Exploring cultures of evidence in energy policymaking in the UK, Germany, and the Netherlands

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Abstract

This paper explores different "cultures of evidence" in energy policymaking in the UK, Germany, and the Netherlands. The urgent energy system transformation needed to respond to the climate crisis depends on policies informed by technical and engineering expertise, and particularly energy modeling. Such expertise had traditionally been poorly represented in the energy ministries of the Dutch, German, and UK governments. There is limited understanding of how policy advisory systems have evolved to respond to these emerging evidence needs. This paper presents a framework for describing how cultures of evidence differ, and applies this to a comparative study of energy policymaking in the UK, Netherlands, and Germany. I show clear differences in how evidence is understood and used. The Dutch and German governments have sought technical and modeling evidence from consultants or independent agencies. In doing so, the Dutch and German ministries appear to place stronger value on the "independence" of such evidence, while the UK system builds credibility through adherence to formal procedures. A second clear difference in the cultures of evidence relates to different beliefs about the extent to which expert knowledge can be impartial and value-free. The cases suggest that different cultures of evidence have coevolved with each country's institutional history and shaped the energy policy advisory system.

Keywords: evidence-based policy; cultures of evidence; policy advisory systems; energy modelling; energy policy

Efforts to promote the use of evidence in policy are often doomed to failure because they are naïve about the policymaking process (Cairney, 2016), and a growing body of research explores the dynamics of evidence use in practice. One important suggestion, explored in this special issue, is that there may be different "cultures of evidence" (Lorenc et al., 2014), which might influence how and why evidence is used to inform policy. The implication is that strategies to improve the use of evidence in one context may not be appropriate in another context with a different evidence culture. There is thus a need to better understand how cultures of evidence vary across countries and policy domains (Lorenc et al., 2014).

In this paper, I make a contribution to this emerging literature by providing a comparative analysis of the culture of evidence in three European countries, through a focus on energy policymaking. A key contribution of the paper is a framework that explores three core dimensions across which cultures of

evidence might differ. Applying this framework to the case of energy policymaking, I show that the way in which evidence is understood and used is different in Germany, the UK, and the Netherlands.

Energy policy has features that make it particularly interesting for comparative analysis of cultures of evidence. The importance and complexity of energy policy has grown over the past two decades as countries have struggled to respond to the climate crisis. Despite this, there has been relatively little comparative research on the use of evidence in energy policy. Energy policy also relies heavily on modeling, which presents challenges to the effective use of evidence. The epistemic status of modeling outputs is always negotiated: models can be thought of as thought experiments or "credible worlds," from which we learn by analogy (Sugden, 2009). Energy models are often opaque (Keppo et al., 2021), and as interdisciplinary tools that combine economics and engineering, there are relatively few people that have been trained to use or interpret them, in contrast to mainstream economic models that are widely taught in economics degrees. Comparative assessment of the cultures of evidence in energy policymaking is of value to the growing literature on the use of energy modeling in policy (Strachan et al., 2016; Süsser et al., 2021).

The paper is structured as follows. I first define "cultures of evidence," and develop a framework for describing three dimensions of evidence cultures. After setting out the research design ("Method and approach" section), and descriptions of the three country cases ("Overview of energy modeling and policy advisory systems in the UK, Netherlands and Germany" section), I present the evidence for differences in the culture of evidence in each country ("Differences in cultures of evidence" section). In the discussion, I explore the implications of those differences, and explore how and why cultures of evidence might vary between policy domains within a country.

Cultures of evidence: theory and conceptual framework

There is a rich literature on the role of evidence in policymaking, and the contexts in which evidence is produced and used within bureaucracies. Policy studies have shown that simple models of "evidence-based policy making," in which policy is largely dictated by "what works," miss the complexity and messiness of real-world policymaking processes (Cairney, 2016). Observers have highlighted that the literature on the use of evidence in policy is fragmented (Christensen, 2021; Oliver & Boaz, 2019). The same appears to be true of the literature that describes differences between countries or policy domains in the ways in which evidence is understood and used. Boswell's (2015) idea of a "culture of knowledge use," Lorenc et al.'s (2014) "culture of evidence," Jasanoff's "civic epistemologies" (Jasanoff, 2005), and Campbell & Pedersen's "knowledge regimes" (Campbell & Pedersen, 2015) all explore ways in which actors involved in public policy may operate according to shared rules, norms, or beliefs. In this section, I set out what I mean by culture of evidence, and develop a three-part framework for exploring how cultures of evidence may differ between countries and policy fields.

The use of evidence to inform public policy within a given context is shaped by a "policy advisory system" (Craft & Halligan, 2017), i.e., a structure of actors (individuals and the organizations in which they work), institutions that enable and constrain their activities, and the resources available to those actors. One can think of culture as relating to a set of shared normative and cognitive rules (Hatch & Zilber, 2012), such that "culture" is part of the institutional structure of the policy advisory system. These rules/institutions will be shared taken-for-granted values and beliefs about issues such as the "right way" of understanding evidence, or what makes evidence credible or legitimate in a given context. This echoes Boswell's definition of a "culture of knowledge use" ("historically specific and cumulatively learned patterns of values and beliefs that orient social action"; Boswell, 2015, p. 19), and Lorenc et al.'s definition of a "culture of evidence" as "coherent patterns of norms and orientations governing how knowledge is understood and used" (Lorenc et al., 2014, p. 1045).

My definition has some similarity with Jasanoff's "civic epistemologies," which she defines as: "the institutionalized practices by which members of a given society test and deploy knowledge claims used as a basis for making collective choices" (Jasanoff, 2005, p. 255). However, while she mobilizes the idea to describe the use of science in national public debate, I am applying "culture of evidence" to a more specific, local context that is largely out of the public eye: the energy policy advisory system.

My argument is that each policy advisory system has a culture of evidence, which is a set of shared rules that shape how evidence is used and understood. Clearly these rules will be nested within a broader institutional and cultural environment (Wesselink & Hoppe, 2020)—different civil service traditions, structures of government (Lijphart, 1999), national civic epistemologies (Jasanoff, 2005), and

policy styles (Howlett & Tosun, 2019). The focus of the paper is the cultures of evidence revealed at the level of each policy advisory system. However, as will become clear, participants themselves highlighted their own beliefs about the influence of the national government system on the culture of evidence.

The purpose of this paper is to explore differences in the cultures of evidence in energy policymaking. To do so, I develop and apply a framework for describing these differences. Based on the literature on the use of evidence in policymaking, the framework focuses on three possible dimensions of culture of evidence.

First, there is a spectrum of different beliefs about the nature of evidence itself. At one end of this spectrum is the idea that evidence should strive to be objective and "value-free" (Porter, 1995), with a firm distinction between facts and values when describing the use of evidence for informing policy choices. At the other end of the spectrum is a strong constructivist view that questions the possibility of objective evidence (Newman, 2017). Given these existing philosophical debates, it is plausible that cultures of evidence will differ in the extent to which evidence is expected to conform to a value-free ideal (Newman, 2017). We might not expect to find cultures dominated by either extreme, especially since a strong version of the value-free ideal may be difficult or impossible to maintain (Cooper, 2016; Pielke, 2004), even in questions distant from policy choices (Douglas, 2009). Rather, there may be durable differences in the degree to which evidence cultures emphasize a clear distinction between facts or "evidence" and values.

Second, the literature describes different attributes of evidence that make it more or less useful to policymaking. Cash et al. (2003) argued that evidence is useful for policy when it is credible, salient, and legitimate. Briefly, credibility relates to whether the knowledge is understood to be reliable, which typically is understood in relation to the scientific quality of the work underpinning it. Salience relates to the relevance of the evidence to the specific decision context faced by policymakers. Evidence may be seen as lacking legitimacy—and thus not used in policy—if it is perceived to exclude particular perspectives. This framework has been widely used in studies exploring the use of evidence in policy (e.g., Lentsch & Weingart, 2011; Veit et al., 2017).

Cultures of evidence may be characterized by differences in the perceived importance of credibility, salience, and legitimacy, a point made by Lentsch and Weingart in the context of advisory bodies (Lentsch & Weingart, 2011). There may also be differences in how these attributes are understood, such as shared rules governing what constitutes sufficient legitimacy, or how credibility is constructed. In other words, the way that evidence is assessed and valued may differ between cultures of evidence (Lorenc et al., 2014).

Finally, as explored by Boswell (2015) in her work on immigration policy in Germany and the UK, cultures of evidence can differ in the purposes for which evidence is used (a point also made by Lorenc et al., 2014). Various typologies of evidence use have been suggested (Boswell, 2009; Nutley et al., 2007; Weiss, 1979), and they share key elements. First, evidence can be used instrumentally to inform specific decisions, for example when the choice among policy options is informed by evidence on what might be most effective. Second, evidence can be used politically, to justify and legitimize choices made for purely political or expedient reasons (Weible, 2008), and as a resource in political debate (Daviter, 2015). Third, Boswell highlighted that evidence can be used to provide legitimacy for institutions, even where it is not actually used to inform decision-making, while Daviter (2015) highlights the role of knowledge in re-distributing political authority. Finally, Weiss (1977) highlighted that evidence can have an "enlightenment" function, providing policymakers with new ways of thinking about the policy issue. Such "enlightenment" use of evidence may not initially inform specific policy choices, but might contribute to a wider re-appraisal of the policy problem and only indirectly inform different policy decisions.

In summary, the paper seeks to identify whether the three cases do indeed reveal different cultures of evidence. It explores evidence for such differences across the three dimensions summarized in Table 1.

Method and approach

The approach is comparative and qualitative, exploring differences in the apparent culture of evidence in three countries: the UK, Germany, and the Netherlands. The policy advisory systems of these countries have been the subject of previous study (Hustedt, 2019; van den Berg, 2017; Veselý, 2017), providing a source of secondary material with which to support primary data.

Table 1. Three dimensions of cultures of evidence.

Dimension of evidence culture	Description	Relevant references for each dimension
How evidence is understood	A spectrum from the "value-neutral ideal" at one extreme to relativism at the other.	Newman, 2017
How evidence is used	Whether evidence is used instrumentally, symbolically, or through longer term "enlightenment," for example.	Boswell, 2015, Lorenc et al., 2014
How evidence is judged to be useful	How salience, credibility and legitimacy are evaluated and constructed.	Lorenc et al., 2014, Lentsch & Weingart, 2011

The cases provide an opportunity to explore cultures of evidence across countries with different governance models (Lijphart, 1999). Each has been subject to previous study in terms of science-policy arrangements (Halffman, 2005), culture of knowledge use (Boswell, 2015), or civic epistemology (Jasanoff, 2005), though not in the context of energy policy. The existing literature on these countries enables insight into how cultures of evidence may differ within countries across different policy fields.

The cases focus on recent and current practices within each policy advisory system. However, as will become clear, participants volunteered their views on the historical antecedents of the culture of evidence, and these views are also reported.

Primary data were collected through a series of interviews, during 2020, as part of a wider project on the use of evidence in energy policymaking (reported in McDowall & Britchfield, 2020). Informed consent was obtained prior to all data collection. Interviews were conducted with people active in, or with considerable experience of, the policy advisory system of each country. This included informants both inside and outside relevant government departments and agencies (see the Appendix for brief participant descriptions). Sampling was based on targeted invitations to people in relevant organizations and roles, and through snowballing. Interviews were carried out with 15 people in the UK, 7 in Germany, and 6 in the Netherlands. Primary data were also collected on the structure of the system, in terms of the relative sizes of various advisory agencies, and the numbers of people with analytic roles in central government departments. Secondary sources—journal articles, reports, and book chapters describing aspects of each country's policy advisory system—were used where possible to triangulate the findings from interviews. However, the relatively small number of participants—particularly for Germany and the Netherlands, is a limitation of the study. There is thus a possibility that further interviews would change the findings presented here. To limit this possibility, I have triangulated interview data with secondary sources, and the key points are supported by multiple interviewees, or supported by literature.

Differences in the culture of evidence are revealed through two analytic strategies. First, the formal structures through which evidence is managed within a bureaucracy both reflect the "evidence culture" and reinforce it by shaping how evidence is understood, valued, and used. I therefore pay attention to the administrative structures and formal procedures, using information derived from interviews and from secondary literature. To help structure thinking about this, I draw on the literature on policy advisory systems (Craft & Halligan, 2017).

Second, I examine how participants talk about and understand evidence, drawing on interview data. Interviewees were asked to describe the evidence system for energy policy, particularly in relation to energy modeling. They were not explicitly asked to comment on the three dimensions of culture explored here. These were inferred from the way in which participants described the policy advisory system. While differences in the structure of policy advisory systems are consistent with differences in culture, they are rather weak evidence for it. In contrast, clear differences in the way that actors describe and understand evidence and its relationship with policymaking provide stronger evidence of different evidence cultures. I therefore explore different perceptions of evidence, according to the three core elements set out earlier: (i) the nature of evidence, in particular with regard to a "facts vs. values" dichotomy; (ii) the attributes that make evidence useful for policy; and (iii) what evidence is used for. These categories (as well as subcategories for salience, legitimacy, and credibility) were the basis for a

coding scheme used to analyze the interview data. Additional codes exploring unanticipated dimensions related to the culture of evidence were also developed inductively, in particular relating to the historical antecedents of the evidence cultures explored. Secondary sources were not subject to coding, but were read to triangulate interview-based findings.

Overview of energy modeling and policy advisory systems in the UK, Netherlands, and Germany

This section provides a sketch of the structure of the energy policy advisory systems (particularly related to energy modeling) in each case study country. Classic descriptions of policy advisory systems use two simple dimensions to describe the universe of actors and institutions: the degree of government control and the location (close to ministers at one extreme and external to government at the other; Halligan, 1995).

The focus in this paper is on the system of actors that are—to a greater or lesser degree—under the control of key decision-makers (i.e., ministers), such as internal government analysts, formal advisory bodies, and actors directly commissioned to produce evidence for government. The following sketches of each country's advisory system are structured along Halligan's "location" axis: I first describe analysis and evidence within the energy ministry (i.e., closest to ministers), followed by a description of arms' length bodies and external evidence providers.

United Kingdom
Internal actors: analysis inside the department for energy security and net zero
The ministry responsible for energy policy in the UK (the Department for Energy Security and Net Zero, DESNZ) is seen as having strong analytic capacity (UK2, UK5). The UK civil service makes a formal distinction between "policy professionals" and "analysts." Following recent changes in the structure of UK government departments it is difficult to identify precise numbers, but in 2020 around 200 people with energy-specific roles were employed as analysts. There are also senior figures with responsibility for evidence: a Head of Analysis and a departmental Chief Scientific Advisor.

DESNZ has strong in-house energy modeling skills, with the capacity to run key models such as UK TIMES (used to explore the whole energy system). Larger modeling projects are contracted out, often to universities or consultancies, but such projects are closely monitored by DESNZ modelers to ensure that they conform to DESNZ quality assurance processes (UK10).

Within DESNZ, and the UK civil service more generally, there is a set of formal processes to assess the evidence that underpins policy proposals. For example, a senior civil servant must "sign off" the quality of evidence underpinning policy submissions that go to the minister (UK10). In addition to the approval processes, there are standardized procedures that aim to ensure that all policies are tested against evidence, such as impact assessments. Some previous research has suggested that such processes play little role in shaping policy (Nilsson et al., 2008), and at least one of the analysts interviewed agreed ("bluntly, impact assessments are a fig leaf … [for] decisions that have already been made"; UK13). However, several officials disagreed—one of whom cited an example in which the impact assessment process had resulted in policy changes (UK6). Such processes were described as shaping the development and use of evidence in policy teams long before the impact assessment document itself is drafted (UK10). The expectation of having to justify a policy through the impact assessment disciplines the policy development process (UK7, UK10). Associated with this set of formal evidence processes is a suite of formal guidance documents, covering issues such as *ex ante* policy impact assessments (HM Treasury, 2022), *ex post* policy evaluation, and the use of models (HM Treasury, 2015).

Beyond the ministry: analysis in independent agencies and external organizations
DESNZ is supported by arm's length bodies that provide evidence relevant to policymaking. Two play a particularly big role. First, the Climate Change Committee (CCC) provides advice on long-term strategic issues. It is widely respected for its analysis, including modeling, though it is rather small, with only around 30 permanent staff. The CCC plays an important role in shaping and scrutinizing energy policy—in particular through recommending "carbon budgets" in line with the requirements of the UK's Climate Change Act, and in annual reviews of the performance against carbon budgets. It does not play a direct role in the analysis supporting the detailed design and *ex ante* appraisal of specific policy instruments—for example, it does not carry out impact assessments of specific policy options. Second, the energy

regulator Ofgem plays a role in delivering a range of government programmes, and it has deep knowledge of the energy sector, as well as an internal analysis capacity of around 70 people. Ofgem senior analysts meet regularly with DESNZ counterparts (UK6).

Netherlands
Internal actors: analysis inside the ministry for economic affairs and climate
Energy is the responsibility of the Ministry for Economic Affairs and Climate (EZK). The department has relatively few people in analyst roles, and the distinction between policy officials and analysts is less clearly structured than in the UK (NL5). Interviewees described the role of civil servants within the ministry as policy specialists and "process managers" rather than analysts (NL5), echoing a more general long-term trend in the Dutch civil service away from specialist experts toward generalists (van Thiel, 2013; Veselý, 2017). While there is a strategy team within EZK that has some analytic capacity, detailed quantitative analysis and modeling does not take place within the department (NL6). Instead, Dutch policymakers rely on semi-independent government bodies—the planning bureaus, described further below.

As in the UK, there are formal processes that require the use of evidence—notably impact assessments. However, there are fewer formal processes for evidence sign-off, and there are no standardized procedures for quality assurance of modeling within EZK (NL5, NL6). Instead, the ministry relies on the competence of the planning bureaus.

Beyond the ministry: analysis in independent agencies and external organizations
The Netherlands has a long history of using formal advisory bodies and science councils to inform policy development (Den Hoed & Keizer, 2009; van den Berg, 2017). The two most important bodies for producing technical analysis are the planning bureaus, specifically the Central Planning Bureau (CPB) and Environmental Assessment Agency (PBL). These bodies are government agencies, but they operate with a high degree of operational independence (NL1, NL2). Both planning bureaus are often asked to conduct analysis and modeling underpinning impact assessments for specific energy policies.

The bureaus fiercely protect their operational independence, periodically exercising their right to decline analytic requests from government, for example (NL1). However, they also work closely with government departments (NL1, NL2; Halffman, 2009), conducting analysis in support of impact assessments, evaluations, and strategic long-term analytic work. CPB plays a central role in the Dutch policy advisory system, and their analytic authority is "unrivalled" in Dutch politics (Halffman, 2009).

EZK also contracts private sector consultancies and other organizations for such analytic work, but even then CPB and PBL often review and "double-check" such externally sourced work to ensure that it meets quality standards (NL2). Similarly, while sometimes internal analysis is carried out by central government departments (e.g., budget effects of policies being estimated by analysts within the Ministry of Finance) these are often then double-checked by CPB.

Germany
Internal actors: analysis inside the federal government
Energy policy in Germany's federal government is largely the responsibility of the Federal Ministry for Economic Affairs and Climate Action (BMWK), though historically the Federal Ministry of Environment (BMU) has also played an important role in energy and climate policies, particularly in relation to renewable energy.

The German civil service has traditionally been dominated by legal expertise (DE4; Schmid & Buhr, 2013; Veit et al., 2017). While German ministries include people with strong policy expertise in their fields, neither BMWK nor BMU tend to employ civil servants with the technical and engineering knowledge that underpins energy models. BMWK and BMU were widely perceived by participants to have high levels of policy expertise and analytic capacity (DE2; DE3). However, economic and energy modeling—"number crunching"—is not done by analytic teams within the central ministries (DE5). Instead, it is outsourced to a range of independent research institutes, thinktanks, and consultants.

In this regard, the German system is somewhat similar to that of the Netherlands, with modeling work outsourced to agencies outside the responsible ministry. Energy modeling is not seen as something that government would ever do internally (DE5). But while the Dutch rely largely on CPB and PBL, in Germany modeling and quantitative work is outsourced to a wide constellation of analytic institutions.

A key difference in Germany is that civil servants tend to stay in the same policy area, and the same department, for much longer than is the case in the Netherlands. The result is that people develop subject-specific expertise as their careers progress (DE2; DE1). However, there has also been a process of externalization, with government increasing relying on external consultants, particularly for modeling work. Interviewees attributed this in part to the growing intensity of policy work focused on the energy transition: the need for detailed modeling analysis and other analytic work has grown much faster than civil service capacity (DE4).

The German system involves fewer formal evidence procedures than the UK—the use of standardized rulebooks for evidence use is reported to be less systematic than in the UK (DE6; DE2). There are not the same processes of formal responsibility for evidence "sign off," for example. However, draft policies are circulated for comment and approval within the bureaucracy, including other government departments (DE6). This enables the addition of evidence and consideration of different perspectives—what Veselý (2017) described as "advice by dialogue." While this is not generally seen as part of the "evidence" process, it clearly has significant implications for how evidence is used to inform decisions.

An important difference between the German system and those of the UK and the Netherlands is that in Germany, there is a higher degree of politicization of public servants, with a relatively high tolerance for appointments to senior roles being made on the basis of political affiliation (despite an explicit ban on this in the constitution; Battis, 2013). Around 5%–10% of senior civil servants in Germany have previously worked for a political party (Veit et al., 2017), far greater than the corresponding number in the UK, and the party affiliations of senior civil servants are often widely known (Jann & Veit, 2015).

Beyond the ministry: analysis in independent agencies and external organizations

German governments (both federal and Länder) rely on an ecosystem of independent institutions, many of which receive some core funding from federal or Länder governments, to provide energy modeling. Prominent examples include PIK, Wuppertal, and Öko-institut. Despite the government funding, such institutes were described as operating with a high degree of independence from government (DE4; DE5), something seen as important for ensuring the quality of their analysis (Veit et al., 2017). As in the UK, the network regulator (BundesNetzAgentur) also plays an important role in the advisory system (DE5; DE4), focused on power systems modeling and analysis.

Differences in cultures of evidence

Having explored the different structures and formal processes in each country, this section now discusses apparent differences in the cultures of evidence, drawing on the framework set out in the "Cultures of evidence: theory and conceptual framework" section.

How evidence is understood

I observed clear differences in how actors within each advisory system framed evidence. In the UK, interviews described a dominant culture that treated evidence as a value-free input into decision-making. "Government uses evidence instrumentally, so policymakers can take a scientist view of the world – that science produces facts, [and] that facts tend to look like numbers, models" (UK1). They also described evidence processes as acting as a constraint on political choices, or a "filter" through which policy ideas must pass (UK10; UK15).

Interviewees in the Netherlands similarly described a system that treats evidence as a neutral input into political decisions. This is most clearly expressed in the institutional structures of the Dutch energy policy advisory system, which has been established around the idea that evidence and science can be divorced from the political bargaining and negotiation that characterizes much of Dutch policymaking. Analytic bodies (the planning bureaus) that are largely described as "neutral" provide evidence, while political decisions are then taken through the cabinet, often with the input of consensus-building stakeholder forums such as the Economic and Social Council. In caricature, the Dutch system institutionalizes the distinction between facts and values.

Actors within the Dutch system do recognize that evidence does not always conform to a value-free ideal. One expressed discomfort with an example of a policy process in which a PBL representative had been the sole "voice of science," asked to arbitrate "truth" based on modeling results while stakeholders debated priorities and values (NL1). The planning bureaus themselves—particularly PBL under the

directorship of political scientist Maarten Hajer—have also explored more reflexive practices, drawing on participatory processes and extended peer review for example (NL1; Kunseler, 2016).

Despite this awareness of the limits of a value-free view of evidence, there is an acceptance that organizing the system in this way "works": "Policymaking in the Netherlands is always about finding compromise between competing sides, so it is always valuable to have an apparently independent body of experts to call upon to analyse options" (NL2). A similar tension was observed by Kunseler, in her study of PBL (Kunseler, 2016). She observed that the modernist (i.e., value-free) and reflexive logics coexist within PBL. While actors within the system understand that treating evidence as neutral and value-free can artificially narrow the range of perspectives, they accept it as the institutional background necessary to facilitate a stable context for decision-making. Rather than adhering to the value-free ideal solely on the basis of its epistemic virtues, several Dutch interviewees described the framing of evidence as value-free in terms of a more procedural virtue, in which actors choose to agree a common knowledge foundation in order to facilitate consensus. In other words, it appears that the value-free ideal is implicitly understood to be a "useful myth" (Boswell, 2018).

The widespread acceptance that it is useful to see evidence as value-neutral is actively maintained by the planning bureaus. Halffman (2009) argues that the longevity and influence of the planning bureaus rests in part on their continued efforts to present themselves as providing neutral and expert insight into the consequences of policy choices, without any interest in policy goals or social choices.

In contrast to both the UK and the Netherlands, actors within the German system tended to describe evidence as politically framed and inseparable from political perspectives. Interviewees (DE1; DE2) invoked the concept of advocacy coalitions (Sabatier, 1998), highlighting that different research institutes and individual civil servants were enrolled in advocacy coalitions with different core beliefs. Interviewees explained that many of the research institutes that German federal and Länder governments use for energy analysis and modeling are widely seen as having clear political agendas: "Some [of these institutes] are known to be more conservative and some are known to be more environmentally friendly … They all have a reputation to some degree for being on one side or the other" (DE3). Similarly, individual senior civil servants—particularly those with long careers focused on energy and/or environment issues—were described as often having well-known political leanings or policy preferences (for example with respect to nuclear power or renewables; DE6; DE5). According to interviews, there are "people in the environmental ministry who have been in place for decades, and they become part of … advocacy coalitions" (DE1). The same is true for advisory councils, such as the SRU (environment council), which is widely seen as belonging to a pro-environment advocacy coalition (DE2; Leipprand et al., 2017).

Evidence was described by German participants as part of the political debate, with different actors and organizations producing evidence that aligns with their core beliefs and their political perspectives. In this view, evidence is a resource to be mobilized as part of political struggles.

What makes evidence useful: credibility, salience, and legitimacy
Credibility

In all three cases, the credibility of energy modeling is underpinned by links to academia. In the Netherlands and Germany, key modeling institutions like PBL and PIK operate at the cutting edge of academic debates in energy modeling, which lends them strong scientific credibility. While DESNZ operates models internally, its key model (UK TIMES) is shared with an academic team at UCL.

However, beyond this reliance on links to academic research, there are striking differences in how credibility is constructed in the three cases. In the Netherlands the *independence* of advisory agencies—in both operational and political terms—was described as centrally important to credibility. Dutch interviewees emphasized that the planning bureaus are typically seen as outside the political fray, a point also noted by others (Halffman & Hoppe, 2005; Lenihan, 2015; van Nispen & Scholten, 2014).

Moreover, Dutch civil servants suggested that one reason for relatively weak analytic capacity inside the energy ministry was that internal analysis would not have sufficient credibility—precisely because it would not be seen as sufficiently independent of political considerations ("The question is whether its desirable to do [quantitative analysis] within the ministry. You have to be independent"; NL3). One interviewee reported a case in which a central government department (not in the context of energy) had been criticized because it had relied on internal analysis, which in this view was not sufficiently independent and thus not credible (NL4).

German interviewees also highlighted operational independence as an important criterion for credibility (DE3), though this point was made less frequently and emphatically than by Dutch interviewees. Moreover, while operational independence was seen as important, this was not associated with political neutrality. This is in contrast with the Netherlands, where credibility rests on both operational independence and political neutrality (which are linked in the Dutch framing of independence).

In contrast, evidence and modeling in the UK system does not need to be independent in order to have credibility. The credibility of evidence is instead constructed through adherence to a set of formal procedures, and through the credentials and status of an internal cadre of analysts who are organized into formal analysis "professions" within government. Credibility in the UK system relies on clearly established "best-practices" and a set of organizational procedures and routines (HM Treasury, 2015, 2022) designed to ensure that evidence is of high quality, and that evidence is actually used to inform decisions. While independence is not seen as necessary for credibility, analysts do sometimes seek external validation and peer review—particularly for important analytic tools like models (UK10).

Salience

I observed no obvious differences across how salience is understood. The UK system arguably prioritizes salience in the sense that analysts are embedded alongside policy teams, and energy modeling capacity is held in-house—allowing constant iteration and intimate working relationships between policy development and analysis. The reliance of the German and Dutch systems on external organizations for energy analysis comes with a potential cost to salience. Policy teams do not have an analyst in their midst to facilitate challenging ideas with evidence, and supporting policy teams to identify good evidence.

Legitimacy

Two dimensions of legitimacy were particularly prominent in interviews. First, in all countries, interviewees expressed anxieties about the transparency of models ("it's a big issue. Policymakers are nervous about the transparency of models"; NL2). At root, this anxiety relates to concerns about power and accountability—the fear that models may contain assumptions that cannot be challenged by anyone outside a small group of the most competent modelers. The lack of transparency in models is a consistent theme in the literature on the use of energy models in policy (Süsser et al., 2024).

Second, in the UK there is also some anxiety about the representativeness of evidence. The strong internal orientation of the policy advisory system (e.g., with an in-house modeling team) means that a narrower range of views are expressed, because there are fewer opportunities for peer judgment of analysis, or different perspectives. The internal processes are geared toward producing a small range of options, with clearly identified implications. As one former ministerial adviser put it: "The problem with everything working towards one version of the truth, is that you don't always end up with a summary of the competing arguments" (UK11). Part of the concern relates to the narrowness of the procedures used: "Impact assessments are very economic in focus, numbers-focused, with false precision" (UK11).

This concern about representativeness of evidence was less prominent in Germany and the Netherlands, but it was not clear whether this was because of differences in the process of generating evidence, or instead related to the wider policy process in which evidence is used. In the Dutch case, PBL has a history of participatory engagement in policy analysis (Kunseler, 2016). Both countries typically have coalition governments requiring greater negotiation among different perspectives, and make greater use of corporatist stakeholder engagement models than the UK. Such processes enable the incorporation of a wider range of views in decision-making, beyond the production of evidence itself.

Dominant rationales for evidence use

In her study of immigration policy in the UK and Germany, Boswell (2015) suggests a difference between the German and UK cultures of evidence use. She found that the UK system was much more prone to use evidence instrumentally to inform policy decisions, while the German system did not make direct use of evidence in decision-making, but had a higher valuation of evidence in the abstract—resulting in a need to be seen to use evidence. In the German case, she found that evidence was therefore used to legitimate institutions, rather than inform decisions.

The case studies in energy offer an interesting contrast with Boswell's conclusions. The cases do not provide clear support for the idea that evidence in Germany is used to legitimate institutions more than

is the case in the UK. This perhaps suggests that the "culture of evidence" can vary significant between policy areas within the same country (consistent with Lorenc et al., 2014).

In most respects, the use of evidence in the three cases appears similar. In all countries, interviewees described two of the classic roles of evidence in policy: first, evidence is used to inform policy decisions (a substantive role), and second, evidence is used politically to legitimate choices ("the model … [is] just grabbed and used as a political tool"; UK11).

However, the UK and Dutch cases also revealed an approach to evidence use that was not observed in Germany. In the UK people spoke of the role of evidence—particularly from economic or energy models—in cutting through uncertainty and enabling decisions to be made. For example: "given that uncertainty is high and the potential is significant for getting things wrong, people breathe a sigh of relief when a scientist or modeller says, 'here's a future fact'" (UK1).

Something similar was observed in the Dutch context. As noted previously, evidence from the planning bureaus was framed as impartial, helping to create a shared reality to serve as the basis for political consensus, particularly in the context of coalition governments and negotiations between social groups. After the messy business of agreeing coalition priorities, interviewees argued that it can be politically expedient for all involved in government to avoid opening up new spaces for disagreement in how they understand the potential impacts of pursuing those priorities ("the Dutch love de-politicisation"; NL1). Hoppe also identified this framing as a prominent discourse in Dutch policy advisory systems, which he described as "rational facilitation of political accommodation" (Hoppe, 2014, p. 53). This use of evidence, and the willingness of actors within the system to defend a distinction between facts and values, appears to be two sides of the same coin.

Actors in both the UK and the Netherlands thus report a tendency to use evidence (particularly from models) to narrow the decision space and take some options off the table—thus facilitating the process of closure around specific options. Modeling is used here to facilitate "closing down" around specific options, rather than "opening up" decision contexts to alternative possibilities (using the language of Stirling, 2008). This creates a risk for democratic accountability: after all, models are by definition simplifications of reality that necessarily exclude some perspectives (Süsser et al., 2024). It is not clear how widespread this tendency is to use models to exclude certain perspectives and thus simplify decision-contexts.

The historical roots of different evidence cultures

These observations raise questions about how such differences in cultures of evidence come about, and what factors shape them. While the main focus of this paper treats the culture of evidence as an independent variable providing explanations for how evidence is produced and used, the cases also suggest some of the historical particularities that have shaped the development of those cultures. Several interviewees offered historical rationales for features of their evidence cultures and these are reported here.

The interviewees—and wider literature—on the German case point to a specific history that has shaped the view that evidence reaches the policy sphere through the activities of actors that are enrolled in one or another advocacy coalition. Several of the major modeling institutions in the German energy policy landscape were originally founded by scientists concerned about nuclear radiation in the wake of the Chernobyl disaster (DE1; DE3). These institutes were based on analysis and evidence, but also had an unambiguously political goal—the phase out of nuclear power. The historically political agenda of these institutes has shaped the way that they are seen, and this seems likely to have contributed to a policy environment in which expert analysis and evidence is inevitably colored by political values. This echoes Strünck (2013), who argued that the environmental movement was seen as having "captured" some state agencies. In short, while this paper depicts Germany as having a specific culture of evidence, it seems plausible that this culture is specific to the field of energy policy, born out of Germany's contested history with nuclear power.

Similarly, the Dutch culture of evidence has deep roots, with the prominence of the independent, neutral planning bureaus being a long-established and studied feature of policymaking. The Dutch tendency to protect such institutions—thus upholding the "rational facilitation of political accommodation"—was argued by participants to be a legacy of the traditionally consensus-based approach to policymaking. This tradition relied on the need to create consensus across social groups, and thus benefited from the presence of an impartial arbiter of economic analysis in the CPB (and later the other

Table 2. Main observed differences in the cultures of evidence.

	UK	Netherlands	Germany
Position of energy modeling within the policy advisory System	Largely internal, some role for arms'-length bodies	Arms'-length government bodies	Largely external, some in state regulator
Shared views on evidence	Leans toward "value-free" ideal	Leans toward "value-free" ideal	Evidence is shaped by core beliefs
Basis for judging credibility of evidence	Constructed through adherence to formal procedures	Rooted in independence and status of planning bureaus	Rooted in credentials of independent think tanks/institutes
Uses of evidence	Instrumental; political; supporting consensus	Instrumental; political; supporting consensus	Instrumental; political

planning bureaus). "The way that the Dutch want to reach consensus in their politics is via technocracy – it's the legacy of Protestant-Catholic-Socialist-Liberal divides" (NL1).

Unlike in the Dutch or German cases, UK interviewees did not offer direct historical explanations for the key elements of the UK system. (I note my positionality here as a British researcher—interviewees are perhaps more likely to report on the historical roots of an institutional setup to an outsider than they are to a compatriot). However, one person did make oblique reference to the origins of the UK's formal guidance document on the use of modeling in policy (HM Treasury, 2015). This guidance was initiated following an embarrassing policy failure, known as the west coast mainline rail fiasco, which involved a flawed policy decision based on faulty modeling. The resulting review led to a suite of guidelines and procedures for modeling, which since then appear to have become embedded in the evidence culture of DESNZ. A further potential explanation for the UK's culture of evidence rests in the UK's strongly centralized government (Ward et al., 2024), which results in a civil service tradition that is less dependent on compromise and negotiation than is the case in the Netherlands or Germany. This has perhaps led to a focus on internal sources of evidence, which require internal quality assurance (rather than external reputation or independence) as a source of credibility.

Discussion and conclusions

The three cases suggest that in each country, energy policy is influenced by a different culture of evidence. Differences were observed across different dimensions of evidence culture, as summarized in Table 2.

Implications of different evidence cultures

The three systems have different strengths. The UK system prioritizes salience, with policy teams supported by analysts that work alongside them, and with an in-house modeling team to support the effective use of modeling to support policy development. The Dutch system actively maintains independent expertise that strives for political impartiality, and in this sense prioritizes the credibility of evidence.

The German system provides for high-quality evidence while accepting that evidence is frequently contested and inseparable from fundamentally political choices. This perspective is well suited to the context of energy modeling, in which "facts are uncertain and values are in dispute," requiring what Funtowicz and Ravetz (1990) describe as "post normal science." The contestation of evidence underpinned by different core beliefs within the German system (or "advice by dialogue"; Veselý, 2017) has the potential to enable the kind of "extended peer review" advocated by post normal science (Funtowicz & Ravetz, 2018). Interviewees noted (DE3; DE4) that the system does not always succeed in this regard: The process of contestation and debate can often be untransparent to the wider public, limiting the extent to which it genuinely enables opening up to more diverse perspectives.

Efforts in all three countries to promote the use of evidence need to be sensitive to the existing culture of evidence, since this culture shapes how actors judge and use evidence. For example, efforts to achieve greater extended peer review within the Dutch context would need to navigate the entrenched position

of the planning bureaus as gatekeepers of credibility and builders of consensus. In the UK, the reliance on internal expertise and procedures presents a potential barrier to new approaches and models that are less well understood by those in DESNZ.

National vs. domain-specific cultures of evidence

In the Netherlands, my observations are consistent with existing characterizations of Dutch evidence-policy arrangements and culture in other policy domains (Hoppe, 2014; van Nispen & Scholten, 2014). However, in the case of the UK and Germany I observe features that differ from those observed in the same countries by others in different policy fields. In the UK, both Halffman (2005) and Jasanoff (2005) stress the UK's reliance on informal and tacit ways of constructing credibility, through the status of individual experts. In contrast, I find that in the case of energy modeling there is strong reliance on a set of formal internal procedures. In Germany, my observations also differ from those of Boswell, who described a "reverence" for research in the German policy advisory system for immigration. In energy policy, I observed instead a widespread perception that evidence is simply another element of the political debate.

A key area for future research is thus the extent to which—and why—"cultures of evidence" differ across policy domains within countries. In his work on the science–policy boundary in different regulatory styles, Halffman (2005) suggests two complementary mechanisms that might explain both the durability of recognizable national evidence cultures that span many policy areas, alongside variation in evidence cultures across policy fields within a country. He highlights the potential for mimicry-based institutional isomorphism (drawing on DiMaggio & Powell, 1983) to foster a shared national style of science–policy arrangements, akin to what I describe as a culture of evidence. He also notes the potential for divergence in specific policy fields, following the opening of "policy windows" (drawing on Kingdon, 1984).

My observations provide tentative support for Halffman's view. The UK's west coast rail fiasco arguably opened up a window of opportunity for a shift in the culture of evidence related to modeling, while the aftermath of Chernobyl facilitated the emergence of advocacy groups with differing and deeply held core beliefs relevant to energy that continue to shape perceptions of evidence in German energy policy debates. In both cases, there is the possibility that specific windows of opportunity led to change in the energy policy advisory system that resulted in deviations from a national culture of evidence.

Conclusions and avenues for future research

This paper has identified clear differences in the culture of evidence in British, Dutch, and German energy policymaking, in terms of how evidence is understood, judged, and used. The findings suggest that those seeking to improve the way that evidence is used in policymaking need to understand the culture of the policy advisory system, since this will shape the effectiveness and ease of reforms.

The framework presented in this paper has proven to be useful, and further research could extend it to encompass two further dimensions. First, whether cultures of evidence vary in how they value specific forms of evidence (such as the relative importance placed on randomized controlled trials; Cooper, 2018) or disciplinary framings (Kattirtzi, 2016). Second, whether cultures of evidence differ in the roles played by different external evidence provider groups (universities, thinktanks, etc.).

Finally, the paper shows that cultures of evidence differ across policy advisory systems within a country, and highlights the value of future research to explore how and why particular policy domains diverge from recognizable "national" cultures of evidence.

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Conflict of interest

None declared.

Appendix Summary of interviewees

Key	Description
DE1	Analyst in policy thinktank
DE2	Leadership role in science advisory body; formerly official in BMU
DE3	Academic energy modeler
DE4	Analyst in policy thinktank
DE5	Analyst in policy thinktank
DE6	Policy official in BMWK
DE7	Analyst in science advisory body
NL1	Academic, formerly senior role at a planning bureau
NL2	Senior role in a planning bureau
NL3	Leadership role in science advisory body
NL4	Role in science advisory body, formerly EZK official
NL5	Senior policy official at EZK
NL6	Senior policy analyst at EZK
UK1	University academic, formerly in science advice role in government
UK2	University academic, formerly analyst role in government
UK3	Analyst in policy thinktank
UK4	Science advice role in DESNZ
UK5	Academic and policy thinktank
UK6	Analyst at Ofgem
UK7	Analyst in DESNZ
UK8	Analyst in DESNZ
UK9	Policy official in DESNZ
UK10	Senior analyst at DESNZ
UK11	Senior role in thinktank, formerly ministerial adviser
UK12	Senior analyst in CCC
UK13	Analyst in DESNZ
UK14	Analyst in DESNZ
UK15	Senior policy official in UK government, formerly at CCC

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