

Costs and Benefits of Energy Efficiency Targets

Replicating the results from the Impact Assessment (IA) for the Energy Efficiency Communication using alternative discount rates for energy efficiency measures in households and private cars, and comparing total system costs with external benefits (air pollution reduction and GDP increase)

An Ecofys study commissioned by Friends of the Earth

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By Oskar Krabbe & Kornelis Blok

Reviewer: Wouter Meindertsma

Introduction

In the recent report *Evaluating our future*, the role of discount rates in energy system modelling for the European Commission (such as the modelling done for impact assessments) is discussed (ECEEE & Ecofys, 2015). Its main finding is that often the same discount rates are used for both individual decision making and the calculation of system costs and that by doing so the costs and benefits to society are not adequately expressed in the impact assessments. In the formulation of an energy efficiency target, the Commission recommended a level of ambition based on the system costs from the impact assessment (European Commission, 2014a) (European Commission, 2014b). It did not give equal consideration to the socio-economic benefits of efficiency. Using a lower discount rate for energy efficiency measures for households and private cars would have resulted in different system costs, which could point to a more ambitious energy efficiency target. This study calculates the energy system costs using a 10% discount rate for households and private cars instead of the original 17.5%. Additionally, external costs are taken into account and their relation to the total system costs is assessed.

Results

Figure 1 shows the effect of reducing the discount rate of households and private cars. The more ambitious energy efficiency targets have far less additional costs than in the Impact Assessment. This notable effect is caused by the significant contribution of households and private cars to the energy efficiency target.

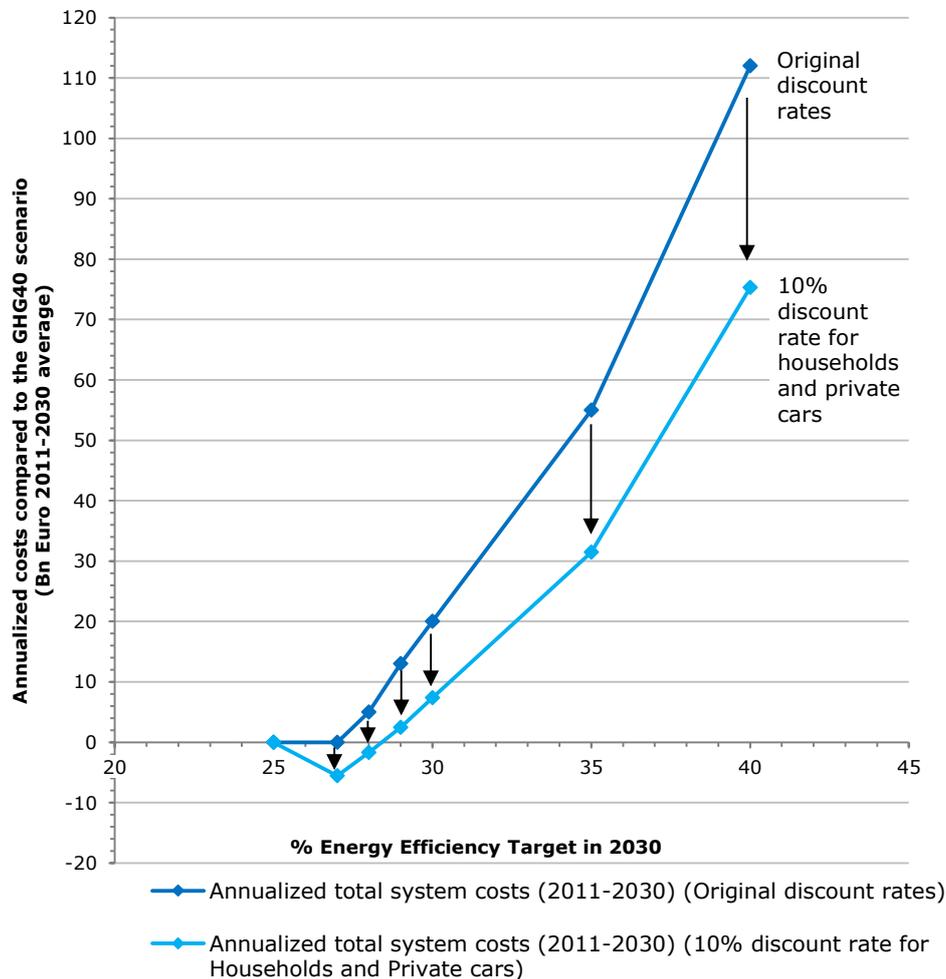


Figure 1: Additional annual average energy system costs and fossil fuel savings compared to the central scenario of 40% greenhouse gas target, 27% renewable energy target and 25% energy savings target with original and with lowered discount rates.

The total system costs in Figure 1 include capital costs, direct energy efficiency investments, and energy purchases, as defined in the Impact Assessment (European Commission, 2014b).

Figure 2 again depicts the additional total system costs, but this time also shows additional benefits (i.e. air pollution cost reductions, including reduced pollution control costs and damage reduction, and GDP increase). It shows that although the system costs increase with increasing ambition of the energy efficiency target, the benefits increase as well. At an energy efficiency target of 35% the additional benefits are still higher than the additional system costs. More benefits are expected in the form of employment and climate change mitigation. These benefits are not taken into account in Figure 2.

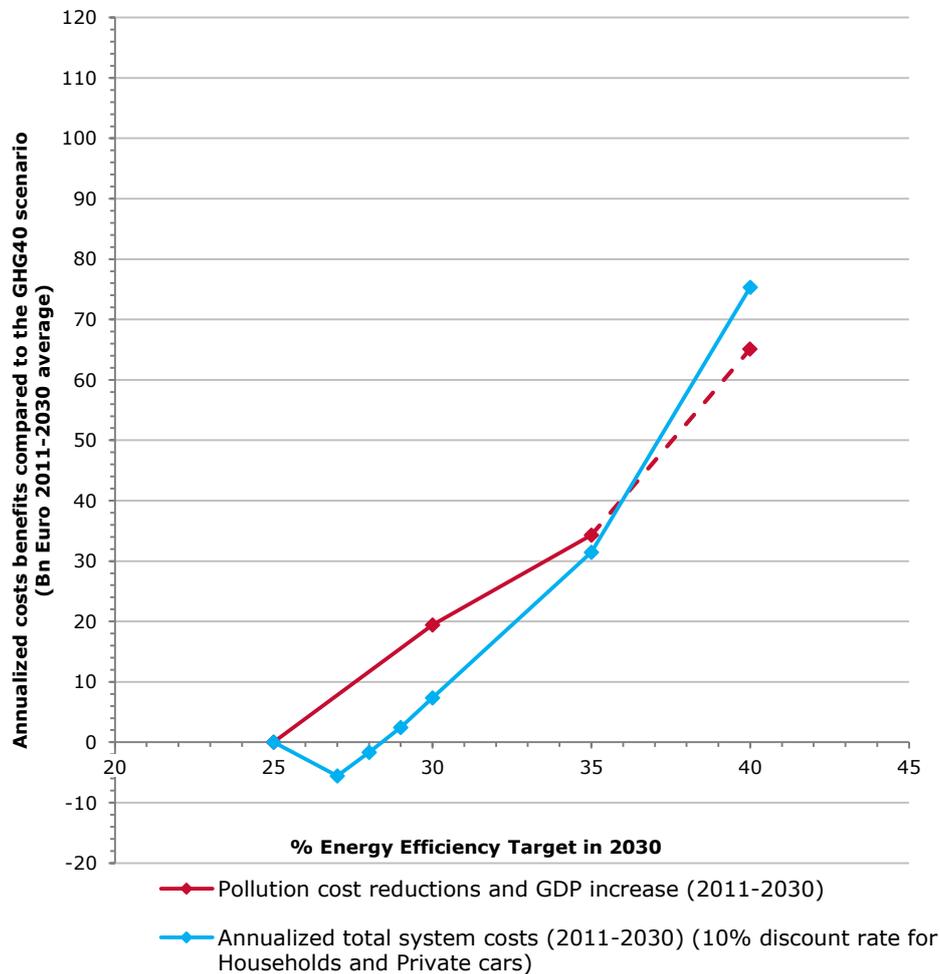


Figure 2: Additional annual average energy system costs and pollution cost savings compared to the central scenario of 40% greenhouse gas target, 27% renewable energy target and 25% energy savings target with lowered discount rates. The dashed line indicates that the pollution costs are estimated for the 40% energy efficiency target. GDP increase was not given for 27% and 29% energy efficiency targets, which is why no values are shown in the red line for these percentages.

Methodology

System costs with updated households and private cars discount rate

The investment costs in the Impact Assessment are annuitized using a capital recovery factor. The discount rates are used to calculate the capital recovery factor using the formula below:

$$\text{Equation 1}$$

$$CRF = \frac{i(1+i)^n}{(1+i)^n - 1}$$

Where:

CRF = capital recovery factor
i = discount rate
n = the number of annuities (years)

The number of annuities is not given in the Impact Assessment. We assume it to be 20 years. The new discount rate is 10% for households and private cars. To calculate the new investment costs from the old investment costs, the following formula is used:

$$\text{Equation 2}$$

$$I_{i=10\%} = I_{i=PRIMES} * \frac{CRF_{i=10\%}}{CRF_{i=PRIMES}}$$

Where:

$I_{i=10\%}$ = the annualized additional capital costs calculated with a 10% discount rate
 $I_{i=PRIMES}$ = the annualized additional capital costs calculated with the standard PRIMES discount rates
 $CRF_{i=10\%}$ = the capital recovery factor calculated with a 10% discount rate
 $CRF_{i=PRIMES}$ = the capital recovery factor calculated with the standard PRIMES discount rates

The PRIMES discount rates are presented in Table 1. Because the Impact Assessment does not give one discount rate for transport, but 4 discount rates for transport subsectors, we assume that 50% of transport is private cars, and that the average discount rate for other transport is 12%. Table 1 also shows the change of the annualized investments resulting from shifting to a 10% discount rate (the right term in Equation 2).

Table 1: Discount rates used in the PRIMES modelling, and the change in annualised investments resulting from a shift to a discount rate of 10%

Sector	Discount rate in PRIMES	Lowered discount rate	Change in annualized investments resulting from switch to 10% discount rate
Transport	15%	11%	-21%
Private cars (assumed to be 50% of transport)	17.5%	10%	
Other transport (assumed to be 50% of transport)	12% (assumed average)	12%	
Households	17.5%	10%	-32%

Applying the change to the capital costs and direct energy efficiency investments in the respective sectors, and subsequently adding the energy purchases results in the values depicted in Figure 1 and Figure 2.

Air pollution

The air pollution cost figures are retrieved from table 11 from the Impact Assessment accompanying COM(2014) 15 final (European Commission, 2014c). Because this table does not include the costs of the EE40% scenario, this value is estimated, assuming that the cost savings increase with energy savings.

GDP increase

GDP increase in the scenarios is retrieved from table 11 from the Impact Assessment (European Commission, 2014b). GDP values were not given for EE27 and EE29.

References

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