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Saving energy: bringing down Europe's energy prices for 2020 and beyond

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Summary

In November 2012 the EU adopted its Directive on Energy Efficiency, which puts forward new measures to help meet the EU's 20% by 2020 energy savings target[1]. The EU is now working on a post-2020 climate and energy framework, including which goals should be established for energy savings for 2030.

Apart from the environmental benefits – including reducing greenhouse gas emissions – energy savings have significant economic benefits for European economies: (1) they reduce the amount of money businesses and consumers need to spend on energy, (2) they have positive effects on employment and (3) they decrease dependency on fossil fuel imports.

But the actual scale of the benefits is often underestimated. In this paper, we show that energy savings do not only bring direct cost savings; they also indirectly reduce energy prices. In other words, consumers would use fewer units of energy, and the price of the units they do use would be lower than they would otherwise be. **Real cost savings resulting from meeting the 20% savings target are therefore likely to be considerably higher than figures commonly cited.**

Energy savings can reduce energy prices in the following ways:

1. **Decreasing fossil fuel prices:** international fossil fuel markets are under pressure because there is little reserve production capacity. This means prices are very sensitive to changes in energy demand. Because energy savings in Europe and the spillover effects of this action in other world regions will reduce demand, we expect significant reductions in future energy prices.
2. **Decreasing electricity prices:** cheaper fossil fuel prices will reduce electricity prices (because roughly 50% of the EU's electricity is produced from fossil fuels). In addition, a lower demand will impact the fuel mix in electricity production: it will occur more often that lower-priced fuels determine the marginal costs. This will have an additional reduction effect on electricity prices.
3. **Decreasing energy prices in the longer term:** tapping the EU's cost-effective energy savings potential is expected to save tens of billions of Euros per year due to avoided investments in energy infrastructure (power generation and transmission, fuel import and storage facilities). Since it is usual practice to pass on investment costs to energy consumers, a reduction in these investments will lead to an additional cost saving.

Energy savings in 2020

On the basis of the evidence examined in this report, we estimate that the indirect impact on energy prices will be of the same order as the direct impact of the energy savings. Put simply, for every €1 of energy cost saving, an additional €1 could be saved due to lower energy prices. And since net direct savings are expected to amount to €107 billion annually by 2020, this means that **the *total* net savings in 2020 can be estimated at around €200 billion per year.**

Energy savings in 2030

If ambitious energy savings would continue to be pursued in the 2020-2030 period, we expect net direct energy cost savings by 2030 to be in the order of €200 billion per year and indirect energy cost savings in the order of €50 billion per year, **adding up to total net savings of €250 billion per year for consumers.**

1 In March 2007 the European Council adopted a target to reduce the EU's energy consumption by 20% in 2020, compared to projected energy consumption levels for 2020. This target derived from the 2005 Green Paper from the European Commission "Doing More with Less".

1. Introduction

In November 2012 the European Union adopted its Directive on Energy Efficiency, which puts forward new measures to help meet the EU's "20% by 2020" energy savings target.[2]. The EU is now working on a post-2020 climate and energy framework, including which goals should be established for energy savings for 2030.

Many studies have already shown that energy efficiency measures generate net economic benefits including increased employment, decreased dependence on energy imports, and cost savings. Net savings for European businesses and consumers are projected to amount to an impressive €107 billion annually in 2020 if all cost-effective efficiency measures[3] are taken.

This figure, however, looks only at avoided energy costs for businesses and consumers – i.e. the effect of buying less energy. To this must be added the indirect cost savings, which are the subject of this paper.

Through a number of related mechanisms, energy savings have a positive impact on price development:

1. Reduced demand will have a downward effect on fossil fuel energy prices
2. Electricity prices on the spot market will be lower
3. Fewer investments in energy infrastructure will be needed

We will consider each of these mechanisms in further detail in the following chapters and give estimates of Europe-wide energy cost savings for 2020. In addition, we give an outlook on what those savings might be in 2030, assuming ambitious energy savings up to that period are realised. Before doing so, we will briefly discuss how the direct and indirect elements of energy costs relate to each other.

Europe's energy supply and prices

Currently, 80% of the EU's primary energy consumption is provided by fossil fuels. The EU is highly dependent on external suppliers, importing over 80% of the oil, 60% of the gas and 40% of the coal it uses. Coal imports have doubled since 1990[4]. In a business-as-usual scenario energy consumption will increase by 12% from 2005 to 2020. Overall import dependency may reach 66% in 2020 (compared to 53% in 2010) if energy consumption keeps rising until 2020. At the same time, world prices of oil, gas and coal are expected to rise until 2020 in business-as-usual trends[5].

2 In March 2007 the European Council adopted a target to reduce the EU's energy consumption by 20% in 2020, compared to projected energy consumption levels for 2020. This target derived from the 2005 Green Paper from the European Commission, "Doing More with Less".

3 B. Wesselink, R. Harmsen, W. Eichhammer, "Energy savings 2020, how to triple the impact of energy saving policies in Europe", Ecofys and Fraunhofer ISI (2010). Taking all cost-effective measures in combination with meeting the target of renewable energy sources will enable the 20% savings target to be reached. "Cost effective" means that, over the lifetime of the measure, the money saved is greater than the investment and maintenance costs.

4 EU energy and transport in figures, European Commission, 2011.

5 P. Capros et al, EU energy trends to 2030 – UPDATE 2009, EUROPEAN COMMISSION Directorate-General for Energy in collaboration with Climate Action DG and Mobility and Transport DG (2010).

2. What determines our energy bills?

The first element which influences how much we spend on energy is the amount of energy we use. If all cost-effective efficiency measures are implemented, by 2020 net annual savings for European businesses and consumers would be an estimated €107 billion. This figure represents **the money no longer spent on energy**, based on a very conservative oil price of €52 per barrel, minus the investment cost of energy savings options[6].

The second element determining how much we spend on energy is the **price of each unit** that we do use. End prices are determined by costs, and these are made up of variable and fixed costs:

+ **Variable costs.** These mainly include the cost of fuels, but other costs, e.g. environmental charges and taxes may be included. For electricity, around 50% of the wholesale price is made up of the costs of the fuels used for power generation[7].
+ **Fixed costs.** These include energy infrastructure – gas pipelines and storage centres, electricity power plants, transmission and distribution networks.

Investments in energy efficiency can reduce energy prices by lowering both variable and fixed costs. Sections 3.1 and 3.2 of this paper discuss the influence of demand on fossil fuel prices and electricity. Section 3.3 looks at the influence of demand on energy infrastructure investment needs.

The focus of this paper is to show that energy savings can reduce energy prices with respect to "business as usual". Depending on each country's energy choices, however, prices may not actually undergo net reductions compared to today's levels. An example is increased electrification of transport and heat demand, which could result in higher electricity infrastructure costs. But any increases will be lower than they would be without demand reduction.

It should also be realised that effective regulatory policies to ensure fair and transparent pass-on of cost savings need to be in place in order to translate lower costs into lower prices for businesses and consumers.

3. How energy savings lower energy prices – 2020 outlook

3.1 Impact on future fossil fuel prices

Some fossil fuel markets are global, some are more regional, but they are all at least partly connected. The prices of oil, coal and natural gas are also to some extent correlated.

The supply of crude oil is clearly under stress. One reason is that world oil demand is close to the capacity with which oil can be pumped out of the ground. This is a vulnerable situation, jeopardising the chances of stable and moderate prices. Currently the oil price is about a factor of 4 above production costs[8].

6 Oil prices (brent) averaged €80 per barrel in 2012, according to the International Energy Agency.

7 "Why are energy prices rising?" – Ofgem Factsheet 108, 14.10.11

8 IEA World Energy Outlook 2011, p. 140.

A recent special report by McKinsey discusses the risk of unstable prices in further detail. It concludes that increasing demand, especially from emerging markets, could make demand outpace supply. In recent years, it has proven very difficult to increase production capacity when needed. As a result, price increases and high price volatility can be expected. Higher prices, but especially shocks in prices, could seriously slow down economic growth, with export-oriented economies being most vulnerable[9].

This section considers the impact that reduced energy demand within Europe could have on fossil fuel prices. We have analysed future scenarios by the International Energy Agency (IEA) on a global level and on a European level. The IEA's most recent World Energy Outlook looks at three scenarios: "New Policies", "Current Policies" and "450", with the latter setting out an 'illustrative energy pathway that is consistent with a 50% chance of meeting the goal of limiting the increase in average global temperature to 2°C'[10]. The scenarios show the effect of lower energy demand on the price of oil, gas and coal.

In table I we show the differences in world oil demand between the "Current Policies" and "450" scenario and the resulting difference in world oil price in 2020. Similarly, we show the difference in European imports for natural gas and coal and the resulting differences in price for the two scenarios.

Table I: Differences between the "Current" and "450" scenario in 2020 in quantities consumed or imported and prices. In the case of oil it relates to world consumption and world price. In the case of gas and solid fuels it relates to European imports and European import prices.

	% decrease in demand between Current and 450 scenarios	% by which price is lower under 450 scenario compared to Current	Approximate global € price savings per € saved due to lower quantity
oil	7%	18%	2.4
natural gas	6%	11%	1.7
solid fuels	16%	14%	0.7

(Source: IEA World Energy Outlook 2011)

Table I shows that the world price of oil is very sensitive to a change in demand: for every €100 spent in the Current Scenario, only €76[11] needs to be spent in the "450" scenario, as the quantity consumed, as well as the price, is lower. In other words, not only are there savings of €7 because less oil is consumed – there are additional savings of €17 because the oil that is used costs less.

In this way approximately €2.40 is saved due to a lower oil price for every €1 due to a lower demand. There would be similar savings for natural gas and to a lesser extent for solid fuels. The results are shown in the third column of Table I.

These model results show very strong impacts of demand reduction on energy prices. But these models are for the world as a whole, so what will be the effect of EU energy efficiency policies?

The European Union's energy consumption represents only about 15% of global energy demand. Therefore the impact of European demand reductions on prices for global markets, notably for oil, will be much less significant than for demand changes on a global scale.

That said, the relative effect of European action to save energy will be more significant in those cases where markets are more regional. This is the case for natural gas. And even for fuels where the market is more global, strong energy efficiency efforts in the EU can be expected to have spill-over effects. Technology that is developed for the EU market will to a certain extent also be deployed outside the EU, e.g. for consumer goods. Countries outside the EU may also follow policy targets and regulatory examples of the EU and its member states.

9 T. Janssens, S. Nyquist, O. Roelofsen, "Another oil shock?", McKinsey Quarterly, nov. 2011.

10 CAN-Europe and Friends of the Earth Europe both call for stablisation of greenhouse gas emissions below 350ppm, in order to limit global average temperature increase to well below 2 degrees Celsius.

11 93%*82%*€100

Overall we may expect that fossil fuel prices paid in Europe will decrease with ambitious EU energy savings policies. Taking account of the relative proportion of global demand represented by the EU and the extent to which EU energy prices are determined globally, the multiplication factor will be smaller than those mentioned above; most likely 0.5 to 1.0. This means that for every 1% energy savings in the EU, we estimate that fuel prices will come down by 0.5 – 1%.

3.2 Short term electricity prices

As electricity cannot be easily stored in large quantities, a price premium can be charged by those generators able to dispatch electricity the moment it is needed.

The way it works is schematically depicted in Figure 1. Electricity demand varies significantly during the course of a 24-hour period. At night demand is low. It increases during the day, peaks in the afternoon until late in the evening and then goes down again. At night only the electricity generators with the lowest marginal costs will be in operation. When demand increases, generators with higher marginal costs are successively brought online. In the afternoon, peak power with very high marginal costs is being used. And because the price of electricity is set by the most expensive power generation, this means higher electricity bills.

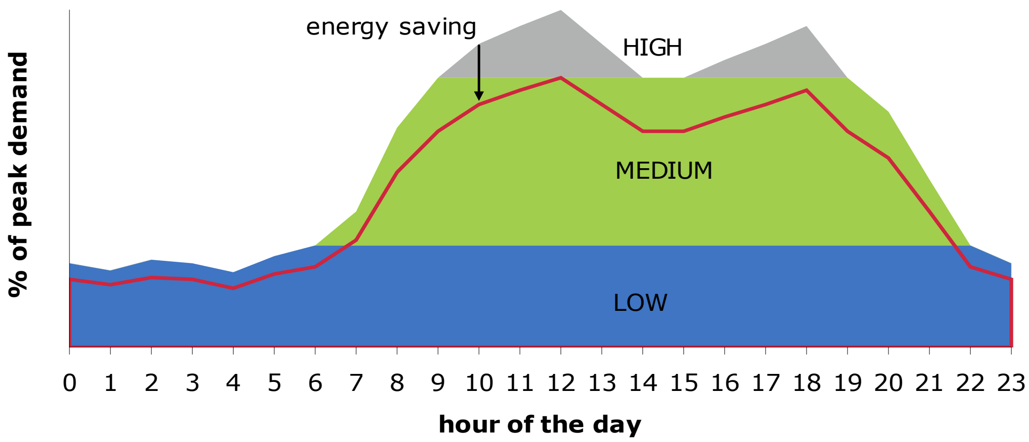

Figure 1: Illustration of electricity demand during the day with demand being fulfilled by generators of different marginal cost (low, medium, high). Energy savings enable demand to be met with lower-cost generation.

So how do energy savings reduce electricity prices? When measures are taken to reduce demand, expensive peak-load generators will be the first to be turned off. This means electricity prices will be set by cheaper power generators – with lower marginal costs. Consequently, the overall price of electricity will go down if less electricity is used. This is known as the merit order effect.

Added to this, some efficiency measures work by shifting demand from the heaviest-demand points in the day to those when demand is lower ("peak shaving"). This will increase the periods when low cost fuels determine the marginal costs, thereby further lowering prices.

Still, it is important to note that upward pressure on electricity prices can be expected upon increasing electrification of transport and heating. Therefore it is possible that prices may not actually undergo net reductions compared to today's levels. But any increases will be lower than they otherwise would have been without the effect of energy savings.

A second point to note is that the downward trend on short-term electricity prices will hold as long as more generation capacity is installed than is needed. In the longer term, investments in power plants will be reduced thanks to the lower demand resulting from energy efficiency measures, and the peaks and troughs arising from variable demand will be smoothed out. The impacts described above could therefore diminish. The precise impact will be country-specific.

Electricity spot prices in Germany

In Germany an enormous amount of decentralised photovoltaics (PV) has come online in the last ten years. From the perspective of an energy utility this can be seen as a lowering of demand. The daytime spot price of electricity was found to be substantially lower in 2011 compared to 2007, with up to 40% lower spot prices observed around noon. This is attributed to added PV-capacity[12]. In a similar manner, ambitious efficiency measures can have an effect on electricity spot prices.

3.3 Avoided investment in energy infrastructure

As explained in section 2, the price of energy is made up of variable and fixed costs. The fixed part is determined by investments in energy infrastructure. A substantially lower future energy demand compared to business as usual will reduce the need for these investments[13]. Additional power generation capacity may not be needed. The expansion of transmission lines can be avoided or reduced in capacity. New distribution grids can be designed for lower capacity. Imports of oil, natural gas and coal will be substantially lower, reducing the need for storage and import facilities for these fuels.

Gas infrastructure savings

The proposed Nabucco pipeline project is expected to cost €12-15 billion. The motivation for this pipeline is based on the assumption that Europe's natural gas consumption will increase by 60% from 2005 to 2030. The pipeline has a capacity to import 6% of Europe's current natural gas consumption. In other words, a savings of 6% of our current natural gas consumption would remove the need for this €12-15 billion investment. For example 10% savings in primary energy consumption compared to 2009 levels would save the investment costs of the equivalent of 1-2 Nabucco pipelines.

In the "New Policies" scenario in the IEA's World Energy Outlook 2011, energy infrastructure investments in Europe are calculated to amount to more than €3,000 billion over the period 2010 to 2035, or €130 billion per year. This is a scenario where primary energy consumption rises by 8% between 2009 and 2035, or from 1766 to 1876 million tonnes of oil equivalent (Mtoe). If the European 20% savings target were met, primary energy consumption would decrease from 1750 Mtoe in 2005 down to 1575 Mtoe in 2020[14]. This consumption level in 2020 would imply 10% savings with respect to 2009.

12 Renewables International 02-02-2012.

13 See European Climate Foundation's report "power perspectives 2030" on www.roadmap2050.eu/pp2030

14 B. Wesselink, R. H., W. Eichhammer, "Energy savings 2020, how to triple the impact of energy saving policies in Europe", Ecofys and Fraunhofer ISI (2010). Note that the Energy Efficiency Directive specifies a 2020 target of 1474 Mtoe. However, this excludes energy for 'non energy uses'.

Our conservative estimate of the amount by which investments in infrastructure would be reduced in line with this lower consumption level until 2035 is roughly 25%, or about €30 billion per year, compared to what would have been the case under the IEA "New Policies" scenario[15].

These savings in infrastructure investments should reduce electricity prices as well as fossil fuel end-user prices – a welcome relief for countries facing the replacement of old infrastructure in the coming decade, such as the UK and Poland.

However, for this to happen it is essential for the EU to **set binding energy savings legislation.** Making only loose commitments on energy efficiency may lead to unnecessary and expensive investments being made in energy infrastructure[16]. Firm commitments on energy efficiency – i.e. setting a legally binding 20% by 2020 target – will unambiguously and predictably reduce the need for infrastructure investments, and therefore the portion of energy prices which results from the cost of these investments.

It should be noted that – as is the case with lower electricity costs – the savings in infrastructure investments may not automatically result in lower prices for end-users. It is important that close monitoring of how well cost savings are passed on to consumers occurs, and that action be undertaken by energy regulators when needed.

It can be concluded that **savings in energy infrastructure when aiming for the 20% savings target will be on the order of several tens of billions of Euro, per year and should reduce electricity prices for end-users.**

Large Polish infrastructure investments call for large savings

Poland's energy, and particularly electricity, sector has a number of unique characteristics.
First, it is dominated by coal, which makes up 90% of electricity generation. Second, Poland's per capita energy consumption is one-third lower than that of the rest of OECD Europe, while per capita electricity consumption is just more than half that of OECD Europe. Third, Poland's existing energy infrastructure is, by and large, old and inefficient. In the electricity sector, 37% of installed capacity is between 30-40 years old; 20% is as old as 40-50 years. Thus the Polish energy sector faces a period of heavy investment. The National Program for Low Emissions Development, an advisory board established under the Ministry of Economy, estimates that between €90 and €100 billion will need to be invested in the electricity sector by 2030[17].

Fortunately, like many other countries, Poland also has a large potential for energy saving – around 30-35% according to the public sector National Energy Conservation Agency.

It is clear that Poland faces a substantial energy challenge. It should be recognised that energy efficiency can have a positive effect on not only the 2020 targets, but also in reducing infrastructure investments, as we discussed in section 4. The International Energy Agency (IEA) has stated that, on average, every $1 spent on more efficient electrical equipment, appliances, and buildings avoids $1.5 of investment in electricity supply (IEA World Energy Outlook 2006). This makes a case for Poland to strongly support ambitious energy efficiency legislation. A further important point for Poland is that, at a time when investment costs for nuclear or carbon capture and storage, or future oil and gas prices, are highly uncertain, energy savings reduce uncertainty. Such risk mitigation has a monetary value.

15 Assuming a 2.5% replacement rate per year (based on an average life time of 40 years), the New Policies scenario has a 2.8% per year rate of new and replacement infrastructure installations. If the 20% savings target is met, however, the replacement rate could go down to 2.1% per year. This results in 25% or ~€30 billion per year less in expenditure on energy infrastructure investments. Note that this is a particularly conservative estimate, since the lower investments should strictly be calculated in comparison to the Business as Usual scenario (rather than New Policies).

16 These investments are likely to be especially expensive if commitments on energy savings are unclear, since the returns on investment will be uncertain and the cost of capital will be higher.

17 T. Spencer, "Time for a grand bargain with Poland on energy and climate", European Energy Review, March 8th 2012.

4. Outlook to 2030

In Chapter 3 we discussed and estimated the effects that 20% energy savings in 2020 would have on energy prices. In this chapter we give a brief outlook on what those effects could be in 2030 under a "high energy savings" scenario up to 2030. We discuss which factors will come into play for 2030 and derive an estimated range of total energy cost savings from those factors.

4.1 "Business as usual" and "energy savings" scenarios

For a "high energy" savings scenario we take a scenario with a total EU primary energy consumption of 1170 Mtoe / 49EJ by 2030[18]. For our Business as Usual scenario we have taken the PRIMES update 2009[19]. The numbers used for calculating price effects are based on the WEO2011 scenarios (Current Policies and '450').

4.2 Fuel cost savings

For calculating fuel cost savings only the fossil fuel-based primary energy consumption and savings are taken. Based on the difference in fossil fuel consumption between the PRIMES 2009 and high energy savings scenario, and using fuel prices in the Current Policies scenario, direct savings due to lower fuel use can be calculated. These gross savings, based on world market prices, are in the order of €200 billion[20].

In order to estimate the effect of lower prices, we follow a similar argumentation as for 2020 in Section 3.1. In table II, an overview of changing demand and changing prices between the Current Policies and "450" Scenarios is given.

Table II: Differences between the "Current Policies" and "450" scenario in 2030 in quantities consumed or imported and prices. In the case of oil it relates to world consumption and world price. In the case of gas and solid fuels it relates to European imports and European import prices.

	% decrease in demand between Current and 450 scenarios	% by which price is lower under 450 scenario compared to Current
oil	23%	28%
natural gas	24%	23%
solid fuels	53%	36%

Comparing these results to the 2020 results in table I, we observe that the sensitivity of price to the demand is somewhat less than in the earlier period.

This is likely to be due to underlying assumptions in the scenarios that markets will be less strained in 2035 compared to 2020 (more time to adjust to new market conditions, less changes in overall demand from 2020 to 2035 compared to the period before in all scenarios. Nonetheless the sensitivity is still very significant.

18 Analysis based on 'The Energy Report', Ecofys and WWF (2011), adjusted to the EU27.

19 The PRIMES 2009 update gives a figure which is close the to the primary energy consumption in the IEA's Current Policies Scenario (1754 vs 1791 Mtoe).

20 We used a fossil fuel fraction of 72% of primary energy consumption for the PRIMES scenario and 64% for the "high savings" scenario, respectively. For the relative contributions of oil, gas and coal we used the IEA scenarios and the prices in the Current Policies Scenario. The oil price in the Current Policies Scenario for 2030 corresponds to €97 per barrel.

Similar arguments as brought forth in Section 3.1 are valid here:

- Savings in Europe will have the strongest effect on prices that are more regionally determined, such as natural gas and coal.
- On the other hand, for fuels like oil that are dominated by the global market, it should be taken into account that savings in Europe only have a relatively small effect on prices. By 2030 Europe will make up only 10% of the total world primary energy consumption.
- However we expect the technology spill-over effect of increasing efficiency in the world as a result of efficiency developments begun in Europe, to be even stronger in 2030, as more time will have elapsed during which these changes can take effect and be incorporated in the policies and practices of different regions.

The "high energy savings" scenario has a much lower consumption than the "450" scenario. However, we do not expect the change in price to be completely linear, as stress on prices is expected to be the strongest near the business-as-usual level. We have assumed the price change to be half as strong in going from the "450" to the "high energy savings" scenario as it is in going from the baseline to the "450" scenario. With this moderate assumption, and taking into account regional effects and spill-over effects (see Section 3.1), we estimate the indirect savings to be in the order of €50 billion[21].

This is lower than the indirect savings in 2020 for two reasons. The first reason was already mentioned (less strained markets). The second reason is that the indirect savings are not only proportional to the prices difference between business as usual and the "high energy savings" scenario, but also to the energy consumption in this scenario. As this is much lower, the indirect savings are much lower as well (but nonetheless still very significant).

4.3 Short-term electricity prices and avoided investment in energy infrastructure

In making estimates for these effects for the year 2030 there are distinct differences in argumentation compared to the 2020 outlook, due to the longer time horizon.

Firstly, the effect of decreased or avoided investment in energy infrastructure must be seen in conjunction with short-term electricity prices. If the mechanisms described in Section 3.3 have worked, then, over time, investment in infrastructure for energy production and distribution will have reduced. This may mean there will be little reserve in energy infrastructure, in which case there will be periods when energy supply is difficult to meet, hence spot prices will increase. At the same time, however, the fixed costs per kWh produced and consumed will be lower.

On the other hand, if infrastructure investments have been overestimated compared to the evolution of demand, the reverse situation will arise: there will be a lowering effect on electricity spot prices in the longer term, but the fixed costs per kWh produced will be higher. In Section 3.2, it was argued that electricity prices on the spot market will be lower due to energy savings, as power plants with high operating costs will be used less. This assumes a situation where demand is lower than foreseen, resulting in a situation of oversupply. This argument is valid in a timeframe until 2020. But in a scenario until 2030, we would expect that energy infrastructure and capacity plans have had more time to adjust to a lower demand. Therefore, if planning is done in the right way and infrastructure planning results in the right balance of supply and demand, we do not expect any downward effects on the short-term electricity prices due to high energy savings.

21 We took into account the full price effect for gas and coal as prices are expected to be regional. For oil, we used a factor of 10% to take into account the influence of European savings on world oil prices, and then doubled the result to take into account the expected spillover effect. For example: 20% savings in Europe would then cause a 4% change in world oil prices.

Secondly, as the penetration of renewables increases toward 2030, its effects on prices will become more significant. This effect cannot be seen as completely separate anymore from the energy savings effect. Increased penetration of renewable energies will result in a larger fraction of the total energy consumption being covered by electricity. Electricity consumption is expected to rise in the Current Policies scenario as well as the "450" scenario, on average by 1.1% and 0.7% per year until 2035, respectively. In the "high energy savings" scenario final energy consumption stays constant between 2020 and 2030, and primary energy demand due to electricity consumption decreases as the share of renewable increases and the share of fossil energy decreases (due to higher efficiency of renewable electricity generation).

Increased electrification will require increased electricity infrastructure costs. In order to arrive at a ballpark estimate for avoided investment in infrastructure we refer to a recent study by the European Climate Foundation. In this study, effects on the power sector of different scenarios that lead to the same goal of a 90% decarbonised power sector in 2050 are calculated[22]. It shows that energy efficiency measures yield substantial benefits in mitigating the investment and grid challenges in the power system. They observe that 2 scenarios, one that involves a 1.8% growth in electricity demand and a "high efficiency" track that involves a 0.3% growth in electricity demand per year from 2020 to 2030, results in 50% decrease in transmission investment costs and a 31% decrease in back-up investment, saving €300 billion in investments in the period 2020–2030. This would amount to yearly infrastructure savings of €30 billion per year. It should be noted that this concerns only the power sector. Effects in the energy infrastructure due to decreased energy consumption in other sectors, such as transport or buildings, are not considered. Therefore, it is likely to be a conservative estimate for this study.

4.4 Net savings for consumers

In the analysis in 4.1 and 4.2 two issues have not been discussed yet. These are necessary to come to an estimate of total net savings for final energy consumers. For 2020, a calculation of net direct savings for final energy consumers was available from literature (€ 107 billion per year in 2020). This number is not available for 2030. Therefore, we derive our own estimate in the following way:

+ Net savings are calculated using final energy consumer prices of the end use of the fossil fuels rather than world market prices. We determined the ratio between costs of fossil fuel demand based on end consumer prices and the costs based on world market prices. This ratio was 1.7 for 2010[23]. The difference between the two represents conversion and distribution costs as well as margins for suppliers and includes conversion to electricity. Applying this factor to our calculation of gross direct savings based on world market prices, this would give 200 x 1.7 = € 340 billion per year gross direct savings for consumers.
+ To arrive at net savings, an estimate of the investments costs needed to realise those savings needs to be made and subtracted from the gross savings. We estimate that 40% capital costs (interest and depreciation) and operation and maintenance costs are necessary to realise the savings[24]. This gives (100-40%) x €340 billion = € 200 billion per year net direct savings per consumers.

Adding up the net direct savings of € 200 billion per year and the indirect savings of € 50 billion per year results **in total net savings for consumers of € 250 billion per year[25].**

It should be noted that these are estimates. Given the long time frame and the crude assumptions in the calculations, we expect the uncertainty in these estimates to be in the order of 50%.

22 "Power perspectives 2030, on the road to a decarbonised power sector", ECF, 2012.

23 Using world market prices for fossil fuels from BP Statistical Review of World Energy, June 2012, quantities used based on the 2010 Energy Balance from Eurostat, and EU-averaged retail prices from Eurostat Energy Price Statistics.

24 We come to the estimate of 60% net savings / gross savings, by combining investments costs from Wesselink et al. 2011 (B. Wesselink et al, "The upfront investments required to double energy savings in the European Union in 2020", Ecofys and Fraunhofer ISI, 2011) with net savings from Wesselink et al 2010 (B. Wesselink et al, "Energy savings 2020, how to triple the impact of energy saving policies in Europe", Ecofys and Fraunhofer ISI, 2010). It assumed that this percentage remains approximately the same from 2020 to 2030 because continuing innovation ensures continued development of cost-efficient technologies, based on Blok et al 2005 (K. Blok "Improving Energy Efficiency by 5% and more per year", J. Ind. Ecology, vol 8., no. 4, 2005).

25 The €30 billion infrastructure savings mentioned in section 4.3 are part of the gross direct savings for consumers.

5. Conclusions

Many studies on efficiency conclude that there is a large potential for cost-effective savings. But these studies generally only consider the cost savings for consumers and businesses resulting from avoided energy use. In this paper we have drawn attention to the fact that energy savings do not only result in direct cost savings, but have a multiplier effect due to their downward effect on energy prices. **The result is that real cost savings from exploiting the EU's cost-effective energy savings potential are likely to be considerably higher than figures commonly cited.**

Savings in 2020

We have shown the three main effects of energy savings on energy prices:

1. Energy efficiency policies in the EU will lead to lower fossil fuel prices in Europe
2. In addition, lower electricity demand will lead to lower electricity prices
3. Infrastructure investments can be cancelled or postponed, leading to a further reduction of energy prices

We have estimated that the first effect is already substantial, leading to a decrease in energy prices of up to 1% for every 1% of energy saved. The impact on short-term electricity prices is difficult to quantify, but will be significant for electricity. The impact on infrastructure investments will be more noticeable in the long term.. It is important to note, however, that there will be trade-offs between the three effects (notably that more investment in certain types of infrastructure supports the use of lower cost fuels).

All in all we expect that **for every €1 of direct energy cost savings, an additional €1 could be saved due to lower energy prices. Therefore, net additional annual cost savings on the order of €100 billion can be expected on top of the €107 billion that will result from implementing cost-effective energy savings measures.**

Savings in 2030

If ambitious energy savings are pursued further in the period 2020 - 2030, we expect **net direct energy cost savings to be in the order of €200 billion per year and indirect energy cost savings on the order of €50 billion per year in 2030, giving €250 billion per year total net savings for consumers.**

To conclude, we note that energy efficiency can bring great economic benefits to European consumers, but without effective regulation savings will not materialise. It is therefore of vital importance that ambitious and effective policies are put in place in order to see these benefits realised.

Notes

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