'acquis communautaire' which implies that all EU directives must to be transposed into national legislations and subsequently enforced after some period of transition. This 'forced' adoption of new practices delivered new opportunities and challenges to the CEE states in terms of 'social learning processes' but also 'social un-learning' as the soviet system left important 'negative legacies' to be overcome to implement the environmental policies of the European Union. 'Negative legacies' (Doersch 2011) of the soviet system included:

- Inefficient production methods and rampant corruption
- No built in market signal for resource scarcity
- Oversized scale and over proportionate share of heavy industry in the economies
- Limited knowledge and data on energy consumption
- Limited use of energy conservation methods leading to high energy waste.[13]

[12] One example is the gradual disappearance of the Aral Sea in Soviet Union, but there were also protests on the 'killing' of the Vistula and Oder rivers in Poland, which were over 70 percent 'ecologically dead' in the 1980s.

[13] However there were also 'positive legacies' to draw upon in environmental transformation such as shared commuting and widespread public transport, extensive use of district heating and the use of waste heat stemming from industrial sources and cogeneration facilities.

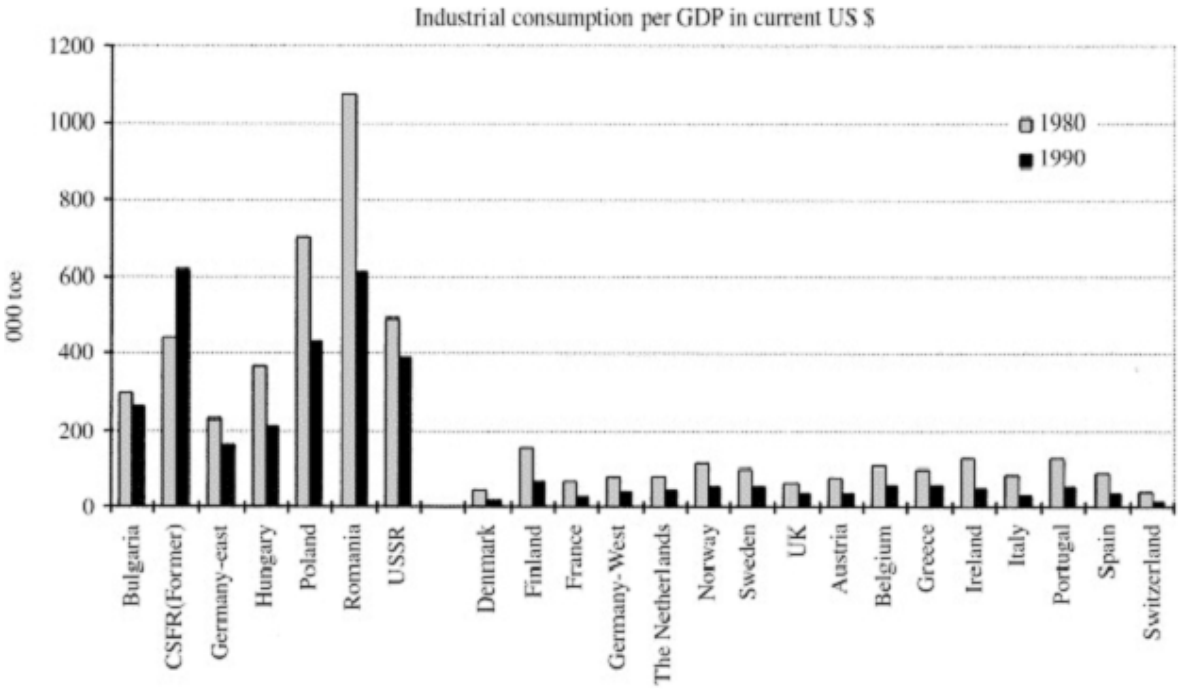


**Fig 6 - 2 Industrial energy consumption per GDP for East and West European countries**
Source: Midttun and Chander (1998), based on IEA(1990-91), GDP in current US$

Figure 6-2 shows the intensity of industrial energy consumption per GDP in comparison with the rest of Europe's consumption rate (Midttun and Chander, 1998). While all European countries were facing some inefficiencies and market imperfections with regard to the use of energy and natural resources in the economy, these externalities in production were particularly outstanding in the Central and Eastern European countries.

CEE states lacked the necessary knowledge, funding, technology and public support to deal with the growing problem. In 1999, in assessing the progress of Central and Eastern Europe States on environmental protection for the first time, the OECD found that 'sufficient capacity for developing, implementing, and maintaining environmental standards was often not available in CEE states'[14]. Furthermore, they found that if and when government owned companies did not meet pollution standards, adjustments to standards could be made and "temporary" limits or pollution waivers could be extended (Zamparruti, 1999).

## 6.2 Social learning processes

Joining the European Union required the CEE states to take on the *aquis communautaire* and work hard and 'out of stand' towards new policies. Accession was granted only after 'sufficient progress' in human rights, democratization, economic stability, market liberalization *and environmental practices* was achieved (Fazekas, 2009). In 2005, one year after the first ten CEE states joined, the ETS was launched. As we saw in Figure 6-1, in terms of 'emission reductions', the CEE were far below their collective Kyoto goal of minus 6 to 8 percent. In fact, in 2005, they had 28 per cent lower emissions compared to 1990. This presented great opportunities to economically incentivise the fast and sustained implementation of the EU ETS. However, it also represented major challenges, of which three stand out: First, the submission of National Allocation Plans on time. Second, the submission of NAPs was connected to established national registries and developed inventories of affected

[14] For example, in 1990 Hungary had standards for monitoring of for more than 380 air pollutants. Of the 380, they only had equipment at measuring stations to measure 10 of these (OECD 1999, 104).

companies. Third, the largest challenge the EU12 faced was convincing investors of EU15 to buy into the EUA surplus of CEE countries.

- **National Allocation Plans**

The new EU member states had a difficult time publishing their NAPs on time in light of conflicting interests among ministries and limited records from the past, leading to data availability and quality issues. Conflicts between government and industry leaders arose about the critical decisions of which companies to include in the ETS and who should be allocated free EUAs, considering competition issues (Fazekas, 2009). These conflicts resulted in important delays. The deadline for presenting NAPs to the European Commission was set for 31 March 2004 in the EU. Because of CEE accession, it was extended to May 1, 2004. Even with the extra time, ministries faced difficulties determining the total maximum emissions levels for sectors, and allocations within sectors as well as the level of installations. Additionally, decision on the allocation of free credits caused conflict among the industries and the governments. Some states applied a top-down macro-economic forecasting method (Hungary, the Czech Republic, Lithuania and Romania), while other states tried a more 'industry friendly' microeconomic bottom-up method (Poland, Slovakia, Estonia and Latvia). This led to problems when it came to the European Commission approval and consequent delays in the effective working of the ETS. The Czech Republic and Hungary were the first to submit a NAP in October 2004. It was reviewed by the Commission and they were required to make an additional 9.5% reduction. By the mid of April 2005, their NAPs had been accepted and they were ready to participate. Between October 2004 and June 2006, all CEE states were finally able to have their NAPs approved. Poland was the final state to gain approval after one and half years of delay.

- **National Registries**

Similar to the NAP challenge, the EU 12 were facing problems with setting up national registries. This task was resolved only after long delays due to a lack of internal capacity to develop baseline emissions and benchmark data. Calculations were also more difficult because of a lacking history of record keeping in the Soviet system (Van Harmelen 1995). Therefore, the limited experience and lack of capacity resulted in missed opportunities to participate in the EU-ETS. The EU 12 companies were not able to offer their excess EUAs to interested buyers in EU 15 who were short stocked in the first phase of EU-ETS (as indicated by the high prices in 2005 and 2006).

- **Market uncertainty and the 'stigma' of 'hot air trading'**

Market access was also limited for CEE countries based on the uncertainty in the market. Part of the limitations arose from price volatility in the pilot phase of EU ETS and the volatile rates on investment returns (Fazekas 2009). Another aspect hindering market participation was caused by the issue of 'hot air trading', where companies in the West took advantage of the de-industrialization in post-communist CEE countries by using the lower cost abatement possibilities while just shifting emissions. However, investors in the CEE countries, after accession, moved actively towards less environmentally damaging energy sources. According to a report from PricewaterhouseCoopers in 2007 (Fazekas 2009), businesses, when asked what impact the EU ETS has had on their investments, proclaimed that investments in renewables, gas-fired generation and nuclear energy went up across the board (see Fig. 6-3).

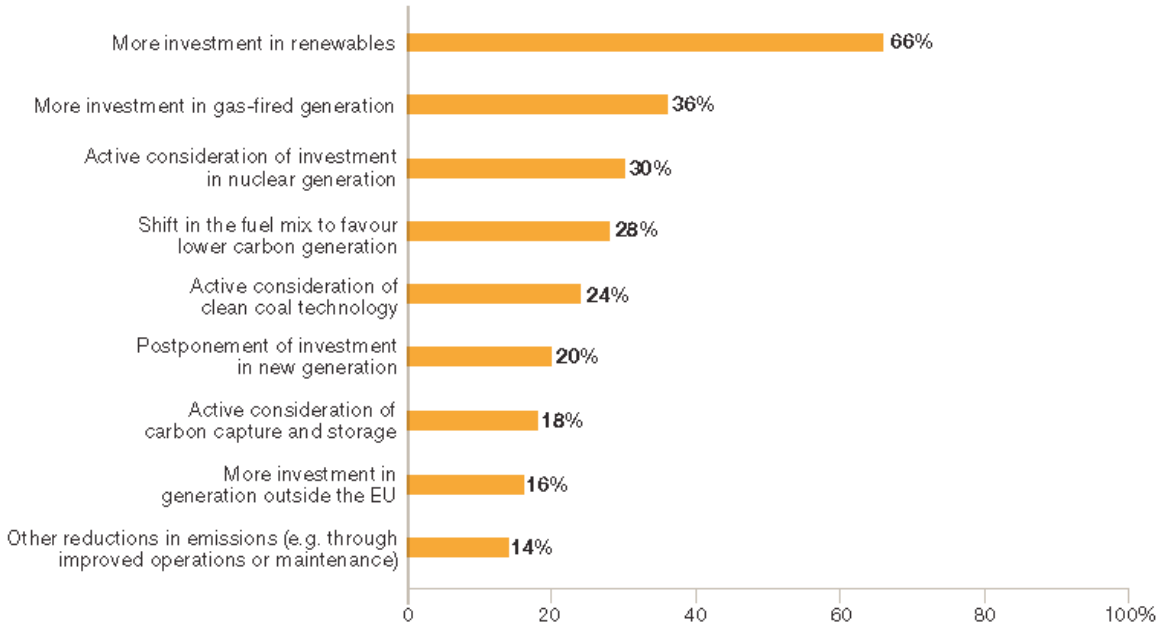


**Fig 6 - 3 The impact of EU ETS on utility investment**

Source: PricewaterhouseCoopers, Utilities global survey 2007 as found in Fazekas 2009

Long supplies of EUAs continue to exist in most CEE countries in the second phase of EU-ETS. Table 6-1 shows the difference between cap allowed (2008-2012) and verified emissions (average 2005-2006) in CEE countries, which meant that businesses in CEE countries have credits to trade within the EU ETS.

**Tab 6 - 1 Difference between cap allowed and verified emissions in CEE countries**

| Countries | Deficit/surplus [Mt CO2/year] | Deficit/Surplus [in percent of total] |
|---|---|---|
| **Bulgaria** | + 1.7 | 4.1% |
| **Czech Republic** | + 3.8 | 4.6% |
| **Estonia** | +/-0.0 | 0.3% |
| **Hungary** | -0.5 | -1. 8% |
| **Latvia** | +0.5 | 18.3% |
| **Lithuania** | +2.2 | 34.0% |
| **Poland** | -3.5 | 1.7% |
| **Romania** | +5.1 | 7.3% |
| **Slovak Republic** | +3.8 | 14.9% |
| **Slovenia** | -0.5 | 5.5% |

Source: Doersch (2011), adapted from EEA (2007).

"-" = deficit ; "+" = surplus

To access the market and overcome the stigma of 'hot air trading', they had to learn 'new ways'. For example, CEE states, as Annex 1 members of the Kyoto Protocol, can offer Joint Implementation (JI) projects where the environmental effects are established in project design documents and externally validated, which is one way to avoid 'hot air trading' while ensuring true emissions reductions. Another way is to engage in Green Investment Schemes (GIS), an investment opportunity for businesses that allows investors to purchase carbon credits (UNFCCC AAUs) and ensures that the money is earmarked from emission reduction activities in the host country. These new ways of project financing provide CEE states with market access, financial revenues, and perhaps most importantly, access to knowledge and technology transfers (Fazekas 2009).

## 6.3 Lessons learned by CEE countries in the EU-ETS

The previous section explored the CEE state experience in the EU ETS since 2005. Twelve new states, with strongly different backgrounds from the EU 15 states, joined the European Union and had to immediately operate in the European Union's emissions trading system, which itself was still in a pilot phase of social learning. There were worries about 'negative legacies' of the Soviet system in these countries, lacking capacity and little trust, as well as 'hot air trading'. Early efforts to adapt to the system proved to be difficult, especially in the area of national allocation plans and registries. What have the CEE states learned?

After learning and building national capacities, the CEE states gained important experience in **National Allocation Plans preparation**, which also brought two main benefits to the EU ETS as a whole. Firstly, the national ministries, after having learned how to draw up allocation plans, developed competencies on European emission trading, useful even after the European Commission abolished NAPs in the third phase. Secondly, the Commission is now equipped to adequately manage the allocation and carbon cap from a central perspective for the ETS III based on this national learning exercise performed jointly with competent partners in the member states.

Developing **national registries** has brought the CEE states to the level of the rest of Europe. The issue of benchmarking was resolved in a practical manner by taking the top 10 percent of firms (from the EU 27) in a sector and using their aggregate emissions values as benchmarks for emissions caps. This levels the playing field and encourages real change. With set emission goals, companies above the benchmark level have the opportunity to learn from others and further integrate by seeking cooperation to transfer knowledge and increase overall emission reductions in CEE states.

The **market uncertainty** was only overcome after the stigma of 'hot air trading' was resolved and new ways found to reach out to other member states. The offer of Joint Implementation projects and other ways to engage in Green Investment Schemes (GIS) allowed investors of EU 15 to purchase carbon credits while ensuring 'true' emission reduction activities in the CEE country are achieved.

The progression of CEE states from centrally-planned economies with little regard for the environment to functioning in EU ETS is a large step. It represents an overall social learning capability in these countries. Joining the European Union and the EU ETS was the pressure to change. Although the changes were initially demanding, with time, these countries were able to adapt to the system and learn how to benefit from it. Economic opportunities have arisen in the form of attractive markets for trading surplus carbon credits. CEE countries have shown they can learn new ways and overcome the negative legacies of the Soviet system.

# 7 General findings

**(1) Framing of climate change as economic goods' development going through different phases is useful**
From an institutional economic view climate change policy is a capacity development and social learning issue. Every country (or region in the world) will have to find effective and efficient policies and measures of responding to climate change, going through a transition period of learning new ways and unlearning old ways in find national appropriate mitigation and adaptation measures and policies.

**(2) Three phases of transformation can't be separated completely, and the end of phase 3 may never be reached.**
The three phases approach used here is a very simplified and stylized theoretical framework based on the economic goods typology of (global) public goods versus (regional or local) economic goods and services, framing it as process of transition of economic goods development. In looking at our case studies in China and the EU, we find that social learning is an ongoing process and that 'perfect markets' of climate change goods may never be reached, as it became obvious that, in many cases, climate change economic goods contain an element of public goods and need a administrative regulatory framework to assure necessary pre-conditions for market functioning and rational behavior. The appropriate policies and measures to combat climate change will be always a combination of governance regimes, instead of the alternative, of market based versus Command-and-Control administrative rules. Our paper demonstrated in case studies that the climate good characters will become more clearer and better adapted to national circumstances in the transition from global public good to regional economic service. Overall, market based measures will be included more frequently and more extensively in the portfolio of nationally appropriate mitigation and adaptation actions.

**(3) The transitional phase will extend over a few decades and will be a social learning process**
Based on our case studies, it will take a long period, first to satisfy the necessary preconditions of climate goods market: scarcity, rationality and functioning markets. Second, the period is a process of social learning, i.e. making mistakes and learning from it, and overcoming obstacles from the past, and unlearning these detrimental practices. In economic term, production factors, production functions, and constraint conditions will change, but also and more importantly new ways of economic governance will evolve. Both, the EU-27 and China are in this transitory phase into the 2020s. Government review of this transitions process will be necessary in many fields, such as EU ETS price stabilization mechanism and the development of Green Investment Schemes in CEE countries demonstrate.

**(4) There are many common issues for China and the EU-27 in the transformation to low carbon and climate change resilient economies**
Despite many differences, the climate change affects all countries and regions throughout the world. There are many issues faced by both EU 27 and China, and many tasks need to be tackled to be resolved. One most common question which we identify in this paper is to find a balance between top-down and bottom-up governance schemes. Importantly, we find similar issues with regards to harmonization versus differentiation of administrative and market based rules. "The same rule for every region" is a logical but not necessary effective and efficient way of governance of regions with very different backgrounds and at a different stage of institutional development as demonstrated here for CEE countries acceding the EU-ETS. Studying climate change from a transitional approach is a promising approach to further the cooperation and mutual learning of China and the EU.

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