

# The role of energy demand in policymaking for a just transition to net zero: a comparative survey in the UK, the Netherlands and Germany

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## Abstract

Historically, energy demand reductions have been the main driver of carbon emission reductions. However, there is concern that this contribution is not recognised, and that policymaking attention remains focused on the supply side. The current and potential future role of demand in energy policymaking is explored via surveys of energy experts and stakeholders in the UK ( $n=77$ ), the Netherlands ( $n=54$ ) and Germany ( $n=80$ ). In all three countries, the respondents identify some current policy support on the demand side, especially in the context of retrofitting. On the whole, however, they suggest that decarbonisation policies mainly support technological substitution, infrastructure investment and vector switching on the supply side. This focus, to the detriment of funding/finance and changing practices, does not appear conducive to a just transition to net zero. To help energy policy contribute to such as transition, the respondents support the Energy Efficiency First principle which entails a better balance between supply and demand solutions. While German respondents have a strong preference for technological solutions, UK and Dutch respondents support more policymaking emphasis on the demand side, especially through changing practices such as a modal shift to active travel. Overall, German respondents appear broadly content with current policy, Dutch respondents have the greatest faith in policymakers, and UK respondents are neither content with cur-

rent policy nor do they have faith in policymakers. Despite these discrepancies, trends among responses from all three countries suggest that energy and climate policy solutions appear more suitable for decarbonisation than ensuring justice and fairness of the underlying socio-technical transformation process. This suggests that both energy and non-energy policies need to be more closely aligned to gain more legitimacy and ultimately succeed in achieving net zero.

## Introduction

The UK, the Netherlands and Germany have set legally binding targets to achieve net zero (or 95 % emissions reduction relative to 1990 in the case of the Netherlands) by 2050 (or 2045 in the case of Germany) (Government of the Netherlands 2019a; UK Government 2019; Bundesverfassungsgericht 2021). Despite the publication of accompanying strategies such as the UK's Net Zero Strategy (its Nationally Determined Contribution required under the Paris Agreement – BEIS 2021), it is unclear how the vision for decarbonisation set in such strategies will be delivered in practice.

Scenarios play an important role in the development of potential pathways. At national level, these encompass those developed by independent organisations, see Prognos, Öko-Institut, Wuppertal-Institut (2020) for Germany; CCC (2019) for the UK; and Sjim et al 2020 for an overview of energy transition scenarios for the Netherlands; as well as those developed by government, see BEIS (2021) for the UK; BMU (2016) for Germany; and Government of the Netherlands (2019b) for the Netherlands. At the international level, scenarios developed by

the Intergovernmental Panel on Climate Change (IPCC 2019) and the International Energy Agency (IEA 2021a) are among the most respected.

What these scenarios have in common is the assumption that demand will outstrip supply of sustainable energy in some way or another, which necessitates abatement of several Gigatons of CO<sub>2</sub> per year using expensive, controversial, risky, unproven and potentially conflictual negative emissions technologies such as carbon dioxide removal and carbon capture, utilisation and storage (CCUS). This is echoed by the IEA which argues that “reaching net zero will be virtually impossible without CCUS” (IEA 2020: 13). Alternative perspectives, on the other hand, suggest that dominant scenarios and pathways tend to be biased towards the supply side, while relying on similar assumptions regarding inflexible or even increasing demand and technological substitutability.

In contrast, low energy demand scenarios point towards decarbonisation pathways which do not rely on negative emission processes and technologies (Grubler et al. 2018; Barrett et al. 2021). They build on a growing evidence base which indicates that the decoupling of energy demand from economic activity (reduction of the energy intensity by improving efficiency) has been the main driver of carbon emissions reduction (IPCC 2014; Lees and Eyre 2021). According to Eyre and Killip (2019:10), “more than 90 % of the progress in breaking the relationship between carbon emissions and economic growth globally has come from reducing the energy intensity of the economy”. Low energy demand scenarios suggest that decarbonisation is possible through the rapid transformation of energy services by combining social, organisational and technological innovation as well as by placing greater emphasis on end-user engagement and decent living standards (Grubler et al. 2018; Eyre and Killip 2019; Barrett et al. 2021). This perspective has also been embraced by the European Union through its Energy Efficiency First principle (EE1st; EC 2021).

Furthermore, energy demand reductions are associated with many more positive effects (synergies) than negative effects (trade-offs) in relation to the Sustainable Development Goals (SDGs) compared to energy supply (IPCC 2018). The SDGs are closely aligned with the principles of a just transition to net zero, which ensures “that the transition towards a climate-neutral economy happens in a fair way, leaving no one behind” (EC 2019).

Despite these multiple benefits associated with energy demand reductions (Fawcett and Killip 2019), energy efficiency assets often receive a different accounting treatment compared to supply assets, they suffer from lower visibility, their evaluation is more complex, and risk perceptions and the scale of transactions in markets are unfavourable compared to supply assets (Eyre 1997). These ‘meta-barriers’ are associated with financial costs, hidden and intangible costs and transaction costs, which help explain the persistent observed gap between energy efficiency potentials and the implementation of cost-effective energy efficiency options (Grubb et al. 2014). To complicate matters, energy efficiency by itself may not result in equivalent reductions in energy demand due to rebound effects (Sorrell 2015).

Based on these findings we hypothesize that:

- Energy demand receives less policymaking attention than energy supply, even where demand side change can secure similar policy objectives more cost effectively
- Energy demand solutions play a more significant role in achieving a just transition to net zero than energy supply solutions
- Policy to deliver decarbonisation of energy supply will not be sufficient for a just transition

We test these hypotheses through a survey which comprises nine questions. Due to space restrictions in this publication, we limit our analysis to eight of these questions covering current (existing) scenarios, predictive (probable) scenarios, normative (preferable) scenarios, and causal (determinative) scenarios among energy experts and stakeholders in the UK (n>77), the Netherlands (n>54) and Germany (n>80). These countries bear some similarities. The Netherlands and the UK are similarly dependent on gas as a share of their total energy supply, while the UK and Germany have a similar share of nuclear as part of their total energy supply. All three countries have experienced a reduction in energy demand in the last 15 years (IEA 2021b). All three have ambitious decarbonisation targets (as mentioned above), increasing green awareness (evident in protests by environmental movements and increasing shares of votes for green parties where proportional representation applies) and significant research capacity in energy policy.

This study starts by exploring respondents’ views on the beneficiaries and priorities of current energy policymaking. It subsequently assesses their view on policymakers’ understanding of energy demand and their own opinion on how energy demand solutions should be financed. Next, it explores their view on energy system decarbonisation policymaking priorities and the innovations and outcomes that are likely to result from these priorities. These are contrasted with the respondents’ preferred policymaking priorities for a just transition to net zero and preferable innovations and outcomes from changing policymaking priorities. Finally, it establishes whether there are any trade-offs between just transition and net zero objectives for various systemic determinants of sustainable energy. The paper is structured as follows. Section 2 introduces the methodology. Section 3 reports the result of the survey. Section 4 discusses these results and concludes.

## Methodology

### SURVEY DESIGN

The survey includes eight questions. Some focus on the status quo and general preferences, while others seek subjective assessments of policymaking priorities and outcomes. Rather than establishing facts, these questions seek answers, which entail normative judgement. The questions can be grouped as follows (adapted from Börjeson 2006):

- Current (existing) scenarios – status quo that address the questions what *is*? (Table A)
- Predictive (probable) scenarios – what-if scenarios that address the question what *will* happen? (Table B)

- Normative (preferable) scenarios – transforming scenarios that address the question *what should* happen? (Table C)
- Causal (determinative) scenarios – identifying drivers of change that address the question *whether* it will happen: (Table D)

The questions address the hypotheses as follows in Table 1.

Multiple-choice Question 1 explores expert and stakeholder views on the beneficiaries of current energy policymaking. Wealth and privilege are assessed by the following answers – home ownership, car ownership, and affluence. Level of education, age, and fuel and transport poverty are included as demographic and circumstantial metrics. Access to services, the presence of supportive organisations, local authority engagement, and governmental priorities either indirectly or directly

reflect supportive policymaking. It is informed by previous studies such as Boardman (2010: 90), who suggested that “the liberalised market is working and the better-off are benefiting handsomely from it, as they have for some time”.

Single choice Question 2 establishes expert perspectives on policymakers’ understanding of energy demand.

Single choice Question 3 asks respondents to choose between general taxation, energy bills and private investments as the main way to finance energy demand solutions. It is informed by research which suggests that only around a quarter of policymaking proposals to decarbonise in the UK seek to do so through regulatory or fiscal measures (taxation), while policies funded through energy bills have received considerable attention in recent years (Eyre and Killip 2019). Private finance is often leveraged through support mechanisms funded

Table A.

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | What are the key determinants for an individual to benefit from current national energy policies? (select up to 3)<br><input type="checkbox"/> Home ownership <input type="checkbox"/> Car ownership <input type="checkbox"/> Affluence <input type="checkbox"/> Level of education <input type="checkbox"/> Age <input type="checkbox"/> Fuel and transport poverty <input type="checkbox"/> Access to services <input type="checkbox"/> Presence of supportive organisations <input type="checkbox"/> Local authority engagement <input type="checkbox"/> Governmental priorities                 |
| 2 | Do policymakers understand the contribution of energy demand solutions to a zero carbon future? (sing, choice)<br><input type="checkbox"/> Yes, and they see it as policy priority <input type="checkbox"/> Yes, but they don't see it as policy priority <input type="checkbox"/> No                                                                                                                                                                                                                                                                                                               |
| 4 | Which approaches to sustainable energy receive the most policymaking attention? (choice of 3)<br><input type="checkbox"/> Technologies (e.g. solar PV) <input type="checkbox"/> Regulations (e.g. banning the sale of fossil-fuel powered cars) <input type="checkbox"/> Market-based instruments (e.g. Feed-in tariffs) <input type="checkbox"/> Target setting (e.g. carbon reduction targets) <input type="checkbox"/> Funding/finance (e.g. the European Green Deal) <input type="checkbox"/> Labelling (e.g. A++ ratings) <input type="checkbox"/> Changing practices (e.g. working from home) |

Table B.

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6 | What changes will net-zero policies bring about? (choice of 5)<br><input type="checkbox"/> More nuclear power <input type="checkbox"/> More offshore wind <input type="checkbox"/> More household solar PV <input type="checkbox"/> Development of a hydrogen infrastructure <input type="checkbox"/> Development of an EV infrastructure <input type="checkbox"/> More demand-side response <input type="checkbox"/> Circular material and product economies <input type="checkbox"/> More whole house retrofits <input type="checkbox"/> Modal shift to active travel <input type="checkbox"/> Changing work practices |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Table C.

|   |                                                                                                                                                                                            |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3 | How should energy demand be mainly financed? (sing. choice)<br><input type="checkbox"/> General taxation <input type="checkbox"/> Energy bills <input type="checkbox"/> Private investment |
| 5 | Which approaches to sustainable energy require more policymaking attention for a just transition to net zero? (choice of 3) – Same answers as Question 4                                   |
| 7 | What changes should be prioritised for a just transition to net zero? (choice of 5) – Same answers as Question 6                                                                           |

Table D.

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8 | To what extent do you think the following are important for a just transition to net-zero? (4-point Likert scale)<br><input type="checkbox"/> Participation in international carbon markets <input type="checkbox"/> Assigning monetary value to carbon emission reductions <input type="checkbox"/> Research & development support for new technologies <input type="checkbox"/> Policy support for existing technologies <input type="checkbox"/> Regulatory and institutional change of energy system operation (focus on humans, not technology) <input type="checkbox"/> Shifting the focus to energy demand solutions <input type="checkbox"/> A shared understanding of the energy system as a socio-technical system <input type="checkbox"/> Education and awareness of the public |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Table 1. Which questions address which hypothesis.

| Hypothesis                                                                                                                                                      | Questions  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Energy demand receives less policymaking attention than energy supply, even where demand side change can secure similar policy objectives more cost effectively | 3, 4, 6    |
| Energy demand solutions play a more significant role in achieving a just transition to net zero than energy supply solutions                                    | 4, 5, 6, 7 |
| Policy to deliver decarbonisation will not be sufficient for a just transition                                                                                  | 1, 2, 8    |

through both taxation and energy bills but also through other sources such as Green Bonds, and is increasingly considered an essential component of decarbonisation strategies at both national and international level (Carney 2020).

Multiple-choice Question 4 compares the respondents' perception on which current approaches to sustainable energy receive the most policymaking attention. Technologies, regulation and market-based instruments are different means to achieve the same outcome. While regulations focus on the means of delivery, such as specific technologies or sectors, market-based instruments focus on outcomes, such as energy saving or low-carbon energy deployment (Rosenow et al. 2019). Technology is a separate variable as it tends to command a lot of policymaking attention, often linked to market-based instruments (Eyre and Killip 2019; Fawcett et al. 2019; Barrett et al. 2021). Target setting is more about directionality, while funding/finance supports outcomes driven by targets, regulations, market-based instruments and labelling. Labelling and changing practices tend to be more important on the demand side (Rinkinen et al. 2021).

Multiple-choice Questions 5 reframes Questions 4 to elicit normative views and preferences on which approaches should receive more policymaking attention for a just transition to net zero. The focus on a 'just transition' alongside 'net zero' is linked to the increasing recognition of a need for holistic societal transformation to achieve the Sustainable Development Goals (Grubler et al. 2018; IPCC 2018). It follows on from the UK Committee on Climate Change's statement that "a broader strategy will also be needed to ensure a just transition across society, with vulnerable workers and consumers protected" (CCC 2019:15) and the EU's just transition strategy (EC 2019).

Multiple-choice Question 6 elicits respondents' opinions of likely innovations and outcomes of existing net zero policymaking, which can be grouped as following: More nuclear power, more offshore wind and more household solar PV are supply technologies with decreasing scale fall under 'predict-and-provide' and are all to be included in the EU's sustainable finance taxonomy. Hydrogen infrastructures and EV infrastructures support electrification and fuel (vector) switching. Hydrogen is associated with increasing energy demand and EVs with decreasing energy demand. They rank alongside EE1st as the key pillars of the EU Strategy for Energy System Integration (EC 2020). Demand-side response, a core component of flexibly energy systems (EC 2020), can shift or reduce demand, but potentially also increase demand. The same applies to circular material and product economies which can reduce energy and material demand in supply chains but may increase energy demand in recycling processes. Whole-house retrofits, a model shift to active travel, and changing working practices reduce energy demand respectively, through energy efficiency improvements, through delivering the same energy services for less energy, and through reducing demand for energy services (Barrett et al. 2021)

Multiple-choice Question 7 reframes Question 6 to elicit normative views and preferences on which innovations and outcomes of net zero policymaking should be prioritised for a just transition to net zero.

Questions 8 uses a 4-point Likert-scale on 'just transition importance' and 'net zero importance' from 'very low' (low value

of 0) to 'very high' (high value of 3) to help establish whether there are synergies and trade-offs between just transition and net zero objectives for various systemic determinants of sustainable energy influenced by policy, ranging from markets and technologies to regulation and public engagement. The determinative scenario underlying Questions 8 also seeks to identify robust strategies under uncertainty to help identify 'low-regret' options regarding both decarbonisation and a just transition (see Li and Pye 2018).

#### DATA COLLECTION AND ANALYSIS

Data was collected in three phases, one for each country. Respondents could opt out of answering individual questions, hence the n range for each answer. The higher number is the total number of respondents, the lower number is the minimum number of answers to any particular question. Data in the UK was collected between June and November 2020. Academics were engaged through the Centre for Research into Energy Demand Solutions (CREDS) (n=45–52). Practitioners, industry representatives and policymakers were engaged through the Community Energy England 2020 Conference in June 2020 (n=19–27), the UK-German Energy Symposium in October 2020 and qualitative interviews between September 2020 and June 2021 (n=7–16). The overall distribution is ~65 % academics, ~20 % practitioners and industry representatives and ~15 % public sector/policymakers.

Data in the Netherlands was collected between February and June 2021 with the help of a student. Contacts were identified through existing networks, snowballing and internet searches across academia, public sector and policymaking. Experts were contacted by email with an information sheet and invited to participate. As the survey was anonymous, there is no way of determining the exact split/ratio among experts who answered the survey. The distribution of people invited to participate is 70 % academics, 15 % practitioners and industry representatives, and 15 % policymakers and public sector representatives.

Data in Germany was collected at the aforementioned UK-German Energy Symposium in October 2020 (n=5–9) and between May and July 2021 with the help of a market research organisation (n=75). Regarding the latter, the survey first had to be translated into German. Due to linguistic differences it was not possible to create an exact translation. This must be taken into account when comparing the results. The market research organisation conducted the survey by phone among experts they contacted through existing networks. As a result, there is a strong bias towards practitioners and industry representatives among the German sample with a distribution of ~5% academics, 90 % practitioners and industry representatives, and ~5 % policymakers and public sector representatives.

Overall, and despite the dominance of certain groups/sectors among the different national samples, the survey represents a mix of generalist and specialist energy expertise. Data from all three samples was compiled in spreadsheets and cleaned to enable comparability. As this paper presents initial findings, it does not delve into statistical analysis. Instead, it reports survey responses and provides insights into trends which emerge across all three samples as well as areas where there is a noticeable difference between the three samples.

## Findings

### BENEFITING FROM ENERGY POLICY

The survey started with a multiple-choice question to establish the key determinants for an individual to benefit from current energy policies (Figure 1):

Across all three countries, and bearing in mind the predispositions of the national samples, responding experts suggest that the key determinants for an individual to benefit from current energy policies are homeownership and affluence (see Figure 1). In the Netherlands, national and subnational governmental priorities appear to play a more dominant role compared to the UK and Germany, which might suggest greater trust in policymaking or trust that policies will successfully lead to intended results. Other national peculiarities are also evident, such as the relative importance afforded to car-ownership in Germany and to both affluence and fuel and transport policy in the UK. These might reflect Germany's car culture (Kunze 2021) and the UK's long-standing engagement with fuel and transport poverty and the resulting presence of supportive organisations (Boardman 2010).

### ENERGY DEMAND POLICYMAKING AND FINANCING

The second set of questions shifted the focus towards energy demand. Question 2 asked whether policymakers understand the potential contribution of energy demand solutions to a low-carbon future (Figure 2). Question 3 asked how energy demand solutions should be mainly financed (Figure 3).

The most striking difference is that only around 6.5 % of Dutch respondents suggest that policymakers do not understand the potential contribution of energy demand solutions to a zero-carbon future compared to over 40 % in both the UK and Germany (Figure 2). This is also mirrored in nearly 40 % of Dutch responses which suggest that policymakers see it as a policy priority. This might have something to do with the relative importance the Dutch respondents assigned to national and subnational governmental priorities for an individual to benefit from national energy policies in Question 1.

In contrast, only 10 % of UK respondents suggest that policymakers consider energy demand solutions a policy priority, which might reflect the energy demand reduction bias of the UK sample. Overall, the respondents across all three countries appear to agree that even where politicians do under-

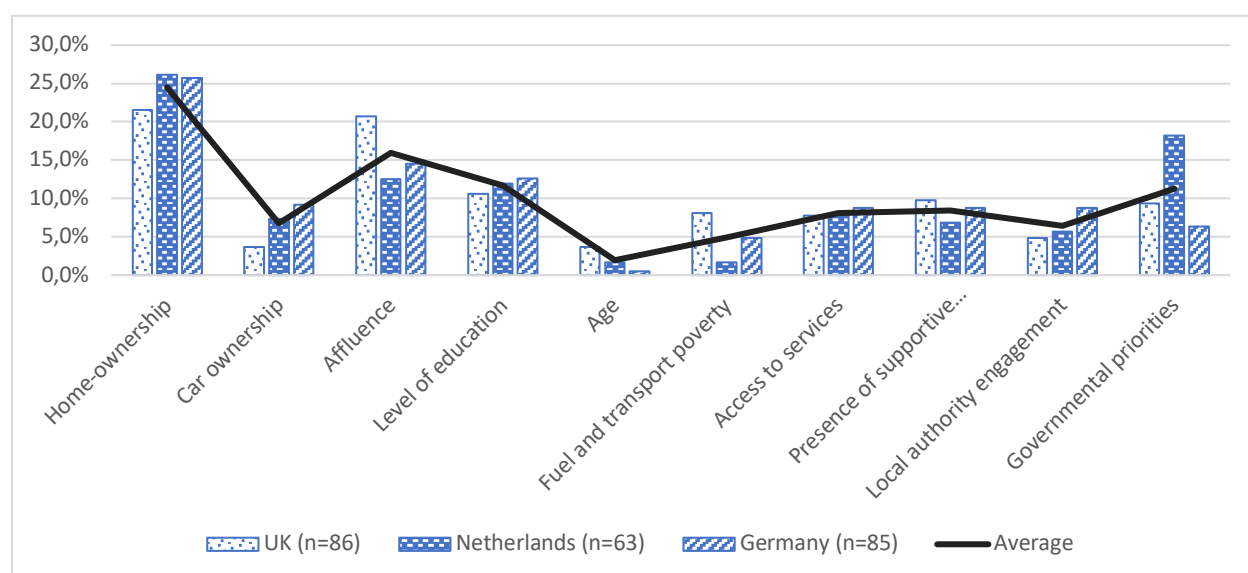


Figure 1. What are the key determinants for individuals to benefit from current energy policy (select up to 3)?

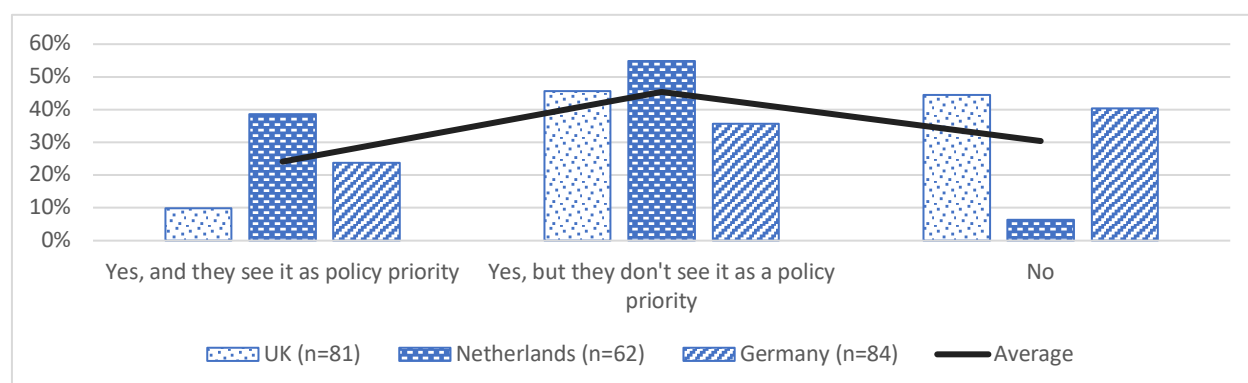


Figure 2. Do policymakers understand of the potential contribution of energy demand solutions to net zero (single choice)?



stand the potential contribution of energy demand solutions to a zero-carbon future, they do not see it as a policy priority. UK respondents are the most pessimistic about their policymakers while the Dutch appear to have a relatively favourable view.

Regarding the financing of energy demand solutions, the respondents across all three countries favour general taxation over private investments and energy bills (Figure 3), although the difference in Germany in relation to private investment is only marginal. Lack of support for paying for such solutions through energy bills in the UK and Germany may be related to their experience with feed-in tariffs which are commonly associated with higher energy prices which are disproportionately born by lower income groups (Granqvist and Grover 2016).

#### POLICYMAKING ATTENTION

The next set of questions compared the respondents' perception of energy policy priorities on both the demand and the supply side with their preferred policy priorities for a just transition to net-zero (Figure 4 & 5).

Respondents in all three countries suggest that technologies and target setting receive the most policymaking attention (Figure 4). German respondents appear to credit their policymakers with the most balanced approach among the options provided (Figure 4). Their responses also suggest

that regulation receives more attention than market-based instruments and nearly as much as target setting. Standards appear to play a more important role in Germany, and to a lesser extent the Netherlands, compared to the UK, which might be the result of the UK leaving the EU with its significant standard-setting capacity. In contrast, the respondents' views on what should receive more policymaking attention for a just transition to net zero paints a very different picture (Figure 5), nearly an inverse of their views on current policymaking (Figure 4).

Overall, there is a preference for more emphasis on changing practices, funding/finance, regulation and standards (Figure 5). While responses from the UK and the Netherlands are closely aligned, which might have something to do with their samples being dominated by academics, German respondents (the sample is dominated by practitioners) favour technology ahead of changing practices, regulation and finance. German respondents also do not appear to see the need for a significant change in policymaking to achieve a just transition to net zero, while both the UK and the Netherlands respondents favour a more significant shift in policymaking for a just transition to net zero.

#### NET ZERO VS JUST TRANSITION

The next set of questions contrasts the respondents' views on changes that the net zero will bring about (Figure 6 & 7).

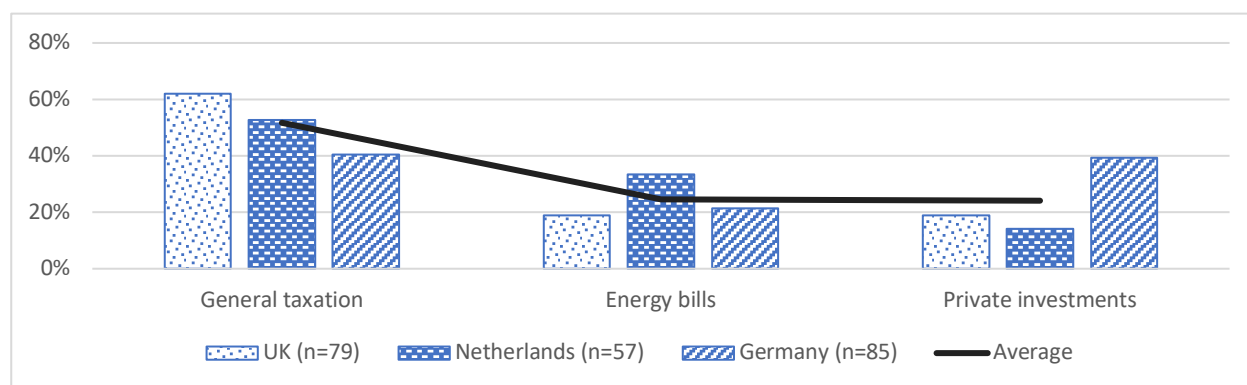


Figure 3. How should energy demand solutions be mainly financed (single choice)?

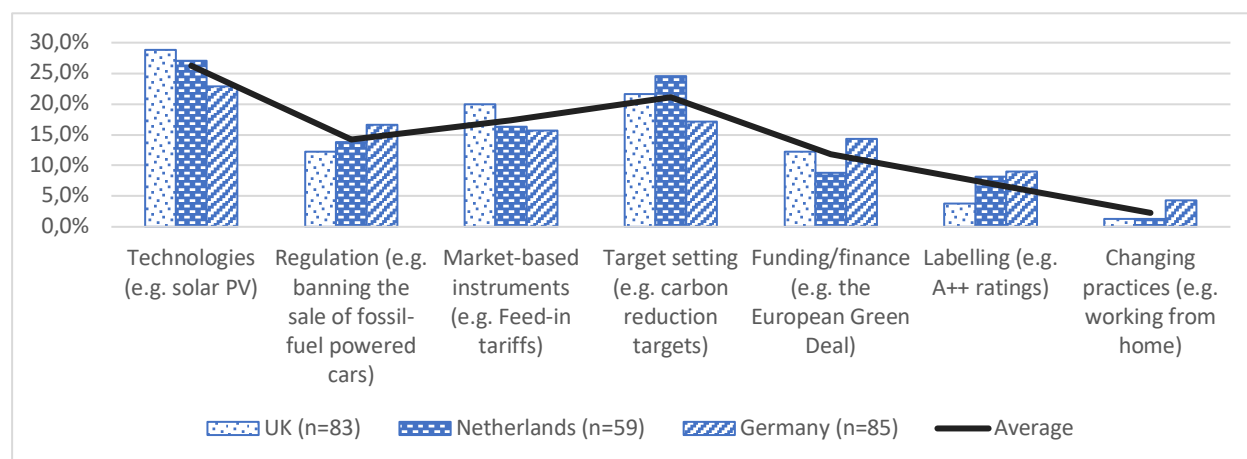


Figure 4. Which approaches to sustainable energy receive the most policymaking attention (select up to 5)?

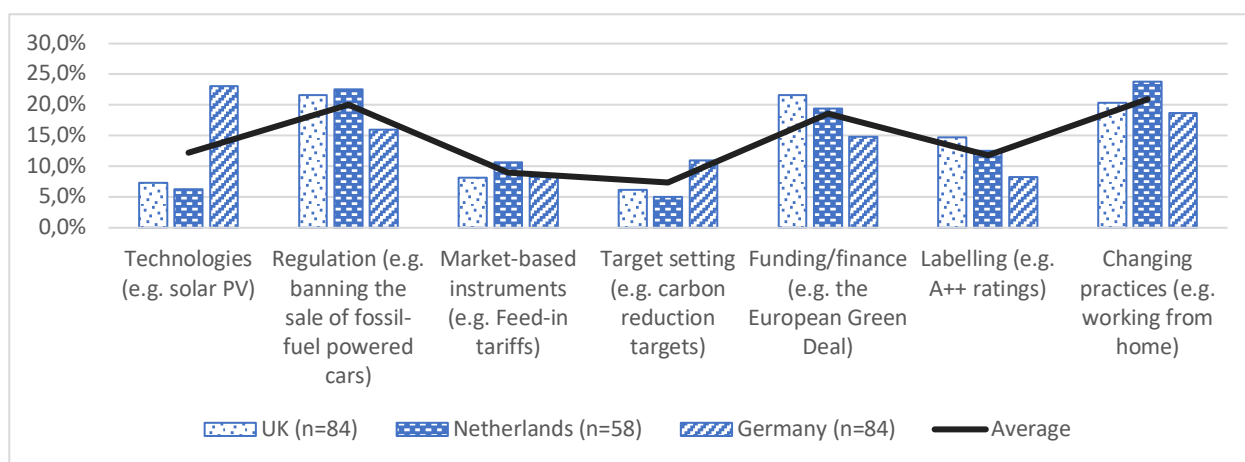


Figure 5. Which policymaking approaches require more attention for a just transition to net zero (select up to 5)?

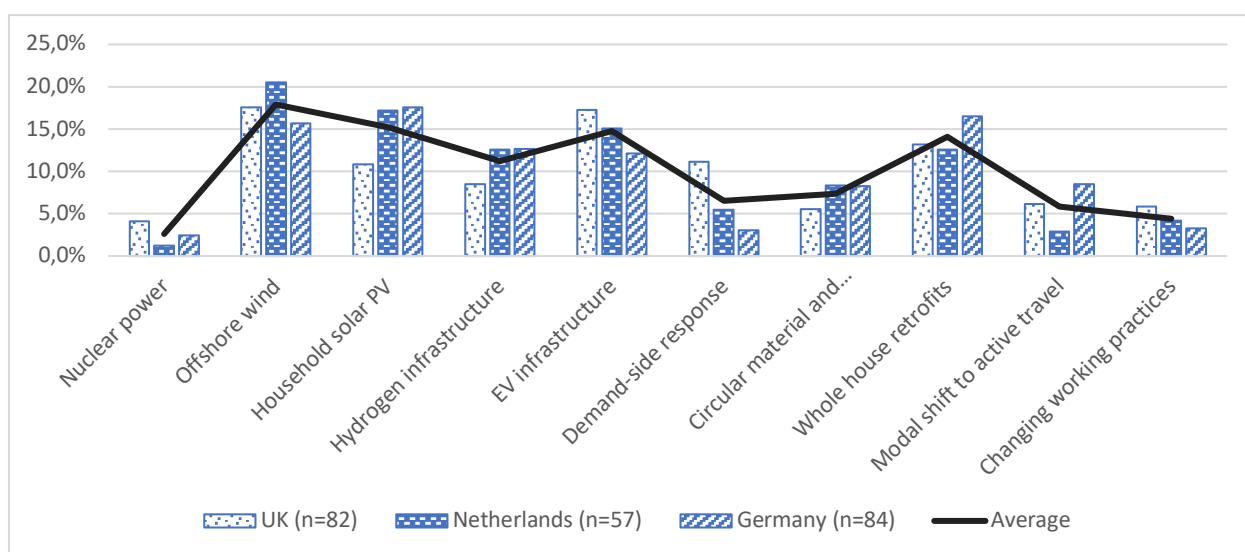


Figure 6. What changes will policymaking for net zero bring about (select up to 5)?

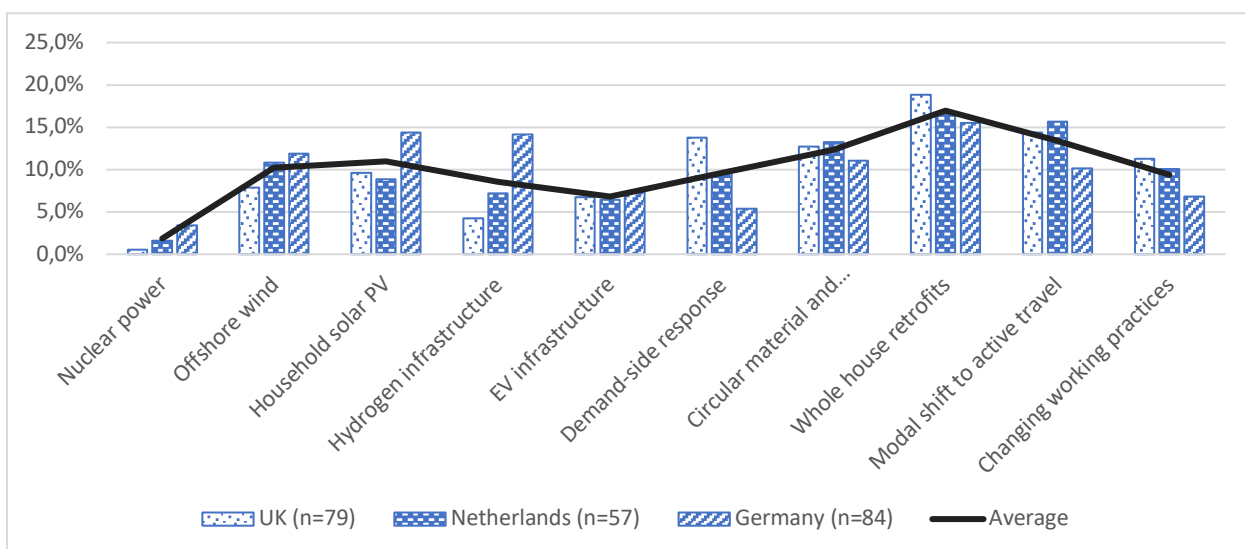


Figure 7. What changes should be prioritized for a just transition to net zero (select up to 5)?

Responses from all three countries suggest that decarbonisation policies will deliver further expansions of supply side technologies, especially offshore wind and household solar PV, the expansion of infrastructures which support fuel switching, and more whole-house retrofits on the demand side (Figure 6). Interestingly, and in contrast to the set of questions above, Dutch and German responses are closely aligned regarding current policymaking compared to the UK. This might reflect perceived or actual policymaking priorities at EU level.

Overall, respondents expect net zero policies to be dominated by technological substitution and vector switching (to the left of Figure 6) rather than demand reductions and changing practices (to the right of Figure 6), such as working practices and modal shift. This reflects earlier findings in the UK (Wiskel and Kattritzi 2020). However, the respondents' expectation that we will see more high-standard whole-house retrofits, especially in Germany, more household solar PV, less so in the UK, and more demand-side response, especially in the UK, also suggests that we are seeing a patchy emergence of policies decarbonising our living arrangements alongside those encouraging technological substitution and the decarbonisation of supply. Many studies point towards the need to shift our emphasis towards solutions addressing our living arrangements (Shove 2017; Grubler et al. 2018). Equally, however, many studies also suggest that such a change in policymaking attention is uncertain given our current policy environment (Wiskel and Kattritzi 2019; Rosenow et al. 2020).

The overall trend regarding preferable changes to achieve net zero among respondents from all three countries is similar (Figure 7). Relatively speaking, more respondents prefer demand-side and practice-oriented solutions for a just transition (towards the right of Figure 7) to supply-side and technologically oriented solutions (towards the left of Figure 7). However, German respondents once again show an overall preference for technological substitution and infrastructure investment. Similar to the results in Figure 5, these results suggest that German respondents are more content with current policymaking compared to UK and Netherlands respondents.

### NET ZERO AND JUST TRANSITION TRADE-OFF

Question 8 explores expert opinions on the importance of a range of energy and non-energy approaches for achieving net zero (Figure 8) and for achieving a just transition (Figure 9) using a Likert-scale. These questions allow us to establish whether our respondents foresee a trade-off between focusing on net zero (Figure 8) and a just transition (Figure 9). In the following Figures we combine the percentage of 'Very high' and 'high' Likert-scale answers to enable visual comparison.

Respondents from all three countries have little faith in markets to deliver decarbonisation, whether just or not (Figures 8 and 9). Technologies, policy and regulation are deemed equally important for decarbonisation although German respondents once again show a preference to technological solutions. Dutch respondents in contrast favour more regulatory and socio-technical approaches which might again reflect their trust in policymakers identified above. Education and awareness of the public is deemed the most important driver for decarbonisation (Figure 8).

To achieve a just transition to net zero, respondents in all three countries again agree on the importance of education and awareness of the public (Figure 9). Similarly, respondents from all three countries deem market-based solutions of least importance. Once again, German responses regarding both decarbonisation and a just transition to net zero are very similar, which mirrors findings above. UK and Dutch respondents indicate a slight preference for regulatory, socio-technical and social approaches, such as a shared understanding of the energy system as a socio-technical system, over market-based and technical approaches to achieve a just transition. Overall, however, a greater share of respondents in all three countries deem these approaches more suitable to achieve net zero than a just transition.

This suggests that non-energy policies and approaches are potentially more important to achieve a just transition to net zero than energy policies by themselves. This is reflected by a growing body of research which points towards synergies between air pollution, health policies and carbon emissions as

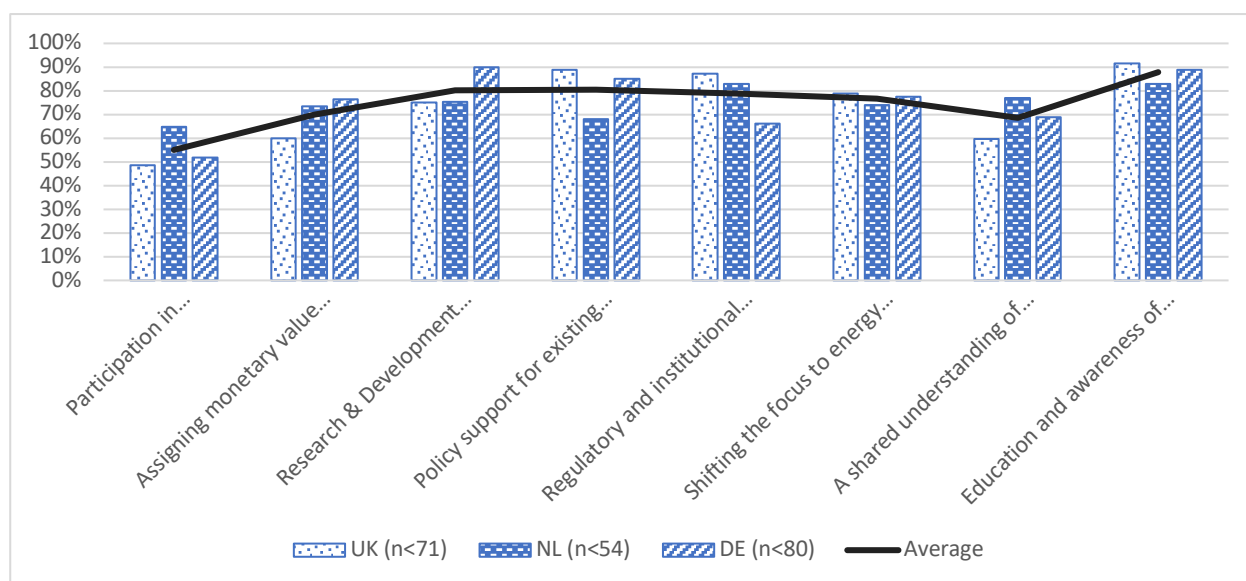


Figure 8. To what extent do you think the following are important for a just transition to net zero?



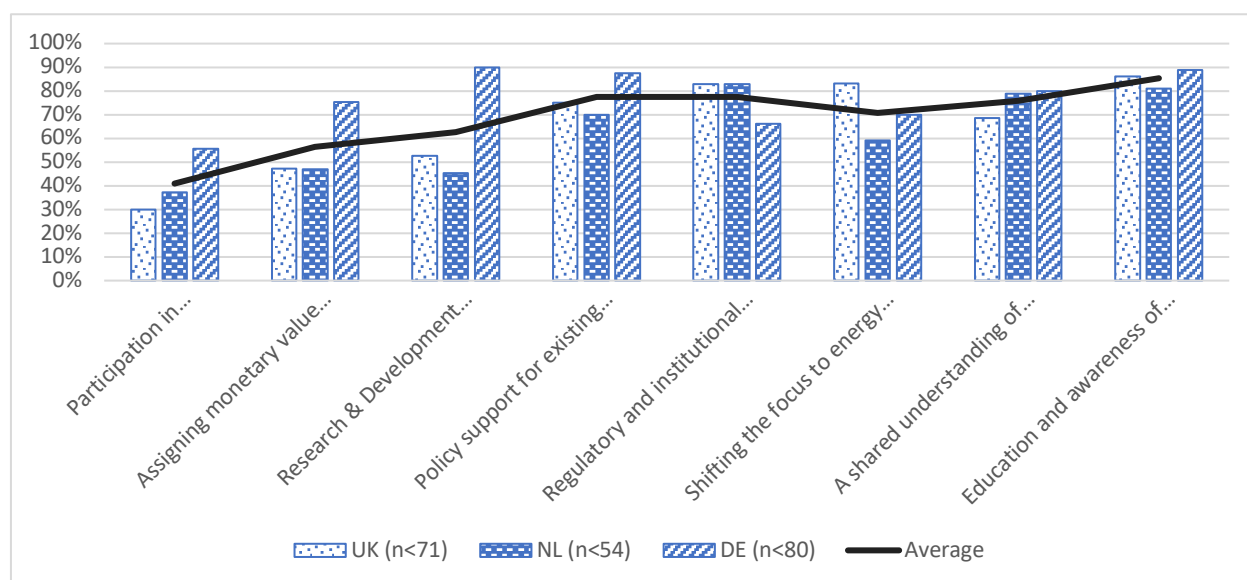


Figure 9. To what extent do you think the following are important for a just transition to net zero?

well as social welfare policy and fuel poverty alleviation (see for example The Lancet Planetary Health). Overall, however, policy integration across energy and climate policies and non-energy and climate policies is an emergent area of policymaking and warrants further research to establish synergies and trade-offs and provide the basis for a just transition to net zero (Royston et al. 2018).

## Discussion and conclusion

In the UK sample, the fact that over half of the respondents work in the CREDS research community might create a positive energy demand reduction bias. Its interdisciplinary mission nevertheless ensures a good mix of academic backgrounds, including engineering, social and environmental sciences. Similar results among the UK and the Dutch sample, which does not suffer from such a possible energy demand bias, suggests that this bias is minimal. At the same time, a similar reliance on academics among the UK and Dutch samples also creates a predisposition removed from the practicalities of policymaking. The German sample's dominance of practitioners and industry representatives, in contrast, creates a different sectoral predisposition towards technical solutions, removed from overarching policy imperatives of EE1st. As a result of these differences in sample distribution, this paper identifies relative trends as opposed to absolute truths, and is careful not to over-interpret national differences.

The responses to questions 3, 4 and 6 broadly confirm the first hypothesis that *energy demand receives less policymaking attention than energy supply, even where demand side change can secure similar policy objectives more cost effectively* (Figure 3). Despite significant variations among respondents from the three countries, it does not appear to be a policy priority in either. Most Dutch respondents suggest that policymakers at least understand the potential contribution of energy demand solutions to a zero-carbon future. Over two fifths of German and UK respondents, on the other hand, suggest that policymakers do not understand its potential contribution. Instead,

current energy policymaking approaches are dominated by technologies, targets, and market-based instruments (Figure 4). These appear to skew decarbonisation efforts towards technological and vector substitution on the supply side (Figure 5). This calls for organisations such as CREDS nationally and the European Council for an Energy Efficient Economy (eceee) internationally to step-up their efforts to raise awareness among policymakers and the general public of the necessity to reduce demand in order to achieve our decarbonisation targets.

The comparative responses between questions 4 and 5 as well as 6 and 7 broadly confirm the second hypothesis that *energy demand solutions play a more significant role in achieving a just transition to net zero than energy supply solutions*. To achieve a just transition, respondents, on average, would place greater policymaking emphasis on standards, regulation, funding/finance, and especially changing practices (Figures 4 and 5). This is particularly evident among respondents from the UK and the Netherlands. Although German respondents also support such a shift, they still prioritise technologies while their overall opinion regarding current national decarbonisation policies is a lot more favourable compared to the other two countries. Regarding the changes that should be prioritised for a just transition to net zero we see a similar pattern (Figures 6 and 7).

To achieve a just transition, respondents place greater emphasis on demand-side solutions such as whole house retrofits, changing work practices and a shift to active travel for a just transition to net zero (which confirms both hypotheses 1 and 2). Once again, and bearing in mind the differences in sample distribution, this is particularly evident among respondents from the UK and the Netherlands. Respondents across all three countries also support more demand-side response and circular material and product economies. Although it is too early to determine how such changes will affect energy demand, as components of low energy systems they would contribute to reducing energy demand compared to current trajectories (Barrett et al. 2021). This again needs to be clearly communicated. But it also requires a paradigm shift away from ecological-mod-

ernist decarbonisation approaches (dominant in Germany and evident in German responses in favour of technological solutions) towards a more holistic appraisal of need, sufficiency, excess, and equity in an increasingly resource-constrained world.

Answers to Question 1 suggest that the key determinants for an individual to benefit from current energy policies are home-ownership and affluence (Figure 1). Answers to Questions 8 suggest that fewer systemic determinants of sustainable energy influenced by policy, ranging from markets and technologies to regulation and public engagement, are conducive to achieving a just transition to net zero compared to decarbonisation by itself (Figure 8 and 9). Regarding Question 8, respondents from the UK and the Netherlands in particular suggest that more technical, financial or market-based solutions appear less conducive for a just transition to net zero compared to decarbonisation by itself. German respondents strongly support R&D support for new technologies which reflects the overall ecological-modernist trend among German respondents and might be the result of predispositions among the sample. Overall, fewer of the options provided are deemed conducive to achieving a just transition to net zero compared to decarbonisation by itself.

Combined, these answers broadly confirm the third hypothesis that *policy to deliver decarbonisation of energy supply will not be sufficient for a just transition*. Question 2 indirectly supports this conclusion. It reveals that the preferred option of paying for energy demand reductions is general taxation ahead of both levies on energy bills and private investment (Figure 2). Paying through general taxation is associated with fewer distributional consequences as levies in bills tend to be more regressive while private investments may privatise profits but socialise costs and risk. This points to the need to ensure that justice and equity is integral to policy input as well as outcome. Overall, these findings suggest that energy policy needs to be more holistically embedded in climate policy as well as other policy areas to support and legitimise transformative decarbonisation processes and ultimately succeed in achieving net zero.

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