Extension of EU Emissions Trading Scheme to Other Sectors and Gases: Consequences for Uncertainty of Total Tradable Amount

S. Monni · S. Syri · R. Pipatti · I. Savolainen

Received: 28 May 2006 / Accepted: 20 December 2006 / Published online: 23 January 2007
© Springer Science + Business Media B.V. 2007

Abstract Emissions trading in the European Union (EU), covering the least uncertain emission sources of greenhouse gas emission inventories (CO₂ from combustion and selected industrial processes in large installations), began in 2005. During the first commitment period of the Kyoto Protocol (2008–2012), the emissions trading between Parties to the Protocol will cover all greenhouse gases (CO₂, CH₄, N₂O, HFCs, PFCs, and SF₆) and sectors (energy, industry, agriculture, waste, and selected land-use activities) included in the Protocol. In this paper, we estimate the uncertainties in different emissions trading schemes based on uncertainties in corresponding inventories. According to the results, uncertainty in emissions from the EU15 and the EU25 included in the first phase of the EU emissions trading scheme (2005–2007) is ±3% (at 95% confidence interval relative to the mean value). If the trading were extended to CH₄ and N₂O, in addition to CO₂, but no new emissions sectors were included, the tradable amount of emissions would increase by only 2% and the uncertainty in the emissions would range from −4 to +8%. Finally, uncertainty in emissions included in emissions trading under the Kyoto Protocol was estimated to vary from −6 to +21%. Inclusion of removals from forest-related activities under the Kyoto Protocol did not notably affect uncertainty, as the volume of these removals is estimated to be small.

Keywords emissions trading · EU · greenhouse gas · Kyoto Protocol · uncertainty

1 Introduction

In the 2008–2012 commitment period, the Kyoto Protocol aims to reduce greenhouse gas emissions from industrial countries by an average of 5% from the 1990 level. Several flexibility mechanisms (emissions trading, joint implementation, and the clean development mechanism) have been implemented to lower the overall costs of achieving emission targets.

The European Union (EU) started its carbon dioxide (CO₂) emissions trading scheme (EU ETS) in 2005 both to improve cost-efficiency in emission reductions and to give member states experience in emissions trading (Official Journal of the European Union, 2003). CO₂ emissions from power plants with thermal capacity greater than 20 MW, and emissions...
from metal, pulp and paper, and mineral industries, and from oil refineries are included in the first phase of the system, 2005–2007. The majority of emissions included are derived from combustion, but some originate from the use of raw materials. National authorities in each country have allocated initial emission permits to plants covered by the system in their national allocation plans (NAPs), which were approved by the European Commission. Altogether, emissions trading in the EU25 will cover around 2,200 Tg CO₂ emissions annually from 11,500 installations. The amount of emission allowances for the EU15 is 1,740 Tg (European Commission, 2005), which corresponds to more than 40% of CO₂-equivalent emissions from the EU15 in 2002 (the share is calculated without land use, land use change, and forestry (LULUCF); no information on activities under Articles 3.3 and 3.4 was available) (EEA, 2005; Gigele, Huttenen, Ritter, & Gager, 2004). The new member states of the European Union participating in emissions trading are expected to be mainly sellers of emission allowances during the first phase.

As emissions trading involves high monetary values, appropriate verification of emissions is needed to ensure equitable trading. Thus, the monitoring guidelines for the EU emissions trading scheme (EC, 2004) also give advice on acceptable uncertainties in plants that participate in the emissions trading scheme.

Emissions trading under the Kyoto Protocol will begin in 2008. It will cover all gases of the Kyoto Protocol (CO₂, methane [CH₄], nitrous oxide [N₂O], hydrofluorocarbons [HFCs], perfluorocarbons [PFCs], and sulfur hexafluoride [SF₆]) as well as all sectors: energy, industrial processes, waste, agriculture, and LULUCF activities defined in Articles 3.3 and 3.4 of the Protocol. Article 3.3 covers afforestation, reforestation, and deforestation; Article 3.4 covers revegetation, forest management, cropland management, and grazing land management. The rules for emissions trading under the Kyoto Protocol were adopted by the first Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol (UNFCCC, 2005). Emissions are traded among Parties, not among companies. Parties can enable companies to trade under domestic and multilateral schemes, such as the EU ETS. Parties to the Convention have an obligation to estimate and report the uncertainties in their emission estimates to the United Nations Framework Convention on Climate Change (UNFCCC), but no bounds for uncertainty in tradable emissions are given. Proposals for the treatment of uncertainties in emissions trading are presented, for example, by Gillenwater, Sussman, and Cohen (2007) and Nahorski, Horabik, & Jonas (2007), and the effect of uncertainty on the costs of emissions trading is estimated by Godal, Ermoliev, Klaassen, & Obersteiner (2003) and Bartoszczuk and Horabik (2007). Nahorski et al. (2007) present an undershooting concept, where proving compliance is required at a specified risk level and where “effective emissions” (to be used in trading) are derived based on the selected risk factor and uncertainties in emission estimates. Gillenwater et al. (2007) also present two methods for using uncertainty estimates to adjust greenhouse gas trading ratios. Godal et al. (2003) study the outcome of the carbon permits market, given the uncertain emission levels, and examine the possibility of reducing this uncertainty by investing in monitoring. They conclude that the inclusion of uncertainty in the Kyoto Protocol would increase marginal emission reduction costs.

In this paper, we present a comparison of uncertainties in different emissions trading schemes. The aim is to present the pros and cons of different schemes from two points of view: first, we consider the importance of market size for cost-effective emission reduction; second, we estimate the changes in uncertainty introduced by the inclusion of different sources in the emissions trading. We estimate uncertainty in emissions included in the EU CO₂ emissions trading scheme (2005–2007) for both the EU15 and EU25. In addition, we present uncertainty estimates for a hypothetical scheme that also covers CH₄ and N₂O emissions from the source categories included in the EU emissions trading scheme. This example is only illustrative, as it is unlikely to occur in reality. Finally, we present estimates for the Kyoto emissions trading scheme, both with and without the forest-related activities defined in Articles 3.3 and 3.4. All uncertainty estimates are based on uncertainties in national inventories.

Section 2 presents uncertainties related to different emission sources and sinks based on the relevant literature. Section 3 outlines the methods used in this study to estimate uncertainties in emissions trading. Results are given in Section 4, and a discussion and conclusions are presented in Section 5.