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Unravelling projected energy savings in 2020 of EU Member States using decomposition analyses

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HIGHLIGHTS

- The difference in energy use between the 2007 and 2013 EU baseline scenarios is decomposed.
- The impacts of the economic recession and the Climate and Energy policies are quantified.
- This study could help policy makers to improve their understanding of the EU baseline scenario.

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ABSTRACT

The objective of this paper is to provide deeper insights into the energy savings efforts of EU Member States by exploring the impact of new policies, the recent economic recession and other effects, using decomposition analyses. The results of the study show that the difference between the two official EU baseline projections, PRIMES-2007 (pre-recession, pre-Climate and Energy Package) and PRIMES-2013 (post-recession, including the new policies of the Package), can be explained by the combined impact of the new policies, the economic recession and other effects such as differences in energy prices. However, the impact of the other effects remains largely unexplained in the official PRIMES-2013 report and is clouding the right interpretation of the policy effect. By providing these insights, this study could help policy-makers in better understanding scenario outcomes and the impact of their policies.

If EU Member States would be able to achieve their 2020 energy savings targets, then an important step has been taken to bridge the energy savings gap. Since the economic recession plays a major role in bridging this gap and economic recovery is aimed for, further intensification of energy efficiency policies is crucial to contribute to the GHG reduction target for 2030 and beyond.

1. Introduction

The European Union has set targets to reduce its greenhouse gas (GHG) emissions by 80–95% below 1990 level in 2050 (European Commission, 2011). The 2020 targets, often referred to as the 20/20/20 targets, set in the Climate and Energy Package (European Commission, 2008), are the first step towards the realisation of this long-term goal. The 2020 targets include a 20% reduction of GHG emissions compared to 1990, a share of 20% renewable energy in total final energy consumption and 20% lower primary energy consumption than the projected consumption level for the year 2020 in the 2007 EU baseline scenario (see below).

In 2013, the progress towards the 2020 targets was assessed by the European Environmental Agency (EEA, 2013). One of the main conclusions of the EEA study is that "good overall progress across EU Member States towards the 20/20/20 [is made] but progress on energy efficiency remains slow" (EEA, 2013, p.11). Regarding GHG emissions, a 21% reduction is expected with the current set of national policies in place, and a 24% reduction with the implementation of additional measures. For renewable energy the EEA concludes that, although currently on track, "[f]urther efforts are needed to ensure that Member States and the EU as a whole will meet their binding renewable energy targets in 2020" (EEA, 2013, p. 113). Different from GHG emissions and renewable energy, the energy savings target is topic of concern as the national reported consumption targets[1] do not sum up to 20% energy savings (EEA, 2013). Therefore the European Union as a whole is heading for 16.4% primary energy saving. Fig. 1 shows significant differences between the Member States: the projections for some countries (top of the graph) suggest an overachievement of the 20% target,

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[1] Submitted by the Member States under Article 3 of the Energy Efficiency Directive (European Parliament & Council, 2012).

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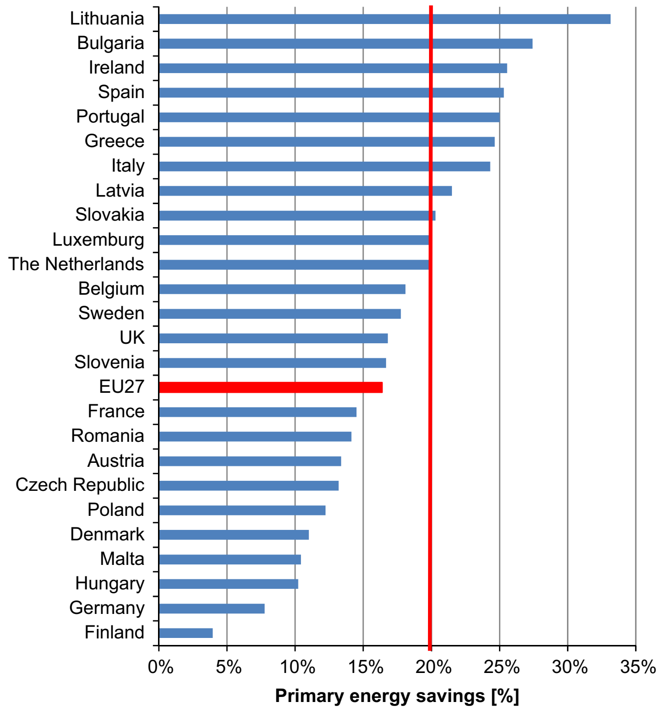

Fig. 1. Relative primary energy savings in 2020 based on the reported national primary energy consumption by each EU Member State.

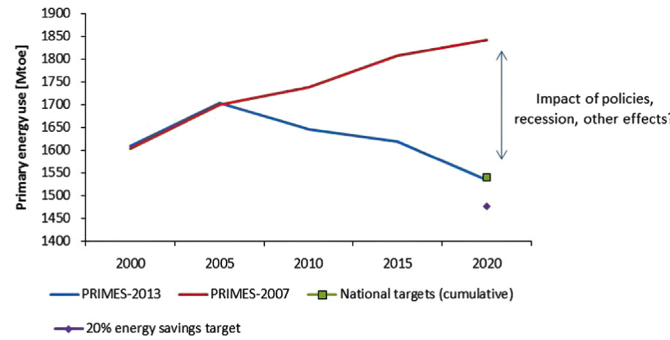

Fig. 2. Projected values of primary energy use (excl. feedstock: As feedstock is not included in the definition of the energy savings target, the energy resources used for feedstock are excluded from the graph.) EU27 in two EU baseline scenarios: In this paper ton oil equivalent (toe) is used rather than Joule. The reason is the use of toe in the official EU projections, following the standard used by Eurostat and the European Commission. Not using toe would make it difficult for the reader to compare this analysis with the original sources. (1 toe=41.868 GJ).

whereas other Member States are heading towards an energy savings gap.

As indicated by the EEA, the 20% GHG reduction target is expected to be achieved, whereas achievement of the 20% energy savings target is not on track. This suggests that the ambition level of both targets is different. Harmsen et al. (2011a and 2014) show that the 2020 20% energy savings target is equal to 14% energy savings compared to energy use in 2005. As the 2020 20% GHG reduction target equals 14% reduction compared to 2005 as well, achievement of the 14% energy savings target with an unchanged fuel mix would lead to 14% GHG reduction. However, more options are available for GHG reduction, such as decarbonising the fuel mix and a reduction of the non-CO_2 GHGs,[2] which implies that the current savings target would be consistent with a much more ambitious GHG reduction target for 2020.

The objective of this paper is to provide deeper insights into the energy savings efforts of EU Member States. This is done through analysing the difference between the 2020 projections of two EU baseline scenarios: *European Energy and Transport Trends to 2030 – Update 2007* (hereafter: PRIMES-2007) (Capros et al., 2008) and *EU Energy, Transport and GHG Emissions Trends to 2050 – Reference Scenario 2013* (hereafter: PRIMES-2013) (Capros et al., 2013). The PRIMES scenarios are the official EU energy and GHG projections and reflect the impact of new policies in the context of expected economic growth. PRIMES-2007 is the baseline projection used as starting point for the Climate and Energy Package (European Commission, 2008) and, therefore, does not include the new policies and targets of the Package. Furthermore, PRIMES-2007 does not include the impact of the recent economic recession, which started in 2008. PRIMES-2013 is the most recent EU baseline scenario and reflects the impact of the new policies of the Climate and Energy Package and the economic recession. As Fig. 2 shows, the sum of reported national primary energy saving targets, reported by the European Member States,[3] equals the 2020 primary energy use of PRIMES-2013. The interesting question for policy makers is how the difference between the two scenarios can be explained: What is the impact of new climate and energy policies, to what extent does the economic recession contribute, and what is the impact of other effects such as differences in energy prices and population size, and revisions of base year data and the effect of earlier policies?

2. Methods

In this paper a new application of decomposition analysis is introduced. Decomposition analysis is a mathematical method, which has been applied in a variety of studies in energy-related environmental analysis (for an overview see Ang and Zhang (2000) and Ang (2004)). Decomposition analysis can be used to decompose an aggregated indicator, e.g. energy use or CO_2 emissions, into its driving forces. Two basic approaches are in use: methods linked to the Laspeyres index and methods linked to the Divisia index (Ang, 2004), where the Laspeyres index is based on the concept of percentage change, and the Divisia index is based on the concept of logarithmic change. Decomposition analysis has been applied to decompose *historic* development of energy use into explanatory factors (e.g. volume, structure and savings effects) and energy and GHG *scenarios* (Kesicki, 2012). To the knowledge of the authors this is the first study in which the difference in energy use *between two baseline scenarios* (PRIMES) which have been developed in different years (i.e. 2007 and 2013) is decomposed rather than decomposing the development of energy use in *one scenario* or decomposing the difference between *scenario variants*.

2.1. Research steps

The analysis included four steps. As this study focused on the "difference" change between PRIMES-2007 and PRIMES-2013, additive decomposition analysis was applied rather than multiplicative decomposition analysis. For steps 1, 2 and 3 a two-factor

[2] According to non-CO_2 GHG emissions scenarios for EU27 developed with the GAINS model, the 2020 mitigation potential for non-CO_2 GHGs could reach about 42% reduction against the 2005 emissions level (Hoglund-Isaksson et al., 2012). In PRIMES-2013 (Capros et al., 2013, p. 148) non-CO_2 GHG emissions for EU27 decrease from 896 Mton CO_{2eq} in 2005 to 752 Mton in 2020 (−16.1%).

[3] Accessible via: ⟨http://ec.europa.eu/energy/efficiency/eed/reporting_en.htm⟩. Croatia, the 28th Member State is not included in this analysis.