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Time Regimes of Renewable Deployment Administrative Community Ecological and Infrastructural Dynamics

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Abstract

Renewable energy deployment is commonly discussed as a matter of technologies, costs, and permitting, yet many decisive conflicts revolve around time: who must wait, whose risks accumulate during delay, and how future-oriented promises are made credible in the present. As projects proliferate, institutions confront competing temporal demands, including urgent decarbonization goals, long-lived landscape and ecological consequences, and the slow work of building durable consent. This paper develops a social science argument that transition outcomes depend on temporal governance, defined as the institutional production and management of timelines, sequences, and revision pathways that connect evidence, accountability, and legitimacy across the project lifecycle. The core contribution is a conceptual framework distinguishing four interacting time regimes in renewable deployment: administrative time, community time, ecological time, and infrastructural time. These regimes generate predictable friction when they are misaligned, producing procedural escalation, strategic delay, and crisis-driven policy shifts. Rather than treating delay as mere inefficiency, the paper treats time as a distributive and interpretive resource that shapes power, credibility, and the meaning of participation. Building on this framework, the paper specifies mechanisms through which institutions can convert time from a source of confrontation into a resource for learning, including staged commitments, scheduled review windows, bounded transparency practices, and revision rules that preserve standing after approval. The paper also identifies how intermediaries and narrative politics influence temporal governance, shaping what counts as sufficient evidence and when closure is legitimate. The analysis concludes with design implications for accelerating deployment while reducing legitimacy fragility, emphasizing that stable transitions require institutions to govern not only projects, but the temporal relations through which projects become socially durable.

Time Regimes and Institutional Friction in Energy Transitions Across Administrative Community Ecological and Infrastructural Domains

1. Introduction

Renewable energy transitions are increasingly governed by conflicts that are not reducible to yes-or-no questions about individual projects [1]. Many disputes instead concern when decisions are made, how long uncertainty persists, and whether commitments are reversible or adaptive. The politics of renewable deployment therefore often hinge on temporal experiences: communities describe being rushed through consultation windows while bearing long-term consequences; developers describe being trapped in open-ended review cycles that threaten financing and contractual obligations; authorities describe facing incompatible expectations to be both fast and thorough; and civil society actors describe learning too late that monitoring and enforcement are weaker than promised. These temporal experiences matter because they shape whether actors interpret governance as fair, trustworthy, and capable of learning.

This paper argues that time is a central, undertheorized dimension of renewable governance. In everyday policy discourse, "time" often appears as a neutral measure of efficiency, expressed through queue backlogs, months-to-permit, or years-to-connection [2]. In social experience, time is neither neutral nor merely quantitative. Time is distributive because delays and accelerations allocate costs and risks unevenly. Time is interpretive because the timing of evidence and the sequencing of decisions shape what actors can plausibly claim, contest, or demand. Time is institutional because agencies, courts, markets, and infrastructures impose distinct temporal logics that interact unevenly. When these temporal logics are misaligned, conflict intensifies and governance becomes brittle, often responding through procedural expansion, ad hoc exceptions, or abrupt policy shifts rather than through sta-

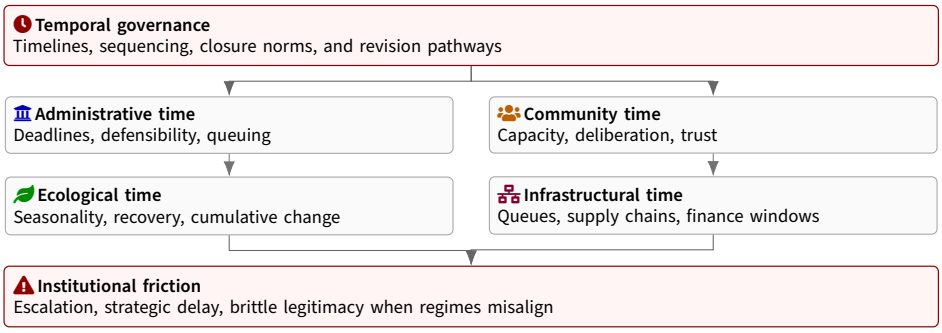


Figure 1. Framework: renewable deployment is shaped by how institutions coordinate four time regimes. Misalignment produces predictable friction; robust temporal governance specifies sequencing, closure conditions, and credible revision pathways.

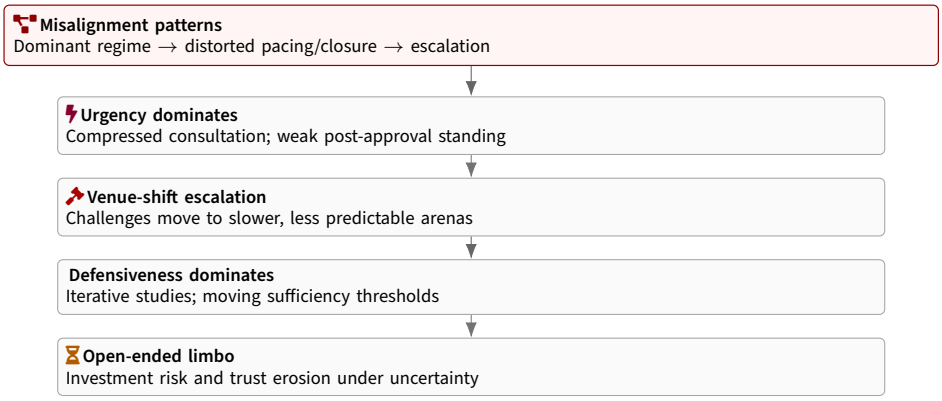


Figure 2. Common failure modes: acceleration that forecloses standing often triggers legal/political escalation, while defensive procedure can create limbo. Both dynamics intensify when closure and revision rules are unclear.

ble learning [3].

The central concept advanced here is temporal governance: the institutional production, coordination, and justification of timelines, sequences, and revision pathways that structure how renewable projects become authorized, constructed, operated, monitored, and adjusted. Temporal governance includes formal artifacts, such as statutory deadlines, consultation periods, and monitoring schedules, but it also includes informal practices, such as when authorities consider concerns "too late," how developers stage disclosures, and how communities mobilize around moments of perceived closure. Temporal governance is therefore a practical site where legitimacy is produced or eroded. When stakeholders believe that time is being used strategically to foreclose participation or evade accountability, they respond through escalation, including litigation, political mobilization, and demands for categorical bans. When stakeholders believe that time is governed fairly and that revision remains possible under credible rules, they are more likely to accept compromise under uncertainty [4].

The paper's goal is not to romanticize deliberation or to imply that more time always yields better outcomes. In many contexts, slow permitting and uncertain timelines create real harms, including slowed decarbonization, higher energy costs, and foregone resilience benefits. The argument is instead that acceleration strategies that ignore temporal governance often backfire, because they treat time as an administrative throughput problem rather than as a legitimacy condition. Efforts to shorten procedures without strengthening the credibility of post-approval accountability can produce opposition that reintroduces delay through courts and politics. Conversely, efforts to increase scrutiny without clarifying revision rules can produce indefinite limbo that erodes investment and trust alike. Temporal governance provides a way to diagnose why these patterns recur and how institutions might redesign processes to reduce both delay and conflict [5].

The analysis proceeds from a broad thesis: renewable transitions require institutions that can close decisions while keeping consent and accountability alive over time. Closure is necessary because infrastructures must be built, and interminable contestation is not a workable governance mode. Yet closure that is experienced as irreversible under uncertainty is a recipe for resistance, because affected publics rationally seek leverage before it disappears. Temporal governance there-

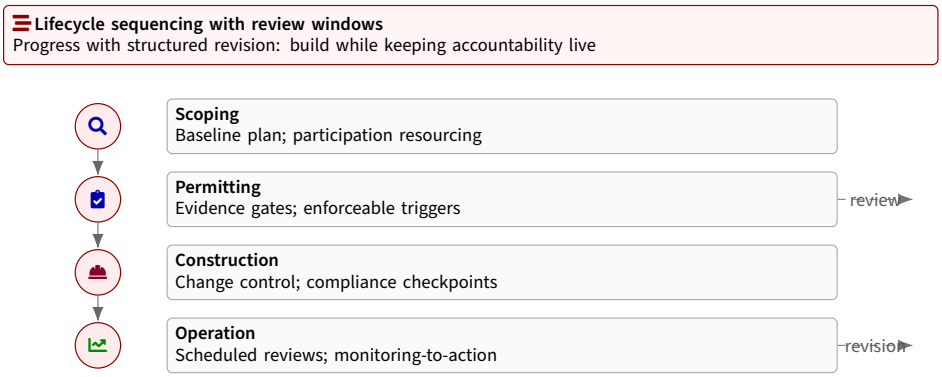


Figure 3. Lifecycle design: staged closure separates "permission to build" from "permission to drift." Review windows and revision rules turn monitoring into legitimate adjustment rather than a contested afterthought.

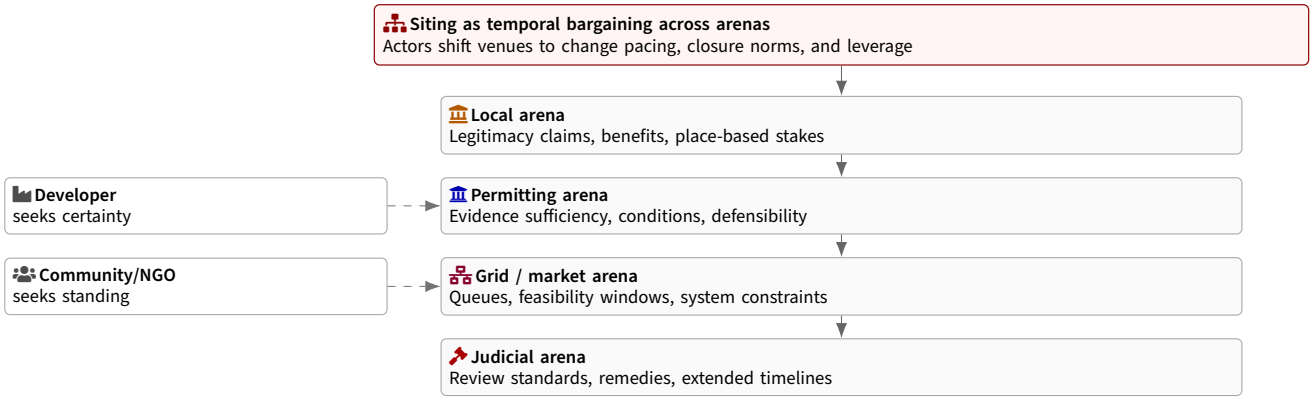


Figure 4. Multi-arena governance: "streamlining" in one venue can trigger slower, less controllable timelines elsewhere. Stable temporal governance clarifies where issues must be raised and how standing persists after approval.

fore requires mechanisms that separate "permission to build" from "permission to drift," allowing projects to proceed while preserving structured standing for review and adjustment when evidence warrants it. This orientation reframes the role of monitoring and adaptive management [6]. Monitoring is not simply compliance; it is an institutional promise that time will remain a site of accountability rather than a one-way transfer of power.

To develop this argument, the paper adopts a social science stance that treats institutions as producers of temporal order. It draws on interpretive policy analysis and institutional sociology rather than on technical modeling. The contribution is conceptual and design-oriented: it articulates a typology of time regimes in renewable deployment, identifies typical misalignments and their conflict dynamics, and proposes institutional mechanisms for aligning time regimes without demanding unrealistic consensus. The paper is written to be applicable across technologies and jurisdictions, focusing on recurring patterns rather than on any single national case [7].

The following section introduces the paper's conceptual framework of interacting time regimes and explains why their misalignment produces legitimacy fragility. The subsequent section clarifies the methodological orientation, emphasizing how temporal governance can be studied as a practical accomplishment rather than as a formal schedule. The next section analyzes siting and deployment as temporal bargaining across governance arenas. The subsequent section examines delegation and evidence production, highlighting how intermediary roles shape the credibility and timing of knowledge. The next section examines narrative politics and the construction of regulatory meaning, emphasizing how urgency and uncertainty are framed over time. The final body section offers institutional design implications for durable temporal governance, focusing on staged commitments, review windows, and revision rules that preserve standing after approval [8]. The conclusion summarizes the argument and identifies limits and research directions.

2. A Framework of Time Regimes in Renewable Deployment

Temporal governance is difficult because renewable deployment is structured by multiple time regimes that are partially incompatible. A time regime is a patterned way in which an institution or social group or-

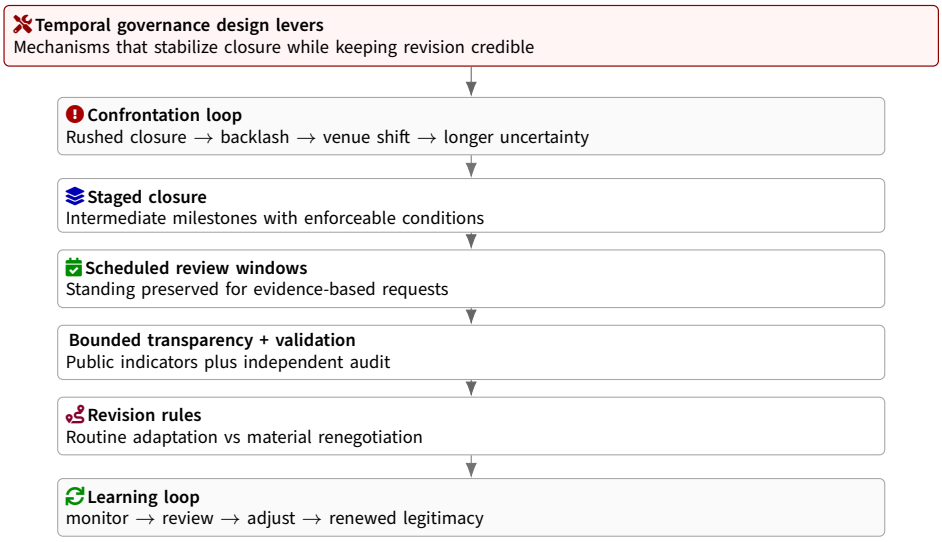


Figure 5. Design implications: durable acceleration comes from clear closure-and-revision contracts. Staged commitments, review windows, validation practices, and revision rules reduce incentives for all-or-nothing conflict while preserving accountability over time.

Table 1. Core time regimes structuring renewable energy deployment.

Time regime	Core focus	Typical metrics & cues
Administrative time	Procedural completeness and legal defensibility	Queue length, days-to-permit, number of consultation rounds, backlog statistics
Community time	Lived experience, learning, and organization capacity	Meeting frequency, volunteer hours, turnout at hearings, perceived rushedness
Ecological time	Seasonal dynamics and cumulative landscape change	Breeding/migration windows, recovery periods, long-term trend indicators
Infrastructural time	System needs, finance, and path-dependent build-out	Connection queue, construction seasons, PPA timelines, reliability indicators

ganizes expectations about sequence, duration, closure, and revision. Time regimes are not simply calendars. They are norms and constraints about what must happen before what, what counts as timely, what counts as too late, and what constitutes legitimate closure [9]. In renewable deployment, at least four time regimes are especially consequential: administrative time, community time, ecological time, and infrastructural time. These regimes interact continuously, and conflict often emerges when one regime dominates others without a credible translation mechanism.

Administrative time is the time regime of agencies and formal procedures. It includes application windows, statutory deadlines, consultation periods, and the sequencing of approvals. Administrative time is oriented toward legibility and defensibility: it structures decisions in ways that can be justified in audits and courts [10]. Yet administrative time is also vulnerable to overload and to defensive expansion. When authorities anticipate challenge or lack confidence in evidence, they may add steps, request additional studies, or reopen issues, producing delay that appears arbitrary to applicants. Administrative time therefore often oscillates between rigidity and improvisation, especially under political pressure to accelerate.

Community time is the time regime of affected publics and local institutions. It includes seasonal rhythms, livelihood cycles, and lived experience of place, as well as the time required to learn, deliberate, and organize. Community time is often slower than administrative time in the sense that building understanding and trust is laborious, especially when technical documents are dense and when participation is unpaid [11]. Yet community time can also be rapid when mobilization is

Table 2. Recurrent misalignment patterns between time regimes and their governance consequences.

Dominant regime	Suppressed regime(s)	Typical friction	Illustrative outcome
Infrastructural urgency	Community, ecological	Compressed consultation, contested impact claims	Legal challenges, reputational backlash, moratoria
Administrative defensiveness	Infrastructural, community	Procedural expansion, moving evidentiary targets	Open-ended limbo, investment withdrawal
Community mobilization	Infrastructural	Escalation across arenas, politicization of siting	Project cancellation or categorical bans
Ecological precaution	Infrastructural, community	Demand for extensive baselines and mitigation	Perceived paralysis, shift to other regions or technologies

Table 3. Key empirical dimensions for studying temporal governance as institutional practice.

Governance dimension	Guiding question	Indicative observations
Sequencing of decisions	What must happen before what?	Order of siting, assessment, consultation, benefit agreements, and grid commitments
Duration and pacing	How fast must actors respond?	Length of comment windows, document volume, response expectations for unpaid publics
Closure norms	When is an issue considered settled?	Rules on late evidence, doctrines about raising concerns "in time"
Revision pathways	How can decisions change after approval?	Existence of adaptive clauses, amendment procedures, enforcement escalations
Justifications and narratives	How are timelines framed as reasonable?	Use of urgency, precaution, and fairness stories in documents and hearings

triggered by perceived threats or disrespect. Community time is deeply shaped by asymmetry: developers and authorities have paid staff, while communities rely on volunteers. When processes presume that communities can respond quickly and continuously, participation becomes unequal and legitimacy erodes.

Ecological time is the time regime of landscapes, species, and cumulative change. It includes seasonal migration, breeding cycles, habitat recovery periods, and the slow accumulation of disturbance [12]. Ecological time often exceeds political and administrative cycles, which makes it easy for short-horizon decision processes to discount long-horizon ecological uncertainty. Ecological time is also nonstationary: climate change alters baselines and variability, making past patterns less reliable guides. This nonstationarity complicates "once-and-for-all" impact claims, because the ecological meaning of a project can change as conditions shift and as cumulative impacts emerge.

Infrastructural time is the time regime of grids, supply chains, and finance. It includes connection queue dynamics, construction seasons, contractual deadlines, depreciation horizons, and the timing of system needs [13]. Infrastructural time is often characterized by path dependence: delays can cascade because they miss windows for equipment, labor, or interconnection capacity. Infrastructural time also includes urgency narratives driven by decarbonization targets and reliability pressures. These narratives can be empirically grounded, yet they also function politically by shaping what tradeoffs appear acceptable and how much uncertainty is tolerated.

Misalignment among these time regimes produces predictable legitimacy dynamics. When infrastructural

Table 4. Siting conflicts as temporal bargaining across multiple governance arenas.

Arena	Primary authority	Time logic	Common temporal tactic
Permitting administration	Specialised agencies	Deadline-driven, file-based	Consolidate approvals, invoke statutory clocks
Environmental assessment	Environmental authorities, expert panels	Precaution, completeness of evidence	Request additional studies, extend review
Municipal and regional politics	Local councils, planning boards	Electoral cycles, local salience peaks	Delay votes, add conditions, seek compromises
Grid and market operation	TSOs/ISOs, regulators	System adequacy and investment cycles	Queue management, staged connection dates
Courts and tribunals	Judiciary, quasi-judicial bodies	Case calendars, precedent building	Seek injunctions, challenge timeliness or sufficiency

Table 5. Delegated intermediaries and how they reshape the timing and credibility of knowledge.

Intermediary role	Main function	Temporal risk
Impact assessment consultants	Produce baseline and impact studies for applications	Evidence arrives late, perceived alignment with developers undermines trust
Monitoring contractors	Collect operational and ecological data post-approval	Reporting lags, weak triggers from exceedances to corrective action
Technical advisors to authorities	Translate complex findings for decision-makers	Bottlenecks and review delays if capacity is thin
Community experts and NGOs	Interpret documents for affected publics	Overload and burnout, limited availability during compressed windows
Independent auditors or reviewers	Validate key claims and methods	Activated only at crisis points rather than embedded in routine cycles

urgency dominates, consultation can be compressed and ecological uncertainty discounted, producing resistance that reintroduces delay through political and legal means. When administrative defensiveness dominates, iterative study requests can create open-ended limbo that undermines both investment and trust [14]. When community time dominates without closure mechanisms, decisions can stall indefinitely, producing frustration and politicization from other actors. When ecological time is treated as an absolute veto without governance mechanisms for learning and adaptation, compromise becomes difficult even when mitigations might reduce risk.

Temporal governance failures are not merely the sum of these misalignments; they are also produced by how institutions translate between regimes. Translation mechanisms include staged approvals, adaptive management commitments, monitoring schedules, and the rules by which evidence can reopen decisions. When translation mechanisms are weak, actors interpret misalignment as bad faith [15]. Developers interpret delay as politicized obstruction; communities interpret acceleration as capture; authorities interpret contestation as unreasonable; environmental actors interpret compromise as disregard for irreversible loss. These interpretations harden positions, making subsequent negotiation more difficult.

The framework proposed here emphasizes that temporal governance is distributive. Time is not only a constraint; it is a resource that can be allocated. Authorities can allocate time by deciding how long consultation runs, how quickly evidence must be produced, and how often review occurs [16]. Developers allocate time by deciding when to disclose information and how

Table 6. Competing narratives that shape what counts as reasonable timelines in deployment conflicts.

Narrative	Core claim	Temporal implication	Risk if dominant
Climate urgency	Delays threaten targets and system reliability	Compress procedures, accept higher upfront uncertainty	Backlash, legal reversal, perception of bypassed accountability
Precautionary protection	Irreversible ecological harm demands caution	Extend assessments, require extensive baselines	Perceived paralysis, shift of projects to less regulated spaces
Participation fairness	Decisions must reflect informed local consent	Lengthen deliberation, resource engagement	Fatigue, capture by well-resourced voices if support is weak
Administrative legality	Rule-following ensures defensibility	Focus on checklists and deadlines	Proceduralism without substantive learning, defensive delay

Table 7. Illustrative temporal governance mechanisms and the problems they aim to prevent.

Mechanism	Primary purpose	Key temporal feature	If absent
Staged closure	Separate phases of authorization	Multiple decision points with distinct meanings	High-stakes frontloading, maximalist early conflict
Scheduled review windows	Keep consent and accountability alive	Regularized post-approval assessment moments	Standing perceived to vanish once permits are granted
Revision rules hierarchy	Differentiate minor and major changes	Predefined categories and triggers	Each adjustment feels like reopening the whole project
Bounded transparency & validation	Support trust in delegated knowledge	Timely summaries plus independent checks	Data disputes erupt late, accusations of withholding
Participation resourcing	Enable equitable engagement	Time and expertise funded for publics	Unequal ability to respond within compressed timelines

much time they give communities to respond. Communities allocate time by deciding when to mobilize and when to negotiate. These allocations create winners and losers. For example, fast timelines may advantage actors with resources and legal teams, while disadvantaging volunteer publics. Conversely, prolonged uncertainty may advantage actors who can wait and absorb costs, while disadvantaging actors whose viability depends on timely decisions. Recognizing time as distributive clarifies why debates about timelines are not only administrative but also political [17].

The framework also emphasizes that temporal governance is interpretive. The meaning of evidence depends on when it is produced relative to decision points. Baseline studies produced early can be questioned later as conditions change. Monitoring data produced after approval can be dismissed as irrelevant if revision pathways are unclear. Conversely, late-breaking concerns can be dismissed as untimely even if they are substantively important [18]. Institutions therefore continuously manage temporal legitimacy by deciding what counts as timely evidence and when it is too late to raise issues. These decisions can be justified, but they must be predictable and fair to avoid appearing arbitrary.

A further implication is that temporal governance is relational. It is not solely about schedules; it is about the relationship between closure and revision. In long-lived infrastructure, closure without revision is often experienced as coercive under uncertainty, while revision without closure is experienced as paralysis [19]. Temporal governance must therefore specify how clo-

Table 8. Example of staged closure across the lifecycle of a renewable energy project.

Phase	Decision scope	Main evidence	Revision opportunities
Exploratory / access phase	Preliminary site use, surveys, and community contact	Initial constraints mapping, early ecological scans, local knowledge	High: layout, footprint, and even site can still change
Construction authorization	Civil works and major infrastructure build-out	Completed assessments, negotiated conditions, mitigation plans	Moderate: operational constraints, layout refinements, safeguards
Operational authorization	Full operation under specified conditions	Commissioning tests, monitoring systems in place, compliance checks	Ongoing: periodic review windows with defined triggers
Decommissioning and repowering	End-of-life and future use decisions	Legacy impact data, technology options, community preferences	Potentially high: pathways for repowering or restoration

Table 9. Illustrative revision rule categories linking evidence to participation and action.

Revision category	Triggering evidence	Participation requirements	Typical responses
Routine adjustment	Minor deviations within agreed ranges	Notification plus brief comment opportunity	Operational fine-tuning, updated monitoring protocols
Targeted mitigation change	Localized exceedances or hotspot impacts	Consultation with affected stakeholders, expert review	New curtailment rules, habitat measures, timing adjustments
Material project modification	Substantial footprint or output change	Formal public process, expanded assessment	Permit amendment, rebalancing of benefits and burdens
System-scale or cumulative concern	Evidence of corridor-wide or systemic effects	Multi-stakeholder forums, higher-level authorities involved	Corridor plans, caps, or strategic re-siting decisions

sure and revision are balanced across the lifecycle. This balance is not a technical optimum; it is a governance settlement. Yet institutions can make settlements more stable by specifying revision rules ex ante and by maintaining evidentiary practices that make revision legitimate when it occurs.

This conceptual framework provides a lens for analyzing renewable deployment conflicts not as isolated disputes but as recurring tensions among time regimes. The next section clarifies how such tensions can be studied and how "time" becomes observable in institutional practice.

3. Methodological Orientation: Studying Temporal Governance as Practice

A social science analysis of temporal governance does not require a single country case to be useful, but it does require clarity about what is being observed [20]. Temporal governance becomes visible in the practical work of institutions and actors: how meetings are scheduled, how deadlines are enforced, how evidence is commissioned, how delays are justified, how participation is organized, and how revisions are negotiated. The methodological orientation adopted here is interpretive and institutional. It treats documents, procedures, and public statements as artifacts through which actors construct temporal legitimacy, rather than as neutral representations of objective constraints.

First, temporal governance can be studied through sequencing. Sequencing refers to the ordering of decision points and the points at which issues become settled or reopened [21]. In renewable deployment, sequencing includes when site selection is fixed relative to ecological assessment, when community consultation occurs relative to design finalization, when benefit agreements are negotiated relative to approval, and

when monitoring and enforcement responsibilities are specified relative to construction. Sequencing choices are consequential because they shape what is negotiable and what is foreclosed. For example, consultation that occurs after design is effectively fixed can be experienced as performative even if it meets formal requirements. Conversely, early consultation without credible post-approval standing can be experienced as inadequate because communities anticipate drift.

Second, temporal governance can be studied through duration and pacing [22]. Duration is how long steps take; pacing is how quickly actors are expected to respond. Institutions often measure duration, but pacing is equally important because it affects participation equality. Pacing is visible in comment windows, document volumes, meeting schedules, and the responsiveness expected from volunteer publics. Pacing also appears in how quickly developers are expected to respond to agency requests and how quickly agencies are expected to respond to applications. When pacing is misaligned with actor capacity, legitimacy suffers. Communities may feel rushed; agencies may feel overwhelmed; developers may feel trapped by moving targets [23].

Third, temporal governance can be studied through closure norms. Closure norms specify when a matter is considered settled. They are visible in doctrines such as "issues must be raised during consultation" and in institutional practices such as refusing to consider late evidence. Closure norms can protect decisionability, but they can also suppress legitimate concerns when evidence emerges late or when stakeholders lacked capacity to participate earlier. Closure norms are therefore central to legitimacy because they determine whether participation has real consequences [24].

Fourth, temporal governance can be studied through revision pathways. Revision pathways specify how decisions can change after approval. They include adaptive management clauses, permit amendment procedures, enforcement escalation, and monitoring-triggered reviews. Revision pathways are critical because long-lived infrastructure inevitably confronts new evidence and new conditions. Yet revision pathways can be experienced as either credible safeguards or as empty promises depending on how they are structured [25]. Credibility depends on who has standing to trigger review, how evidence is validated, what actions are available, and whether authorities have capacity and willingness to enforce.

Fifth, temporal governance can be studied through justifications and narratives. When time regimes conflict, actors justify their preferred timelines. Developers invoke urgency and opportunity costs; communities invoke deliberation and precaution; environmental actors invoke irreversibility; authorities invoke legality and capacity constraints. These justifications are not mere rhetoric; they are strategies for shaping what counts as reasonable time [26]. Studying these narratives reveals how temporal legitimacy is constructed and contested.

This methodological orientation also recognizes that temporal governance is shaped by asymmetries in expertise, resources, and endurance. Some actors can persist through long processes; others cannot. Volunteer burnout is a temporal phenomenon that affects participation. Financing constraints are temporal phenomena that affect developer strategy. Administrative backlog is a temporal phenomenon that affects agency behavior [27]. A social science account treats these as constitutive of governance outcomes rather than as background constraints.

The aim of this orientation is not to adjudicate which time regime is correct. The aim is to show how institutions can reduce destructive temporal conflict by designing translation mechanisms and by making closure and revision rules intelligible and predictable. With this orientation in place, the analysis turns to how siting conflicts are structured as temporal bargaining across multiple arenas.

4. Siting as Temporal Bargaining Across Governance Arenas

Renewable deployment is rarely governed by a single arena [28]. Decisions are distributed across permitting bodies, environmental authorities, municipal politics, grid operators, market regulators, and sometimes courts. Each arena has its own time regime, and actors move strategically across arenas to gain leverage. Siting conflicts can therefore be understood as temporal bargaining: actors negotiate not only substantive outcomes but also the timing and sequencing of decisions, the moments of closure, and the conditions under which issues can be reopened.

A key feature of temporal bargaining is that actors often seek to shift decisions into arenas with more favorable time regimes. Developers may seek fast-track procedures, administrative consolidation, or statutory deadlines to reduce uncertainty [29]. Communities and NGOs may seek judicial review or political escalation, which can slow decisions but also create opportunities for leverage. Authorities may seek to defer controversial decisions through additional study requests, buying time to reduce political risk. These moves are not necessarily cynical; they can be rational responses to institutional incentives. Yet they can produce instability because they create cycles of acceleration and deceleration rather than stable timelines.

Negotiation across arenas also produces interpretive drift: the meaning of a commitment can change as it moves from one arena to another. A local compromise about operational limits may be reinterpreted in a grid arena as infeasible under reliability constraints [30]. A national policy about rapid deployment may

be reinterpreted locally as a mandate that overrides place-based concerns. A monitoring plan negotiated in an environmental arena may be reinterpreted in an administrative arena as sufficient even if communities see it as weak. Drift occurs because arenas use different languages and standards of proof. Temporal governance must therefore address not only timing but translation of meaning across institutional boundaries.

Social science analyses of renewable policy emphasize that deployment outcomes are constructed through negotiation across interconnected arenas, where tradeoffs and authority relations are repeatedly renegotiated rather than simply implemented from top-down policy [31]. This perspective is crucial for temporal governance because it shows why "streamlining" in one arena can intensify contestation in another [32]. For example, compressing consultation in a permitting arena may increase the probability of legal challenge, shifting the decision into judicial time. Judicial time is often slower and less predictable, which can create more delay than the original consultation would have. Similarly, expanding environmental assessment requirements without clarifying revision rules can shift contestation into political arenas where categorical opposition becomes more likely, again increasing uncertainty.

Temporal bargaining is also shaped by the lifecycle structure of renewable projects. Early stages involve high uncertainty and high malleability [33]. Later stages involve sunk costs and reduced malleability. Actors therefore fight hardest at moments when leverage is high. Communities may oppose early because they anticipate that later standing will be weak. Developers may seek early closure because they anticipate that later revisions will threaten investment. Authorities may seek early closure to demonstrate progress, yet later face legitimacy problems if monitoring reveals unexpected impacts. Temporal governance mechanisms that preserve structured standing after approval can change these incentives by reducing the need to win everything early [34].

Cumulative impacts intensify temporal bargaining. When multiple projects are proposed, stakeholders may perceive that approving one project sets precedents and reduces capacity to resist others. This perception makes early opposition more intense. Developers may interpret this as irrational obstruction, but it is often a rational response to uncertainty about corridor-level governance. If no institution credibly governs cumulative impacts over time, communities may treat each project as a decisive battle [35]. Temporal governance mechanisms that create corridor-level review rhythms and cumulative monitoring can reduce this dynamic by demonstrating that approval does not foreclose future correction.

Temporal bargaining also involves strategic use of evidence timing. Developers may commission studies that support approval and present them when decisions are imminent, limiting time for critique. Opponents may introduce counter-evidence late to force delays. Authorities may request additional evidence late, extending processes [36]. These timing strategies can be viewed as tactical, but they also reflect institutional uncertainty about what evidence is sufficient. If evidence sufficiency standards are unclear, actors will test boundaries through timing. Temporal governance can reduce this by specifying evidence expectations and by creating predictable windows for critique and revision.

Importantly, temporal bargaining is not only about delay. It is also about the legitimacy of acceleration. Some communities may accept faster timelines if they believe accountability and revision remain credible [37]. Conversely, they may reject slow processes if they believe slowness is used to exhaust participation. Temporal governance therefore requires attention to participation capacity and to the durability of standing. If standing ends at approval, acceleration appears coercive. If standing persists through structured review, acceleration can be legitimate because it is coupled to ongoing accountability.

This section has emphasized that siting conflicts are temporal bargaining processes across arenas [38]. The next section examines how delegation to intermediaries shapes temporal governance by affecting when evidence is produced, who controls interpretation, and how credible revision is.

5. Intermediaries, Delegation, and the Timing of Credible Knowledge

Evidence infrastructures rely heavily on intermediaries, including consultants who produce assessments, contractors who conduct monitoring, and advisors who translate technical content for decision bodies. Delegation is often necessary given limited public capacity and specialized expertise. Yet delegation reshapes temporal governance because it affects when knowledge is produced, how quickly it can be validated, and whether stakeholders trust its timing and framing.

Delegation changes the pace of governance [39]. Consultants can accelerate evidence production by providing staffing and standardized methods, but they can also slow decisions when their outputs are contested and require independent review. Delegation can create bottlenecks when specialized firms are scarce and when multiple projects compete for the same expertise. It can also produce synchronization problems: monitoring data may be produced on schedules that do not align with decision timelines, making it difficult to use in time-sensitive disputes. When these timing mismatches occur, stakeholders often interpret them through lenses of trust: communities may suspect that inconvenient data is delayed; developers may suspect that review is slowed strategically.

Delegation also changes closure and revision dynamics. When evidence is produced by developer-funded intermediaries, authorities may accept it procedurally while communities remain skeptical, leading to post-approval disputes [40]. When monitoring is conducted by contractor networks, communities may doubt that exceedances will be reported promptly, making adaptive management commitments seem weak. These doubts affect temporal bargaining because they increase the perceived necessity of pre-approval leverage. If post-approval knowledge is not trusted, communities will resist approval more strongly.

A broader governance concern is that privatization can shift power and reduce transparency. Analyses of delegated governance emphasize that outsourcing compliance-related functions can expand capacity and efficiency while creating risks of dependence, conflicts of interest, and diminished public oversight, motivating stronger auditing and safeguards [41]. In renewable deployment, this concern is not abstract [42]. When consultants become repeat players whose business depends on developer contracts, their methods may subtly align with developer interests even without deliberate bias. When authorities rely on those methods due to capacity constraints, procedural legitimacy may be maintained while substantive legitimacy erodes. The erosion occurs because affected publics evaluate not only whether a method is professional, but whether it is independent and contestable.

Intermediary roles also shape the temporality of learning. Adaptive management requires that monitoring produces timely signals and that institutions can act on those signals [43]. If monitoring results are filtered through intermediaries and reported in annual summaries, the time lag may be too long to sustain credibility. Communities may experience adaptive management as deferral rather than as protection. Conversely, if intermediaries report frequently but without clear triggers for action, communities may experience monitoring as noise rather than as accountability. Temporal governance therefore requires that intermediary outputs are embedded in revision rules that specify how quickly issues are reviewed and what actions follow.

Delegation can also contribute to the hardening of regulatory stances over time. When conflict persists and evidence credibility remains contested, authorities may respond by increasing scrutiny, requesting more studies, or adopting more oppositional positions, partly to protect their legitimacy in the face of public distrust [44]. In some contested settings, environmental authorities have been observed to incorporate local concerns into formal positions, contributing to more resolute opposition and more intense scrutiny of certain wind proposals [45]. Regardless of whether one views such shifts as justified precaution or as obstruction, they illustrate a temporal dynamic: legitimacy pressures can accumulate and eventually reshape institutional posture. Delegation that fails to produce trusted evidence can accelerate this accumulation by leaving authorities exposed to accusations of capture or negligence. Temporal governance must therefore treat evidence credibility as a preventive legitimacy strategy, not only as a compliance detail.

The section's core implication is that delegation is not merely an efficiency choice; it is a temporal governance choice. Institutions can improve temporal governance under delegation by clarifying intermediary mandates, separating roles, and strengthening contestability [46]. For example, authorities can require that key evidentiary claims are validated by independent reviewers at defined stages, reducing the likelihood that skepticism erupts only at the end. Authorities can create shared funding mechanisms for certain monitoring functions, reducing the appearance that developers control knowledge. Authorities can standardize reporting formats and schedules to align monitoring with review windows, reducing timing mismatches. Authorities can also invest in internal capacity to interpret evidence, reducing dependence on intermediaries for meaning-making.

These steps are not guaranteed to remove conflict, but they can reduce the temporal amplification of mistrust [47]. When evidence timing is predictable and validation pathways are credible, communities can accept staged decision-making more readily, and developers can accept review without fearing indefinite limbo. The next section turns to how narratives of urgency and uncertainty shape temporal governance by influencing what counts as reasonable time and legitimate closure.

6. Urgency Narratives, Regulatory Meaning, and the Social Construction of Timelines

Timelines are not only set by laws and project plans; they are also justified through narratives that frame what is urgent, what is risky, and what is reasonable. In renewable deployment, urgency narratives often invoke climate targets, energy security, cost trajectories, and reliability needs. Precaution narratives invoke irreversibility of ecological loss, cumulative impacts, and the history of broken promises. Participation narratives invoke democratic standing and fairness [48]. These narratives compete and interact, shaping how institutions interpret evidence and how they decide when closure is legitimate.

Narratives matter because temporal governance often involves discretionary judgments. Even where statutory deadlines exist, authorities interpret what constitutes sufficient evidence, whether additional studies are necessary, and whether concerns are timely. Courts interpret whether procedures were adequate. Political leaders interpret whether acceleration is jus-

tified [49]. These interpretations are shaped by narratives, which provide moral and political reasons for prioritizing certain time regimes. A climate urgency narrative may justify compressing consultation and accepting uncertainty. A precaution narrative may justify extending study and delaying approval. A fairness narrative may justify longer deliberation or stronger benefit arrangements. Because these narratives are not commensurable, institutions must construct compromise timelines that are socially acceptable, not merely administratively feasible [50].

The construction of compromise timelines is influenced by strategic communication. Actors do not merely express sincere beliefs; they also frame arguments to gain advantage under uncertainty. Developers may frame projects as aligned with public goods, emphasizing decarbonization and jobs, and may present mitigations as sufficient to reduce the need for delay. Opponents may frame projects as emblematic of broader injustices, emphasizing place identity and cumulative harm, and may argue that urgency is being used to bypass accountability. Authorities may frame decisions as balanced, emphasizing procedure and expert evidence [51]. These framings shape what evidence is demanded and how quickly decisions are expected.

A useful analytic lens is that regulatory meaning is socially produced through interaction. When rules are ambiguous or evolving, actors attempt to stabilize meaning in ways favorable to their interests and values. Research on pitching to regulators describes how actors strategically frame feasibility, value, and societal relevance to reduce regulatory uncertainty and shape regulatory responses [52]. In renewable deployment, analogous pitching occurs when developers propose fast-track pathways, argue for particular interpretations of mitigation sufficiency, or advocate for adaptive management as a reason to approve now. Communities and NGOs also pitch, advocating for stricter interpretations and for precautionary timelines. The result is that timelines become contested not only because of objective constraints, but because the meaning of "sufficient" and "too slow" is negotiated [53].

This negotiation can produce two temporal pathologies. One pathology is crisis acceleration: after a political shock or a reliability incident, urgency narratives dominate and institutions compress procedures, creating decisions that later face legitimacy challenges and legal reversal. Another pathology is precautionary paralysis: after an environmental controversy or a perceived enforcement failure, precaution narratives dominate and institutions expand procedure, leading to indefinite delay and politicization. Both pathologies are partly products of weak temporal governance. When institutions lack stable translation mechanisms between time regimes, they swing between extremes in response to legitimacy pressures [54].

The social construction of timelines is also influenced by whose time is visible. Administrative time is highly visible through metrics and dashboards. Infrastructural time is visible through queue statistics and construction schedules. Community time is less visible, often appearing only when mobilization occurs. Ecological time is often represented through technical indicators that may not translate into public experience [55]. This uneven visibility affects whose claims about urgency are treated as legitimate. If community learning and deliberation are not institutionally recognized as time-consuming, compressed timelines can be framed as reasonable. If ecological recovery and cumulative impacts are not institutionally recognized as slow and uncertain, mitigation claims can be framed as sufficient. Temporal governance therefore requires institutional practices that make invisible time visible, such as resourcing participation, representing cumulative impacts over long horizons, and acknowledging how uncertainty management requires time for learning.

Finally, narratives shape revision legitimacy. Adaptive management is often proposed as a way to reconcile urgency with precaution: approve now, monitor, and adjust later [56]. Yet adaptive management can be perceived as a broken promise if revision pathways are weak. Narratives then shift: communities interpret adaptive management as a tactic to secure approval; developers interpret subsequent revisions as moving goalposts; authorities interpret conflict as unreasonable. Temporal governance must therefore ensure that adaptive management is not merely a narrative device but an enforceable temporal contract, specifying who can trigger review, what evidence counts, and what actions follow.

This section has shown how narratives and strategic framing shape the social construction of timelines. The next section turns to institutional design implications: how can institutions create temporal governance arrangements that reduce destructive temporal conflict while enabling faster, more durable deployment? [57]

7. Design Implications: Building Temporal Governance for Durable Consent

Designing temporal governance means designing how closure and revision are balanced, how evidence is timed and validated, and how standing is preserved across the lifecycle. This section proposes institutional mechanisms that are non-technical in the sense that they concern rules, roles, and practices rather than engineering specifications. The goal is to outline how institutions can accelerate decision-making without amplifying legitimacy fragility.

A first mechanism is staged closure. Instead of treating approval as a single moment of irreversible closure, institutions can stage closure across phases with clear meanings [58]. Early-phase closure can au-

thorize site access and preliminary works under strict constraints while preserving the ability to adjust layouts and operational conditions based on early monitoring and consultation outcomes. Mid-phase closure can authorize construction with enforceable conditions and clear monitoring triggers. Late-phase closure can authorize full operation contingent on demonstrated compliance and on the functioning of monitoring and response systems. Staged closure reduces the incentive for maximalist pre-approval conflict because it preserves structured opportunities for adjustment. It also reduces developer risk by providing clearer intermediate milestones rather than indefinite limbo.

A second mechanism is scheduled review windows with preserved standing [59]. Many conflicts arise because stakeholders believe that after approval, their standing disappears. Institutions can counter this by embedding scheduled review windows, such as seasonal reviews or annual reviews, during which monitoring evidence is presented, deviations are explained, and adjustments can be negotiated or enforced. Standing means that communities and relevant civil society actors have a recognized right to request review and to receive reasoned responses, not a veto. Preserved standing makes adaptive management credible because it creates predictable moments when evidence can influence operations.

A third mechanism is revision rules that distinguish adaptive adjustments from fundamental renegotiation [60]. Revision is inevitable, but if every revision is framed as reopening the entire legitimacy of a project, conflict escalates. Institutions can specify categories of revision. Some revisions are technical and routine, such as updating monitoring methods or adjusting operational schedules within agreed bounds. Other revisions are material, such as expanding footprint or materially increasing disturbance. The revision rules should specify what evidence triggers each category, what participation is required, and what authority is needed [61]. This reduces the perception of arbitrary drift while preserving the ability to adapt.

A fourth mechanism is bounded transparency coupled to credible independent validation. Full disclosure is often infeasible, yet secrecy fuels mistrust. Institutions can specify what information must be public in intelligible form, such as summary monitoring indicators, compliance status, and explanations for deviations, while allowing sensitive data to be validated by independent auditors who are accountable to the public process rather than to any single party. Bounded transparency turns transparency from a conflict over disclosure into a structured assurance relationship. It is especially important under delegation, where intermediaries produce evidence that must be trusted [62].

A fifth mechanism is participation resourcing. Community time is constrained by unpaid labor and unequal capacity. Institutions can provide resourcing mechanisms that enable participation without requiring volunteer burnout. Resourcing can include funded independent advisors, translation of technical documents into accessible language, and scheduling practices that recognize livelihood cycles. Resourcing participation is not merely a fairness gesture; it is a temporal governance strategy because it reduces the need for late-stage escalation by enabling earlier, more informed engagement [63].

A sixth mechanism is corridor-level temporal governance. Many legitimacy disputes are cumulative and corridor-scale. Corridor-level forums can coordinate monitoring, benefit-sharing, and revision across multiple projects. They can create shared baselines, shared review calendars, and shared dispute mechanisms. Corridor-level governance reduces the sense that each project is a one-off battle and can reduce competition among communities for concessions [64]. It also allows institutions to manage cumulative ecological time more credibly by tracking trends over long horizons.

A seventh mechanism is explicit integration of adaptation and resilience commitments into temporal governance. Climate hazards and nonstationary conditions change the meaning of both urgency and precaution. When deployment is framed primarily as mitigation, timelines may emphasize rapid build-out, while adaptation-relevant commitments, such as diversification, hazard-readiness, and local resilience benefits, may remain vague. Analyses of adaptation policy emphasize that renewables can contribute to resilience through decentralization and diversification, yet implementation can remain oriented toward mitigation with less emphasis on those adaptation-relevant considerations [65]. Temporal governance can address this by making adaptation commitments explicit and time-scoped, such as defining how hazard periods alter operational regimes, how resilience services are maintained, and how review windows incorporate hazard-related evidence. This reduces the risk that hazard-driven operational changes appear as unilateral drift and increases the credibility of resilience narratives [66].

A final mechanism is institutional memory and reason-giving. Temporal governance requires that decisions and revisions are justified with traceable reasons. When institutions cannot explain why a condition changed or why enforcement occurred, stakeholders infer capture or arbitrariness. Maintaining institutional memory means preserving accessible records of commitments, monitoring outcomes, review decisions, and enforcement actions. It also means reason-giving practices in which authorities explain how evidence and values were weighed [67]. Reason-giving is a legitimacy practice because it allows stakeholders to contest reasons rather than to contest the existence of a decision itself.

These mechanisms are mutually reinforcing. Staged closure is more credible when review windows preserve standing. Review windows are more legitimate when

bounded transparency and independent validation support trust. Revision rules are more stable when corridor-level governance reduces cumulative uncertainty [68]. Participation resourcing improves the quality of negotiation within review windows. Adaptation integration makes revision appear as planned rather than opportunistic when hazards alter operations. Institutional memory supports consistent application across cases.

The mechanisms also clarify that temporal governance is not a single reform. It is a shift from treating time as throughput to treating time as a legitimacy infrastructure. Institutions that can govern time in this way may be able to accelerate deployment by reducing the likelihood of backlash, litigation, and crisis-driven policy swings [69]. They may also be able to preserve fairness by making participation and revision credible rather than symbolic.

8. Conclusion

This paper has argued that renewable deployment is constrained not only by technology and finance, but by temporal governance: the institutional management of timelines, sequences, closure norms, and revision pathways through which projects become socially durable. By distinguishing administrative, community, ecological, and infrastructural time regimes, the paper has shown why conflicts often recur as misalignments among temporal logics, and why treating delay as mere inefficiency can obscure its distributive and interpretive character. The analysis emphasized that time is a resource that allocates power and credibility, shaping whether stakeholders trust evidence, accept closure, and believe in adaptive accountability.

The paper's contribution is a social science framework that treats uncertainty as a governance object and legitimacy as an outcome of temporal practice [70]. Delegation to intermediaries reshapes the timing and credibility of knowledge, while narrative politics and strategic framing shape what counts as reasonable time and sufficient evidence. Negotiation across multiple arenas constructs policy coherence, and temporal bargaining is a central mechanism through which actors seek leverage. In this context, efforts to accelerate deployment without redesigning temporal governance can produce legitimacy fragility that reintroduces delay through escalation and conflict.

The design implications presented focus on mechanisms that convert time from a battleground into a resource for learning and accountability: staged closure, scheduled review windows with preserved standing, revision rules that distinguish routine adaptation from fundamental renegotiation, bounded transparency with credible validation, participation resourcing, corridor-level temporal governance, explicit integration of adaptation and resilience commitments, and institutional memory through reason-giving. These mechanisms do not eliminate normative disagreement about land, biodiversity, and development [71]. They instead aim to contain disagreement within predictable, credible temporal contracts that make compromise more stable and conflict less crisis-driven.

Temporal governance mechanisms require capacity, and capacity is uneven across jurisdictions. Preserving standing and funding participation can be politically contested. Corridor-level governance can conflict with existing administrative boundaries. Nonetheless, the framework suggests that durable acceleration is more likely when institutions invest in temporal legitimacy infrastructures rather than relying on procedural compression or procedural expansion alone. Future research can operationalize this framework through comparative studies of how staged closure and preserved standing affect dispute intensity, how delegation arrangements affect trust in monitoring, and how adaptation integration changes the politics of urgency under increasing climate hazards [72].

References

[1] R. Cowell, G. Ellis, F. Sherry-Brennan, P. A. Strachan, and D. Toke, "Rescaling the governance of renewable energy: Lessons from the uk devolution experience," Journal of Environmental Policy & Planning, vol. 19, pp. 480–502, 2 2015.

[2] R. F. Karadeniz, "'the middle power moment' revisited in global governance: A chance for mikta's legitimacy crisis in post-pandemic world?," Marmara Üniversitesi Siyasal Bilimler Dergisi, vol. 8, pp. 22–39, 12 2020.

[3] N. Edomah, "The governance of energy transition: Lessons from the nigerian electricity sector," Energy, Sustainability and Society, vol. 11, pp. 1–12, 11 2021.

[4] A. Herranz-Surrallés, Energy Cooperation: The Leading Light of the Revised European Neighbourhood Policy? Drivers and Limits of the EU's Functionalist Extension, pp. 241–261. Palgrave Macmillan UK, 11 2016.

[5] A. Schiffer, M. Greene, R. Khalid, C. Foulds, C. A. Vidal, M. Chatterjee, S. Dhar-Bhattacharjee, N. Edomah, O. Sule, D. Palit, and A. N. Yesutanbul, "Brokering gender empowerment in energy access in the global south," Buildings and Cities, vol. 3, pp. 619–637, 8 2022.

[6] C. Espinosa, "Response to "investigating ministry names for comparative policy analysis: Lessons from energy governance"," Journal of Comparative Policy Analysis: Research and Practice, vol. 20, pp. 340–343, 5 2018.

[7] R. Verhoog, "Book review: Renewable energy governance. lecture notes in energymichalenae. and hillsj.m. (eds.), renewable energy governance. lecture notes in energy, 23," Competition and Regulation in Network Industries, vol. 15, pp. 302–304, 9 2014.

[8] A. N. Asthana and N. Charan, "How fair is fair trade in fisheries?," Journal of Survey in Fisheries Sciences, pp. 205–213, 2023.

[9] T. V. de Graaf, The IEA, the New Energy Order and the Future of Global Energy Governance. Palgrave Macmillan, 3 2015.

[10] D. İlkhan Söylemez and A. Söylemez, "Governance frameworks for renewable energy development: Energy transition and public governance," Revista de Gestão Social e Ambiental, vol. 18, pp. e09423–e09423, 11 2024.

[11] S. Jaglin, "Métropoles des pays émergents : des acteurs de la transition énergétique ? leçons du cap (afrique du sud)," Géographie, économie, société, vol. 19, pp. 243–265, 6 2017.

[12] S. Aslam, V. Bukovszki, and M. Mrissa, "Decentralized data management privacy-aware framework for positive energy districts," Energies, vol. 14, pp. 7018–, 10 2021.

[13] F. Batzella, "Engaged but constrained. assessing eu actorness in the case of nord stream 2," Journal of European Integration, vol. 44, pp. 821–835, 2 2022.

[14] T. Hunter, Converging energy governance in mature petroleum provinces: political, legal and economic dimensions in governing mature petroleum fields in the North Sea, pp. 155–174. Springer International Publishing, 11 2017.

[15] Private Actors in Transnational Energy Governance, pp. 301–318. Routledge, 3 2016.

[16] A. Radzi and P. Droege, "Latest perspectives on global renewable energy policies," Current Sustainable/Renewable Energy Reports, vol. 1, pp. 85–93, 7 2014.

[17] L. Teso, T. D. Mora, P. Romagnoni, and F. Peron, "European projects on district energy-renovations and italian best practices," E3S Web of Conferences, vol. 111, pp. 03004–, 8 2019.

[18] "10 - the potential contribution of the bbnj agreement towards a sustainable international governance of marine renewable energy technologies this chapter is an update and continuation of the research started in the contribution, c. soria-rodríguez, "marine renewable energy technologies on the high seas: Challenges and opportunities to strengthen international environmental and renewable energy governance", cambridge international law journal, vol. 11, no. 2, 2022, pp. 202-219.," 1 2025.

[19] N. Malz, F. C. Montoya, P. Y. Parra, and P.-Y. Oei, "China's climate and energy policy paradox revisited – domestic and international implications of a carbon lock-in 'with chinese characteristics'," Energy Sources, Part B: Economics, Planning, and Policy, vol. 18, 2 2023.

[20] B. Daßler, The Institutional Topology of International Regime Complexes. Oxford University PressOxford, 11 2023.

[21] A. Andreoni, K. Creamer, M. Mazzucato, and G. Steyn, "How can south africa advance a new energy paradigm? a mission-oriented approach to megaprojects," Oxford Review of Economic Policy, vol. 38, pp. 237–259, 5 2022.

[22] M. Alam, "Environmental education and non-governmental organizations," in The Palgrave Encyclopedia of Urban and Regional Futures, pp. 495–502, Springer, 2023.

[23] B. Vasić, I. Pekić, and G. Šimić, "Energy security and corruption in central asia as the main challenges for the european union energy diversification policy," 5 2023.

[24] D. Hawkey and J. Webb, "District energy development in liberalised markets: situating uk heat network development in comparison with dutch and norwegian case studies," Technology Analysis & Strategic Management, vol. 26, pp. 1228–1241, 10 2014.

[25] A. V. Belyi, "Rafael leal arcas, andrew filis and ehab s. abu gosh (eds), international energy governance," The Journal of World Energy Law & Business, vol. 8, pp. 288–288, 3 2015.

[26] T. Meister, B. Schmid, I. Seidl, and B. Klagge, "How municipalities support energy cooperatives: survey results from germany and switzerland," Energy, sustainability and society, vol. 10, pp. 1–20, 3 2020.

[27] D. Petrovics, D. Huitema, and A. Jordan, "Polycentric energy governance: Under what conditions do energy communities scale?," Environmental Policy and Governance, vol. 32, pp. 438–449, 4 2022.

[28] N. Gunningham, "Energy governance in asia: beyond the market," 5 2011.

[29] D. Gribkova and Y. Milshina, "Energy transition as a response to energy challenges in post-pandemic reality," Energies, vol. 15, pp. 812–812, 1 2022.

[30] D. A. Permatasari and N. Lazuardy, "Indonesia multilateral cooperation in enhancing energy sustainability through g20 forum," SSRN Electronic Journal, 1 2019.

[31] A. Eitan, "Negotiating the energy transition: Governance trade-offs in solar deployment," Energy Strategy Reviews, vol. 61, p. 101854, 2025.

[32] Preface, pp. vii–xii. Columbia University Press, 12 2018.

[33] G. C.-F. Chen, Jiangsu: Regional Renewable Planning and Deployment, pp. 167–196. Springer International Publishing, 6 2016.

[34] A. B. Stambouli, Z. Khiat, S. Flazi, H. Tanemoto, M. Nakajima, H. Isoda, F. Yokoyama, S. Hannachi, K. Kurokawa, M. Shimizu, and H. Koinuma, "Trends and challenges of sustainable energy and water research in north africa: Sahara solar breeder concerns at the intersection of energy/water," RE&PQJ, vol. 12, pp. 1–8, 1 2024.

[35] Global Energy Governance, pp. 708–708. Springer International Publishing, 1 2021.

[36] M. Giuli and S. Oberthür, The EU's external energy governance in the age of the energy transition, pp. 404–419. Edward Elgar Publishing, 11 2023.

[37] M. Alam, "Activists' heterodoxic beliefs in fostering urban environmental education in indonesia," Local Development & Society, vol. 4, no. 1, pp. 128–145, 2023.

[38] I. Bailey, O. Fitch-Roy, T. H. J. Inderberg, and D. Benson, "Idealism, pragmatism, and the power of compromise in the negotiation of new zealand's zero carbon act," Climate Policy, vol. 21, pp. 1159–1174, 1 2021.

[39] R. M. F. Arroyo and L. J. de Miguel, "Low-carbon energy governance: Scenarios to accelerate the change in the energy matrix in ecuador," Energies, vol. 13, pp. 4731–, 9 2020.

[40] R. L. Ottinger and J. Bowie, "Innovative financing for renewable energy," Energy, Governance and Sustainability, vol. 32, pp. 701–, 5 2016.

[41] A. Eitan, "Privatizing environmental governance: the evolving relationship between regulators and private entities," Journal of Environmental Policy & Planning, pp. 1–27, 2025.

[42] R. Shabaneh and J. F. Braun, Saudi Arabia's Clean Hydrogen Journey, pp. 33–62. Routledge, 4 2024.

[43] L. Suetyi and S. Zhi-qin, "How china views the eu in global energy governance: A norm exporter, a partner or an outsider?," Comparative European Politics, vol. 15, pp. 80–98, 2 2017.

[44] J. Terwilliger and I. Christie, "Cities and governance for net-zero: Assessing procedures and tools for innovative design of urban climate governance in europe," Sustainability, vol. 17, pp. 2698–2698, 3 2025.

[45] A. Eitan, "Navigating sustainability trade-offs in wind energy governance: The role of environmental regulators," Energy Policy, vol. 203, p. 114645, 2025.

[46] M. Iyoda, Energy transition in Japan, pp. 32–44. Routledge, 2 2022.

[47] E. İşeri and T. Uygurtürk, Energy Governance in Turkey, pp. 1217–1254. Springer International Publishing, 9 2022.

[48] S. Bouzarovski, C. Bichsel, D. Boyer, S. Ferenčuhová, M. Gentile, V. Mykhnenko, Z. Oguz, and M. Tysiachniouk, "Forum: Russia, europe and the colonial present: the power of everyday geopolitics," Geographica Helvetica, vol. 78, pp. 429–451, 9 2023.

[49] R. Karim and A. B. Munir, "A historical overview of nuclear energy regulations in asean," SEJARAH, vol. 27, pp. 11–25, 8 2018.

[50] J. Saurer and J. Monast, "Renewable energy federalism in germany and the united states," Transnational Environmental Law, vol. 10, pp. 293–320, 12 2020.

[51] H. L. Heubaum, Introduction, pp. 1–20. Routledge, 12 2021.

[52] A. Eitan and I. Fischhendler, "Shaping niche innovations in energy transitions: The role of pitching to regulators," Energy Research & Social Science, vol. 126, p. 104170, 2025.

[53] Y. Ding, W. Qu, S. Niu, M. Liang, W. Qiang, and Z. Hong, "Factors influencing the spatial difference in household energy consumption in china," Sustainability, vol. 8, pp. 1285–, 12 2016.

[54] E. Contipelli, "Polycentric approach to global constitutionalism and climate change," Revista Catalana de Dret Ambiental, vol. 10, pp. 9–, 7 2019.

[55] S. de Jong, The International Energy Charter: a new impetus for global energy governance?, pp. 250–260. Edward Elgar Publishing, 9 2024.

[56] D. Kim, 3 Britain's Energy Cooperation with Emerging Powers, pp. 133–144. Routledge, 3 2016.

[57] P. Cameron, States, Investors, and Energy Agreements, pp. 25–91. Oxford University Press, 10 2021.

[58] A. X. He, "China in global energy governance: A chinese perspective," International Organisations Research Journal, vol. 11, pp. 71–91, 4 2016.

[59] M. Knodt and M. Ringel, Creating Convergence of National Energy Policies by Increased Cooperation: EU Energy Governance and Its Impact on the German Energy Transition, pp. 123–145. Springer International Publishing, 2 2019.

[60] F. Umaroğulları, S. Kartal, and D. Aydın, "A comparative study on turkey's national green building certification system under energy policy developments," Iconarp International J. of Architecture and Planning, vol. 8, pp. 187–210, 6 2020.

[61] M. Rahman, N. W. Keat, M. A. K. Masud, and M. Albaity, "Powering growth: The dynamic impact of renewable energy on gdp in asean-5," International Journal of Energy Economics and Policy, vol. 14, pp. 118–130, 9 2024.

[62] E. Eckert and O. Kovalevska, "Sustainability in the european union: Analyzing the discourse of the european green deal," Journal of Risk and Financial Management, vol. 14, pp. 80–, 2 2021.

[63] A. T. A. Borba, L. J. M. Simões, T. R. de Melo, and A. Álisson Bandeira Santos, "Techno-economic assessment of a hybrid renewable energy system for a county in the state of bahia," Energies, vol. 17, pp. 572–572, 1 2024.

[64] H. Ahn, "Republic of korea's energy security conundrum:the problems of energy mix and energy diplomacy deadlock," Handbook of Energy Politics, vol. 22, pp. 67–87, 5 2018.

[65] A. Eitan, "Climate change adaptation through renewable energy: The cases of australia, canada, and the united kingdom," Environments, vol. 11, no. 9, p. 199, 2024.

[66] D. Torney, Handbook of Energy Governance in Europe - Energy Governance in Ireland, pp. 1–21. Springer International Publishing, 5 2019.

[67] S. Bouzarovski, J. Brajković, S. Robić, C. Brown, and I. Vuchkova, "Energy poverty in the energy community region: Interrogating policy formulation and coverage.," European urban and regional studies, vol. 31, pp. 184–199, 4 2023.

[68] S. Becker and C. Kunze, "Transcending community energy: collective and politically motivated projects in renewable energy (cpe) across europe," People, Place and Policy Online, vol. 8, pp. 180–191, 12 2014.

[69] A. Asthana, "Water: Perspectives, issues, concerns.," 2003.

[70] C. Demski and S. Becker, Energy security, pp. 93–104. Routledge, 9 2021.

[71] F. A. PAULO and J. A. G. de LIMA, "Modelos de usinas solares fotovoltaicas e seus impactos na diversificaÇÃo da matriz energÉtica brasileira," Revista ft, vol. 29, pp. 47–48, 7 2025.

[72] M. P. Devi, M. D. Choudhry, G. B. Raja, and T. Sathya, A Roadmap Towards Robust IoT-Enabled Cyber-Physical Systems in Cyber Industrial 4.0, pp. 293–313. Apple Academic Press, 3 2022.