Cost-efficient emission abatement: Mitigation costs and policy impacts

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Overview

Bearing in mind the policy aim of cost-efficient emission abatement in the energy generating and the non-generating sector, this paper develops a framework to compare these different technologies (Figure 1). To assess cost-efficient GHG reduction, we conduct a simultaneous assessment of economic and environmental performance through life cycle costing and life cycle assessment. To enable the comparison of generating, non-generating, and combined technologies; we calculate the GHG mitigation cost and we create reference systems within the base scenario (Lazarus et al., 1995). Furthermore, we extend the concept of the mitigation cost, allowing to compare different technologies given a limited investment resource (De Schepper et al., 2012). Finally, we evaluate the impact of policy measures by calculating the subsidized mitigation cost. The framework is illustrated with a Belgian case study -including a sensitivity analysis- of photovoltaics (PV), grid powered battery electric vehicles (BEVs), and solar powered BEVs. Using this framework, policy recommendations are provided.

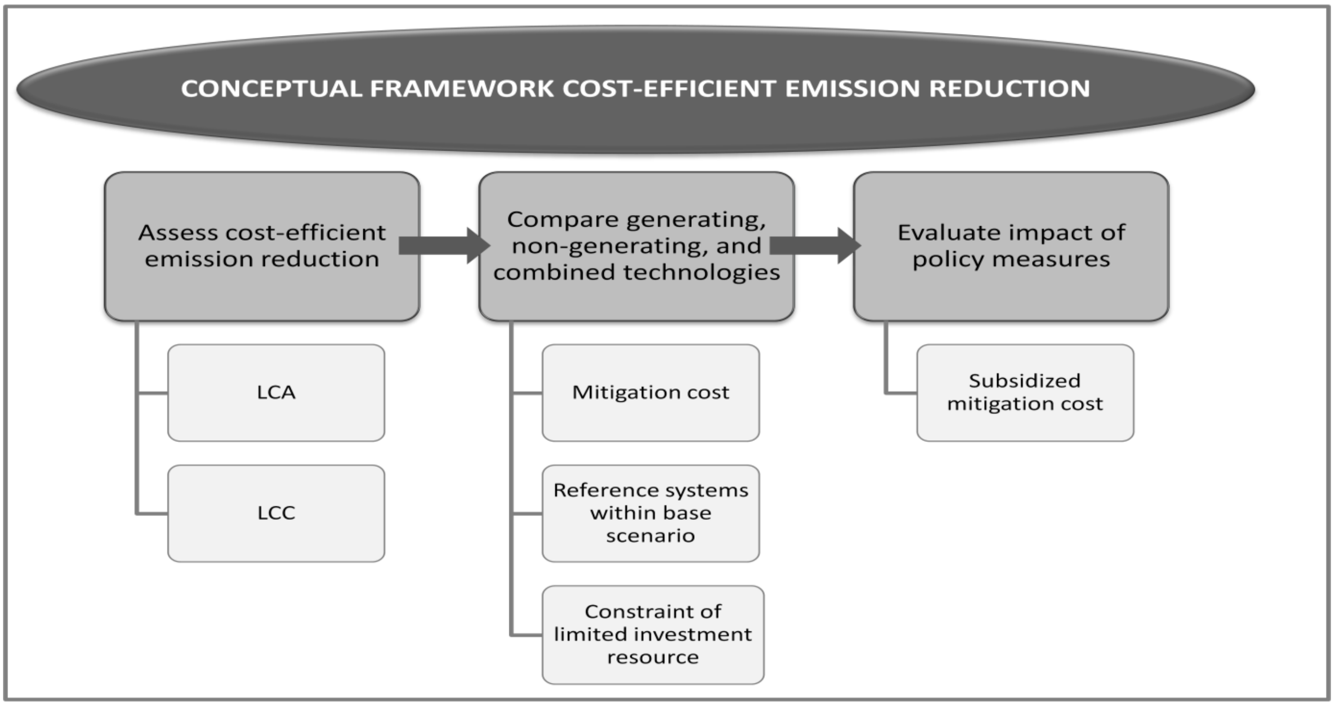

Figure 1 Conceptual framework to assess cost-efficient emission reduction of clean technologies

Method

In order to address the different aims of the developed framework, a four-step methodology is created. In a first step, the base scenario (including reference systems) and the investment scenarios are defined. Next, we can proceed to the calculations of the investment sizes of each scenario, given the constraint of limited investment resources. Thirdly, the mitigation cost of all scenarios can be determined. In a final step, we assess the impact of financial policy measures by calculating the subsidized mitigation cost.

Results

The framework is illustrated by a case study of PV solar power, grid powered (mass produced) battery electric vehicles (BEVs), and solar powered (mass produced) BEVs for a Belgian SME. The impact of policy measures on the mitigation cost is illustrated in Figure 2. It shows that solar technology for Belgian SMEs without any type of direct subsidization or taxes -even after a market presence of over 35 years- largely exceeds the projected CO_2 market value (European Commission, 2012). Mass produced BEVs on the contrary approximately achieve this targeted value. When the two technologies are used to complement each other, even better results are achieved in terms of the mitigation cost. The sensitivity analysis indicates that the obtained results are robust to variations in assumptions regarding the investment resource, the travel distance, and the amount of electricity generated.

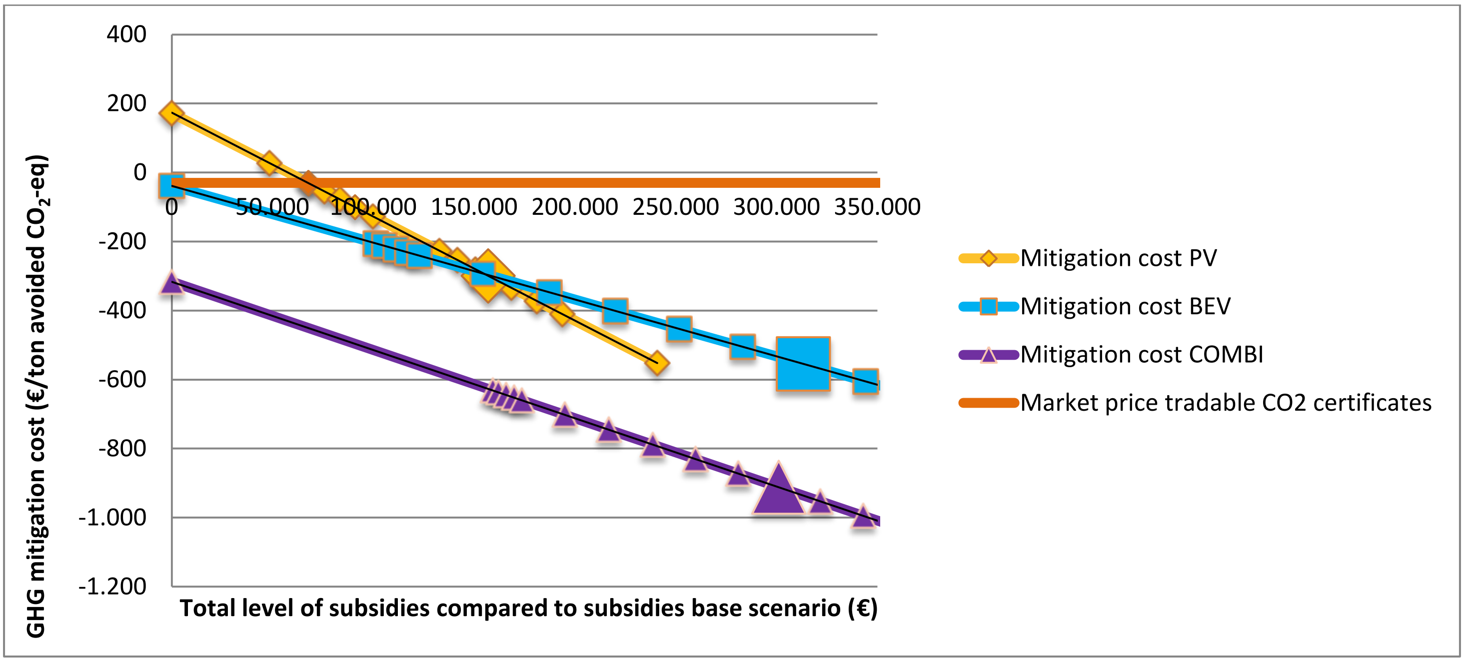

Figure 2 Impact of financial incentives on the GHG mitigation cost; larger data points reflect current (June 2012) subsidized GHG mitigation cost for Belgian SMEs

Policy recommendations are to lower subsidies for the PV technology such that each installation receives only a small return on investment. For BEVs, generous subsidization is necessary to stimulate a fastened adoption of the (emerging) technology and to offset the higher purchase price. We recommend to provide an additional financial incentive when one invests in a solar powered BEV rather than a grid powered BEV. This corresponds to our vision that some profit is needed as innovation rent to compensate investors that help to address climate change.

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