House of Commons Environment, Food & Rural Affairs Select Committee Inquiry - International Challenge of Climate Change: UK Leadership in the G8 and EU

Request for written evidence

Response by the Institution of Civil Engineers

Institution of Civil Engineers

The Institution of Civil Engineers (ICE) is a UK-based international organisation with over 75,000 members ranging from professional civil engineers to students. It is an educational and qualifying body and has charitable status under UK law. Founded in 1818, ICE has become recognised worldwide for its excellence as a centre of learning, as a qualifying body and as a public voice for the profession.

1 Introduction

1.1 The ICE welcomes the opportunity to present the following statements and evidence as part of the inquiry. As an international organisation, the ICE represents members drawn from a number of constituencies – UK members and residents, British engineers working throughout the world, and foreign members working through out the world, and of course in the UK. Although impossible to canvass the views of all members, we take a position of arguing both for the UK economy and its engineering profession. Engineers have a key role in the team that will deliver a low carbon future.

1.2 Climate change is a key part of the debate on sustainability and it is now commonplace to ascribe exceptional weather conditions as being caused by global warming. The evidence suggests that these issues affect all parts of our lives. Climate change is not a national problem, or even a regional problem; the impacts will change conditions for everyone on the planet. Although individuals can try to reduce their own production of climate change emissions, their decision is for a large part swamped by the actions of all mankind.

1.3 Climate change gases arise directly from the various energy industries as well as transport, other industries, including construction and mining, commercial operations and domestic life. Nature itself can also produce climate change gases in such examples as volcanic eruptions and coal bed methane. So the problem is widespread and must be considered in terms of the sum of many parts.

1.4 The UK has accepted the policy of prevention, or reduction in climate change, but as the UK only contributes about 2% of climate change gases, we must use international persuasion to influence the producers of the other 98%. Of course, energy supply and associated processes are one side of the coin; on the other side is energy demand. Both need to be addressed if the problem is to be resolved.

1.5 We urge an international response to the issues of climate change based on the themes of limiting overall global emissions and setting equitable emission rights between nations – the “Contraction and convergence” model. Engineers, members of this Institution and the other engineering Institutions are well aware of the importance of sustainability. Our education, training and professional responsibilities place our duties towards the environment at a high level in our work. The engineering profession is prepared to face the challenges of climate change.

2 Feasibility of an international ETS

2.1 CO_2 reduction

2.1.1 The purpose of an international ETS is to attempt to reduce the production of GHG (in particular CO_2) or at least to maintain the production at current levels.

2.1.2 First, we must look at the demand for energy, and consider the ongoing demand, especially in the developing world.

2.1.3 We are concerned that energy efficiency and energy use reduction needs to be developed and understood. Energy consumption per capita is increasing at an annual rate of about 0.7% across the EU, and at a much higher rate in the recent accession countries to the EU. We expect this trend to be reflected amongst other regions in the world - in Asia, South America and Africa - as development relies on energy. Table 1 shows the increase in electrical consumption in the EU and USA. Data on electrical production is an indication of the growth in energy production. Total energy use is approximately three or four times higher than electrical production alone.

- **Table 1: Electrical Energy Consumption in the EU and USA 1985-2002**

	EU 1985	EU 1997	EU 2001	EU Increase 1985 - 2001	EU[1] candidates 1985	EU candidates 1997	EU candidates 2001	**Increase 1985 - 2001**	USA 1985	USA 1997	**USA 2002**	**Increase 1985 -2002**
Generating capacity per inhabitant kW / person	1.34	1.5	**1.56**	16%	0.55	0.77	0.87[2]	**32%**	2.94	2.95	**3.5**	**19%**
Electricity generated per inhabitant kWh / person	5355	6487	**7029**	31%	2883	3012	3181	**10.3%**	10659	13754	**13778**	**29%**
CO2 emissions per inhabitant Tonnes / person	8.3	8.1	**8.3**	0	7.5	5.5	7.5	**0**	19.6	20.7	**21.3**	**9%**

Source: EU, Eurostat , EIA and Private estimates

2.1.4 The UK Government's policy to meet its targets for CO_2 reduction depends for a large part on increasing the proportion of renewable generation for the production of electricity to 10% by 2010 and onwards. Engineers, recognising the significance of climate change, have a major part to play in driving towards these targets, but the targets are challenging and will not be reached without a major re-appraisal of short term and medium term policy in a number of areas.

[1] Accession countries and candidate countries
[2] Estimate

- **Increasing Energy Consumption**

2.1.5 Overall energy consumption is increasing. Almost as fast as energy efficiency is introduced, more and more demands are placed on the electricity network, both domestically and in the work place. The National Grid has had to revise upwards its forecast for generation capacity.[3] Renewable sources of generation offer a diverse portfolio – and all must be considered if we are to meet these targets. Although significant, the growth in windpower alone will not be able to satisfy the UK's increased demands for electricity. Other forms of renewable generation must also be considered as part of our plans. Solar pv will make a contribution, biomass and geothermal offer more controllable energy sources.

- **Renewable Generation**

2.1.6 Other large-scale renewable generation needs to be considered in order to extend our energy resources. The next wave of renewable energy sources is in the marine sector, in particular tidal flow and wave energy. The UK should be persuaded to invest heavily in this area and bring forward commercially viable technologies. This will not be possible without significant investment and R&D into this fledgling industry – with significant long-term downstream benefits to UK's civil/marine engineering industry as well as to the nation's energy resources. We welcome initiatives to increase the adoption of solar photo-voltaics (pv), both in the UK and world-wide, as well as the greater use of biomass as a fuel source. In any case, the Institution continues to press for a debate on the longer-term security of supply issue. This debate must give serious consideration to the use of tidal power barrages and the renewed use of nuclear power alongside increased use of renewables. Most of the UK's existing nuclear power capacity will be retired by 2025. The UK should take steps to ensure that skills and process are maintained so that, should new nuclear capacity be required, the licensing and construction processes can be completed expediently. A more equal emphasis should be given to both nuclear and renewable technologies than at present.

- **Centralised Power & Combined Heat and Power (CHP)**

2.1.7 The model of centralised power systems has served the UK well for more than 80 years. Significant progress is now being made in restructuring power systems to include more distributed generation and combined heat and power projects. Flagship projects such as the CHP in Woking illustrate modern thinking. Their benefit is three fold: first a reduction in overall energy consumption as higher efficiency generating plant is used, secondly a reduction as losses in transmission are reduced and thirdly, encouragement of the attitude that focuses on the sustainable long term use of energy use. Similar projects are limited in their take up because of the need for them to meet rigorous cost benefit analyses before project money is available.

2.1.8 We should beware of the false promises that sometimes spring from the merchants of new technology. Micro and distributed generation may offer apparently lower cost energy when compared on a metric such as pennies / kWh taken on an annual basis, whilst quietly ignoring the true cost of "load following" the demand of the individual consumer. We see micro-generation as part of the solution, but, for the most part users of micro-generation will remain connected to power networks for provision of energy management and ancillary services.

- **The Relationship Between Energy & Power**

2.1.9 Some other countries are making good progress towards installation of renewable energy resources, but we need to look behind the first layer of the figures. For while wind generating capacity has increased in many European countries, actual energy production from wind is much lower because of the relatively low capacity factor and the intermittent nature of wind energy.

2.1.10 We must differentiate between energy production and power requirement, especially when we debate wind energy. A power network needs generating capacity, expressed usually in MW or GW, but the users of the network require energy to be available, usually varying with the time of day. To meet the instantaneous demands requires all the wind generators to be operating at rated output, hence an allowance must be made for low- or no-wind days. Even if the UK could produce more than 20% of its electrical power from renewable resources, there would need to be major changes in the electrical infrastructure and more electrical energy storage to make the power available when required. To put this simply, more generation is required than would be calculated directly from the theoretical annual production from renewable resources.

[3] National Grid Transco, Seven Year Statement 2004

- **Generation from Gas**

2.1.11 The UK's reliance on imported natural gas is an insufficient response. It was a fortuitous co-incidence that a large proportion of power generation switched from coal to natural gas during the early 1990's. This brought together several threads: improved combined cycle gas turbine efficiency (CCGT), the lifting of the embargo on generation from natural gas and the privatisation of the power industry. The reductions in emissions have now been obtained, and there will only be marginal gains from natural gas. The UK is close to its 12.5% Kyoto target. CO_2 decreased by 7.5% between 1990 and 2003 despite an 8% rise in consumption. We do note that there was a 1.5% increase in CO_2 emissions in 2003. The switch to natural gas is also reflected in the average figures for the EU.

2.1.12 The UK Government's aim of reducing CO_2 by 20% by 2010 hinges crucially in reducing coal burnt in power generation. Reductions to date have all come from a switch from coal to gas burn for electricity generation - the other sectors totalling 82% of energy use, in commercial and domestic heating and transport have achieved no real savings. The split of the latter two is roughly 40% each of the total. CO_2 from domestic and commercial heating and vehicles are rising inexorably with no likely curtailment in the short term.

- **Other Sectors**

2.1.13 Indeed, the environmental audit committee of the Commons reported in August 2004 that the Government's energy strategy was now "seriously off course" and "that more imaginative and radical" policies were needed for transport. Transport's share of UK emissions are expected to rise from 18.7% to 26.3% in 2010. Air transport has almost doubled between 1990 and 2002. The large increase in regional aviation might reduce emissions and wasted energy involved from travel between major hub airports, but much of the increase appears to have made from the increase in the overall market for aviation. There has been a 17% increase in road traffic since 1997. There is very little enthusiasm within the UK for the preparation of liquid fuels such as bio-diesel made from renewable resources, which might show some small savings. Such bio-fuels are however being used in other countries, such as France, showing a welcome link between agricultural policy, EU subsidy, transport action and action for sustainability.

- **The Hydrogen Economy**

2.1.14The hydrogen economy is still many years away. Hydrogen should be seen as an energy vector, and not as a fuel source. As an energy vector it is currently has a low through efficiency. Unless the hydrogen is produced from very low carbon-emitting sources, such as hydrolysis using nuclear[4], wind power or hydro-power there is little to be gained. We are also concerned that the effects of hydrogen in the upper atmosphere are not understood. Estimates of hydrogen leakage vary from 0.1% to as much as 10% when transported. We also note that despite widespread research on the development of the hydrogen infrastructure, there has been little attention paid to the use of the oxygen that is also produced during the hydrolysis process. It is claimed that hydrogen would offer a credible form of energy storage, but there is not yet sufficient evidence to conclude that problems would be solved by use of a hydrogen infrastructure. The PIU reported [5] that to produce sufficient hydrogen for transport in the UK would require more energy than our present electrical consumption. Even a small proportion of the world-wide speculative investment in fuel cells and hydrogen infrastructure would make a significant difference to stimulating development of other more near term renewable resources.

2.1.15 Low cost energy storage would be an essential enabling technology to support large-scale integration of renewable generation. Electrical energy storage is available – for example, pumped hydro and many types of batteries. However large-scale battery storage is still viewed as an emerging technology, and large scale demonstrations of battery storage and renewable generation should be encouraged with a similar level of enthusiasm and financial support that is given to hydrogen storage.

2.1.16 Although hydrogen is seen as replacement fuel for road transport, care needs to be taken that the problem is not simply shifted from the city centre to an electrolysis plant. For unless the hydrogen is produced from surplus nuclear or renewable energy, its value in displacing CO_2 is doubtful. There is a small societal credit to be gained from encouraging individuals to behave more responsibly, but large savings in CO_2 production are not likely in the short term.

---

[4] Nuclear technology can be used to produce hydrogen through electrolysis and also thermochemical routes.

[5] Cabinet Office, Performance and Innovation Unit, Energy Review, February 2002

2.2 National ETS

2.2.1 Before an international ETS can be considered, we should examine the feasibility of a more local or regional ETS.

2.2.2 We do not believe that it will be credible to persuade individuals to join an ETS. There would need to be real financial incentives to persuade individuals to buy and sell rights to emissions – and in any case, it would probably have to be restricted to those fuels which can be measured, such as mains supplied electricity, gas and road fuel. Solid fuels are likely to be excluded from the market. The initial allocation of emission rights would be open to debate. For example, should it be based on historic rights or on a uniform allocation? We suspect therefore that incentivising individuals will need some form of economic signal, with a social bias to reduce hardship and fuel poverty for the most vulnerable. It is likely that the most vulnerable are using the most inefficient forms of heating, although as a total proportion of national energy use, this may be a very small fraction.

2.2.3 The challenge arises when one considers the commercial, transport and industrial sectors. If an allocation is made on the basis of historic use of fuel, then there is a danger that older, less efficient industries can continue to pollute, and thereby make it harder for new entrants to the market to offer cleaner processes. If the allocation is made purely on economic signals – for example purchases of rights to emit, then older industries may find themselves stranded.

2.2.4 Such considerations need to be weighed against international activities. Each nation will look at its economic growth and standing in world markets, and consider whether it wishes to stunt growth or even curtail it.

2.2.5 International agreements are therefore a necessary activity. However the record of participation in international agreements is not good. Several countries are seeking to increase their emissions under the Kyoto agreements, and many countries are taking little action to participate. This means that if the UK takes its responsibilities seriously, it is penalising itself through additional economic and technical burdens against its competitors who are avoiding such action. This should not mean that the UK withdraws from these agreements, but we should re-double our efforts to not only meet the targets, but also persuade other countries so to do, and furthermore, encourage British industry to benefit in the process.

2.2.6 Radical agendas require radical measures. Wide ranging legislation across a wide variety of topics appears to lead to widespread avoidance of compliance. Using EU directives as a means of stabilising climate change simply adds to the burden of red tape affecting industry and commerce. Changing the industrial lifestyle will require more than restrictive directives. Leaving choice to the market is also likely to be ineffective.

3 Alternatives to an ETS

3.1 An ETS might not be necessary if there was a substantial switch to cleaner energy sources, coupled with a dramatic reduction in energy use. Carbon sequestration might also make a small impact on the total production of CO_2.

3.2 The UK Renewables Obligation Certificate (ROC) has had a major impact on the planning of the UK's power industry. Although imperfect, it has many desirable features and the ICE will support its retention in the longer term. European or International adoption of ROCs (or very similar schemes) would be a simple, yet effective means of increasing the proportion of non fossil-fired power generation, provided that such schemes were extended to all low carbon technologies.[6] At present, ROCs cannot be claimed by nuclear generators. A step change, allocating ROCs to nuclear generators would distort and disrupt the present market, but nevertheless the scheme should eventually cover all non CO2 emitting generation.

3.3 An extension of the ROCs project to other industries besides electricity would also be desirable. It could for example be applied to road fuel. Railway systems (using electric traction) already have to

[6] ROCs have helped promote renewables in the UK, but they cannot be used by nuclear generators. As the focus of this consultation is reduction of CO_2 emissions we believe nuclear should be included.

subscribe to the ROC's scheme through their power purchases, but are not covered for their supplies of oil for diesel traction.

3.4 We would also propose consideration of "negative ROCS" to be earned by reforestation or other CO absorbing projects.

3.5 There would be strong benefits in extending a ROCs scheme internationally. An international ROCs project, operating with common rules should simplify international actions. Emissions are not subject to frontiers and it would be unfortunate if a polluting producer on one side of a frontier is able to continue in business, while restrictions in a neighbouring country limit production from a competitor. As more electricity is traded internationally, there should also be international trade in ROCs.

3.6 Applied uniformly and fairly, the ROCs could and should be extended internationally. There will always be minor anomalies, but these should not be insuperable. The risk is that heavy CO emitters will continue to move to non-enforcing countries, but this threat should not be used as a counter argument.

4 The approach and objectives of the UK government during the presidency of the G8 and EU

4.1 There are many worthy issues for today's political agenda. Issues rise to the top of the sheet when they gain public awareness and public ownership. Public confidence can just as easily be lost when hypocrisy and bureaucracy override the underlying issues. We recommend against large worldwide conferences to discuss climate change. Numerous large national delegations travelling to central locations are inherently environmentally inefficient. Some other way of gaining international consensus should be found.

4.2 As the UK is only in the Chair for a relatively short period, the UK should push for a policy that can be followed in successive rounds. Overall, all countries should reduce their emissions by improving the efficiency of energy conversion and reducing energy demand, and there should be equality between nations with convergence of emissions measured in terms of production of CO_2 / person.

4.3 We urge the UK government to focus on some simple messages:

- Reduce energy use at source – energy efficiency in lighting, heating, industrial production and transport;
- Reduce indirect energy use – encourage sustainable communities: reduce un-necessary transport costs, waste disposal costs;
- Increase the proportion of energy produced from non-GHG sources.

4.4 As the world becomes smaller and international co-operation increases, climate change issues should be an integral part of the consideration of multi-national policy such as the WTO / GATT forum. The links between climate change and health, poverty, food shortages, weather related natural disasters should be a priority part of any international agenda.

4.5 These messages are as relevant to the UK as they are to the EU and to the world in general.

4.6 Sharing these common values should be the international objective. Actions to promote ETS or ROCs are only necessary because these messages have not been accepted internationally.

5 Contributions of individual government departments

5.1 The messages from government departments should be consistent. Often they are overlapping and at worst contradictory.

5.2 Example a) New building regulations such as Part L for the commercial and domestic sector, do not ensure a minimum energy profile for any new building. The developers still build to the lowest cost and not the lowest energy consumption. Current building projects and approved developments as part of the massive UK expansion in Town Centre developments (supported in most part by English Partnership funding) do not come anywhere near the low energy options that are well-tried and available now. This includes, better low energy lighting systems, better control and the use of natural ventilation and free cooling options. The planning process does not allow for the selection of low energy options, it just relies on Part L which is definitely not the only solution. Energy options and energy reductions in new buildings

will need to re-addressed during the buildings' lifetimes and constraints imposed now are reducing the opportunities for improvements later.

5.3 Example b) The integration of local CHP based on the development of both gas fired and renewable energy are not being fully explored or implemented.

5.4 Example c) The Department for Education & Skills should reconsider the specification for new school buildings. At present the specification is too prescriptive and encourages LEA's to hide behind the regulations rather than opening up the design to include best practice and future innovation.

5.5 Example d) Local authority planning guidance does not encourage best practice for siting new houses, offices, shops and schools with respect to long-term sustainability. Business premises are closing at a large rate in many communities and being turned into high value homes, which rely on individuals commuting by cars to work in new business premises on out-of-town industrial estates. More generally, transport links to new businesses and infrastructure need to be assessed at an earlier stage in the planning process. Transport needs must also include waste recycling and disposal.

5.6 Example e) DFID policy (which rightly targets poverty reduction first) is not wholly consistent with trends pushing for increased sustainability of UK infrastructure (e.g. Integrated Travel Plans, Sustainable Buildings) and (increasingly) renewable energy to lead to long term commitment to 60% CO_2 reductions in the UK by 2050.

5.7 Example f) The omission of air travel from the Kyoto agreement, and the contradiction between the Aviation White Paper and the UK climate change commitments is not co-ordinated policy. A real debate on what mobility is achievable within a framework for climate change emissions reduction is needed.

5.8 There continues to be a discontinuity between road and rail. While the South East is served by a good infrastructure of surface and subsurface lines and interconnecting bus services, this is not the case elsewhere. Railway lines follow routes laid down by the engineers of former centuries and provided connections into centres of population. Transferring people to rail requires new railway stations to be opened in accessible places, park and ride projects are to be commended in this regard.

5.9 The use of energy within both domestic and commercial buildings is largely un-controlled. With the growing use of home computer based systems and additional domestic electrical appliances, electricity consumption will continue to rise without any foreseeable controls.[7] Government policy is to encourage the use of broadband domestically – which is invariably left to run continuously.

5.10 Substantial reductions in CO_2 and other GHG can only be achieved by substantial switches to other fuel sources in all sectors. Nuclear power is one such obvious choice. Tidal barrages should also be considered. The UK government's support for large-scale generation switches to alternative technologies should be reflected by an increase in industrial activity in the nuclear and tidal engineering industries, both to service the home and overseas markets. There is a requirement not only to plan future capacity to meet increases in generation, but also improved capacity to match plant retirements.

6 Conclusions

6.1 Meeting the UK's own targets to reduce GHG will be challenging. Increasing renewable generation to provide 10% of energy by 2010 requires a thorough commitment by both Government and industry. The target should be seen as part of a sustainable strategy for energy policy that takes the country through to the government's targets for 2050. We wish to see a greater informed debate about other generation sources, such as tidal barrage and nuclear in order to balance the stochastic generation from wind and other renewable sources.

6.2 We believe that the current use of ROC's is providing a workable means of identifying non-GHG generation and shows the right incentives to producers and consumers. We would encourage extension of the ROCs project to include all types of non-GHG generation. The principles of ROCs should be applied in other areas such as road and rail fuels.

[7] Many domestic devices are designed to be "on" or "standby" continuously, which adds to the demand for both energy and capacity. Standby domestic power consumption is about 10% of the total. Source IEA 2001.

6.3 The power industry is only one part of the energy industry. Equal attention must be given to industrial, domestic and transport sectors.

6.4 Our national energy policy should encompass reduction of consumption, reduction of emissions as well as fuel sources and security of supply. The energy policy should be in the context of an overall framework, linking targets to policy through a network of consistent and achievable actions. We should be prepared to stand by our principles, let them carry weight in the international arena and encourage their adoption by other nations as well.