Waters Wye Associates

The Cumulative Impact of Climate Change Policies on UK Energy Intensive Industries – Are Policies Effectively Focussed?

A summary report for
The Energy Intensive Users Group
and the Trades Union Congress

Prepared by Waters Wye Associates

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Executive Summary

The sponsors of this report, the Energy Intensive Users Group (EIUG) and the Trades Union Congress (TUC), both firmly support the shift to a low carbon economy as an essential response to the challenge of climate change, and believe that the energy intensive industries are vital to the success of this transition. The government has explicitly recognised the need to rebalance the economy[1], away from financial services back towards manufacturing. It is evident that this needs to be done within the context of a low carbon transition. To enable energy intensive industries to participate in the creation of an efficient low carbon economy, they require policies that underpin equitable burden-sharing for the associated costs between all sectors; domestic, commercial and industrial.

The purpose of this report is to open an evidence-based and informed discussion on the effects of climate change policies on the UK's energy intensive sectors, such as steelmaking, chemicals and ceramics. Both employers and trade unions in these manufacturing industries have a major interest in securing their future within a low carbon economy, both to protect and promote reasonable terms and conditions of employment for the long term, and achieve a "*just and fair transition*"[2] for these industries who make a significant contribution to the UK's economy.

As tax structures stand today, energy intensive industries are carrying the greatest burden of polices to tackle climate change and reduce energy use. In future, the impact will become even more disproportionate and intense. It has been suggested that the cumulative impact of these policies has not been fully understood by government and it is essential that an assessment should be made as to whether the UK's climate change policies are appropriately balanced; in that the sectors which have the potential to underpin a lower carbon economy and reduce the UK's energy use are not commercially compromised by the policies aiming to deliver one.

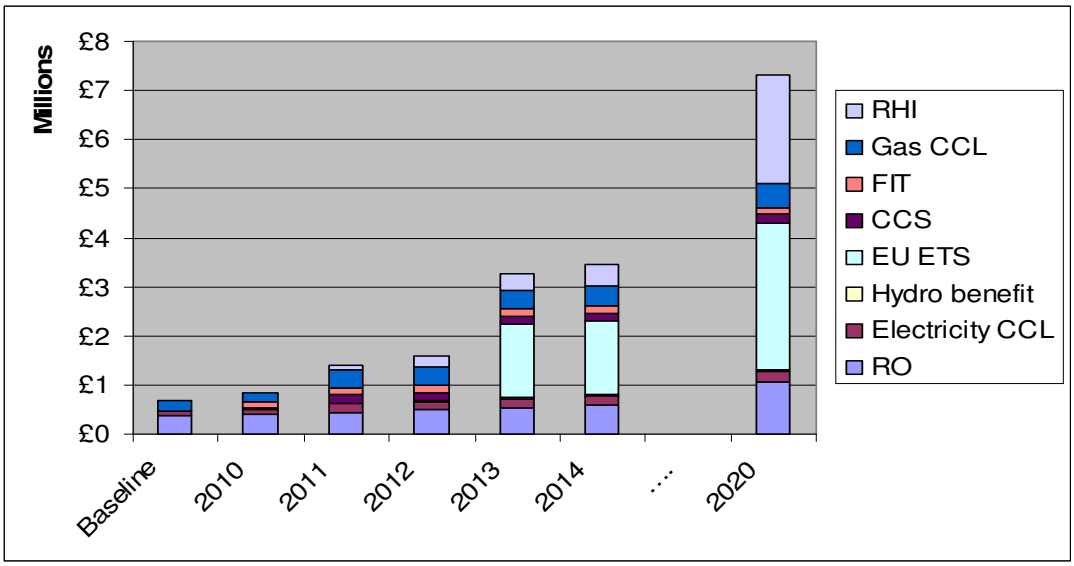
This report shows that the cumulative impact of all climate change policies is significant, especially on energy intensive sectors (see Graph 1). It also illustrates that if the government continues to simply add one energy or carbon reduction levy after another on to the energy intensive sectors then the risk is that these industries will no longer be able to compete internationally and will simply cease to operate in the UK. Facing this burden in the UK, some sectors are already proving unable to reinvest in their infrastructure due to the increased energy tax burden in the UK and will consequently "wither on the vine" through an inability to produce cutting edge products or compete with foreign producers. In either scenario, "carbon leakage"

[1] David Cameron's speech of 28 May 2010: Transforming the British economy: Coalition strategy for economic growth

[2] TUC publication: A Green and Fair Future: For a Just Transition to a Low Carbon Economy

will result: the loss of investment, jobs and carbon emissions to competitors, some may have fewer controls on CO_2 emissions or regimes that better protect energy intensive sectors from these tax burdens.

Graph 1: Cumulative impact of climate change policies on an energy intensive user's costs



Source: Waters Wye Associates

Graph 1 summarises the cumulative tax burden, without the cost of delivered energy, from the levies/taxes identified as relating to climate change policy in the UK. These are based on a "representative[3]" energy intensive company using a stable level of gas and electricity demand and adding the projected tax increases to the bills. The increase in EU ETS costs is driven by an assumed increase in the price of allowances, but the majority of the tax burden is directly from UK government designed policies.

Energy intensive sectors - iron and steel, aluminium, cement and lime manufacture, pulp and paper making, basic inorganic chemicals, and nitrogen fertilisers – together employ an estimated 225,000 workers[4], accounting directly for about 1% of UK GDP (some £15 billion). Many of them are based in regions of relatively high unemployment and their continued operations are vital to the economies in which they are based. They also provide raw materials to other sectors of the economy such as construction, automotive, aerospace, food and packaging. Therefore any increases in costs that they try to pass through results in increasing costs further down the supply chain; ultimately increasing prices, and thus inflation, and making UK produced goods less competitive.

[3] See chapter 2
[4] Energy Intensive Industries, TUC, November 2009

If these sectors do not remain in the UK, future UK demand for energy intensive products will be met by imports from countries with less hostile fiscal environments at the expense of UK jobs, economic growth and tax revenues. Of course, there are additional downsides to increasing our reliance on imports: foreign manufacturing methods may not meet the environmental standards employed in the UK; and the transportation of products will generate additional emissions per unit of demand. Investment decisions by multinational companies are being made now for projects to be delivered in the next few years.

Energy intensive industries are also interlinked, for example the production of steel, glass and many chemicals use industrial gases; in turn, industrial gases productively use some by-products from chemicals. Overall, energy intensive sectors have the biggest incentive to be efficient as controlling energy costs are vital to their long term profitability. Energy is often their largest production cost and is thus at the heart of their profitability. The firms participating in this study report that they have invested in energy efficient technologies and work processes. They have for a long time argued that they require secure energy supplies at internationally competitive prices and this report highlights that they are instead facing uncertainty and rising energy bills.

Energy intensity is not bad for the environment, energy inefficiency is. The government's policies do not target energy inefficiency so much as the amount of energy used, and they fail to recognise that many energy intensive products have a low life cycle carbon footprint, mainly due to their durability and recyclability. Energy intensive sectors, such as steel, chemicals and ceramics provide many of the materials and products that are at the heart of an equitable transition to a low carbon economy: sustainable products; recyclable products; and products that go to make the low carbon generation and energy efficient homes for the future; as well as providing many high quality jobs and tax revenue. In addition to creating the raw materials for wind farms and nuclear reactors, they help UK customers reduce their energy use by providing homes with energy efficient glass, insulation and fertilisers to help grow carbon absorbing trees and crops.

Companies participating in this study reported increasing reluctance by their owners to commit to any investment in the UK given not only the scale of climate change costs, but the ongoing uncertainty surrounding the climate change regime and its impact on energy prices. The Renewable Heat Incentive (RHI) is due to come in April 2011, but the details of the scheme are unknown. Likewise uncertainty surrounds EU ETS III. Capital intensive industries need time to plan investments and to respond to policies where they can.

This report has been prepared at the request of the Energy Intensive Users Group (EIUG) and the Trades Union Congress (TUC). Major companies have participated in this study. They are:

- Corus UK Ltd
- GrowHow UK Ltd
- Sheffield Forgemasters
- BOC Ltd
- Ibstock Brick Ltd
- Dudson Ltd
- Lucite International
- RioTintoAlcan
- Iggesund

Based on the data provided by these companies, WWA has estimated the increase in overall energy bills, including all of the climate change policies that attach to energy bills, along with the EU ETS III exposure that companies will directly face, is as follows:

- WWA forecast that the impact of the various electricity based charges will increase total electricity bills by between **15% and 22% by 2020.** This does not include the costs of EU ETS phase III.

- WWA forecast that the increase in total gas bills resulting from these schemes will be between **20% and 22% by 2020**. Again, this does not include the costs of EU ETS phase III.

- The forecast increase in the total energy bill, taking electricity, gas and emissions reductions schemes together is projected to be between **18% and 141%.** These figures include the costs of EU ETS phase III.

Contents

Recommendations

From the analysis undertaken in this report WWA would recommend that the government must take action to:

- Examine the balance of climate change policies between industry and other sectors of the economy with the aim of ensuring that the industries needed to achieve an equitable transition to a low carbon economy are encouraged to invest in the UK;
- Review the impacts of climate change policies on energy intensive sectors as a specific group;
- Clarify policies such as the Renewable Heat Incentive (RHI) and European Emissions Trading Scheme (EU ETS) benchmarks, so that intensive users can plan investment against a more stable economic background;
- Assess the contribution that products produced by the energy intensive sectors will make in moving the UK towards becoming a low carbon economy;
- Ensure that in future all climate change policies are accompanied by impact assessments that look at the **cumulative** effect of all related policies on the intensive energy users as a discrete sector;
- As government contemplates more ambitious policies for 2020 and beyond, they and the European Commission must assess the tax burden, as well as the employment and investment consequences of current and future policy; and
- The government should undertake a full cost benefit analysis of this broad sector to assess to better understand the direct impact on the companies, employment and GDP benefits to the UK and its regions. The Commission also needs to understand the wider economic impacts of policies it designs.

1. Rationale for the study

This study has been commissioned by the Trades Union Congress (TUC) and the Energy Intensive Users Group (EIUG). Both sponsors of this study firmly support the shift to a low carbon economy as an essential response to the challenge of climate change, but recognise that policies must aim to alter behaviour where it is most economic to do so. The EIUG member companies and the TUC believe that the intensive energy using sectors in the UK, such as steel, chemicals and ceramics, are vital to the UK in its transition to a low carbon economy. Furthermore, sourcing these products from the UK will limit emissions resulting from the transport of imports from overseas suppliers as well as adding value to the UK economy.

Being energy intensive does not equate to being bad for the environment. For example, wind turbines - which are already making a significant contribution to the UK renewable generation portfolio - are manufactured largely from steel (which uses industrial gases in its production) and carbon fibre made with ammonia, glass and aluminium. Wind farms are installed on platforms of cement. Many energy intensive products go into light weight vehicles, solar panels and efficient light bulbs, as well as the cables that deliver the energy used in making the equipment the UK needs to become low carbon. The UK cannot produce low carbon energy or consume energy more efficiently without energy intensive products.

EIUG and TUC are concerned that the aggregate effect of raising the costs of energy to these essential UK industries will ultimately make them uncompetitive, forcing production offshore and increasing the UK's reliance on imports of energy intensive products. Not only will this have serious economic consequences, with lost revenue and jobs, but environmental ones too. A policy that may well drive the leakage of both jobs and CO_2 emissions does not represent an equitable transition to a low carbon economy, but a short cut to hitting targets by removing the largest energy users rather than sharing the burden of policies on the sectors that use energy most inefficiently (e.g. transport and housing).

The TUC share the EIUG's concerns as these energy intensive sectors are important national or regional employers, providing direct and indirect employment. Employment in these sectors generally comprises skilled, relatively well paid workers, with many longstanding union recognition agreements. Many plants sit at the heart of the communities in which they operate and their futures are vital to their local economies. As an example, analysis of the impacts of the proposed shutdown of the Corus plant in Teesside demonstrates the economic benefits of the manufacturing sector: a manufacturing job in the steel and chemical industries contributes around £70,000 per employee to the region's gross value added, whereas a job in warehousing contributes £30,000 an employee. *"If the gap in economic performance of the Tees Valley and the UK is to narrow, then the*

retention of manufacturing jobs in steel, engineering and the process industries is essential".[5]

The rationale for the study was twofold:
Estimate the cumulative impact of climate change polices on business costs.
Estimate the effect of the policies specifically on energy intensive companies.

The policies classed as being "climate change policies" are:

- the Renewables Obligation (RO);
- the Climate Change Levy (CCL);
- the Assistance for Areas with High Electricity Distribution Costs (formerly known as "Hydro Benefit")
- the EU emissions trading scheme (EU ETS);
- the Renewable Heat Incentive (RHI);
- the Carbon Capture and Storage (CCS) levy;
- the Carbon Reduction Commitment (CRC); and
- the feed in tariff (FIT).

The focus of the analysis has been to estimate the **cumulative** effect of all climate change policies on the energy related spend of intensive energy using sectors over the coming decade. The work has been based on data provided by energy intensive companies on their energy usage and emissions profiles. The methodology used by WWA is outlined in chapter 5. The report's key aim is to illustrate the scale of the costs that arise from these policies.

The government is to be commended for its many and detailed impact assessments on each policy aimed at achieving a low carbon economy. However, the TUC and EIUG are concerned about the **cumulative** effect of all these policies. While each impact assessment lists other climate change policies that aim to reduce energy use or lower greenhouse gas emissions, focus has been mainly on the effect on domestic customers. Less attention has been given directly to industrial companies and none draw comparisons between individual sectors such as energy intensive sectors and the retail sector. The effect of climate change policies on a supermarket - where absolute energy bills may be large but as a proportion of overall costs are small - is much less than the effect on energy intensive businesses.

The government needs to think urgently about how to strike the right balance in the economy. It wants policies that reduce emissions, but it should also want manufacturing that can provide many of the products that will help the economy as a whole to reduce emissions. The current balance appears to be heavily focussed

[5] Tees Valley Unlimited: Report to North East Regional Select Committee Inquiry, 19 January 2010 www.teesvalleyunlimited.gov.uk/

on taxing the intensive users, but not those sectors that actually produce the greatest emissions or have the lower marginal costs of reducing emissions. The UK needs an industrial strategy that aims to build the businesses that will serve the low carbon economy of the future.

It should be noted that the policies examined in this report are those that will directly impact the energy intensive industries. This means, for example, the Carbon Reduction Commitment (CRC) energy efficiency scheme is not considered as this covers emissions not covered by Climate Change Agreements (CCA) or EU Emissions Trading Scheme (EU ETS). Moreover, any parts of an organisation with more the 25% of their energy emissions covered by a CCA will be exempt from the scheme. All companies in this study here are therefore excluded.

This report has not looked at the treatment of similar industries in the rest of Europe or in other countries where the energy intensive industries direct competitors are based. Anecdotal evidence from EIUG members suggest that other countries have a wide variety of mechanisms for trying to protect intensive users from taxes where the companies' competitiveness would be impacted, or where they believe the policy will not change behaviour for technical reasons (such as the laws of physics simply not allowing energy use reduction). For example an IFIEC study in 2007 showed that some countries exclude intensive users from paying surcharges for renewable energy support schemes or give them substantially reduced tax rates[6].

Waters Wye Associates (WWA) is an independent energy consultancy focusing on the economic, regulatory and technical aspects of electricity, gas and renewable markets.

[6] Characteristics of RES support schemes in different EU Member States, International Federation of Industrial Energy Consumers, 2007

2. The participants

The EIUG and TUC asked a number of companies to participate in this study. The companies, all EIUG members, represented steel and forging, ceramics and brick, fertiliser, aluminium, pulp and paper making and industrial gases. Many of them are among the largest companies in their fields. All have a significant exposure to electricity and gas prices with energy accounting for between 25%-60% of their production costs. A list of the EIUG member sectors is given in Annex 3.

The participants in the study were:

- Corus UK Ltd
- GrowHow UK Ltd
- Sheffield Forgemasters
- BOC Ltd
- Ibstock Brick Ltd
- Dudson Ltd
- Lucite International
- RioTintoAlcan
- Iggesund

The participants' data has been kept confidential, but their data forms the basis of the analysis undertaken. WWA has also included examples of a hypothetical yet "representative customer", which was constructed using real data to further illustrate the cumulative impacts of the climate change policies examined. The main analysis focussed on the impact to 2014. Further, we have examined future potential impacts on the representative customer to illustrate the course on which the UK is currently headed looking out to 2020.

The results of the analysis carried out by WWA paints a worrying picture for the UK. The scale of the increases in costs is significant and if these energy related price rises are realised the future of energy intensive sectors in the UK must be in serious doubt. The argument that these companies can pass these costs through has been long debated. However, these are global industries and there are no obvious reasons why energy intensive products could not be imported into the UK if the cost of production offshore is markedly lower than in the UK.

3. Increases in costs related to climate change policies

Annex 1 summarises the assumptions which have been used to determine cost estimates associated with the climate change policies. These estimates have then been applied to the companies' data. These policies are either in existence today or have been announced climate change policies. Table 1 gives the current values of each policy and a brief description of methodology underpinning the value used to project future liabilities for the companies that participated in the study.

Table 1: Assumptions used in this study

Measure	Current level	Assumption as to future
Assistance for Areas with High Electricity Distribution Costs	£0.16265/MWh	**No increase. Note that scheme was previously known as the "hydro benefit"**
Renewable Obligation (RO)	£3.719/MWh	**For the purposes of this study, WWA have increased the cost of the RO on electricity bills by 10%[7] a year. The report starts with the 2009 buy-out price of £3.719/MWh[8], or where appropriate, the companies declared exposure to the RO in the last year.**
Electricity Climate Change Levy (CCL)	£4.70/MWh	**It is intended that the CCL increases in line with inflation. WWA has therefore assumed a 3% a year increase in companies' exposure. Note however that most energy intensive companies have 80% discounts on these rates, but the discounts reduce to 65% in 2011.**
Gas Climate Change Levy (CCL)	£1.64/MWh	**It is intended that the CCL increases in line with inflation. WWA has therefore assumed a 3% a year increase in companies' exposure. Companies have discounts on these rates, as well as some gas being**

[7] See Annex 1 for explanation of 10%
[8] http://www.ofgem.gov.uk/Media/PressRel/Documents1/RO%20Buy-Out%20price%202010%2011%20FINAL%20FINAL.pdf
Note WWA used the 2009/10 buy-out price as 2009 is our base year, but we note that that the RO auctions clear at a price above the buy-out price, around £40/ROC.

		treated as "feedstock" and therefore levy exempt.
EU Emissions Trading Scheme (EU ETS)	Effectively zero	**WWA has used a low price of £15/tCO_2 to 2014. However, many expect the price to somewhat higher than this, possibly due to a minimum price for emissions being established. In the report WWA have therefore modelled a somewhat higher price of £30/tCO_2[9] in 2020. It is widely acknowledged that electricity prices are already inflated by the cost of EU ETS II so energy consumers are already facing an indirect tax liability via their wholesale electricity prices.**
Carbon Capture and Storage levy (CCS)	Zero	**For the purposes of this study, WWA has assumed a 2% increase in industrial electricity bills, effective from 2011[10].**
Renewable heat incentive (RHI)	Zero	**For this study, WWA has assumed 1% a year increase in industrial gas bills, starting in 2011. This reaches 4% in 2015. Clearly faster increases would be required to reach 20% by 2020 which is the government estimated target and therefore impact would be greater faster. WWA uses the 20% figure in 2020.**
Feed in tariff (FIT)	Zero	**For the purposes of this study, WWA has assumed an increase in electricity bills of 1.5%, starting in 2010.**

[9] We note that DECC has estimated short term traded carbon prices of £14 to £31 (Carbon valuation in UK policy appraisal: a revised approach, DECC, July 2009)

[10] This 2% is on an estimate energy bill before "new" green charges are added but including projected increases in the RO and CCL.

4. Increases in costs indirectly related to climate change policies

As well as the policies directly levying charges on customers' bills, as outlined in chapter 3, there are a number of further impacts arising from the move to a lower carbon economy. While these effects are difficult to quantify, it is useful to identify the areas where further cost pressures may arise to allow both government and other bodies, such as energy regulator Ofgem, to consider the impact on the energy intensive sectors.

4.1 Energy Prices

All energy customers are likely to see increasing energy bills over the coming years as the low carbon policies come into force. Other policies, such as the Industrial Emissions Directive (IED), will alter the generation market in the UK and across the EU, closing old coal and oil plant. While there are a wide variety of forecasts about which generation technologies will dominate the GB electricity markets by 2020, there are also diverse views on the costs of these technologies and the subsidies that may be given to achieve renewables targets, but there is general agreement the cost of wholesale power looks set to rise.

Under EU ETS III, from 2013, the generators will have to buy all of their allowances in the open market. It is widely accepted that the generators have already factored the carbon price in EU ETS II into electricity prices, taking account of the opportunity cost of carbon, pushing electricity prices higher than under a zero carbon cost scenario. This means that despite their free allowances, the energy intensive users are paying for EU ETS II through electricity prices, which WWA has not separated out as a direct climate change policy cost at the current time. Under phase III WWA believes that it is likely that EUAs will be more expensive increasing the generators costs and undoubtedly further pushing up wholesale power prices. However, we have only counted the direct costs to the users of phase III, making the impact assessment on the low side.

There are also debates about the changing shape of the gas market, with new pipelines and shale gas providing alternative sources of supply. The role of gas is particularly difficult to forecast since while the government forecasts that gas fired generation will replace capacity as old plant is retired, the rise of renewables will then tend to reduce the load factor of gas fired power generation. This is likely to make electricity from gas power stations more expensive as load factors decline. Coal may play a role, but the government policy that it must demonstrate Carbon Capture and Storage (CCS) capability will make it expensive.

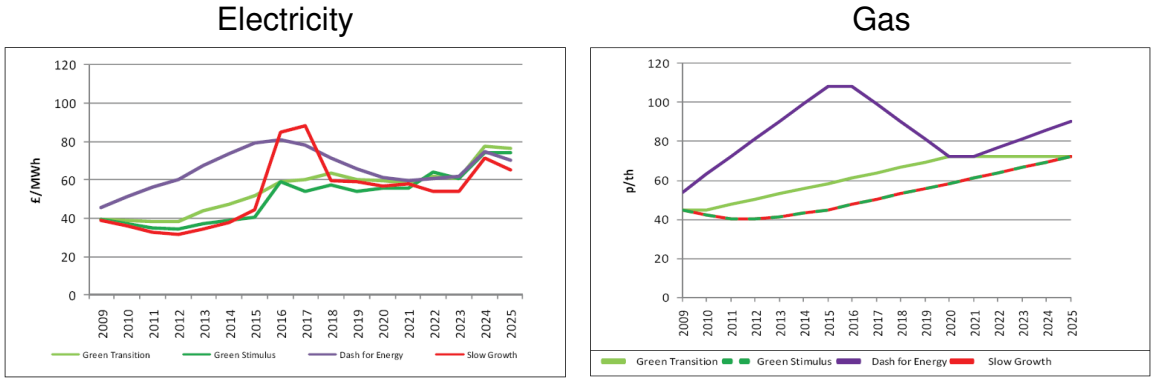
Energy prices will rise in the future.

It is undoubtedly true that the energy markets are facing monumental change. It is difficult to conclude anything other than energy prices will increase in the future. This view seems to be supported by the government and the sectoral regulator.

There are various forecasts of energy prices carried out by the government. A recent DECC document, "UK Low Carbon Transition Plan"[11], shows government "central" forecasts of increasing prices for oil, gas and traded carbon prices. Ofgem's recent Project Discovery work has also forecast rising prices. The two graphs below are taken from Ofgem's Discovery Energy Market Scenarios document[12] published in October 2009. They are purely illustrative of the trends expected by the energy market regulator, but many similar forecasts exist.

WWA, in consultation with EIUG and TUC, decided that to forecast electricity or gas prices in detail would add unnecessary complexity to the analysis, the main focus of which was on drawing attention to the cumulative impact of UK or EU-only climate change policies. We have therefore left energy prices unchanged in the main analysis of this report. Intensive users would hope that the government would be mindful that the impact of any policy that unilaterally increases customer bills will be further exacerbated by the general increase in energy prices.

Graph 2: Ofgem's Forecasts of Electricity and Gas Prices under a variety of scenarios



Source: Ofgem

WWA left energy prices unchanged in the main analysis of this report, but consider price rises in chapter 10.

WWA believes that it is unrealistic, given the market changes, to assume that energy prices will remain unchanged and the government must, when assessing its policies, factor in its own forecasts. WWA has therefore carried out a high level projection of customer costs increasing with the climate change policies and a rise in energy prices in chapter 10 of this report.

4.2 Increases in distribution, transmission or transportation charges

The connection of renewable generation will lead to an increase in electricity transmission and distribution charges. Wind generation, partly due to its location, will need significant additions to, and reinforcement of, the existing grid. Offshore

[11] UK low carbon transition plan, emissions projections", DECC, July 2009, page 10-11
[12] http://www.ofgem.gov.uk/Markets/WhlMkts/Discovery/Documents1/Discovery_Scenarios_ConDoc_FINAL.pdf

wind farms will require that whole new networks are built in extremely difficult environments. Much of this investment will take place in the second half of this coming decade.

For this study, a starting point for estimating increased electricity transportation charges could be the most recent Ofgem distribution price control review document, DPCR5[13]. This allows an average of 5.6% increase per year (in real terms) for distribution charges, between 2010 and 2015. However, with the exception of chapter 10, the effect of increased electricity transmission and distribution charges has been ignored in the analysis presented in this report.

WWA has assumed no increase in electricity transmission and distribution charges, 2010 for 2015, for the majority of analysis in this report.

It should be noted that this assumption ignores two important cost increases for larger consumers:

- As well as setting the recent distribution price control (DPCR5), Ofgem has also considered the charging methodologies used by the electricity distribution companies. By and large, this has – from 1 April 2010 – decreased distribution charges for smaller customers, and increased distribution charges for larger customers[14]. Major increases are being forecast for some customer's Extra High Voltage (EHV) charges, for some sites they have gone up by 76.5%[15] and study participants have all reported above inflation increases.

- Distribution companies have introduced forms of peak pricing into their charges. Specifically described as funding the connection of renewable electricity connections, these charges will directly impact continuous process businesses – which most of the energy intensive industries are.

WWA has also ignored changes in gas transportation prices. These could also increase if the addition of "green gas" to the network were to result in increased gas blending costs. National Grid has also been looking at using some of its network for carbon transportation, which could increase compression costs on the rest of the network.

In chapter 10, as well as increasing energy prices, WWA has carried out a high level sensitivity on possible increases in electricity transmission and distribution charges, but left gas transportation charges unchanged.

[13] http://www.ofgem.gov.uk/Networks/ElecDist/PriceCntrls/DPCR5/Documents1/FP_1_Core%20document%20SS%20FINAL.pdf
[14] Table 2.1, document as above
[15] http://www.westernpower.co.uk/Stakeholder-Engagement/Charging-Methodologies-Event---April-2010-(1).aspx – p40

4.3 Increase in balancing charges

Energy suppliers are incentivised under the wholesale energy market rules[16] to "balance" their energy buys with energy sells in each trading period (half an hour in electricity and daily in gas). When their off-taken energy (customers' demand) does not match their energy input (energy bought or produced) they are "cashed out" for either having too much or too little energy. The cost of this energy bought or sold from/to the system operator[17], known as a balancing cost, are related to the cost of the actions that the system operator has taken to keep the networks balanced in real time. To incentivise energy suppliers to keep themselves in balance, balancing prices for energy bought or sold are usually worse than could have been achieved in the market.

The connection of intermittent renewable generation will lead to higher balancing costs as the system operator will need more reserve for example when it is not windy. There will also be rising constraint costs from managing the connection of new generation prior to the completion of all necessary transmission reinforcements, under the "connect and manage" regime being implemented by DECC[18]. These charges have been held constant for the main analysis along with wholesale energy prices so as not to confuse the price rises from climate change policies with indirect wholesale price changes.

Balancing costs will add to prices.

Finally, energy intensive companies have expressed concerns that the new generation needed to maintain secure supplies may be late arriving and the generation margin reduce. The transmission access queue has delayed some new connections, planning issues have slowed approvals and market uncertainty (financing new plants, ROC grandfathering, etc.) may also have delayed new build creating a potential generation gap. Ofgem's Project Discovery[19] scenarios showed generation plant margins could fall below 5%, when most systems look to have margins of around 20% and gas interruptions could increase. Were such scenarios to occur, security of supply would be reduced and the probability of blackouts increase. Supply interruptions are especially damaging to continuous processes which by definition will consume masses of abortive power if they have to be stopped and restarted because of power cuts. Such production uncertainties do not encourage investment, but are hard to put a precise cost to.

4.4 Carbon Floor Price

How and when this will be implemented is currently unclear, but announced as a policy of the coalition government, a carbon floor price would create a minimum

[16] Balancing and Settlement Code and Uniform Network Code
[17] National Grid is the system operator in both the GB gas and power markets.
[18] http://www.decc.gov.uk/en/content/cms/consultations/improving_grid/improving_grid.aspx
[19] Ofgem, Project Discover, Energy Market Scenarios, October 2009: page 40, Figure 3.9: GB electricity de-rated capacity margins and page 63, Figure 4.4: Potential demand curtailment in response to exporting GB winter gas under the Slow Growth scenario (2005/6 - 2020)

price for emissions in the market for carbon[20]. A minimum carbon price would impact EU ETS, increasing the cost of fossil fuel generation and making nuclear generation more competitive as it does not need to buy EU ETS allowances. As the companies studied for this report are in EU ETS they will be directly impacted by this policy, though it is difficult to tell if it would impact more on electricity than gas users. They will also be indirectly impacted as the floor price will push up the cost of marginal generation (coal and gas) and increase the price of wholesale electricity.

A carbon floor price may well add further to the already substantial costs associated with EU ETS.

Previously, the Conservative Party manifesto had talked about changing the CCL to implement the carbon floor price. Without more details it is difficult to judge how this policy will alter both the CCL and the EU ETS price. We have therefore used the two different prices of European Union Allowances (EUAs), the emission allowances traded under the EU ETS, to capture the direct effect of higher carbon prices on customers. We have used a lower price (£15/EUA) for the period to 2014 and a higher price (£30/EUA) for the year 2020.

Generally the EU has favoured a cap and trade system for encouraging investment in energy efficiency and other emissions reduction measures. The government's CRC policy has aimed to adopt this system across a wider section of the economy than that impacted by EU ETS. Were a floor price to be adopted that is below the traded price of EUAs under EU ETS, but higher than carbon costs under CRC, the policy should impact CRC participants and not EU ETS participants. The TUC has supported the notion of a minimum effective price of carbon.

For CCL, it has been assumed that the levy will continue to rise in line with inflation. However, since this policy option is not really needed to support nuclear generation until 2018, the Government may consider deferring implementation until the impact of EU ETS III on carbon prices is seen.

4.5 New Nuclear Build and Carbon Capture

EDF, the company most likely to undertake the first new nuclear build, has said it does not want a direct subsidy for new build, but instead favours a minimum price for carbon[21]. However, it is known that they will not necessarily need a high carbon price until their new nuclear stations come on stream in around 7 years time. If a floor price for carbon is not sufficient, there remains a possibility that direct support for new nuclear build will be reconsidered. It may be that nuclear plant will be built without any subsidies or other interventions, but policies may change depending on the power price and costs of financing the required new build.

[20] Coalition Policy Document: The provision of a floor price for carbon, as well as efforts to persuade the EU to move towards full auctioning of ETS permits, see Annex 4.
[21] Vincent de Rivaz, 27th May 2010, speech to the Global Energy Capital Markets Conference: Financing the Future of Energy

Support for new nuclear build or CCS is likely to increase power prices in the future.

A legislative framework for a new levy on energy prices, to fund the carbon capture and storage (CCS) demonstration projects, was introduced in the Energy Act 2010. The Act allows for a levy on electricity suppliers that could support up to four industrial scale CCS demonstration projects in the UK. The CCS levy will be administrated by regulator Ofgem, with the details will be set through regulations due to be consulted on later this summer. The coalition is committed to the CCS programme. It is not yet clear what this levy will be on, how large it will be, when it will be introduced. The lack of clarity adds to investment uncertainty.

4.6 Other UK Policy Measures

The coalition government's policy paper[22] has raised a number of new policies that could further increase energy prices (see Annex 4). It is as yet unclear how smart grids, support of anaerobic digestion and policies like "Green Deal" will be financed.

New energy policies and their impact on power prices need clarifying.

There are also concerns about what terms such as "*security guarantee of energy supplies*"[23] mean, but there is a reasonable expectation that if this translates to public service obligations – as has already been suggested by Ofgem – there will be further increases in energy bills to fund such policy. There is also the possibility that the policy actual reduces supply security for industrial users who may feel they then have to invest in back-up supplies to maintain the security they require. As the energy companies have licence obligations to meet reasonable demands, WWA are unclear what this new policy is trying to achieve, but policies that aim to manipulate markets invariably result in higher costs.

[22] http://programmeforgovernment.hmg.gov.uk/files/2010/05/coalition-programme.pdf
[23] The Coalition: our programme for government (see Annex 4)

5. Forecasting the impact of climate change policies on energy intensive companies

WWA were provided with energy consumption data from 9 companies representing sectors that are defined as energy intensive, i.e. energy makes up a significant proportion of their business costs. WWA have used the same approach with each data set to give a baseline position of the companies today. Once the data sets were established, WWA forecast the increasing costs of the climate change policies for each of the participating companies looking first from 2010 to 2014 then on to 2020.

5.1 Approach to the study

1. The participants provided WWA with their company's energy usage for electricity and gas; a breakdown of their energy bills including current exposure to climate change policies; and a forecast of their emissions which will be subject to EU ETS.

2. WWA established the company's **current** exposure to the cost of low carbon policies, based on their historic energy bills.

3. WWA agreed with the companies the annual levels of energy usage that they would reasonably expect to 2014. We then held their energy usage and their energy cost (£/MWh and p/therm) stable and applied the climate change policy costs to their bills. This gave each company a projected **cumulative effect** of existing low carbon schemes, increases in existing low carbon policies (CCL, RO, etc.) and new low carbon schemes (RHI, FIT and CCS levy), as set out in chapter 3.

4. For a 2020 point projection, WWA again kept the energy usage and price stable, but increased the costs of the policies in line with the agreed policy costs. For EU ETS we increased the EUA price from £15 to £30. There is also a step change in the RHI cost by 2020, based on the government's forecast of a 20% increase in industrial gas bills.

5. WWA provided each company with a confidential annex of the analysis for their company. In this report we have shown the range of the cost increases seen by the participants to protect their confidentiality.

6. WWA was mindful that each company is very different, so to capture the scale of the costs these policies impose on energy bills we felt creating a "representative customer", based on the participants own data, would be a useful tool in illustrating the cumulative impact. The representative customer data was subject to the same analysis as each of the companies and the results are included in this report.

7. One company agreed to have their actual costs and forecast tax increases in the report, and their data is included in chapter 8.

8. WWA discussed with the companies whether they could pass the costs of these policies onto customers, and were convinced by them that companies in other countries, or other installations in the same group, could import cheaper products were UK costs to continue to rise. Assuming cost pass through would be very limited; we then examined with the companies the financial impact on their forecast margins. Qualitative explanations of the scale of effects on three companies are given in chapter 9.

9. As WWA believes that it is probable that wholesale energy prices will themselves rise, using the typical customer data, we increased the base energy cost of wholesale electricity, transmission and distribution charges (chapter 10). We then imposed the same climate change policy costs on top of the higher energy bills.

10. WWA then reviewed, with the clients, the importance of the energy intensive users to the UK economy (chapter 12) and to a transition to a low carbon economy (chapter 13).

5.2 Policy Cost Projection Methodology

Each company was provided with an explanation of the methodology used to generate forecasts of the policy impacts on their costs. In summary, the following assumptions were made:

Energy Usage

For the participating companies, WWA agreed with the companies a representative level of production. This was normally the average of the most recent years of available data. In one case, this was thought to give too low a level of production, so an estimate of future consumption was agreed with the company.

Emissions

Each company provided an emissions forecast for 2013 which was then held stable for the purpose of assessing the impact of EU ETS III.

Energy Price

As explained above, for the companies we did not assume any increase in energy prices from the main analysis. Therefore, to derive an energy price for each company WWA used, where possible, the weighted average of the last two year's actual prices for each of the companies.

WWA recognise that this gives an energy price that is probably on the low side as wholesale energy prices fell significantly between 2007 and 2009. Forward price curves show that prices are likely to rise in the coming years, before any levies are applied. As a result the company analysis has understated the true costs of final bills to the companies.

WWA used the representative customer that we created to illustrate the impact of energy price rises (see chapter 10) along with electricity distribution and transmission cost increases.

Transportation, transmission and distribution charges
As with the energy price, WWA has assumed the companies face no increase in gas transportation, electricity transmission or distribution prices charged by the gas and electricity monopolies. The weighted average transportation price reported by the companies has been used instead. Again this will result in a dampening of the increases in energy costs over time.

In chapter 10, WWA illustrates the impact of the rising costs associated with electricity transmission and distribution costs using are representative customer. It must be remembered that these costs will be site specific, so even where we have shown price rises, the impact on a specific site could be markedly different.

Effect of green policies
Table 1 in chapter 3 explains how WWA calculated the costs associated with each climate change policy into the future. Further explanation of each policy is given in Annex 1.

Calculating the Impact on company costs
Having created the baseline energy costs and forecast carbon emissions, ignoring energy price rises, WWA used the rules associated with each of the policies to show the rising tax burden on each of the companies concerned, and the typical customer we created.

Confidentiality
Participants have been concerned that the confidentiality of their data is maintained. In response, at the request of the EIUG and TUC, WWA have prepared confidential summaries of the effect of low carbon policies upon their forecast margins. Each of these summaries has been given to the companies, but they are not included in this summary report. They are of course available for the relevant companies to submit to the government as they see fit.

In this report WWA have prepared ranges of impact based upon the responses of the companies which are outlined in chapter 7 and 8 below. All summaries have been agreed with the relevant companies for inclusion in this report.

6. The companies

The energy intensive sectors represented in the report are discussed in more detail in chapters 12 and 13. Outlined below is a brief overview of the companies who provided data for the report.

BOC Ltd is the UK operating unit of The Linde Group, the global leader for supply of industrial gases and related technologies, serving customers from food freezing to steelmaking and from hospitals to fuel cells. The company employs over 3,000 people in the UK. Almost a quarter of its operating expenditure is on electricity (used for the primary production of oxygen, nitrogen and argon) or natural gas (used for hydrogen manufacture). It also runs a significant in-house distribution operation delivering liquefied gases, and cylinders direct to end-users, so is also exposed to diesel prices.

Corus UK Ltd is Europe's second largest steel producer with annual revenues of around £12 billion and a crude steel production of over 20 million tonnes. The company employs over 20,000 in the UK. Recently, at a cost of over £60m, the company opened a new plant at its Port Talbot steelworks that will reduce the site's carbon dioxide emissions by some 240,000 tonnes per year, the single largest climate change investment in Wales. Corus UK Ltd is one of the UK's largest consumers of electricity.

Dudson Ltd is a world-leading specialist in the manufacture and supply of ceramic tableware for the international hospitality industry and remains a privately owned family business, the oldest in the UK tableware industry. The company manufactures all ceramic products at two factory sites in Stoke-on-Trent, England and exports more than 70% of production to over 100 countries worldwide. The company employs just over 500 people.

GrowHow UK Ltd is the UK's only manufacturer of ammonia, nitric acid and nitrogen fertiliser. It also supplies utilities and site services at its Billingham Site in the Tees Valley. Ammonia and ammonia solution are also supplied for NOx abatement for use within power generation and cement manufacture. Downstream, nitric acid is used within the production of polyurethanes, including building insulation. GrowHow UK Ltd is a significant consumer of electricity and is the UK's largest industrial consumer of gas used as a feedstock within its manufacturing process. Over 50% of its operating expenditure is energy related and energy costs vary significantly from year to year. The company employs in excess of 500 people. In 2009, its revenue was over £300m.

Ibstock Brick Ltd is the UK's leading manufacturer of bricks. Ibstock Brick Ltd now has 20 brick and paver plants with a total annual capacity in excess of 850 million bricks. The company employs a total of 1300 people across the UK and has the backing of one of the world's largest building materials companies, CRH. Ibstock Brick Ltd is a relatively large consumer of electricity and gas.

Iggesund Paperboard is a member of the Holmen Group and Europe´s leading manufacturer of high quality virgin fibre paperboard for use in the packaging and graphics sectors with a global turn over SEK18,071 million in 2009. Their facility integrated mill Workington employs around 500 people and has a capacity of 260,000 tonnes of Incada per year. Incada is a multilayered Folding Box Board (FBB). All fibres are virgin fibres and Incada products are widely used for book covers, greeting cards and the packaging of food, cosmetics, chocolate, pharmaceuticals and tobacco products.

Lucite International is a global leader in the design, development and manufacture of acrylic-based products. Lucite has global operations with 14 manufacturing sites, 5 in the UK, and 2000 dedicated personnel. Lucite has a sales revenue is around £220 million and global revenues of US$1.5 billion. Lucite International is the world's leading supplier of Methyl Methacrylate (MMA), the foundation for a diverse range of products from mobile phone screens, through solid surfaces for kitchens and bathrooms to coatings for use in both home and industrial environments.

In the UK, **Rio Tinto Alcan** owns and operates aluminium smelters at Lynemouth in Northumberland and Lochaber in the Scottish Highlands. The smelters manufacture primary aluminium using an electrolytic process from electricity generated at Rio Tinto Alcan' dedicated, on-site power facilities. The 420MW Lynemouth Power Station is the most thermally efficient coal-fired power station in the UK and the Lochaber Smelter is powered by two hydro-electric facilities, generating a total of 80MW. Rio Tinto Alcan directly employs more than 700 people in the UK and through supply chain industries, indirectly supports a further 3,000 jobs. The company have invested over £250m in recent years on environmental and energy efficiency improvements.

Sheffield Forgemasters International Ltd is a world leader in supplying total engineering packages to solve industry's needs. As the world's largest independently owned forgemaster, SFIL specialises in a broad range of heavy steel forgings and steel castings as well as stocking steel ingot and bar. The company employs just under 1,000 people in the UK. It is a significant consumer of electricity and gas.

6.1 A "representative" company

To address issues of confidentiality, WWA has developed a "representative" company. The company is not real, in so much as it is not based on specific bills, but its profile is based on the data provided to WWA. Like the study participants, the representative customer is assumed to have a CCA and thus receive a CCL discount.

WWA believes that the representative customer will give other energy intensive users a feel for the type of exposure that they will face from climate change policies by being representative of real customers.

The representative customer has the following profile:

- Electricity consumption was set at 100,000 MWh a year

- Baseline energy price was £70/MWh, with transmission, balancing and distribution costing £9/MWh
- Gas consumption was set at 20,000,000 therms a year
- Baseline gas price was 50p/therm, with transportation costing 5p/therm
- Purchased emissions in 2013 was set at 100,000 tonnes

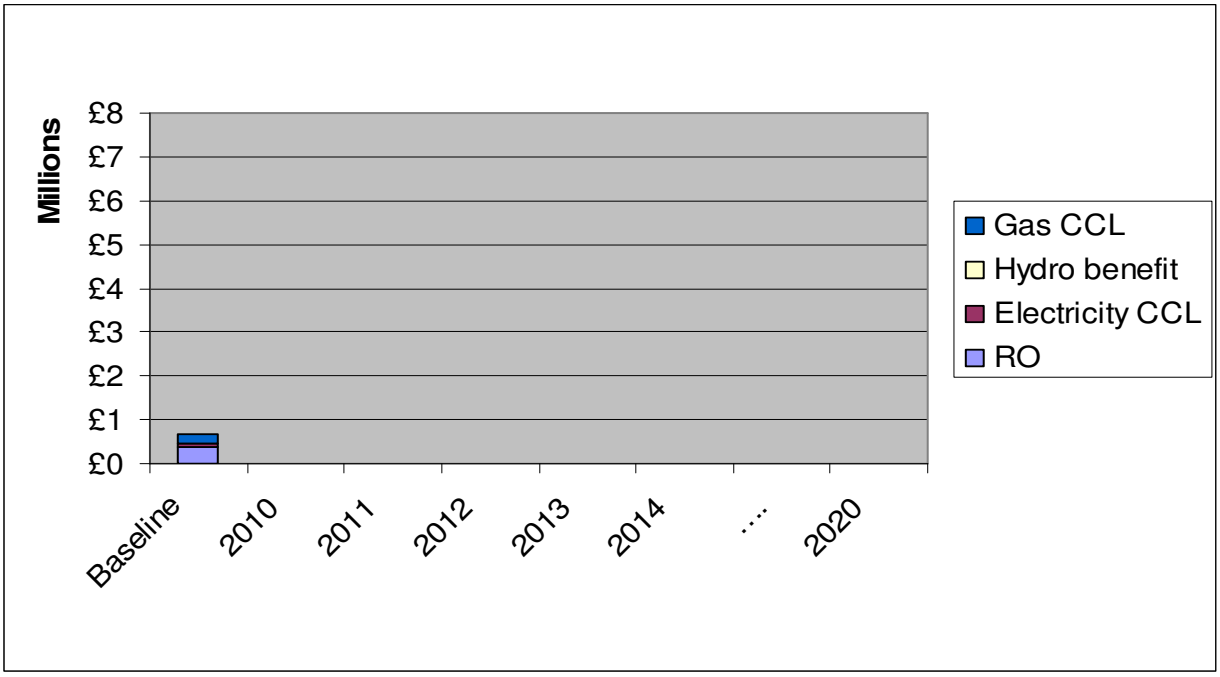
7. Resulting increases in energy intensive users' energy bills

The following impacts have been calculated for the participating companies. As explained above, low and high estimates for the cost per tonne of CO_2 of the EU ETS programme have been used, set at £15/tCO_2 for EU ETS III to 2014 and £30/tCO_2 in 2020. The costs of this scheme have been compared to forecast electricity usage and expenditure giving a range of impacts.

7.1 Baseline

The analysis starts with the representative customer. The existing exposure to the two CCL schemes as well as the RO can be seen in graph 3. The RO has the biggest impact at the current time for this customer's profile.

Graph 3: Current cost for a representative customer of CCL and RO



Source: Waters Wye Associates

The current exposure of case studies to the renewables obligation that all customers are paying in their energy bills amounts broadly to the equivalent of the buy-out price plus a slight mark-up. The direct exposure of the customers to the CCL schemes differs depending upon the position of the particular company in question in terms of energy usage and Climate Change Agreement (CCA).

7.2 Increase in electricity bills by 2014

The first stage of the analysis estimates increases in costs to 2014, the impact of the various charges that are intended to flow into customers' electricity bills. Two main effects are seen in the graph below for the typical customer.

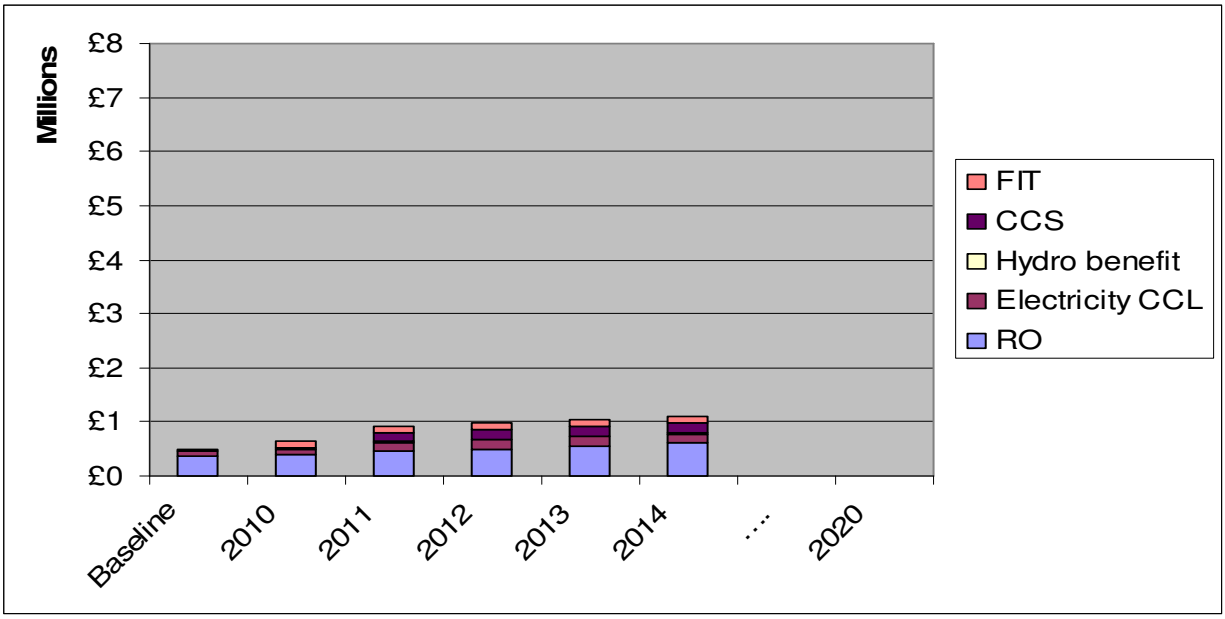
First, the increase in the renewables obligation is evident. As explained above, the assumption used in the analysis is a 10% increase in the equivalent £/MWh charge;

an assumption that WWA considers to be conservative given the new government's intention to accelerate the move towards a low carbon economy. While the intention may not be deliverable, the tax impact may well be.

Second, the change announced in the 2009 Pre-Budget report in the discount on the CCL from 80% to 65% in 2011 is clear.

The first stage of the FIT and CCS can also be seen.

Graph 4: Forecast electricity based taxes for a representative customer to 2014



Source: Waters Wye Associates

In the case studies, WWA forecast that the impact of the various electricity based charges (RO, CCL, hydro benefit and FIT) will increase electricity bills by between **7% and 11%** by 2014.

By 2014 climate change polices increase electricity bills by between 7% and 11%.

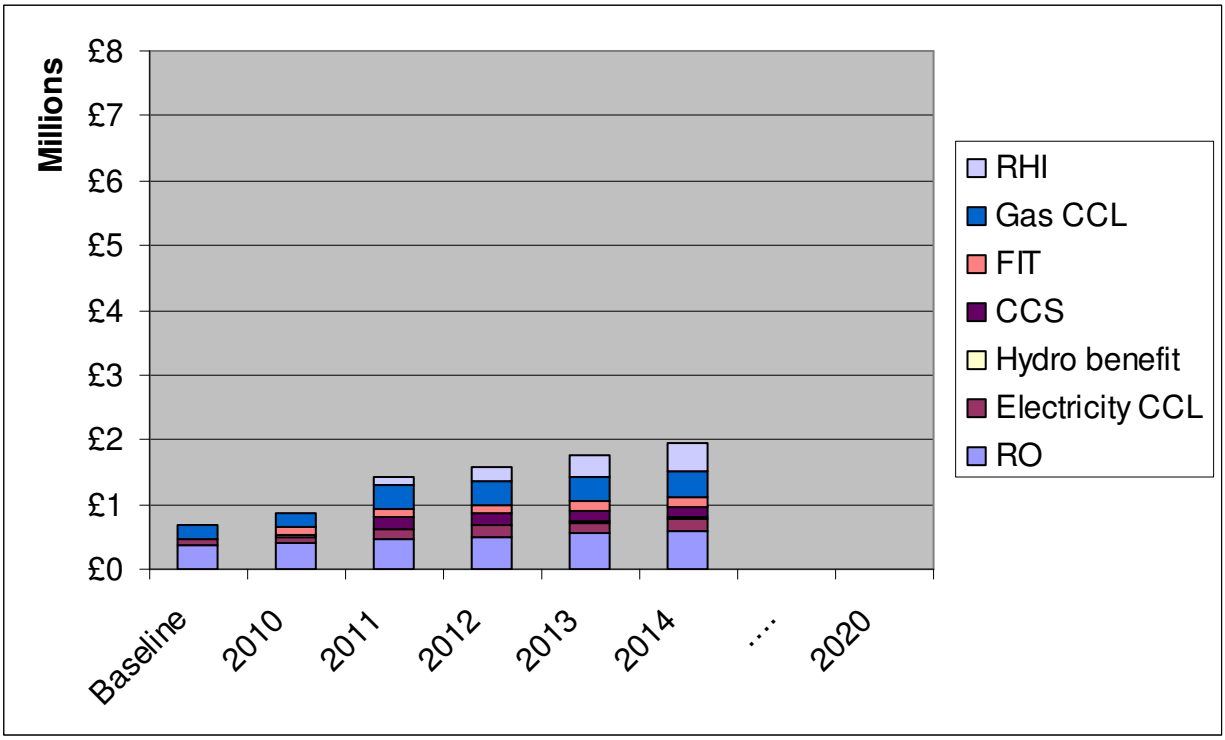
7.3 Increase in gas bills by 2014

The next stage of the analysis was to add in the gas related taxes; the CCL and the RHI. WWA has forecast the impact on a representative customer's bill and this is shown below in graph 5. Two features of this graph are of interest:

First, the relatively large impact of the RHI – even in its early stages – can be seen. It must be noted that there is no clarity as to how this particular tax is to be levied, but WWA has assumed a 1% increase in prices starting in 2011. By 2020 the government estimated bills would have risen by 20%, which is used in WWA's projections. To reach such levels a faster rate of increase would be required and therefore the tax burden in the earlier years should be seen as a low estimate.

Second, the change in the CCL discounts from 2011 is also evident.

Graph 5: Forecast electricity and gas based taxes for a representative customer to 2014



Source: Waters Wye Associates

In the case studies, WWA has projected that as a result of the CCL and RHI by 2014 the participants' gas bills will increase by between **4 and 6%.**

By 2014 climate change policies will increase gas bills by between 4% and 6%.

7.3 Increase in total energy bills including EU ETS by 2014

The next stage of the analysis was to add in the possible exposure to EU ETS phase III.

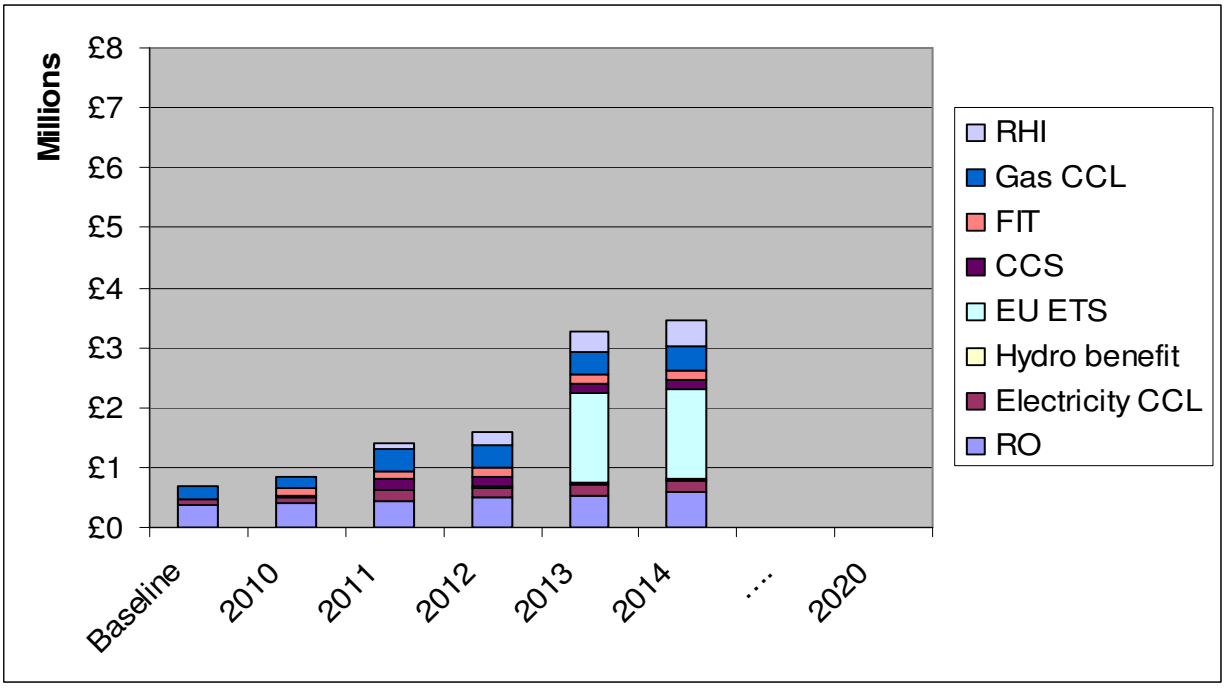
In the case studies, the dramatic impact of the EU ETS is demonstrated in the returns from the companies. Forecasting emissions for which EUAs must be purchased is difficult as the benchmarking methodologies for allocating free allowances is not yet fixed. However the proportion of free allowances reduces from 80% in 2013 to 20% by 2020 under EU ETS III.

WWA has forecasted that in 2014, the combination of the electricity and gas taxes outlined above is further compounded by adding in EU ETS. The result is an increase in total energy expenditure of the surveyed companies by between **7% and 56%,** as a low estimate (£15/tCO_2), and between **8% and 128%** as a high estimate (£30/tCO_2).

By 2014, if carbon is £30/tCO2, the energy costs of the participants will rise by 8% to 128%.

As previously discussed, it is difficult to know what the price of carbon will be under EU ETS III. However, the government's proposed floor price for carbon suggests that they believe that the price should be relatively high compared to current levels. The lower of the prices used in our projections, to 2014, £14/tCO_2 would equate to around €18/tCO_2, at the current exchange rate, not far from today's price. The higher value of £30/tCO_2, applied in 2020, equates to around €36/tCO_2, not unrealistic if the EU ETS III scheme has tighter allocations.

Graph 6: Forecast cost of all climate change policies for a representative customer to 2014

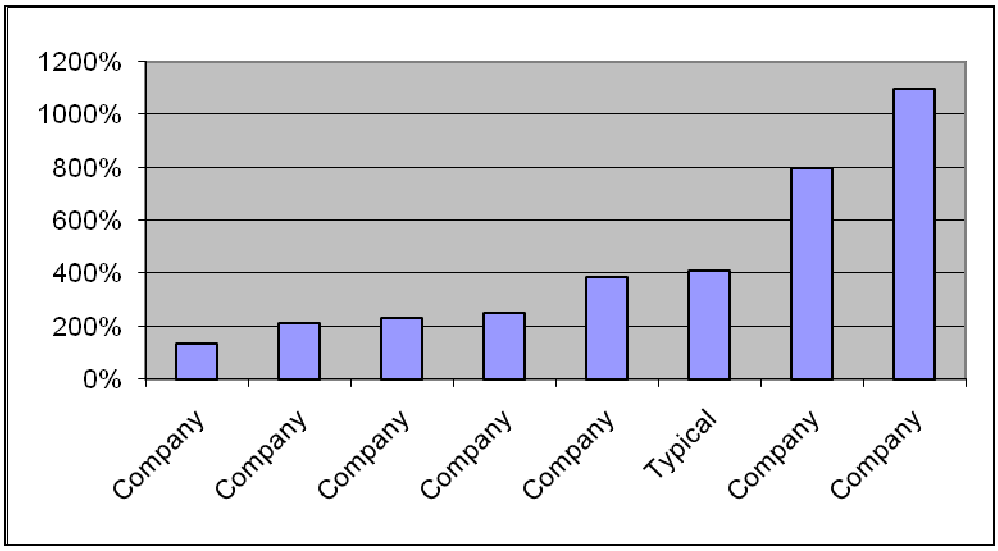


Source: Waters Wye Associates

It is important to test whether WWA's "representative customer" is providing a reasonable estimate of the increase in costs. WWA therefore compared the increase in climate change costs across all of the companies that participated. This percentage increase, including that of the representative company (labelled as "typical"), is compared in the graph 7.

This shows that the spread of impacts is large, though for all of the companies the impact can be described as significant. It must be remembered that, as these are energy intensive companies, these are enormous percentage rises on energy bills that are already accounting for a significant proportion of the companies' costs.

Graph 7: Percentage increase in climate change costs to 2014 for companies participating in the report



Source: Waters Wye Associates

7.4 Increase in total energy bills by 2020

Finally, WWA has made a point estimate of the impact of these charges in 2020. This is to pick up several important impacts beyond 2014.

First, the EU ETS scheme is intended to gradually remove allowances between 2013 and 2020. Given the uncertainty over benchmarks, allowances and carbon leakage, as well as the UK government's interpretation of the EU's rules in this area, WWA has not made a detailed forecast of the shape of EU ETS III in 2020. Rather, WWA has assumed the higher end of its EU ETS scenario (£30/tCO_2) to estimate the likely impact of EU ETS III in 2020. WWA considers this estimate to be conservative.

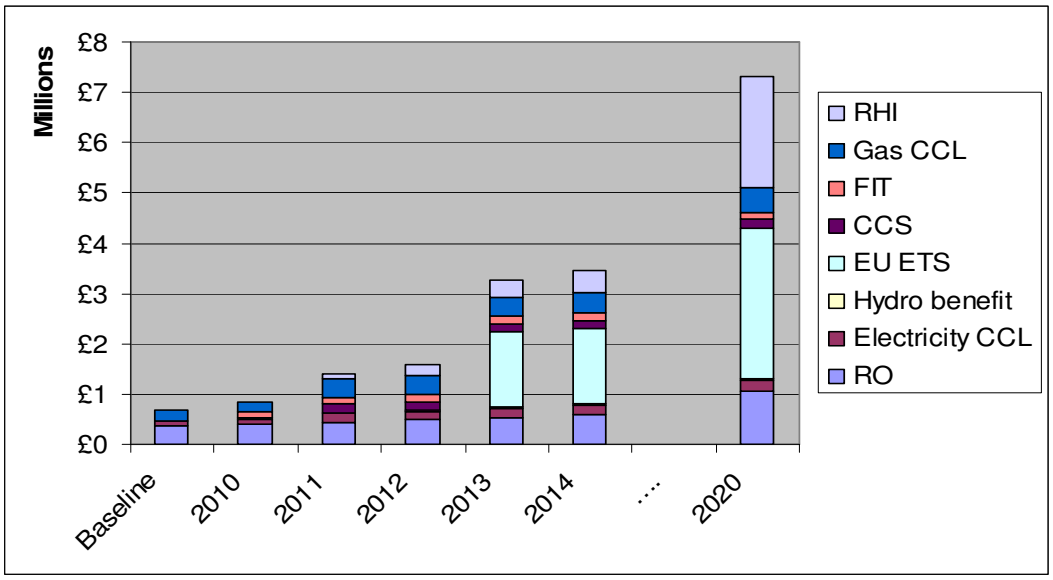
Second, the government's impact assessment of a 20% increase in industrial gas bills due to the RHI has been calculated for the participant companies.

Third, WWA has modelled a continued increase in the renewables obligation using a forecast rise of 10% per year starting with a buy-out price of £3.719/MWh.

The impact of these assumptions will be the extra charges likely to be seen on the typical energy intensive user bills by 2020.

The effect of the EU ETS scheme on energy costs is clear, but it is the impact of the RHI that is particularly striking. By 2014, WWA estimate that for the representative customer, costs associated with climate change policies will increase four fold. By 2020, the picture is much starker. WWA estimate that for the representative customer, costs associated with climate change policies will increase by close to **ten times**.

Graph 8: Forecast cost of all climate change policies for a representative customer to 2020

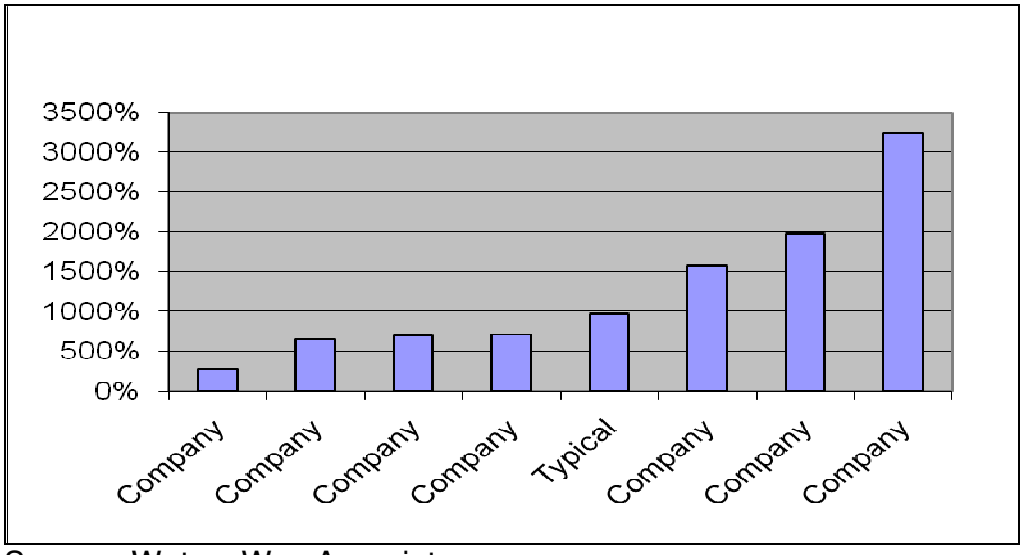


Source: Waters Wye Associates

It must be noted that the forecast cost increases shown above are all calculated holding wholesale energy prices constant. By not making any adjustment for the cost increases forecast for wholesale energy prices, transportation, transmission, distribution or balancing charges, these illustrative impacts must be seen as low.

WWA also compared the percentage increase in climate change costs for all the participating companies, shown in graph 9, in 2020. This graph is only showing the increases in the climate change policy costs, not the total increases in the energy bills (which include some of these costs). Again it must be remembered that these are substantial percentage increases on bills that make up a significant proportion of the companies' costs.

Graph 9: Percentage increase in climate change costs to 2020



Source: Waters Wye Associates

Turning to the case studies, WWA has estimated the impact on the basis of each of the company returns. This analysis is looking at the overall energy bills, including all of the climate change policies that attach to energy bills, along with the EU ETS III exposure that companies will directly face.

- WWA forecast that the impact of the various electricity based charges will increase total electricity bills by between **15% and 22% by 2020.** This does not include the costs of EU ETS phase III.

- WWA forecast that the increase in total gas bills resulting from these schemes will be between **20% and 22% by 2020**. Again, this does not include the costs of EU ETS phase III.

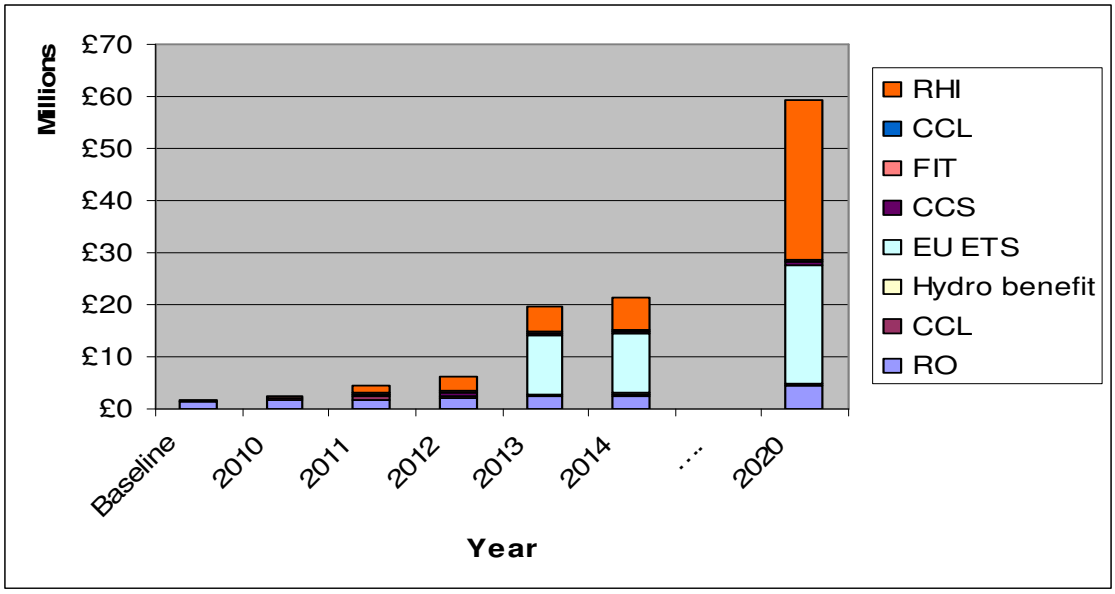
- The forecast increase in the total energy bill, taking electricity, gas and emissions reductions schemes together is projected to be between **18% and 141%.** These figures do include the costs of EU ETS phase III.

By 2020 the UK's climate change policies will increase energy costs to intensive users by between 18% and 141%.

8. 2020 – One company's actual exposure

One of the companies was comfortable with the disclosure of its actual expenditure on gas and electricity, as well as an estimation of its exposure to the EU ETS scheme. WWA has therefore used its data to forecast its exposure to climate change policies out to 2020. This was done using the same assumptions as the previous forecasts, with energy prices held stable. The graph below shows the extra costs that will be faced by this company, excluding the cost of the energy itself.

Graph 10: Energy Tax Exposure to 2020 for an Actual Intensive Energy User



Source: Waters Wye Associates

The detailed forecast to 2014 was already seen as wiping out the entire margin of the company. However, the level of costs forecast for 2020 greatly outstrip earlier costs estimates. WWA is projecting an increase in costs associated with climate change policies of close to £60m for this company in 2020.

While the impact of EU ETS is understood, what is surprising about this picture is the impact of the renewable heat incentive (RHI). For this customer, the RHI has more of an impact that all other schemes combined. It must be remembered that the RHI is as yet an undefined levy despite being due to be introduced from April 2011, so the cost increase shown illustrates the government's suggestion that it will increase gas bills by 20% in 2020.

9. Impacts on the businesses of these costs

If the government recognises that these companies cannot simply pass these costs to their own customers, as they compete in international markets, then it has to be assumed that the companies must pay these charges out of their profits or by cutting costs

Each company was asked for an estimate of its profitability in 2014. Having been shown the scale of their increasing energy costs, WWA compared their exposure to climate change policies with the level of forecast profits. Some illustrative responses are given below, but it should be noted that the companies use differing terms to measure profitability.

Company 1
This company provided an estimate of its margin in the last 2 years. It saw no reason for its margin to increase.

For company 1, the increase in its energy bill is forecast to be larger than current and projected margins.

Company 2
The company gave WWA an estimate of its "steady state" profitability.

At this level of profits, the cumulative impact of low carbon energy policy – in 2014 – is that the company's expenditure on low carbon policies could be larger than the company's level of profitability.

Company 3
Company 3 provided a rough estimate of its profit in 2014.

For company 3, the cumulative impact of these low carbon policies results in almost all of the margin (measured as EBITDA) of the company being apportioned to the costs of low carbon policies by 2014. By 2020, the impact of low carbon policies represents three times the possible margins of company B.

10. Assessing the cost increases with rising energy, distribution and transmission prices

The main part of the analysis carried out by WWA assumes no increase in energy, transmission, distribution and transportation prices. This is intended to highlight the impact of the various climate change related taxes on energy intensive customers. It also reflects the difficulty that customers find in predicting energy and (regulated) transportation prices more than a year or so into the future.

Nevertheless, the government and Ofgem are forecasting significant increases in energy prices, as well as transmission and distribution prices, directly resulting from the move to a lower carbon economy. In this section, WWA has analysed the broad impact of these price rises.

10.1 Energy prices

There are many forecasts of energy prices that could be used in seeking to analyse the impact of increased energy prices. As has been the approach for this report, WWA has used a conservative forecast. As part of its Renewable Energy Strategy, DECC projects future energy price changes. The projections for the years 2009-2020 are shown in the table below.

Table 2: Energy price assumptions, DECC[24]

Gas p/th	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	% annual change, 2009- 2020
High	67.0	69.7	72.4	75.1	77.8	80.4	83.1	85.8	88.5	91.2	93.9	96.5	3.37%
Central	52.5	58.3	60.4	61.1	61.9	62.6	63.3	64.1	64.8	65.6	66.3	67.0	2.24%
Low	45.4	32.8	32.9	32.9	33.0	33.1	33.2	33.3	33.4	33.5	33.6	33.7	-2.68%

Electricity p/kWh	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	% annual change, 2009-2020
High	7.3	8.0	8.3	8.4	8.6	8.9	9.1	9.4	9.7	9.9	10.1	10.3	3.15%
Central	7.1	7.2	7.5	6.9	7.0	7.3	7.3	7.4	7.5	7.6	7.7	7.7	0.68%
Low	6.9	5.6	4.9	4.2	4.0	4.0	4.0	4.0	4.0	4.0	4.1	4.1	-4.60%

The methodology used by WWA has been to set a baseline energy price, and calculate the various taxes against that baseline. The projections start in 2010 and go forward annually to 2014. WWA has then taken a point estimate of the effect of these charges in 2020. WWA has calculated the percentage annual increase in each of the projections over the period 2009 to 2020. This is shown in the final column of the table above, the central estimate being an annual real increase of 0.68% a year. Assuming an inflation forecast of 3% a year gives an energy price rise of 3.68% a year. To be conservative, WWA used only a 3.6% increase in energy prices per year. This percentage has been used to increase the baseline energy cost accordingly for the representative customer.

WWA has assumed electricity prices increase by 3.6% each year in the period 2010 to 2020.

[24] UK low carbon transition plan, price assumptions, DECC, July 2009

Since the customers have been providing nominal data, the energy price increases also assume inflation to be 3% per annum. WWA has used the central estimate from the table above.

10.2 Increase in distribution and transmission (T&D) charges

The connection of renewable generation will lead to an increase in electricity transmission and distribution charges. Wind generation, partly due to its location, will need significant additions to, and reinforcement of, the existing grid. Offshore wind farms will require that whole new networks are built in extremely difficult environments. Much of this investment will take place in the second half of this coming decade.

For this study, a starting point for estimating increased transportation charges was the most recent Ofgem price control document, DPCR5[25]. This allows an average of 5.6% increase per year (in real terms) for distribution charges, between 2010 and 2015. In nominal terms, this would be equivalent to an increase of 8.6% a year, skewed to penalise industrial users over domestic customers, so the increases for EHV customers is likely to be closer to 12% a year.

For gas transportation prices, there seems to be no reason why the gas investment programme will be unduly affected by the transition to a lower carbon economy. It is possible that more investment, or resilience in the existing investment, could be required to meet increasing flows of gas due to the closure of coal and oil fired plant in 2015. However, WWA has not forecast the increase in gas transportation prices that might result.

WWA has assumed an 8% increase in electricity transmission and distribution (T&D) charges, arising from climate change policies during the period 2010 to 2020.

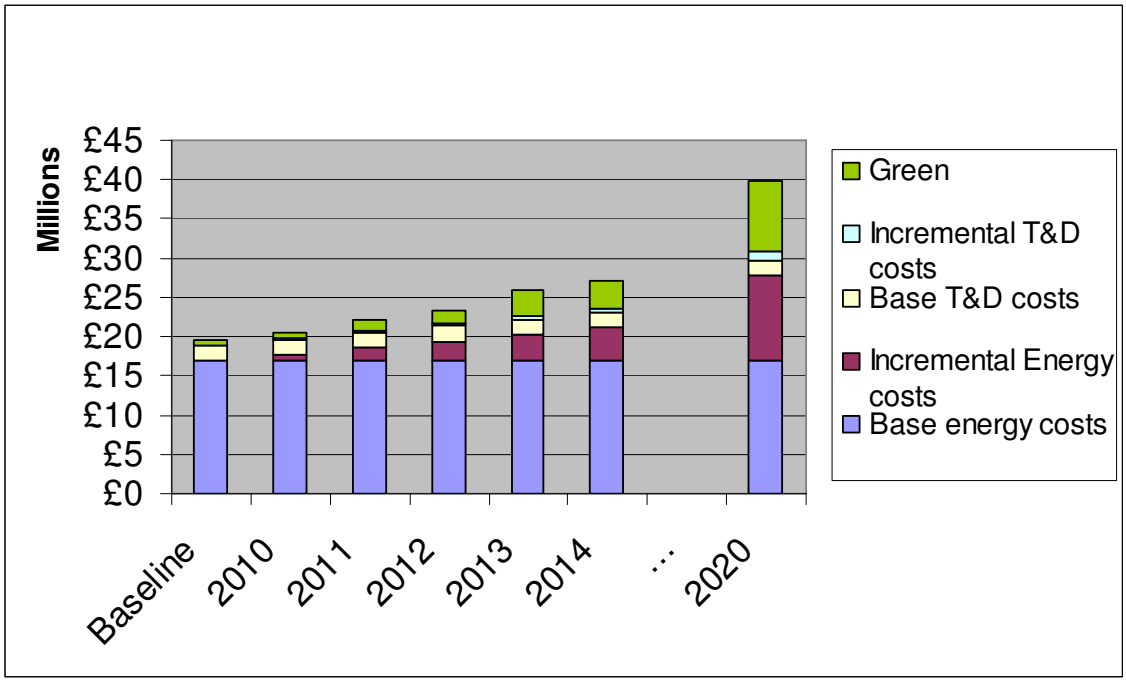
10.3 What do these price rises mean?

As before, WWA has used the profile of the representative energy intensive customer, holding energy consumption constant. The impact on the total energy bill of this customer is shown in graph 11 below. The lowest block of the bar is the customer's current energy costs; we have then added the incremental costs from the estimated price rises described in 10.1. The same is done with the transmission and distribution costs. The top of the bar has the climate change policies, labelled as "Green" costs.

For this representative energy intensive customer, WWA is forecasting an increase of over 100% in the company's total energy related expenditure.

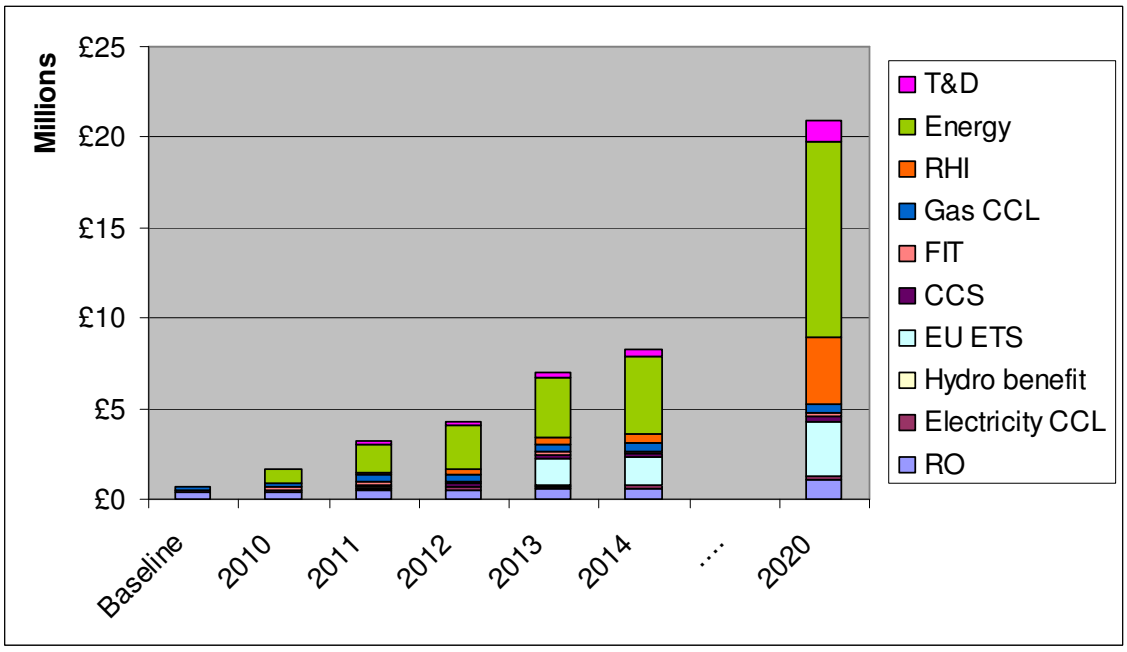
[25] http://www.ofgem.gov.uk/Networks/ElecDist/PriceCntrls/DPCR5/Documents1/FP_1_Core%20document%20SS%20FINAL.pdf

Graph 11: Impact on the total bill of a representative customer of: costs of climate change policies; higher energy prices and higher transmission and distribution prices.



Source: Waters Wye Associates

Graph 12: Incremental impact on a representative customer of: costs of climate change policies, higher energy prices and higher transmission and distribution prices



Source: Waters Wye Associates

Graph 12 shows a more detailed breakdown of these incremental costs arising from the energy prices, transmission and distribution charges increasing and the associated increase in the tax bill. The reason that the price rises increase the tax burden so substantially is because these taxes are being levied on the basis of percentage of energy costs. Given the energy usage of the representative customer, this is particularly highlighting the impact of the taxes on gas consumption.

In this analysis the EU ETS price is £15/tCO_2 to 2014 and then £30/tCO_2 for 2020.

Notable features of this analysis are:

- The EU ETS direct costs are a relatively small part of the overall cost increases being faced by energy intensive companies.

- The impact of the RHI is evident, reflecting the major effect that this gas related charge would have.

A company would have to have significant business margins to be able to absorb this level of cost increases. If it did not face any competition it could pass the costs through to its customers, but as already noted intensive users do have competitors. Furthermore the sectors are each other's customers, so pushing up the price of industrial gases, for example, will push up the costs for steel and chemicals. It would therefore appear necessary for the government to review the implications of energy cost increases for the UK's low carbon transition.

11. Government's estimates of the impact on industrial customers of climate change policies

As part of its ongoing programme of developing policies to move to a low carbon economy, the previous government provided several estimates of the impact of the strategy. Most recently, it estimated the incremental impact of its Renewable Energy Strategy[26] (RES) resulting from proposed policies.

Table 3: Renewable Energy Strategy Price Impact

	2015 Average fossil fuel prices	2015 Upper bound fossil fuel prices	2020 Average fossil fuel prices	2020 Upper bound fossil fuel prices
Electricity	2%	1%	15%	2%
Gas	6%	4%	30%	18%

It is important to note that this is the incremental effect of the RES, i.e. not including existing CCL and RO. It would be reasonable to assume that these percentage rises in prices would be from a starting point of energy bills in the region of £70/MWh for electricity or 50p/therm for gas.

The government has analysed the impact on domestic and non-domestic customers. The numbers in the table are the estimated impacts on non-domestic customers. The government recognises that these figures may conceal some distributional impacts, in particular costs may be higher for energy intensive customers.

> *"The RES will also have some negative impacts on business, especially in energy-intensive sectors, due to increased energy prices, driving up costs and reducing competitiveness.[27]"*

Further, the government recognised that the costs of the RES result in prices for carbon abatement that are in fact higher than the likely cost of traded carbon.

> *"The estimates show that none of the emissions reductions in the RES are below the EUA/non-traded price of carbon. However these indicators can only include those factors that are quantifiable. There are other benefits of the RES which are not included in the above such as improving security of supply and diversifying the energy mix, that are important considerations. As stated in the rationale, investment now will reduce costs longer term and put the economy on a transition to a low carbon economy – needed to avoid the higher costs of inaction[28]."*

[26] UK Renewable Energy Strategy 2009, DECC, July 2009
[27] UK Renewable energy Strategy 2009, Overall Impact Assessment, DECC, para 63, July 2009
[28] UK Renewable Energy Strategy 2009, Overall Impact Assessment, DECC, para 39, July 2009

There have been many impact assessments to justify the introduction of climate change related energy policies. These impact assessments are a valuable tool in helping to understand the wider consequences of each singular policy. However they fail to deliver on two different levels:

What is the cumulative impact of all the climate change policies?

While a successful renewables strategy is essential to the low carbon transition, there is no publicly available overall impact assessment of all the schemes taken together. Without understanding the cumulative impact the government will not be able to judge if its policies are effectively focussed to deliver a low carbon economy.

As noted above, the impact of the policies on energy intensive users has not been specifically assessed.

What is the impact on energy intensive sectors of the policies to move to the UK towards a low carbon economy?

WWA believes that the analysis in this report has illustrated how vital it is that the government does understand and address these two questions.

WWA recognise that the government has acknowledged the issues, notably in the Technical Annex[29] of their document Transition to a Low Carbon Economy:

> *"Chart 28 presents the change in cost (as a proportion of the sector gross value added) for sectors as a result of a €20 carbon price in the EU ETS. It suggests that the risk of leakage, while significant for some sectors, is confined to a few energy-intensive sectors, such as iron and steel, aluminium and cement, which account for a small proportion of overall UK GDP. However, given the sectors most at risk, the potential loss of GDP as a result of leakage is significant but small."*

Given this explicit recognition of the problem it is surprising that there are no tables in the document that show the direct impact of all the climate change policies on these sectors. A key concern raised by this report is that the risk to the UK's energy intensive industries is greater than has so far been understood, rather than the *"significant but small"* impact on which policy design has so far been based.

[29] http://www.decc.gov.uk/en/content/cms/publications/lc_trans_plan/lc_trans_plan.aspx

12. The importance of energy intensive industry employment, exports and wealth creation to the UK

Energy intensive sectors should be a key part of an equitable transition to a low carbon economy. These industries - iron and steel, aluminium, cement and lime manufacture, pulp and paper making, basic inorganic chemicals, and nitrogen fertilisers – together employ an estimated 225,000 workers[30], accounting directly for about 1% of UK GDP (some £15 billion).

12.1 Challenges to the sectors

The TUC has identified that energy intensive sectors face strategic transitional challenges, including:

- energy bill increases to 2020 – the subject of this study - as a result of a combination of climate change policies;
- their need to secure an adequate quota of free emissions allocations, benchmarked against high production standards;
- securing government-supported investment in a range of low carbon technologies, reducing energy usage and the carbon footprint of installations;
- skills and training for a low carbon future; and
- the need to ensure consultation between government, industry and trade unions to ensure an effective strategic response to these challenges.

They compete in a global economy with many other non-UK based industries. The danger is that the combined effect of energy and climate change policies will add costs to UK manufactured products compared with overseas producers; especially those based outside the EU, where fewer or no carbon constraints apply. This could lead to UK plant closures, job losses and outsourcing and carbon leakage.

12.2 The role of the sectors in UK manufacturing

The sectors are important as they produce products that we all demand and use on a daily basis, with many being reliant on each other in their manufacturing process. They are also a vital part of the UK economy in terms of jobs and wealth creation, as highlighted in Table 4 below. The UK cannot achieve its low carbon aspirations without the materials that these sectors produce.

Solar panels, building insulation and the materials from which electric cars are constructed are all made using products manufactured by energy intensive industry. Engineering solutions to climate change require the output from intensive industries. On a global basis, UK-based industry is energy and carbon efficient and there is no reason that they should not continue to make

[30] Energy Intensive Industries, TUC, November 2009

a valuable contribution to the UK economy if they can compete on a fair and level playing field.

Table 4: Contribution of energy intensive sectors to the UK economy

	direct employees	indirect employment	contribution to balance of trade	annual turnover
steel	23,000	100,000	£3bn	£7bn
chemicals	166,000	600,000	£8.8bn	£58bn
paper	25,000	25,000	£2.5bn	£4bn
ceramics	20,000	60,000	£0.5bn	£2bn
glass	8,000	120,000	£92m	£2bn
Total	242,000	905,000	£15.72bn	£73bn

Source: EUIG members

The UK **aluminium** industry's annual turnover is between £2.5 billion- £3 billion per year. The directly employed workforce is 20,000, but the ability of other sectors to source aluminium in the UK creates significant indirect employment. The UK has only two primary smelters left in the UK, Lynemouth and Lochaber, this is following the closure of Anglesey Aluminium as it could no longer find competitively price electricity with Wylfa power station closing.

The UK's **ceramic** sector, producing bricks, tiles, sanitary wear and fine china, has sales of £2 billion, including their supply chain. The sector employs more than 20,000 people and has export sales of £500 million, particularly for industrial ceramics, refractories, table and giftware and clay drainage pipes.

The **chemical and pharmaceutical** sector, which includes fertilisers and industrial gases, is a £60 billion UK industry. Every day for the past decade, the sector has added £20 million to the UK balance of trade whilst the rest of manufacturing has shown a £200 million deficit. The jobs of 600,000 people in the UK depend on the chemical and pharmaceutical industry. Workers in the sector perform high quality, skilled jobs reflected in pay levels that are 20% higher than other manufacturing sectors.

The **glass** industry produces in the region of 3.3m tonnes of glass annually with an estimated turnover of £1.8 billion. The industry employs 108,000 people directly, with 8,000 in direct manufacturing and 100,000 in up and down-stream activities. The industry is valued by the Office for National Statistics at £457 million.

The **mineral products**, such as cement, aggregates, lime and mortar account for around 60,000 jobs. They industry is responsible for the largest materials flow in the economy and like other energy intensive sectors provides products to a range of other industries. It is a £5 billion industry and provides jobs across all regions of the UK.

The UK **paper** industry employs around 30,000 people directly and over 250 paper installations are to be found across the UK, from paper mills through to converting plants and recovered paper depots. The industry's annual turnover is of the order of £4 billion. Some 4.3 million tonnes of paper are made in the UK each year but nearly 11 million tonnes are consumed meaning well over half of the paper used in the UK is imported. This has a significant impact on the UK's trade balance.

In 2010 the UK **steel** industry will contribute £7 billion to UK GDP. It directly employs 23,000 people and up to 100,000 people indirectly, mainly well rewarded jobs in areas with relatively high unemployment, and makes a positive contribution to the balance of trade of £3bn a year. Over half of the steel made in the UK is exported. The sector spends £50m each year on research and development. This is an important sector and will be vital in helping the UK become a low carbon economy. The metals industry as a whole is one of the UK's very biggest manufacturing sectors, employing over 400,000 people with a sector turnover in excess of £41 billion according to the government's statistics.

The government should therefore undertake a cost benefit analysis of this broad energy intensive sector to assess the overall direct and employment and GDP benefits to the UK and its regions.

12.3 Links to the wider economy

Outlined above is the contribution the intensive energy using sectors make to the UK economy. WWA has noted that the potential impact on the profitability of some companies in these sectors in chapter 9. The TUC commented to WWA that they were particularly concerned about the secondary impacts on the UK economy were the price of energy intensive products to become more expensive or had to be imported. WWA has not examined these wider impacts, but agree that the indirect effects need to be understood by the government and considered when undertaking impact assessments on climate change policies.

As already noted, the output from energy intensive industries provide materials to many other sectors of the UK economy. This report has made no attempt to assess the potential impact that climate change policies will have on these secondary sectors. Nor have we identified the indirect effects on secondary sectors of their suppliers raising costs or them having to import raw materials. However, it would be reasonable to assume that if, for example, the price of UK steel increases then the cost of producing cars will rise, which in turn may reduce the profitability of car manufacturers and raise the price of UK cars. Price rises could feed through to inflation and reduce car exports, worsening the balance of trade.

The energy intensive users also have employees with specialised qualifications and skills. They are committed to investing in their staff and

also undertake a significant amount of research and development (R&D)[31]. It is this investment that helps maintain a well paid, skilled work force and delivers lower carbon products such as energy efficient glass, photovoltaics, lighter steel, etc… Increasing these companies' costs will reduce their ability to invest in their own businesses.

Were the sectors to cease to exist in the UK, the skills base and R&D infrastructure will also cease to be maintained. In the future, were UK energy costs to become attractive, companies in these sectors would face new barriers to entry when looking at the UK for potential new capacity. Skilled employees would require training, R&D facilities and expertise re-establishing, etc… This problem of a skills gap has recently been highlighted by the nuclear sector, where the new nuclear build programme may be slowed due to a lack of skilled nuclear experts[32].

When undertaking the cost benefit analysis of the energy intensive sectors secondary, indirect impacts also need to be explicitly recognised.

[31] The UK steel sector spends £50m each year on R&D.
[32] Innovation, Universities, Science and Skills Committee, Engineering: turning ideas into reality, March 2009: *"We found plenty of evidence to suggest that there are very real skills shortages in the nuclear industry."*

13. The importance to a low carbon economy of energy intensive companies

It is widely acknowledged that industrial processes have impacts on the environment in which they operate. The UK's energy intensive sectors are no exception, but they do face some of the most stringent environmental regulations in the world and aim to improve environmental performance year on year. They recognise that they are part of the transition to a low carbon economy. However, as well as minimising their own impacts, they are also vital in delivering changes to the rest of the economy.

Another area that government policy does not address is the tax burden relative to the carbon footprint of products based on their lifecycle. Looking that durability and the recyclability of the products produced by energy intensive sectors, WWA suspects that their carbon footprint over the life of their products is probably very low compared to many other sectors.

13.1 Energy Intensive, but lower carbon products

Aluminium

Aluminium is light weight, high strength, resistant to weathering, able to be treated in a variety of finishes and finally very recyclable. It is widely used in sectors such as construction, automotive, aerospace and packaging. With a move to lighter modes of transport to improve energy efficiency, aluminium as a proportion of transport structures, such as cars, ships and planes, is expected to increase significantly. It is also used significantly in buildings, such as windows, shop fronts, heating and ventilation systems and equipment such as ladders and machinery.

Every kilo of aluminium used in a car's manufacture saves 20 kilos of CO_2 emissions over its lifetime. Buildings using aluminium facade systems can use 50% less energy. Recycling rates of over 95% are achieved by the industry year on year because of the high intrinsic value of aluminium products and the ease with which it can be recycled. Recycling aluminium scrap in Europe saves over 90 million tonnes of greenhouse gas emissions in a year, equivalent to the annual emissions from 15 million cars. As a sector, the aluminium industry has reduced its carbon dioxide emissions by 39% since 1990.

Bricks

Bricks last for over 150 years of serviceable life without maintenance. Very few other materials would be able to claim such a life expectancy. As such, bricks contribute to a low carbon building shell if the effective CO_2 per m^2 per year of building use is taken into account.

Bricks are used in building the housing the UK needs, in factories and recycled bricks are used for hardcore in construction, roads and new buildings. The UK needs bricks: the issue is how far they will travel to reach the UK market. The carbon footprint of the bricks the UK uses will rise if they are transported significant distances to the market.

Ceramics
Many ceramic materials enable the transition to a low carbon economy. Ceramic products have low lifecycle carbon footprints. Industrial ceramics provide critical components for renewable energy and electricity production and distribution. Long-life refractory materials are essential for glass, steel and ceramic production – which are key materials in construction and low carbon energy generation.

Chemicals
The Chemical Industries Association (CIA) estimates that for every unit of greenhouse gas emitted through chemical industry production, the resulting products enable savings of 2-3 units. Chemicals are required to produce home insulation, they are used in crop production, they go into lighting solutions and into fuel efficient vehicles, the transition to a low-carbon economy needs a chemical sector. The products and services of the chemical and pharmaceutical industry also deliver clean water, vital medicines, food, clothing, housing and transport, modern communications and leisure activities.

The CIA runs a Responsible Care programme for their members. This requires that companies continuously improve their performance related to the safety of their sites, the health of their employees when at work and the impact of their operations on the environment. This demonstrates the sector's commitment to achieving sustainable development.

Fertiliser
As plants grow, they capture CO_2 from the atmosphere. In a recent lifecycle analysis study carried out by the Oko Institute and McKinsey for ICCA[33], it was concluded that fertiliser was the second largest contributor to emissions savings.

The report concluded that fertiliser saves over six times the amount of CO_2 equivalent than is emitted during the product's entire life cycle. As with the other sectors, there is no debate that the UK needs not only fertiliser, but other industrial chemicals produced within the sector. Ammonia is used within the manufacture of carbon fibre wind turbine blades and nitric acid, for building insulation. Implementing a project to reduce emissions by over 1.3 million tonnes $C0_2$ equivalent by the end of this year, UK emissions of N20 from nitric acid production will become the lowest in Europe.

Again the issue is whether the UK imports the products with the associated loss of jobs, revenue, etc. or protects them and refocuses carbon reducing policies on sectors that can respond more easily by reducing energy use rather than moving offshore. Fertiliser is a globally traded commodity. The fertiliser sector faces intense competition and increases in capacity from regions where energy costs are kept at an artificially low level and carbon reducing policies are not an issue. Production can move if the government forces it out but will result in carbon leakage as well as resulting in job losses in the UK's industrial heartlands.

[33] Innovations for Greenhouse Gas emissions, ICCA, July 2009

Glass

Glass can be recycled indefinitely without any loss of quality. The savings of CO_2 within closed loop glass recycling is 315kg per tonne of glass. Intelligent coated glazing is vital in insulating modern homes and offices, with low energy glazing saving 13kg CO_2/m^2 each year. Glass insulation can save 200t/CO_2 in a property over 50 years. Glass fibres also go into wind turbines, solar panels and energy saving light bulbs.

Container glass, the manufacture of which uses half the energy consumption that it did twenty years ago, produces 9 billion bottles and jars used for storing food in every home. 120 million meters squared of glazing not only goes into new home each year, but also to the automotive sector, for optical instruments, aerospace and other industries on which the UK economy relies.

Industrial Gases

Industrial gases are essential for almost all manufacturing. Large quantities of oxygen, nitrogen and argon are used in steel manufacture. Use of industrial gases is also vital to the medical sector and liquid nitrogen is vital in the recycling of plastics, packaging and scrap tyres as well as the material separation of electric motors and batteries. Oxygen reduces emissions by helping in the treatment of toxic waste. It can also help treat contaminated soil through biological cleaning without the need to remove the soil[34]. Dry ice can be used for the environmentally friendly clean up of oil spills. Industrial gases are used to dramatically increase the efficiency of recycling aluminium cans[35].

Paper and Pulp

Paper is intrinsically sustainable; being both renewable in origin and reusable after use. Around 80% of paper produced in the UK is made from recycled fiber; the value of this market underpinning many recycling schemes. New pulp comes from well managed plantations; both the plantations and paper itself providing a valuable carbon sink. Even when recycling is no longer feasible the material is not waste; valuable uses are to improve soil structure or as a source of renewable energy.

The Confederation of Paper Industries estimates that in 2008 the paper industry achieved a carbon saving of over 11.5 million tonnes arising just by diverting waste paper for recycling rather than going into other disposal routes.

Steel & Forging

Almost everything we use either contains steel or has been made using steel. Whether it is bolts or buildings, clothes or chemicals, all depend on steel at some point. Windmills are made largely of steel, nuclear power plants have steel and forged components, as do the offshore oilrigs and the decks on which wind farms are constructed. Steel is also a sustainable choice: strong, a long duration of use, re-usable and, unlike many other materials, can be 100% recycled time and again without loss of quality.

[34] European Industrial Gases Association
[35] http://www.linde.com/international/web/linde/like35lindecren2.nsf/docbyalias/p_metall_glas_sub2

New, innovative steels, coupled with sophisticated design, can also deliver carbon savings in their applications. Examples include the development of low weight/high strength steels that enable the production of lighter vehicles; and new steels that deliver efficiencies in power generation and transmission[36]. The sourcing of steel and associated products will be important when considering the overall carbon footprint of the decarbonised energy production sector that will be required for the UK to meet its renewable energy targets. Sourcing steel from local, efficient steel makers will be beneficial to the global environment and good for the UK economy.

13.2 EU climate change policy: beyond 20% emissions reduction by 2020

As the European Commission[37] acknowledged recently, one of the important considerations in the evolution of EU climate policy is avoiding "carbon leakage". This concerns the risk that in the absence of sufficient global effort, domestic action leads to a shift in market share towards potentially less efficient installations elsewhere, thereby resulting in increased emissions globally. Across the EU, the Commission suggests that the organic chemicals, inorganic chemicals and fertiliser sectors have been hardest hit.

There are, of course, many reasons for competitive advantages and disadvantages other than the costs of carbon, but the more competitor countries sign up to comparable levels of effort to cut emissions, the less the risk of carbon leakage. The EU is due to receive a report on carbon leakage in June 2010, following the 2009 climate and energy package, which recognised that the risk of carbon leakage had to be monitored, and some measures put in place to counter it.

The EU is committed to securing an ambitious global deal on climate change. In considering a move to uplift its 2020 emissions reduction target from 20% to 30%, it argues that "*the more that major trading partners implement their high-end pledges, the lower the risk of carbon leakage*."

However, the EU claims that evidence gained so far from the emissions patterns of energy-intensive industries is "*inconclusive*", in particular as to the extent EU climate policy has triggered the relocation of economic activity outside Europe. On the one hand, the emissions of energy intensive sectors have significantly declined over the last years, but they would argue that their investment in low-carbon technology in energy-intensive sectors has strengthened their overall productivity.

Arguing that the key issue for carbon leakage is the competitive difference between the EU and third countries, the Commission proposes three ways in which carbon leakage, "*if it can be demonstrated*", could be tackled:

- by giving further support to energy-intensive industries through continued free allowances;

[36] Boston Consulting Group, looking at Germany, has calculated that carbon savings from the innovative use of steels delivers a carbon reduction for the German economy that exceeds the total emissions of the German steel industry: http://www.oecd.org/dataoecd/5/8/45152681.pdf.
[37] Analysis of options to move beyond 20% greenhouse gas emission reductions and assessing the risk of carbon leakage, COM (2010) 265 final, EU 26 May 2020

- by adding to the costs of imports to compensate for the advantage of avoiding low-carbon policies; or
- by taking measures to bring the rest of the world closer to EU levels of effort.

But this study suggests that energy intensive industries as a group are already under pressure from climate change/energy policies. The Commission's reservation about the extent of carbon leakage, summed up in the remark "if it can be demonstrated" is not reflected in the case study evidence of this report.

As the Commission and the Member States contemplate moves to more ambitious policies for 2020 and beyond, it is vital that both the government and the Commission assess this evidence and the employment and investment consequences of current and future emissions reduction policies.

Annex 1: Increases in Costs Arising from Existing "Climate Change" Policies

There are a number of increases in the costs of existing carbon reduction and other climate change schemes which this report has sought to estimate in terms of their incremental effect on industrial energy customers. Outlined below are the assumptions used to give the forecasts of increasing climate change policy costs.

Increases in the renewables obligation

It is the current intention to keep the Renewables Obligation in place until 2028 with a steadily increasing RO target to maintain the demand for renewable generation. As the RO target is set year-by-year, the ROC prices will vary over time. The required RO has been set out as follows[38]:

Table 5: Obligation levels for 2009/10 forwards

	2009/ 10	2010/ 11	2011/ 12	2012/ 13	2013/ 14	2014/ 15	2015/ 16
England and Wales	9.7%	10.4%	11.4%	12.4%	13.4%	14.4%	15.4%
Scotland	9.7%	10.4%	11.4%	12.4%	13.4%	14.4%	15.4%
Northern Ireland	3.5%	4.0%	5.0%	6.3%	6.3%	6.3%	6.3%

Source: DECC

Due to the "headroom" concept, the actual level of the RO for 2010/11 has been uplifted by 8%, making the level 0.11ROC per MWh for 2010/11. WWA have assumed the same level of uplift for each of the successive years of the RO.

It is not clear what the buy-out price associated with this increase in the RO will be. It is also not clear how the buy-out price, the uplift and the traded ROC price will interact.

For the purposes of this study, WWA have increased the cost of the RO on electricity bills by 10% a year. The report starts with the 2009 buy-out price of £3.719/MWh or where appropriate, the companies declared exposure to the RO in the last year.

WWA considers that this represents a conservative estimate of the cost of the RO for industrial customers.

Increases in the climate change levy

It is intended that the CCL rates increase in line with inflation. As elsewhere in the report, WWA has assumed a 3% inflation rate.

[38] Calculating the level of the renewables obligation, DECC

WWA has assumed a 3% a year increase in companies' exposure to CCL.

A more immediate impact is the decision that relief from the CCL arising under the CCAs will reduce from 80% to 65% in April 2011. This is equivalent to an increase in costs for companies with CCAs.

EU ETS phase III

As has been well documented, the first two phases of the EU ETS have not resulted in significant costs to energy customers since allocations of allowances for most emissions have been allocated free. However, energy consumers have indirectly born the cost of EU ETS II via increased electricity prices as generators have sought to pass the opportunity cost of their allowances though to customers.

The lack of a direct impact is set to change in 2013 under EU ETS III, when it is expected that a proportion of a company's emissions will have to be purchased. Except for leakage sectors which could receive up to 100% according to a system of benchmarks, for industrial emitters this proportion of purchased EUAs has initially been set at 20%, rising to 80%. As such, costs to UK business in EU ETS will increase significantly in 2013, with continued increases as various transitory measures are withdrawn.

There are significant issues still to be resolved over this scheme. Companies' exposure will vary significantly with respect to decisions yet to be taken on, for example:

- Benchmarking
- Leakage
- Allowances for competing industries
- Site thresholds
- The interaction with new Climate Change Agreements

Given the likely impact of this particular scheme, WWA has assumed a low and high estimate for the possible cost of purchasing allowances, the EUA (European Union allowance) price.

WWA has used a low price of £15/tCO_2 to 2014. However, many expect the price to somewhat higher than this, possibly due to a minimum price for emissions being established. In the report WWA have therefore modelled a somewhat higher price of £30/tCO_2 in 2020.

Annex 2: Increases in Costs Arising from New "Climate Change" Policies

There are a number of other schemes which are also aimed at helping the UK achieve its carbon reduction targets. These are discussed below.

Carbon Capture and Storage (CCS) Levy

The Energy Bill allows the government to place a CCS Levy on all electricity suppliers by 2011. It depends on the type of framework they use, but it is likely that government will place a new CCS levy only on licensed electricity suppliers, similar to the CCL. The government's impact assessment[39] for the CCS levy proposal estimates the impact on electricity bills as 2%.

For the purposes of this study, WWA has assumed a 2% increase in industrial electricity bills, effective from 2011.

Renewable Heat Incentive (RHI)

The objective of the RHI is to facilitate heat sector contributions to the government's legally binding target of supplying 15% of total energy demand from renewable sources by 2020. It is intended certain types of renewable heat generators will be subsidised. At this stage, it is not clear how the scheme is to be funded. However, the government's impact assessment suggested that there be a levy placed on gas suppliers. The February 2010 impact assessment[40] estimated industrial gas bills could increase by 4% in 2015 rising to 20% by 2020. The impact assessment was clear that no funding decision had yet been made (it was expected in the 2010 Budget).

For this study, WWA has assumed 1% a year increase in industrial gas bills, starting in 2011. This reaches 4% in 2014/15. Clearly faster increases would be required to reach 20% by 2020, used by WWA.

WWA cannot tell from the impact assessment if the government is planning the levy to relate to energy bills or energy consumption. One would assume the latter, but this clarity is not given, any more than a forecast of levy rates.

Feed in tariff (FIT)

The objective of the Feed in Tariffs is to encourage the growth of small scale renewable electricity generation. The tariffs are set by government. Suppliers then contract to take the electricity generated in return for payment of these tariffs. Suppliers are expected to pass on the costs of making these payments through

[39] Impact assessment of coal and carbon capture and storage requirements in "a framework for the development of clean coal" consultation document, DECC, June 2009
[40] Impact assessment of the Renewable Heat Incentive scheme for consultation in January 2010, DECC, February 2010

their electricity supply bills. The government's impact assessment[41] estimates an increase in industrial electricity bills of 1.5% will result.

For the purposes of this study, WWA has assumed an increase in electricity bills of 1.5%, starting in 2010.

[41] Impact assessment of Feed-in tariffs for small-scale, low-carbon, electricity generation, DECC, February 2010

Annex 3: Energy Intensive Users Group Members

The Energy Intensive Users Group's membership comprises trade associations and customer groups representing industrial sectors with the heaviest energy consumption in the UK. These are:

Sector	Association
Steel	UK Steel
Chemicals	Chemical Industries Association
Paper	Confederation of Paper Industries
Glass	British Glass Manufacturers Federation
Ceramics	British Ceramic Confederation
Aluminium	Alcan
Industrial Gases	BOC Air Products
Minerals & Cement	Mineral Products Association
General	Major Energy Users Council
	EnergyQuote

Annex 4: Policies of the new government

The Coalition: our programme for government

The coalition government published its policy statement on 20 May 2010. Outlined below are the policy statements, under the headings given in the document that may impact the energy intensive industries either directly or indirectly via the energy market.

CONSUMER PROTECTION

We will take forward measures to enhance customer service in the private and public sectors.

We will seek to extend protection and support to 'off-grid' energy consumers.

ENERGY AND CLIMATE CHANGE

We will push for the EU to demonstrate leadership in tackling international climate change, including by supporting an increase in the EU emission reduction target to 30% by 2020.

We will seek to increase the target for energy from renewable sources, subject to the advice of the Climate Change Committee.

We will continue public sector investment in carbon capture and storage (CCS) technology for four coal-fired power stations.

We will establish a smart grid and roll out smart meters.

We will establish a full system of feed-in tariffs in electricity – as well as the maintenance of banded Renewables Obligation Certificates.

We will introduce measures to promote a huge increase in energy from waste through anaerobic digestion.

We will introduce measures to encourage marine energy.

We will create a green investment bank.

We will establish an emissions performance standard that will prevent coal-fired power stations being built unless they are equipped with sufficient carbon capture and storage to meet the emissions performance standard.

We will introduce a floor price for carbon, and make efforts to persuade the EU to move towards full auctioning of ETS permits.

Through our 'Green Deal', we will encourage home energy efficiency improvements paid for by savings from energy bills. We will also take measures to improve energy efficiency in businesses and public sector buildings. We will reduce central government carbon emissions by 10% within 12 months.

We will reform energy markets to deliver security of supply and investment in low carbon energy, and ensure fair competition including a review of the role of Ofgem. We will instruct Ofgem to establish a security guarantee of energy supplies.

We will deliver an offshore electricity grid in order to support the development of a new generation of offshore wind power.

We will encourage community-owned renewable energy schemes where local people benefit from the power produced. We will also allow communities that host renewable energy projects to keep the additional business rates they generate.

As part of the creation of a green investment bank, we will create green financial products to provide individuals with opportunities to invest in the infrastructure needed to support the new green economy.

We will work towards an ambitious global climate deal that will limit emissions and explore the creation of new international sources of funding for the purpose of climate change adaptation and mitigation.

Liberal Democrats have long opposed any new nuclear construction. Conservatives, by contrast, are committed to allowing the replacement of existing nuclear power stations provided that they are subject to the normal planning process for major projects (under a new National Planning Statement), and also provided that they receive no public subsidy.

We will implement a process allowing the Liberal Democrats to maintain their opposition to nuclear power while permitting the Government to bring forward the National Planning Statement for ratification by Parliament so that new nuclear construction becomes possible. This process will involve:
– the Government completing the drafting of a national planning statement and putting it before Parliament;
– specific agreement that a Liberal Democrat spokesperson will speak against the Planning Statement, but that Liberal Democrat MPs will abstain; and
– clarity that this will not be regarded as an issue of confidence.

Glossary

CCA	Climate Change Agreement
CCL	Climate Change Levy
CCS	Carbon Capture and Storage
CRC	Carbon Reduction Commitment
DECC	Department of Energy and Climate Change
EHV	Extra High Voltage
EUA	European Union Allowance
EU ETS	EU Emissions Trading Scheme
EU ETS III	Phase 3 running 2013-2020
FIT	Feed in Tariff
IED	Industrial Emissions Directive
MW	Megawatt
MWh	Megawatt hour
Ofgem	Office of Gas and Electricity Markets
RES	Renewables Energy Strategy
RO	Renewables Obligation
ROC	Renewables Obligations Certificate
RHI	Renewable Heat Incentive
tCO_2	Carbon dioxide measured in tonnes