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Trade-offs in energy and environmental policy

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ABSTRACT

The energy sector is undeniably undergoing a critical period, faced with multiple challenges, whether economic, political or technological. These challenges are related to the requirements set on the sector to meet a wide range of social demands associated with the three traditional dimensions of a sustainable energy system, i.e., environmental sustainability, security of energy supply and economic sustainability. In particular, the environmental pillar has gained ground after the Paris Agreement, which has reinforced the requirement of a low-carbon transformation of the sector. A main challenge is to balance trade-offs among competing goals when designing energy and environmental policies. Although making the energy sector greener is a common aspiration of governments, and many countries are indeed being successful in this regard, the success comes at a price in terms of the other, non-environmental dimensions, of a sustainable energy system. The aim of this special issue is to look in detail on some of the most pressing environmental challenges faced by the energy sector as well as the trade-offs involved in reaching a greener energy system.

1. Introduction: trade-offs in energy and environmental policy

The energy sector is undisputedly undergoing a critical period, faced with multiple challenges, whether economic, political or technological. These challenges are related to the requirements set on the sector to meet a wide array of social demands which can be linked to the three traditional dimensions of a sustainable energy system, i.e., environmental sustainability (e.g., greenhouse gas mitigation), security of energy supply (diversification of energy sources and reliability of supply) and economic sustainability (a competitive energy system, i.e., affordable energy). The environmental pillar has gained ground after the Paris Agreement negotiated at the 21st Conference of the Parties to the United Framework Convention on Climate Change in December 2015, which declares a global consensus to keep the global mean surface temperature increase below 2 °C compared to pre-industrial levels. This Agreement has reinforced the requirement on a low-carbon transformation of the energy sector since it has sent a clear signal to investors, businesses, and policy-makers that the global transition to clean energy is here to stay and resources have to be shifted away from polluting fossil fuels.

However, energy and environmental policy can be expected to result in internal conflicts and contradictions. As in other policy areas, conflicts between objectives are common and an inherent feature of energy policy that needs to be taken into account in regulatory design. This is clearly observed in the European Union (EU), which faces a major challenge in the energy realm: the EU's main energy plan (the Energy Union) needs to be successful in order to comply with the Paris Agreement, but energy policies in Europe also need to be designed in a way which makes the compliance costs affordable for the European economy (Buchan and Keay, 2015).

Therefore, a main challenge is to balance trade-offs among competing goals when designing energy policies. As in other policy areas, there is a strong political economy dimension in this debate. Different types of stakeholders put the emphasis on different pillars. Balancing the pressures from different types of stakeholders, in order to make energy and environmental policies more consistent and simpler, is certainly not a trivial issue. Although making the energy sector greener is a common aspiration of governments, and many countries are indeed being successful in this regard, this success comes at a price in terms of the other, non-environmental dimensions, of a sustainable energy system. In particular, rising energy prices and energy costs are a main concern both for consumers and policy makers in Europe and elsewhere, since higher energy prices could have detrimental impacts on industrial competitiveness and aggravate the fuel poverty problem suffered by the most vulnerable energy consumers. Indeed, the energy winter package, recently unveiled by the European Commission (see EC, 2016), which aims at helping to reduce carbon emissions by 40% by 2030, shows both the pre-eminence given to the environmental pillar and the difficulties involved in designing regulation in order to mitigate the conflicts between environmental protection and other policy goals in the energy sector. It is certainly more realistic to consider that energy policy necessarily has to be designed in a context of trade-offs among competing goals.

The aim of this special issue is to look in detail to some of the most pressing environmental challenges faced by the energy sector (without trying to be exhaustive in coverage) as well as the trade-offs involved in reaching a greener energy system. In this context, this special issue covers topics which are deemed relevant on both sides of the Atlantic, and potentially relevant worldwide. These topics include a proposal for a less complex design of climate policies, guidelines on the appropriate design of policies to promote energy storage, smart connections and the market integration of renewable energy, analysis of the consequences of different degrees of harmonization of renewable energy policies in the context of the EU, the impact of electricity losses on CO_2 emissions, the efficiency cost of protective measures in climate policy, the drivers for changes of energy costs, the

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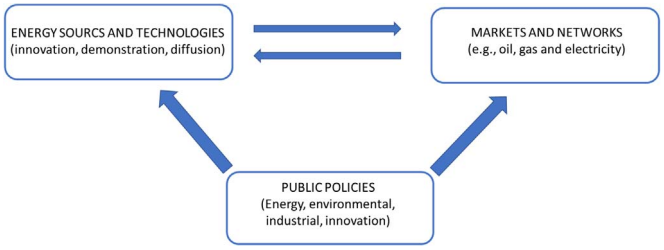

Fig. 1. Illustrating the interactions between the elements of an energy sector.

determinants of investment in environmental R & D and the incentives provided by emissions trading markets to create mergers.

As mentioned above, the focus of this special issue is on the environmental pillar. Our starting point is that environmental challenges and the trade-offs with other competing goals should be contextualised within the energy system, which is made up of several elements as well as the dynamic relationships between them: energy sources and technologies, markets and networks, and public policies (Fig. 1). Using an arguably simplified picture of this sector, which nevertheless is deemed useful for illustrative purposes, this sector covers several areas (oil, gas and electricity) and is made up of different energy sources and technologies. Some of these energy technologies can be considered quite mature, whereas others are emerging and are rather immature (storage). Obviously, there are many alternatives in the middle. The position of the technologies along the innovation process, from R & D to demonstration and deployment suggests that the challenges for these technologies are necessarily different and require different types of public policy support. Note that the technologies themselves interact between each other. Often times they compete, but sometimes they complement each other. This is particularly the case of storage and RES, since the former can amplify the diffusion possibilities of intermittent RES. And the other way around: an increasing diffusion of RES encourages the support for the cost reductions and quality improvements in innovation in storage.

A main techno-economic feature of the recent evolution of the energy sector is the impressive penetration of some technologies in some countries, including the most widespread renewable energy sources (RES) nowadays (wind and solar PV generation) and unconventional gas and oil. These have a critical impact (together with other factors) on a main element of the energy sector, markets and networks, and particularly on the electricity and oil markets. The effect is not univocal, but bidirectional, i.e., the design of existing markets poses challenges for those technologies as well. The deployment of RES affects networks and the electricity distribution model. The deployment of smart grids and distributed generation certainly implies a change in the role of Distribution System Operators (DSOs).

And, obviously, markets, networks and energy technologies can be influenced by policies, which is a third key element in our simplified energy sector framework. Policies can influence directly the other two elements, but also the relationships between them. In short, they can address some of the technological, economic or social acceptability challenges which feature this sector. Relevant policies influencing energy technologies and sources as well as markets and networks are also themselves multifaceted and obviously include the most direct influence of instruments and design elements adopted in the energy policy realm, but also industrial, innovation and environmental policies.

This special issue investigates a critical subset of the environmental challenges and associated trade-offs currently faced by the energy sector as affecting the interactions between the aforementioned components of an energy system and derive implications for energy policy accordingly.

In order to advance knowledge regarding some of the most pressing challenges faced by policy makers in tackling the environmental pillar in the energy sector, the associated trade-offs and the implications for the design of energy policies, a Symposium on Energy and Environmental Policy was organised in Barcelona in February 2016, where the papers of this special issue were presented. In this introduction, we have outlined the general framework on the main elements of the energy sector and the potential trade-offs, with a main focus on environmental and energy policy. In the next section, we introduce the articles that make up this special issue.

2. Overview of the contributions to the special issue

The papers in this special issue address a subset of the challenges faced by policy makers when designing energy and environmental policies which try to tackle the environmental pillar of a sustainable energy system.

Despite recent achievements towards a global climate agreement, climate action to reduce greenhouse gas emissions remains quite heterogeneous across countries. Tol (2017) discusses the main policy meta-challenge in the energy and environmental realm: to make policy consistent and simpler in a context of different goals and stakeholders' pressures. His article addresses the political economy of climate policy, which has been subject to the influence of different types of stakeholders, leading to a complex climate policy. The author stresses that first-best climate policy is a uniform carbon tax which gradually rises over time but that civil servants have complicated climate policy to expand bureaucracies, and politicians to create rents. Environmentalists have exaggerated climate change to gain influence, and other activists have joined the climate bandwagon. Opponents to climate policy have attacked the weaknesses in climate research. The climate debate is convoluted and polarized as a result, and climate policy complex. Climate policy should become easier and more rational as the Paris Agreement has shifted climate policy back towards national governments. Changing political priorities, austerity, and a maturing bureaucracy should lead to a more constructive climate debate.

A main area in the energy/environmental policy realm is public support for electricity from renewable energy sources. Several papers focus specifically on this area, providing relevant policy implications. An analysis of policy pathways for harmonization of support schemes for electricity from renewable energy sources (RES-E) in a 2030 horizon is carried out by del Río et al. (2017) according to different assessment criteria with the help of simulation which the Green-X model shows. It is found out that there are small differences between the evaluated cases regarding the degree of harmonization or design elements and that they can mostly be attributed to the different instruments. The model-based assessment clearly points out that the degree of harmonization has only a small impact upon the performance of an instrument at the aggregated level. In short, compared to other pathways, harmonization (with whatever instrument being chosen) would not be substantially different for the other alternatives. It would modestly increase the static efficiency of RES-E deployment (i.e. cheaper technologies in the best locations), but at slightly higher support costs compared to the alternatives. This suggests that harmonization would be neither as beneficial as its proponents argue nor as detrimental as its