# *ENERGY EFFICIENCY POLICY: A REVIEW OF INSTRUMENTS AND POTENTIAL INTERACTION EFFECTS*

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## Overview

Increasing energy efficiency and savings is considered to play a key role regarding the achievement of the climate and energy targets in the European Union. In order to meet the targeted objectives with respect to greenhouse gas emission reductions, renewable energy use and energy efficiency improvements, a number of energy policy instruments is designed and implemented on various policy levels. One purpose of the paper is to give an evaluation of relevant policy instruments and to emphasise their strengths and weaknesses. The evaluation is based on a review of scientific articles on the topic of policy instruments for energy efficiency and savings. It demonstrates the variety of possible policy instruments and points at the complex policy environment where not a single instrument is able to meet the respective energy targets, but a combination of multiple instruments is necessary. Thus, the paper furthermore aims at assessing potential interactions between combinations of policy instruments for energy efficiency and savings, i.e. the extent to which the different instruments counteract or support each other. So far, only limited attention has been paid to the effect of interacting policies in the literature. In the paper, the interaction effects that have been identified are reviewed and analysed with respect to influencing factors that determine the interaction (e.g. policy design characteristics). Based on that, specific interaction effects between energy efficiency policies are defined, allowing for an assessment of systematic patterns and an indication of necessary future research.

## Methods

The paper is based on a literature review of energy efficiency policies and interaction effects between them. The review of policies gives an overview of relevant measures promoting energy efficiency and savings at the end-use level. Thus, the focus is on measures that create a framework or requirement for industries or households in particular to invest in energy efficient technology and products or provide an incentive to save energy through behavioural change. These measures are listed in a comparative assessment taking into account effectiveness, efficiency and feasibility criteria and pointing at their strengths and weaknesses.

Policies for energy efficiency and savings are commonly implemented in a policy mix i.e. a combination of instruments aiming at the same target. When multiple instruments all aiming at a reduction in energy consumption are implemented simultaneously, interactions between them are inevitable. Yet, only a limited number of research has directly addressed interactions between policies particularly aiming at energy efficiency and savings. The review of interactions between energy efficiency policies therefore gives an overview on what has been done and based on the existing literature, influencing factors that determine if there is a risk for overlapping energy efficiency instruments or potential for reinforcing effects between them are identified. Furthermore, specific cases of interacting policies are analysed.

## Results

When the energy price does not correspond to its real marginal costs, i.e. external costs are not internalised, the adoption of energy efficiency and saving measures is disincetivised. Market-based instruments address this problem adding external costs to the energy price and thereby incentivising energy efficiency and savings while allowing for cost-effectiveness. Besides the externality, fully competitive market conditions, e.g. rationality, perfect information and lack of transaction costs, are assumed when applying market-based instruments as a first best solution. However, in the markets for energy efficiency and savings it has long been argued that market failures and barriers beyond the negative externality problem exist, which cause a suboptimal level of energy efficiency and explain the existence of the so-called energy efficiency gap; e.g. imperfect and asymmetric information, principal agent problems, behavioural failures, including bounded rationality, and limited access to capital. Therefore, the energy efficiency policy portfolio also includes instruments addressing these market failures and barriers: financial incentives, regulatory and non-regulatory measures, and information and feedback.

The influencing factors that determine potential interaction effects when multiple policies all aiming at a reduction in final energy consumption are implemented simultaneously can be divided in three broad categories: steering mechanism, scope and timing. The category steering mechanism includes factors that determine the type of incentive provided by a specific policy instrument, thus, how it shall steer the behaviour of the relevant target group. The instrument scope points at the sector, the technology or the target group addressed, thus the overarching group to which a policy instrument pertains. The timing factor simply indicates that two or more instruments can only interact when they are implemented at the same time. The basic intuition behind these influencing factors is that the relevance in interactions of two or more instruments increases to the extent that they are based on the same steering mechanism, have the same scope and are applied at the same time. Instruments tend to be reinforcing when they are different in at least one of the three categories. I.e., when two or more instruments are implemented at the same time and target the same sector, the interaction between them is most likely mitigating when also using the same steering mechanism, but rather reinforcing when being different with respect to this factor.

Analysing the interaction effects that have been identified in the relevant literature, a systematic pattern can be identified. Instruments that enforce a certain target of energy efficiency or savings, as performance standards and energy efficiency obligations, are more likely to overlap with other instruments, as they do not increase effectiveness implemented in combination. On the other side, instruments that provide flexibility regarding how a sector or target group responds to a certain instrument, e.g. energy taxes or information measures, are more likely to be complementary with other instruments and to have a reinforcing effect in combination.

## Conclusions

Policy makers can choose from a range of policy instruments to foster future energy savings and efficiency and in fact, multiple policy instruments are implemented on various policy levels. Given the policy crowded environment, policy interactions are inevitable. As the number of implemented instruments increases, so does the incidence of interactions between them, which can be complementary and mutually reinforcing, but there is as well a risk of mitigating effects between different policy instruments. It can be expected that efficiency targets will become more stringent. Therefore, it is crucial to achieve a better understanding of the effectiveness of different instrument combinations, as the need for a well-functioning policy mix will increase as well. In order to maximize effectiveness, i.e. the energy saving effect of a policy mix, interaction effects between combinations of energy efficiency policies have to be taken into account.

Future research should consider a potential acceptability of mitigating interactions between instrument combinations, e.g. when policy targets beyond the energy saving effect are intended, and moreover, focus on the quantification of case-specific interactions in order to sharpen the analysis of interactions and to be able to give concrete policy advise.