The Problem:

Political and societal factors play critical roles in energy transition, but they are difficult to understand and manage

Deep and structural changes in the energy system can take many years, sometimes decades, to happen. Power plants, buildings and infrastructure networks have long lives, while patterns of energy use in industry, commerce and households are well established and critical for everyday life.

Image 2

The timescale available for the UK to achieve its legislated net zero emissions target is short, from now to 2050. There is little spare time to respond to policies that perform poorly or adapt plans that prove too difficult to achieve. To successfully meet this huge challenge, we need both swift and effective policy action from government, and broad societal responses that support and reinforce energy transition policy actions.

Looking back over the past few decades, it is clear that political and societal factors have play critical roles during system-wide changes in the energy system, in tandem with technologies and fuel supplies; however, not enough is known about this phenomenon to be able to manage it well. This policy brief describes a new approach to modelling

A new model, TEMPEST, provides a more holistic view of the energy system and how it changes. Its design was based partly on historical evidence from the past few decades of UK energy system changes and energy policies, and partly on expectations about the remainder of the energy transition, up to 2050 and be

Image 3

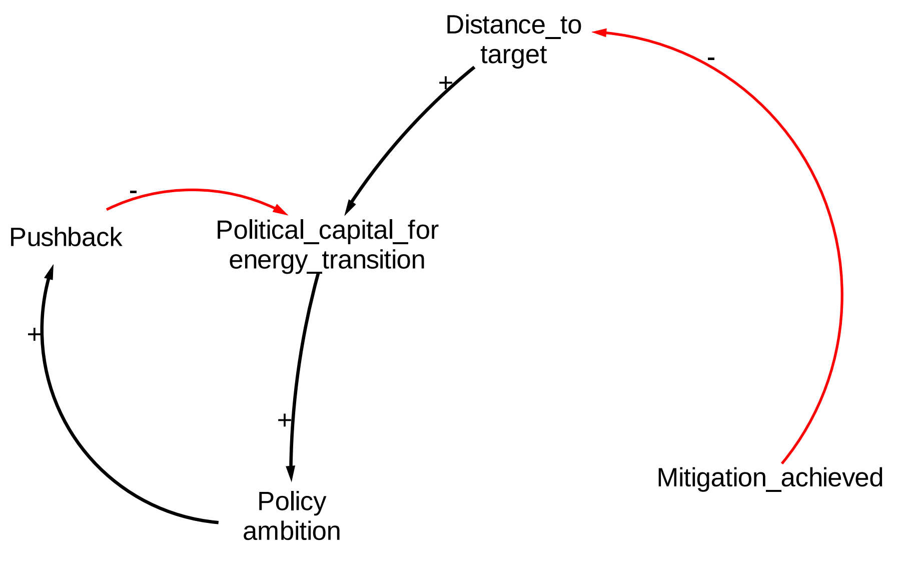

Figure 1: The TEMPEST model as a causal loop diagram

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Loop 3. Balancing: policy ambition uses up political capital.

As policies are launched, available political capital is used. The amount of political capital available limits the ambition of policies. The supply of political capital is influenced by the distance to the final target, and by drivers and barriers such as economy and elections.

Loop 4. Balancing: pushback can affect political capital.

Pushback (negative public responses) to policies can happen when there is a combination of high measure difficulty (behavioural or technological) and high policy ambition. It tends to reduce political capital.

Loop 5. Reinforcing: measure achievements reduce difficulty4 (aieJ T*o)-4 oievemulf (t)2(aieJ (t)..a>BDC 0.0

Figure 2: Histogram of cases according to future cumulative emissions (top), and plot of emissions against year that target is met for those cases that do achieve the target (bottom).

Analysis by groups of cases

Four groups of cases were derived from the uncertainty analysis based on their success in reducing emissions. Group 1 (20% of cases) is the best. It stays within the $MtCO_2$ budget in the Committee on Climate Change's (CCC's) 6th Carbon Budget [7], and reaches the net zero target by 2056. Group 4 (20% of cases) is the worst. Its emissions are 70% higher than Group 1 and it fails to reach the target before 2080.

Figure 3 (overleaf, top) illustrates emissions over time for the four groups. While groups 1 and 2 achieve steady reductions in emissions and net zero by 2060, groups 3 and 4 achieve reductions much more slowly, emissions begin to rise again after 2060, and the net zero target is not met.

Figure 3 (bottom) shows percentage differences in the key indicators of energy transition for groups 2 to 4, as a percentage change against group 1. Political capital, policy ambition, and public willingness all decline significantly from group 2 to group 4, although there is a much smaller change in learning by doing.

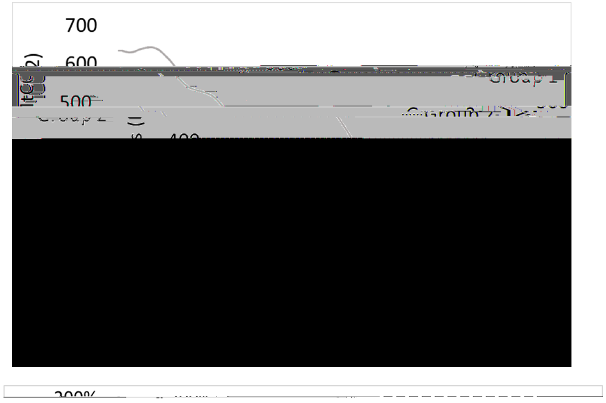

Figure 3: Comparison of four groups of cases from the uncertainty analysis. Annual emissions over time (top) and percentage differences in key indicators compared to the most successful group (bottom).

The importance of political capital availability

The uncertainty analysis shows the importance of having sufficient political capital available for energy transition from now up to

2030. The more available early on, the lower the total emissions reductions needed to get to net zero.

While spending a lot of political capital early on could be risky for politicians, the rewards for society would be seen in shortening the length of the energy transition and reducing its overall cost.

The importance of behavioural measures

Between 1980 and 2012, energy service demand in air and surface transport, residential, and services increased steadily, starting to decrease slowly after 2012. The uncertainty analysis showed how important behavio 3ph (s)4 (t)2 (h)10 (e)]TJ 0 Tc 0 Tw ( )Tj 0.004 Tc 10.004 Tw 15-1.72 Td [(f [(l)6 eet)2 (yho)-2 (hi

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Solutions: Achieving a good glide path to net zero emissions

An ideal glide path to net zero emissions would be neither too fast, risking damage to the economy and poor policy outcomes, nor too slow, risking increased cost of energy transition and missing the net zero target. The following recommendations are made in this aim.

Ensure sufficient political capital

Communicate the full benefits of the energy transition to the public, to put any transitory economic and disruption costs into perspective. Find and utilise co-benefits with energy transition actions, to align with other strategic priorities. This is particularly important from now up to 2030.

Ensure sufficient public willingness through social innovation

Aim to mix incentives, regulation, educational programmes, and taxes in a balance that ensures consumers and firms have sufficient support to act, sufficient motivation to act, and sufficient information feedback to see the results of their actions. Social movements that support climate action could increase public willingness by supporting actors across society to implement mitigation measures where needed and finding new solutions that work in diverse situations.

Reduce the likelihood of pushback or policy failures

Aim to balance levels of policy ambition, and the types of policies being run, with public willingness, to reduce the likelihood of pushback to policies. Where needed, design policies specifically to reduce disruptions to households and businesses from implementing climate actions. Pay attention to non-economic issues that 86 (c)i 86 (c)i 86 (c.73 T

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