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## **The Problem**

### *Complexities*

Complex problems require knowledge from multiple lines of evidence, whereas we live in a world where politics is often framed around single issues taken in isolation. How does the body politic identify the key questions on which to base a thorough debate on the pros and cons of diverse solutions? How is a strategic approach to the implementation of solutions nurtured, while acknowledging attendant complexities and uncertainties, when politics demands certainty not ambiguity? How do we avoid the risk that uncertainty and ambiguity stifle decision-making and decisive action?

There is no better exemplar of this challenge than the allegedly 'wicked' problem of man-made global warming (or climate change for short), which will require a strategic approach, sustained over many Parliaments, to enable the transition to a decarbonised society of 2050 or beyond.

While several research institutions, information providers and policy bodies provide excellent analysis and reports<sup>1</sup> to support policy development at the UK level and globally, these are generally not in a form that enables politicians and civic society to mutually engage in debate within both national and local settings, by providing tools to explore futures together.

One attempt to do this, the UK Government's 2050 Calculator<sup>2</sup>, was ground breaking and has since been copied by several countries. But it has failed to engage people in the UK beyond a narrow circle of policy experts, perhaps in part due to the lack of wider qualitative factors in the model, or the practicalities that emerge when considering real-world plans at a more local scale.

### *Values*

The difficulties in making progress are often seen as the result of conflicting values<sup>3</sup>, and the resulting framings, which stymie agreement on assumptions and data. Across civic society, inconclusive debates lead to binary choices. In almost every case, these dialogues are fraught with a tendency to exaggerate the strengths of one solution while minimising its difficulties, and to denigrate any alternative to it.

It is important to acknowledge the values of different groups, because they play an important role in making sense of the future. However, resolving conflicting positions means that values and evidence should not be conflated, when considering what options and pathways are feasible.

Feasibility assessments must precede value-based decision making, but we must beware of values intentionally or unintentionally narrowing the range of options that are considered for feasibility assessment.

### *Horizons*

The window for action is rapidly closing if the world is to avoid dangerous global warming<sup>4</sup>, requiring countries including the UK to go beyond their Paris<sup>5</sup> 'Nationally Determined Contributions', to ensure that the global mean surface temperature (GMST) rise stays within 2°C.

And while there is overwhelming support for renewable energy in the UK<sup>6</sup>, currently, the political establishment, and civil society, has pursued partial and fragmented responses, and these can create a mood of complacency, which is not proportionate to the scale and speed with which we need to decarbonise. It is also clear that politicians are avoiding confronting these difficult issues - perpetuating a socially constructed silence<sup>7</sup> on climate change - if one is to judge from the lack of focus these have attracted in recent elections.

While a Clean Growth Strategy<sup>8</sup> has been published by the current UK Government, which is welcome, translating this into action requires greater urgency. Developing implementation strategies - with clear intermediate horizon goals - will require a great deal more consultation and engagement than hitherto. This must extend beyond the usual circles of expertise - because energy impacts our lives in every way, and the political questions will be no less intrusive.

## **A Proposed Way Forward**

### *Opportunity*

There is a general willingness to address climate change in the UK, and this is assisted by the mechanisms of the Climate Change Act<sup>9</sup>, but as the Committee on Climate Change has itself observed, the new Clean Growth Strategy must be translated urgently into action<sup>10</sup>.

People are not apathetic when effectively engaged and can be active on global issues. We have seen the nationwide response to plastic waste in the oceans, but the cry often heard is “I don’t know what to do?”. What actions help the most and by how much? Where do we start? What should Governments do and what is best done through local or personal action? These are questions not dissimilar to those that people ask in relation to action on climate change.

In the past, Government has employed incentives to promote low-carbon solutions, but these can lead to unintended side effects. Many have called for a carbon tax and dividend mechanism, to enable the market to drive out fossil fuels in all sectors, but Government will also need to provide a transformed infrastructure and regulatory framework to make the transition to zero carbon achievable.

### *Feasibility*

The lack of knowledge of the constraints of some solutions - and hence their feasibility in respect of key time horizons - can lead to wishful or magical thinking, inconsistent with the UK’s ambitious 2050 decarbonisation goal. There are also interdependencies between different interventions and outcomes that are not immediately obvious and rarely discussed outside of expert forums.

To illustrate the difficulties, we only need to look at renewable energy penetration of the UK energy market. There has been a significant growth in UK’s renewable energy<sup>11</sup>, and the Centre for Alternative Technology’s Zero Carbon Britain (ZCB) report<sup>12</sup>, offers a comprehensive vision for the UK in 2050 that runs entirely on renewables, across all sectors.

Research in both the USA<sup>13</sup> and UK<sup>14</sup> shows that achieving 100% penetration of renewables is very hard, due in part to intermittency of wind and solar (even at continental scale), which can occur over periods of days and sometimes weeks. ZCB recognised this issue and includes an energy storage solution with very large ‘despatchable’ biogas/ synth-gas storage (at least 30 days of UK energy needs). But this in turn will have significant implications for land-use, to provide sustainable biogas at this scale; this issue is rarely discussed in climate change debates.

### *Enriching the Debate*

There are many questions of this character that we need to explore in the political and public sphere, and not in isolation - acknowledging interdependencies - and we want to be able to easily explore these without needing to execute research each time such a question is raised. We need to combine social and behavioural factors, and not rely solely on technical innovations to supply the answers (the reliance on unproven Carbon Capture & Storage (CCS) is an example of an unproven technology, which Governments are nevertheless relying on in their planning). Futurism can lead people to avoid simple low-tech solutions available today.

What rate of electrification of transport and heating is realistic, when considering building out the new energy infrastructure? Are concerns on diet and need for land-use change a possible win-win for health and climate? What assumptions are made in respect of increasing the efficiency of domestic and industrial devices? Is Britain an energy island; or should we be exploring Europe wide solutions for managing intermittency, demand and supply? Etc.

We need to be exploring rich and difficult questions like these, rather than simply pursuing a list of possible interventions, with no clear vision. Many solutions have downstream consequences in terms of their technical and social outcomes. The risk is that we rely on market forces and loud voices (championing favoured solutions) and end up with a sub-optimal low-carbon future, with possibly many unintended side effects, and a lack of civic engagement.

The challenge now facing all countries is even more complex, and goes beyond merely switching energy sources. The combined consequences of the lower intensity and wider distribution of renewables generation and electrification across all sectors, will transform or create sectors of the economy: smart grids, demand management, food production, bio-fuels, energy storage, transport, heating, forestry, waste management and more. Each of these will be coupled in different ways with each other and at multiple scales. Models should reflect the creative opportunities that exist in making this transformation (not merely answer closed questions).

### *An Illustrative Taxonomy of Climate Solutions*

In the *Illustrative Taxonomy of Climate Solutions* figure below, we can see both top-down and bottom-up approaches to the larger question of how we prevent dangerous global warming; with no preferences implied or intended. This is viewed across five thematic areas: *The Way We Live*, *Sequestering Carbon*, *Energy Generation*, *Economics*, and *Geo-engineering*. No solution can be seen in isolation, and there will be feedbacks between the blocks. Each block in itself represents a class of solutions with many sub-types contained within them; for example, at the community and social enterprise scale, we can use Project Drawdown<sup>15</sup> for inspiration; with nearly 100 types of solutions. This richness of solution types is rarely explored in the public sphere.

In order to achieve a multidisciplinary and broad approach to global warming that eschews dichotomous dialogue, we need to agree on a common basis for a more constructive debate, incorporating the established body of scientific knowledge and technical design data, and a general commitment to evidence-based decision making. But this must be in a consumable form that allows for a collaborative 'what if' exploration of futures, over successive time horizons: 10, 20 and 30 years hence.

So we must recognise that the solution landscape will evolve over time, and for strategic planning we need to explore and anticipate the ways in which it might evolve, in order to plot a pathway (or pathways) to envisioned futures.

### *Beyond Economics*

Policy development within Government is often dominated by economic criteria and models, with relatively weaker roles for science, engineering, sociology, ecology and agriculture. For example, the Clean Growth Strategy includes a key measure - the Energy Intensity Ratio (EIR) which everyone agrees must come down, but there is no discussion on whether growth itself is part of the problem, and whether new economic models (such as the circular economy) might be part of the solution. That is why resources such as the 2050 Calculator are an important part of the tool-kit, but not the whole story.

As an illustration on a local scale of the interactions involved, we can imagine a foodie town of 10,000 people wishing to invest in a solar PV farm, but also wishing to reduce pollution in its bustling town centre, where parking has become a challenge. Traders are concerned at the introduction of parking charges by the cash-strapped district council.

By combining the perspectives of carbon reduction, transport innovation, health and well-being, the town could frame a project that addresses all of these: an EV out of town parking facility with EV shuttle bus, for townspeople and employees, could help address their diverse goals.

This requires an integrated approach, and access to a wide range of information and data to ensure a fully funded, evidence-based solution, but also one that tunes into the values of the town. And if the Government used other measures - such as well-being - to assess progress, this town might score better than most.

The rebalancing of disciplines must be promoted to facilitate a more strategic, long-term planning process, beyond short-term party political horizons, and acknowledging poorly quantified externalities, such as species loss<sup>16</sup>, or surprises due to global warming (that is already in the pipeline) which will require adaptation measures that could interact negatively with the energy transition measures.

### *Decision Support for Climate Solutions*

An heuristic approach that includes objective factors (such as the energy storage requirements for 100% renewables), as well as subjective ones (such as a vision for rural land use) - including quantitative and qualitative measures - is sorely needed to enable a long term strategy for climate change to emerge that will sustain public engagement.

Decision support tools, data sources, project tools and consultation processes will all be essential for communities - supported by local political representatives, social enterprises, business and agencies - wishing to implement projects at a local level.

The same philosophy should be scalable to city-scale, regional or even national initiatives.

Values are often revealed through the choice of framing, and so it is important to allow for different framings to be used for diverse communities, when exploring solutions, but within the context of an agreed palette of feasible solutions.

A range of problem solving and decision support tools and methods could be deployed: systems thinking, benefits mapping, trend analysis, resource mapping, critical path analysis, linear programming, balanced scorecards, and more.

Whatever the mix, it will need to be packaged in a way that is intuitive and inclusive, suitable for a range of actors wishing to collaboratively navigate a complex solutions landscape.

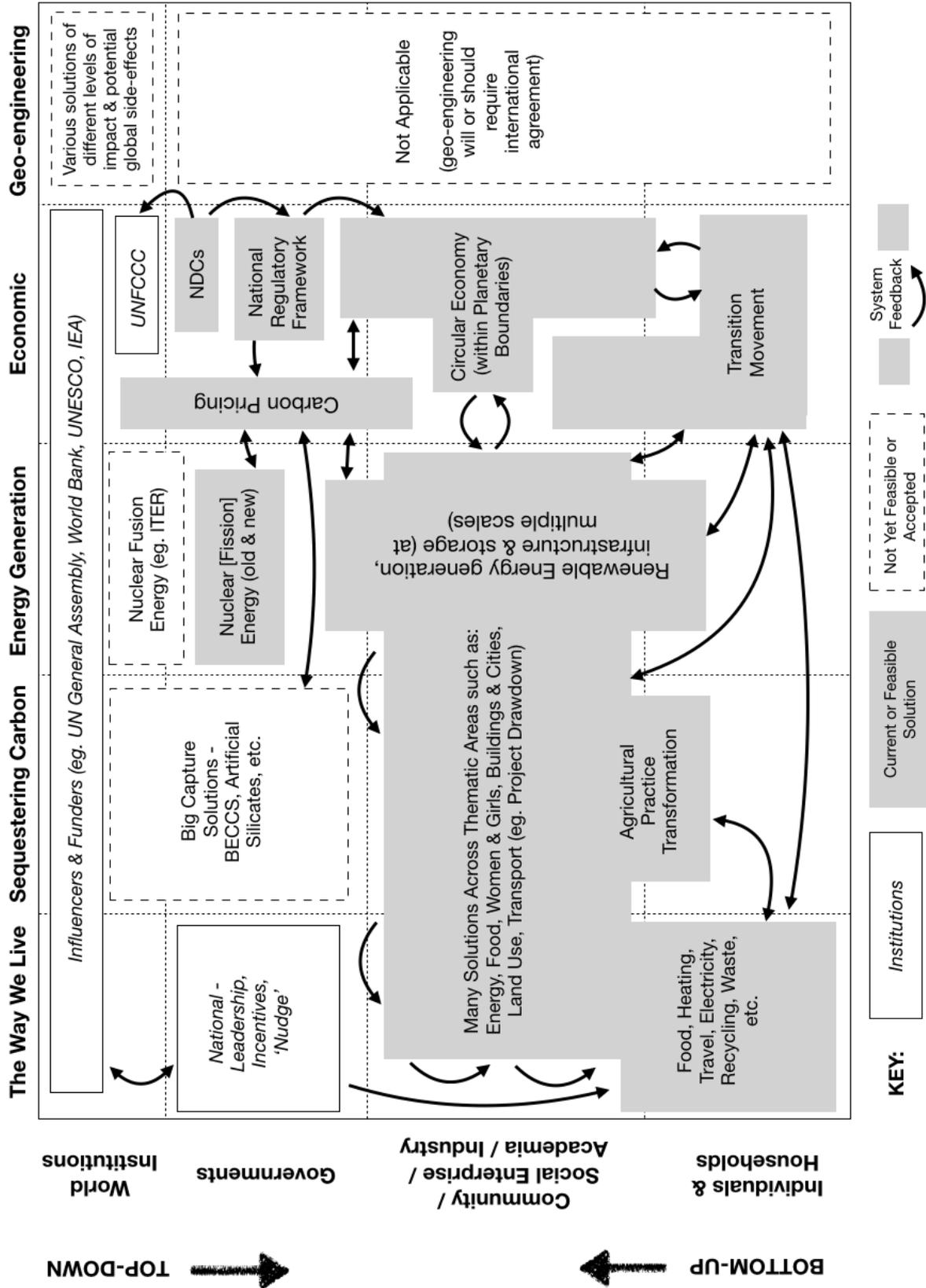
Systems thinking should play a significant role because it reveals the power of the interrelationships that exist between different drivers, assumptions, constraints and solutions. Ultimately, we need to be able to model these relationships in quantitative ways that enable 'what if' solution-scenarios to be evaluated, to explore future outcomes and their implications.

There are many questions of ownership and governance over such an approach, but it is increasingly urgent that local authorities and communities have the ability to engage in this way, and are able to share experiences and good practice across the UK.

Politics is getting more complex, not less, and everyone is struggling to keep up.

There are several other areas of public policy, such as the *health & well-being*, which would benefit from a similarly inclusive approach.

# An Illustrative Taxonomy of Climate Solutions



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