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Scottish Parliament Finance and Constitution Committee: Climate Change (Emissions Reduction Targets) Bill

Financial Memorandum

Response by the UK Energy Research Centre (UKERC)

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Note on UKERC positionality regarding the Climate Change Bill

UKERC has not directly contributed to the consultation preceding the Bill, and has not previously commented on the financial assumptions made in the Bill. Dr Winskel co-authored a response written by the ClimateXChange Directorate members to the Climate Change Bill consultation paper published in June 2017 and submitted a written response to the Scottish Parliament, as part of parliamentary scrutiny of the draft Climate Change Plan. Dr Winskel and Professor Bell gave oral evidence on the draft CC Plan to the Scottish Parliament's Economy, Jobs and Fair Work Committee. Dr Winskel, Professor Bell and Professor Watson lead-authored UKERC's extensive response to the draft Scottish Energy Strategy. Dr Gross co-authored the synthesis of key global assessments of the costs of climate change action for ClimateXChange which is cited in the Financial Memorandum to the Climate Change Bill (Blyth et al., 2017). We have drawn on elements of these earlier consultation responses in our current response. We

stand willing to offer further support to the Scottish Government and Parliament as the consultation and revision processes continue.

Our response to the CC Bill Financial Memorandum (FM) collectively addresses only the most relevant consultation questions for UKERC as an independent publicly funded research centre, these are:

5. Do you consider that the estimated costs and savings set out in the FM are reasonable and accurate?
7. Does the FM accurately reflect the margins of uncertainty associated with the Bill's estimated costs and with the timescales over which they would be expected to arise?
8. Do you believe that the FM reasonably captures any costs associated with the Bill? If not, which other costs might be incurred and by whom?

Firstly, we welcome the Scottish Government's ambition, set out in the CC Bill to continue to be in the vanguard of ambition on climate change mitigation globally, and to support efforts to design a pathway to net-zero for Scotland. Although there is a compelling evidence base and significant international climate policy efforts for the shift to a 90% emissions reduction target, there less evidence of the economic and social implications involved. We note the earlier advice of the Committee on Climate Change (CCC) to the Scottish Government stating that a pathway to net-zero by 2050 cannot be reliably drawn from current evidence.

Inevitably, there will be considerable uncertainties associated with any '90% by 2050 pathway' for Scotland. It is only by exploring a range of assumptions and outputs that the feasibility and implications of such a shift can be properly considered across all parts of the economy. We therefore encourage the Scottish Government, working with independent expertise available in the CCC and elsewhere, to support the development of the evidence base. It is vital that such evidence is generated and subsequently interrogated by the scientific community and wider public groups.

We endorse the Scottish Government's efforts to develop an integrated and holistic understanding of this challenge. In practice, however such 'whole systems' analysis is highly challenging, particularly at a time of high technical, economic and political change and uncertainty, and there are particular challenges in the Scottish context. As part of its efforts to better integrate policy, the Scottish Government commissioned the Scottish TIMES energy model, and in assessing the reasonableness and accuracy of the societal costs set out in the FM, a clear understanding of the purpose of long term energy system modelling is necessary.

Scottish TIMES is a detailed, bottom-up, perfect foresight, least-cost optimisation model of the Scottish energy system. The TIMES modelling system was developed by ETSAP Implementing Agreement of the International Energy Agency (IEA) in the 1990s. It is under continuous development by the IEA and is used by around 70 groups around the world. UK TIMES is being actively used by BEIS, National Grid, Committee on Climate Change, UCL, Brunel, Imperial College, and Strathclyde. The Scottish Government commissioned Scottish TIMES as an offshoot model of UK TIMES, and plans to make the model available for academic research.

Within a set of constraints defined by the user, Scottish TIMES develops 'optimal' (i.e. least cost) future energy paths for the Scottish territorial boundary, with flows in and out of the Scottish system seen as imports and exports. This is an abstraction, in that energy supply and

use in Scotland is highly integrated within a GB system, especially for both electricity and gas / heating infrastructures, and the wider UK economy. It is also affected by global trends that affect the availability and cost of key technologies and fuels. A focus on Scottish Government action is welcome and highlights important responsibilities and actions that can be taken within Scotland, but an under-emphasis on the mutual support across nations risks imposing additional costs on energy users in any one domain.

These cross-scale issues also apply at finer scales, for cities and regions. There is an ongoing need to develop models and associated evidence at different scales while also offering consistency across scales. A particular research priority is to better link Scottish TIMES and the UK TIMES models, as part of a broader effort at improved multiscale modelling. Another approach would be to create a multi-region UK or European TIMES model that examines Scotland within the UK or wider context.

A credible whole system model such as Scottish TIMES can allow economy-wide costs and sectoral trade-offs to be explored and sensitivities better understood. However, the FM includes only a single quantitative scenario with a particular set of inputs and constraints. There is a danger that this single path is interpreted as a 'forecast' rather than one pathway based on particular assumptions. Retrospective analysis of UK energy futures by UKERC has shown that scenarios should incorporate a wide range of alternative futures (McDowall et al., 2014).

We welcome the discussion of the benefits and costs and benefits of more ambitious climate change mitigation pathways in the FM – including the review of global assessments carried out by Blyth et al. (2017). However, the quantified pathway in the FM appears not include any assumptions of avoided costs due to the reduced impacts from climate change. Clearly these avoided costs will only be realised if other countries implement a similar increase in ambition and this results in a significant impact on the extent of climate change. In addition, some of these benefits may not materialize until later in the century.

Used as single path forecasts, energy system models tend to underplay uncertainties and develop false confidence. This is especially the case for optimisation models such as TIMES which in most cases assume 'perfect foresight' and are not designed to capture real-world decision making by multiple actors or the politics of energy transitions. Some of these shortcomings can be ameliorated using complementary analyses, including other more specific sectoral and energy-economy models, or by running sensitivities that are designed to explore real world limitations, or through the use of models that run in 'myopic mode' (Nerini et al., 2017).

Close-to-optimal solutions could be used to find alternative transitions at a similar cost to the presented pathway, for example using Modelling to Generate Alternatives. Trade-offs for key uncertainties (e.g. whether the gas networks should be converted to hydrogen in the future) could be explored using stochastic analyses (Price and Keppo, 2017). We encourage the Scottish Government to undertake such additional and structured exploration of pathways and uncertainties to meet the CC Bill targets under different assumptions about the future. This could include sensitivities to different assumed availabilities and costs of low carbon technologies (such as with or without CCS); differing possible levels of energy demand reduction and efficiency; and differing land-use, lifestyle and behavioural changes.

Systematic analysis of some energy system uncertainties has been carried out by the CCC and UKERC among others (e.g. Watson et al., 2014; Blyth et al., 2017), and while the results are strongly shaped by analytical assumptions and framing, they allow for a structured

consideration of where policy effort might be best directed and the timing of key decision points, according to some transparent assumptions about the future.

TIMES modelling also assumes, within the principles of cost minimisation, that all investment decisions are made in a universally coordinated and centralised manner. This simplified version of the world can provide extremely useful insights, in particular in illustrating the mix of options available to meet carbon targets in a somewhat idealized world. In practice, such decisions are made by a wide spectrum of different organisations, each with different financial resources and investment criteria. Real world outcomes are likely to be different, and this is why it is important to explore a range of possible scenarios, allowing if possible for the 'inefficiency' of the real world. TIMES also has very limited ways of taking into account the wider environmental, financial and health benefits or costs of climate policy, and analysing the pros and cons of radical changes to the current energy system (e.g. shifting to a more distributed and decentralised energy system). These are all gaining increasing attention in policy, especially in Scotland.

There is also a need to better differentiate between sectors and solutions where supporting evidence is relatively robust and consistent (e.g. the increasing affordability of large-scale offshore and offshore wind, and opportunities for buildings efficiency improvements) and other areas where there is still considerable uncertainty and variability in the evidence base (e.g. on low carbon heating supply technologies). Energy systems are undergoing many changes and there is considerable uncertainty about optimal transition pathways. For example, there was until recently little mention of hydrogen based low carbon heating systems, yet this has now emerged as a strategic area of interest for Scotland and the UK, as it enables re-using the existing gas distribution network.

In our response to the draft CC Plan and Energy Strategy, we called for more evenly distributed emissions reductions across different sectors of the Scottish economy, given the concentration of effort (and therefore risks) on the buildings and power sectors in the draft CC Plan. In the same way, the Scottish Government should consider alternative pathways for meeting the raised ambitions in the CC Bill, drawing on advice from the CCC and others. It is essential that the Scottish Government – and Scottish businesses, civil society groups and the wider public – have transparent access to the best available independent advice.

Mitigation pathway costs in TIMES decarbonisation scenarios increase rapidly as the target moves from 80% to 90% and beyond. Most (though not all) global mitigation scenarios consistent with 1.5 degree warming limits rely on extensive use of negative emission technologies such as Bioenergy with CCS (BECCS), and the costs of 90% and beyond scenarios in Scottish TIMES are likely to be very sensitive to the cost and availability of BECCS. UKERC has an ongoing research project on the energy systems implications of BECCS, led by Professor Pete Smith of the University of Aberdeen, and CXC Science Director.[1] A high carbon price is normally required to achieve ambitious targets beyond 80%, and it would be worth considering whether all possible higher-cost decarbonisation options have been incorporated into Scottish TIMES as costs might otherwise be overestimated.

While TIMES is a useful decision-support tool, it has many limitations (which are widely discussed in the modelling research literature) and should be seen as one source of evidence

[1] http://www.ukerc.ac.uk/programmes/resources-and-vectors/assess-beccs.html

and analysis alongside others. A more systematic and detailed presentation of model data, outcomes and interpretation is necessary. However, given the inherent limitations of optimisation models such as TIMES, it is also important that other forms of evidence are used to inform policy development and implementation.

In summary, we welcome the Scottish Government's efforts at integrated analysis of the implications of the Climate Change Bill, including the use of TIMES modelling. However, we would encourage more systematic treatment of the benefits and costs of greater policy ambition, and greater recognition of the uncertainties involved by exploring a range of scenarios and approaches, avoiding a single path analysis. There is also a need for extensive engagement with stakeholders, academics and the wider public on the evidence base, and its implications for policy. We believe these steps will help realise the Government's ambition for a holistic and managed economic and social transition in response to climate change.

References

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