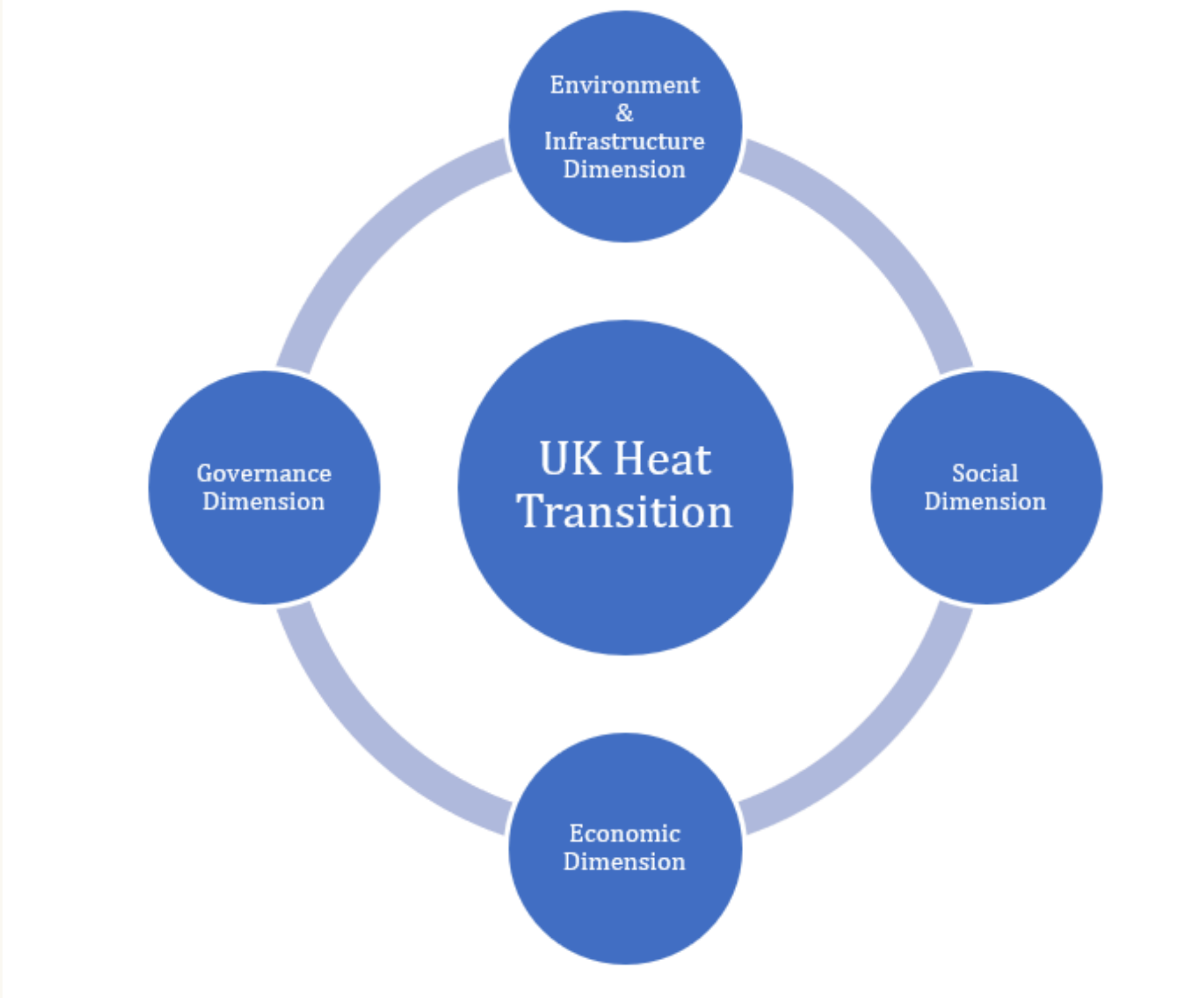


Freezing energy bills without freezing ourselves

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Four Pillar Analysis



1.1 Environment & Infrastructure

- Oldest housing stock in Europe with **38 % of homes built before 1946**.
- **8.5 million ‘hard-to-treat’ dwellings** responsible for 50% of carbon emissions from the domestic sector [7];
- **29 million existing homes** will need to be made low-carbon [3];
- 1/3 of greenhouse gas emissions in the UK can be attributed to heating. Only 5% of total heat demand is met by low-carbon sources [16];
- **74% of households use gas central heating**;
- “Unlike electricity which is generated centrally and distributed to end-users via the grid, heat is typically generated within homes”[9].

1.2 Social

- **8.8 million households in England will be fuel-poor in 2023**.
- Consumers are left making a choice between heat and basic necessities in the UK.
- Physical and mental health impacts;
- **Women are more likely than men to live in cold homes** [2].

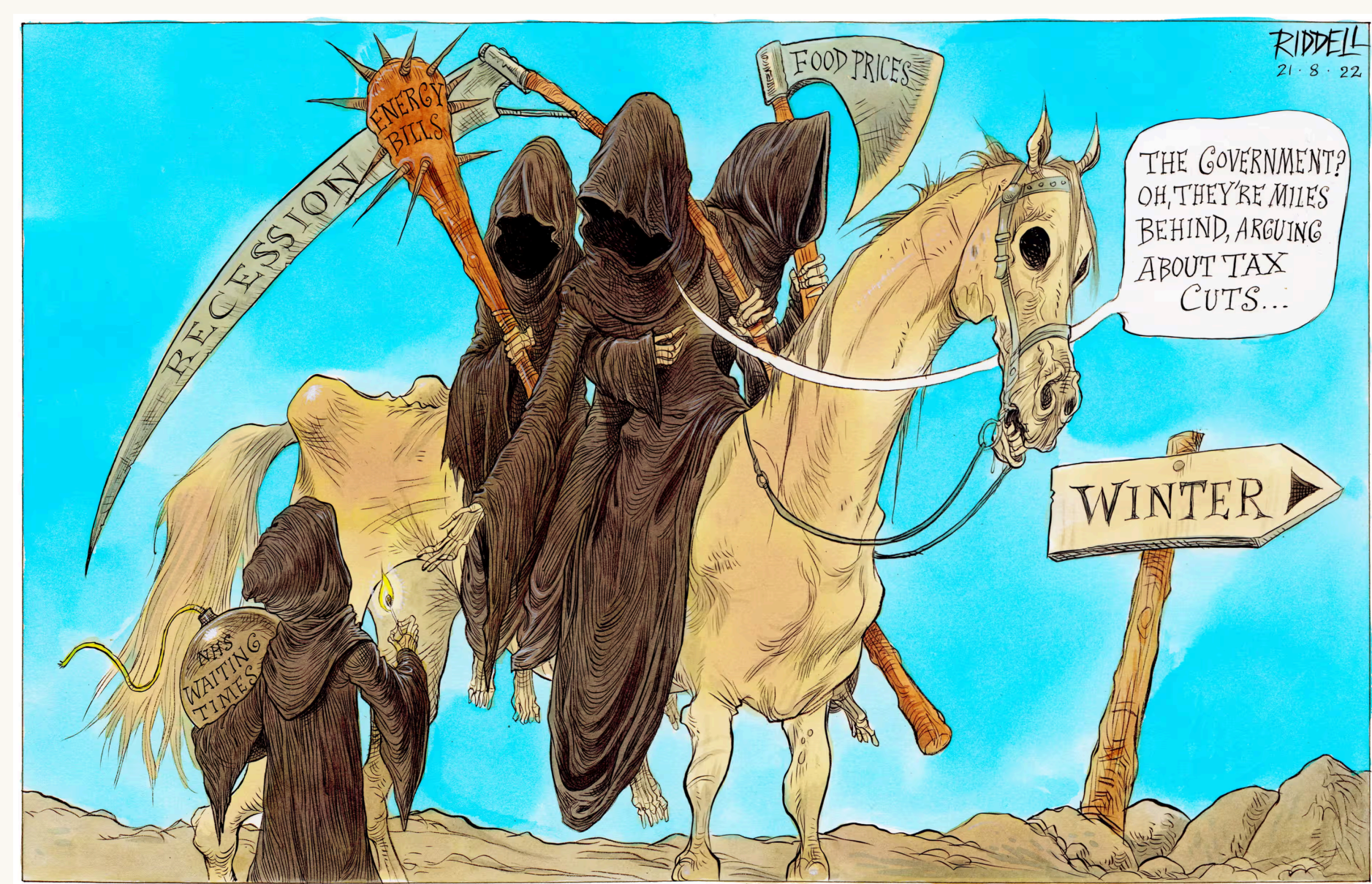


Illustration by Chris Riddell for The Guardian (August 2022)

1.3 Economic

- **Financing gap**
- **Large upfront costs** create wide inequalities:
 - Difficulty understanding how owners will recover the value of their investments [8].
- Lacking consistent **price signals** to drive low carbon technology uptake [3];
- **Skills gap**: A national shortage of experienced technical consultants[18].

1.4 Governance

- Policymakers perceive heat decarbonisation as “**disruptive**” with technological pathways being **uncertain**, with little “up-side” [12];
- “Policies have been **weakened** or **withdrawn**.
- **New homes built to minimum standards** for water and energy efficiency [3];
- The role of Local Authorities: **do not have sufficient resources** [3] and do not understand **their responsibilities** in delivering net zero [5];
- The **funding landscape is fragmented** competitive funds prevail.
- Local governments are inconsistent in **reporting plans** and **progress** [15].

2.1 Identified Challenge

- The four-pillar analysis of the heating transition suggests the need to explore:
- 1.The (combinations) of heating decarbonisation methods that can be implemented in the UK centred on consumers.
 - 2.How stakeholders imagine heating futures and their interactions with those.

2.2 Some Questions

- 1.What is the current state of heat decarbonization in the UK?
- 2.Have there been successful case-studies and what lessons can be drawn from these?
- 3.What are the socio-economic and environmental risks and impacts of the adoption of different heating technology scenarios for UK household consumers?
- 4.Against the backdrop, what are stakeholders’ preferences concerning energy futures scenarios in heating decarbonization in the UK?

2.3 Research Objectives

- 1.Characterise the rising environmental risks to civil society on this low carbon futures course reversal;
- 2.Evaluate the current UK heating decarbonization measures in terms of their potential individual contributions towards the mitigation of environmental risks;
- 3.Compare the UK measures to Denmark.
- 4.Assess stakeholder and expert preferences for our low carbon futures;
- 5.Model three future energy system scenarios of the adoption of different heating technology to assess their environmental, and socioeconomic footprint;
- 6.Evaluate these scenarios under an energy justice lens;

2.4 Methodology

- 1.Horizon Scanning
- 2.Denmark Case Study
- 3.Energy Modelling
- 4.Stakeholder Validation
- 5.Storytelling Scenario Analysis
- 6.Energy Justice as an Analytical Tool



Why tell stories?

- Energy modelling is described as “**storytelling with numbers**” [6].
- **Strengthens decision-making** by working “backwards” from a decision point [17]
- Motivates interested groups and stakeholders to engage with scientific evidence as illustrated by the IPCC [10].

2.5 Research Outputs

- 1.Energy Justice as an **analytical framework** for socio-technical transitions.
- 2.**Framework strategy** for climate and environmental risk reduction measures that are consistent with contemporary UK energy security and affordability needs.

3. Initial Findings: Heating in Denmark

- 1.**Modes of ownership**: cooperative (**34%**), municipal (**60%**) and private (**6%**) [11].
- 2.Potential for **decentralised energy systems** through the empowerment of energy communities.
- 3.All Danish heating is regulated by the **non-profit principle**.
- 4.Energy-community-owned DH enables **flexible integration of renewable energy** [1].
- 5.Energy Communities can mitigate operational electricity costs for heat, and manage peak loads[19].

References

[1] Bordignon, S., Quaggitto, D., Vivian, J., Emmi, G., De Carli, M. & Zarrella, A. (2022) A solar-assisted low-temperature district heating and cooling network coupled with a ground-source heat pump. Energy Conversion and Management. 267, 115838. doi:10.1016/j.enconman.2022.115838. [2]Clair, A. & Baker, E. (2022) Cold homes and mental health harm: Evidence from the UK Household Longitudinal Study. Social Science & Medicine. (314). [3]Climate Change Committee (2019) UK housing: Fit for the future? [4]Danish Energy Agency (2021) Energy Statistics 2021. [5]Department for Energy Security & Net Zero & Department for Business, Energy & Industrial Strategy (2023) Mission Zero - Independent Review of Net Zero. [6]Ellenbeck, S. & Lilliestam, J. (2019) How modelers construct energy costs: Discursive elements in Energy System and Integrated Assessment Models. Energy Research & Social Science. 47, 69–77. doi:10.1016/j.erss.2018.08.021.[7]Gordon, J.A., Balta-Ozkan, N. & Nabavi, S.A. (2023) Divergent consumer preferences and visions for cooking and heating technologies in the United Kingdom: Make our homes clean, safe, warm and smart! Energy Research & Social Science. 104, 103204. doi:10.1016/j.erss.2023.103204.[8]Green Heat Finance Taskforce (2023) Green Heat Finance Taskforce Report: Part 1.[9]Hoseinpoori, P., Hanna, R., Woods, J., Markides, C.N. & Shah, N. (2023) Comparing alternative pathways for the future role of the gas grid in a low-carbon heating system. Energy Strategy Reviews. 49. doi:10.1016/j.esr.2023.101142.[10]IPCC (2023) Climate Change 2023 Synthesis Report.pp.35–115. [11]Johansen, K. & Werner, S. (2022) Something is sustainable in the state of Denmark: A review of the Danish district heating sector. Renewable and Sustainable Energy Reviews. 158, 112117. doi:10.1016/j.rser.2022.112117.[12]Lowes, R. & Woodman, B. (2020) Disruptive and uncertain: Policy makers’ perceptions on UK heat decarbonisation. Energy Policy. 142, 111494. doi:10.1016/j.enpol.2020.111494.[13]Moezzi, M., Janda, K.B. & Rotmann, S. (2017) Using stories, narratives, and storytelling in energy and climate change research. Energy Research & Social Science. 31, 1–10. doi:10.1016/j.erss.2017.06.034. [14]Piel, Eloi, Mata, Crélida, Lucas, Pauline, & Pesce, Gabriele (2023) District Heating and Cooling Market Outlook Insights & Trends. [15]Rankl, F., Collins, A., Tyers, R. & Carver, D. (2023) The role of local government in delivering Net Zero. [16]Rosenow, J., Lowes, R., Broad, O., Hawker, G., Wu, J., Qadrdan, M. & Gross, R. (2020) The pathway to net zero heating in the UK. doi:10.5286/UKERC.EDC.000941. [17]Slingo, J. (2021) Chapter 1: Latest Scientific Evidence for Observed and Projected Climate Change. In: UK Climate Risk Independent Assessment (CCRA3). London, UK Climate Risk. [18]Stabler, L. & Foulds, C. (2020) Governing the UK’s transition to decarbonised heating: Lessons from a systematic review of past and ongoing heat transitions. [19]Vivian, J., Chinello, M., Zarrella, A. & De Carli, M. (2022) Investigation on Individual and Collective PV Self-Consumption for a Fifth Generation District Heating Network. Energies. 15 (3). doi:10.3390/en15031022.