# Optimal Timing of Greenhouse Gas Emissions Abatement in Europe

**Chryso Sotiriou and Theodoros Zachariadis[±]**

## ABSTRACT

Decarbonization by the mid-21st century requires strong commitment to greenhouse emission abatement measures, but national emission reduction pledges are made for the medium term. Achieving medium term targets without taking into account the long term can lead to a lock-in effect, binding countries in pathways that cannot lead to strong decarbonization. This paper sheds light in this issue by combining a theoretical approach with real-world engineering and cost data. We develop a constrained optimization model to examine least-cost greenhouse gas emission abatement pathways, taking into account a) emission reduction objectives for two years: 2030 and 2050; and b) the potential speed of implementation of each measure, which expresses technical and behavioural inertia in the deployment of a measure. We focus on European countries and economic sectors that are not subject to the EU Emissions Trading System. We derive relationships between 2030 abatement targets of varying ambition and the possibility for a country to achieve a strong 2050 target. We find that more ambitious EU-wide targets have to be set by 2030 so that Europe delivers deep decarbonization by 2050. Moreover, if air pollution costs are taken into account, strong decarbonization by 2050 has lower social costs than less ambitious policies.

[±] Corresponding author. Tel. +357 25002304, Email: t.zachariadis@cut.ac.cy