CXC Consultation Response: Scotland's Energy Future

ClimateXChange (CXC) is Scotland's Centre of Expertise on Climate Change, which provides independent advice, research and analysis to support the Scottish Government as it develops and implements policies on adapting to the change climate and the transition to a low carbon society.

The response below draws on the CXC response to the Scottish Government's consultation on its Energy Strategy earlier in 2017. We reference several CXC-based research insights in our submission. Full details of the work are available from the CXC website, or from Ragne Low, CXC Programme Manager, at ragne.low@ed.ac.uk
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Energy Landscape
What are the most significant challenges to, and influences on, the energy landscape that a future strategy needs to take into account?

1. Energy systems are undergoing significant (and in some areas very rapid) change. The changes are complex and contested, shaped by a combination of top-down policy drivers (especially decarbonisation and the drive for improved energy access and affordability) and bottom-up forces, especially the changing techno-economics of energy supply and demand, and new patterns of ownership and use. Understanding these changes, and their implications – and opportunities – for Scotland is a formidable challenge. In some areas, such as buildings energy efficiency, the Scottish Government has significant direct influence on the direction and pace of energy system change. In other areas, such as the cost and availability of low carbon generation technologies, understanding international patterns of innovation and supply chains is critical. In other words, there is a complex interplay between local and global forces, with 'multi-level governance' across local, regional, Scottish, UK and European / transnational scales.

   The Scottish Government's draft Energy Strategy – and the accompanying draft Climate Change plan – mark a new phase for Scotland in terms of integrated analysis and policymaking in this area. The Scottish Government highlights the need for a 'whole systems' approach to managing the energy transition, and we believe that this is also essential for developing, synthesising and drawing conclusions from the evolving evidence base. This is far from straightforward: energy research and modelling is infused with claims and counterclaims and selective use of evidence, and there are multiple possible future energy pathways, each with different combinations of disruption and continuity, and new and old infrastructure, business models and organisational arrangements. An interdisciplinary approach is also vital, as the changes involved span the concerns and competences of engineering, physical and environmental sciences and social, economic and behavioural sciences.

Supply and Demand

2. Energy system and bottom-up technology models, including those used by the Scottish Government for analytical work underpinning their Energy Strategy and Climate Change Plan (TIMES model) and those used by their statutory advisors, the Committee on Climate Change, provide scenarios for the likely energy demand in Scotland in 2030, 2040 and 2050. Compared with today, we might expect to see a heavily electrified transport sector (with more than 60% cars and vans electrified); and substantial efforts to reduce energy (heat) demand from buildings by 2030.

   Increasing the efficiency and productivity of energy use across the economy should be a priority for Scotland's energy policy. Increased efficiency means reduced consumer costs and can support a reduced need for expenditure on supply infrastructure. Fuel poverty reduction is another important driver. As research at the Centre for Energy Policy and Fraser of Allander Institute has shown (e.g Figus et al., 2016), improving household energy efficiency can increase households' incomes and drive system-wide benefits. There is a need to locate energy use

patterns and expectations within a "whole systems" framing, and with an understanding of the scope for further reductions in energy demand reflecting recent historic trends; or possible demand increases in some areas, reflecting for example the electrification of heat and transport. The focus on energy saving and efficiency also plays into the need to frame energy systems in terms of the energy services they provide, with the underpinning technology a secondary consideration.

3. The Government's Energy Strategy and Climate Change Plan lay out sector plans for delivering the energy system over the next few years. Major barriers to meeting our energy needs through to 2050 include:
    - The multi-level nature of energy systems, which requires actions at EU, UK, Scottish and local levels;
    - Private, as well as public investment and finance to deliver the planned system change;
    - Citizen behaviours;
    - Skills and learning needed to deliver the rapid improvement in Scottish building stock, electrification of transport; export of know-how; etc.
    - Market design to deliver flexible, principles-based regulation to enable local energy systems to thrive.

4. On power supply security, recent CXC research has highlighted the role of electricity generation and the transmission network in providing security of electricity supply to Scotland (Gill and Bell, 2017). The project examined changes in the electricity generation landscape in Scotland and northern England, due to the closure of large dispatchable power stations and the continued growth of renewable generation.

    The research developed methodologies to consider the role of transmission interconnection between regions as well as the availability of flexibility from demand, storage and generation, and to use them to analyse future Scottish electricity.

    Reference: Gill, S. and K. Bell 'Meeting Scotland's peak demand for electricity', ClimateXChange

The Energy Mix: what overall role should be played by various elements of the energy landscape?

5. Scotland needs to retain a flexible approach to the energy mix, given current uncertainties around what the 'right' supply technology mix will be for 2030, 2040 and 2050. A strategy should set the overall direction of travel, with high-level targets aligned to that, under which innovation and cost reduction can be achieved by the market. Beyond this, there is a need to consider individual supply options in a whole systems context, to understand the balance between supply and demand, the likely role of each option in contributing to Scotland's own energy transition, and to wider (social, economic, environmental) policy goals. These other goals will include export potential and the value added to local and regional economies. This requires the development and use of a consistent set of assessment criteria for different supply options, and, drawing on a whole systems account, the balance between 'keeping options open' versus 'picking winners', key decision points, and differentiating between technologies or solutions where the evidence base is already reasonably settled or where more research / evidence review is needed to develop or consolidate the evidence base. The recognition of the role that data and digital technologies will play in Scotland's future energy system would be welcome.

    To support future policy design and deployment decisions against these priorities, research should be actively directed to improve understanding of supply options in terms of: their temporal and spatial applicability in Scotland; levelised and social costs and learning rates; and, system integration across scales.

For example, CXC delivered a model to represent the electrification of heat and electricity network capacity in Scotland, allowing exploration of the potential impact of electrifying a proportion of heat demand (Delta-EE, 2016). The model was designed to 'soft-link' to the Scottish TIMES model. Other CXC research and expertise addressed heat decarbonisation and the strength of the evidence base for various heat decarbonisation solutions, and case study reviews of heat strategies in Germany, the Netherlands and Sweden. Building on its strong relationship with the UK Energy Research Centre (UKERC), CXC co-hosted with UKERC a 'Heat Summit' in Edinburgh in September 2016, bringing together Scottish policymakers and leading UK researchers on heat transitions. The summit identified priority areas for research, policy and practice to support the decarbonisation of Scotland's heat supply and demand in the context of emerging Scottish policies and wider UK ambitions.

Reference:
Delta-EE: 'Electrification of Heat and the Impact on the Scottish Electricity System', ClimateXChange

Climate Change and Renewable Energy

6. The recent (September 2017) statutory assessment by the Committee on Climate Change (CCC) suggests that Scotland is performing well compared with other countries in the UK, and the UK is performing well as a whole, when considering its progress in reducing greenhouse gas emissions. Whilst the Committee argues that some of Scotland's (Climate Change Plan) sector plans for decarbonising are unrealistic, they suggest other sector plans are not ambitious enough. Overall, they assess that, with more focus on new policies to support specific sector outcomes and the articulation of key decision points, Scotland can be on track for both meetings its current legislated targets and its forthcoming new Climate Change Bill targets.

7. Given the current cost-reductions that are being realised by clean energy technologies in Scotland and elsewhere – making them largely cost-competitive with fossil fuel alternatives - the key factors and risks which may impact upon the Scottish Government meeting their long-term targets on sustainable and renewable energy are largely concerned with public acceptability and community engagement. See our answer to Q13 on how we can encourage evidence-informed debates around energy in Scotland.

Environmental Impact

Ethics, Social Issues and Impact on Communities

10. Actions to ensure energy is accessible to all at an affordable cost for those on low incomes start with improving energy productivity across society. For example, the draft Climate Change Plan (CCP) sets out an expectation that energy efficiency improvements will be applied to 90,000 homes per year from 2018 to 2032. This rate of uptake requires an ambitious level of government funding and support. On consumer understanding and engagement, there is evidence from research of how to improve uptake, such as that being conducted by ClimateXChange at Edinburgh on behaviour change in the SEEP pilots (Bush et al., 2017). Valuable insights from research at the Centre for Energy Policy (Strathclyde), on the wider economic impacts of energy efficiency and the complexities of the socio-economic 'case' for government intervention in energy efficiency, should also be noted (e.g. Figus et al., 2016b). Given the centrality of energy efficiency and residential & non-residential buildings-related energy demand for delivering affordable energy, there is a need to carefully consider the international and UK / Scotland-specific evidence base on the energy and carbon savings from efficiency and insulation measures. This evidence base, alongside experience from the SEEP pilot phase, will better establish the appropriate levels of ambition and investment set alongside supply side changes in a whole systems framework.

References:

Ruth Bush, Jan Webb, James Wakelin, Fiona Flynn, 'Interim report: Scotland's Energy Efficiency Programme pilot evaluation', published by Scottish Government
Figus, G., Turner, K., Lecca, P., McGregor, P.and Swales, K., (2016b) 'Increasing Energy Efficiency in Scottish Households : Trading-off Economic Benefits and Energy Rebound Effects?'

11. The evidence base for the advantages (and challenges) of rural/remote/urban community energy schemes is still emergent and based on a varied set of modelling-studies, pilots and local demonstrations. A key challenge is evidence synthesis and positioning in a multi-scale energy system.
    Electricity distribution networks will be key to facilitating large parts of local energy ambitions. Innovation projects that integrate heat, transport and power will also continue to be needed. However, there is also a need to reflect on the emerging evidence on smart, local energy systems in a whole systems setting, so as to generate evidence on the total system cost of localisation, and the techno-economic interdependencies between local and national energy systems.
    CXC has developed a significant programme of research on the potential of local energy in Scotland, reflecting its recent strategic prominence as one of the three pillars of the draft Energy Strategy. This includes research investigating the technical and regulatory implications of moving to a local, decentralised energy system, frameworks that will enable local energy balancing and how emergent local systems will interact with national energy systems.
    CXC recently convened researchers, policymakers, community energy practitioners, and other private, public and third sector stakeholders to discuss examples and exchange knowledge on the transition towards local energy systems. The conference produced a set of key research questions that are being taken up across multiple institutions, in particular, through a collaborative project between CXC and the Centre for Sustainable Energy on barriers and solutions in local energy economies.

Regulation and governance

12. System flexibility, local engagement and a principle-based approach to regulation will be critical in making space for energy system innovation. This is likely to involve city-scale and local energy service companies managed by or through local authorities or communities. A flexible electricity system is important for achieving local energy objectives in a cost-effective way. This implies a move away from incentives to invest in infrastructure to increase network capacity, and towards making 'smarter' use of existing assets through operational measures such as curtailment, 'virtual private wires' and local market designs. Whilst the network utilities have been active in a wide range of successful innovation projects covering all of these operational measures over the past decade, more work is needed to move those innovations onto a business-as-usual footing; and research and evidence has an important role to play here. On transport, characteristics are geographically distinct (for example, mode shares for personal transport). Local and regional energy planning can improve understanding of local conditions, how these conditions facilitate certain transport energy activities whilst restricting others, and the opportunities which this presents for the development of integrated local solutions. Building in some degree of consistency across local energy plans at the outset would be valuable in allowing comparability and the ability to generate consistent insights across plans

Informed Debate

13. ClimateXChange has already provided research insights on ways in which public engagement on energy issues, and in energy policies, can be deepened. A CXC report delivered by researchers from Cardiff University offered a summary of insights on Scottish public values towards energy system change (Pidgeon and Demski, 2017). These insights on public values provide critical 'social intelligence' for energy policy and energy systems decision making. CXC

also organised a workshop on public engagement with energy issues in March 2017, which explored the range of activities already underway in citizen engagement with energy in Scotland, and what the potential modes of engagement with the Scottish Energy Strategy might be. The workshop produced a scoping note to inform Scottish Government thinking on public consultation and citizen engagement in the Strategy. CXC's experience of running in-depth citizen engagement activities in the energy field – including through our Citizens' Juries project (Roberts and Escobar, 2015) – make us well placed to support this objective of deepening public engagement.

References:
Christina Demski and Nick Pidgeon, 'Public Engagement with Energy System Change in Scotland', ClimateXChange
Jennifer Roberts and Oliver Escobar, 'Citizens' juries on wind farm development in Scotland' ClimateXChange

Meeting the Challenge

15. Energy systems around the world are undergoing disruptive change. Scotland is as well placed as any country, with its dynamic Universities, an engaged government, vibrant business and social enterprise energy and "tech" sectors, and a strong financial sector, to exploit innovation opportunities. A key driver for energy in coming years will be the "personalisation" of energy services, driven by data availability and innovation (the data/digital revolution); and the use of new materials that underpin energy services, such as energy storage or building materials (the materials revolution).