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Costs and benefits of Energy Efficiency Obligations: A review of European programmes

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ABSTRACT

The economics of energy efficiency programmes have been subject to considerable academic debate lasting well over three decades now. In this paper, we contribute to this debate by reviewing the costs and benefits of a specific type of policy+ instrument that recently gained significant traction in Europe – Energy Efficiency Obligations - EEOs. Following the introduction of the EU Energy Efficiency Directive in 2012 the number of EEOs in Europe has grown from five schemes to now 16 EEOs in operation or planned across the EU. There is an emerging body of evidence on the costs and benefits of Energy Efficiency Obligations covering a wider range of EU countries, which offers an opportunity to improve our understanding of the economics of Energy Efficiency Obligations. In this paper, we draw on this new data and provide a) a comparative analysis of the costs and benefits of EEOs in a number of European countries, b) discuss the uncertainties and challenges around calculating the costs and benefits of Energy Efficiency Obligations, and c) provide a categorisation of the multiple benefits often overlooked in cost-benefit-analyses.

1. Introduction

The economics of energy efficiency programmes, including their costs and benefits, have been subject to considerable academic debate lasting well over three decades now (Allcott and Greenstone, 2012; Blumstein et al., 1980; Geller, 1997; Gillingham et al., 2006, 2009; Hausman and Joskow, 1982; Jaffe and Stavins, 1994a, 1994b; Jaffe et al., 2004; Joskow and Marron, 1992; Metcalf, 1994; Sutherland, 1996). Yet, consensus on which programmes are most cost-effective and under which circumstances appears to be a long way off, even though the discussion is moving in the right direction. In essence, the two poles of the argument can be stylised as 'technological optimism' and 'economic pessimism' (Sorrell et al., 2004) and it is unlikely that full agreement will ever be reached given the fundamental differences between the perspectives.

Robust data on the cost-effectiveness of different types of energy efficiency policy instruments is still scarce. In the past, most of the peer-reviewed literature providing data on the costs and benefits of programmes focused on the US (for an overview see Gillingham et al., 2006), which is a result of regulatory requirements for this data to be collected, a practice that is less common elsewhere. A recent investigation into economic instruments supporting energy efficiency by the International Energy Agency (IEA, 2012, p. 14) concluded that 'very few thorough evaluations of economic instruments in energy efficiency policy are available that would facilitate benefit-cost ratio comparisons'.

In this paper we contribute to filling this gap by reviewing the costs and benefits of a specific type of policy instrument that recently gained significant traction in Europe – Energy Efficiency Obligations (also known as White Certificates or energy efficiency resource standards). Globally, there are now more than 50 EEOs operating (Lees and Bayer, 2016). About half of them are located in the US, which is also the origin of this type of instrument that was established in California after the energy crisis (York et al., 2012). In Europe, the introduction of the Energy Efficiency Directive in 2012 has led to an increase in the number of EEOs across Europe. 12 EU Member States (Austria, Bulgaria, Denmark, France, Ireland, Italy, Luxembourg, Malta, Poland, Slovenia, Spain, UK) have active EEOs with another three due to start shortly (Croatia, Greece, Latvia) and the Netherlands considering their introduction (Rosenow et al., 2016). For a detailed description of the architecture of EEOs and how they operate see Lees and Bayer (2016) and Rosenow et al. (2017).

Whereas data on the schemes in the US is abundant, a recent review for example provides data for 20 US states for electricity programmes

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and for 10 US states for gas programmes (Molina, 2014), the picture in Europe is very different. Even though there is now a rich literature on the economics of European EEOs (Farinelli et al., 2005; Langniss and Praetorius, 2006; Mundaca, 2007; Mundaca and Neij, 2009; Mundaca et al., 2008; Oikonomou et al., 2008; Perrels, 2008; Sorrell et al., 2009) most of the analysis is theoretical and does not provide cost-effectiveness data.

Three comprehensive reviews of the costs and benefits of European EEOs were published in 2009 and 2012 (Bertoldi et al., 2010; Eyre et al., 2009; Giraudet et al., 2012) but those are dated as the data analysed in the papers relate to time periods before 2010 and only include three countries, the UK, Italy, and France. There is now an emerging body of evidence on the costs and benefits of EEOs covering a wider range of countries (the UK, Demark, France, Italy and Austria) which offers an opportunity to improve our understanding of the economics of EEOs. Ideally, we would have analysed data for all of the existing European EEOs, but currently data is only available for five of the schemes that are operational. In future years, we expect data to become available also for some of the more recent EEOs.

In this paper we draw on this new data, provide a comparative analysis of the costs and benefits of EEOs in a number of European countries, discuss the uncertainties, and contrast it with evidence from the US. In the first section of this paper we present background information on the different schemes analysed. We then carry out the analysis of the costs of EEOs in the second section. This is followed by an investigation into the benefits of EEOs and a final discussion section before we conclude. We do *not* perform a full cost-benefit analysis arriving at a simple benefit/cost ratio. The reason for this is the lack of quantitative data on many of the benefits. Instead, we quantify those costs and benefits where data is available and discuss any other costs and benefits qualitatively.

2. Analytical approach

In this section, we introduce the main definitions of costs and benefits, the metrics used, and the comparative approach applied.

2.1. Costs of EEOs

EEOs incur a cost, as does any other energy efficiency policy. We classify the costs of EEOs as follows:

- **Programme costs**: This includes the costs to the obligated parties required to meeting their targets. Most of those costs consist of grant payments to customers to partly (or in some cases fully) fund energy efficiency measures. There is a range of other programme costs depending on the geography and the design of the EEOs. In addition to providing subsidies to programme participants, obligated parties need to spend financial resources on lead generation (finding consumers and businesses willing to receive energy efficiency measures), internal administration of the programme, contracting installers, liaising with third-parties promoting energy efficiency measures on their behalf, reporting, and monitoring and verification where required.
- **Societal costs**: This includes both the cost to the obligated parties and the additional costs incurred by customers who participate. For example, if a programme offers a €500 incentive to defray a €1500 cost to insulate a loft, the societal cost for a customer persuaded to insulate their loft by the rebate is the full €1500 (a €500 programme rebate plus another €1000 incurred by the participating customer).
- **Administrative costs**: This is a subset of EEOs costs, typically borne by regulators or their designees, to establish the rules for an EEO, oversee the implementation of the EEOs (at a high level), verify/estimate/evaluate what the EEO actually achieved and report on its results. The term 'administrator costs' is sometimes used in the US instead of programme costs (see for example Billingsley et al., 2014). In this paper, we use the term administrative costs to describe the costs to public agencies of administering the EEO rather than the cost to the utilities.
- **Start-up cost**: This is a one-off cost for setting up the EEOs. Typically, the start-up costs would include the establishment of new procedures, guidelines, training of staff, consultations etc.

2.2. Benefits of EEOs

EEOs deliver a variety of benefits. It is because of this that a recent IEA (2014) report dedicates a whole section solely on the multiple benefits of EEOs. The benefits of EEOs can be grouped into three distinct categories (Lazar and Coburn, 2013):

- **Participant benefits**: Those are the benefits that accrue directly to the participating individual households and businesses that install energy efficiency improvements. The energy cost savings are commonly discussed as the main participant benefit but participants often also benefit from increased comfort and increased values of their properties/ assets.
- **Utility system benefits**: Those are the benefits that accrue to the energy system through reduced costs in providing energy services to end-users. A good example are reduced line losses resulting from load reduction within the electricity grid.
- **Societal benefits**: Those are the benefits that accrue more broadly to society – the community, the region, the nation, or the planet – rather than to a specific energy system. Good examples are carbon emission reduction and air quality improvements.

Despite the diversity of benefits most evaluations that are currently carried out in Europe focus on one benefit only - bill savings. This is often compared to the cost of EEOs. A more comprehensive analysis would need to incorporate a much wider suite of benefits, acknowledging the value of monetising these broader benefits from a policy-maker's perspective as well as recognising that people invest in energy efficiency for a multitude of reasons rarely limited to saving energy costs (Fuller et al., 2010).

2.3. Metrics and comparative approach

We discuss all the costs and benefits mentioned above. Because data on the wider costs and benefits is scarce our quantitative analysis focuses on the programme costs and participant benefits. We use negawatt costs in money spent per kWh saved as a result of EEOs as this metric is particularly useful for comparing such programmes (Gillingham et al., 2006) and commonly used across the world when assessing the costs and benefits of energy efficiency schemes. Negawatt costs can be compared to the cost of energy supplied to final customers (or megawatt costs) to establish if the programmes are cost-effective.

In order to provide information in a clear, comparable summary format, we have had to make a number of assumptions. Data are presented in a homogenous format to facilitate drawing conclusions on the impact of EEOs across different programmes. This is challenging as the methodologies used by the countries analysed to estimate and report costs and savings are not consistent in several ways:

- Discounting: Some countries discount energy savings whereas others do not.
- Free-riders: Estimates for free-ridership vary across the different countries.
- Rebound effects: Those are taken into account to different degrees.
- Lifetimes: The lifetimes of the measures are not always the same even for the same measure.
- Units: Differing units of savings from different mixes of fuels and conversions to kWh equivalents.
- Evaluation methods: Some of the evaluations are ex-ante, others ex-