Energy Research & Social Science xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Energy Research & Social Science

journal homepage: www.elsevier.com/locate/erss

Original research article

The missing link: The influence of instruments and design features on the interactions between climate and renewable electricity policies

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ARTICLE INFO

Keywords:
Renewable energy
Emissions trading
Feed-in tariffs
Interactions

ABSTRACT

Climate and energy targets and instruments coexist in many countries, leading to interactions. In particular, the combination of CO_2 targets, the European Union (EU) emission trading scheme and promotion of electricity from renewable energy sources (RES-E) have raised significant concerns in the past, given the allegedly negative influence of RES-E support on CO_2 prices. This (negative) interaction has been analysed with modeling techniques, but an assessment of the impact of specific instruments and design features on those interactions has so far been neglected. The aim of this paper is to provide an initial attempt to cover this gap. An analytical framework to discuss the impact of instruments and design features on the interactions is provided and the comparative impact of different instruments and design features on the interactions between RES-E support and CO_2 mitigation instruments is evaluated. Our results show that, while negative interactions can be mitigated through coordination, adaptability depends on the choice of instruments and design features. The negative interactions are more likely under quantity-based than under price-based CO_2 mitigation instruments. In contrast, they are more likely with price-based than with quantity-based RES-E support instruments. Notwithstanding, the choice of design features critically affects this result.

1. Introduction

The analysis of policy mixes has received considerable attention in the energy and climate areas (see, e.g., [1–7]). However, while those contributions have tried to advance in either the theoretical or empirical fronts, justifying the co-existence of different instruments and analysing the interactions between those instruments, the impact on those interactions of different types of climate and energy instruments as well as the design features within instruments has not received a comparable attention. This paper aims to cover this gap in the literature, focusing on the micro aspects of those interactions.[1]

Climate and energy targets and instruments will continue to coexist in a number of countries, including European Union (EU) member states. While climate instruments are those with emissions reductions as the primary goal and primary outcome, energy instruments are implemented primarily for other reasons with emissions reductions being one of their benefits [8]. The coexistence of targets and instruments which have some overlaps unavoidably leads to interactions between them. These interactions can be negative (conflicts) or positive (complementarities or even synergies). They can be regarded as an inherent feature of the climate policy/instrument mix in the EU, where targets and instruments for greenhouse gas (GHG) emissions, RES deployment, energy efficiency and carbon capture and storage (CCS), among others, have been set [9]. Some of these targets and instruments are adopted and designed at the EU level, others at the Member State (MS) level. Some cover several sectors, while others address specific sectors. Those targets and instruments interact with each other in complex ways [10]. Such mix and their interactions have raised the concern of policy makers. Inconsistencies between different energy and climate targets and instruments have been criticised by different types of stakeholders (see, e.g., [11]).

In particular, the combination of CO_2 targets and the EU emission trading scheme (EU ETS) and instruments for the promotion of electricity from renewable energy sources (RES-E) has raised significant concerns in the past, given the allegedly negative influence of RES-E support on CO_2 prices (see Section 2). This (negative) interaction has been analysed in the past with modeling techniques [12–14]. A similar case is the interaction between energy efficiency policies and the ETS. Although the focus of this paper is on the EU ETS, the analysis and results can be extrapolated to other countries with a cap-and-trade ETS

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[1] The terminology of Rogge and Reichardt [5] will be used throughout this article. Our design features refer to the "descriptive design features" in Rogge and Reichardt [5], i.e., not to the "abstract design features".

http://dx.doi.org/10.1016/j.erss.2017.09.010
Received 26 January 2017; Received in revised form 24 August 2017; Accepted 6 September 2017

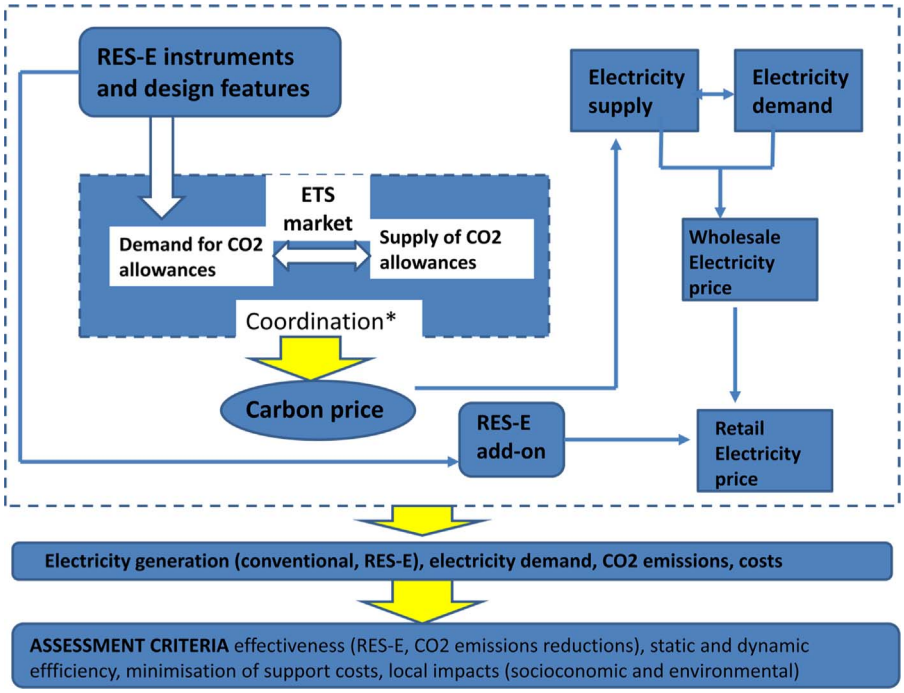

Fig. 1. Illustrating the analytical framework.
*Coordination is between the demand for allowances (affected by RES-E support) and supply of allowances (given by the CO_2 cap).

(but not a credit-based ETS).

While the literature on interactions between an ETS and RES-E support is very abundant (see [2,15] for comprehensive reviews), an analysis of the impact of specific instruments and design features on those interactions has so far mostly been neglected. NERA [16] discusses the interactions between RES-E support and an ETS, but the analysis is circumscribed to only one RES-E instrument and one CO_2 mitigation instrument. Although the design features for quotas with tradable green certificates (TGCs) are described, their influence on the interactions is not discussed. Duscha and del Río [10] have analysed the interactions between RES-E support and other climate and energy instruments in the EU, but these authors do not provide an analytical framework to systematically analyse the effects of different instruments and the assessment of design features is lacking. On the other hand, the analysis of the impact of design features on different assessment criteria has received scant attention in the literature. One exception is del Río [17], which provides an analysis of the effects of different design features of FITs on dynamic efficiency (innovation effects). Hood [8] provides a brief discussion on the impact of different carbon price instruments (CO_2 tax and ETS) on the interactions with other instruments but does not pay attention to different RES-E support instruments and design features. She proposes the idea that the nature of interactions can be different for carbon taxes and ETS and argues that the precise details of interactions will depend on the design details of the ETS.

Despite acknowledgement of the relevance of instruments and design features in the interactions [16,17,8], there is a lack of analysis on the possible influence of regulatory design on those interactions. This is unfortunate since it is well-known that the success of policy crucially depends on the choice of instruments and design features and CO_2 mitigation and RES-E instruments can be designed in quite different ways. Furthermore, the choice of instruments and design features can minimize the negative interactions between targets/instruments. Design details may need to be adapted to ensure the climate-energy policy mix is well aligned [8]. This may allow policy makers to carry out potential adjustments with a view to stronger integrating renewable targets and instruments and carbon pricing. From an academic perspective, this analysis might be incorporated in modeling of climate and energy policy strategies, which has abstracted from the choice of RES-E support instruments and design features.

The aim of this paper is to provide an initial attempt to cover this gap, illustrating the influence of instruments and design features on the interactions between climate and energy policy strategies, focusing on the case of the combination of climate mitigation instruments with RES-E support. An analytical framework to discuss the impact of instruments and design features on the interactions is provided and the comparative impact of different instruments and design features on the interactions between CO_2 mitigation and RES-E support instruments is evaluated.

Accordingly, the article is structured as follows. The next section provides the analytical framework. The method used in this paper is described in Section 3, whereas the results are provided and discussed in Section 4. The paper closes with some conclusions.

2. Analytical framework

The analysis of the negative interactions between RES-E support and CO_2 mitigation is based on the assumption that different instruments and design features can influence two main variables (effectiveness in support and possibility to coordinate the targets/instruments). The focus here is on the impact of RES-E support instruments and design features on carbon prices (whether from an ETS or a carbon tax).[2] Effectiveness refers to the extent to which a RES-E instrument encourages RES-E deployment (i.e., measured as either generation or capacity). The adaptability of targets/instruments refers to the capability to take into account the expected outcomes of one policy on the design of the other policy, and make adjustments accordingly.[3] These "intermediate" variables have an impact on: 1) the possibility that both policy fields interact in a negative way. This negative interaction would occur if a reduction of CO_2 prices results; 2) the ability to coordinate targets/instruments in both policy fields. However, such interaction should be viewed as part of a more general picture on the effectiveness and efficiency of climate and energy policies (Fig. 1). In this broader setting, the final goal is to have a successful transition to a decarbonised energy system, of which the electricity system is a main element. This success can be assessed with several criteria, including effectiveness (in CO_2

[2] For an analysis of the impact of an ETS on RES-E instruments, see Jensen and Skytte [52].

[3] Note that we do not refer here to the literature on policy coordination.