Germany's decision to phase out coal by 2038 lags behind citizens’ timing preferences

Adrian Rinscheid and Rolf Wüstenhagen

Coal-fired power generation is the single most important source of carbon dioxide emissions in many countries, including Germany. A government commission recently proposed to phase out coal by 2038, which implies that the country will miss its 2020 climate target. On the basis of a choice experiment that assessed 31,744 hypothetical policy scenarios in a representative sample of German voters, we show that voters prefer a phase-out by 2025. They would uphold their support for greater climate ambition up to an additional cost to society of €8.5 billion. Voters in Rhineland and Lusatia, the country’s main coal regions, also support an earlier phase-out, but to a lesser extent than voters in other regions. By demonstrating that political decision-makers are more reluctant than voters in overcoming energy path dependence, our analysis calls for further research to explain the influence of particular stakeholders in slowing energy transitions.

Eighty per cent of the world’s coal reserves must stay in the ground to reach the target of limiting global warming to well below 2 °C compared with pre-industrial levels. In 2008, climate scientists had called for a complete divestment from coal-fired electricity by 2030, a proposition reiterated by a recent roadmap for rapid decarbonization. Yet despite the strong growth of renewable energies, coal still accounted for 28% of the world’s primary energy supply in 2017. As Pfeiffer et al. point out, coal-fired power plants “will need to be underutilized, retired early, or retrofitted […] or—in short—stranded” if countries are serious about reaching the targets set in Paris.

As private markets will not spur such necessary developments on their own, government policies play an important role in phasing out coal. However, in democratic countries, such policies may face public opposition. While several studies suggest that the global energy transition (that is, shifting from non-renewable to renewable energies) is likely to lead to net job creation in most economies, the closure of coal mines and coal-fired power plants may lead to temporary and regionally concentrated job losses. The anticipation of negative employment effects could lead to opposition by those working in the sector. Moreover, the coal industry has become an identity-shaping symbol deeply engrained in the culture of some communities and countries, such as in the German region of Lusatia, Silesia in Poland or Appalachia in the United States. Opposition to a phase-out of coal is also likely to be fuelled by the economic actors that have to bear parts of the costs, such as utilities whose business models depend on coal, and labour unions representing coal workers. Given their desire to be re-elected, democratic governments may be responsive to these concerns. At the same time, recent assessments such as the Intergovernmental Panel on Climate Change’s Special Report ‘Global Warming of 1.5 °C’ emphasize the urgency of ambitious action to prevent irreversible climate change. While some jurisdictions have committed to phasing out coal, such as Canada and the United Kingdom who launched the Powering Past Coal Alliance in November 2017, many others are not delivering policies ambitious enough to meet the climate challenge. Germany, the largest energy consumer in the European Union, the world’s largest producer of lignite and one of the top-ten coal-burning countries in the world, has recently started to organize its departure from coal.

Germany has relied heavily on coal for power generation for a long time. In the 1950s, more than 500,000 people were employed in the sector, contributing to the German Wirtschaftswunder after World War II. While the oil crisis in 1973–1974 aided the development of nuclear power, domestic coal was viewed as important to ensure energy security, and utilities were thus required to burn a quota of domestic hard coal. As operating costs in the coal industry started to outpace market revenues in the 1960s, federal and state governments introduced subsidies for hard-coal mining. These amounted to more than €320 billion until they were phased out in 2018.

In the 1970s, coal-fired energy generation started to become more controversial. The environmental movement and (later) the newly established Green Party opposed coal-fired power plants and open-pit mining but were even more concerned with nuclear power, largely avoiding simultaneous contestation on two fronts. The coal industry nurtured strong ties to the country’s two largest parties, the Christian Democrats (CDU/CSU) and the Social Democrats (SPD), with the SPD in particular aiming to keep coal mines open as long as possible. In the wake of the 1986 Chernobyl nuclear accident, Germany adopted a policy framework in 1990 for the promotion of renewable energies, which fundamentally changed electricity markets. The share of power generated by renewables soared from 3.6% to 35.2% between 1990 and 2018.

While Germany has been successful in transitioning from nuclear to renewable energy, 35.3% of electricity generation still came from coal in 2018 (Fig. 1). Policy support for renewables is an important element in decarbonizing the energy sector, but it is an open question whether layering support schemes for sustainable technologies on top of the existing institutions without addressing the legacy of fossil fuels is enough to “effectively lead energy systems out of carbon lock-in.” Given only gently decreasing emissions (Fig. 1), the question of a coal phase-out gained prominence in the aftermath of the adoption of the Paris Agreement. In November 2016, the German government adopted the Climate Action Plan 2050, outlining measures to achieve the country’s climate targets. This plan failed to develop a phase-out strategy, and in 2018 the task was delegated to the Coal Commission, an expert commission on growth, structural change and employment consisting of a variety of
stakeholders including industry associations, labour unions, state-level governments, environmental non-governmental organizations and independent scientists appointed by the federal government. In early 2019, this group recommended to phase out coal-fired power generation by 2038, proposing an array of measures to support the coal regions in restructuring their economies.

In light of recent concerns about populist backlash against climate policy, some observers consider the proposed timeline a reasonable compromise between public acceptance and climate change mitigation. Although the compromise has been praised for representing a broad societal consensus, given the urgency of ambitious climate action, some members of the Coal Commission have criticized the plan as not ambitious enough (ref. 24, pages 118 and 119) to deliver on Germany’s climate policy targets.

Given these concerns and the view expressed in the German Climate Action Plan that public support is a central precondition for successful implementation of climate policies, we investigate whether the recommendations of the Coal Commission are in line with citizens’ preferences, particularly regarding the temporal dimension. First, we investigate how citizens’ support for a coal phase-out is affected by different timelines and other features of a phase-out and examine the moderating influences of political orientation and climate change-related beliefs. Second, we explore the preferences of citizens living in Germany’s two largest coal regions, Rhineland and Lusatia. Our analysis suggests that compared with the recommendations of the Coal Commission, a more ambitious timeline for phasing out coal would actually have been better aligned with citizens’ preferences.

Effects of phase-out design on public support

With data from a large-scale choice experiment, we examine how public preferences for a coal phase-out in Germany are affected by different proposed phase-out timelines and compare citizens’ preferences with the recommendations of the expert commission. We also investigate the role of other policy attributes (cost, effects on jobs and supporting measures for the transformation of the coal regions; see Table 1 and Methods for details). Our analysis is based on an online survey administered to a nonprobability but representative sample of 2,161 Germans who are eligible to vote (see Supplementary Table 1). The choice experiment involved a rating task whereby respondents were exposed to eight consecutive pairs of hypothetical policy scenarios to phase out coal. In the scenarios, the attribute levels of the phase-out policy were varied.

Table 1 | Policy attributes and levels for the choice experiment

| Policy attributes | Attribute levels |
|-------------------|-----------------|
| End date of the phase-out | • By 2025 • By 2030 • By 2040 • By 2100 |
| Annual cost per two-person household (overall costs for the economy) | • €0 • €6 (€250 million) • €12 (€500 million) • €18 (€750 million) |
| Number of lost jobs in the coal industry | • −5,000 • −10,000 • −15,000 • −20,000 |
| Number of newly created jobs | • 5,000 • 10,000 • 15,000 • 20,000 |
| Measures for structural change | • Investment in expansion of renewable energies • Investment in regional funding programmes for new businesses (for example start-up funding) • Investment in modern infrastructure (electric vehicles, digitalization) • Investment in research and development • Mixture of further training and early retirement for coal industry employees |

Fig. 1 | Share of coal in German electricity mix and energy-related greenhouse gas emissions, 1990–2018. Based on data from AG Energiebilanzen and the German Environment Agency.
that policy scenarios with 2025 as an end date have a significantly higher probability of being supported than policies with later end dates. Postponing the phase-out to 2040 leads to a decrease in policy support of 10.7 percentage points, and postponing it to 2100—as reflected in the G7’s statement to phase out fossil fuels by the end of the century—leads to a decrease in policy support of 15.3 percentage points, compared with the 2040 baseline. As is apparent in the data, Germans are also sensitive to the cost of a coal phase-out. Every increase in annual cost of €10 per household (or about €400 million per year for the German economy as a whole) decreases public support by about seven percentage points. With regard to employment effects, people prefer scenarios with lower job losses over scenarios with higher job losses, but they value newly created jobs slightly higher than lost old jobs. For instance, while the scenario with 20,000 lost jobs decreases phase-out support by 9.2 percentage points compared with a scenario with only 5000 lost jobs, creating the same number of new jobs increases phase-out support by 12.2 percentage points. The type of supportive measures for the local economy is the least important of the five attributes. Among the design options offered here, the preferred attribute level is an expansion of renewable energies.

Partisan differences and gateway beliefs

As the discussions of the Coal Commission showed, the main question about phasing out coal is not if, but when, the phase-out is going to happen. Hence, the following analyses focus specifically on the question of timing. While Fig. 2 indicates that the timeline does indeed have a considerable effect on citizens’ preferences, there may be differences between population subgroups. In particular, it has been suggested that party identification structures people’s energy policy preferences\(^2\)\(^3\). Germany’s party elites represent opposing views on the coal phase-out, ranging from the Greens’ position for an early phase-out to the conservative parties tending to defend the status quo\(^3\)\(^4\). In the context of the 2017 federal elections, the partisan divide on the topic became highly visible, and the question of timing was one of the reasons why the negotiations for a government coalition of the Christian Democrats, the Liberal Democrats (FDP) and the Green Party failed in November 2017\(^5\)\(^6\). Figure 3a shows that there is some variation among partisans with regard to the strength of their timing preferences. Unsurprisingly, Green Party supporters show the strongest preference for an early phase-out in 2025. What may be more surprising is that supporters of almost all other parties also prefer 2025 over 2040. The only exception is the relatively small subsample supporting the Bavarian arm of the CSU, where the preference for 2025 is not significant. In contrast to public statements by their party leaders, FDP and Green Party voters have similar views on this issue. For all respondents, phasing out in 2100 was the least preferred timeline, although supporters of the right-wing populist party Alternative für Deutschland (AfD) are comparatively more positive about such a late phase-out date than supporters of all other parties. In light of other surveys investigating public attitudes on the German energy transition (either surveys with a broad focus\(^7\) or those with a specific focus on the coal phase-out\(^8\)), the muted differences across different partisans actually reflect a recurring pattern. See Supplementary Table 3 for the supporting regression analyses.

We also expected beliefs about climate change to influence citizens’ support of different phase-out timing options. We assessed climate change-related beliefs by asking respondents to estimate the share of global climate scientists who think that the rise in the atmospheric CO\(_2\) concentration since the mid-twentieth century is primarily due to human activities. Perceived scientific consensus about the anthropogenic nature of current climate change functions as a ‘gateway belief’ that influences several other attitudes related to climate change and energy\(^9\)\(^10\). While quantifications show that the consensus is shared by 90–100% of publishing climate scientists\(^11\),
a recent study conducted in the United States highlights that only 15% of US citizens are aware of this high level of consensus. In our German sample, the mean estimate of consensus is 66% (s.d. = 22.9), and 18.3% of respondents estimate the consensus to be 90% or higher. Figure 3b shows that perceived consensus strongly moderates the effect of phase-out timelines on preferences. Respondents who think the consensus is below 50% are indifferent to whether the proposed end date is 2025, 2030 or 2040, but their support still decreases if the proposed end date is 2100. The closer respondents’ climate-related beliefs approximate the true level of scientific consensus, the more pronounced their preference for an earlier phase-out. Respondents who (accurately) estimate the consensus to be 90% or higher prefer a 2025 phase-out date by more than 40 percentage points over a phase-out date of 2100. See Supplementary Table 5 for the supporting regression analyses.

### Ties to coal industry weaken support for early phase-out

To explore the influence of social embeddedness on preferences for a coal phase-out, we rely on two additional samples of residents of the two major coal regions, Rhineland (n = 533) and Lusatia (n = 501), who took the same survey. Within these independently collected regional samples, we further investigate whether the preferences of people having direct ties to the coal industry, for example, through acquaintances or by being employed in the sector, differ from those of other respondents in the region. The results (Fig. 4 and Supplementary Tables 7 and 9 for supporting regression analyses) suggest that people in the coal regions have less pronounced preferences for an early phase-out than respondents in the nationwide sample. However, there are some differences between the two regions. Phasing out coal by 2025 or 2030 instead of 2040 has significantly higher support in Rhineland, while respondents in the eastern German region of Lusatia tend to support a phase-out in 2030. Even here, later phase-out dates are significantly less preferred. An analysis of respondents with strong (red symbols in Fig. 4) and weak (blue symbols) social ties to the coal industry suggests that in both regions, people with strong ties are indifferent to whether the proposed phase-out date is 2025, 2030 or 2040, as the confidence intervals around the point estimates for 2025 and 2030 include the dotted reference line.

### Conclusion

Addressing climate change effectively and rapidly requires not only investing in new energy technologies but also divesting from carbon-intensive energy infrastructures. Our study is among the first to investigate citizens’ views on the second part of this equation. Using a large-scale survey, we assessed German voters’ preferences for different policy design options to phase out coal. We found that the average respondent consistently prefers a more ambitious timeline. All else being equal, the preference was to phase out coal by 2025, which contrasts with the Coal Commission’s proposal to phase out coal by 2038. A particular strength of our methodological approach is that the choice experiments allow us to scrutinize respondents’ timing preferences in relation to possible trade-offs between the different attributes of an accelerated phase-out, such as higher cost. By comparing preferences across attributes, we find that support for an accelerated phase-out is upheld up to an additional cost to society of €8.5 billion (see Supplementary Fig. 1).

The acceptance of policy proposals is also sensitive to the employment effects of the energy transition. Cost matters, as do job losses. If delaying the phase-out from 2025 to 2030 would result in halving job losses from 20,000 to 10,000, voters would—with all else being equal—accept the later phase-out. Our analysis also shows that the creation of new jobs matters even more than the loss of old jobs. Policymakers aiming to find support for ambitious climate policies are therefore well advised to make credible claims about how these policies will lead to new employment opportunities in low-carbon industries.

Our results also shed light on the similarities and differences among population segments. With respect to party identification, preferences for earlier over later phase-out dates are widespread among almost the entire political spectrum. Even voters in Germany’s two largest coal mining regions share—to a large extent—the preference for an earlier over a later phase-out. The only notable exception are citizens with strong ties to the coal industry, who have no significant preference for a 2025 phase-out over one that happens in 2030 or 2040. Similarly, voters in the eastern German region of Lusatia slightly prefer 2030 over 2025 as the phase-out date. Moreover, knowledge about the scientific consensus on anthropogenic climate change is an important predictor of supporting an ambitious phase-out. Slightly less than one-fifth of respondents are aware that more than 90% of climate scientists agree that climate change is human-made. These well-informed respondents have a stronger preference for phasing out coal in 2025 than those who (erroneously) believe that no such consensus exists.

In light of our findings, the German Coal Commission’s proposal to phase out coal by 2038 does not appear to correspond well with voter preferences. This might be an indication that...
860

ARTICLES

commission members over-estimated voters' conservatism, as political elites have been shown to do frequently44,45. However, even assuming that the commission members gave constituents in coal-mining regions precedence over voters in other parts of the country would not explain why such a late date was chosen, as even in those regions respondents preferred phase-out dates between 2025 (western Germany) and 2030 (eastern Germany). An alternative explanation for this mismatch is that voter preferences simply did not play a decisive role in the consultations of the commission. As Fig. 5 illustrates, citizen voices (represented by non-governmental organizations, for example) were under-represented among the 28 commission members. Moreover, most commission members were insulated from re-election pressures, and some might have emphasized short-term economic interests, such as the Confederation of German Employers' Associations (BGA) or the trade union representing workers in mining, chemicals and energy (IGBCE). While a detailed analysis of the decision-making dynamics within the commission is beyond this paper's scope, the strong representation of incumbent interests within the commission highlights an important institutional barrier against overcoming energy path dependence. Further work in this area could investigate the ability of corporatist styles of decision-making to reform today's carbon-intensive energy systems46. To successfully manage "the next phase of the energy transition"47, which implies making established technologies and infrastructures redundant, we need to enhance our understanding of incumbents' survival strategies, including their corporate political activity aimed at slowing down the transition. Moreover, given the prevalence of particular stakeholders who stress job losses rather than new opportunities, the nexus between employment considerations and the political feasibility of decarbonization measures needs more scholarly attention48. Energy transition researchers and modellers would benefit from engaging with political scientists and sociologists to unveil the interests and activities of various actors who are shaping energy policies. Policymakers trying to develop ambitious climate change mitigation policies should be encouraged to find ways of being exposed to a balanced view of the risks and opportunities of the energy transition. Our results suggest that in a democratic setting, such action could be rewarded in future elections by voters.

Methods

Choice experiment rationale and design. To investigate voters' policy preferences, we conducted a choice experiment. Choice experiments were developed in marketing research to investigate the importance of different product design features in determining purchasing preferences. The idea is to put respondents in a hypothetical yet realistic choice situation in which they are confronted with bundles of relevant product attributes. By observing stated preferences with regard to the presented alternatives, it is possible to examine the relevance of certain product attributes and their characteristics to individual choices.

Political scientists have adopted the method to gauge citizens' preferences with regard to different policy proposals or scenarios49–53. Analytically, the design features of a policy are similar to product attributes, which is why the method provides a powerful approach to simultaneously estimate the individual effects of several attributes of a policy proposal on voter preferences54. Choice experiments require decision-makers to make trade-offs between different policy attributes when evaluating various multidimensional alternatives. As a consequence, they can mitigate the problem of social desirability bias in public opinion research on environmental matters55. In our case, using choice experiments may reduce the likelihood of overestimating voters' appetite for an ambitious phase-out of coal.

At the beginning of the choice experiment, respondents were familiarized with five attributes of a potential policy to phase out coal: the timescale of the phase-out, estimated costs, effects on employment in terms of layoffs and newly created jobs, and supporting measures for the transformation of the coal regions. We selected these five attributes on the basis of the following considerations. In 2017 the German Advisory Council on the Environment (SRU), an expert advisory panel to the federal government, recommended a staged approach in which the coal-fired power plants with highest emissions would be disconnected from the grid as early as 202956. The most efficient power plants would be successively shut down in the 2030s, and the phase-out would be completed by 2040 at the latest.

Fig. 4 | Average effects of the timing attribute on respondents’ preference for a coal phase-out in Rhineland and Lusatia. a,b Symbols represent AMCEs for the timing attribute (base 2040) for the (a) Rhineland and (b) Lusatia samples, excluding inattentive respondents. The analyses also differentiate between respondents employed by or with acquaintances in the coal industry and those without strong coal industry ties. The horizontal bars represent the 95% confidence intervals.

Fig. 5 Composition of the Commission on Growth, Structural Change and Employment. Numbers indicate number of members of the Coal Commission entitled to vote per category based on the list of commission members55.
The SRU stresses the climate–political necessity of immediately starting the phase-out to achieve appropriate implementation of the Paris climate targets in Germany. Other studies reach similar conclusions. Depending on the ambition of the first stages of the phase-out, studies show that it is technically feasible to accomplish a coal phase-out by 2035\(^{\text{ transfers}}\) or as soon as 2030\(^{\text{ transfers}}\). If the 1.5°C target of the Paris climate agreement is taken as the reference point, however, the phase-out of coal in Germany must already occur by around 2025\(^{\text{ transfers}}\). A different time horizon for the phase-out of coal was adopted by the G7 in 2015 when they decided to end the use of coal fuels by the end of the century\(^{\text{ transfers}}\). Hence, reflecting these different scenarios, our choice experiment uses 2025, 2030, 2040 and 2100 as attribute levels.

Arguments about costs, the second attribute of our choice experiment, play a large role in the public debate on phasing out coal. During the negotiations for a government coalition consisting of the CDU/CSU, the FDP and the Green Party (the so-called Jamaican coalition) in November 2017, a number of energy-intensive firms publicly warned that a phase-out of coal would mean a rise in electricity prices by up to 30\(\%\) (ref. \textbf{[1]}). While the exact effect of reducing coal-fired power generation on the electricity market depends on a variety of factors, including demand response, growth in renewable power generation and cross-border traffic, it seems plausible that changing the demand–supply balance could have an effect on price levels. In general, it would be technically feasible to accomplish this in the case of a phase-out that would entail considerable employment-related costs\(^{\text{ transfers}}\). Various proposals for financing the phase-out of coal have been articulated, such as a levy on the electricity price or a structural transformation fund for the German coal regions\(^{\text{ transfers}}\).

To make the costs a relevant choice consideration for individual respondents, we included a dummy variable ‘Phase-out Support’ in the dependent variable ‘Phase-out Choice’. To ensure that respondents themselves or someone they know works in a coal mine or a coal-fired power plant.

Data analysis. The fully randomized design allows us to simultaneously estimate the causal effects of multiple treatment components based on simple linear regression\(^{\text{ transfers}}\). Hence, average marginal component effects (AMCEs) were calculated using a simple linear regression estimator with standard errors clustered by respondent, using Stata 14.2 (by StataCorp, see https://www.stata.com/stata14/). The dependent variable is based on the rating scale, and the models include sets of dummy variables for the values of all attribute levels.

To ease interpretation of the results, we dichotomized the obtained data with the rating scale using the median (which is 4) as the cut-off value. The resulting dependent variable ‘Phase-out Support’ is hence coded 0 for cases where a respondent rated a proposal as poor to neutral (1 to 4) and 1 for cases where (s)he rated a proposal as positive (5 to 7). The rationale for using the rating outcome as the dependent variable (instead of the forced-choice outcome) is that it may allow for a more fine-grained assessment of preferences. In the first task (forced choice), respondents had to choose one out of two scenarios in each of eight rounds. However, the comparison of scenarios may include instances where respondents have either strong preferences for or against both proposals—a situation that can be captured by a forced-choice measurement. Therefore, in the rating task respondents could appraise both scenarios independently and on a more fine-grained scale. Nevertheless, replicating the analyses based on the forced-choice outcome leads to substantively the same results (see Supplementary Fig. 2).

**Samples.** The choice experiment was implemented in an online survey, which was fielded between December 2017 and January 2018. Study participants were drawn from the opt-in online consumer panel operated by Kantar/Lightspeed, which includes more than 230,000 registered individuals in Germany\(^{\text{ transfers}}\). From this panel, a nonprobability but representative sample of 2,161 Germans entitled to vote at national elections was drawn using an algorithm to match the census population as closely as possible on age, gender and household income. Supplementary Table 1 shows that the sample matches the German population well in terms of age and gender. With regard to income, both low-income and high-income households are under-represented. However, given the fact that we also allowed respondents to provide no answer, the deviations appear to be relatively small overall.

The two additional regional samples for Rhineland (n = 533) and Lusatia (n = 501) were drawn from the same consumer panel. As the two coal regions do not by themselves constitute administrative units, the target population for each region was defined on the basis of postal codes covering all towns and municipalities that border the open-pit coal mines. The final lists include 33 postal codes for the Rhineland and 92 postal codes for Lusatia. It is difficult to assess the representativeness of these samples, as no data comprising the distribution of socio-demographic variables for exactly these regions are readily available. Compared to the German population as a whole, the two regional samples show some deviations with regard to gender and age. The distribution of income varies between both samples: while the Rhineland sample includes more high-income individuals than the German sample, the Lusatia sample includes higher shares...
of low-income individuals. This is in line with the different economic conditions between western and eastern Germany.

To identify random responders, we implemented a short attention test immediately after the survey experiment. All responses shown in the paper are based solely on the responses of all participants who passed this test. Hence, the final samples consist of 1,984 (Germany), 491 (Rhineland) and 473 (Lusatia) respondents (see Supplementary Table 1). As can be inferred from Supplementary Table 1, 247 participants failed to answer the attention test correctly across samples.

Ethics. We have complied with all relevant ethical regulations and guidelines for study procedures set forth by the Ethics Committee of the University of St. Gallen. The survey for this study was fielded by Kantar/LightSpeed, and all respondents were first informed about the nature of the study before being asked to consent.

Reporting Summary. Further information on research design is available in the Nature Research Reporting Summary linked to this article.

Data availability
Replication data for the study are available in the Harvard Dataverse with the identifier https://doi.org/10.7910/DVN/TEFCBL63.

Code availability
Replication code for the study is available in the Harvard Dataverse with the identifier https://doi.org/10.7910/DVN/TEFCBL63.

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Author contributions
A.R. designed the study and analysed the data. A.R. and R.W. wrote the paper.

Competing interests
The authors declare no competing interests.

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Correspondence and requests for materials should be addressed to A.R.

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Behavioural & social sciences study design

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| Study description | The study uses quantitative data based on a survey with an embedded choice experiment. |
|-------------------|-----------------------------------------------|
| Research sample   | The main sample consists of 2,161 Germans entitled to vote at national elections. This sample is a nonprobability but representative sample, matching the German population well in terms of age and gender. Two additional samples were fielded in the coal regions Rhineland (n = 533) and Lusatia (n = 501). It is difficult to assess the demographic representativeness of the additional samples, as no data comprising the distribution of socio-demographic variables for exactly these regions are readily available. Supplementary Table 1 gives more details on how the 3 samples compare with the German population in terms of distribution of sex, age, and household income. All samples were collected through online sampling, based on the panel operated by Kantar/Lightspeed, which includes 230,000 individuals in Germany. |
| Sampling strategy | Respondents were recruited online through the survey firm Kantar/Lightspeed. We used quotas to ensure representativeness of the general population. Hard quotas were used on sex (male/female) and age (five groups). Soft quotas were used on household income (deciles). |
| Data collection   | The surveys were completed online individually by respondents. |
| Timing            | 18th December 2017 to 8th January 2018. |
| Data exclusions   | We excluded the data from respondents who failed to respond correctly to an attention test implemented during the choice experiment from the analyses shown in the paper. The rationale is that respondents failing the attention test may have provided random responses, hence adding random noise to the data. This exclusion criterion was pre-established and reduced the sample size as follows: main sample (Germany): 177 exclusions; Rhineland sample: 42 exclusions; Lusatia sample: 28 exclusions. As a robustness check, we re-ran all analyses with the full samples, including inattentive respondents. None of the results described in the paper change substantially if inattentive individuals are included in the analyses (for the full results, see Supplementary Tables 2, 4, 6, 8 and 10). |
| Non-participation | There were no drop-outs. |
| Randomization     | For each participant, the choice experiment consisted of eight successive rounds with two pairs of policy scenarios. The levels of attributes were randomly varied both within and across the binary comparisons. To prevent order effects, the order in which the attributes appeared was randomized across respondents but fixed for each respondent. |

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### Materials & experimental systems

| Involved in the study |
|-----------------------|
| Antibodies |
| Eukaryotic cell lines |
| Palaeontology |
| Animals and other organisms |
| Human research participants |
| Clinical data |
| n/a |

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| Involved in the study |
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| ChIP-seq |
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| Population characteristics | See above. |
|-----------------------------|------------|
| Recruitment                 | Subjects were recruited through the online survey panel operated by Kantar/Lightspeed. This opt-in sample is likely to under-represent individuals who have little or no internet access. |
| Ethics oversight            | Ethics Committee of the University of St.Gallen |

Note that full information on the approval of the study protocol must also be provided in the manuscript.