



# UKERC

UK ENERGY RESEARCH CENTRE

## UKERC response to the consultation on proposals for a Scottish Climate Change Bill

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## THE UK ENERGY RESEARCH CENTRE

The UK Energy Research Centre (UKERC) was established in 2004 following a recommendation from the 2002 review of energy initiated by Sir David King, the UK Government's Chief Scientific Advisor.

The UK Energy Research Centre's mission is to be the UK's pre-eminent centre of research, and source of authoritative information and leadership, on sustainable energy systems.

UKERC undertakes world-class research addressing the whole-systems aspects of energy supply and use while developing and maintaining the means to enable cohesive research in energy.

To achieve this we are establishing a comprehensive database of energy research, development and demonstration competences in the UK. We will also act as the portal for the UK energy research community to and from both UK stakeholders and the international energy research community.

We are funded by three research councils: the Engineering and Physical Sciences Research Council (EPSRC), the Natural Environment Research Council (NERC) and the Economic and Social Research Council (ESRC).

For more detail, go to [www.ukerc.ac.uk](http://www.ukerc.ac.uk)

## Introduction

The UK Energy Research Centre welcomes this opportunity to provide input to the Scottish Government's Consultation on proposals for a Scottish Climate Change Bill. We have addressed a number of the questions posed in the consultation document calling on all UKERC members for input.

Summary of key points:

- Achieving an 80% reduction in Scotland's carbon dioxide (CO<sub>2</sub>) emissions by 2050 will require a policy framework that encompasses the potential of current and future technological and behavioural innovation, in a national and international context, that sets out a pathway that gives clear long-term signals to the market.
- Emission budget periods should be set at least 15 years in advance to provide certainty for companies and organisations to plan and implement their investment strategies.
- Renewable energy sources will play an important part towards meeting the target, and the wind and marine resources in Scotland are second to none. Nevertheless, the changes and investment required for the electricity supply system should not be underestimated and to an extent conflict with the present remit of the Regulator.
- It is important to recognise that demand reduction policy measures, from top-down targets to technology-specific incentives, across different policy arenas, offers scope for backfire and rebound effects. UKERC has conducted a study in this area, which has concluded that direct and indirect rebound effects can be, but are not always large.
- Whilst the expertise of the Committee on Climate Change will be available to the Scottish Government, it may also be desirable to appoint a specific Scottish advisory group comprising independent and unbiased experts acting in a personal capacity.
- There is a case for strengthening of Scottish-based research capacity on analysis and modelling of energy system futures, and underpinning research on Scotland's future energy technology portfolio.
- UKERC, through its Research Atlas and Technology Policy and Assessment function has published a number of landscapes, roadmaps and reports that are relevant to the scope of the Scottish Climate Change Bill.

# Full list of questions and UKERC responses

## TARGETS

- 1. Should a Scottish target be based on carbon dioxide only or the basket of six greenhouse gases?**
- 2. Should the Bill contain provisions to alter which gases are included, for example if the reliability of data for a particular gas improves or if science changes in the future about which gases cause climate change?**

In principle, the Scottish target should focus on a basket of greenhouse gases (GHGs), and be expressed in carbon dioxide equivalents. This would encompass sources of GHGs particular to Scotland including those arising from soil decarbonisation and seabed methane hydrates. Whilst Scotland has made significant progress in reducing the emissions from GHGs other than CO<sub>2</sub>, this is not the case elsewhere in the world. Should Scotland wish to reduce GHGs by investment in international projects then it may prove more cost effective to seek projects that mitigate GHGs other than CO<sub>2</sub>. As a point of note, the UK Government has asked the Committee on Climate Change to examine whether other GHGs should be included in the overall UK target.

It may, however, make pragmatic sense to start with CO<sub>2</sub> and move on to other gases. Including all GHGs should be the policy aspiration and this possibility should be kept under review as ranges of uncertainty narrow and in the light of evolving information. Government should not take a passive role in this respect. Further research should be promoted with the goal of reducing uncertainty and creating an adequate knowledge base for a more comprehensive system.

- 3. The Scottish Government wishes to ensure that the Bill gives sufficient incentives to invest in energy efficiency and renewable electricity. Should the targets be based on source emissions; an end-user inventory; or on individual targets for energy efficiency and renewable electricity? Do you have any other suggestions?**

It is vital that there is a scientifically robust measurement system which enables the effect of regulatory actions to be assessed. Source emissions are the most obvious methodology to measure effectiveness in government policy to improve energy generation efficiency and emissions. End-user inventory is used by the Intergovernmental Panel on Climate Change (IPCC), and whilst it is significantly more challenging to audit, it can provide an appropriate way to measure behaviour and track the level of embodied energy in imported goods. The IPCC AR4 WG3<sup>1</sup> report gives many examples of sectoral mitigation potential at different shadow prices of carbon (chapters 4 to 11), as well as the policies and measures available to realise the potential (chapter 13).

The Scottish economy is market-based and responds to price, not quantity signals. This implies that a robust long-term carbon price, real or implied, appropriate to the CO<sub>2</sub>-reduction target is essential if the target is likely to be met. The carbon price for the electricity and heavy industry sectors is likely to be set by the EU ETS, so a key role for the Bill is to establish how best to set the Shadow Price of Carbon (SPC)<sup>2</sup> and its effects on the Scottish economy, especially how the SPC is set for the Scottish economy, especially if the Scottish CO<sub>2</sub> target is more stringent than the UK target. The SPC will effectively convey to the market, via private and public cost-benefit analysis, the price of carbon that is judged sufficient to achieve the CO<sub>2</sub> target. It also informs the economics of energy-efficiency regulations, housing standards, and infrastructure projects, such as a DC high voltage link, and high speed rail, as well as airport expansion.

It is important to recognise that Scotland's carbon emissions arise from energy (electricity, heat and transport fuel), land-use, agriculture and waste management. Whilst energy efficiency and renewable energy will contribute towards reducing carbon emissions, targets in these areas, alone they will not achieve the ambitions of the SCCB. In part this is because of the rebound effect, in which improvements in energy efficiency are taken in the form of increased use of energy rather than energy saving (Sorrell, 2007)<sup>3</sup>.

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<sup>1</sup> [http://www.mnp.nl/ipcc/pages\\_media/ar4.html](http://www.mnp.nl/ipcc/pages_media/ar4.html)

<sup>2</sup> <http://www.defra.gov.uk/Environment/climatechange/research/carboncost/index.htm>

<sup>3</sup> <http://www.ukerc.ac.uk/ResearchProgrammes/TechnologyandPolicyAssessment/ReboundEffect.aspx>

The Scottish Government has a policy that states that energy, and especially electricity export is a key growth area of the economy. If this is to be sustainable, then the exported electricity must be low carbon. It must be recognised that if England and Ireland (and a wider EU market) allocates emissions to source nations, then Scotland could be disadvantaged if it exports high carbon electricity. A transparent and robust method of carbon measurement needs to be established across all the generation technologies, so that for example, pumped storage is not classified as renewable if the electricity used to pump ultimately derives from nuclear or any other non-renewable power source.

Because of the UK and EU electricity market, it will only be commercially viable for Scotland to invest in large tranches of renewable energy capacity, if the wholesale price of dispatched electricity is close to that of the rivals in UK and EU. Consequently CO<sub>2</sub> reduction may be cheaper through methods additional to development of renewable energy. A cost curve for Scottish CO<sub>2</sub> reduction would be a useful aid to policy, if this could include factors such as improved housing stock, fishing, merchant and ferry fleet fuel, personal transport, aviation, agriculture, forest management. However, the approach is essentially static, and largely ignores the potential for induced technological change, which may be very important for the development of, e.g. wave or tidal power, for the Scottish economy.

Flexibility, in terms of delivery, is important for meeting long-term targets, and the Scottish Government's CCB consultation paper recognises the risks of very specific targets, in terms of poorly directed public spending and signals to investors. A distinction should be drawn here between meeting overall targets for decarbonising the economy, and indigenous economic potential.

Although long-term commitments by government are a vital signal to the economy, the influence of SCCB targets on private sector investment is uncertain. More direct measures and market interventions to incentivise investment, such as capital / R&D support programmes, and deployment support such as the Renewables Obligation (RO), are essential. These long-term direct incentives and penalties are major drivers for private sector investment in low carbon technologies. Revision of these mechanisms, for example, RO 'banding' to introduce differential support for specific

technologies, and the future design of the EU Emissions Trading Scheme, will be key influences on investment and deployment in renewable technologies.

It is important to recognise that policy measures, from top-down targets to technology-specific incentives, across different policy arenas, offers scope for backfire and rebound effects. UKERC has conducted a study in this area, which has concluded that direct and indirect rebound effects are significant (Sorrel, 2007).

**4. Do you agree that the Bill should allow the means of measuring the target to be changed through secondary legislation to reflect international developments or unforeseen consequences of the Bill?**

UKERC has no view on the mechanisms through which modifications might be made but emphasise that flexibility to adapt policy in the light of the best available scientific evidence (which covers engineering and economics as well as physics and chemistry) is important.

**5. Should the emissions reduction target take account of the abatement effort made by companies under emissions trading schemes? If so, how?**

The Bill should recognise that the EU ETS will have an effect on Scottish GHG emissions, and will affect the shadow price of carbon required to achieve the CO<sub>2</sub> target. This can best be done in a consistent modelling framework, allowing for projections of the Scottish economy at a sectoral level and the effects of the ETS on those sectors.

**6. Do you agree that international credits should be counted towards Scottish targets? Should there be limits on credits counted towards Scottish targets?**

Yes, but there ought to be a quantitative limit on the degree to which overseas effort contributes to Scotland's emissions reductions. Unlimited access to credits through the Kyoto mechanisms resulting in the majority of Scottish effort being applied to international projects could undermine progress towards Scotland's ambition to show

international leadership on domestic decarbonisation. It is equally important that organisations and individuals in Scotland have an opportunity to contribute to global efforts and to invest where the returns in terms of carbon are more cost-effective.

**7. Should the Bill allow the level of the 2050 target to be changed through secondary legislation? If so, should this only be allowed on the basis of independent, expert advice, to reflect international developments or unforeseen consequences of the Bill? Should any changes to the target be limited to an increase in the target?**

The science of climate change is evolving rapidly and it is vital that flexibility remains to be able to embody the latest developments. For example, if an authoritative body, such as the IPCC, were to conclude that there is a need for the carbon emission reduction target to be amended (most likely upwards) then this should be possible within this proposed system.

As a point of note, the UK Climate Change Committee has been asked by the UK Government to consider the merits of a raised target (i.e. above 60%) for UK CO<sub>2</sub> emission reductions to 2050. The Committee is due to report their findings in late 2008.



## SUPPORTING FRAMEWORK

### **8. What factors should be taken into account when setting the level of budgets?**

The main factor will be the shadow price of carbon, which will help government to assess the effort appropriate for the different sectors. If the price is substantially below the EU ETS price, then additional measures, raising the implicit price will be justified. It is important that Scotland clearly defines the scope of its GHG budget in relation to the targets and their shadow prices (e.g. does it or does it not include, for example, private and public transport on land, marine ferries fishing and merchant shipping).

Budgets are in essence the trajectory/pathway towards the target of 80% CO<sub>2</sub> reduction by 2050. In this respect budgets predict to what extent technology and behavioural innovation, supported by a policy framework, can reduce CO<sub>2</sub> emissions over a finite timescale. In order set a trajectory towards the 2050 target, it is important to know the capabilities of existing and near market technologies and measures in addition to understanding research and development timelines for new technologies. To this end it is critical that the Scottish Government receives independent, unbiased, expert and evidence based advice that covers all the relevant technologies and behavioural sciences and from sources that also have a firm understanding of policy.

The Scottish Government will be able to seek such advice from the UK Committee on Climate Change. However, it may also be desirable for the Scottish Government to seek additional expert advice with knowledge particular to Scotland.

There is a case for strengthening of Scottish skill base on analysis and modelling of energy system futures, and underpinning research on Scotland's future energy technology portfolio.

On a more specific point, the factors noted on pages 52 and 53 of the consultation document (paragraph 6.5) seem sensible, but growth in demand for energy and

energy services to support economic growth may be more meaningful than population growth.

### **9. How long should interim budget periods be?**

The Scottish Government has a declared preference for 3-year interim budgeting periods, and there are some advantages for 3-year, rather than 5-year or annual periods. Three years would provide a sufficient period to take account of annual variability of emissions. Equally, there are benefits from synchronising the SCCB budgeting periods with EU and UK measures, typically 5-years, wherever possible, including consistency of either production or end-use accounting. Differently-phased targets and penalties are likely to result in added complexity in terms of regulation and investment planning.

It is noted in the SCCB consultation document that Scotland's CO<sub>2</sub> emissions profile is sensitive to changes in production at a small number of large coal-fired and nuclear power stations. For example, if a nuclear power station in Scotland were to go offline, it is likely that the gap would be filled by coal power and as a consequence the carbon dioxide emissions would rise. This is not only significant in terms of fluctuating annual emissions, according to plant dispatch and availability, but also, in terms of potential step changes in emission reductions, associated with plant replacement or clean technology retrofitting.

Lead times for investment in emerging technologies are difficult to predict, as they are sensitive to long-term research, development and demonstration programmes, and also relatively short-term fluctuations in capital availability, materials costs, relative fuel prices, etc. UKERC, within its Research Atlas<sup>4</sup>, has published a number of authoritative research landscape and roadmap documents on energy technologies and policy that will be of interest to the Scottish Government.

### **10. How many years in advance should emissions budget periods be set in order to provide sufficient time to develop infrastructure?**

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<sup>4</sup> <http://ukerc.rl.ac.uk/ERA001.html>

The emission budget periods should be set at least 15 years in advance to provide certainty for companies and organisations to plan and implement their investment strategies. Experience with the Renewables Obligation shows that this kind of time horizon is critical in maintaining investor confidence.

**11. What should be the limit (in terms of absolute quantity or as a percentage of the budget period) on the amount of emissions which the Government can borrow from a following budget period?**

Banking and borrowing should be permissible.

In the case of banking it is suggested that there should be quantitative limits to avoid organisations relying on picking up "low hanging fruit" in the short-term and failing to put in place strategies for long-term action which will secure deep cuts in emissions. No specific circumstances for withdrawing the provision are immediately obvious as it is important not to change the rules mid-way through the enactment of policy or longer-term strategy. Perhaps the only circumstance would be where an organisation has flagrantly broken the rules in terms of reporting or compliance.

Some members of UKERC believe that borrowing should be allowed as it gives headroom for the development of long-term strategies or for unforeseen circumstances. However, this provision risks organisations simply postponing action. Therefore strict quantitative limits should be set on borrowing. Borrowing should also be subject to serious penalties, i.e. 100% of the borrowed amount plus a considerable penalty should be deducted from subsequent budget period.

**12. Should the Bill include an interim point target? If so, what year (or years) should it be for (2020, 2025, 2030, etc.)? How should the level be chosen?**

Interim targets may be desirable in order to focus minds and demonstrate a clear trajectory towards the 2050 target. However, interim targets can only be defined when the pathway towards the 2050 target is known (i.e. is it a linear, concave, convex or a more complicated pathway). There is also a question as to whether interim targets should align with UK, EU and international targets (e.g. 2020).

Excessive "tinkering" with targets and timetables will create political and regulatory uncertainty and risk, which could jeopardise the achievement of the goals.

## **REPORTING SCRUTINY AND FRAMEWORK**

### **UKERC comments on whole section:**

The UK Committee on Climate Change (CCC) remit is to advise Government on how best to achieve a 60% cut in UK CO<sub>2</sub> emissions by 2050. The expertise of the CCC is also available to the Scottish Government and it would seem sensible to tap in to this to avoid duplication of effort. However, it may also be desirable for the Scottish Government to appoint a specific Scottish advisory group with knowledge particular to the Scottish situation to offer advice on the SCCB target. Independent advice would be particularly relevant if Scotland chooses a pathway and/or interim targets that are significantly different to those in the UK.

Should an advisory group be deemed appropriate it is recommended that its membership should comprise of independent and unbiased experts who act in a personal capacity. The advisory group to the Scottish Government would ideally map a trajectory towards the 2050 target through setting a series of interim targets (for example 5 year interim budgets and 15 years budgetary periods). This trajectory would need to be evidence-based and subject to scrutiny and review over time. The advisory group should also have a strongly analytical role in monitoring progress towards targets. The expertise of members of the advisory group should ideally cover all economic, social, environmental, business and technological aspects of existing and potential future policy measures, so that advice to Government is evidence-based and scientifically sound.

Ultimately, climate change decisions require difficult choices which are political in nature and should lie with ministers. However, an authoritative, independent body which establishes and advises the advantages and disadvantages associated with different options will improve the rigour and credibility of the overall process and provide means of accountability.

There may be a requirement for additional independent research (e.g. impact of statutory targets on introduction of new technologies, potential unintended consequences of CC targets in relocating economic activity overseas). UKERC has built up a body of research (for example the Research Atlas, Technology and Policy

Analysis reports<sup>5</sup>) but these are discrete pieces of focused-research on specific issues and technologies. There is a need for greater research capacity and partnerships involving Scottish-based research groups, to address the (international) challenge of society-wide decarbonisation.

**13. Should the Scottish Ministers be required to report on any other issues related to climate change in addition to the requirements already set out. If so, what and how often?**

It may be appropriate for a regular report on opportunities for Scotland through technology development. The relative potential contribution of Scottish-based firms and research institutes varies between technologies. For example, there is a particular concentration of marine energy firms and research capacity in Scotland, and although the future size of the international market in marine energy is difficult to predict, this represents an opportunity for Scotland. There are also numerous opportunities for Scottish institutions and companies to participate as partners in international/European/UK supply chains and collaborative research networks and projects.

The UK Energy Research Centre's technology-specific Research Landscapes<sup>6</sup> offer analysis of this for specific technologies. However, there may be a need for additional research to assess economic potential and commercial opportunities on a case-by-case basis, and to assess cost and performance issues related to emerging low-carbon technologies.

**14. Is a process of Parliamentary scrutiny the appropriate way of holding the Scottish Government to account if targets or budgets are not met?**

**15. What should be the primary source of advice to the Scottish Government for setting emissions targets or budgets and why?  
Options include: the proposed UK Committee on Climate Change, a new Scottish Committee on Climate Change, an existing public body in Scotland, or the Scottish Government itself.**

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<sup>5</sup> <http://www.ukerc.ac.uk/ResearchProgrammes/TechnologyandPolicyAssessment/TPAProjects.aspx>

<sup>6</sup> <http://ukerc.rl.ac.uk/ERL001.html>

The answer to this question has been covered within the general comments at the start of this section.

- 16.If it were to be an existing Scottish public body, which public body is most suited to carrying out this task and why?**
- 17.Which organisation should be tasked with monitoring the progress of the Scottish Government on reducing emissions and why? Options include: the proposed UK Committee on Climate Change, a new Scottish Committee on Climate Change, an existing public body in Scotland, or the Scottish Government itself.**
- 18.If it were to be an existing Scottish public body, which public body is most suited to carrying out this task and why?**
- 19.Should additional independent mechanisms for scrutinising the effectiveness of the Scottish Government's policies in reducing emissions be created by the Bill (in addition to any scrutiny already provided by the Scottish Parliament)?**
- 20.If so, which organisation is best placed to carry out this function and why? Options include a new Scottish Committee on Climate Change or an existing public body in Scotland.**
- 21.If it were to be an existing Scottish public body, which public body is most suited to carrying out this task and why?**
- 22.Are there any other functions related to climate change, existing or new, which should be carried out at arm's length from the Scottish Government and why?**

**SUPPORTING MEASURES****General comment:**

The questions in this section fall outside of the expertise of UKERC members.

- 23. Should the Bill contain enabling powers to introduce a duty on certain parts of the public sector (i.e. local authorities and large public bodies) to take specified actions on climate change or other specified environmental issues? Why?**
- 24. What should such a duty (or duties) include?**
- 25. Should the Bill contain enabling powers to introduce statutory guidance for certain public sector bodies (i.e. local authorities and large public bodies) on specified climate change or other environmental measures? Why? Are there gaps in any existing guidance?**
- 26. What should this guidance include?**
- 27. Should the Bill contain enabling powers to create a requirement for certain public sector bodies (i.e. local authorities and large public bodies) to make regular reports on specific measures they are taking to tackle climate change (whether mitigation or adaptation) or other environmental issues? Why? What should be included in such reports?**
- 28. As a potential non-legislative measure, should current Best Value guidance be amended to take specific account of climate change mitigation and adaptation? If so, how should Best Value guidance be amended?**
- 29. Are there any amendments to existing legislation or any enabling powers needed to allow for variable charging (for example by local authorities) to incentivise action or eliminate perverse incentives?**
- 30. Are there any provisions to help Scotland adapt to the impacts of climate change which should be included in the Scottish Climate Change Bill?**
- 31. Should provisions within the Environmental Assessment (Scotland) Act 2005, be amended in order to provide clearer links with emissions reduction? If so, how should this be done?**



**32. What are the equalities implications of the measures in the proposals for the Scottish Climate Change Bill?**

**33. Is there any existing legislation within the competence of the Scottish Parliament (devolved) which needs to be amended so that appropriate action on climate change can be taken by sectors in society?**