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Multiple impacts of energy efficiency – A comprehensive indicator approach

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EXTENDED ABSTRACT

Abstract

Energy efficiency (EE) is considered as essential for the achievement of all major objectives of climate and energy policies and was coined as the "first fuel" in the EU 2030 climate and energy policy framework[1] and by the International Energy Agency[2]. EE is one of the five core dimensions of the Energy Union, next to energy security, solidarity and trust; the internal energy market; decarbonisation of the economy; and research, innovation and competitiveness[3]. Today, a significant share of the EE options are not (or not enough) cost-effective from an investor perspective when only energy savings are accounted as benefits, while policy makers frequently justify energy efficiency measures by pointing to co-benefits. Co-benefits of energy efficiency like the reduction of emissions, enhanced competitiveness, health and economic benefits can be significantly higher than the cost of energy measures[4]. Some counteracting effects such as additional material consumption for energy-efficient equipment are not considered directly, for example, because the approach presented does not include such upstream chains in detail. However, other effects such as reduced tax revenues or job losses are (partly) considered in our approach. Against this background, it was the objective to develop a set of indicators that present different aspects of energy savings in a comparable and comprehensive way. The methods should be simple to apply and, if possible, based on data that is easy to obtain, to build a comprehensive toolbox on the multiple impacts of EE.

For our approach, we designed a set of indicators, which allows examining important impacts of energy efficiency. The impacts covered are classified into three groups: environmental (e.g. energy savings, emissions), economic (e.g. GDP, employment), and social (e.g. health effects, energy poverty) aspects. The selection of the indicators is based on a trade-off between comprehensiveness and practicality in view of data availability and the complexity of modelling. Thus, we have chosen the indicators in such a way that they can shed adequate light on as many of the aspects as possible without, however, requiring great efforts in terms of data collection and very elaborate methods and/or modelling. Some aspects, e.g. the effects of noise on health, would require

[1] Y. Saheb, H. Ossenbrink; Securing Energy Efficiency to Secure the Energy Union: How Energy Efficiency Meets the EU Climate and Energy Goals, Publications Office, Luxembourg (2015)
[2] IEA; Energy Efficiency: Market Trends and Medium-Term Prospects, OECD Publishing, Paris (2013)
[3] European Commission; Communication from the Commission to the European Parliament, the council, the European economic and social Committee and the Committee of the regions: a policy framework for climate and energy in the period from 2020 to 2030, Available from http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014DC0015R(01) (2014)
[4] S. Zhang, E. Worrell, W. Crijns-Graus, M. Krol, M de Bruine, G. Geng, et al.; Modeling energy efficiency to improve air quality and health effects of China's cement industry, Appl. Energy, 184 (2016), pp. 574-593, DOI: 10.1016/j.apenergy.2016.10.030

a spatially and temporally differentiated analysis of the noise sources and the affected humans, which is beyond the scope of the present paper not only in terms of data collection but also with regard to modelling of the ultimate health impacts. Furthermore, the link with energy efficiency is rather indirect (since traffic is the most likely to play a role here and primarily activity reduction would lead to lower noise pollution, which cannot be easily matched with energy efficiency improvement).

In order to preserve the character of the simple applicability of our indicator approach, we do not include such and similar indicators. The goal of our approach is a set of easy-to-use indicators that allow the user to estimate the multiple impacts of energy savings without having to resort to time and data-intensive models. We also consider ready availability of the required data. Thus, the indicator set may evolve to cover further aspects as data availability improves in future.

Our methods can be applied by policy makers in the design process of energy efficiency policies, thereby allowing to consider the various aspects at an early stage and potentially facilitating the promotion of EE policies. Also monitoring processes related to energy efficiency policies could benefit from an implementation of our indicator set (or a subset), e.g. by tracking the effects over time.

The indicator set can be applied by researchers to assess several or single aspects of energy savings from energy efficiency policies or related to top-down energy savings. While we characterised the quality of the various indicators, future improvements in the methodology, e.g. through a systematic gauging of results with in-depth studies on single indicators, can further improve the quality of the indicator approach. Further work may also analyse how such indicators could be combined to composite indicators, aggregating categories into single indicators. Such aggregate indicators have been developed for renewables[5] and for some aspects of energy efficiency[6].

We exemplified in our analysis the multiple impacts approach for Germany. For example, our analysis regarding the employment effects of energy efficiency showed that from 2010 to 2015 around 570,000 FTE of new jobs were created solely related to energy efficiency of buildings. By way of comparison, the automotive industry, which is one of the most important economic sectors in Germany, employs around 790,000 people equalling to around 610,000 FTE. Extension of the scope of the methodology to a larger number of countries in Europe and beyond appears as feasible, e.g. in the frame of reporting to the United Nation Framework Convention on Climate Change UNFCCC.

The findings and methodology developed in our approach are currently further developed as part of the MICAT project[7] to provide an online tool allowing for analyses at three different governance levels (local, national and EU) to address a broad target group and interested actors. This allows simplified analyses to be carried out on the basis of different data (both ex-post and ex-ante) and policy scenarios in order to compare and assess the relevance of the multiple impacts and establish a culture of underlining the importance and assessment of multiple impacts in scenario approaches and policy evaluations.

[5] I. Boie, M. Ragwitz, A. Held; A composite indicator for short-term diffusion forecasts of renewable energy technologies – the case of Germany Energy Environ., 27 (1) (2016), pp. 28-54, DOI: 10.1177/0958305X16638571

[6] D. Bosseboeuf, B. Lapillonne, W. Eichhammer ; Measuring Energy Efficiency Progress in the EU: the Energy Efficiency Index ODEX (2005)

[7] For more information see http://micat-project.eu