Summary of the Impact assessment for a 2030 climate and energy policy framework

Contents

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Overview

a. Drivers of electricity prices

Whilst recognising the impact of renewable energy support schemes on – mainly – the tax component of electricity bills, the Commission's documents all indicate that:

- ⇨ Fossil fuel prices remain a major concern as a key driver of prices
- ⇨ Increased amounts of mature renewables (RES) will have a beneficial effect on costs by limiting fossil fuel imports.
- ⇨ Energy system costs are similar with or without renewable energy targets. Cost savings and increased investment and support costs offset each other.

Figure a.i. Increasing and decreasing cost elements connect to increased renewables deployment

Costs that increase with RES deployment	Costs that decrease with RES deployment
Investment	Fuel
Grid	Energy imports
Support mechanism	CO2 / ETS
	Wholesale electricity
	Pollution/health

b. Jobs and economic growth

All Commission analyses indicate that RES, and in particular wind energy, create significantly more employment and economic growth than conventional energy sources. The capital intensity of RES, and the fact that it does not require energy imports from outside the EU, mean that RES investments create jobs and growth within the EU.

- ⇨ A GHG target alone will not stimulate the same amount of investment in EU economy as a GHG target coupled with RES target.
- ⇨ A RES target will create 568,000 more jobs than a GHG target alone in 2030.

c. Energy dependence

The EU's dependence on energy imports increased by seven percentage points (+15%) between 2000 and 2011. This comes at a huge cost.

- ⇨ The EU's energy trade deficit amounted to €421 billion (bn) in 2012 (3.3% of GDP). Moreover, the EU is a subject to prices set globally on the global fossil fuel markets and this is set to continue.
- ⇨ The trade deficit has increased by 180% in eight years.
- ⇨ Wind energy alone avoided €2.2bn in imported fuel costs in 2010. Electricity from renewable sources avoided over €10bn during the same year.
  Fuel costs avoided due to RES are currently equivalent to the costs of RES support mechanisms. Therefore increasing renewables will increasingly help the EU to reduce the cost of fuel imports.

d. Trade

The EU has a first mover advantage in RES technologies which have a favourable balance of trade, especially wind energy.

- ⇨ Balance of trade in EU wind energy sector was +€2.45bn in 2012.
- ⇨ The EU has 22% more world patents in RES technologies than overall patent applications (39.6% compared to 32.5%).
- ⇨ The EU share of global wind energy patent applications is 55%, 69% more than the EU's overall patent applications.

A. Impact assessment for a 2030 climate and energy policy framework

1) Introduction and scenarios

The European Commission published, in December 2013, Energy Trends to 2050, an update of the PRIMES business as usual scenario last used in 2011 for the Energy Roadmap 2050. The projection, assumes no new energy and climate policy initiatives beyond those already agreed.

This scenario forms the reference scenario in the Commission's impact assessment for a 2030 climate and energy policy. The latter compares policy decisions on setting a greenhouse gas reduction target of 35 or 40% (GHG35 and GHG40) only, to a GHG target and high energy efficiency (EE) measures (GHG+EE) to a GHG target with high EE measures and a renewable energy target of 30% (GHG+EE+RES30) and a RES target of 35% (GHG+EE+RES35).

Scenarios with RES targets above 35% were not taken into account as it was assumed that they would make the Emission Trading System ineffective[1], because the EC deliberately did not want to go beyond 45%GHG emissions reductions.

In all, the impact assessment (IA) considers six Scenarios, two without any enabling policies and four with more ambitious policies. Scenarios with "enabling policies" take into account action on areas important to achieving a long-term transformation of the energy system, such as infrastructure, R&D and social acceptance.

Table A.1: Assessed scenarios

Scenario	Scenario Name	Reduction in GHG in 2030 (vs. 1990)	RES in 2030 (% final energy consumption in 2030)	EE in 2030 (% change vs. 2030 pro)
Reference Scenario	Reference	32.4%	24.4%	-21%
Reference Scenario Setting				
GHG35	*GHG35*	37%	No pre-set target (25%)	No pre-set target (-22%)
GHG40	*GHG40*	40%	No pre-set target (26%)	No pre-set target (-23%)
Enabling Setting				
GHG40	*GHG only*	40%	No pre-set target (26.5%)	No pre-set target (-25.1%)
GHG40/EE	*GHG+EE*	40%	No pre-set target (26.4%)	No pre-set target (-29.3%)
GHG40/EE/RES30	*RES30*	40%	30%	No pre-set target (-30.1%)
GHG45/EE/RES35	*RES35*	45%	35%	No pre-set target (-33.7%)

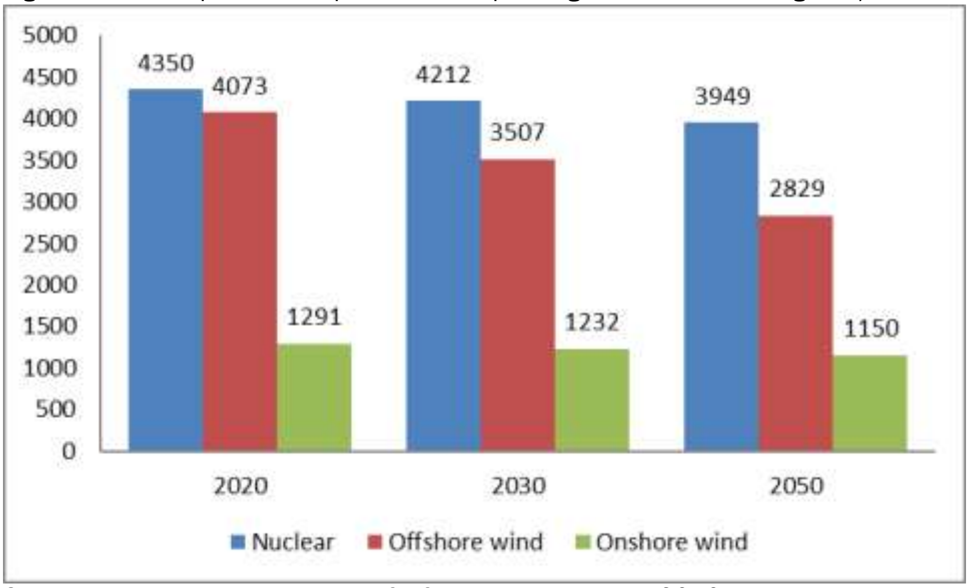
Sources: Impact Assessment for a 2030 climate and energy policy framework and EU energy, transport and GHG emission trends to 2050

The reference scenario also assumes investment costs for all the power generating technologies.

- ⇨ Nuclear costs seem under-estimated
- ⇨ Onshore wind costs are over-estimated. A €/kw level below 1,000 is expected before 2020
- ⇨ Projected decrease in offshore wind energy costs is unambitious and starting from a high assumption.

[1] A scenario driven by very ambitious levels of renewables and energy efficiency, but with a continuation of the current reduction factor in the ETS was analysed but is not evaluated in full detail […], primarily as this approach would result in continuing increases of the surplus of allowances in the EU ETS up to 2030 and therefore seriously undermining the future relevance of the ETS in providing the right incentives for low-carbon investment. P.23 Impact Assessment for a 2030 climate and energy policy framework.

Figure A.1 Development of capital costs for power generation technologies €/kW



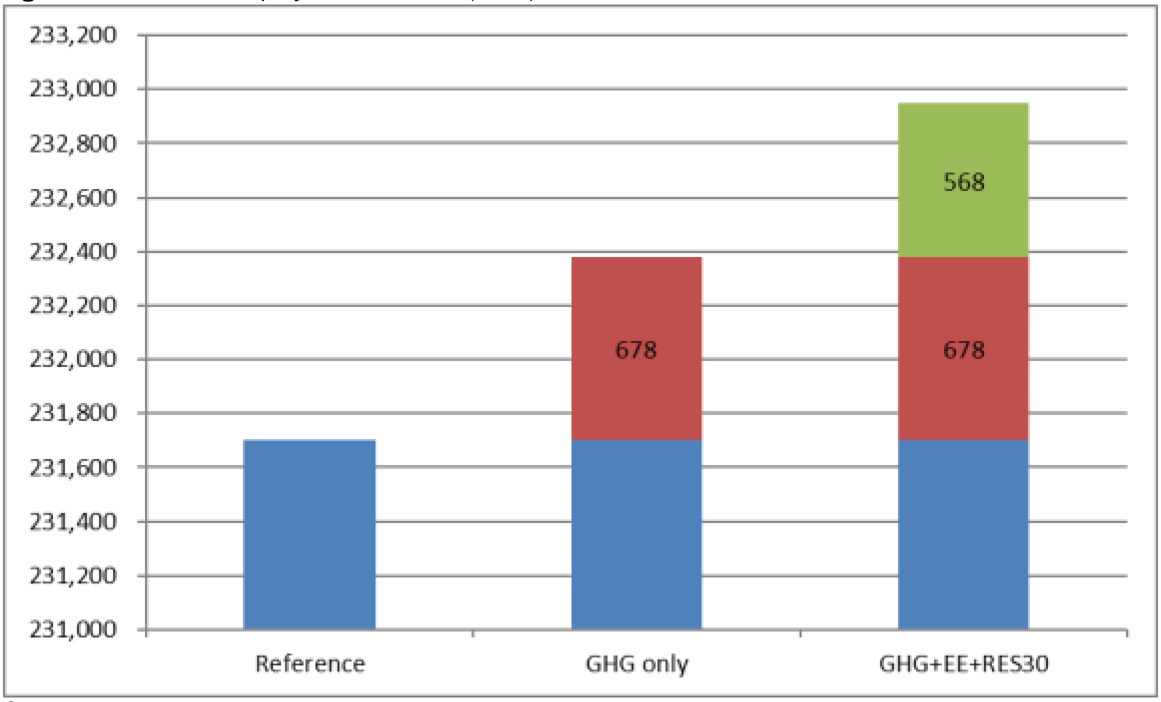
Source: EU energy, transport and GHG emission trends to 2050

2) Employment

Setting RES targets has a beneficial impact on job creation. Renewables are investment intensive and a significant part of the latter is made in the EU. This is particularly the case for wind energy.

- ⇨ Scenarios with a 30% RES target create 1.25 million jobs more in 2030 than the reference scenario and 568,000 more jobs than the GHG only scenario.

Figure A.1: total EU employment in 2030 ('000)



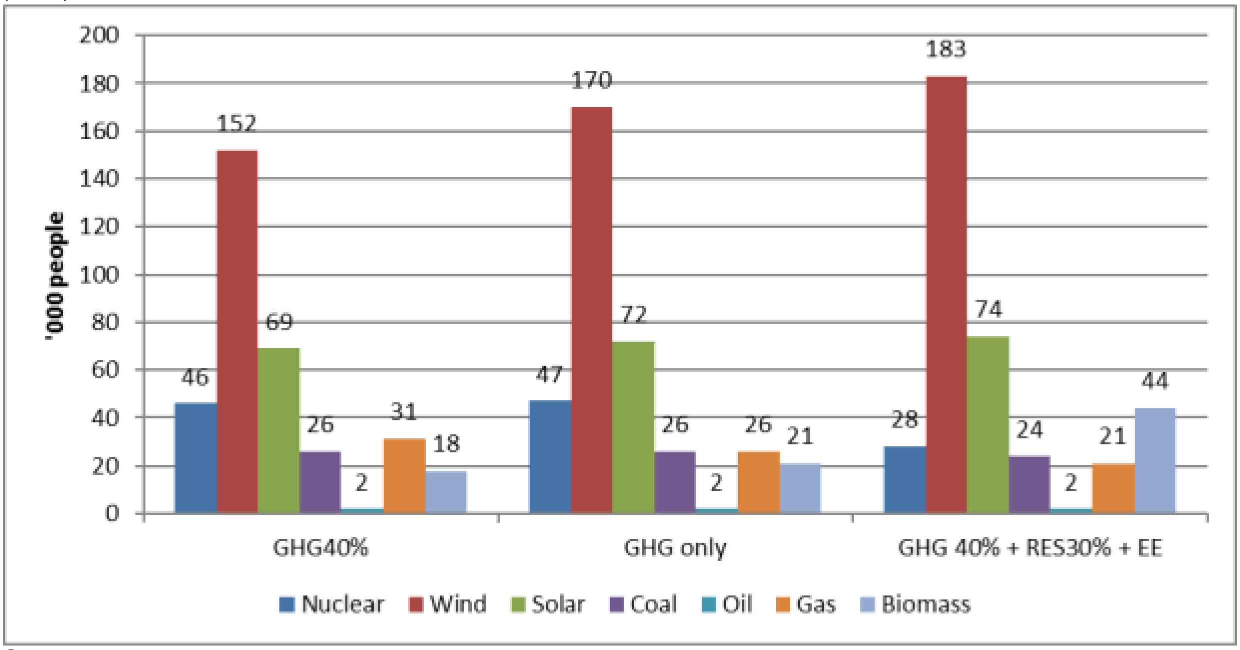
Source: Impact Assessment for a 2030 climate and energy policy framework

In the power sector, renewables - and singularly wind – offer the best prospects for job creation.

- ⇨ Wind energy related jobs grow the most in absolute terms across scenarios between 2011 and 2030
- ⇨ In the reference scenario wind energy increases employment by over 150,000 jobs between 2011 and 2030, 170,000 in GHG only and 183,000 in the RES30 scenario.

⇨ Nuclear energy related jobs grow by 46,000 units between 2011 and 2030 in the reference scenario, by 47,000 in GHG only and by 28,000 in RES35.

Figure A.2: average annual employment related to investment 2011 - 2030 ('000)



Source: *Impact Assessment for a 2030 climate and energy policy framewor*

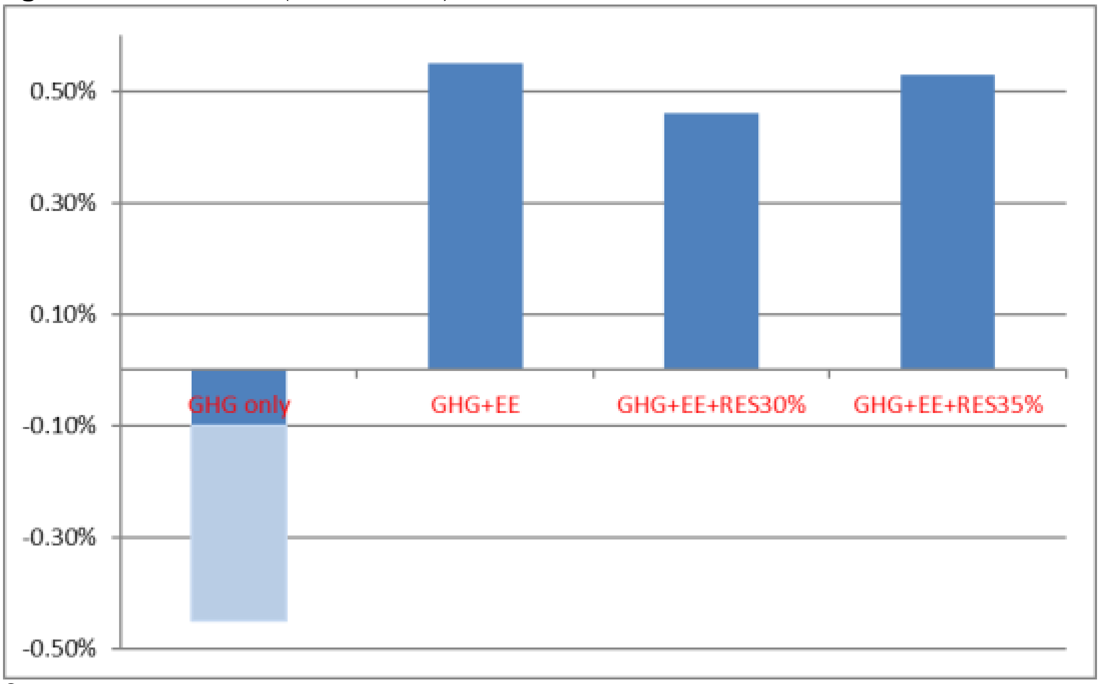
3) **GDP evolution**

Higher levels of efficiency and RES targets has a positive impact on economic growth. The differences between scenarios in terms of impact on GDP are small, but all scenarios with renewable energy targets have greater GDP than the reference scenario. On the contrary, GHG only scenarios have a negative GDP impact.

⇨ The RES30 scenario results in a 0.46% increase in GDP with respect to the reference scenario while RES35 increases GDP by 0.53%.

⇨ The GHG only scenario results in a decrease in GDP, between -0.1 and -0.45% compared to reference

Figure A.3: GDP in 2030 (€2005Trillion)



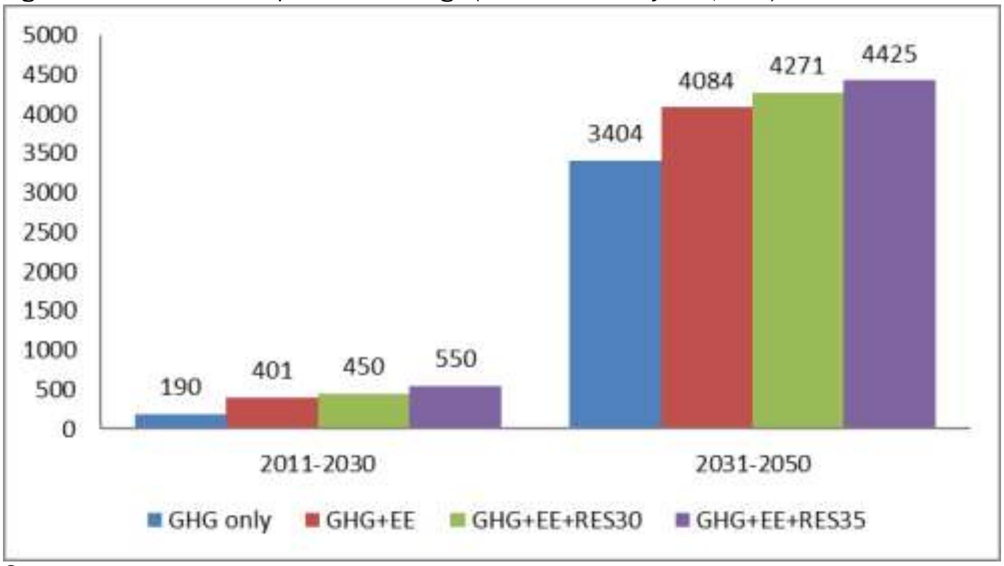
Source: *Impact Assessment for a 2030 climate and energy policy framework*

4) Fossil fuel imports bills

The RES35% scenario delivers savings of €547bn in fossil fuel imports between 2011 and 2030 and of over €4 trillion in the period 2031 to 2050.

- ⇨ A renewable energy target of 30% would save €260bn more on fuel imports compared to a GHG-only scenario
- ⇨ A renewable energy target of 35% would save €360bn more on fuel imports compared to a GHG-only scenario

Figure A.4: Fossil fuel imports bill savings (Cumulative 20 years, €bn)



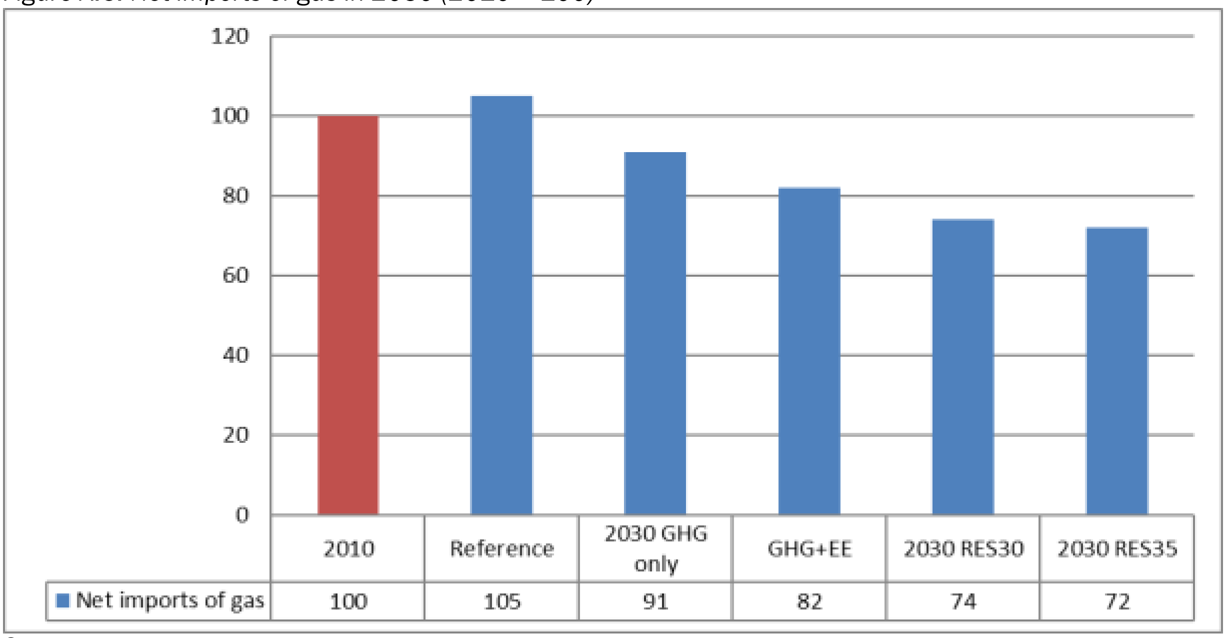
Source: *Impact Assessment for a 2030 climate and energy policy framework*

5) Net imports of gas

Higher levels of efficiency and RES targets decreases the imports of gas compared to both the reference and a GHG-only approach.

- ⇨ The reference scenario results in 5% more gas imports in 2030 compared to 2010
- ⇨ The RES30 scenario results in 26% less gas in 2030 compared to 2010, while the GHG-only scenario results in only 9% less

Figure A.5: Net imports of gas in 2030 (2010 = 100)



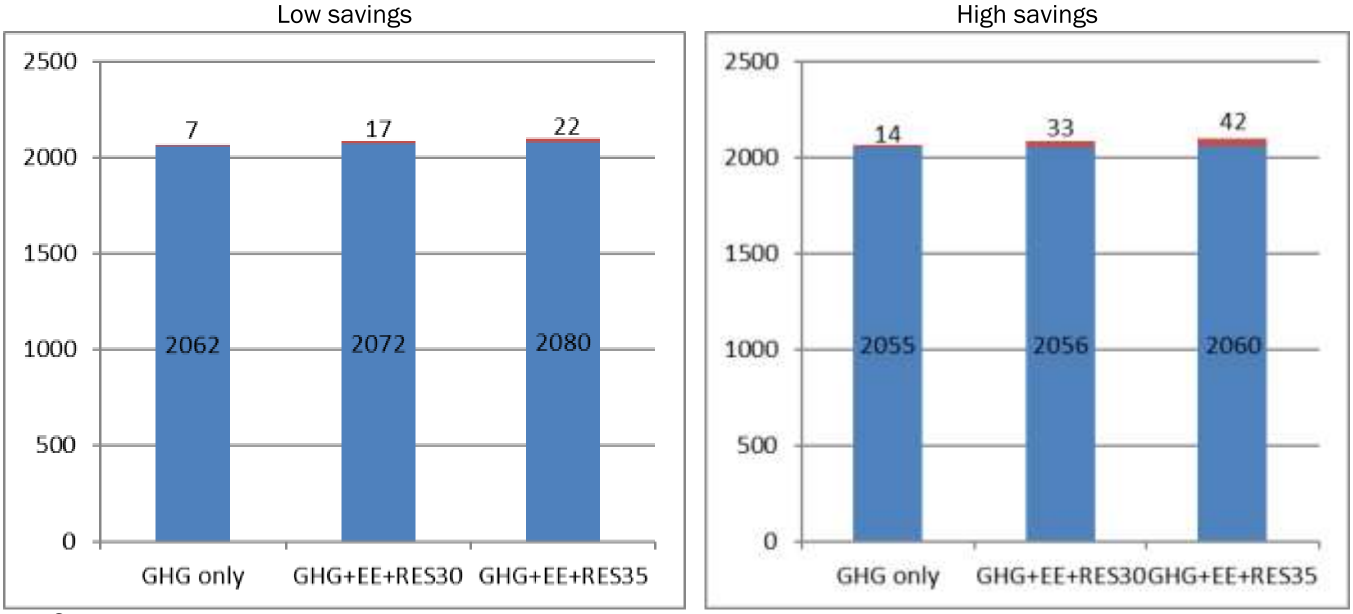
Source: *Impact Assessment for a 2030 climate and energy policy framework*

6) Pollution costs and energy system costs

Energy system costs are similar in all decarbonisation scenarios. However, factoring in reduced pollution associated costs (mainly health), the scenarios with RES targets have the same or lower costs than the GHG only approach.

- ⇨ Assuming the lowest pollution cost savings, €17bn are saved per year in the EU in the RES30 scenario, compared to €7bn savings in the GHG only scenario, making the RES30 scenario less than 0.5% more expensive.
- ⇨ Assuming the highest pollution cost savings, €33bn are saved per year, making the RES30 scenario equal in cost with the GHG only scenario.

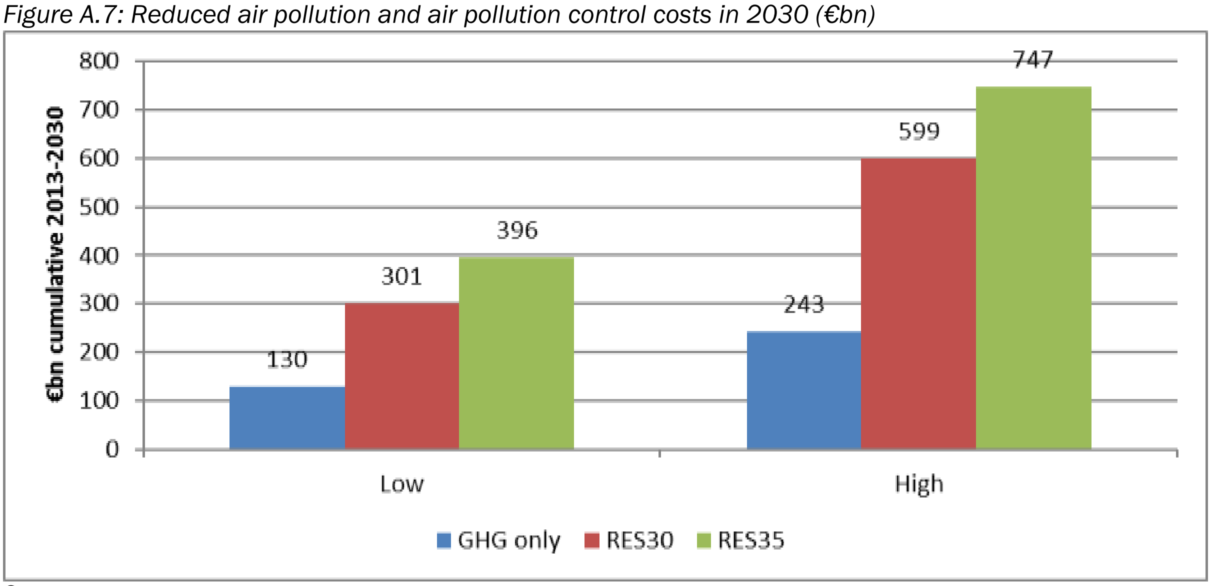
Figure A.6: Total annual system costs in 2030 minus saved impacts on air pollution control costs (in red) in 2030 (€bn) – low and high savings



Source: Impact Assessment for a 2030 climate and energy policy framework

- ⇨ Scenarios with a RES target avoid significantly more air pollution costs than a GHG only scenario (from a low of €301bn between 2013 and 2030 with a RES target of 30% to a high of €747bn with a 35% RES target).
- ⇨ RES35 Scenario reduces the costs of air pollution and air pollution control by €1,143bn in the period 2011-2050, almost €30bn per year.

Figure A.7: Reduced air pollution and air pollution control costs in 2030 (€bn)



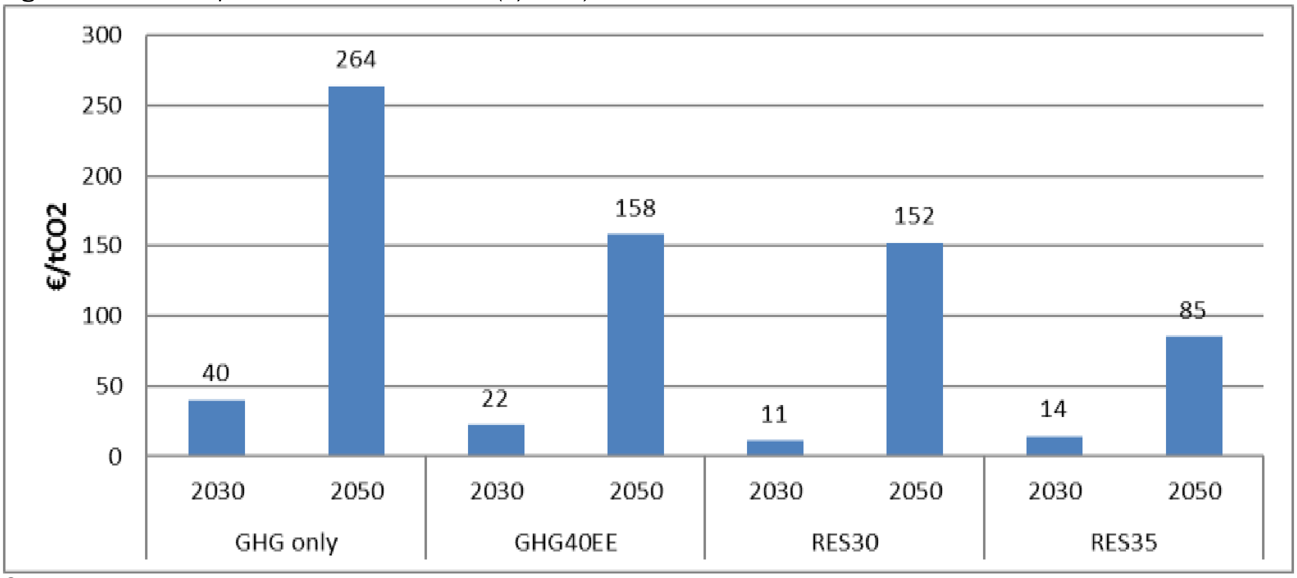
Source: Impact Assessment for a 2030 climate and energy policy framework

7) **Carbon price**

CO_2 price is significantly lower in scenarios with RES targets compared to the GHG only scenario.

⇨ CO_2 price in the RES35% scenario is 36% less in 2030 than the GHG only scenario and 46% less in 2050.

Figure A.8: Carbon price in 2030 and 2050 (€/tCO_2)



Source: Impact Assessment for a 2030 climate and energy policy framework

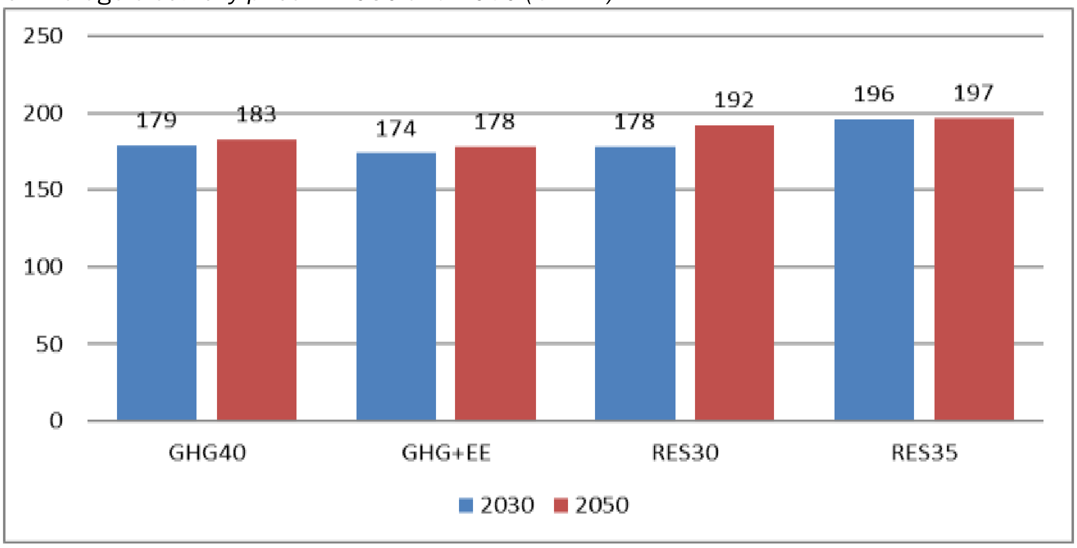
8) **Electricity prices**

All scenarios with targets increase electricity prices by 30% to 33% between 2011 and 2030. The RES35 scenario, however, increases them the most (46%). However, between 2031 and 2050, in the RES35 scenario electricity prices stabilise whereas in the other scenarios they keep increasing.

⇨ A scenario with a 30% RES target increases average electricity prices by less than a GHG only scenario.

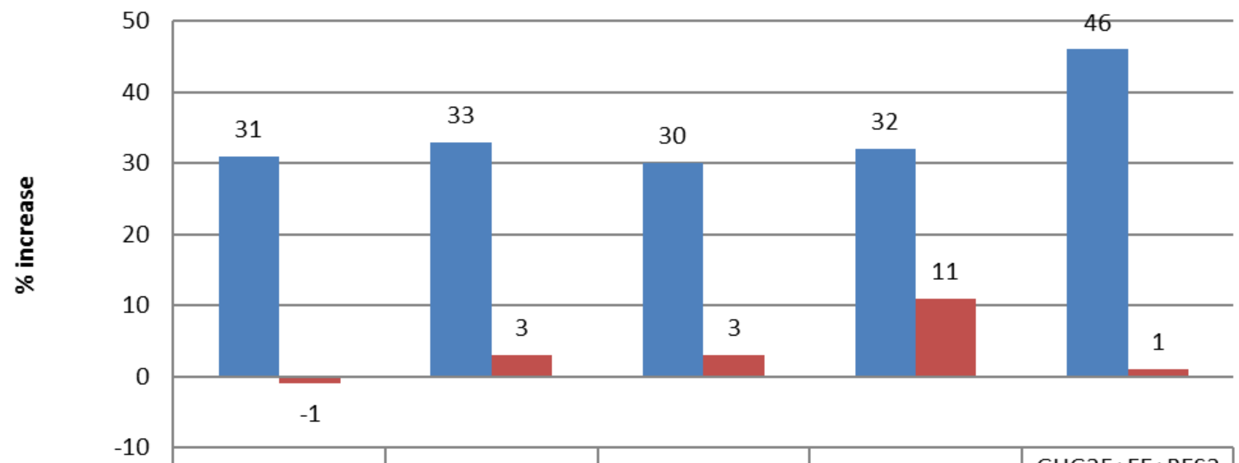
⇨ A scenario with a 35% target increases electricity prices to 2030 after price increases are stable, whereas they continue rising in all other scenarios.

Figure A.9: Average electricity price in 2030 and 2050 (€MWh)



Source: Impact Assessment for a 2030 climate and energy policy framework

Figure A.10: Average electricity price increases 2010-2030 and 2030-2050 (%)



	Reference	GHG only	GHG40+EE	GHG+EE+RES30	GHG35+EE+RES35
2011-2030	31	33	30	32	46
2030-2050	-1	3	3	11	1

Source: *Impact Assessment for a 2030 climate and energy policy framework*

B. Communication on Energy prices and costs in Europe

1) Introduction

This short communication from the Commission is based on the DG ENER document "The cost of energy in Europe" (see below). It is, therefore, a summary of the latter's findings.

2) Key points

- ⇨ Fossil fuel prices are drivers of electricity bills and this will continue post-2020.
- ⇨ Household electricity bills increased by 4% per year on average in EU between 2008 and 2012.
- ⇨ Industry electricity bills increased by 3.5% per year on average in EU between 2008 and 2012.
- ⇨ Tax component rose the most over the period, followed by the grid component.
- ⇨ Energy component of bills (wholesale price) has decreased.
- ⇨ Renewable energy taxes represented 7% of household bills on average to over the 5 year period and 10% to industry bills before exemptions.
- ⇨ When the merit order effect of RES is factored in, the net effect of hydro, wind and solar can be to reduce prices (such as in Spain and Ireland but not in Germany) as the decreased cost of the energy component of bills should pass through to final consumers.
- ⇨ Market liberalisation and market coupling between Member States has had beneficial effect on bills.

3) Outlook

- ⇨ Electricity prices will carry on rising to 2020
  - o Increase in price of fossil fuels;
  - o Necessary investment in infrastructure and generation capacity.
- ⇨ Beyond 2020 prices stabilise than decrease
  - o Fossil fuels are replaced by renewable energy;
  - o Capital costs decline;
  - o Carbon price rises.

4) Conclusions

- ⇨ Increased bills driven mostly by taxes and grid costs, but can be offset with lower energy component in properly functioning markets.
- ⇨ Commission to push for completion of internal energy market in 2014.
- ⇨ As global fossil fuel prices cannot be influenced by EU (EU is price-taker and will remain so), EU must diversify its energy supply and gas supply routes and promote energy efficiency.
- ⇨ Policies financed via energy taxes must be done so as effectively as possible. Member States should review their practices in light of state aid guidelines.

C. The cost of energy in Europe (DG ENER)

1) Introduction

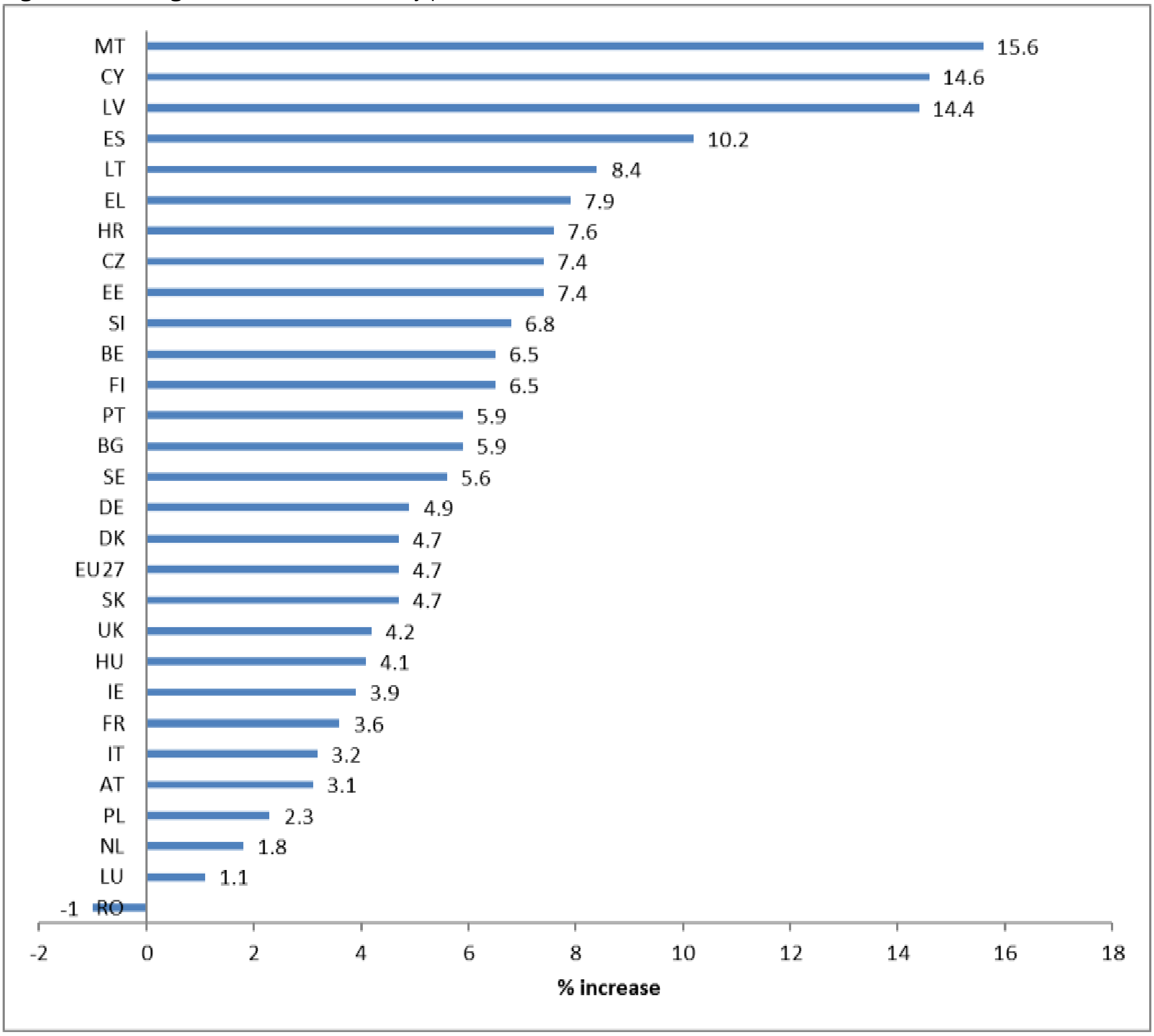
DG ENER has conducted an analysis of energy costs and prices across Europe to determine to what extent high energy prices are hampering the EU's competitiveness.

The report breaks down energy price components (cost of production, grid costs, taxation, ...) to determine main drivers. The study analyses the relationship between wholesale and retail prices of energy.
The study also compares energy prices in Europe with other areas of the world and examines the possible macroeconomic consequences of further cost increases.

2) EU electricity prices

- ⇨ Electricity prices vary considerably across Europe, much more so than prices of motor fuels. However, the degree of dispersion of electricity prices is less than that of labour costs.
- ⇨ Between 2007 and 2012 nearly all EU Member States have seen increases in the retail price of electricity of 5% a year on average. In Romania, electricity prices have decreased over the period.

Figure C.1: Average annual retail electricity price increase in EU between 2007 and 2012



Source: The cost of energy in Europe, DG ENER

- ⇨ Average retail price increase excluding VAT has been of 4% per year in the EU.
- ⇨ For industrial users, electricity price increases vary more widely across the EU, with decreases over the period in Hungary, the Netherlands and Romania.
- ⇨ However during the same period, wholesale prices decreased by 35% to 45%.
- ⇨ In 2012 51% of the EU's households have regulated prices, down from 57% in 2008.

For households, in 2012, the energy component in bills varied between 18% (DK) and 82% (MT) of the total. For industrial consumers, it ranges from 39% (DK) to 88% (MT).

Table C.1: Range of energy component of household and industry electricity bills in EU Member States (2012).

	Lowest	Highest
Household	18%	22%
Industry	39%	88%

Source: The cost of energy in Europe, DG ENER

3) Conclusions evolution of price elements 2008 to 2012

- ⇨ Taxes and levies increased by the biggest amount for both industry and households. For households on average they account for 30% of final price, up from 26% in 2008.
- ⇨ Network costs increased by 30% for industrial consumers and 18.5% for households.
- ⇨ Energy element was stable for households and down for industrial consumers.
- ⇨ Countries highly dependent on gas and imports, power trades at a premium price on wholesale market (UK and Italy cited as examples).

4) Main messages

- ⇨ Europe is price-taker on global fossil fuel market (oil, gas and to a lesser extent coal).
- ⇨ Europe is an increasingly import-led coal market.
- ⇨ Since 2005 wholesale gas prices have increased across the world (except N. America).
- ⇨ Industrial electricity prices have been fairly stable between 2009 and 2012.

D. Energy Economic Developments in Europe (DG ECFIN)

1) Introduction

DG ECFIN prepared a study to assess how energy costs impact EU heavy industry's global competitiveness. The study looks at industry competitiveness, main drivers of electricity, fossil fuel and carbon prices and, finally, trade in energy equipment.

Many of the calculations and findings were used to complete DG ENER's study on the cost of energy in Europe (see above).

The study substantially investigates renewables and shows their positive impacts on the EU's economy, despite a somehow biased interpretation of its own results in the Executive Summary

2) Findings on EU industrial competitiveness

Despite increases in energy costs, EU industry has low Real Unit Energy Costs (RUEC)[2] compared to its main trading partners (US, Japan, China, Russia).

- ⇨ EU industry has better energy intensity performance.
- ⇨ EU industry improves costs through use of global supply chain.

Higher energy costs have, thus, incentivised EU industry to become more efficient than in other world regions. Energy price increases have, therefore, been offset so far.

- ⇨ Industry value-added performance is decoupled from its energy consumption.
- ⇨ EU-US goods balance is positive for EU.

EU has highest real energy prices.

- ⇨ Heavily reliant on energy imports making EU vulnerable.
- ⇨ Energy price highly linked to global oil price fluctuations.
- ⇨ Majority of gas is supplied through long-term contracts indexed to the price of oil.

3) Findings on electricity prices

Electricity bills rise faster than the cost of producing energy. The energy component of bills is, therefore, decreasing.

- ⇨ Retail electricity prices have risen for both industry and households, respectively, +50% since 2004.
- ⇨ Wholesale prices have increased by 23% since 2004.
- ⇨ Taxes are the component of bills that have increased the most. In the 2008 to 2011 period they increased by 43% for households and 67% for industry.
- ⇨ In absolute terms, taxes and levies are a bigger part of household bills than industry bills, where supply costs have a more important share.

Main drivers of electricity prices are

- ⇨ Oil prices. However this has diminished slightly since 2008 mainly driven by price regulation. Wholesale prices are more strongly linked to oil price fluctuations.
- ⇨ Market structure. Market liberalisation is observed to have positive effect on retail electricity prices.
- ⇨ RES generation also increases electricity bills, but to a lesser extent, and not for heavy energy consuming industries which are mostly exempted in the EU.
  Solar thermal, photovoltaic and wind were calculated separately, but then aggregated into one variable. More detailed analysis shows that wind is not the main driver. This is covered in the document by the concept of "immature RES technologies". The EWEA/Deloitte analysis of drivers of electricity prices, carried out using a similar methodology as the DG ECFIN

[2] RUEC measures the amount of money spent on energy sources to obtain €1 of value added.

document, also concludes on wind energy's smaller impact on bills compared to other RES technologies. This can be explained in part by support mechanisms designed in such a way that over-compensated[3] solar PV by not taking its rapidly decreasing installation costs into account.

- ⇨ ETS did not have an effect on prices due to very low carbon price.

Wholesale price effects on retail prices are negligible.

- ⇨ Given sufficient competition, the merit order effect of renewables drives down wholesale prices which should drive down the energy component of retail prices.
- ⇨ At low levels of penetration RES support schemes outweigh merit order effect.
- ⇨ At higher deployment levels, such as wind energy, the merit order effect outweighs effect of support scheme.

4) Findings on drivers of carbon prices

RES policy and carbon policy are more effective in reducing CO_2 emissions than a carbon policy alone. The interaction of both policies reduces the carbon price. *The executive Summary presents RES as a main factor in reducing the carbon price, in contradiction with the finding in the document that the main drivers of the carbon price decrease were the economic crisis and international credits, which were not foreseen in the original 2008 proposals[4].*

A perverse effect of the interaction between the two policies is to increase CO2 emissions. However the literature is contradictory and further evidence is needed[5].

Carbon price is at historic low and decoupled from other fuel prices, particularly gas and coal.

- ⇨ Reduction in energy demand due to economic downturn,.
- ⇨ Large-scale auctioning of free allowances.
- ⇨ International offsets.
- ⇨ Regulatory decisions.

5) Findings on equipment trade

Support for renewable electricity generation makes up 7.2% of end-user electricity price for industry and 5.4% for households.

- ⇨ PV has high generation costs, but with strong decrease over last years.
- ⇨ Onshore wind is more expensive than coal generation but can compete in favourable local conditions.
- ⇨ Annual subsidies to renewable energy in EU amounted to €36bn in 2011, however no references are available for this figure. CEER estimates €27bn in 2010 for electricity only and IEA between €27bn and €47bn for all renewables including heating and transport.
- ⇨ Weighted this amounts to an average support level of €9.3/MWh compared to average end-user price of €128/MWh (industry) and €173/MWh (households): 7.2% and 5.4% respectively.

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[3]Several Member States were not quick enough to adjust their support mechanisms to the rapid decrease in RES technology costs, especially solar PV. This has sometimes led to overcompensation, a rush for investment, and an unnecessary burden on public budgets or consumer electricity bills.

This is the result of poor national policies not of EU RES targets. Support mechanisms can be designed dynamically and lead to greater market integration as technologies mature; in Denmark, with a 30% wind power penetration, support for renewables only makes up for 3.2% of consumers' power bills, and industrial prices for electricity are the 7th lowest in the EU. In the UK, less than 7% of rises in fuel bills since 2004 was due to renewable policies, while 60% was due to gas[3].

[4] The economic downturn is the main factor having led to the surplus, reducing production in heavy industry sectors as well as electricity demand, and thereby reducing emissions. Additionally, access to international credits flooded a market where demand for EUAs was already too low creating the current surplus estimated at 2,200Mt.

Renewables (RES) did reduce emissions, but did not significantly affect the ETS surplus:

- The ETS design foresees the achievement of the 20% RES target by 2020, so that only development above the target trajectory can increase the surplus
- Renewable electricity development in 2012 was slightly higher than foreseen (1.74% above trajectory), avoiding an additional 39 $MtCO_2$.

[5] An EWEA analysis of part-loading gas power plants found that increased emissions due to inefficiencies of ramping do not offset the benefits of reduced emissions from wind energy deployment.

- ⇨ In 2011, support levels for onshore wind were too high in IT, RO, SK and the UK.

Renewables create growth and jobs. They are more jobs intensive than conventionals per MW installed, per MWh produced and per euro invested.

- ⇨ Employment in renewables is expected to rise from 1.2 million people in 2011 to 3 million people in 2020 (1.2% of total employment in EU).
- ⇨ 270,000 of the 1.2 million (22.5%) jobs were in wind energy.
- ⇨ Net employment effect of the RES sector is +300,000 to 400,000 jobs.
- ⇨ Of the 3 million jobs in 2020, 1.2 million will be in installation and manufacturing (40%).

Renewables have increased trade flows in components and equipment. The EU-27 has built a strong position in wind energy components.

- ⇨ The EU has negative trade flow in PV components.
- ⇨ In 2012 the EU had a surplus of €2.45bn in wind components.
- ⇨ The EU has 39.6% of world patent applications in RES technologies compared to 32.5% of overall patent applications, 22% more.
- ⇨ The share of wind energy patent applications was 55%, 69% more than the EU's overall patent applications.

6) Findings on avoided fuel costs

The EU's energy import dependency was 54% in 2011 rising from 47% in 2000. Renewables help the EU avoid fuel imports. **In 2010 avoided imported fuel costs offset the entirety of support scheme expenditure.** *The Executive Summary argues that fuel cost savings are "still too low", suggesting that further deployment of RES would be increasingly beneficial in this respect.*

- ⇨ In 2012 the EU's energy trade deficit amounted to €421 bn (3.3% of EU GDP). The deficit was only €150 bn in 2004 (180% increase in 8 years).
- ⇨ New Member States have a larger energy trade deficit than Western European Member States, 5% of GDP or more on average.
- ⇨ In 2010 RES-e avoided €10.2bn in imported fuel costs, of which €2.2bn from wind alone.
- ⇨ New wind and solar capacity that came online in 2010 saved €460 million in imported fuel costs, and will save €7.5bn over their 20 to 25 year life span.
- ⇨ RES overall avoided imported fuel costs of €30bn in 2010, covering almost the entirety of expenditure in support schemes.
- ⇨ Security of supply increases with RES deployment.