A multicriteria approach to identify investment opportunities for the exploitation of the clean development mechanism

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Abstract

The aim of the present paper is to investigate the prospects for the exploitation of the Kyoto Protocol's Clean Development Mechanism (CDM) in Greece. The paper is addressing 3 questions: in which country, what kind of investment, with which economic and environmental return? The proposed approach is based on a multicriteria analysis for identifying priority countries and interesting investment opportunities in each priority country. These opportunities are then evaluated through a conventional financial analysis in order to assess their economic and environmental attractiveness. To this purpose, the IRR of a typical project in each investment category is calculated by taking into account country-specific parameters, such as baseline emission factors, load factors, costs, energy prices etc. The results reveal substantial differences in the economic and environmental return of different types of projects in different host-countries and show that for the full exploitation of the CDM a multifaceted approach to decision-making is necessary.
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1. Introduction

According to the Kyoto Protocol (KP), the industrialized countries (Annex-I countries) have committed themselves to reduce their emissions of greenhouse gases (GHG) to the amounts agreed under article 3. In order to meet their commitment in the most cost-effective way and taking into consideration that the location of emission reduction is practically non-important, KP provides a co-operative framework giving to Annex-I countries the possibility to reach part of their target through the so-called flexible mechanisms: Emissions Trading, Joint Implementation and Clean Development Mechanism (CDM).

In the case of CDM, article 12 of the KP provides that any Annex I country or any licensee legal entity of Annex I country is allowed to be credited for emissions reductions achieved by investing in projects located in developing (non-Annex I) countries, thus profiting from the lower abatement costs in the host-country. Moreover, the CDM is intended to support the sustainable development of host-countries, since Annex-I countries are expected to contribute with financial resources and technology transfer in the realization of projects that would not have been implemented without the incentive of gaining tradable certified emission reductions (CERs) (UNFCCC, 2001).

In the framework of the KP and the burden-sharing agreement within the European Union (EU), Greece is committed to retain the increase of GHG for the period 2008–12 up to 25% compared to the 1990 level. Emissions inventories and existing augmentative trends (approximately 23.2% by 2003) show that current policies are not enough for complying with this limit without additional measures and recourse to the KP flexible mechanisms.

This paper is addressing 3 questions related with the exploitation of the CDM: In which country to invest? What kind of project to realize? Which could be the environmental and economic return of the investment? In the literature there are already some answers to each single question separately: for example, the CDM market

potential is explored in Halsnæs (2002), Jotzo and Michaelowa (2002), Zhao and Michaelowa (2005) for indicating promising markets worldwide; the conformity of different projects to the CDM is examined principally with respect to investment additionality in order to check that the mechanism is not going to subsidize viable projects (Greiner and Michaelowa, 2003; Shrestha and Timilsina, 2002); finally, the attractiveness of individual investment projects has been estimated in several studies focusing mainly on the procedure followed to establish the baseline scenario and subsequently the amount of CERs to be accredited (CDMWatch, 2005; Parkinson et al., 2001; Shrestha and Shrestha, 2002; Zhao and Michaelowa, 2005).

The present paper proposes an integrated approach to address all these issues from the perspective of an Annex-I country, seeking to identify the practically exploitable CDM potential and to pick up the most attractive investment opportunities. The developed screening approach is implemented in Greece and includes 3 inter-related steps based on the combined exploitation of multiple criteria decision analysis and traditional financial analysis. In the 1st step, a number of pre-selected candidate host-countries are evaluated by taking into account criteria reflecting their economic and geographical association with the investing country and their suitability to host development projects. In the 2nd step, candidate projects in each country are evaluated on the basis of techno-economic and legislative criteria, while the most highly ranked projects are evaluated in the 3rd step through a conventional financial analysis that takes into account the revenues raised by the expected CERs.

The remainder of the paper is structured as follows: Section 2 includes a short description of the applied methodology with emphasis on the multicriteria method used, Section 3 presents the evaluation criteria and the obtained ranking of candidate host-countries, Section 4 the evaluation criteria and the obtained prioritization of candidate projects in each priority country, while Section 5 presents the parameters used and the results of the financial analysis. The main findings and the conclusions drawn are included in Section 6.

2. Methodology

2.1. General description

The scope of the present paper is to identify the most attractive opportunities to exploit the CDM flexible mechanism of the KP from the perspective of Greek legal entities. More specifically, the objectives of the study are the following:

- To identify a set of priority host-countries in which to investigate investment opportunities for CDM projects.
- To detect a set of priority project types in each priority host-country.

- To assess the economic feasibility and the investment additionality of the priority project types in each country in order to find out attractive CDM investment opportunities.

The interconnection of the above objectives determines the sequence of steps of the proposed methodological approach as shown in Fig. 1. Moreover, the nature of the issues addressed prescribes the kind of methodological tools that should be implemented for deriving the desired results. The steps of the developed methodological procedure are shortly described below:

In the 1st step, the aim is to select among a limited number of candidate countries that have been pre-selected according to the revealed preferences of Greek investors. The analysis is namely restricted to countries of Eastern Europe, Middle East and Northern Africa assuming that the competitive advantage of Greece is higher in these countries compared to other big CDM markets in Asia or Latin America. Moreover, a screening procedure is applied for excluding countries that do not meet relevant eligibility criteria as having still not signed or approved the KP. The pre-selected countries are then evaluated with respect to a number of criteria influencing their attractiveness for Greek investors. A Multi-Criteria Decision Analysis (MCDA) method is applied in order to obtain a unique measure of their relative advantages against which the countries are ranked in a descending order of preference. An extensive sensitivity analysis is used to confirm the stability of the resulting ranking.

In the 2nd step, the aim is to indicate in each of the priority host-countries the most interesting investment opportunities that are worth to be further investigated. To this purpose a number of project types have been evaluated with respect to a number of criteria reflecting technological, legislative and political aspects influencing the effective integration of the project in each host-country. The so defined project types are ranked in a descending order of preference by implementing the same MCDA method.

In the 3rd step, the most highly ranked project types are further investigated in order to assess their financial return and the degree by which the CDM assists in the project's realization. The analysis is based on a number of project- and country-specific characteristics such as the emission factor of the baseline scenario, the load factor and other parameters specifying the project's output, costs and energy prices etc. with only investment cost assumed to be the same in all countries for a typical project specification. An extensive sensitivity analysis is performed in order to check for the stability of the obtained results and to identify the most risky parameters.

2.2. The PROMETHEE multicriteria outranking method

A multiplicity of MCDA methods is currently available for use in a wide variety of decision situations. In this study