How to shape a binding energy savings target for Europe that allows for effective evaluation?

Dr. Robert Harmsen (Copernicus Institute of Sustainable Development, Utrecht University, NL), Dr. Bart Wesselink (WWF NL), Dr. Wolfgang Eichhammer (Fraunhofer ISI, DE)

ABSTRACT

This paper considers which design of a binding energy savings target for the EU is the most feasible to both make it work and to ensure it can be evaluated in an efficient and transparent manner. We look at four possible design options. We conclude that a binding target at Member State level applied to end-users is the most feasible. Such design option covers the vast majority of the cost-effective energy savings potential, maintains the flexibility for companies in the EU Emission Trading Scheme (ETS) and supports the most cost-effective achievement of a greater share of renewables. To allow for adequate evaluation, such binding end-use target should be defined in absolute energy terms (an "energy consumption cap"), which means that the energy use which remains is measured, rather than estimating the savings. We propose to express the target in (adjusted) final energy terms to avoid a disconnection between the target (when alternatively expressed in primary energy) and the energy statistics of end-users being also expressed in final energy. Such disconnection would unnecessarily make the job of the future evaluator more difficult. Insight into the potential contributions to the target of different energy carriers (fuels, electricity, district heat) and sectors (transport, residential, services, industry) would steer the evaluation of the energy efficiency policies that (are intended) to support target achievement and allow (if needed) for effective strengthening of existing policy instruments or adding new ones to the package.

Introduction

Today, Europe has a binding target for renewable energy (20% in 2020) and a binding target for greenhouse gas (GHG) emission reduction (-20% in 2020 compared to 1990). For energy savings there is only an indicative target of 20% in 2020. This 20% target, estimated against the 2007 EU Baseline Scenario (Capros et al. 2008) represents an absolute primary energy use of 1474 Mtoe in 2020. With a projected primary energy use (excluding non-energy use) for 2020 of 1842 Mtoe (Capros et al. 2008), 368 Mtoe needs to be saved.

It is clear that Europe is not on track in meeting its 2020 energy savings target. In a study for the European Climate Foundation it has been evaluated that without intensified policies a gap of around 208 Mtoe will remain towards the target (Ecofys & Fraunhofer 2010, p.5). Also in the 2011 Energy Efficiency Plan of the European Commission it is recognized that with current policies the target will not be met: '[…] recent Commission estimates suggest that the EU is on course to achieve only half of the 20% objective.' (European Commission 2011a, p.2). Figure 1 visualizes the energy savings gap.

As current energy efficiency policies - for cars, buildings, appliances - fail to close the energy savings gap, the need for binding energy savings targets have become topic of debate in recent years. So far, the European Commission has refrained from setting a binding target. As stated in the 2011 Energy Efficiency Plan (European Commission 2011a, p.4): 'The leading principle of this plan is to propose stringent binding measures without binding national targets.' In the introductory text of the proposed Energy Efficiency Directive the following argument is given (European Commission 2011b, p.3): 'It indicates that such [energy savings] targets do not need to be binding at present and that binding measures can achieve the same or better results.' Although the proposed Energy Efficiency Directive holds a provision to set legally binding national targets for 2020 in case the proposed measures would not get Europe back on track in meeting the 20% target (European Commission 2011b, recital 13), it seems there is limited political room to make the current indicative target for 2020 a binding one (European Council 2011).

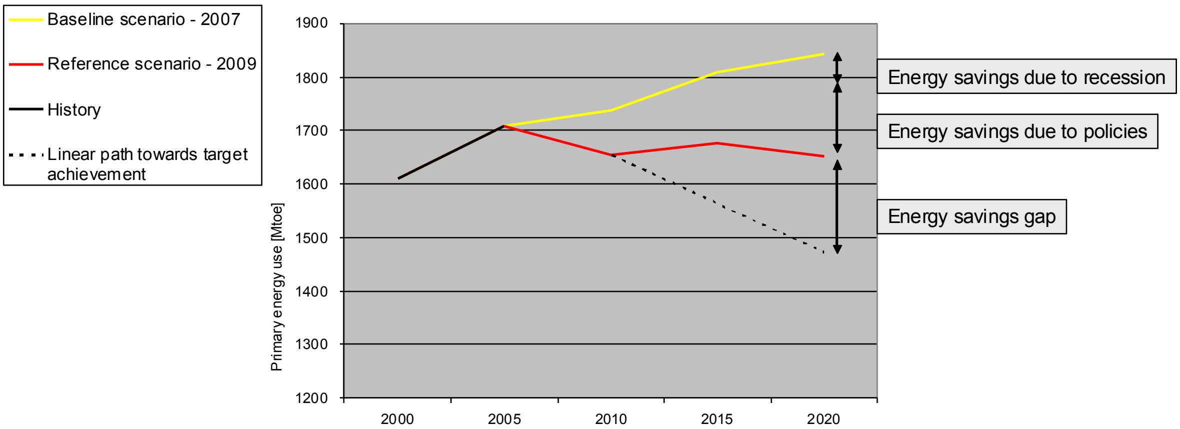

Figure 1Europe's energy savings gap (analysis based on data from Capros et al. 2008 & 2010)[1]

This paper considers which design of a binding energy savings target for the EU is the most feasible to both make it work and to ensure it can be evaluated in an efficient and transparent manner. The report 'Energy Savings 2020: how to triple the impact of energy saving policies in Europe' for the European Climate Foundation (Ecofys & Fraunhofer 2010) serves as background document for this exercise. All three authors of this paper are lead authors of the Energy Savings 2020 report.

Justification of a binding energy savings target

An argument against a binding energy savings target is that binding elements in the current energy efficiency policies will do the job (like stated in the proposed Energy Efficiency Directive, see quote above). Among these are:

- The minimum energy performance standards for different product groups (electricity and fuel) set in the Implementation Measures under the Eco-design Directive (European Parliament & Council 2009a).
- The recast of the Energy Performance of Buildings Directive (EPBD) (European Parliament & Council 2010), with "nearly zero energy standards" for new buildings, energy performance standards for "major renovations" and the obliged issuing of energy performance certificates for existing buildings, being complemented with a binding 3% renovation rate of public services buildings in the proposed Energy Efficiency Directive.
- Regulation setting limits on CO_2 emissions from new passenger cars and light duty vehicles (European Parliament & Council 2009b).

Regarding the minimum performance standards for product groups it must be noted that for a great number of product groups Implementation Measures have not been adopted yet. So far, 12 Implementation Measures have been adopted. These cover around 40% of final electricity consumption in Europe. For 2012-2013 another twelve Implementation Measures will be adopted including one on boilers, one on water heaters and one on electric and fossil-fueled heating equipment (European Commission 2011e). Fifteen more product groups are scheduled for after 2013. Missing in the above list of energy efficiency policies are minimum energy performance (or CO_2) standards for heavy duty trucks, ships and airplanes. Moreover, the binding character of the EPBD for existing buildings seems rather weak as 1) "major renovations" should meet the minimum performance requirements in so far this is

[1] The 70 Mtoe impact of the recession has been determined in Ecofys & Fraunhofer (2010).

technically, functionally and economically feasible, and 2) it is unclear at the moment whether the energy performance of a whole building or only of the renovated part needs to be improved.

Given the present state of play of energy efficiency policies, one could argue that a binding energy savings target would, as an umbrella policy, add value to the existing policy package. It would help to:

- Speed up the implementation process of the remaining Eco-design Implementation measures and make sure that ambitious minimum energy performance standards are being set.[2]
- Stimulate Member States towards a fast and ambitious implementation of the EPBD, especially for existing buildings.
- Speed up adoption of CO_2 regulation for heavy duty trucks, ships and airplanes.

There is another important argument to go for binding energy savings targets. All current policies aim at *increasing energy efficiency* but lack the means to *limit volume growth* (e.g. in car transport) and *structural change* (e.g. increased use of electric appliances in households). A binding energy savings target may stimulate governments to realize e.g. the energy savings potential of modal shifts in transport and to discourage ever growing electricity consumption in households.

Considerations on evaluation

Policy design is one of the early steps in the policy cycle. After problem recognition (Europe being not on track in realizing its energy savings ambitions), solutions have been identified (a huge cost-effective energy savings potential is out there) and policy proposals have been identified (a binding energy savings target being one of them). From the perspective of the European Commission the general criteria for evaluating a new policy are (European Commission 2009):

- Effectiveness – the extent to which a new policy achieves the policy objectives.
- Efficiency – the extent to which objectives can be achieved for a given level of resources/at least cost (cost-effectiveness)
- Coherence – the extent to which a new policy is coherent with the overarching objectives of EU policy, and the extent to which it is likely to limit trade-offs across the economic, social, and environmental domain.

In this paper we do not focus on the efficiency criterion in relation the binding savings target. As stated in the previous section a binding energy savings target can be considered an umbrella policy that stimulates the accelerated implementation and/or intensification of energy efficiency instruments. It is merely the set up of those policy instruments rather than the binding target that determine the cost-effectiveness of individual instruments and the full package.

Our focus in this paper concerns the effectiveness and coherence criteria. Regarding the evaluation of effectiveness, data measurement and data transparency are key-factors. As part of the evaluation of coherency we look at two issues: 1) the flexibility that the options provide to Member States and 2) the interaction with standing policies. In Huitema et al. (2012) a similar criterion (labeled as "coordination criterion") is used to assess a policy in coherence with other policies. Ideally, a new policy should strengthen current policies. The coherency argument has been introduced in the White Paper on Governance (European Commission 2001) and is an important element of the EU Impact Assessment Guidelines (European Commission 2009). Maximizing coherence means maximizing the mutual reinforcement of policies actions across government departments and agencies, creating a synergy that promotes the achievement of EU objectives.

[2] The current set of Implementation Measures has been criticized for not being set at top ambition (see Ecofys & Fraunhofer 2010, p.31).

Approach

In our analysis we follow a four-step approach. In step 1, we first define four main design options for a binding energy savings target. In step 2, we discuss how to express or define an energy savings target. Effective future evaluation strongly depends on the choices made here. In step 3, we analyze the interaction of the four design options with standing policies. Insight in the interaction between policies is not only valuable in the design process of a new policy but also provides handles for evaluation. In step 4, we analyze the feasibility of the design options regarding the flexibility to Member States under each design option to shape their own national policies under binding EU provisions. We show that insight in the flexibility to Member States is both valuable in the policy design process and for evaluation purposes. Finally, we discuss our main findings and conclude on the most feasible design of a binding energy savings target for Europe.

Step 1: defining four main design options

In our analysis we distinguish between four possible design options for a binding energy savings target:

1. One economy-wide energy savings target at the EU level.
2. A target set at the EU level for end-use sectors only.
3. One economy-wide energy savings target for each Member State.
4. A target set at the Member State level for end-use sectors only.

Each of the four design options will be shortly described below.

Ad 1 One economy-wide energy savings target at the EU level

Today's 20% energy savings target is an economy-wide target set at the EU level. However, this target is non-binding. A single EU economy-wide *binding* energy savings target needs to be incorporated in a new legal EU act. On the one hand, such could potentially be envisaged as a "master frame" for a new set of energy policies under the new energy chapter of the Lisbon Treaty (European Commission 2005). One should note, however, that this requires innovative policy making and we are not aware of comparable examples in other EU policy areas.

Ad 2 A target set at the EU level for end-use sectors only

An alternative design option is to introduce a binding target at the EU level that covers part of the EU economy, e.g. the end-use sectors. A comparable example for such design is the EU-ETS Phase III. An argument for setting a target for end-use sectors only is that most of the cost-effective energy savings potential can be found there (see Table 1).

Table 1Identified energy savings potential in 2020 additional to the 2007 EU Baseline Scenario (Ecofys & Fraunhofer 2010, p.94)

Sector	**% of savings potential covered**
Economy-wide	100
Cost-effective energy savings potential	85*
End-use sectors excluding ETS fuel use	79
End-use ETS fuel use	6**
Efficiency improvement in the power sector (mainly renewable electricity***)	15

* Derived from the EU energy savings study carried out by Fraunhofer Institute & Partners (2009) for DG-Energy
** For industrial ETS installations, more than in other sectors, the 2007 EU Baseline Scenario already assumes a considerable amount of energy savings due to policies. As a result the additional energy savings potential identified in Fraunhofer Institute & Partners (2009) is comparatively low.
*** Also the efficiency improvement of power production, as a result of autonomous improvement and policies, is considerable in the 2007 EU Baseline scenario, leaving limited additional energy savings potential for the power sector. The energy savings from renewable electricity is explained further on in the text.

Ad 3 One economy-wide energy savings target for each Member State

A single economy-wide target, set for each EU Member State, would implicate that an overall EU target (like option 1) is burden shared over the 27 Member States

Ad 4 A target set at the Member State level for end-use sectors only.

An alternative for design option 3 is to introduce a binding national target that covers part of the economy, e.g. the end-use sectors. Comparable examples are Europe's renewable energy target and the GHG reduction target under the Effort Sharing Decision. Related examples from other policy areas than energy & climate are for example the emissions ceilings for air pollutants under the NEC Directive, the EU milk quota and the Total Allowable Catches in EU fisheries policies.

From the viewpoint of evaluation, options 2 and 4 are preferred as they offer an adequate starting point for evaluation, opposed to options 1 and 3 where the evaluator has first to disentangle the interaction between demand and supply side. For example, in case of higher energy use at the supply side: can this be explained by higher growth (than projected) at the demand side or has the supply side itself become less efficient?

Step 2: scanning target definitions

How to express and monitor a target?

An energy savings target can be expressed in a number of different ways:

1. Setting a cap on energy use in the target year (e.g. 2030). It would set a target value in Mtoe energy consumption for the EU27 in the target year. Such an approach would be comparable with the emissions cap set on the EU-ETS scheme. Monitoring would be straightforwardly based on currently available energy statistics.
2. Setting a target for energy use in the target year relative to a base year. This approach would be comparable to the current greenhouse gas emissions target of the EU for 2020 (-20% compared to 1990). The energy use target would only change over time if the monitoring data of energy use

in the base year are redefined. Similar to option 1, monitoring would be straightforwardly based on currently available energy statistics.

3. Setting an energy savings target relative to a projected baseline energy use in the target year. This is how the current EU energy savings objective is expressed (20% in 2020 savings estimated against the 2007 EU Baseline Scenario). Because the target is set as a relative target, its implications for the absolute energy use in the target year can be unclear. A good illustration is how the European Commission redefined the 20% target from a 393 Mtoe effort in the 2008 Commission Communication 'Energy efficiency: delivering the 20% target' (European Commission 2008) to a 368 Mtoe effort in the 2011 Energy Efficiency Plan (European Commission 2011a) as in the latter document the non-energy use is excluded from the 2020 energy use projection. This (limited) downscaling of the required effort would have been impossible if the target would have been expressed as an energy cap for 2020 (option 1).[3] This type of target setting does mostly not make explicit how the introduction of a new baseline projection affects the target.
4. Setting a certain volume of energy savings volume to be realized in the target year. This is somewhat comparable to the way current Member States' targets under the Energy Services Directive[4] (the predecessor of the proposed Energy Efficiency Directive) are defined. Typically, monitoring of a savings volume requires bottom-up data from sub-sectors or projects. This requires harmonized and data-intensive monitoring and calculation procedures. Note that this target-option does not necessarily lead to absolute energy use reduction.
5. A fifth way is to express an energy savings target as an improvement in energy intensity of the economy. Here intensity points to the ratio of energy use over GDP. For example China has expressed its energy savings target as an energy intensity improvement. A target based on energy intensity allows for absolute growth of energy use, as long as the energy intensity improves. A key-sensitivity of expressing a target as energy intensity is that it masks whether intensity improvement indeed occurs from implementation of more energy efficient technologies or from changes in the economic structure. For example, high growth of sectors with a high value added like the services sector or the tourism sector also improves a country's energy intensity.

The EU 2020 strategy (European Commission 2010) postulates that 'These targets […] must be measurable […..] and based on sufficiently reliable data for purposes of comparison'. In other words, a target should be transparent and easy to monitor and evaluate. In our view, these criteria are a starting point for any design of a binding energy savings target. By far the most straightforward way to comply with these criteria is to define a target as an absolute energy use in a target year and monitor the absolute development of energy use over time (option 1). This means that the energy use which remains is measured, rather than estimating the savings (option 4). In this approach, the volume of energy savings, as compared to a baseline development is only estimated once, and upfront, when setting the target. Subsequently, existing energy statistics, already implemented in all EU Member States through statistical offices, provide a straightforward way to monitor progress towards target achievement. This approach implies that other changes in energy use than those stipulated by energy efficiency improvement (e.g. structural change and volume effects due to higher or lower GDP growth) need not be corrected for when monitoring target progress. Also other variations in energy use such as variable weather conditions and business cycles (a target year can be extremely cold or hot and industry can have extremely low or high output) should in principle not be corrected for. This is similar to e.g. the GHG target which is also defined without allowing corrections for such variables. Of course, in refining the design of a binding energy savings target, one could include the possibility to make ex-post corrections on the statistics if a Member State can prove that the target year was significantly deviating from the long term average in certain aspects (weather, business cycles).

---

[3] Note that a target definition according to option 2 also leaves room for such kind of redefinition.

[4] Source: European Parliament & Council 2006.

Transparent monitoring data serves as a starting point for adequate evaluation. If monitoring data shows that one is not on track in achieving the binding energy savings target, data transparency allows the evaluator to trace which sectors fail to contribute to target achievement[5] and try to explain this failure: Are policy instruments not effective, is the economic growth higher than projected etc.? Insight in the potential contributions to the target of different energy carriers (fuels, electricity, district heat) and /or sectors (transport, residential, services, industry) would steer the evaluation of the energy efficiency policies that (are intended) to support target achievement and allow (if needed) for effective strengthening of existing policy instruments or adding new ones to the package.

Expressing a target in primary or final energy

The choice of expressing a target in primary or final energy is directly related to the scale of the target. An economy-wide target, like the Europe's current 20% energy savings target, will by definition be expressed in primary energy terms. This is because inclusion of secondary energy like electricity and district heat would lead to double counting. On the other hand, in case a target is set for end-use sectors, it can be expressed in final energy terms *or* in primary terms. A final energy target relates to the sum of the fuel, electricity and heat demand of end-users. In case of a primary energy target not the secondary electricity and heat use are counted, but rather the primary energy needed to produce these.

From an evaluation point of view, the advantage of an end-use target based on final energy is that no conversion efficiencies for electricity and district heating are needed. The disadvantage is that fuel savings are weighted stronger than electricity savings, meaning e.g. that switching from fuels to electricity will be counted as energy savings, which is not always true. The advantage and disadvantage of an end-use target based on primary energy is vice versa: the weight of electricity savings and district heat savings compared to fuel savings is better accounted for in a primary energy target, but one needs precise conversion efficiencies (which are often subject of debate) for electricity and district heating. The choice between a target expressed in final or primary energy strongly depends on the design of the binding energy savings target, see Table 2.

Table 2 Relation between target design option and choice for expression in primary or final energy

Design options	Target expression in final or primary energy?
1. One economy-wide energy savings target at the EU level	Primary (by definition)
2. Target set at the EU level for end-use sectors	Primary *or* final
3. One economy-wide energy savings target for each Member State	Primary (by definition)
4. Target at Member State level for end-use sectors	Primary *or* final

Rather than applying a precise conversion factor on final electricity and district heat (end-use targets expressed in primary energy under design options 2 and 4), one could alternatively use a "weighting factor" in what we call "adjusted final energy" approach. The aim of such factor is to weigh electricity savings (and district heat savings) in a similar way as fuel savings, rather than to apply the exact (often Member State specific) conversion factor to primary fuels. We recommend applying a weighting factor that is constant across Member States and over time. A constant factor over time would provide a most transparent view on end-use energy savings achieved. A constant factor across Member States would assure that fuel, district heat and electricity savings are weighted the same way across Member States, which would provide an EU-wide level playing field for end-use energy savings. Such weighing factor could be 2.5 for electricity conversion and around 1.2 for district heat conversion.[6]

From the viewpoint of an evaluator, the choice how to express a target is very important to allow for adequate evaluation. A binding energy savings target for end-use sectors that is expressed in primary

---

[5] In case the binding target is based on the cost-effective savings potential, one has a good idea how much each sector should contribute for realizing the target.

[6] A factor 2.5 represents a conversion efficiency of 40%. Note that this factor is also used in the energy savings calculations under the Energy Services Directive (European Parliament & Council 2006). A factor 1.2 represents a conversion efficiency of 80-85% which can be considered a reasonable efficiency for district heat.

energy obscures transparency of the savings achieved as a direct link with the statistics is missing[7]. When an end-user target is expressed in final energy, any failure in progress towards target achievement can be directly linked to end-use energy statistics. Applying the "adjusted final energy" approach takes on board the benefits for evaluation and at the same time recognizes the weight of electricity and district heating savings compared to fuel savings.

Step 3: Interaction with standing policies

Earlier in this paper we argued that a binding energy savings target would, as an umbrella policy, add value to the existing policy package by speeding up ambitious implementation of Eco-design standards, stimulating Member States towards a fast and ambitious implementation of the EPBD and speeding up adoption of CO_2 regulation for heavy duty trucks, ships and airplanes. This can be considered interaction of a binding energy savings target with (existing) energy efficiency policies. In case of no further policy interactions, the ex-ante effect of implementing a binding energy savings target on top of existing (and already intended) energy efficiency policies would be the difference between a baseline projection without a binding target and a projection including such target. However, interactions with other policies will take place. Insight in these interactions is crucial from the viewpoint of evaluation as they provide input in explaining either success or failure in the progress made towards target achievement. In this section, we analyze the interaction between a binding energy savings target and the following policies:

- EU-ETS Directive (European Council & Parliament 2009c).
- Effort Sharing Decision (European Council & Parliament 2009d).
- Renewable Energy Directive (European Council & Parliament 2009e).
- CCS Directive (European Council & Parliament 2009f).

Interaction with the EU ETS Directive

Each of the four design options identified under Step 1 will interact with the EU-ETS. An economy-wide binding energy savings target includes the energy use of ETS companies and has therefore a *direct* interaction with the ETS. A binding energy savings target including only the energy use of non-ETS end-users interacts *indirectly* with the ETS via electricity and district heating savings. A binding energy savings target that would promote electricity savings by end-users will reduce emissions of the power producers that participate in the EU-ETS.[8] This is a clear interaction, but what does it mean? One view is the following:

- The EU-ETS scheme forwards a CO_2-price signal to electricity end-users which in theory should already provide sufficient incentives for reducing electricity demand. Additional incentives for end-use electricity savings (e.g. by means of a binding energy savings target) would be redundant, because the EU-ETS cap will guarantee that the emissions reductions associated with electricity are reduced one way or another (e.g. by fuel shift from coal to gas in power production, demand side savings, shift to renewables, etc.). Stronger electricity end use savings than envisaged in setting the ETS cap (because of introducing a binding energy savings target) could even endanger the EU-ETS as it reduces the scarcity under the scheme, reducing the CO_2 price and thus reducing the incentive to make long term investments in clean technology.

Alternatively one could argue that:

---

[7] Statistics for end-use sectors are expressed in final energy use. The related primary energy use (with emphasis on electricity and district heat) is headed under the energy supply.

[8] Note that this potential interaction also exists between Eco-design and ETS. The same type of interaction between a binding energy savings target and ETS can also be found for district heating. Also this policy interaction is not new as it exists between the EPBD and EU-ETS.

- EU-ETS is not the silver bullet for end-use electricity savings. A policy-mix is always required, as price incentives alone are not sufficient to stimulate electricity savings due to the so-called bounded rationality of end-users. From a societal, economy-wide, cost-perspective electricity end-use savings are often cheaper than alternative options like a shift to low carbon fuels, renewables, CCS, etc. Realizing cheap emissions reductions outside the ETS scheme reduces costs for ETS-participants, which is fully in line with the primary aim of the EU-ETS, i.e. to achieve the emissions cap against the lowest cost. Policies for stronger electricity savings than envisaged when setting the ETS cap should be designed in conjunction with future adjustments of the EU-ETS cap, in order to maintain the full incentives from the ETS instrument. In line with the latter, it is currently discussed to include a tightening of the ETS cap under the new Energy Efficiency Directive (see e.g. WWF 2012). Both the Environment (ENVI) Committee (December 2011) and the Industry (ITRE) Committee of the European Parliament (February 2012) voted in favor for such adjustment.

  From an evaluation point of view we observe the following:
- The effectiveness of the ETS does only change in case the ETS cap is corrected downwards because of additional electricity and district heating savings. In case of no correction, it is unlikely that more reductions than demanded will take place in the market. In that case, the additional electricity savings realized by the binding savings target will not lead to additional CO_2 savings.
- The efficiency of the ETS will most likely improve as the electricity and district heating savings are in general more cost-effective than e.g. renewable electricity options. This effect will be stronger in case the ETS cap will not be adjusted.
- Without correction of the ETS cap, strengthening of the ETS by a binding energy savings target is only limited (coherence criterion).
- Disentangling the ETS impact and the impact from binding savings target with respect to electricity savings is virtually impossible. Evaluation of both policies separately would almost by definition lead to double counting. In case of a combined evaluation, an attempt could be made to isolate the impact of both policies, but the political meaning of such exercise would be doubtful.

Interaction with Effort Sharing Decision

Each of the four design options identified under Step 1 will interact with the Effort Sharing Decision or any follow up of this Decision after 2020. The targets under the Effort Sharing Decision are for direct GHG emissions from built environment, transport, non-ETS industry, agriculture and waste sectors (the non-ETS sectors), and do therefore not include electricity consumption. The interaction between the Effort Sharing Decision and binding energy savings targets is therefore relevant for all target designs that include fuel consumption in the non-ETS sectors. The overall EU27 Effort Sharing target is -10% GHG emissions in 2020 compared to 2005, with individual Member State targets ranging between -20% for Denmark and +20% for Bulgaria. In the Effort Sharing Decision a quote can be found that directly links to a binding energy savings target: 'Energy efficiency improvements are a crucial element for Member States to meet the requirements under this Decision. In this context, the Commission should closely monitor progress towards the objective to reduce energy consumption by 20 % by 2020, and propose additional actions if progress is insufficient.'[9] A binding energy savings target, therefore, would strengthen the objectives of the Effort Sharing Decision. Alternatively, one could argue that political resistance may occur when a stringent binding energy savings target "overrules" a modest Effort Sharing target. Such resistance is not hypothetical as for a number of EU countries the effort sharing does not result in incentives for energy savings, whereas for other countries the burden is high (see

[9] Decision No 406/2009/EC, recital 5 (European Parliament & Council 2009c).

Harmsen, Eichhammer & Wesselink 2011). Recent developments in the policy debate on the proposed Energy Efficiency Directive have shown that resistance against a binding energy savings target is not any longer hypothetical.

From an evaluation point of view we observe the following:

- The Effort Sharing Decision would in general be strengthened by a binding energy savings target (coherence criterion). Because of the identified imbalance in the Effort Sharing, this effect will be stronger for some Member States than for others.
- Disentangling the impact from the Effort Sharing Decision and the impact from a binding savings target with respect to fuel savings is virtually impossible. Double counting would most likely occur in case of separate evaluation of both policies.

Interaction with the Renewable Energy Directive

Only design options that include the supply side of the economy will interact with the Renewable Energy Directive. This is true for design options 1 and 3.

The objective of the Renewable Energy Directive is to realize an overall 20% share of renewables in total EU27 final energy consumption and 10% renewable energy in transport in 2020. It is explicitly stated in the Directive that energy efficiency and energy saving policies are some of the most effective methods by which Member States can increase the percentage share of energy from renewable sources.[10] Thus, a binding energy savings target would help to meet any renewable energy target that is defined as a fixed percentage of energy consumption. The societal profit that arises from energy savings is double. Savings as such are very cost-effective from a societal perspective, where renewables still come at a net cost - disregarding external costs. This emphasizes the cost-efficiency of energy savings measures.

Less known is that an increase of renewable electricity from wind, solar and hydro results in primary energy savings. In Eurostat energy statistics and the official energy scenarios for the EU27 (Capros et al. 2008 & 2010) the “physical energy content method” is used for reporting renewable energy statistics. In this method primary energy is defined as the first commodity which can be converted into secondary energy (e.g. electricity). For wind, hydro and solar power this first usable commodity is considered the electricity produced. One unit of primary wind, hydro or solar energy converts into 1 unit of electricity, i.e. a conversion efficiency of 100% is assumed. This implies that renewable electricity from wind, hydro or solar “saves” energy in case conventional power production is replaced, see Figure 2. For biomass the situation is different as power generation from biomass is less efficient than power generation from fossil energy sources, at least natural gas. More than 20% of the energy policy impact identified in Figure 1 is due to the *net* savings effect of renewable electricity (i.e. the “unsavings” from biomass power are corrected for). So far, this contribution has been unrecognized in any of the evaluations carried for or by the Commission focusing on Europe’s energy savings gap (see e.g. European Commission 2006, 2008, 2011a & 2011c). For a more detailed analysis of the “energy savings” effect of renewable electricity, see Harmsen et al. (2011).

[10] See Recital 17 of the RES Directive.

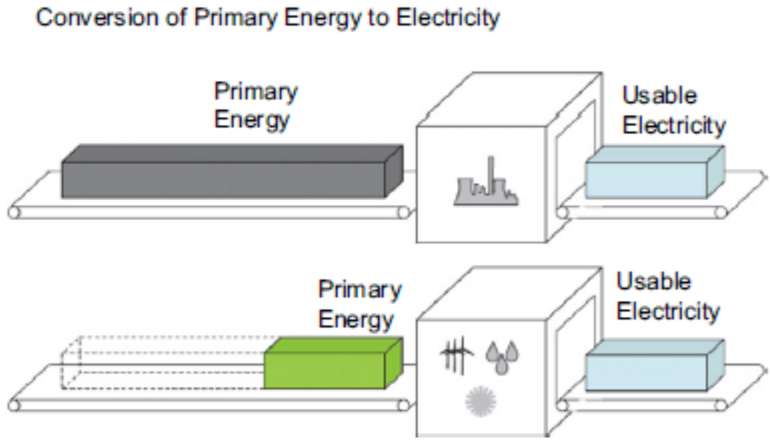

Figure 2 "Energy savings" effect from wind, solar and hydro electricity (source: Ecofys & Fraunhofer 2010)

From an evaluation point of view we observe the following:

- Disentangling the net energy savings impact from additional renewable electricity and the impact from a binding savings target that includes the supply side can be done. From a policy design point of view it makes sense to account for the savings effect from renewable electricity when setting the target.
- The approach for disentangling is to isolate the additional electricity production from wind, solar and hydro, and biomass and then calculate how much energy would have been used in case non-renewable power plants would have been built (using efficiencies of state-of-the-art non-renewable power plants). Subtracting both figures provides the net "saving" effect of renewable electricity.

Interaction with the CCS Directive

Capture, transport and storage of CO_2 consume energy. CCS decreases the net efficiency of a power plant by 15 to 25% (Hendriks et al., 2004). Large scale application of CCS will therefore interact with all target designs that include the fossil supply sector (CCS for coal or gas based power production) and, to a smaller extent, power production from biomass plants and large industrial boilers. An energy savings target including those sectors and, thus, expressed in primary energy, needs to take into account the amount of additional primary energy due to application of CCS when setting the target.

Only design options that include the supply side of the economy will interact with the CCS Directive. This is true for design options 1 and 3..

From an evaluation point of view we observe the following:

- Disentangling the additional energy use from CCS and the impact from a binding savings target that includes the supply side can be done. From a policy design point of view it makes sense to account for the additional energy use from CCS when setting the target.
- The approach for disentangling is to isolate the energy consumption of CCS plants and recalculate this energy consumption as if no CCS takes place. Subtracting both figures provides the additional energy use.

Step 4: analyzing the feasibility of design options regarding flexibility to Member States

Flexibility in relation to binding savings targets

A binding energy target at EU level that includes fossil fuel use from ETS-installations limits the flexibility that EU-ETS provides. Instead of a market based choice between fuel-switching, reducing non-CO_2 GHG emissions, using CDM or improving energy efficiency, ETS companies would be forced to deliver a certain amount of energy savings. This will most likely have an impact on the mix of measures implemented. Although it will not interfere with the effectiveness of the ETS, it might have consequences (either positive or negative) on the cost-effectiveness of the instrument.

Member States may conceive incoherency of a national energy savings target that includes the ETS companies with EU-ETS policies. This is because the ETS sector in a Member State is allowed to increase CO_2 emissions (and thus its primary energy use) as long as this is compensated EU-wide, elsewhere in the Trading Scheme. In such case, the increased primary energy use would require an additional effort from this Member State to meet its energy savings target. This will most likely have a negative impact on the cost-effectiveness of the ETS.

The limitation what abatement options to choose is especially true for design options 1 and 3, but also for design options 2 and 4 in case ETS-industry (being part of the end-use sectors) is included in the target. From a flexibility point of view, there are good arguments to exclude the ETS from the binding savings target. From an evaluation point of view, however, this may introduce a data problem. Currently, statistics do not make a distinction between ETS and non-ETS fuel use in industry. Without such distinction, the impact evaluation of a binding energy savings target that excludes ETS industry would become more difficult.

Conclusion

The aim of this paper was to consider which design of a binding energy savings target for the EU is the most feasible to both make it work and to ensure it can be evaluated in an efficient and transparent manner. Although in the current political debate there seems no room for discussing a binding energy savings target - at least for 2020 -, our analysis contributes to the debate of defining policies and targets beyond 2020, being initiated by the EU 2050 roadmap (European Commission 2011d).

Whether a binding target is set at the Member State level for the economy as a whole, or for selected section(s) of that economy, success in achieving that target relies on effective implementation. Experience suggests that there is no single “silver bullet” for achieving deep and large-scale energy savings through efficiency, but rather a mix of delivery strategies and national policies will be needed, tailored to local circumstances (ECF, 2010).

Though in theory all four design options identified can be chosen, our analysis suggests that the most feasible design option which is workable and can be effectively evaluated, is to introduce a binding energy savings targets for end-users at the Member State level. Our key findings on this and related design issues are summarized below:

A binding target for end-use sectors at Member State level is the most feasible….

A binding target at Member State level would ensure political accountability and commitment to deliver results while providing flexibility to choose and apply the most suitable tools to achieve the target. It could provide a framework to guide ambitious and coherent implementation of existing EU energy efficiency policies, like the Energy Performance in Buildings Directive (EPBD), as well as the strengthening of national policies. Such policy package should reduce the risk of fragmented or weak national implementation activities. Furthermore, binding targets at Member State level will make

Member States take an ambitious position in Brussels when new energy performance standards for e.g. appliances or cars are to be set.

A Member State binding target applied to end-users (excluding ETS companies) is a design option that covers the vast majority of energy savings potential (see Table 1) maintains the flexibility for ETS companies and supports a most cost-effective increase of the share of renewable energy.

…..best defined in absolute energy use terms….

A savings target should be transparent and easy to monitor and evaluate. By far the most straightforward way to comply with these criteria is to define the target as an absolute energy use in a target year and monitor the absolute development of energy use over time. This means that the energy use which remains is measured, rather than estimating the savings. Under this approach, the volume of energy savings, as compared to a baseline development is only estimated once, and upfront, when setting the target. Subsequently, existing energy statistics, already implemented in all EU Member States through statistical offices, provide a straightforward way to monitor progress towards target achievement and an adequate starting point for policy evaluation. Such approach would also best safeguard the strong energy savings that are required to achieve the EU's ambition of deep GHG reductions towards 2050.

…. and best expressed as "adjusted final energy"

Our analysis suggests that a target for end-users should preferably not be expressed in primary energy terms to avoid a disconnection between the energy statistics of end-use consumption and the target. The target may preferably be expressed as "adjusted final energy use". Here, the electricity and district heat components of final energy use data, readily available from energy statistics, are weighted with a factor of 2.5 and 1.2 respectively. This is to assure a level playing field between electricity and district heat savings on the one hand and fuel savings on the other. We recommend weighting factors that are constant over time and across Member States. This method resembles the primary energy use definition but may take away some of a natural tendency to use Member State specific conversion factors. A constant factor over time would provide a most transparent view on end-use energy savings achieved. A constant factor across Member States would assure that fuel, district heat and electricity savings are weighted the same way across Member States, which would provide an EU-wide level playing field for end-use energy savings.

How to evaluate such target?

A binding energy savings target for end-use sectors at Member State level such as described above can be evaluated in relatively straightforward way. Energy statistics are the base for determining the impact of the savings target and allow assessing whether target achievement is on track or not. In case target achievement is not on track, the evaluator should descend into the specific sectors to find out which one of them is responsible for the underachievement. Insight in the potential contributions to the target of different energy carriers (fuels, electricity, district heat) and/or sectors (transport, residential, services, industry) would steer the evaluation of the energy efficiency policies that (are intended) to support target achievement and allow (if needed) for effective strengthening of existing policy instruments or adding new ones to the package. The main difficulty for evaluators related to our recommended design is the exclusion of ETS-industry from the target. In order to facilitate future evaluation, it is highly recommended to provide separate statistics for both ETS and non-ETS industrial energy use.

Our recommended target design avoids a number of difficulties that would make effective evaluation harder. Most of these difficulties relate to economy-wide binding energy savings target which cause interactions with renewable electricity and CCS, which create obscurity in energy savings achieved at the supply or demand side and which have a relatively loose link with end-use savings, especially with regard to electricity and district heating savings. A more general difficulty for evaluators relates to the introduction of a binding energy savings next to existing policies such as ETS and the non-ETS Effort Sharing. Inevitably, impact evaluation of those policies in isolation will lead to double counting.

Final remark

The design of new policies is often a bumpy road heavily influenced by multiple interests. As long there is no consensus of introducing a binding energy savings target, the debate is more focused on the arguments whether to go for it or not than on the more subtle design considerations as discussed in this paper. In that sense it is not so strange that in the Compromise Amendments prepared by the ITRE Committee of the European Parliament (European Parliament 2012) the proposed design of a binding energy savings target is about economy-wide Member State specific targets, meaning that it *will* interact with renewable electricity and CCS, it *will* reduce flexibility for the ETS and it *will* introduce a relative loose connection with the end-use energy savings. For the sake of future evaluation, it is hoped for that a positive decision on introducing a binding energy savings target will allow for sufficient time to evaluate the merits of the possible design options before its actual implementation.

References

Capros, P., Mantzos, L., Papandreou, V., Tasios, N. 2008. *European Energy and transport. Trends to 2030 – update 2007*. ICIS-NTUA, Athens, Greece. Prepared for the European Commission.

Capros, P., Mantzos, L., Tasios, N., De Vita, A., Kouvaritakis, N. 2010. *EU Energy Trends to 2030 – update 2009*. ICIS-NTUA, Athens, Greece. Prepared for the European Commission.

Ecofys and Fraunhofer Institute. 2010. *Energy Savings 2020 - How to triple the impact of energy savings policies in Europe*. Prepared for the European Climate Foundation.

European Commission. 2001. *European Governance: a White Paper*. COM(2001) 428 final.

European Commission. 2005. *Communication to the Spring European Council – Working together for growth and jobs – a new start for the Lisbon Strategy*. COM(2005) 24 final.

European Commission. 2006. Communication from the Commission – Action Plan for Energy Efficiency: Realising the potential. COM(2006) 545 final.

European Commission. 2008. *Communication from the Commission - Energy efficiency: delivering the 20% target*. COM(2008) 772 final.

European Commission. 2009. *Impact Assessment Guidelines*. SEC(2009) 92.

European Commission. 2010. *Communication from the Commission – Europe 2020: a strategy for smart, sustainable and inclusive growth*. COM(2010) 2020.

European Commission. 2011a. *Energy Efficiency Plan 2011*. COM(2011) 109/4.

European Commission. 2011b. *Proposed Directive on Energy Efficiency*. COM(2011) 370 final.

European Commission. 2011c. Impact Assessment of the Energy Efficiency Directive. SEC(2011) 779 final.

European Commission. 2011d. *A Roadmap for moving to a competitive low carbon economy in 2050*. COM(2011) 112 final. European Commission (EC), Brussels, Belgium.

European Commission. 2011e. *The Eco-design Directive – State of play.* Presentation prepared for the AISE 8th Information Day, Brussels, 30 November 2011.

European Council. 2011. Interinstitutional file 2011/0172 (COD), Brussels, 8 December.

European Parliament (Committee on Industry, Research and Energy - ITRE). 2012. *Compromise Amendments 1 – 18.* Draft report Claude Turmes PE472.358v01-00. 22 February 2012.

European Parliament & Council. 2006. *Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006 on energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC*. OJ L, 27.4.2006, p.64.

European Parliament & Council. 2009a. *Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of eco-design requirements for energy-related products (recast)*. OJ L 285, 31.10.2009, p. 10.

European Parliament & Council. 2009b. *Regulation (EC) No 443/2009 of the European Parliament and of the Council of 23 April 2009 setting emission performance standards for new passenger cars as part of the Community's integrated approach to reduce CO_2 emissions from light-duty vehicles*. OJ L 140, 5.6.2009, p. 1.

European Parliament & Council. 2009c. *Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community*. OJ L 140, 5.6.2009, p. 63.

European Parliament & Council. 2009d. *Decision No 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020*. OJ L 140, 5.6.2009, p. 136.

European Parliament & Council. 2009e. *Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources.*

European Parliament & Council. 2009f. Directive 2009/31/EC *of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide*. OJ L, 5.6.2009, p.114.

European Parliament & Council. 2010. Directive 2010/31/EU *of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (recast).* OJ L, 18.6.2010, p.13.

Fraunhofer-Institute for Systems and Innovation Research and partners. 2009. *Study on the Energy Savings Potentials in EU Member States, Candidate Countries and EEA Countries*. Prepared for the European Commission Directorate-General Energy and Transport. EC Service Contract Number TREN/D1/239-2006/S07.66640.

Harmsen, R., Eichhammer, W. & Wesselink, B. 2011. *Imbalance in Europe's Effort Sharing Decision: Scope for strengthening incentives for energy savings in the non-ETS sectors*. Energy Policy, 39(10), 6636-6649.

Harmsen, R., Wesselink, B., Eichhammer, W. & Worrell, E. 2011. *The unrecognized contribution of renewable energy to Europe's energy savings target*. Energy Policy, 39(6), 3425-3433.

Hendriks, C., Harmelink, M., Burges, K. & Ramsel, K. 2004. *Power and heat production: plant developments and grid losses*. Ecofys report prepared for the Joint Research Centre.

Huitema, D., Jordan, A., Massey, E., Rayner, T., Asselt, H., Haug, C., Hildingsson, R., Monni, S. and Stripple, J. 2011. *The evaluation of climate policy: theory and emerging practice in Europe*. Policy Sience, 44, 179-198.

WWF. 2012. *Energy Efficiency for EU Industries: Why WWF supports reviving the European Emissions Trading System (ETS) in the context of the Energy Efficiency Directive (EED).* WWF briefing paper.