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Overestimation of savings in energy efficiency obligation schemes

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ABSTRACT

In energy efficiency obligation schemes, energy savings are accredited for implementing energy efficiency measures. Individual measures need to add up to the cumulative savings target. With regard to the savings accredited in energy efficiency obligation schemes that existed when the EU's Energy Efficiency Directive entered into force, economic literature attests this policy instrument to effectively deliver additional savings at low costs. This paper relativizes these optimistic results and shows that *accredited* energy savings are likely to be significantly overestimated compared to the *real* savings achieved in course of the scheme. First, bargaining processes increase accredited savings per measure. These include bargaining on the volume of the savings target, standardised saving values, discount rates, and the lifetimes of measures. Second, arbitrary methods of measurement are an integrated element of obligation schemes to minimise excessive administrative costs. However, it is shown that arbitrary methods of measurement incentivize overestimation of real savings. Both aspects imply that real savings are lower than accredited savings, querying the policy instrument's actual effectiveness and efficiency.

1. Introduction

While the ongoing transition to carbon-free sources of energy [13] faces not only economic, but also social challenges [7], energy efficiency improvements are commonly accepted as they deliver the same energy service and are often accompanied by improvements in comfort [2]. Energy efficiency supports a decrease in energy intensity and is often stimulated by regulation or incentives like subsidies and taxes [10]. Energy efficiency obligation schemes are an innovative policy instrument primarily aiming to increase end-use energy efficiency. The government obliges energy suppliers (retailers or distribution system operators) to deliver a certain volume of energy savings. These energy savings need to be achieved on the end-users' property, e.g. by exchanging inefficient appliances. Energy savings are measured *bottom-up*, implying that every single measure needs to be recorded and individual savings are accumulated until the obligation is complied with. For details on the basic functioning of energy efficiency obligation schemes see Ref. [4].

Energy efficiency obligation schemes have been applied since 1994, when Great Britain introduced this policy instrument. The obligation scheme proved to be highly effective, probably because no other instruments addressing energy efficiency had been in force. As an indirect regulation (suppliers are obliged to implement measures at a third party), the instrument operated outside the fiscal budget and both the use of capital (energy efficiency measures) and the source of financing (higher energy prices) support end-use energy efficiency. For details on the British scheme see Refs. [17,24]. Expert interviews conducted in course of the EnergieZer project suggest that the Danish, Italian and French scheme were installed based on the positive British experiences [17]. Of course, policy installation was affected by existing national energy legislation and framework conditions, which led to some variations in scheme design. For details on these schemes see Ref. [5].

Before the EU's Energy Efficiency Directive (2012/27/EU) entered into force in December 2012, about 40% of the EU population had already been subject to energy efficiency obligation schemes. Additionally, due to the EU's Energy Service Directive [8] (2006/32/EC), voluntary schemes existed in Austria and Finland. Poland planned to start an obligation scheme then [17]. According to the Directive's article 7, Member States shall install energy efficiency obligation schemes on a national level. Energy distributors and/or retail energy sales companies shall be obliged to save 1.5% of the energy delivered to final customers excluding energy for transport purposes. However, article 7 also lists alternative policy instruments the member states may use to comply with the 1.5% target.

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1.1. Advantages of energy efficiency obligation schemes

Why does the Directive enforce this specific policy instrument so prominently, compared to alternative policies? Extensive research has been conducted on energy efficiency obligation schemes. In comparison to other policy instruments, research almost homogenously detected theoretic advantages and good policy performance in practice.

1.1.1. Increasing energy efficiency market activity

According to recital 9 of Directive 2006/32/EC, the liberalisation of energy markets "*has almost exclusively led to improved efficiency and lower costs on the energy generation, transformation and distribution side. This liberalisation has not led to significant competition in products and services which could have resulted in improved energy efficiency on the demand side*." Energy efficiency obligation schemes are expected to significantly increase energy efficiency market activity, by stimulating market turnover, the number of energy service companies acting on the market and supporting the marketability of new energy efficiency products.

1.1.2. Polluter-pays-principle

Neglecting administration and transaction costs, an obligation should ideally be imposed on the "polluter", i.e. the energy end-user. In order to limit the scheme to a manageable number of obliged parties, energy retailers and/or distributors should be obliged, as they are the penultimate actor in the supply chain [4]. Moreover [28], identify further arguments in favour of obliging energy retailers and/or distributors: most of them have sufficient financial and human resources, direct customer contact and knowledge about the consumption, have knowledge on savings potentials and are competent in marketing and implementing measures.

1.1.3. Cost minimisation

Energy efficiency obligation schemes are a market-based instrument, constituting a "floor" of savings. Based on the axiom of economic theory, profit-maximising companies minimise their costs. As the obligation represents a burden to the suppliers, they minimise the costs of compliance (i.e. minimise the costs of implementation of measures) [12]. An ideal-theoretic scheme allows for full flexibility, meaning that there are no restrictions concerning the type of energy efficiency measures, saved energy carriers, customer groups, purchase of savings achieved by third parties, etc. For a detailed illustration of flexibilities see Ref. [21]. This means, for example, that gas retailers could support electric cars or that petrol station operators could give away LEDs to comply with their obligations. Suppliers socialise the costs by passing them on to their customers or by receiving public refunds. Thus, suppliers' cost minimisation theoretically guarantees minimal costs for the society when a certain savings target is to be achieved. However, energy suppliers supporting end-use energy efficiency remains a paradox and needs regulatory constraints [25].

1.1.4. Additionality

Those measures which would *not* have been implemented *without* the energy efficiency policy are called *additional*. The higher the share of additional measures is, the more effective the policy instrument is. Usual additionality of demand side management programs ranges from 10 to 50% [11]. Regarding energy efficiency obligation schemes, additionality is estimated 50% in the Danish scheme and 80% in the British scheme [14,27].[1] For the first period of the French scheme in operation from 2006 to 2009, it was a political consensus that obliged suppliers "market" the government's subsidies, i.e. suppliers increase the additionality of another policy instrument in force, while they bear low costs [17]. For a detailed analysis of additionality see Ref. [5].

1.2. Disadvantages of energy efficiency obligation schemes

Reviewed literature uniformly refers to transaction costs and administration costs as the most important disadvantages of energy efficiency obligation schemes. Transaction costs are defined as costs which do not directly contribute to the production of a good (here: an accredited energy efficiency measure). These include "*search for information, persuasion of customers, negotiation with business partners, and measurement and verification activities*" [20]. As every implemented measure needs to be documented, monitored and verified, these activities are identified as the main sources of transaction costs [5,22]. Additionally, governmental institutions also face high expenses for activities to control and review the measures and the measurement process of the savings. The costs associated with measurement and verification will be subsumed as *administrative costs* in this paper.

One straightforward approach to reduce administrative costs is to standardise accredited savings for a certain type of measure. Using an average value, total savings expectedly are accurate while the deviation of individual measures can be neglected. For example, in Austria, 205 kWh are accredited for replacing an old refrigerator by an efficient one [1]. Standardised measurement is practically indispensable for bottom-up accreditation of savings in energy efficiency obligation schemes and constitutes an integrated part of this policy instrument. Without providing a standardised savings value the supplier would, to be accurate, need to measure the consumption of the *old* refrigerator on-site, measure the consumption of the *new* refrigerator on-site, and then calculate the difference. Existing literature concentrates on avoiding administrative costs by providing recommendations on how to standardise and process savings values [3–5,20–22]. If at all, literature hardly considers the consequences of (i) the real-life standardisation process and (ii) standardised measurement itself on the whole scheme's performance.

Based on the volume of savings accredited in existing schemes, research attests high efficiency (low costs of savings) and high effectiveness (high additionality). In the author's opinion, economic efficiency of one obligation schemes is hardly comparable to other schemes or alternative policy instruments: parameters[2] are not recorded uniformly in the various national schemes [16], vary between policy instruments in the same country, and depend heavily on the preconditions (instruments already in force, efficiency potentials, etc.) [17,26]. support this opinion by showing the complexities and the bulk of assumptions necessary in order to be able to compare the results of the national schemes. Concerning additionality, most stated numbers obviously are estimates [14,27]: generally, an obligation scheme first tends to absorb business-as-usual measures (as suppliers' costs are minimal if the customer would have implemented the efficiency measure anyhow). This is supported by the finding that there "*appears to be*" a trade-off between additionality and the capital levered by parties other than the obligated entities [23], i.e. the more money is spent by private investors, the higher the probability that the scheme accredits savings to measures implemented anyhow.

[1] Remark: later analysis by Ref. [6] relativizes these figures by finding additionality of 10% in the Danish residential sector; note the low sample size of n = 46.

[2] Standardised saving values, inclusion of measures' lifetimes, application of discount rates, acquisition of direct cost data, etc.