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Participation in Energy Transitions: A Comparison of Policy Styles

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ABSTRACT

Stakeholder and public participation in policymaking for energy transitions is one of the most promising approaches to fulfilling the promises of a democratic sustainability transition. Over the years, many studies have been published about concepts, methodologies, and empirical results of participatory approaches and implementations. In this paper, we focus on the compatibility of participatory processes with different policy styles of democratic governance. We conducted a systematic literature search comparing different concepts of democratic governance and applying them to public participation, in particular that associated with energy transitions. Our main objective in this paper is to link the requirements for a sustainable energy transition to governance processes and structures; we further aim to delineate suitable formats for stakeholder and public participation. Our analysis provides a basis for a wide-ranging and multi-perspective research agenda that promises to provide a deeper understanding and explanation of complex governance arrangements for energy transitions. The five democratic policy styles that we selected for this review are: autocratic, adversarial, collaborative, reflexive, and inclusive governance. We conclude that none are adequate on their own, and so we put forth a novel hybrid we call the "mediative approach." From this approach, we derive a new research framework for addressing the current challenges of democratic decision-making in energy transitions. Three pressing questions emerge, one relating to the interplay of top-down and bottom-up modes of governance; a second to the conditions for actor collaboration; and a third to the perception of democratic legitimacy by affected parties.

1. Introduction: Evaluating democratic governance in energy transitions

Energy transitions are essential for achieving climate neutrality, a topic of international discussions, notably in negotiations by the United Nations Climate Change Conferences on the longevity of fossil fuels in the global economy. Consensus is broad that reducing global warming requires a rapid reduction of greenhouse gas emissions, with one pathway being the transition to renewable energies [1].

Governments, supranational institutions and regional authorities are developing new, often experimental policies to govern renewable energy transitions. The most promising strategies involved collaborative, multi-actor arrangements across all governance levels, including representatives from the economy, politics, government, administrations, and civil society [2,3]. These arrangements and the creation of new energy services could lead to a new level and quality of public and stakeholder participation. This possibility prompts our research questions: *Which policy styles of democratic governance best facilitate the transition to sustainable energy transitions, and how can they be implemented in a pluralistic and often polarized society?*

To address these questions, we first explore democratic legitimacy, energy justice, and stakeholder and public participation. Policies that hope to be effective need to be regarded as legitimate, just, and genuinely participatory. These three conditions are frequently mentioned in the literature and reflect the findings of many empirical studies on how transformations towards sustainability can be achieved [2,4–8]. Whatever governance principles are followed, they need to achieve democratic legitimacy, promote inclusion, and deliver energy justice.

While this is true for nearly all public policies, the crucial challenge in the energy transition lies in solving the trilemma of balancing the negative impacts (rising costs, impairments, landscape change), building a robust new energy regime (security of supply, independence from fossil fuels, cyber security) and providing environmental sustainability. Achieving this requires nothing less than a consensus based on community, stakeholder, and institutional acceptance. This demands an energy governance architecture that (1) balances top-down and bottom-up policymaking; (2) incorporates the best innovations in energy systems; and (3) addresses citizen concerns and needs.

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For decisions about the energy transition to be seen as democratically legitimate, they must be made in a manner inclusive, participatory, collaborative, reflective and deliberative. Exactly these qualities are needed if the green deal is not to be undermined by populist movements, public skepticism, and autocratic politics. Achieving these qualities calls for developing a new framework for energy transition governance, inspired by a multi-dimensional, inclusive, and reflective understanding of collective action in a complex world [9].

Pursuing this end means looking more closely at stakeholder and public participation in the governance of socio-technological transitions. While many transition studies emphasize bottom-up approaches, known as invented participation, the more traditional public policy studies focus on invited participation, where actors are invited to participate in governance arrangements following a top-down approach [10,11]. Both perspectives are important for considering energy policy effectiveness [12–14].

When looking at policy styles in sustainability and energy transition politics, we consider five different prototypes of governance, strongly influenced by the political conditions in different nations [15–17]. Of course, energy transitions are also shaped by supra-national constellations, and not only by specific economic, technological, and regional conditions. However, typologizing governance styles reflects the structures of energy transitions analyzed on the national and international level [18]. These prototypes are reflected both in national frameworks and in cross-border energy systems arrangements, such as legal frameworks or technological networks such as those in Europe (see in particular [19]). We then critically analyze each governance prototype for its likely impacts on an energy transition.

We identify a research gap exists in synthesizing and integrating theoretical foundations of participation in energy transitions, different governance styles in real-world politics, and the perspectives of the old and new schools of policy and transition studies. We seek to close this gap by linking these elements into a new framework that offers a comprehensive, multi-perspective and inclusive model of participation in governing energy transitions.

In the next chapter, we review our methodology, and in Chapter 3, we lay down the theoretical foundations on which we discuss policy prototypes in Chapter 4. In Chapter 5, we discuss our critical analysis, followed by future prospects for governance in Chapter 6, and a concluding call for governance innovation in Chapter 7.

2. Methodology: A literature review

The objective of this study is to introduce a novel perspective on inclusive governance in energy transitions by developing a new typology of policy styles with respect to facilitating or impeding participatory energy transitions. This was achieved through a combination of our research experiences and a comprehensive literature review on policy styles, participation in energy transitions, and inclusive governance strategies. We conducted a systematic literature review following established protocols to ensure methodological rigor and comprehensive coverage [20,21].

We conducted an extensive search of databases, including Web of Science, ScienceDirect, Google Scholar, ResearchGate, and various library catalogues. Relevant keywords were used to capture the full range of literature, including terms such as “energy governance,” “policy styles,” “regulatory regimes,” “energy democracy,” “energy justice,” “participation,” “autocratic,” “adversarial,” “collaborative,” “reflective,” and “inclusive governance.” Keywords were refined through preliminary searches and analysis of review papers and meta-analytic studies [22]. For the systematic internet search, we used Boolean operators (AND, OR, NOT) to enhance comprehensiveness and search precision [23]. The search process was iterative, involving multiple rounds of searching and refinement to include emerging literature and capture recent developments [24].

To ensure the quality and relevance of the literature included in our study, we established specific inclusion and exclusion criteria. These are listed in Table 1.

We included peer-reviewed journal articles, books, and policy reports published in English from 2000 to 2024 that addressed governance styles in energy transitions and participatory governance. We excluded non-peer-reviewed sources, grey literature, articles not focused on governance or participation in energy contexts, and studies outside the specified timeframe. The methodological quality of the studies was assessed using the Critical Appraisal Skills Program (CASP) criteria, focusing on research design, data analysis, and validity of findings [25]. This evaluation included clarity of research questions, methodological rigor, and relevance to our research objectives [26].

Data extraction followed a structured framework, enabling systematic coding and categorization of key themes, governance typologies, and participatory practices. MaxQDA software was used for qualitative data analysis, facilitating a semantically meaningful categorization of the literature landscape. The data extraction process involved extracting data on governance modes, stakeholder engagement, decision-making processes, and outcomes of participatory practices, as well as applying thematic coding to identify patterns and relationships within the data [27].

Findings were synthesized using an integrative approach, linking theoretical perspectives and empirical evidence to provide a nuanced understanding of governance dynamics in energy transitions [28]. This synthesis included analyzing governance modes in energy policies, differentiating between top-down and bottom-up approaches, and examining empirical studies on democratic practices, procedures, strategies, and instruments in energy transitions. We focused particularly on the challenges, limitations, and long-term impacts of participation within the analyzed arrangements.

Based on the literature review, we developed a conceptual framework to classify governance models in energy transitions. This framework reflects and integrates various theoretical constructs that we were able to identify in the literature. In particular we investigated studies on key dimensions of governance, including decision-making processes, stakeholder engagement mechanisms, citizen participation, and democratic legitimacy. In the end, we chose a distinction that differentiated between five prototypical policy styles: autocratic, adversarial, collaborative, reflexive, and inclusive governance styles. This typology of policy styles was constructed using a deductive approach and validated through feedback from experts in energy governance, participatory democracy, and sustainable development.

Despite the comprehensive approach, our study has several limitations. The focus on peer-reviewed literature may result in publication bias, excluding relevant insights from grey literature or unpublished studies [29]. The evolving nature of the field may mean some relevant studies were not included, and although systematic methods were employed, the interpretation of findings is inherently subjective and influenced by researchers' perspectives [30].

In conclusion, our methodology integrates a comprehensive literature review, stakeholder engagement, and empirical analyses to develop a sophisticated typology of governance models in energy transitions. This study contributes to the advancement of energy governance scholarship and offers practical implications for policymakers and practitioners.

3. Theoretical foundations: Multilevel governance, democratic legitimacy, and participation

Developing and exploring participation concepts has a long tradition in the social sciences, particularly in relation to planning, implementation, and strategies for technology assessment [31,32]. Common forms of participation have emerged, especially within the context of energy transition policies [33]. They may occur at micro, *meso*, and macro levels of society and can influence different governance levels from the local to the supra-national level [34]. What distinguishes these types of

Table 1
Source selection criteria.

1. Inclusion Criteria:
- Peer-reviewed journal articles, books, and policy reports published in English.
- Studies explicitly addressing governance styles (or regimes or regulatory frameworks) in energy transitions and participatory governance/practice/concepts.
- Publications from 2000 to 2024, ensuring the inclusion of contemporary insights and findings.
2. Exclusion Criteria:
- Non-peer-reviewed sources such as opinion pieces and editorials.
- Grey literature.
- Articles not focused on governance or participation in energy contexts.
- Studies outside the specified timeframe.

participation in the energy transition?

First, they are related to multiple governance levels and require coordinated actions on each level ([35], case studies in [36]). These actions need to be synchronized and coordinated with each other. This requires formats and structures that link different policy and governance levels [19,37,38].

Second, energy transitions are closely linked to political legitimacy. They rely on actions and policies that impose costs and hardships on people in the short term to gain major benefits in the long term. Such deferred gratification requirements need particular justification to be widely accepted [39–42].

Third, transition policies can have major effects on how benefits and burdens are distributed, potentially leading to inequitable outcomes and breaches of environmental justice [43–45]. Environmental justice has three dimensions: (1) an equal or unequal distribution of goods and resources, income and expenditures; (2) equal access to information, transparency, individual rights, and influence on collective decision-making, and (3) equitable recognition of and respect for the claims, concerns, and identities of local communities and vulnerable groups [46,47]. These three dimensions materialize in different contexts (economic, sociopolitical, geographic, and technological) [48,49]. They also unfold in time and run through the familiar policy cycle stages of

Table 2
Four prototypes of participatory energy transitions covering all types of energy democracy and participation, concepts of stakeholder involvement and modes of participation and planning (adapted by [60–63]).

Prototypes of Participatory Energy Transitions	Types of Energy Democracy	Concepts of Stakeholder Involvement	Types of Participation	Policy Styles	Modes of Participation & Planning
Classical Type of Public and Stakeholder Participation in Institutionalized Settings	**Participatory Energy Democracy** (Individual) participation in political decision-making	**Functionalist & Neoliberal Concept of Involvement** To improve the quality of decision output. To represent all values and preferences in proportion to their share in the affected population	**Instrumental type** Find the most cost-effective way to make the risk acceptable or tolerable **Epistemic type** Use experts to find valid, reliable, and relevant knowledge about the risk	**Autocratic Governance** Limited participation **Adversarial Governance** Strong public participation	**Conventional mode of community planning** *Planning process*: Less emphasis on the specifics of local context, often driven by concerns for economic efficiency *Management strategy*: Top-down in management and implementation; hierarchical power structure *Location of knowledge and expertise*: Outsiders are experts, locals are beneficiaries *Outcome objectives*: Pre-determined, concrete
Discursive Type of Participation in Open Spaces	**Deliberative Energy Democracy** Focus on public debate to achieve more legitimate decision-making	**Postmodern Concept of Involvement** To demonstrate variability, plurality, and legitimacy of dissent	**Reflective type** Involve all affected stakeholders to collectively decide best way forward	**Reflective Governance** Strong public participation and deliberation	**Participatory mode of community planning** *Planning process*: Approach is multi-dimensional and context-specific, driven by local knowledge and concerns for economic equity *Management strategy*: Bottom-up, or synergy between top and bottom; collaborative; egalitarian power structure *Location of knowledge and expertise*: Locals are experts, outsiders are facilitators *Outcome objectives*: Evolving outcome objectives; process and outcome in constant dialogue
Direct Type of Participation in Decision-Making	**Direct Energy Democracy** Voting on options for energy policies by the public or citizen assemblies	**Anthropological Concept of Involvement** To engage in common sense as the ultimate arbiter in disputes (jury model)	**Participatory type** Include all actors so as to expose, accept, discuss, and resolve differences	**Inclusive Governance** Strong direct public participation	
Community Type of Material and Collaborative Participation in Energy Projects	**Associative Energy Democracy** Self-governance by voluntary and democratic associations **Material (Type 1) Energy Democracy** Equal access to material resources **Material (Type 2) Energy Democracy** The ways in which objects contribute to the enactment of public politics	**Emancipatory Concept of Involvement** To empower less privileged groups and individuals	**Participatory type** Include all actors so as to expose, accept, discuss, and resolve differences **Epistemic type** Use experts to find valid, reliable, and relevant knowledge about the risk	**Collaborative Governance** Strong stakeholder participation	

translation, application, manifestation, adjustment, and re-evaluation [50,51]. At its core, energy justice rests on two principles: (i) "Equal rights to reliable and affordable modern energy services" and (ii) shared "benefits and burdens of modern energy systems" [52].

Fourth, energy transitions demand specific processes and practices for including different stakeholders and the public. This is often referred to as energy democracy [53]. The call for energy democracy focuses on two key principles: (i) equal access to socially acceptable energy system services, and (ii) equal distribution of the benefits and risks related to transitional policies. The first principle includes the need for democratic management of a common pool of resources [54–56] to determine how access to these resources (such as clean air) is regulated and how fair solutions for use are implemented.

The second principle is linked to the question of who has the authority to promulgate collectively binding decisions. To achieve inclusive energy democracy, the conventional system of energy management must be replaced by a more democratic, egalitarian policy style, mainly through resistance, appropriation, or restructuring [57,58]. These transformative actions necessitate a radical reform of regulations, market mechanisms, and the organization of the private as well as public sector. The need for creating new institutions seems unavoidable given the persistence of the existing governing structures. Democratic reforms leading to energy transitions require an active redesign of policy regimes through both top-down initiatives by governments and bottom-up initiatives through civic engagement [59].

The four conceptual approaches to participatory energy transitions, governance levels, political legitimacy, and energy justice are summarized in Table 2, where we distinguish the different types of energy democracy, concepts of stakeholder involvement, and fundamental types of participation in decision-making. Additionally, we relate these styles to two essential modes of participation and planning and include the five different prototypes of energy policy on which we focus in the next chapter.

As explained later in Chapter 5, we categorize the concepts of participatory energy transitions into five policy styles, grouped into three distinct categories: autocratic and adversarial, collaborative, and reflective and inclusive.

The autocratic and adversarial type operates within institutionalized settings, characterized by a typical top-down approach (summarized as the classical type of public and stakeholder participation in institutionalized settings (prototype #1)). Decision-making is driven by economic efficiency and includes input from various perspectives but does not offer any opportunity for co-determination of policymaking. Autocratic governance features centralized control, whereas adversarial governance involves confrontational decision-making processes among key parties or stakeholders.

In contrast, the cooperative style of participation – including all participatory approaches to energy transitions based on the participatory mode of community planning – emphasizes input from all organized stakeholders in society and promotes negotiation and consultation processes for reaching consensus or at least overwhelming support. Inclusion is reserved for those who are recognized as worthy members of the "club" by the political elite.

This second model of participatory energy transitions covers three forms of governance. First, reflective governance, considered as an outflow of the discursive type of participation that occurs in open spaces (prototype #2), emphasizes deliberative energy democracy. It promotes public debate and legitimacy in decision-making, valuing local knowledge and equity. This approach features a discursive, bottom-up planning process with robust public participation. Second, inclusive governance is similarly characterized by direct energy democracy, where citizens vote on energy policies (summarized as the direct type of participation in decision-making (prototype #3)). This approach is focused on strong direct public participation through referenda and citizen assemblies, ensuring inclusive governance. Third and finally, collaborative governance is reflected within the community type of material and collaborative participation in (community) energy projects (prototype #4), based on an emancipatory style of involvement of citizens, stakeholders, and institutions and representing the ideas of associative and material energy democracy.

In conclusion, the four prototypes of participatory energy transitions illustrate various approaches to participatory governance in energy transitions, each highlighting different levels of stakeholder involvement and governance styles. The concepts will be further discussed in Chapter 5 but are set out here in Table 2 for clarity and comparison.

Implementing energy democracy requires a deep understanding of the scope and limitations of different concepts and formats of inclusive governance and participation. Renn and Schweizer [63,64] distinguish between functionalist, neoliberal, deliberative, anthropological, emancipatory, and postmodern concepts of participation. The concepts serve different objectives, follow different rationales and result in different models and instruments. The first three types (functionalist, neoliberal, deliberative) are to be understood as classical types of participation. They are manifested in concrete forms such as hearings, referenda, and citizen forums. The second three types (anthropological, emancipatory, postmodern) are less compatible with representative democratic structures; they include policy input by ordinary citizens via citizen juries, action group initiatives, and open forums. And while these new formats meet the need for innovative policymaking to promote the energy transition, they also represent radically democratic approaches to collective decision-making. Breaking the classical top-down mold of invited participation, these new formats are paving the way for bottom-up citizen-initiated action. They are part of a new social movement for dealing with energy planning and conflicts [11].

According to Renn and Schweizer [63,p.73], these concepts of participation provide different approaches to meet three major challenges of complexity: first epistemic complexity in terms of causal connections, feedback, and modifiers asking for joint fact-finding discourses among experts (epistemic discourse); secondly, complexity induced by deep uncertainty aiming at balanced and acceptable solutions for unavoidable trade-offs between conflicting values requiring intensive stakeholder negotiations (reflective discourse); and, thirdly, visionary complexity resolving multiple ambiguities directed towards a consensus on which alternative path for future developments society should pursue. This last type of complexity requires the input of all actors in society (participatory discourse).

The distinction between different discourse types advocated by Renn and Schweizer [63,64] is based on an Habermasian perspective [65–67] on "rational discourse" and pursues the concept of invited participation. It abstracts from the social movements that accompany the transition and acts as trigger for legal and institutional changes.

In addition to the classification by Renn and Schweizer, which focuses on participatory concepts and formats, more generic classifications of inclusive governance have been developed outside of energy transition and sustainability literature (see reviews in: [68–70, pp.28ff]). Two notable classification approaches should be mentioned.

The first approach differentiates between participatory, associative, deliberative, and material (in two variants) understandings of democracy [71–73]. *Participatory democracy* describes a policy regime focused on individual rights to co-determine policies. The most popular instrument of this variant is the inclusion of randomly selected citizens for giving recommendations and advice to governments or administrations. Within the concept of *associative democracy*, environmental NGOs, representatives of social movements such as Fridays for Future and local associations engage in (normally invited) discourses and initiate practical implementations of transitional policies. The concept of *deliberative democracy* builds on organized public discourses that take place in the context of citizens' meetings and dialogues [74–76]. The last form *material democracy* unfolds in two versions [62]. In version 1, municipal utilities, energy cooperatives, and other non-profit organizations offer local, low-cost electricity tariffs and financial participation in solar plants or wind farms. In version 2, individuals and communities are

given the opportunity to influence the design of spaces or energy infrastructures or to install wind or solar systems themselves.

The second notable classification approach distinguishes bottom-up, community-based decision-making from top-down regulation and hierarchical power structures in energy governance and planning procedures [61,77–79]. The conventional mode of energy project planning is driven by concerns for economic efficiency and places little emphasis on the specifics of the local context. It operates by a top-down management approach and within a hierarchical power structure, where external experts provide the knowledge and local actors are beneficiaries, with pre-determined, concrete outcome objectives.

In contrast, community-based forms follow different modes of participation and planning in energy transitions [61]. A participatory mode of community planning adopts a multi-dimensional and context-specific approach driven by local knowledge and concerns for economic equity. This mode emphasizes a bottom-up approach of community participation or synergy between top and bottom, with a collaborative and egalitarian power structure. Local actors are regarded as experts, while external actors serve as facilitators, with evolving outcome objectives and a constant dialogue between process and outcome.

If we change the perspective of the connection between these modes of participation and stakeholder involvement, we find an amalgamation of an instrumental and epistemic type of participation [60]. While the first aims to find the most cost-effective way to make the risk acceptable or tolerable, the second uses experts to find valid, reliable, and relevant knowledge about the risk. Both are typical characteristics of conventional forms of participation in energy transitions. The more open and bottom-up arrangements in energy participation are based on the reflective mode of participation (involving all affected stakeholders to collectively decide the best way forward) and, of course, the participatory prototype (including all actors to expose, accept, discuss, and resolve differences).

This compilation allows us to derive five key policy styles in energy transitions. While the autocratic governance type allows only limited opportunities for participation, the adversarial type promotes strong public participation, though in a top-down, controlled way. The collaborative governance mode also emphasizes strong participation, but primarily with a focus on stakeholder involvement. In a different way, forms of reflective governance prioritize deliberation within procedures of public participation, while inclusive governance fosters direct public participation via the modes of voting, referenda, citizen assemblies, and round tables.

Although the concepts in Table 2 come from different scientific traditions, they all describe approaches to transformations based on internal (discourse rules) or external (political culture) contexts. At the same time, they are insufficient to cover the existing manifestations of new democratic policymaking styles, nor are they differentiated enough to improve our understanding of energy transitions. Therefore, in the following chapter, we will suggest a new classification structure that promises to be more useful for describing and analyzing participation in the context of energy transitions.

4. Five prototypes of policy styles within democratic governance of energy transitions

4.1. Overview of policy styles

There is no agreement among scholars of political theory regarding what democratic governance means with respect to institutional structures, decision-making procedures, and the role of the political elite versus stakeholders and citizens ([80,81], specifically related to energy transitions: [82]). Traditional policy analysis focuses on two categories: the role of citizens and the structure of policymaking. The first category differentiates between direct and representative democracy, the second between republicanism and liberalism [83]. Direct democracy provides a constitutional framework for extensive voting power by citizens, emphasizing referenda and community self-government. Representative democracy follows the principle of delegation: citizens delegate the power and legitimacy of collective decision-making to representational bodies of governance (citizenship as civic knowledge). The two traditions differ the most in their approaches to legitimization in collectively binding decision-making. The representative tradition is based on indirect legitimation, where politicians are elected by citizens. Participation plays only a supplementary role in supporting (or reinforcing) democratic principles of governance [84]. The direct democracy tradition elicits citizen preferences on substantive issues and re-empowers citizens to shape policies and political programs by direct voting [85]. In this understanding, participation is envisaged through instruments for the co-production of collectively binding decisions [86].

Republicanism is focused on collective decision-making for the common good and envisions extensive citizen participation for legitimizing collectively binding rules and policies, while liberalism seeks to protect citizens from an encroaching state, focusing on individual rights and emphasizing social liberties.

In addition to the classic division into direct/indirect and republican/liberalism, many scholars have advocated a distinction between: (i) elitist government of the people where the emphasis is on effective and efficient governance; (ii) participatory government of and by the people where the emphasis is on citizen participation and co-determination; and (iii) social government of, by, and for the people where the emphasis is on social justice and empowerment of citizens [72,87].

In reality, however, these types are not found in a pure form; today's democracies are hybrids that combine various components of all three governance types [88,p.25]. One of these hybrid manifestations is the model of “embedded democracy” [89]. This model implies that political participation controls the political agenda-setting process through the election of representatives. It is based on equal voting rights (elections) and provides opportunities for powerful participation beyond voting (freedom of expression, access to independent sources of information, freedom of assembly, and inclusion of all actors within the relevant political arena). Individual channels of participation correspond to the ideas of representative democracy (participation through elections), associative democracy (input and lobbying by associations), deliberative democracy (participation through open exchange of arguments), and participatory democracy (broad and direct input by citizens). The forms of influence are elections (representative), participatory budgeting (participatory), and citizen assemblies or mini-publics (deliberative).

This short and condensed review reveals that classifying and categorizing different manifestations of democratic systems has been a popular and wide-spread exercise in the political sciences with a wide variety of classification schemes. Most classifications use the role of and division of power between the executive versus the legislative branch of democratic government as the main criterion for assessing and categorizing governance types [90]. Other classifications point to the role and number of political parties as essential criteria for distinguishing political systems [91].

With respect to sustainable transformations in general and to energy transitions in particular, we believe that a classification according to a more detailed form of governance, i.e. policymaking style, is most appropriate [15–17,92,93,9,p. 358–361]. Based on our literature review

and our own research, we suggest distinguishing five prototypes. These are: *autocratic (fiduciary), adversarial (antagonistic, binary, polarized); collaborative (liberal, delegational, pluralistic), reflective (deliberative), and inclusive (participatory)*.[1] These five represent ideal types as used by the sociologist Max Weber. In the Weberian sense, "ideal types" do not represent empirical entities but provide a conceptual tool for analyzing social phenomena, coming closest to what we can observe in reality. From that perspective, most democratic systems are characterized by a mix of the five prototypes, but within each mix there is a dominant structure or rationale that takes the lead in structuring the transition governance. There may be other features linked to the other prototypes, but one approach stands out as the most influential in making policy.

Relying on prototypes rather than on empirical descriptions of each system has several advantages: (1) it reduces the number of governance structures to analyze, allowing research to focus on what is or appears relevant; (2) it allows analysis to concentrate on features that actually matter in the framework of each prototype; and (3) it facilitates the delineation of normative advice because the various rationales provide a consistent framework for aligning or realigning political innovations to the prototype under investigation. These benefits come at the cost of typifying and generalizing over a large range and scope of policy styles, and the classification remains at a rather abstract level. However, it provides guidance and orientation for a more focused analysis of cases and processes of energy transitions in different countries and policy contexts [19,42].

4.2. Autocratic governance prototype (I)

Autocratic governance is characterized by a leading role of a political leader in conjunction with a ruling party. This prototype is particularly significant in shaping the policies and strategies associated with energy transitions, especially in countries where centralized control is prevalent. In order to be called democratic, the leadership needs to be affirmed by regular elections that comply with democratic rules of fairness and free voting rights [95,96].

Provided that elections are free and fair, autocratic-democratic systems attempt to keep opposition parties, civil society organizations, and dissenting individuals at bay and to constrain their political voice and influence as much as legally possible [97]. There is a fine line between autocratic leaderships that orchestrate mock elections and leaderships that use all their communicative powers to put their representatives in a good pole position but respect the democratic rules of free and fair elections. Most often, autocratic leaders also try to limit the power of the judiciary and try to exert influence on the media.

One notable example of autocratic governance – not belonging to the group of democratic regimes but rather prototypical for an autocratic approach – is China. China is often cited as a key example of how autocratic governance can facilitate a rapid energy transition through centralized decision-making and state intervention [287,288,291,300]. The Chinese government has heavily invested in renewable energy, especially wind and solar power, as part of its strategic development plans [290,291,293,294]. This centralized approach allows for rapid mobilization of resources and swift implementation of policies, bypassing the slower consensus-building processes typical in democracies [98,289,292]. Russia provides another example, where the state controls major energy resources and industries, using them as tools of political power and economic strategy [295–297]. The government's control over oil and gas has been utilized not only to drive domestic energy policy but also to exert influence over other countries through energy supply and pricing [101,298,299]. Saudi Arabia's Vision 2030 illustrates how an autocratic regime can attempt to diversify its economy away from oil dependency by investing in renewable energy [104]. The government has initiated several large-scale projects to develop solar and wind energy, aiming to generate a significant portion of its electricity from renewable sources by 2030 [285,286]. Turning to democratic political regimes, on which we focus in this article, political systems such as those in Hungary, Turkey, Israel, and the US under Trump could be associated with this prototype [99]. Several regimes in the Global South can also be described by this category [100,295–299]. They include India, Bangladesh, the Democratic Republic of the Congo, and Ethiopia [102,103, p.14f] [285,286].

In theory, such autocratic systems could initiate sustainable energy transitions by means of executive power. If leaders are convinced that this is necessary and politically wise, they can initiate ambitious energy transition programs (cf. China: [100]). Autocratic governance in energy transitions theoretically offers several advantages – although they are unlikely to be realized [105]. Firstly, it allows for rapid decision-making. Autocratic regimes can make swift decisions without the need for lengthy democratic processes, which can accelerate the implementation of energy policies. In purely democratic systems, ambitious policies for the environment may conflict with the leaders' ambitions to remain popular and gain support from the less informed and less involved parts of the population. Furthermore, the benefits of the energy transition may become clear only after the leader leaves power, so there is no self-serving incentive for initiating actions that are sure to ruffle the feathers of established industry. Secondly, centralized control allows for coordinated policy implementation, ensuring coherent and unified execution, minimizing regional disparities and conflicts. In autocratic systems, political participation is strictly limited [96]. Finally, governments can direct significant financial and human resources towards specific projects, such as large-scale renewable energy installations. Autocratic leaders claim they know best what is good for the population.

However, there are challenges associated with autocratic governance in energy transitions. Autocratic regimes often deliver their message through symbolic and orchestrated forms of participation such as mass campaigns, spectacular popular events, or orchestrated internet forums and platforms. One major challenge is the lack of public engagement. These participatory formats are rarely an expression of the various interests, needs, and values of the population but rather an explicit show of support for the leaders. Policies may be implemented without public consultation, leading to potential social resistance and a lack of community support. Stakeholder and public participation understood as codetermination of collectively binding decisions is widely alien to this system. Additionally, centralized systems can lead to corruption and misallocation of resources, which may hinder the effectiveness of energy transition efforts. This also applies to the influence of environmental NGOs, which are at best tolerated but not supported or even consulted. Without checks and balances, there is also a risk that energy policies may prioritize short-term gains over long-term sustainability and environmental concerns.

Empirical reality seems to confirm this analysis. In conclusion, autocratic governance can significantly influence the pace and direction of energy transitions, offering advantages in terms of speed and coordination but also challenges related to transparency and public engagement. Hungary, Turkey, Poland, the US under Trump, and lately also Israel are all not frontrunners in energy transitions but rather reluctant to move away from fossil fuels [33,105]. The examples from China, Russia, and Saudi Arabia demonstrate how centralized decision-making can drive substantial changes in energy systems but also highlight the need for careful consideration of the social and environmental implications of such approaches. These countries are also reluctant to endorse EU or international policies for more climate protection, let alone respect human rights for self-determination and free expression of

[1] The seminal overview by Howlett and Tosun [17] distinguishes fours styles: representative, centralist, participatory (consultative), and competitive. These four roughly represent our four styles: collaborative, authoritarian, inclusive, and adversarial. We further distinguish between reflective (emphasis on deliberation) and inclusive (emphasis on direct democracy). An earlier version of our classification with slightly different labels has been published in Renn [9,94].

opinions. These insights suggest that while autocratic governance can facilitate rapid energy transitions, it must be balanced with mechanisms to ensure accountability, transparency, and public participation in order to achieve sustainable and equitable outcomes. China might be an exception, but even here fossil energy sources are increasingly placed on the market alongside renewable energy. It is too early to make a robust judgment about the success or failure of Chinese energy transition policies.

As a result, participatory efforts to initiate or promote energy transitions are not supported in autocratic systems. Even if an energy transition program is announced, the autocratic style favors top-down technocratic solutions – as we can see in China, especially concerning wind power expansion [106]. This way of implementing energy transitions ignores the specific regional or local contexts and excludes local communities, stakeholders, and affected citizens. It proceeds like a bulldozer – probably effective, but hardly efficient or resilient, and certainly not socially just [107]. Democratic legitimacy is mainly generated by (blind) trust in political leaders and the central government. It may be difficult to distinguish between authentic trust and a coerced trust based on fear, but it can be stated that this special form of legitimacy is always vulnerable to a shift towards a non-democratic appropriation of power by the leadership and a dismissal of local, regional, or social concerns [108].

4.3. Adversarial governance prototype (II)

The adversarial style of governance is typically characterized by two dominating parties competing for public support and votes. These parties develop strong ties with their constituencies, driven by rigid ideologies and a sense of being the true representatives of the national interest [9,16,94,109]. They often express condemnation for the opposing party, with their primary goal being to remain in power or be (re)elected. To achieve this, all legal means are employed to improve their position, often at the expense of the competing party [110]. Another major aspect of adversarial systems is the strong dependence of policymaking on legal requirements and the significant role of litigation in resolving conflicts [111].

In adversarial governance, if one party sees climate protection as a vote-winning issue, it might pursue ambitious sustainable energy policies. However, these policies are vulnerable to reversal if the opposing party wins elections, as they might not align with its identity and ideology [112]. Ambitious climate policies may also lack widespread public support, potentially risking electoral success, leading to a situation where the rhetoric remains but policies are not implemented, as seen in examples from the US [113], Nordic countries [114], and Turkey [115].

Adversarial systems rely heavily on public support to align citizens and stakeholders with a party's ideology. They tend to emphasize "showcase participation," inviting top-down involvement of stakeholders or citizens in symbolic formats with often predetermined outcomes [116]. The goal is to mobilize as many supporters as possible for the party's agenda [117,118]. Formats such as public assemblies and neighborhood groups are used to keep constituencies committed and recruit new followers, while cross-party participatory formats are avoided. The more polarized the parties, the less likely it is that participatory bodies will cross over.

Countries with long traditions of two dominant parties, such as the US, UK, Australia, and India, often exhibit adversarial styles ([119]; for the US: [120]; for Australia: [121]; for India: [122]). Some Eastern European democracies have also moved towards polarized two-party systems [123]. The rise of right-wing populist parties across Europe and beyond may create adversarial dynamics, with liberal democrats opposing populist autocrats, potentially sidelining climate policies to avoid unsettling constituencies [124].

This style of governance focuses on promoting the ruling party's program and gaining public approval, often avoiding wider public debate or citizen co-determination. For instance, the US infrastructure strategy under President Joe Biden ("Build Back Better Plan") was designed with limited consultation, seeking public support post-announcement [125]. When public pressure necessitates greater participation, it may result in policy adjustments or reluctant public discourse.

Adversarial governance refers to political and regulatory environments where conflicting interests and opposition shape decision-making processes. In energy transitions, this can significantly impact policy development and implementation. The most notable example is the United States, where conflicts between federal and state governments led to disparities in renewable energy adoption [301–303]. Different states also have varying priorities and policies regarding energy, which contributes to these disparities [304,305]. For instance, some states like California have aggressively pursued renewable energy targets, while others have focused on fossil fuel interests. This fragmented approach often results in policy inconsistencies and delays in achieving national energy transition goals [126–131].

While some states like California are aggressively pushing for clean energy, others, reliant on fossil fuels, lag behind due to the influence of powerful investor-owned utilities (IOUs) [320]. These IOUs, along with other interest groups, often resist renewable energy policies to protect their market dominance, leading to significant obstacles in advancing clean energy at the state level. Nonetheless, coalitions of non-utility actors, including environmentalists and renewable energy advocates, have occasionally weakened this opposition by promoting more inclusive and justice-oriented frameworks to ensure marginalized communities benefit from clean energy transitions [317,318,320]. Furthermore, the economic power of states significantly influences the speed and effectiveness of energy transitions, as wealthier states can afford to implement advanced clean energy projects, while poorer, fossil fuel-dependent states struggle to make the shift [321,322,324]. States continue to act as laboratories for climate policy innovation, experimenting with ways to harmonize energy and climate goals despite federal inertia [321]. Regional cooperation, such as the efforts in the Northeast through cap-and-trade programs, demonstrates the potential for progress when states collaborate [321,323]. The introduction of multi-sector partnerships in some states shows that broader stakeholder engagement can lead to more comprehensive and resilient policies [316,319,321]. However, political and economic barriers, combined with the lack of a cohesive national policy, slow the overall energy transition and create inconsistencies in meeting national climate targets [320]. Finally, the Biden administration's focus on both mitigation and adaptation, particularly in underserved communities, reflects the need to balance energy security, resilience, and equity [316,319]. Programs such as Empowering Rural America illustrate how climate justice can be integrated into the transition, yet the challenge remains of how to scale these efforts nationally [325–327]. While federal initiatives like the Inflation Reduction Act (IRA) aim to push the clean energy agenda forward, the ongoing conflicts between state and federal governments, as well as the influence of conservative political actors, remain significant challenges to achieving comprehensive national climate goals [328–331].

Germany's *Energiewende*, or energy transition, aims to shift from nuclear and fossil fuels to renewable energy sources. Despite broad support, this transition faces significant opposition from various political and economic groups concerned about the costs and reliability of renewable energy [306–308,311,312]. These adversarial dynamics have led to debates over energy policy design, subsidies, and the future role of coal and nuclear power [132,309,310,313–315]. In India, the energy transition is characterized by conflicts between different stakeholders, including government agencies, private companies, and civil society. The push for renewable energy is often met with resistance from coal-dependent regions and industries, leading to adversarial negotiations and policy compromises. This complex landscape has resulted in uneven progress and challenges in scaling renewable energy solutions across the country [133–137]. These examples from the US, Germany, and India

illustrate how adversarial dynamics shape energy policy, emphasizing the need for mechanisms to facilitate constructive dialogue and compromise.

Adversarial governance in energy transitions has advantages, such as incorporating diverse perspectives, driving innovation, and enhancing accountability and transparency. However, it also presents challenges like policy gridlock, fragmentation, and inefficient resource allocation due to competing interests. While adversarial governance fosters diversity and innovation, it can lead to delays and inefficiencies. Successful energy transitions in adversarial contexts require balancing competing interests while ensuring accountability, transparency, and equitable outcomes.

4.4. Collaborative governance prototype (III)

Collaborative governance systems are based on the idea of reaching consensus among those who have power and influence [9,125,138]. This governance style is part of a democratic framework where the legislative branch is highly influential, and multiple parties play key roles in setting the political agenda. Powerful economic actors and non-governmental organizations (NGOs) are usually consulted to incorporate and contain potential conflicts and avoid dissent early on. Historically, most negotiations among powerful players occurred behind closed doors, with results communicated to the media and the public afterward [139]. However, the rise of NGOs and social media has made negotiations more transparent, turning consensus-seeking into a public affair [140]. A vote in parliament often symbolizes what has already been negotiated. The executive branch is limited in its discretionary power but remains the official representative of governmental action [141].

If powerful players are convinced that an energy transition is inevitable, they may bring this topic to the table to negotiate policies that promote their goals. However, consensus-seeking will often stall between those pushing for immediate action and those prioritizing other agenda items [138]. Collaborative governance systems rarely initiate radical actions unless these are deemed unavoidable by all parties, as seen with responses to crises like COVID-19. Ambitious sustainability policies are often postponed as urgent issues take precedence.

Collaborative governance is highly inclusive of major stakeholders within the “insider club” but tends to keep other actors at a distance [9, p.360]. Public forums like planning cells, citizens' forums, and assemblies are used to gauge the concerns and desires of various publics, intending to make insiders more responsive to outsider needs. However, this is not meant to give non-organized citizens more power over political decision-making. The best democratic outcome is for decision-makers to hear informed positions representing the population [142].

This collaborative prototype has been strong in Scandinavian countries, Austria, Luxembourg, and parts of Germany [15,17,143,144]. Many European countries have shifted towards reflexive or inclusive policy styles while retaining collaborative characteristics. Outside Europe, Japan and other East Asian democracies are following the collaborative approach to seeking consensual policies [145,146].

In collaborative governance, participation in energy transitions mainly takes place through information or consultation [147]. Town hall meetings, citizen forums, and dialogue formats are often used by planning and local authorities to explain policies and collect limited feedback [333]. Co-designing or co-creating policies typically involves stakeholders from the “insider club” negotiating and testing policy proposals [9]. Direct citizen involvement through grassroots initiatives or random selection in assemblies or juries is rare and limited to non-core interests [336].

In Europe, legal requirements mandate public hearings or inquiries to address public concerns and explain proposed policies [140]. Stakeholders and citizens provide input on urban and infrastructure developments, but the input is formalized and not necessarily considered in further planning [148]. Concerns not properly addressed may lead stakeholders to court, provided procedural violations are proven. Hearings often represent symbolic involvement rather than substantial influence [149]. For example, citizens and stakeholders have had minimal success in Germany in opposing wind power siting [150]. This can lead to local conflicts and protests when community needs and preferences are ignored, violating recognition justice and perceived democratic legitimacy.

Collaborative governance refers to decision-making where multiple stakeholders, including government agencies, private sector actors, NGOs, and communities, work together to achieve common goals [142]. In energy transitions, collaborative governance facilitates policy development by leveraging diverse participants' strengths and resources [151]. We will now present some examples of collaborative energy governance based on case studies from Denmark, the Baltic Sea Region, France, Austria, Indonesia, Australia, South Korea and Austin (Texas). Denmark has pioneered a collaborative approach which is renowned for its widely supported multi-actor transition towards renewable energy, particularly wind power [332]. The Danish government actively involves various stakeholders in energy planning, encouraging public participation and community ownership of renewable energy projects [334,335,337–339]. This approach has fostered widespread acceptance of renewable energy initiatives, leading to Denmark becoming a global leader in wind energy [152–154]. Through policies that support collaborative and cooperative ownership models, local communities can invest in and benefit directly from renewable energy developments. This ensures that the economic benefits are distributed more evenly among residents, thus fostering social equity [210–214]. Co-creation strategies have been increasingly adopted in Denmark to ensure that energy transitions are not solely technocratic but incorporate local knowledge and social needs. Sillak et al. argue that co-creation processes such as those used in Sønderborg, Denmark, help foster collaboration between local governments, industry, and communities by involving all stakeholders in the design, implementation, and evaluation phases of energy transitions [201]. This approach encourages social learning and the acquisition of resources while enhancing the overall acceptability and success of these initiatives.

In energy transitions, the involvement of multiple stakeholders across sectors and scales is essential, as it ensures that diverse perspectives are considered and that the process is more inclusive and widely supported. This collaborative governance approach fosters shared ownership of the transition, which in turn strengthens the commitment of all parties involved. For instance, the Baltic Sea Region’s AREA 21 project highlights the importance of inclusivity and stakeholder collaboration at the district level, and of involving public authorities, energy utilities, property owners, and citizens to create energy-efficient urban districts [340]. Similarly, in France, efforts to decentralize wind energy development demonstrate how collaborative governance between local and national authorities can drive renewable energy initiatives, despite challenges posed by centralized energy and landscape policies [341–343]. Austria’s “energy regions,” such as the Murau district, showcase another example where regional discourses and collaborative networks built around renewable energy have led to both socio-technical innovation and economic revitalization [344]. Collaborative governance plays a critical role in addressing the complex challenges of renewable energy transitions, particularly in regions where multiple stakeholders are involved. In Indonesia, for example, the collaborative efforts between the regional government, the State Electricity Company (PLN), and the biogas power plant in Riau Province demonstrate the potential of such partnerships to address local energy needs through renewable sources like biogas from palm oil waste [345]. However, the collaboration faces significant challenges due to regulatory shifts and jurisdictional changes, which have complicated the management of energy projects at the local level. In Australia, deliberative collaborative governance (DCG) has proven successful in integrating sustainability concerns into urban planning. Initiatives in Western Australia, such as the “Dialogue with the City,” have shown how engaging citizens in decision-making processes can lead to more sustainable urban planning

outcomes, as seen in efforts to reduce urban sprawl in Perth [346]. These cases highlight how collaborative governance, when implemented effectively, can bridge the gap between local communities and governmental institutions to foster more inclusive and just energy solutions [347]. South Korea has engaged local communities and various stakeholders in collaborative projects, particularly as part of renewable energy initiatives, to foster a more democratic energy transition. For instance, there have been efforts to decentralize energy governance by allowing local governments and citizen groups to participate in solar and wind energy projects [348]. However, some problematic challenges remain, such as conflicts and distrust between stakeholders and powerful incumbents in the energy sector as well as policy uncertainties that negatively affect investment decisions, which hinder the full realization of collaborative governance.

In the United States, the city of Austin, Texas exemplifies collaborative governance through its community-driven energy plan. Austin Energy, the city's municipally-owned utility, actively engages with the community to develop and implement its energy transition strategy. Through public consultations and stakeholder meetings, Austin Energy has set ambitious renewable energy goals and developed innovative programs to support energy efficiency and the adoption of solar power. This collaborative approach has helped Austin become a leader in renewable energy among US cities [156–158].

Collaborative governance in energy transitions offers advantages, such as integrating diverse perspectives, fostering innovation, and enhancing transparency and accountability [151,345,346,371]. However, challenges include coordinating multiple stakeholders with differing priorities, ensuring equitable participation, and reaching consensus without diluting policies [142,148,152,344]. Despite these challenges, collaborative governance plays a vital role in achieving successful energy transitions by ensuring equitable and sustainable outcomes through effective coordination, inclusive participation, and shared objectives.

4.5. The reflective governance prototype (IV)

The reflective prototype emphasizes the quality of political decision-making, striving to align with the ideals of deliberative democracy [5,6,74,75,159,160]. This approach is rooted in the belief that governance should provide opportunities for all parties to exchange ideas, arguments, and beliefs in a fair and open discourse. When these rules are followed, a true consensus or dissent may emerge that includes all arguments and offers a competent and fair resolution [9, p.294f]. Unlike the collaborative model, the reflective prototype invites participation not only from powerful, organized actors but also from any citizen who can provide a valid argument or is affected by a decision.

Reflective governance emphasizes controlling undue lobbying influences, power plays, and partial interests, ensuring that debates are governed by fairness and competence [66,67,161]. Ideally, this competitive discourse leads to socially just solutions, where consensus represents the best rational and most accepted resolution for all parties involved [6,162]. However, critical reflection on this ideal reveals several constraints. The selection of participants influences the discourse outcome; limited participation may lead to a consensus that excludes broader interests [163,164]. Power hierarchies often overrule rational arguments [165,166], and negotiating trade-offs implies shared value preferences, which is neither realistic nor desirable [118]. Additionally, arguments beyond rational reasoning may hold significance for some participants but less for others [167].

Advocates of deliberative policymaking suggest alternative forms of closure, such as advocacy or discursive coalitions and agonistic exchanges [168–171]. Dryzek & Niemeyer propose seeking a "meta-consensus" that acknowledges diverse positions and respects dissenting views [172]. This can lead to multiple valid solutions or a majority vote to find the most acceptable option. Reflective governance can drive energy transition policies if arguments are fairly considered [33], making climate protection and energy transitions top priorities in deliberative contexts ([124], review in [173]). However, policies often remain rhetorical, with limited impact on implementation [174–176].

Reflective systems may struggle with the assumption that verbal commitments translate into action. The term "speech acts" suggests that verbal and factual behavior may not align, as seen with Germany's heating act, where intentions clashed with financial implications [177,178]. Reflective governance excels in verbal agreements but faces challenges in implementation. Participation in reflective systems involves stakeholder and citizen input to ensure representation. Although parliamentary debates once sufficed, skepticism over their breadth has led to additional participatory processes like round tables and consensus conferences [2,63,179–181]. These have broadened argumentation but have not closed the gap between consensus and action.

Reflective governance is evident in countries like Italy, France, Ireland, and Spain [124], many US states, Taiwan, and Australia [182–184]. Latin American countries, including Peru and Brazil under Lula, also embrace deliberative elements [185]. However, despite respected cultures of deliberation, public discourse spaces are often limited or formalized, constraining true planning alternatives [186–188]. This experimental democracy often leads to unfulfilled promises that populist movements exploit [108].

Reflective governance in energy transitions emphasizes learning, adaptation, and reflexivity to address complex challenges [349]. It involves continuously evaluating and adjusting policies based on new insights and societal needs, fostering flexibility and responsiveness. In the following, we will discuss some examples of reflective energy governance in Germany, the Netherlands, the UK, and at the city and local level including examples from Austria, Sweden, US cities, and Liverpool (UK).

Although Germany's *Energiewende* is strongly influenced by a cooperative style of governance, there are increasingly elements of reflective governance included in the process of policy generation and implementation [353–357]. Germany's energy transition strategy pursues an adaptive policy approach, which is designed to be responsive to changing circumstances and informed by continuous evaluation and stakeholder feedback [350]. The German government regularly reviews and updates its renewable energy policies, incorporating lessons learned from implementation experiences and technological advancements [352,358]. The process is iterative and adaptive, as policies are continuously reassessed based on feedback from stakeholders, technological advances, and social changes [351]. This reflective approach allows Germany to adjust its strategies to meet renewable energy targets while addressing challenges such as grid integration and market design [189].

The Netherlands provides possibly the most prominent example of reflective governance in its approach to the energy transition, including a transition management framework [359–361,364,367,368]. This approach integrates multi-actor collaboration and long-term strategic visioning while being adaptable in the short term [362,365,372]. Dutch policymakers have recognized the need to involve various stakeholders in the energy transition process, creating "transition arenas" where public, private, and civil society actors collaborate to develop sustainable energy pathways [351]. A good example is the "Sustainable Rijnmond" project, which focuses on the energy transition in an industrial region through a combination of local innovation and stakeholder participation [351,370]. The Dutch energy transition is also organized regionally through the Regional Energy Strategies (RES), which focus on decentralized, region-specific energy solutions including a flexible and local focus [366,367].

In this case, the reflective approach is strongly tied to mechanisms of collaborative governance [369,363,373,374]. The Dutch "Energy Agreement for Sustainable Growth," signed in 2013, is a product of negotiations involving over 40 stakeholders, including government bodies, industry representatives, trade unions, and environmental organizations [351]. This agreement outlines specific targets for

renewable energy, energy efficiency, and carbon emissions reduction, and its collaborative nature ensures that all parties have a stake in its success. The involvement of diverse stakeholders has helped create a stable and predictable policy environment that is conducive to investment in renewable energy [155]. However, despite the inclusive nature of these efforts, socio-spatial inequalities persist, as not all citizens are able to participate equally in local energy transitions, limiting access to the benefits of renewable energy initiatives, particularly in marginalized or lower-income communities [375,376].

In the United Kingdom, reflective governance is evident in the government's approach to integrating renewable energy into the electricity grid. The UK has adopted a dynamic regulatory framework that encourages innovation and experimentation with new technologies and business models. For example, the UK's regulatory sandbox initiative allows energy companies to test new products and services in a controlled environment, providing valuable insights into their potential impact and scalability. This reflective approach helps the UK adapt its energy policies to accommodate emerging technologies and market trends [190]. The European Union (EU) also exemplifies reflective governance through its iterative approach to climate and energy policy. The EU's energy transition strategy is guided by the principle of "learning by doing," which involves continuously refining policies based on implementation experiences and stakeholder feedback. This approach is evident in the EU's periodic revision of its Renewable Energy Directive and Emissions Trading System, which are adjusted to reflect new scientific findings and technological developments. By fostering a culture of reflection and adaptation, the EU aims to achieve a more resilient and effective energy transition [191].

Reflective governance in energy transitions, particularly at the local level in cities, municipalities, and rural areas, emphasizes the need for adaptable, inclusive, and participatory approaches that engage diverse stakeholders [350,378–382]. At the local level, initiatives such as Local Energy Communities (LECs) demonstrate the potential for bottom-up governance models that promote sustainable development and social innovation. Otamendi-Irizar et al. highlight how LECs in European cities act as drivers of local transformation, engaging communities to co-create solutions for energy production and distribution [383]. By involving local stakeholders and integrating sustainability goals, LECs not only address energy needs but also promote wider social and economic benefits, such as job creation, environmental conservation, and public space improvements.

In urban areas, the concept of Positive Energy Districts (PEDs) highlights the importance of community engagement and adaptive systems for long-term sustainability. For example, Derkenbaeva et al. emphasize that PEDs contribute to energy transitions by focusing on renewable energy production and energy efficiency while considering local social and environmental contexts [384]. Moreover, the inclusion of multiple stakeholders in decision-making processes enhances the flexibility and resilience of urban energy systems. Cities in Sweden, such as Stockholm and Gothenburg, are pioneering reflective governance in urban energy transitions [385,386]. With goals to become fossil fuel-free by 2040, these cities are engaging in multi-actor governance frameworks, involving local authorities, businesses, and civil society in collaborative decision-making processes [387]. The reflective governance approach in Swedish cities includes continuous learning and adaptation, in which policies are regularly reassessed to incorporate new technological advancements and societal needs [388,389].

In rural and smaller municipalities, similar approaches are necessary but require tailored governance models [390]. Hoicka et al. explore the significance of renewable energy communities (RECs) in decentralizing energy production, empowering local actors, and promoting equitable energy access [391]. Such models of co-governance ensure that energy transitions are inclusive, addressing the specific needs of rural populations that might otherwise be marginalized. Naumann and Rudolph argue that energy projects in rural areas can lead to contestations over land use, benefit distribution, and local participation [392]. This calls for governance models that prioritize procedural justice and ensure that rural communities have a meaningful role in decision-making [393–402]. In Austria, reflective governance is practiced through regional energy collaborations, such as in the region of Styria [336,403]. Local governments, businesses, and NGOs collaborate to promote renewable energy projects tailored to the region's specific needs [404,405]. This decentralized approach ensures that the energy transition policies are adaptable to local socio-economic and environmental contexts [406]. Reflective governance here focuses on regular policy evaluations and adjustments, aligning local needs with national energy goals [407]. Further examples can be found in rural Italy, Indonesia, and Australia [408].

In many cases, renewable energy systems have been shown to significantly benefit low-income and socioeconomically deprived communities, but they require careful, reflective governance to avoid exacerbating inequalities. Axon and Morrissey highlight that such transitions, if not managed in an anticipative and reflective way, can have unintended consequences, as seen in the case of a biomass energy project in Liverpool, where residents faced increased energy costs and felt excluded from the decision-making process [409]. Similarly, Beauchampet and Walsh argue that for gas-free transitions in the Netherlands, reflective governance plays a critical role, and engaging citizens in decision-making is crucial to ensure a just and effective transition [410]. It has been shown that proactive town leadership and the presence of "policy champions" significantly contribute to successful energy transitions at the local level [411–414]. In US municipalities, policy entrepreneurs play a vital role in aligning clean energy initiatives with local socio-economic conditions, driving community engagement, and fostering broad support for renewable energy projects [415,416]. Thus, the most significant advantage of reflective governance lies in the capability of combining urban strategies, such as PEDs, with local-level leadership and participatory governance models to ensure energy transitions are equitable and sustainable across various regions [417–424].

Reflective governance offers several advantages, such as proactive responses to challenges, enhanced policy effectiveness, and stakeholder engagement. It fosters innovation through experimentation and adaptation. However, challenges include the complexity of continuous evaluation, the need for effective feedback mechanisms, and balancing flexibility with market stability. Reflective governance plays a crucial role in facilitating energy transitions, enhancing policy resilience and effectiveness. While challenges exist, benefits like increased responsiveness and inclusivity make it a valuable strategy for successful energy transitions. Effective reflective governance requires robust evaluation mechanisms, stakeholder participation, and a commitment to continuous learning and adaptation.

Thus, reflective governance in energy transitions is crucial for managing the uncertainties, conflicts, and long-term goals associated with sustainability. The Netherlands, Austria, Germany, the UK and Sweden, as well as many cities and regions all over the world, provide diverse examples of how adaptive, participatory, and iterative governance processes can guide energy transitions at national, regional, and local levels. Although challenges remain – particularly when it comes to balancing the influence of powerful incumbents with the need for innovation – the reflective governance approach enables societies to navigate the complexities of transitioning to a sustainable energy future.

4.6. *The inclusive governance prototype (V)*

The inclusive or participatory governance prototype is built on the belief that direct participation from all constituencies leads to more effective, fair, and resilient policies [87,192]. This governance style provides opportunities for direct participatory measures such as referenda, as well as indirect and informal methods like citizen assemblies and round tables. While advocates of inclusive democracy maintain that collectively binding decisions should be passed by parliaments rather than ad-hoc groups [193,194], local issues can be resolved directly by

those affected, with special conflicts addressed through popular votes or informal processes. Unlike the reflective prototype, which emphasizes fair deliberation, the inclusive model focuses on gathering a representative sample of people empowered to make or prepare collectively binding decisions [195]. The approach is grounded in the idea that if real public representation is achieved, all arguments and viewpoints will be considered, and the outcomes will resonate with public consensus on acceptable compromises [196].

In the context of energy transitions, inclusive governance is effective if relevant actors agree on the urgency of action. However, there is no guarantee that open discourse will favor ambitious energy transition policies ([194,197], see also [198–200]). Strong consensus may weaken if transitions demand too much effort, potentially leading to chaos. Nonetheless, inclusive governance gives confidence that agreed-upon policies will be implemented. The goal is not to find the best solution but to decide on sustainable or agreeable actions.

The inclusive governance model emphasizes broad participation, including formats such as living labs where people voluntarily make changes within their communities [201]. The involvement of non-organized actors is welcomed, adding legitimacy to policymaking. Elements of inclusive governance can be found in countries like Switzerland, Germany, Canada, and some US states, such as Massachusetts [202–204]. Direct participation formats like referenda are popular because they promise direct political influence [205–207]. However, referenda in Switzerland and other democracies often reflect powerful societal actors and are reduced to yes-no options [208]. Effective direct democracy requires extensive information campaigns and informal deliberations [63]. Without these, referenda can increase polarization and manipulation, undermining democratic legitimacy [209].

Inclusive governance in energy transitions emphasizes the representation of diverse stakeholders, including marginalized groups. This approach ensures equitable sharing of energy transition benefits and challenges, addressing social justice by engaging communities that are often excluded from traditional policymaking.

The following presents selected examples of forms of inclusive energy governance in Canada, South Africa, the state of Massachusetts (US), Ireland, Indonesia, and Taiwan.

Inclusive governance is more prominent and popular on the local and regional level than on the national level. One prominent example is Canada, inclusive governance is evident in the country's efforts to involve Indigenous communities in energy transition initiatives. Recognizing the historical marginalization of Indigenous peoples, the Canadian government has prioritized partnerships with Indigenous communities to develop renewable energy projects on their lands. These partnerships provide opportunities for Indigenous groups to lead and participate in energy projects, thereby promoting economic development and energy sovereignty. This inclusive approach acknowledges the rights and knowledge of Indigenous peoples, contributing to more equitable and sustainable energy transitions [215]. South Africa provides another example of inclusive governance in its approach to addressing energy poverty and inequality. The South African government has implemented policies aimed at expanding access to affordable and sustainable energy for low-income and rural communities. Initiatives such as the Integrated National Electrification Programme (INEP) and the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) are designed to improve energy access while promoting local economic development and job creation. These programs emphasize the importance of inclusivity by involving local stakeholders in decision-making processes and ensuring that disadvantaged communities benefit from energy transitions [216].

Strategies of inclusive governance in Massachusetts' clean energy transition emphasize the importance of participation, particularly for marginalized communities, in shaping policies that promote clean energy and climate action in order to ensure that the benefits of the clean energy transition, such as job creation and energy savings, are equitably distributed [425,426]. The 2021 Climate Policy Act and subsequent clean energy plans aim for net-zero emissions by 2050, focusing on including historically excluded groups in decision-making processes. The state's Clean Energy and Climate Plan for 2025 and 2030 highlights the involvement of stakeholders through public meetings and the Climate Justice Work Group, ensuring that low-income and environmental justice communities benefit from climate policies [427]. Additionally, initiatives like offshore wind energy expansion prioritize workforce development and economic inclusion, particularly for low-income and minority communities. The Climate Jobs Roadmap for Massachusetts outlines the importance of prioritizing union jobs and strong labor standards to ensure that workers from underrepresented groups can access high-quality careers in the clean energy sector. It stresses the importance of addressing racial and economic inequality, particularly through initiatives that expand access to well-paid jobs and affordable, energy-efficient housing ([428]; see also the ReImagine Appalachia campaign, which addresses these issues and claims [429]). Moreover, the roadmap highlights the urgency of scaling retrofit programs for buildings to reduce emissions while ensuring transparency and equitable access, especially for low-income communities.

Inclusive energy governance in Ireland focuses on engaging multiple stakeholders, such as policymakers, communities, and local institutions, to shape sustainable energy transitions. Ireland's approach recognizes the importance of integrating non-energy policies, such as health, education, and work, into energy governance to influence energy demand and sustainability behaviors [430]. The inclusion of social practices, health guidelines, and educational programs emphasizes the role of everyday practices in shaping energy consumption [431]. For instance, Irish policies have been designed to nudge consumer choices and promote energy-efficient practices, integrating these measures into broader societal contexts [432]. Reflecting on the limitations of traditional approaches, Ireland's model aims to reduce demand through a combination of technological efficiency and behavioral change, while also considering socio-economic factors that influence individual and community behaviors. Through inclusive energy governance, Ireland aims to address energy-related CO2 emissions and meet its EU climate targets by embedding energy policies into everyday life, ensuring broad societal participation. The application of energy policies, such as recycling programs and water conservation, demonstrates how Ireland involves its citizens in creating a sustainable future [433].

In Indonesia's energy transition, strategies of inclusive governance are regarded as crucial to addressing the socio-political and economic disparities faced by vulnerable groups [434–436], such as local communities reliant on fossil fuels, informal workers, and Indigenous populations [437,438]. The current energy transition policies in Indonesia, while targeting decarbonization and renewable energy growth, often fail to incorporate the voices of these marginalized communities effectively [439–442]. The exclusion of these groups from decision-making processes has resulted in a lack of trust and support for energy policies [408,443]. For example, coal-dependent regions face economic risks due to job losses and reduced local revenues as Indonesia transitions away from coal [444,445]. Additionally, Indigenous communities often struggle with securing land rights, facing displacement due to large-scale renewable energy projects like biofuel plantations and hydropower plants [438,446].

In Taiwan, the governance of Indigenous territories during energy transitions has showcased how deliberative democracy and activism can contribute to energy justice [447]. Indigenous groups, such as those opposing solar projects on their lands, have engaged in a dual deliberative system where local governance interacts with national policymaking [448]. This system emphasizes the importance of communication and collaboration between Indigenous communities and government bodies, allowing for the inclusion of marginalized voices in energy governance [447]. Similarly, in Australia, community renewable energy projects such as those in Northern Rivers demonstrate how local initiatives can foster governance structures that integrate citizen

participation, local government support, and innovative financing models [347,449]. Projects like the Lismore Community Solar Initiative and Enova Energy reflect the growing trend of communities taking an active role in shaping their energy futures through a combination of inclusive and collaborative governance [449]. These examples illustrate the potential of decentralized and inclusive governance models to promote sustainable energy transitions even in high-carbon regimes like Taiwan [450–454].

Inclusive governance offers advantages such as enhanced policy legitimacy, social cohesion, transparency, and innovation. It addresses social and economic disparities by incorporating diverse perspectives and knowledge systems. However, challenges include facilitating meaningful participation, overcoming systemic barriers for marginalized groups, and balancing competing interests. Inclusive governance plays a vital role in equitable and sustainable energy transitions by ensuring diverse stakeholder involvement. Examples from many countries, including Canada, Indonesia, Ireland, South Africa and Taiwan, as well as the specific case of Massachusetts, show how inclusivity promotes social justice, economic development, and energy access. Despite challenges, the benefits of inclusivity, such as legitimacy and innovation, make it a valuable strategy for successful energy transitions. Effective inclusive governance requires empowering marginalized communities, fostering dialogue, and addressing systemic participation barriers.

The following table summarizes the main features of these five governance styles (see Table 3).

5. Discussion and synopsis: The need for hybrid styles of energy transition governance

5.1. Synopsis of the benefits and shortcomings of each policy style

Our analysis demonstrated that none of the five prototypes or styles of democratic governance abstracted from the literature provide an optimal solution for promoting an ambitious energy transition process towards renewable and non-fossil energy sources (cf. [217]). The *autocratic style* of governance is the least likely to be effective in this direction and will not include citizen or stakeholder participation except for symbolic reasons to promote the regime. Within the *adversarial style*, pursuit of an energy transition depends on the strategic outlook of each party and whether ambitious policies will improve their position vis-à-vis the competing party. So far, there is little evidence that this kind of strategic advantage can be maintained over time to effect meaningful change. In the US and the UK, climate protection has been a rallying topic for at least one of the competing parties (Democrats and Labour), but even this has lost momentum over time (for the US: [218], for the UK: [189,219–222]).

The *collaborative style* of governance is more likely to become serious about climate policies but tends to slow down transition efforts so as not to jeopardize cooperation. The *reflective style* is likely to produce high commitment but may lack corresponding actions. Finally, the *inclusive style* of governance may promise energy justice, but it is unpredictable and reliant on the preferences of the actors involved. Given the volatility of these preferences over time, inconsistencies are likely to evolve.

These conclusions point to the need for a hybrid style of governance based on collaboration but enriched by reflective and inclusive elements that overcome the rigidity of the collaborative prototype and add deliberative elements and inclusion opportunities.

How might a mixture of specific styles and modes of participation formats work? In comparing the prototypes, we assumed, first, that the more inclusive styles of governance (collaborative, inclusive, reflective) could be distinguished from the more elitist styles (autocratic, adversarial) (see Table 2). Second, we concluded that the collaborative, inclusive, and reflective governance styles offer the greatest opportunities and best conditions for initiating and implementing participatory processes, but each differs significantly in terms of the input and throughput dimensions of democratic legitimacy. The collaborative style emphasizes joint decision-making by all relevant parties. This is based on the ideal of legitimacy by procedure rather than by results (throughput legitimacy). It provides ample opportunities for co-governance for those who are part of the insiders' club [223].

The reflective style builds on the quality of arguments that would lead to a “good” decision. It emphasizes the output dimension of democratic legitimacy. If it is not compromised by power interventions or unfair performance by moderators and external pressures, it can result in a high quality of outcome in terms of effective policymaking, efficient procedures, and fair distribution of burdens and benefits.

Finally, the inclusive style places the greatest emphasis on the broad and extensive representation of all parts of society, making it the best approach for achieving input legitimacy. In the inclusive policy style, each individual ideally has the right to co-determine policymaking within the frame of the respective decision-making format (i.e. referendum, citizens' assemblies, etc.).

If we consider the real-world conditions of energy transition procedures and the constraints on decision-making processes, the three most responsive styles, i.e. collaborative, reflective and inclusive, may still fail because time pressures, diversity of opinions and values, and political maneuvering may impede a fair and deliberative inclusion of

Table 3
Summary of governance prototypes with emphasis on public participation.

Governance Prototype	Leadership and Decision-Making	Policymaking Style	Participation Procedures	Implementation of Sustainability Policies
Autocratic Governance	Characterized by a dominant political leader and ruling party	Regular elections held, but the leader seeks to limit opposition and control policymaking	Limited political participation, with leaders relying on symbolic forms of involvement	Unlikely to prioritize or effectively implement sustainable energy transition policies
Adversarial Governance	Involves two competing parties seeking public support	Policies may change depending on which party is in power	Emphasizes showcase participation to mobilize support for the ruling party's agenda	Climate policies may be influenced by strategic considerations rather than long-term commitment to sustainability
Collaborative Governance	Focuses on consensus-building among influential stakeholders, often behind closed doors	Economic actors and NGOs are consulted to contain and resolve conflicts early in the decision-making process	Inclusive for major stakeholders but excludes new initiatives and non-organized citizens	Tends to prioritize more urgent issues over ambitious sustainability policies
Reflective Governance	Emphasizes quality decision-making through deliberation	Aims for open and fair discourse, with a focus on competent argumentation	Often results in verbal commitments to sustainability policies	Implementation of policies may be slow or incomplete, and verbal commitments may not translate into practical action
Inclusive Governance	Supports direct participation of all parts of society	Provides ample opportunities for various participatory measures, including referenda	Aims to empower representative samples of citizens to make collectively binding decisions	Effectiveness depends on convincing all relevant actors of the necessity for immediate action Policymaking tends to be inconsistent depending on changing preferences of the electorate

stakeholders and the affected public. This is even more true for the top-down authoritarian and adversarial styles. Many studies have shown that top-down styles increase dissatisfaction and boost local opposition and protests [6,19,42,105,224–226].

5.2. Proposal for a new "hybrid" policy style

Navigating the complexities of energy policymaking and deciding on often painful trade-offs between conflicting objectives calls for a departure from conventional approaches. Hybrid governance in energy transitions is an emerging approach that seeks to navigate these complexities by integrating both top-down and bottom-up processes. It requires a shift from a supranational or national governance level to a balanced combination of centralized directives that respect planetary boundaries and incorporate global environmental, economic and social megatrends, and community-level engagement. Only in this way can we ensure global conditions and constraints are taken into account, while the most locally suitable policies and measures are developed at the community level [12,227]. By shifting focus towards community sovereignty, this governance style prioritizes decision-making at the community level in accordance with the subsidiarity principle, which advocates for decisions to be made as close as possible to the citizens they affect [228].

Community sovereignty is the primary driver for energy transitions, but it is informed by knowledge about planetary boundaries and contained by minimizing external effects on global commons. In conjunction with a reflective and inclusive governance approach, community-centered governance that builds on local initiatives may enhance the level of agency and efficacy for citizens in their own life-world (see for example a series of community-based case studies in [229]). The policy focus needs to shift to the pivotal role of individual experiences in shaping a community's living conditions. Community-based activities, enhanced by an inclusive and bottom-up style of participation, hold the key to unlocking the hidden potential of inclusion, diversity, and collaboration [230].

The first step in this direction involves bottom-up activities to establish deliberative discourses within the community or regional level [231,232]. Via such localized discourses, issues of social justice, energy needs, ecological impacts, and sustainable development can be addressed. Such an approach will also increase and nurture the need for social recognition for stakeholders and citizens by public authorities. One example of hybrid governance combined with bottom-up activities can be seen in the development of community energy projects in Scotland. Here, local communities have been empowered to take ownership of renewable energy projects, such as wind and hydroelectric schemes. The Scottish government supports these initiatives by providing frameworks and financial assistance, allowing communities to benefit directly from the energy transition. This combination of government support and community initiative exemplifies how top-down and bottom-up approaches can be effectively integrated [233].

The second step involves more flexible and inclusive formats for stakeholder and public participation, contributing to procedural justice [234]. This requires the combination of stakeholder round tables with citizen assemblies or forums in which randomly selected citizens represent the perspectives of the non-organized persons who will be affected by the decision being considered [235,236]. In addition, the discourse itself should be inspired by the ideal of deliberative co-creation, leaving enough space for participants to find new and more adequate solutions and to discuss the unavoidable trade-offs between different policy options. In Germany, the Energiewende has been supported by new formats of hybrid governance. A highly promising format is the co-creative development of innovative tools in living labs, since these involve the active promotion and integration of real-world interventions that are imperative for the success of an energy transition [234]. Such co-creative approaches foster a sense of ownership and shared responsibility among the affected parties, mitigating conflicts in the transition process and securing procedural as well as recognition justice. Recognition justice also plays a pivotal role in transition efforts. Joint sense-making, listening to multiple preferences, including place attachments and identities, and sincere efforts to include different viepoints without losing the need for a common agreement can be accomplished more effectively on the local and regional level than in predominantly top-down governance approaches. While national policies set ambitious targets for renewable energy deployment, the implementation occurs predominantly at the regional and local level. This involves local governments and communities in planning and decision-making processes, enabling them to tailor solutions to their specific needs and conditions. Community-led projects, such as local energy cooperatives, are supported by federal policies that encourage decentralized energy generation and consumption [237–244].

The third step involves the sharing of benefits with the local community [131,245]. This is a powerful mechanism to promote distributive justice. By receiving an equitable distribution of benefits arising from energy projects, the potential victims of infrastructure planning become owners of an infrastructure that gives them access to benefits and delivers additional personal agency [455]. Then, with every turn of a wind generator, local residents can watch their earnings grow. Shared benefits may be financial, symbolic, or substantive. The main point is to empower people to be both designers and beneficiaries of the envisioned energy transition. This not only addresses community self-governance, but it also establishes a framework for long-term community engagement.

The fourth and final step is to link the communities to a larger concept of the common good and the obligation to remain within planetary boundaries so that community egoism at the expense of other communities is discouraged [246,247]. The Netherlands launched an initiative that links the local with the national and global level. It is called: "Energy Agreement for Sustainable Growth," and involves a broad coalition of stakeholders, including government agencies, businesses representatives, trade unions, and environmental organizations [456]. During their meeting the are mandated to respect planetary boundaries and to provide a productive interface for the cooperation between regional, national, and supranational governance levels for designing and sustainable energy polices. At the same time, the initiative is requested to adjust the outcomes of one community-driven discourse to the outcomes of other communities to ensure consistency and coherence. The Dutch model emphasizes the importance of stakeholder engagement and the integration of diverse perspectives in crafting energy policies that are both ambitious and locally adaptable [249].

The best way to implement such a close link between vertical governance levels is to have representatives of each community (elected officials as well as discourse members) meet at the next higher governance levels with public officials and modify their plans so that they best serve the interests and values of all communities [248]. This agreement facilitates a collaborative approach to energy transitions, blending national policy objectives with local initiatives.

This approach balances bottom-up and top-down policymaking while ensuring adherence to the core principles of democratic policymaking. Hybrid governance approaches offer several benefits in energy transitions. The power of parliaments is not compromised, but the predecision phase is enriched by deliberative processes to inform policymakers and to provide feedback about public preferences to the decision-making authorities [5,6]. First, hybrid approaches promote inclusivity and diversity by actively involving local communities and stakeholders in decision-making processes. This enhances the legitimacy and acceptance of energy policies, as citizens are more likely to support initiatives they have helped shape. In addition, the subsidiarity principle has been established as a legally prescribed mode of multi-level governance in the EU [250]. Hybrid governance fosters innovation by allowing local experimentation and adaptation of energy solutions, which can then be scaled up or shared as best practices across regions. We foresee no principal argument why this new policy style could not be

extended to all countries with a democratic governance system and an openness for direct input by stakeholders and the public. Additionally, this approach helps balance competing interests and objectives, ensuring that social justice, ecological impacts, and energy needs are considered holistically.

This new style of governance can be seen as a hybrid of reflective and inclusive styles focused on decentralized decision-making and community empowerment. However, there are challenges associated with hybrid governance. One major challenge is coordinating actions across multiple governance levels and ensuring coherence between national and local policies. In earlier publications, one of the authors has labeled this style "mediative" because it provides bridges between citizens and the community, between communities and the state, and between states and the European Union [94]. Effective communication channels and mechanisms for collaboration are essential to address potential conflicts and align efforts. In terms of procedure, a mediative style would include four distinct components. First, a thorough understanding of the local and regional context is paramount, as it lays the groundwork for effective interventions and for setting the boundaries for the various discourses. Second, identifying, testing, and combining different formats that include experts, organized stakeholders, and non-organized citizens creates the deliberative space required for an effective and fair representation at the community level [181,235]. Additionally, there is a need to ensure that local communities have the capacity and resources to participate effectively in energy transitions, which may require targeted support and capacity-building initiatives. The emphasis here is on open and deliberative spaces created through physical and digital platforms. Evaluating and testing new co-creative formats, supported by digital technologies, further strengthens the quality and resilience of community discourses.

Third, to be effective in the energy transition and to handle conflicts constructively, those deliberative discourses require excellent facilitation, continuous support by the municipal administration, and professional input from experts on energy and discourse design [251]. In conclusion, hybrid governance represents a promising approach to energy transitions, offering a pathway to more sustainable, inclusive, and locally relevant energy policies. Ultimately, the overarching goal is to cultivate a creative conflict culture within the context of energy transitions; one that emphasizes inclusive and reflective problem-solving based on shared responsibility. Finally, effective communication channels between the various governance levels need to be established to ensure the exchange of ideas and plans among communities and between communities and higher levels of governance. By combining top-down directives with bottom-up participation, this governance style empowers communities to play a central role in the energy transition while aligning local actions with broader environmental and societal goals. Notwithstanding the fact that each governance level has its own policymaking institutions, the mediative style would require additional bridging capacity that provides financial resources and staff for linking each level to the next higher level. The examples from Scotland, Germany, and the Netherlands demonstrate the potential of hybrid governance to facilitate successful energy transitions that are both effective and equitable. Additional bureaucracy is not intended here but rather a re-orientation of existing administrative bodies to facilitate the crucial discourse between governance levels.

Specialized formats of participation, such as workshops with citizens and stakeholders, have proven effective in activating local communities for engagement in benefit-sharing projects. Such engagement contributes to distributive justice by fostering the wider inclusion of citizens and ensuring that the benefits and responsibilities of energy transition projects are equitably distributed among all affected parties, thereby enhancing the overall legitimacy and social acceptance of these initiatives.

Table 4 provides a synopsis of each of the four policy styles with the addition of the new mediative governance style developed here. The table may provide scholars and policymakers with a quick overview of the promises, merits, and shortcomings of each of the policy styles discussed.

Ultimately, referring to the four prototypes presented in Chapter 3, we can provide a detailed overview of how various governance styles can be integrated into the structures of participatory energy transitions. The *Classical Type of Public and Stakeholder Participation in Institutionalized Settings* closely corresponds with autocratic and adversarial governance. In this prototype, participation is primarily individual and driven by a functionalist and neoliberal concept aimed at improving decision quality through expert knowledge. Autocratic governance reflects limited participation with a top-down management strategy, while adversarial governance involves strong public participation but remains rooted in hierarchical structures where expert outsiders guide decision-making processes.

Table 4
Policy styles, participation opportunities, and energy transition actions.

Governance Type	Mode of Decision-Making and Government	Level of Participation	Aspirations for Energy Transitions	Participation in Energy Transitions	Mode of Legitimacy	Outcome Level of Actions
Autocratic Governance	Strong political leadership	Limited participation	Fewer aspirations for energy transitions	No participation in energy transitions	Trust	Outcome level of actions is limited through a lack of benefits for political leaders
Adversarial Governance	Two dominating parties	Strong public participation	Aspirations for energy transitions	Low level of participation in energy transitions	Persuasion	Outcome level of actions is limited through opposition and fear of losing public support
Collaborative Governance	Multi-stakeholder arrangements	Strong stakeholder participation	Aspirations for energy transitions	High level of participation in energy transitions for stakeholders	Responsiveness	High outcome level of actions is possible, but mostly limited to certain sectors
Reflective Governance	Joint decision-making process	Strong public participation and deliberation	High aspirations for energy transitions	High level of participation in energy transitions for the public	Consensus	Low outcome level of actions, but high level of process quality
Inclusive Governance	Direct participation process	Strong direct public participation	High aspirations for energy transitions	High level of participatory influence on energy transitions	Representation	High outcome level of actions is possible, but lack of coordination and comprehensive strategies is common
Mediative Governance	Scaling up issues: Delegating local representatives to the next governance level	Flexible and inclusive formats for stakeholder and public participation	Strong bottom-up participation in open spaces for deliberative discourse	Enables energy benefit-sharing for affected communities	Inclusion and horizontal as well as vertical governance integration	High outcome level of actions is aspired to achieve empowered energy communities

The *Discursive Type of Participation in Open Spaces* aligns with reflective governance, characterized by a focus on public debate and deliberation to achieve legitimate decision-making. This prototype embraces a postmodern concept of stakeholder involvement, encouraging variability, plurality, and the legitimacy of dissent. Reflective governance involves strong public participation, emphasizing a bottom-up approach where local knowledge and concerns for equity guide planning and implementation, with evolving objectives through constant dialogue between process and outcome.

The *Direct Type of Participation in Decision-Making* is best represented by inclusive governance, where strong direct public participation is achieved through voting and citizen assemblies. This prototype relies on an anthropological concept of involvement, engaging common sense as the ultimate arbiter in disputes and ensuring that all actors are included to discuss and resolve differences openly.

The *Community Type of Material and Collaborative Participation in Energy Projects* is aligned with collaborative governance, which features strong stakeholder participation and emphasizes self-governance by voluntary associations. This prototype is rooted in an emancipatory concept of involvement, empowering less privileged groups by ensuring equal access to material resources and using expert knowledge to address risks.

The newly proposed hybrid policy style that we called "mediative" bridges these prototypes by integrating elements of top-down and bottom-up approaches, and fostering community sovereignty while respecting global boundaries. It embodies characteristics of both reflective and inclusive governance, emphasizing decentralized decision-making and community empowerment. This style supports a synergy between local initiatives and broader policy frameworks, encouraging participatory processes that enhance agency and collaboration across different governance levels. The hybrid model aims to achieve a balance where local contexts inform energy transitions, and community-driven projects align with national and global sustainability goals.

6. Future prospects for energy governance and policy research

Based on our conceptualization of policy styles in energy transitions, we draw together here considerations and derivations for future energy governance research. Besides considering the specific aspects of participatory governance and policies, we take into account current challenges of democratic decision-making in energy transitions and related obstacles recently identified by social science research.

In the following, we first outline different energy governance and policy styles. Second, we examine the possible effects on democratic legitimacy through governance, and third, we consider some indications for research and limitations.

In Table 5, we have amalgamated the principal mechanisms of the five policy styles for energy governance and compiled their effects on democratic legitimacy. They are categorized following the four-class differentiation from Chapter 3 between the classical type of public and stakeholder participation in institutionalized settings, the discursive type of participation in open spaces – in this overview connected with the direct type of participation in decision-making capturing the reflective and inclusive governance styles – and the community type of material and collaborative participation in energy projects.

Using the input, output, and throughput dimensions of democratic legitimacy, we have formulated concrete questions and directions for social science research.

Taking current research studies into consideration, we see the most promising starting points for further research in three pursuits: deeper insights into participatory strategies of inclusive governance and collaborative planning [256]; a better understanding of modes of co-creation by inclusive, collaborative, and hybrid governance [257]; and a means of evaluating the degrees of legitimacy by participatory governance arrangements [258]. For future research on participation in

Table 5
Energy governance and policy styles: Effects on the three core principles of democratic legitimacy (adapted from [252–255]).

Prototypes of Participatory Energy Transitions	Energy Governance & Policy Styles	Effects on Democratic Legitimacy through Governance	Indications for Research
Classical Type of Public and Stakeholder Participation in Institutionalized Settings	**Autocratic and Adversarial Governance Styles** **Top-down National Energy Policy Principles**: Creating 'buy-in', regulation and supply shifts, led by aims and objectives, end-users, risk framing and trade-offs **Industries:** Carrots, sticks & tambourines, co-evolution of institutions and technology; upscaling strategies **Top-down Governance Style** Instruments of invited participation Hard paths for upscaling and governance	Due **Accountability** **Input legitimacy:** Who is accountable for the process for reaching decisions? How are interactions between the participatory process and representational institutions secured? **Throughput legitimacy:** How is feedback in the process between process interactions and the actors that are accountable arranged? **Output legitimacy:** Who is accountable for the final decision? How are representational institutions involved in the final decision-making stage?	**Input:** Formal authority of representative bodies and organized interfaces at the beginning *Influence on energy governance by setting the rules and configuration of governing bodies* **Throughput:** Arranged/ organized moments for providing feedback to formal representative institutions *Control of the energy governance decision-making process by influencing access and procedures* **Output:** Formal organized authority for decisions, actual involvement at the last stage *Using output legitimacy for justifying non-popular measurements*
Discursive Type of Participation in Open Spaces *Direct Type of Participation in Decision-Making*	**Reflective and Inclusive Governance Styles** **Bottom-up Mode in Energy Transitions: Involved Actors and Mechanisms** Regional governments Cities and communities Local firms Grassroots innovations & initiatives Niche innovation networks Diffusion of grassroots innovations Soft paths for upscaling and governance	Due **Deliberation** **Input legitimacy:** Is there equal access to information, debate, etc.? Are the procedures transparent, clear, and understandable? **Throughput legitimacy:** How are procedures applied during the process? Are actors satisfied with the transparency of the process? What is the quality of the debate? **Output legitimacy:** Are participants satisfied with the quality of the process? Are actors satisfied with the quality of the debate of the (end) proposal?	**Input:** Entry possibilities and limitations (and regulations regarding this), clear procedures *Competing strategies of actors for obtaining access and influence* **Throughput:** Satisfaction of actors with transparency, range of arguments brought forward (wide or narrow) *Feedback of actors and influence on designing procedures* **Output:** Overall satisfaction of actors with process, judgment of argumentation *Evaluation of the output/outcome and influence on revisions*

(*continued on next page*)

Table 5 (*continued*)

Prototypes of Participatory Energy Transitions	Energy Governance & Policy Styles	Effects on Democratic Legitimacy through Governance	Indications for Research
Community Type of Material and Collaborative Participation in Energy Projects	**Collaborative and Hybrid Governance Styles Socially Innovative Multi-actor Collaborations Supra-local governance & political framework:** networks, agendas, settings **Local governance & path dependencies:** Multi-actor collaboration regulations and precedents **Actors involved** (specific logics, agenda & resources) **Drivers for collaboration** (both individual and collective) **Collaboration dimensions** (hybrid governance, roles & stages) **Collaboration outcomes** (social innovation process & results)	Due **Voice Input legitimacy:** How is the involvement of stakeholders arranged at the beginning of the process? What are the depth and width of voice possibilities? **Throughput legitimacy:** What opportunities do actors have to participate in the actual process? **Output legitimacy:** In what way can participants' contributions be traced in decisions? Do the stakeholders involved support the decisions?	**Input:** Regulations on entry stakeholders, possible subjects stakeholders have a say about and level of decisions *Negotiating the regulations on the distribution of prioritization of voices* **Throughput:** Opportunities for voice (organized and invited) and actual participation (number of stakeholders and intensity of participation) *Practices of the creational power in procedures and negotiations* **Output:** Correspondence of proposals with ideas, satisfaction of stakeholders with result *Efforts to balance the influence on output/outcome in equal shares*

energy governance, it is important to unravel the local policy focus, characterize public support, and understand the governance approaches taken, including existing sub-national governance arrangements [255]. The examination of energy stakeholders involves the following promising directions:

a) *Unravelling energy governance and stakeholder participation* by revealing trends in privatization and municipalization, understanding public opinion on policy issues, identifying key actors supporting policy ideas, and exploring emerging visioning and governance processes.
b) *Discovering the nature of energy coalitions* by pursuing questions about policymaking structures, existing consensus in visioning or policymaking processes, and the openness of the policy system to new changes and ideas.
c) *Identifying the foundations of participation and constraints* in achieving the vision for energy transitions, meaning understanding the state of underutilized city resources, policy beliefs, municipal strategies, and fiscal resources shaping policymaking.
d) *Outlining impacts on/of policies* by identifying the institutional matters influencing policymaking, including resource allocation and appointments, and by outlining the main policy outputs and their impact.

Finally, we conclude with two remarks on the opportunities and limitations of discovering participatory policy styles in energy governance based on recent academic discourses in social energy research and the current challenges of democratic decision-making in energy transitions around the world.

First, we observe that siting energy infrastructure processes is paramount for a comprehensive understanding of how energy policy and participation may or may not work [259–264]. The support for energy infrastructure, including patterns of acceptance or rejection, is the most decisive question in implementing energy transition policies all over the world [265–269]. The lack of perceived legitimacy is deeply rooted in the complex interaction between local, national, and supranational politics and energy governance [270] on the one hand, and the place-based embeddedness of energy infrastructure on the other hand, from which follows the recognition of place attachment and place identity [271–274] as well as community engagement [275]. Second, what is consequently needed is a re-thinking of relationships between social scientists in the energy field and host communities, and thus a place-based reflexivity in research "to avoid extractive relations with host communities and promote contextually relevant and democratic processes in pursuit of a just transition", providing a "clearer understanding of place and positionality" [276,p.1]. We argue for a combination of investigating the local conditions (regional studies) and insights into democratic decision-making and procedural justice in energy transitions [277,278].

7. Conclusion: A call for a comprehensive energy governance research framework

This paper identifies a research gap when it comes to integrating the theoretical foundations of participation, understanding the contemporary discourses on governance styles, and synthesizing the perspectives from conceptual and empirical studies on public involvement in energy transitions. At the beginning of the paper, we emphasized the global importance of energy transitions in achieving climate neutrality and highlighted the development of experimental strategies, concepts, and formats by national governments, supranational institutions, and regional administrations. Collaborative, multi-actor governance arrangements, shaped by diverse stakeholders, were identified as promising attempts to foster new levels of public and stakeholder participation. Empirical research and theoretical studies of participatory practices have clearly demonstrated that stakeholder and public participation constitutes a promising approach for democratic sustainability transformations [6,63,74,162,180]. Based on this insight, we briefly discussed the efforts in the literature to link the traditional concepts of political legitimacy, environmental justice, energy democracy, and participation to the conditions of energy transitions. Different types of governance arrangements were introduced, reflecting a variety of political conditions, governance structures, and supranational constellations. Based on this review, we felt the need to create a new theoretical framework informed by political, social, psychological, economic, and spatial perspectives that promises to be better suited to capturing the complex relationship between governance, participation, and energy transitions.

To this end, we proposed to differentiate between five styles of democratic policymaking: autocratic, adversarial, collaborative, reflexive, and inclusive. These styles were briefly described and then applied to public participation in and for energy transitions. Each prototype has its strengths and limitations in the context of energy transitions. They are characterized by varying degrees of emphasis on public participation and deliberation (cf. Table 4). The classification in five governance types provides a comprehensive and inclusive approach to analyzing the role, function, and relevance of participation in the context of energy transitions. This classification is meant to offer a better analytical perspective for both research and practical applications.

The proposed classification distinguishes between bottom-up types (collaborative, inclusive, reflective) and top-down types (autocratic, adversarial). The top-down forms of governance seemed to be

inappropriate for promoting energy transitions and gaining public support for such policies. More appropriate are the bottom-up strategies. Each bottom-up type offers unique opportunities and conditions for participatory processes, with differences in the input, throughput, and output dimensions of legitimacy. However, challenges such as conflicts, protests, and opposition may hinder the effectiveness of participatory governance styles in the real world. We assume that while these prototypes exist as ideal types, real-world democracies often exhibit a mix of these policy styles.

In conclusion, we claim that none of the five styles of democratic governance is by itself capable of initiating an ambitious energy transition process. Autocratic and adversarial systems lack effective citizen participation, while collaborative systems may compromise ambitious policies and may lead to inconsistent decisions. Reflective systems may generate commitment but struggle with implementation, and inclusive systems are unpredictable based on actor preferences. There is a need for a hybrid governance model that combines collaboration with reflective and inclusive elements and takes spatial aspects into account. We therefore propose a new policy style that we have labeled "mediative." This style combines the benefits of the reflective and inclusive style and adds a spatial dimension. It places greatest emphasis on the community level and builds bridges between the municipal, regional, national, and EU governance levels. The objective here is to empower experts, stakeholders, and citizens to co-design their life worlds and to find creative and socially acceptable solutions for the energy transition [279].

Within the mediative policy style, we see a decisive need to combine top-down, climate target-influenced national energy policy with the local conditions in the course of implementing energy policies. The hard paths for upscaling and governance and the instruments of invited participation are necessary in certain ways; however, these policy instruments have to be stabilized through stronger democratic legitimacy. In this respect, we argue that in democratic methods of decision-making through participatory governance, due accountability, deliberation, and voice have to be anchored and set in motion by the four principles of mediative governance described above.

This implies a shift towards community-centric decision-making and towards bottom-up, innovative, and inclusive participation styles. Community-based initiatives are seen as key to unlocking more extensive inclusion, more diversity, and more intense collaboration [188]. Recognizing diverse perspectives, and co-creative participation and benefit-sharing are the two crucial elements for fostering recognition, procedural, and distributive justice. A mediative style of governance emphasizes the importance of navigating conflicts by using combinations of participation formats that provide open spaces for designing co-creative solutions and bringing citizens, experts, and stakeholders together. One possibility for reaching this objective is the establishment of both real-world and digital labs, and a synthesis of stakeholder round tables with citizen assemblies [236]. Overall, the aspiration is to implement a cooperative and creative participation culture capable of balancing democratic principles, ecological goals, and socially compatible solutions in the pursuit of a sustainable and harmonious energy transition.

While experiences with participation in energy transitions is a well-researched topic, we propose a stronger reconciliation with research insights from past decades, especially focusing on the local level [280] and the promises and dilemmas of participation in order to overcome the shortage of knowledge about best practices and potential pitfalls [61]. We agree with the assumption by Webler that in recent times, public participation is "challenged by loss of trust in institutions and individuals and by broad socio-political dynamics that are weakening democratic values and processes" [281,p.513]. He argues that "we need better theories and guidance for how to apply general knowledge to specific instances of public participation," and that we can build on a "rich repertoire of methods, a plentitude of case study reports, and a wealth of insights about the importance of openness, transparency, fairness, and competence" (ibid, p.514).

To meet these challenges of both discovering and, based on insights from research, enhancing democratic decision-making in terms of energy democracy and justice, we call for a much stronger focus in social science research on mediative components within the multifaceted outflows of governance arrangements in energy transitions. This enables both the discovery and the resolution of possible missing links between the different spaces and arenas of participation in energy transitions embedded within the diverse policy styles across the world in order to create new participatory procedures in the future. We identify a major future challenge in creating these approaches by finding policy responses to climate change adaption [282,283] and realizing energy communities based on participatory planning [77]. Effective public administration and governance go hand in hand with inclusive forms of participation [284], providing the specific opportunities required for participatory, associative, deliberative, and material citizen engagement in energy transitions. In the end, this could mean reconciling the bottom-up and top-down directions when it comes to managing and fostering energy participation by creating acceptance, addressing public perceptions, prioritizing civic engagement, incentivizing innovation, enhancing systemic coordination across sectors and levels, and acknowledging the causes of climate change and interrelated governance issues [253]. This remains the most decisive cornerstone of the democratic challenge in the societal transition to climate neutrality.

CRediT authorship contribution statement

Jörg Radtke: Writing – review & editing, Writing – original draft, Resources, Project administration, Methodology, Investigation, Conceptualization. **Ortwin Renn:** Writing – review & editing, Writing – original draft, Supervision, Resources, Methodology, Investigation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

No data was used for the research described in the article.

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