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Why should support schemes for renewable electricity complement the EU emissions trading scheme?

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HIGHLIGHTS

- ► The EU ETS addresses policy objectives appropriately under narrow assumptions only.
- ► Deviations from these assumptions may justify RES-E support schemes.
- ► First rationale: technology choices are distorted by market and policy failures.
- ► These failures are aggravated and perpetuated by socio-technical path dependencies.
- ► Second rationale: RES-E schemes address goals beyond mitigating climate change.

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ABSTRACT

In virtually all EU Member States, the EU Emissions Trading Scheme (EU ETS) is complemented by support schemes for electricity generation from renewable energy sources (RES-E). This policy mix has been subject to strong criticism. It is mainly argued that RES-E schemes contribute nothing to emissions reduction and undermine the cost-effectiveness of the EU ETS. Consequently, many scholars suggest the abolition of RES-E schemes. However, this conclusion rests on quite narrow and unrealistic assumptions about the design and performance of markets and policies. This article provides a systematic and comprehensive review and discussion of possible rationales for combining the EU ETS with RES-E support schemes. The first and most important reason may be restrictions to technology development and adoption. These may be attributed to the failure of markets as well as policies, and more generally to the path dependency in socio-technical systems. Under these conditions, RES-E schemes are required to reach sufficient levels of technology development. In addition, it is highlighted that in contrast to the EU ETS RES-E support schemes may provide benefits beyond mitigating climate change.

1. Introduction

To combat climate change, the European Union (EU) has agreed on two ambitious targets for 2020 (European Commission, 2008b). First, greenhouse gas emissions shall be reduced by 20 percent compared to 1990 emissions levels. Second, the share of renewable energy sources in total energy consumption shall be increased to 20 per cent. The EU strategy to attain these targets rests on a portfolio of policy instruments, out of which two measures are outstanding. The EU Emissions Trading Scheme (EU ETS) sets a cap on CO_2 emissions from the electricity sector and certain energy-intensive industry sectors (European Parliament/Council of the European Union, 2003). Additionally, the EU has adopted a framework to promote electricity generation from renewable energy sources (RES-E) (European Parliament/Council of the European Communities, 2001). Within this framework, all EU Member States have now implemented RES-E support schemes, including feed-in tariffs, quotas with tradable green certificates, tender systems or tax incentives (European Commission, 2008a). All of these schemes subsidize RES-E generation in one way or another.

Numerous empirical studies have shown that many RES-E support schemes, particularly those based on feed-in tariffs, have been quite successful in promoting the deployment of RES-E technologies (e.g., Enzensberger et al., 2002; Fouquet and Johansson, 2008; Gan et al., 2007; Harmelink et al., 2006; Lipp, 2007; Wüstenhagen and Biharz, 2006). In recent years, however, this policy mix has been subject to growing criticism (see Section 2). The major concern raised with respect to RES-E support schemes is that they do not contribute anything to CO_2 emissions reduction in the presence of the EU ETS. Instead, the promotion of RES-E only impairs the cost-effectiveness

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of the EU ETS. This paper aims to clarify whether this criticism disqualifies the use of RES-E support schemes in general—or whether there are conditions under which a policy mix is nevertheless required.

We argue that a general rejection of RES-E policies is only justified on the basis of quite narrow assumptions about the design and performance of markets and policies: if technology choices are only distorted by the negative externality from CO_2 emissions and if climate change mitigation is the only policy objective. This paper provides a systematic and comprehensive review and discussion of possible rationales for combining the EU ETS with RES-E support schemes. It reveals that justifications for RES-E policies are numerous—and that a policy mix may also be welfare-increasing.[1] Obviously, the eventual performance of the policy mix depends also on the details of designing RES-E policies, e.g., the support mechanisms (feed-in tariffs vs. quotas with tradable green certificates) or the level and differentiation chosen for such subsidies.[2] Yet, this discussion is beyond the scope of this paper.

The next section reviews the discussion on interactions between the EU ETS and RES-E support schemes. Subsequent sections are dedicated to possible rationales for using a policy mix. Section 3 illustrates possible restrictions to technology development and adoption. Section 4 highlights possible benefits of RES-E support schemes beyond mitigating climate change. Section 5 summarizes and concludes.

2. Interaction between the EU ETS and RES-E support schemes—A review

There is an extensive strand of economic literature which addresses the interaction between emissions trading schemes and RES-E support schemes (see further below). The basic interaction effect these more or less formal studies refer to is illustrated in Fig. 1. It shows a simplified setting where the EU ETS is assumed to cover an electricity sector and an industry sector. The CO_2 emissions cap set for both sectors under the EU ETS, $\hat{E}$, corresponds to the length of the abscissa. The graph depicts hypothetical marginal abatement cost curves for the electricity sector, MAC_E (from left to right), and the industry sector, MAC_I (from right to left). Both curves represent the respective demand functions of each sector for emission allowances, D_E and D_I. In the absence of any RES-E policy, trades on the allowance market result in the equilibrium allowance price p^* and a cost-effective allocation of emissions (and corresponding abatement activities) to the electricity sector, E_E^*, and the industry sector, E_I^*. The introduction of a RES-E support scheme then brings about an additional emission reduction in the electricity sector, ΔE_E. This results in a reduced demand for allowances which is illustrated by a left-shift of the demand curve to D_E^{PM}. At the new equilibrium allowance price, p^{PM}, the electricity sector emits less (E_E^{PM}) compared to the EU ETS-only scenario. As long as the overall emissions cap is not adjusted, this reduction is completely compensated, however, by an increase in emissions in the industry sector (to E_I^{PM} in this case). That is, the RES-E support scheme does not bring about any additional emission reduction compared to a situation with only the EU ETS in place. It only results in a shift of emissions from the electricity to the industry sector. At the same time the cost of attaining the overall emissions cap is increased. The reduction of abatement costs in the industry sector is more than compensated by an increase of abatement costs in the electricity sector. The welfare loss is depicted as the grey-shaded triangle in Fig. 1. Obviously, this triangle represents only the lower bound of the welfare loss. Marginal abatement costs for some of the RES-E technologies pushed into the market may rather be at the upper left end of the electricity sector's marginal abatement costs curve. Rough estimates of Frondel et al. (2008, 2010) and the IEA (2007, p. 74) yield, for example, that abatement costs may be as high as 700 to 1000 euro per ton CO_2 for the use of photovoltaics.

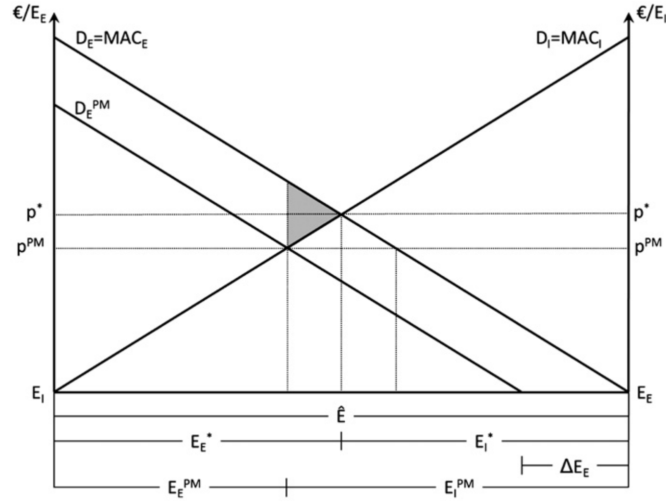

Fig. 1. Interaction between the EU ETS and a RES-E support scheme.

This interaction argument has been put forward by numerous authors on a verbal level (del Rio, 2009; Fischer and Preonas, 2010; Frondel et al., 2008, 2010; McGuinness and Ellerman, 2008, p. 28; Philibert, 2011; Sijm, 2005; Sinn, 2008, p. 177; Sorrell and Sijm, 2003; Weimann, 2008, p. 55; 2009). In addition, it has been underpinned by more formal mathematical analyses, which usually employ partial equilibrium models of the electricity sector (Amundsen and Mortensen, 2001; Böhringer and Rosendahl, 2010; Fankhauser et al., 2011; Jensen and Skytte, 2003; Morthorst, 2003; Pethig and Wittlich, 2009).[3] The interaction effects have also been quantified for different regions of the world using numerical electricity sector models (Böhringer and Rosendahl, 2011; De Jonghe et al., 2009; Hindsberger et al., 2003; Linares et al., 2008; Rathmann, 2007; Traber and Kemfert, 2009; Unger and Ahlgren, 2005) as well as computable general equilibrium models (Abrell and Weigt, 2008; Böhringer et al., 2009; Morris, 2009; Paltsev et al., 2009).[4] To provide only one example of a quantitative result, Böhringer and Rosendahl (2011) show that the cost of attaining a CO_2 reduction target of 25% in the EU may rise by more than 60% if a green quota is increased by 10 percentage point beyond the RES-E deployment level under the EU ETS only. In this situation, the allowance price drops from 41 to 16 euro per ton of CO_2.

This brief overview illustrates that the basic interaction effect between an emissions trading scheme and RES-E support schemes has been confirmed by numerous studies pursuing quite

[1] RES-E support schemes can primarily be justified by market distortions associated with electricity generation. However, RES-E deployment is also hampered by barriers associated with electricity transmission and distribution, storage, and demand-side management. These may call for additional policies (Lehmann et al., 2012).

[2] This also implies that this paper does not provide a comprehensive review the extensive body of impact studies for existing RES-E policies (see, e.g., Enzensberger et al., 2002; Fouquet and Johansson, 2008; Harmelink et al., 2006; Johnstone et al., 2010; Toke, 2005). Evaluation results are usually contingent on the design characteristics of a specific RES-E policy and hardly provide general insight on whether or not to promote RES-E.

[3] A notable exception is the study by Pethig and Wittlich (2009) which uses a general equilibrium model.

[4] del Rio (2007) and Fischer and Preonas (2010) provide more detailed reviews of these studies.