Assessing the EU 2030 Climate and Energy targets

A Briefing Paper

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1 Summary
Putting the EC energy and climate targets into perspective

On 22 January 2014, the European Commission put forward 2030 energy and clime targets of a 40% reduction in greenhouse gas emissions (compared to 1990) and a share of 27% renewables in final energy consumption. This Briefing Paper contains the most important conclusions of an assessment of these targets, as analysed by Ecofys and commissioned by the Greens/EFA group in the European Parliament.

Barely a fair share
Ecofys concludes that the European Commission's proposals will barely bring the EU on track for a fair contribution to limiting the global temperature rise to below 2 degrees.

Renewables: slower than past growth
Regarding renewable energy**,** the 27% target in the 2030 framework as proposed by the European Commission implies a very modest annual growth (1 to 1.5%).

Post-2030 acceleration required
The 2030 targets are not in line with the EU's own climate goals for 2050: 80 to 95% less greenhouse gas emissions. Under the Commission proposals, achieving the less ambitious limit of -80% would require a considerable acceleration of growth in renewables and reduction of energy use after 2030.

Effect of ETS surplus limited by new mechanism
The proposed Market Stability Reserve limits the possibility to use the surplus allowances originating from the EU emissions trading scheme (expectedly some 2.6 billion tonnes of CO_2 in 2020). Surplus allowances can still dilute the target in early years of the commitment period and after 2030. Without the Market Stability Reserve, the surplus allowances could more than satisfy the additional demand for allowances resulting from the proposed stricter ETS cap.

Comparing with the Greens/EFA targets
The assessment shows that the Greens/EFA target proposals (40% lower energy demand than in 2010, 45% of renewables and 60% reduction of greenhouse gas emissions compared to 1990 levels) bring the EU on track to achieve the EU 2050 target of 80 to 95% less emissions. The Greens/EFA targets also allow for contributing a fair EU share to limit the global temperature rise to below 2°C.

Co-benefits of ambitious targets
The more ambitious Greens/EFA targets will achieve a lower energy bill regarding energy imports, hence contributing to a lower dependence on imports of e.g. Russian natural gas. In comparison to the Commission's proposal, the Greens/EFA targets will decrease the import energy bill by 100 million tonnes of oil equivalents (Mtoe) a year, which is about the size of natural gas imports from Russia.

There are also considerable effects involved in both gross and net employment. In terms of net employment, compared to a GHG target only (GHG 40%) situation, additional EE policies and a 30% RES target would create 568,000 additional jobs in the EU in 2030. There are no reliable studies available that have assessed the net employment effects of more ambitious GHG, EE and RES targets until 2030.

2 Context

On 22 January 2014, the European Commission presented its 2030 policy framework for climate and energy. The framework includes the following key proposals:

- Reducing greenhouse gas emissions by 40% below 1990 levels by 2030. To achieve this, the sectors covered by the EU emissions trading system (EU ETS) would have to reduce their emissions by 43% compared to 2005. Emissions from sectors outside the EU ETS would need to be cut by 30% below the 2005 level. This effort would be shared equitably between the Member States.
- Increasing the share of renewable energy to at least 27% of the EU's energy consumption by 2030. In contrast to the 2020 target for renewable energy, this target is only binding at the EU-level and will not be translated into national (binding) targets. The Commission also plans to establish a new governance system based on national plans for competitive, secure and sustainable energy.
- The role of energy efficiency in the 2030 framework will be further considered in a review of the Energy Efficiency Directive due to be concluded later in 2014.

Apart from these three key elements, the framework includes a proposal for a reform of the EU ETS, among other things by establishing a market stability reserve to tackle the imbalance between demand and supply.

As next steps, the Commission invites the Council and the European Parliament to endorse its approach and the EU-level greenhouse gas and renewables targets. The European Council is expected to consider the framework at its Spring Meeting on 20-21 March 2014.

The Greens/EFA group in the European Parliament has put forward alternative targets (40% energy efficiency, 45% renewable energy, 60% greenhouse gas emissions reduction compared to 1990; further referred to as the Greens/EFA targets), which are more progressive than the targets proposed by the European Commission.

2.1 Objective of this report

The Greens/EFA group in the European Parliament has asked Ecofys to provide input for the Spring Meeting. More specifically, Ecofys was asked for an assessment of the ambition of the 2030 framework for energy and climate policies as launched by the European Commission on 22 January 2014.

3 The progressiveness of the climate and energy targets proposed by the European Commission

3.1 The 2030 targets in the context of 80%-95% GHG reductions for 2050

This reports starts with assessing the 2030 target proposals seen in the light of the overall EU climate objective for 2050: 80 to 95% greenhouse gas emissions reductions. Several emission pathways are drawn towards 2050, as is shown in Figure 1.

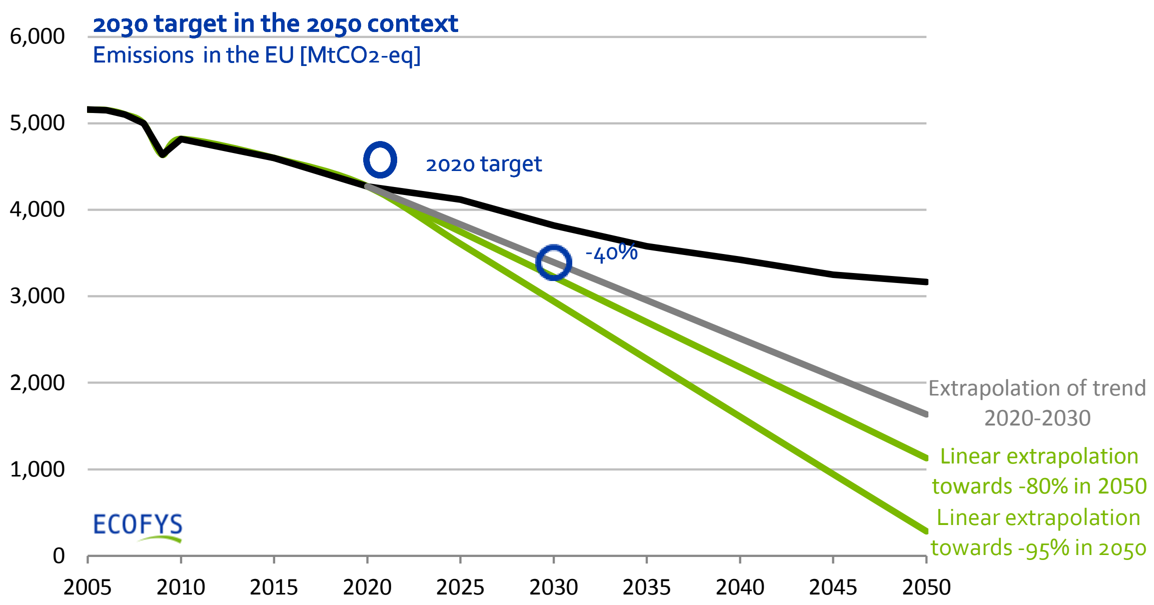

Figure 1 Emission pathways towards 2050, the 2020 target and the 40% for 2030.

First, a baseline is drawn (the black line in Figure 1)[1]. This reference, originating from the PRIMES model, represents the emissions development with currently implemented policies and without any further polices. This reference, used by the European Commission itself, would result in 32% emission reductions below 1990 by 2030 and 44% by 2050.
Next, the trend between 2020 and 2030 (starting at expected emissions in 2020 and ending with 40% reduction in 2030; the grey line) is extrapolated to 2050. This extrapolation would lead to a 71% emission reduction by 2050. For comparison, also lines are drawn between 2020 and 2050, respectively towards the 80% and 95% emission reductions (the green lines). From these pathways we can conclude that if the 40% target is implemented, the emission reductions need to accelerate

[1] European Commission (2013). EU Energy, Transport and GHG Emissions. Trends to 2050. Reference Scenario 2013. Available online: http://ec.europa.eu/energy/observatory/trends_2030/doc/trends_to_2050_update_2013.pdf

after 2030 to achieve 80-95% emission reductions by 2050: The average annual emission reduction has to double in the period 2030-2050 compared to 2010-2030.

3.2 Energy efficiency and renewable energy targets for 2030

A comparison between the targets as proposed by the European Commission, those proposed by the Greens/EFA and the reference scenario for development of the energy consumption provides another perspective into the progressiveness of the Commission's framework.

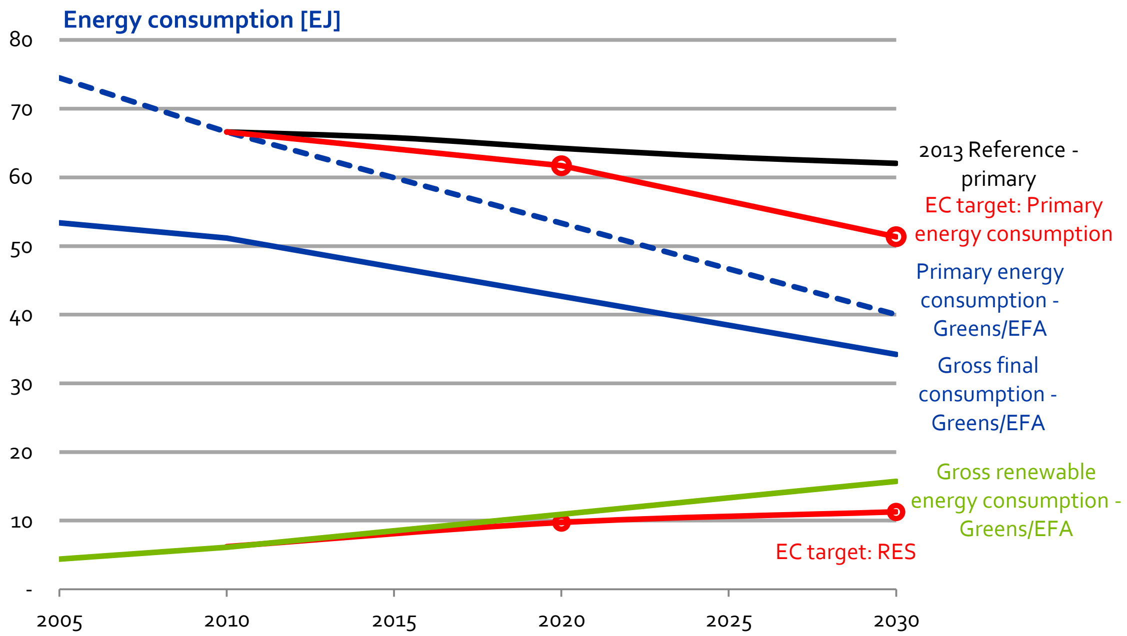

Figure 2. Indicative development of energy consumption until 2030. The red lines indicate the 2020, respectively 2030 targets in the EC framework. The black line is the reference development; the blue lines indicate the primary (dashed) and gross final energy consumption (solid) as aimed at by Greens/EFA.[2]

Figure 2 compares the indicative evolution of the energy consumption and renewable energy as seen by the Greens/EFA group to the 2013 baseline development of energy consumption, as well as the agreed 2020 targets and the new 2030 targets as proposed by the European Commission. The EC's energy savings target is indicative, because the EC energy and climate framework does not contain an official target on savings.

The graph shows:

- The Greens/EFA targets are a continuation of present growth in renewable energy. The EC targets suggest a discontinuity and a slowing in the growth of renewable energy.
- The difference in 2030 primary energy consumption between the EC framework and the Greens/EFA target is about 11 EJ (270 Mtoe), which is equal to the annual primary energy

[2] Final energy consumption indicates the energy that is consumed by the end-user (for example by households). Gross final energy consumption includes heat and electricity that is used in electricity and heat production as well as distribution losses. Primary energy consumption includes the energy that is used in the conversion processes (for example from coal and gas to electricity). Non-energy consumption of fuels in not included in these numbers.

consumption of France. There is some uncertainty, as the EE target of the EC framework is not clearly set.[3]

These calculations assume a share of 14% biomass in renewable electricity production in 2030. If the contribution of biomass to renewable electricity were to increase, the final energy savings (now 30% with respect to 2010) also have to increase to reach the same levels. This is because the conversion efficiency of biomass is lower than wind and solar PV (which is at 100%), so more primary energy is needed to produce the same amount of electricity.

3.3 The impact of the EC targets on a 'fair' carbon budget

To reduce climate change risks and limit the average global temperature increase below 2°C – relative to the pre-industrial average – only a limited amount of greenhouse gases can be emitted during the 21st century: the global carbon budget. It reflects the total amount of greenhouse gas emissions that is allowed to be emitted, cumulative over the 21st century.[4]

Calculations about the distribution of carbon budgets have also been made in the context of the international climate change negotiations under the UNFCCC (UN Framework Convention on Climate Change). In these calculations, every region would be attributed a 'fair share' of the total carbon budget, based on e.g. economic development and historical emissions. Targets suggested in the scientific literature for the EU's fair share range from 40% to near zero (100% reduction) or even negative emission targets (more than 100% reduction) in 2030.[5]

To calculate the 'fair share' of the carbon budget for the EU, we have followed two approaches to illustrate the possible ranges.

We determine the global carbon budget from Meinshausen et al. (2009)[6], who estimate the required carbon budgets corresponding to different probabilities of exceeding 2°C by the end of this century. In order to limit the chance of exceeding 2°C below 25%, the total carbon budget that can be emitted between 2000 and 2049 is estimated at 1500 billion tonnes of CO_2-equivalent ($GtCO_2$-eq). Between 2000 and 2010 about 450 $GtCO_2$-eq where emitted globally, leaving 1050 $GtCO_2$-eq for the period 2010-2050. With this carbon budget it is three times more likely that we meet the 2°C target than it is likely that we miss it.

To calculate the 'fair share' of the carbon budget of Europe, we evenly distribute this global carbon budget over the global population. Currently, the European population makes up 7% of the global population and, thus the corresponding carbon budget for the EU between 2010 and 2050 would be

[3] The European Commission mentions 25% savings, but is not set and also not clear with respect to what baseline. We estimate that a 27% renewable energy target, combined with a 40% emissions reductions target would require 25% primary energy savings with respect to the 2009 reference (35% with respect to 2007 primary energy baseline). See European Commission (2010). EU energy trends to 2030 — UPDATE 2009. Available online: http://ec.europa.eu/clima/policies/package/docs/trends_to_2030_update_2009_en.pdf

[4] The risk of exceeding the 2 C threshold also depends on the development of emissions over the years (the emissions pathway): a high peak increases the risk of exceeding.

[5] For an overview of studies see Höhne, N., Den Elzen, M., & Escalante, D. (2014). Regional GHG reduction targets based on effort sharing: a comparison of studies. Climate Policy, 14(1), 122-147. Or see http://www.ecofys.com/en/blog/what-is-a-fair-contribution-of-the-eu-to-the-2c-limit/

[6] Meinshausen, M., Meinshausen, N., Hare, W., Raper, S.C.B., Frieler, K., Knutti, R., Frame, D.J. and Allen, M.R. (2009). "Greenhouse-gas emission targets for limiting global warming to 2°C", Nature 458(7242): 1158-1162.

76 $GtCO_2$-eq. This approach only shares the future carbon budget and does not take into account the historical emissions. Approaches that take the historically emitted greenhouse gases into account would result in even smaller budget for the EU, because the EU historically emitted more than the global average.

The green area in Figure 3 indicates the calculated carbon budget, assuming a pathway that would lead to 95% emissions reductions and stay constant at that level. The graph shows that a pathway leading through the 40% target by 2030 (the Commission's target) will fully consume the whole carbon budget that would be available for the 21st century. For reference, the graph also shows the -60% target from the Greens/EFA.

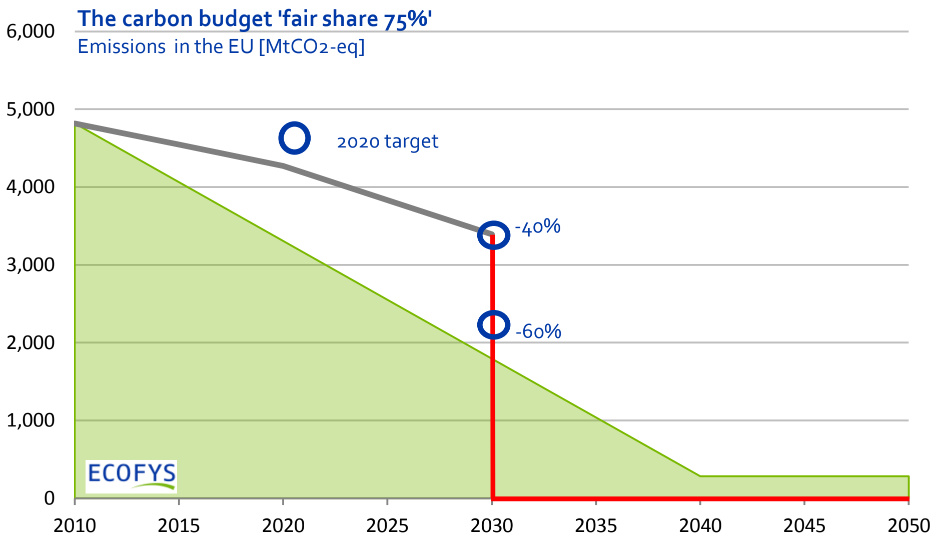

Figure 3. The carbon budget (green area) based on an equal distribution per capita of the future global carbon budget available to stay below a 25% chance of exceeding 2°C by the end of this century. The full carbon budget will already be emitted by 2030 if only 40% emissions reductions are achieved in 2030. The 60% Greens/EFA target is included for reference.

For a second variant, we assume a chance of exceeding 2°C below 50% (not 25%). This means that with this carbon budget, it is equally likely that we miss the 2°C limit as it is that we meet it. Meinshausen et al. (2009) estimated the total carbon budget that can be emitted for this likelihood between 2000 and 2049 at 2000 billion tonnes of CO_2-equivalent ($GtCO_2$-eq).[7]

[7] Between 2000 and 2010 about 450 $GtCO_2$-eq where emitted globally, leaving 1050 $GtCO_2$-eq for the period 2010-2050.

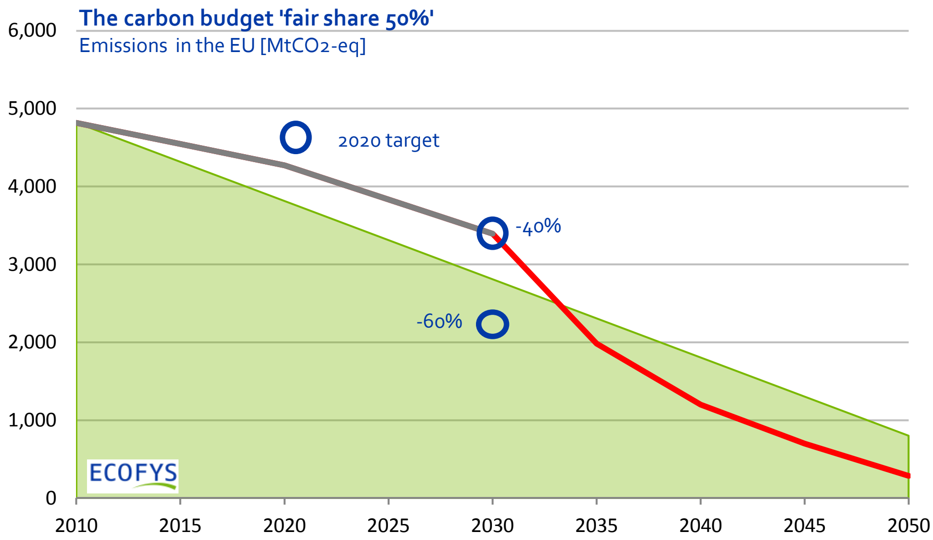

Figure 4. The carbon budget (green area) based on an equal distribution per capita of the future global carbon budget available to stay below a 50% chance of exceeding 2°C by the end of this century. To stay within this budget, an acceleration of emissions reductions is required after 2030 if only 40% emissions reductions are achieved in 2030. The 60% Greens/EFA target is included for reference.

In this case, the budget between 2010 and 2050 (again represented by the green area) totals 112 $GtCO_2$-eq (Figure 4).[8] If the EU emissions would head to -40% by 2030, a budget of 84 $GtCO_2$ will already be emitted by 2030. This leaves a remaining budget of 28 $GtCO_2$ for the years 2030-2050. Figure 4 shows an example (the red line) of how this would require a large acceleration in reductions after 2030: Between 2030 and 2040 the average annual emissions reduction should be a threefold of the average emissions reductions realised between 2010 and 2030.

3.4 EC targets related to actual renewable energy deployment

While assessing the numbers in the historic and assumed future growth figures for renewable energy, similar discontinuities appear. As figure 1 already showed, the European Commission assumes that between 2020 and 2030, growth of renewable energy will be slower than in the previous decades, and could even be slower than the absolute growth in renewable energy consumption that is assumed in the reference if more efficiency measures are implemented.

The table below shows the historical annual growth of renewable energy over different periods, the growth rates as calculated from the 2013 reference, the proposed 2030 EC framework and the Greens/EFA targets.

[8] A linear pathway towards a 80% emissions reduction by 2050 would result in a carbon budget of 126 $GtCO_2$-eq.

Table 1 Average annual growth rate of gross renewable energy consumption.

Period	Average annual growth rate
2000-2010	5.4%
2010-2020	5.0%
2020*-2030: reference*	1.5%
2020*-2030 EC Framework	1%-1.5%**
2020*-2030 40/45/60 Framework	4.5%

*in 2013 reference scenario. **This will eventually depend on the energy savings that will be realised.

The extent of energy efficiency measures determines the absolute level of renewable energy consumption that is implied by the renewables targets because these targets are expressed as share of energy consumption. In the 2013 PRIMES reference, the share of renewables is expected to increase to a 24.4% share (of gross final energy consumption), while the EC framework proposes a share of 27% but with respect to a lower total energy consumption. So a higher *share* in renewables does not necessarily mean a higher *absolute* level of renewable energy. In fact, the absolute amount of renewable energy consumption in the EC 2030 framework could be slightly lower than that in the 2013 reference scenario: 270 Mtoe[9] versus 280 Mtoe.

In order to grow towards 80-95% emissions reduction by 2050, renewables will have to speed up again their growth rates substantially after 2030. This imposes quite a challenge on the flexibility of the manufacturing industry and on maintaining the relevant knowledge on renewable energy, e.g. on how to fit renewable sources into the EU energy system.

Within the EC framework, it is possible that for example the growth in wind and solar PV remains higher, while the contribution of biomass in electricity production decreases. This means that despite the overall low growth rates, some technologies may still experience higher growth rates.

3.5 Utilisation of the cost-effective energy efficiency potential

Relating the proposed EC framework to the insights on potentials of cost-effective energy efficiency measures also shows a modest level of ambition of the targets.

In 2012, Fraunhofer ISI[10] estimated a total potential of over 40% (relative to the final energy consumption in the 2009 reference)[11]. Of this potential about 33% is cost-effective, i.e. to be implemented at no or negative cost. The costs savings from these measures could cover the costs of the more expensive energy efficiency options, accumulating to a 40% cost-effective potential from a system perspective. Calculations show that about 17% of savings of the 2009 reference consumption

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[9] The European Commission mentions 25% savings, but is not set and not clear with respect to what baseline. We estimate that a 27% renewable energy target, combined with a 40% emission reductions target would require 25% primary energy savings with respect to the 2009 reference scenario. Since the targets are not yet fully developed, the numbers presented here are subject to uncertainties.

[10] Fraunhofer ISI (2012). Concrete Paths of the European Union to the 2°C Scenario: Achieving the Climate Protection Targets of the EU by 2050 through Structural Change, Energy Savings and Energy Efficiency Technologies. Accompanying scientific report.
Available online http://www.isi.fraunhofer.de/isi-en/e/projekte/bmu_eu-energy-roadmap_315192_ei.php

[11] European Commission (2010). EU energy trends to 2030 — UPDATE 2009.
Available online: http://ec.europa.eu/clima/policies/package/docs/trends_to_2030_update_2009_en.pdf

is needed to achieve the EC 2030 targets. This represents half of the cost-effective potential, and nearly 45% of the full potential.

This analysis therefore shows that the EU targets in the Commission proposals will not implement all the cost-effective measures. This may lead to higher energy bills than in the case of full implementation of the energy savings potential. This effect has not been assessed in this study.

3.6 The impact of the ETS surplus on the EU's ambitions

According to the Commission's own estimates, by 2020 a surplus of 2.6 billion emission allowances is expected to be available within the EU Emissions Trading System. In principle, the existence of this surplus has the danger of diluting the 40% target for greenhouse gas emissions reduction, because emissions reduction could be partly implemented by submitting allowances (and not by real reduction measures). Ecofys performed some analysis on the possible effects and included the proposal from the Commission for a Market Stability Reserve. Concluding, the Market Stability Reserve limits the possibility to use these surplus allowances. Surplus allowances can still dilute the target in early years of the commitment period and after 2030. Without the Market Stability Reserve, the surplus allowances could more than satisfy the additional demand for allowances resulting from the proposed stricter ETS cap.

The origin of the surplus

The EU Emissions Trading Scheme (ETS) is the region's key policy tool for inducing mitigation action in energy intensive industries and the energy producing sector. Industries have to submit a number of allowances (in million tonnes of CO_2) that is equivalent to their actual reported emissions in the previous year. Over phase 2 (2008-2012) the EU ETS has accumulated a surplus of over 2 billion allowances that have not been submitted during the years, because emissions were lower than the emission allowances allocated. This amount compares to the annual cap in 2013 of just above 2 billion allowances. Because of this availability of excess allowances, allowances prices have been as low as €4 at the end of 2013. Hence, industries take little account of the carbon price signal in their investment decisions. In its Impact assessment, the European Commission estimates the surplus to increase to 2.6 $GtCO_2$ by 2020.

The surplus of EU allowances has been created over the years, due to several reasons[12]. The availability of less expensive international credits (which led to an increase of supply) is one reason. The economic recession slowing down production and energy consumption within the EU (leading to substantially lower allowance demand than anticipated) is another reason. Also inconsistency between the different targets has played a significant role. For instance, the 20-20-20 targets for 2020 are not internally consistent. As Ecofys previously calculated, adding up the 2020 targets for renewables (20% share) and efficiency (20% less than 1990) would add up to almost 30% greenhouse gas emissions reductions by 2020, instead of 20%[13].

Tackling the surplus

Policy makers have recognised the issue of the surplus and its effect on lowering CO_2 prices in the context of structural reform of the EU ETS. For the period until 2020, a short-term attempt has been approved by the European Council and the European Parliament to tackle the mismatch between supply and demand by back-loading auctioning volumes of 900 million allowances from the period of 2014 to 2016, in principle to be 'backloaded' to the system again in the period 2019-2020.

[12] CDC Climat research, Climate Brief No. 32. Oct. 2013 "One billion tonnes of CO2 avoided by the EU power sector and industry since 2005: half due to energy climate policies and half due to economic context". http://www.cdcclimat.com/IMG//pdf/13-10-22_climate_brief_no_32__co2_emissions_and_eu_ets.pdf.

[13] "Consistency of policy instruments - How the EU could move to a -30% greenhouse gas reduction target", http://www.ecofys.com/files/files/ecofysreportconsistencypolicyinstruments20110413.pdf

For the period after 2020, the European Commission made a proposal in order to tackle the surplus of allowances with the so-called Market Stability Reserve, still to be agreed. The Reserve would trigger an automated move of allowances into and out of a reserve in case a considerable and unpredicted imbalance between supply and demand is observed. This mechanism does not affect the total cap for the ETS, because the reserve only temporarily takes out EUAs from the market, to put them back in the market at a later time. The mechanism instead intends to address the so-called 'market imbalances', and therefore may affect the size of the ETS surplus in certain years.

How the Market Stability Reserve affects the surplus

Ecofys has modelled the consequences of the market stability reserve on the surplus with a simplified first order experiment. Starting at the Commission's own estimate of 2.6 billion allowances surplus by 2020, and based on the 2013 PRIMES reference scenario and the annual ETS caps (decreasing by 2.2% a year) we estimated the annual availability of allowances, including aviation. In our modelling, we estimated the yearly shortage in allowances (reference minus target), assumed that it would be met from the surplus and took into account the interaction of this surplus with the MSR (following the design as known at present). This illustrative calculation assumes that the market would not react to changes in the surplus and to MSR actions. It is likely that market players will react but that is hard to predict.

Our analysis shows that the MSR mechanism is projected to limit the surplus and the redemption of surplus allowances. Moving the surplus in the reserve can only be done slowly, by a maximum of 12% of the surplus each year reaching the surplus ceiling level of 833 million allowances in around 2026. By that time around 1600 million allowances would be in the reserve. In case the demand for allowances picks up and the proposed surplus floor of 400 million is undercut, allowances are brought slowly back to the market at maximum 100 million allowances per year. In our experiment this would happen shortly before 2030. By the end of 2030, 1400 million allowances would be in the reserve to be available for future commitment periods. [14]

From our analysis, we conclude the Market Stability Reserve limits the possibility to use these surplus allowances. Surplus allowances can still dilute the target in early years of the commitment period and after 2030. Without the Market Stability Reserve, the surplus allowances could more than satisfy the additional demand for allowances resulting from the proposed stricter ETS cap.

Knowing the market

It is important to realise that our conclusions have to be presented with some caveats. For instance, it is hard to predict how the market will react to the MSR mechanism. Participants knowing that reserve allowances will eventually become available again may affect the price today. Similarly, if the proposed renewable energy target of 27% will be overachieved, the risk become apparent of further surplus build-up. This surplus could undermine mitigation activities in the EU ETS after 2030.

[14] In its analysis PointCarbon estimates that 700 million will be in the reserve by 2030 (https://www.pointcarbon.com/aboutus/pressroom/pressreleases/1.3802237). Lack of data on their assumptions prevents a good comparison.

3.7 Inventory of the socio-economic benefits

Besides the relevance for the issue of climate change and staying under the 2° threshold, assessing the 2030 pathways for emissions reductions and renewable energy is also relevant for socio-economic issues. This chapter focusses on the possible outcomes of the EC proposed framework for reducing the EU's dependence of energy imports and the development of employment.

As could be expected, the Greens/EFA targets show large benefits in reducing energy imports and energy bills when compared to the EC proposed 2030 targets and framework. Regarding employment, studies identify a net positive effect. More relevant is the observation that robust targets in energy efficiency and renewable industry will move several millions of jobs in the EU from the more conventional and fossil fuelled industries to more sustainable activities.

3.7.1 Energy security

In the 2013 World Energy Outlook of the IEA (2013), the New Policy Scenario (the reference scenario, taking into account current and expected policies) foresees that by 2035 80% of Europe's consumed natural gas is imported (from about 60% in 2011). This large dependence underlines the potential benefits of energy savings and renewable energy for increasing European's energy security.

While by 2030, 397 Mtoe of natural gas is consumed in 2013 PRIMES reference scenario, the natural gas demand will be only 210 Mtoe in the Greens/EFA framework. Assuming the same domestic production[15][16], the import dependency regarding natural gas is thereby reduced to about 50%. This implies that natural gas import in the Greens/EFA framework is only 35% of that in the 2013 PRIMES reference scenario. This is a reduction by 185 Mtoe per year. Compared to the EC framework, the additional reduction is about 100 Mtoe. For comparison: in 2011, the EU27 imported nearly 100 Mtoe from Russia.[17]

For oil, the imports can be halved (with respect to the reference). The reduced import of natural gas, oil and gas combined could save more than €200bn per year by 2030. This is comparable to Portugal's GDP.

The potential of improving energy security and savings on the import bills is also underlined by the impact assessment of the European Commission[18], where the scenario with the highest renewable energy share and energy efficiency ambition has the lowest net import of fossil fuels and the highest (cumulative) savings on the fuel import bill. The Greens/EFA framework will result in a further improvement of energy security and reduction of the fuel import bill, as indicated in the right column in Table 3. The numbers for the EC proposed framework are best comparable and expectedly a little lower than the numbers that the Impact Assessment presents for the GHG 40 EE RES30 scenario.

[15] Also based on 2030 numbers from the 2013 PRIMES reference scenario.
[16] The domestic production will also depend on the natural gas prices, which might be lower in the 40/45/60 framework.
[17] Eurostat. 2014. Imports (by country of origin) - gas - annual data (nrg_124a)
[18] EC, 2014. Impact assessment on energy and climate policy up to 2030 [SWD (2014) 15] European Commission (EC), Brussels.

Table 2 Import indicators for different scenarios for 2030 with enabling settings (compatible with 2050 GHG objectives) assessed in the Impact Assessment of the European Commission. The data on the 2030 Greens/EFA targets are calculated by Ecofys.

	Reference	GHG 40	GHG 40 EE	GHG 40 EE RES30	GHG 45 EE RES35	Greens/EFA
Net Imports of Gas (2010=100)	105	91	82	74	72	37
Fossil Fuels Import Bill Savings in 2011-2030 compared to reference (bn € '10) *(cumulative 20 year savings from imports)*	n.a.	190	401	450	550	>1000

3.7.2 Employment

Regarding employment data, economists generally make a distinction between gross and net employment. *Gross employment* refers to the sum of positive direct and indirect employment effects derived from investments in e.g. RES and EE, without taking into account negative employment effects in other sectors. *Net employment* refers to the sum of positive and negative direct and indirect[19] employment effects taking negative employment effects in other sectors into account. The term net employment is more inclusive as it views employment from a macro perspective.

Gross employment

While the extent of employment effects may be debated, most studies covering gross employment effects indicate that there is considerable future potential for gross job creation in renewable energy and energy efficiency. For example, in 2011 the European Renewable Energy Council (EREC) estimated that 45% *renewable energy* in final energy consumption in 2030 would provide gross employment of about 4.4 million in the renewable energy sector – an annual average growth rate of about 6% from the employment in 2020 (2.7 million employees)[20]. Currently, roughly 1.9 million people are employed in the renewable energy sector in the EU-27[21]. Improved *energy efficiency* has both direct and indirect impacts on employment. Jobs are created directly in manufacturing and implementation but there is also an indirect effect: energy efficiency saves costs and frees up money for other consumption and investment. Both effects together could lead to an estimated gross employment impact of up to 1.3 million jobs in the EU by 2030[22].

Net employment

Although studies generally show that the *net employment effects* from energy and climate policies that go beyond business-as-usual are positive, the differences between more and less ambitious scenarios are small. This is due to the different restructuring processes that take place within the economy. For example, investments in renewable energy and energy-efficient equipment and technologies create new jobs in manufacturing, engineering and transport equipment, utilities, construction and their supply changes. On the other hand, extraction industries are negatively affected in more ambitious GHG, EE and RES scenarios.

In the EC Impact Assessment 2014 the net employment effects for 2030, for the different scenarios, are estimated using a number of macroeconomic models. Although differences exist between the outcomes of these models, particularly the scenarios with explicit energy efficiency measures and renewable energy targets show a positive net contribution to employment in the EU economy as a whole compared to a reference or business-as-usual scenario.

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[19] Direct effects are effects which are directly related to renewable energy generation and renewable energy technologies and occur directly in the sector addressed by the policy promotion. Indirect effects are effects in up/downstream sectors that are not directly (but only indirectly) related to the promotion of renewable energy and that might occur with a time delay.

[20] EREC 2011 '45% by 2030 – Towards a truly sustainable energy system in the EU'

[21] EurObserv'ER 2013 'The State of Renewable Energies in Europe'.

[22] Estimations on energy efficiency job benefits are based on data from ACEEE (2008), ACEEE (2011) and Ecofys (2011). Ecofys (2011) is based on the work of ACEEE (2011). ACEEE (2011) estimates a net increase of about 6 jobs per million US$ saved. This would translate to about 60,000 jobs per EJ of saved energy. Multiplying this with the energy savings of 22 EJ in 2030 (the energy saved compared to a reference scenario – PRIMES baseline) results in 1.3 million jobs. ACEEE, 2008. American Council for an Energy-Efficient Economy. American Council for an Energy-Efficient Economy (ACEEE), Washington ACEEE, 2011. Appliance and Equipment Efficiency Standards: A Moneymaker and Job Creator. American Council for an Energy-Efficient Economy (ACEEE), Washington.

The E3ME model projects that compared to the reference case, the 40% GHG scenario would create on the aggregate level of around 0.6 million additional jobs (645,000) and the scenario based on 40% GHG reduction, ambitious explicit EE policies and a 30% RES target could generate 1.25 million additional jobs in a 2030 perspective, compared to the reference scenario. Compared to a GHG target only (GHG 40%) situation, EE policies and a 30% RES target would create 568,000 additional jobs in the EU in 2030. This is depicted in Figure 5 below.

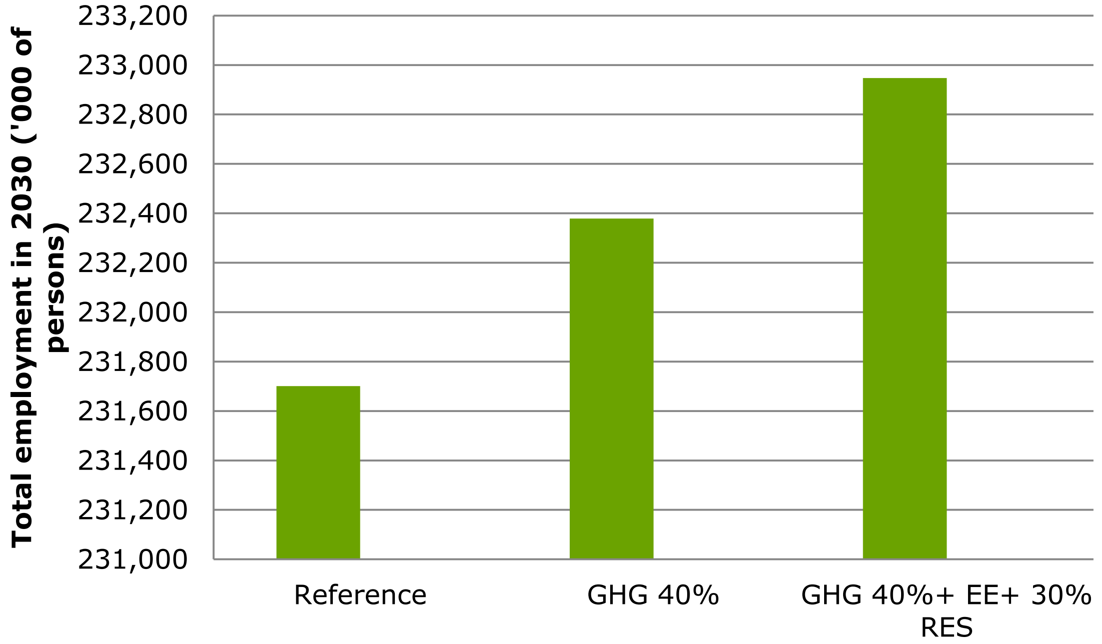

Figure 5. E3ME projections of employment impacts for 2030 compared to Reference of GHG reduction scenario with additional policies for EE and RES, assuming revenue recycling to consumers and energy efficiency and renewable energy investments (x 1000 persons). Source: EC, 2014, Impact assessment on energy and climate policy up to 2030 [SWD (2014) 15] European Commission (EC), Brussels.

Figure 6 below presents the results from the GEM E-3 model, using different assumptions and only focussing on the power sector and energy efficiency, and only on employment effects related to capital investments expected. The results concern total number of jobs per annum in the period 2011-2030. The model projects investments that are equivalent to 750,000 jobs per year in the reference scenario. The additional employment in the two policy scenarios adds up to 219,000 to 304,000 jobs, illustrating the positive impact of both ambitious EE policies and RES developments at the macro level. Compared to a GHG target only (GHG 40%) situation, EE policies and a 30% RES target would create 83,000 additional jobs in the EU in 2030.

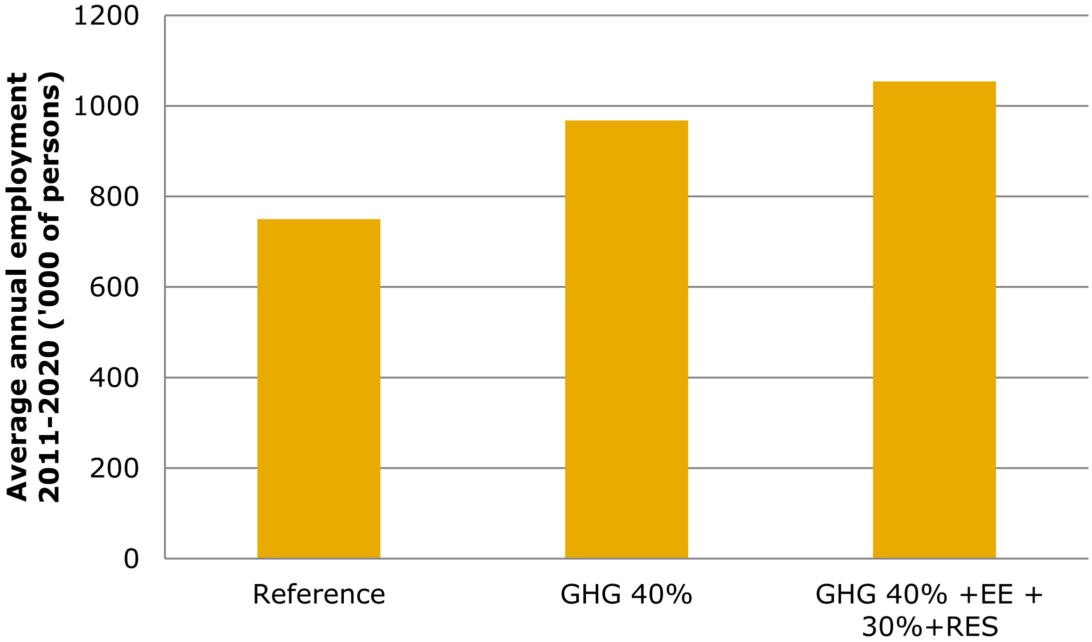

Figure 6 Jobs associated with investments in the power sector and energy efficiency. Average annual employment 2011-2030 related to investments (x 1000 persons). Source: EC, 2014. Impact assessment on energy and climate policy up to 2030 [SWD (2014) 15] European Commission (EC), Brussels.

Higher ambitions

The results in the two above figures illustrate that more ambitious GHG, EE, and RES policies, generally lead to higher net and gross employment compared to a reference or a GHG target-only situation. It is difficult to say whether the Greens/EFA targets will lead to significantly more (net) employment in the EU-28. While we can assume that jobs in the environmental, renewable energy and energy efficiency related sectors will increase, higher EE and RES targets will lead to a reduction of jobs in more conventional energy related sectors. There are no reliable studies available that have assessed the net employment effects of more ambitious GHG, EE and RES targets until 2030.

A study for the European Commission from 2009, led by Fraunhofer ISI, shows that the net employment effects of renewable energy deployment are positive as compared to a reference situation[23]. In case the EU 20% RES target for 2020 is met, this will lead to an estimated net employment of 417,000 to 428,000 additional jobs, depending on which model is used and the assumptions regarding export and trade. When in 2030, a 30% RES share is reached, this will generate between 59,000 and 656.000 additional jobs in the EU-27, also depending on the model used and moderate or ambitious trade assumptions.

The number of actual jobs that are created will depend on a range of factors including the success of deployment and the adoption of measures, industrial and labour policy, ability to take advantage of export markets as well as the multiplier effects of deployment on the rest of the economy. Meanwhile, the shift of jobs from the more conventional industries and energy production to renewable and more sustainable industries is considerable, and runs into millions of people. Also here, the more ambitious Greens/EFA targets have a larger effect than the proposed EC 2030 framework.

[23] EmployRES. The Impact of Renewable Energy Policy on Economic Growth and Employment in the European Union. April 2009. A study for the European Commission DG Energy and Transport. Contract no.: TREN/D1/474/2006

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