

# From Efficiency to Equity: Regulatory Impact Assessment and Governance Lessons from Germany's Energiewende

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## Abstract:

Regulatory Impact Assessment (RIA) has become a standard tool for evaluating policy reforms, yet it often remains narrowly focused on cost–benefit efficiency while neglecting distributive justice, governance dynamics, and legitimacy. This paper addresses that gap by examining RIA practices in Germany's Energiewende, one of the world's most ambitious energy transitions. Using a qualitative research design and systematic document analysis, the study applies the Triple-E Institutional Reform Framework (TEIRF), which integrates efficiency, equity, and environmental sustainability with governance as the mediating foundation. The findings show that Germany's strong institutions sustained efficiency and sustainability outcomes through robust investment mobilization and ecological ambition, but distributive inequities and spatial justice challenges undermined legitimacy. Comparative references to Spain, the United Kingdom, and Belgium reinforce these insights: fiscal fragility, narrow efficiency scoring, or procedural consultation alone are insufficient to reconcile contested trade-offs. Theoretically, the study advances RIA beyond its technocratic origins by positioning it as a governance process that structures negotiation, sequencing, and legitimacy. Policy-wise, TEIRF provides a diagnostic tool adaptable across contexts: for high-capacity systems, it highlights the need to anticipate distributive tensions, while for low- and middle-income countries it underscores the importance of sequencing reforms according to institutional readiness.

**Keywords:** Regulatory Impact Assessment; Energy Transition Governance; Triple-E Institutional Reform Framework (TEIRF); Efficiency, Equity, and Sustainability ; Germany's Energiewende ; Comparative Policy Analysis .

## 1. Introduction

Regulatory Impact Assessment (RIA) has become a cornerstone of modern governance, designed to evaluate the expected benefits, costs, and trade-offs of regulatory interventions before their adoption. Traditionally, RIA has relied heavily on cost–benefit analysis (CBA) and efficiency-based indicators to justify regulatory choices (Boardman et al., 2018; Adler & Posner, 2006). While this technocratic orientation has delivered useful insights, it has also

been criticized for its narrow focus, often overlooking distributive justice, governance capacity, and political legitimacy (Hahn & Dudley, 2007; Radaelli, 2004). These critiques have become increasingly salient in the context of energy transitions, where policy interventions must address climate change, economic competitiveness, and social equity under conditions of deep uncertainty (Rogge & Reichardt, 2016; Cherp et al., 2018).

Germany's Energiewende provides a particularly revealing case for examining how RIA operates in such a complex environment. Launched in the early 2000s and accelerated after the 2011 decision to phase out nuclear energy, the Energiewende has been described as one of the most ambitious energy transitions worldwide (Morris & Jungjohann, 2016). German regulators have relied on scenario-based planning and stakeholder consultation to guide investment decisions, tariff reforms, and long-term infrastructure planning (BMW, 2015; Agora Energiewende, 2017). However, while efficiency and sustainability goals have been relatively well integrated into regulatory appraisal, the treatment of distributional equity, regional burden-sharing, and procedural legitimacy has been less clear (Fitch-Roy et al., 2019). This raises the question of whether RIA in Germany has evolved beyond its efficiency bias to adequately address the equity and governance challenges posed by systemic transformation.

This paper addresses this gap by asking: How have German regulators integrated scenario-based planning, stakeholder consultation, and distributional equity into regulatory impact assessments during the Energiewende, and what lessons does this offer for governance under energy transition?

The study is qualitative and exploratory in nature. Rather than testing hypotheses, it employs document analysis and comparative reflection to trace how German regulatory institutions have engaged with the broader objectives of equity and legitimacy alongside efficiency. To ensure robustness, the analysis draws on qualitative validity criteria such as credibility and transferability (Guba & Lincoln, 1989). It also situates the Energiewende in relation to alternative approaches, including Belgium's Kafka method, which introduces efficiency scoring into qualitative RIA (De Jong & Zanger, 2011; OECD, 2015), and the United Kingdom's consultation-based regulatory practices (Allio, 2009; Baldwin et al., 2012).

The contribution of the paper is threefold. First, it extends the literature on RIA by highlighting the governance and distributive dimensions of appraisal in the context of energy transition. Second, it offers a critical reassessment of Germany's Energiewende, showing that while efficiency and sustainability are relatively well captured, equity and distributional concerns remain underdeveloped. Third, it advances a reframed understanding of RIA that moves from efficiency to equity, embedding governance, participatory legitimacy, and distributive justice as central criteria for regulatory appraisal. These insights not only deepen understanding of the German case but also provide internationally relevant lessons for countries designing RIA frameworks to support just and effective energy transitions.

## 2. Literature Review

The literature on Regulatory Impact Assessment (RIA) has expanded significantly since the 1980s, evolving from a narrowly technical tool for efficiency assessment to a more complex governance practice shaped by institutional, political, and social dynamics. While RIA remains a central instrument in OECD regulatory policy, its application to energy transitions exposes important limitations. Large-scale transformations such as Germany's Energiewende require appraisal frameworks that not only account for costs and benefits but also integrate distributive equity, legitimacy, and long-term sustainability. This section reviews the theoretical and methodological foundations of RIA, critically examines alternative approaches,

and identifies the gap that motivates this study: the need for a governance-centered framework that embeds efficiency within equity and environmental sustainability.

## **2.1 Foundations of Regulatory Impact Assessment**

RIA was institutionalized in OECD countries in the 1980s and 1990s as part of broader governance reforms aimed at improving regulatory quality (Majone, 1997; Radaelli, 2004). Promoted as a rational and evidence-based process, it sought to ensure that regulations were efficient, proportionate, and transparent. The OECD (2012, 2015) codified these principles, making RIA a global benchmark for “good regulation.” Yet empirical studies show that RIA outcomes are conditioned by institutional capacity, bureaucratic traditions, and political economy dynamics rather than being neutral or purely technical (Baldwin, Cave, & Lodge, 2012; Radaelli & De Francesco, 2010). This recognition has shifted the scholarly focus from prescriptive guidance (“how to do RIA”) toward critical inquiry into legitimacy, inclusiveness, and governance (“what RIA does” in practice).

## **2.2 Cost–Benefit Analysis and Its Limitations**

Cost–Benefit Analysis (CBA) remains the cornerstone of many RIA frameworks. By monetizing costs and benefits, CBA provides structured indicators such as net present value or internal rates of return (Boardman et al., 2018). It is praised for its clarity and comparability across projects. Yet CBA has three main limitations for energy transitions. First, it inadequately captures distributive outcomes, often treating equity as external to efficiency (Adler & Posner, 2006; Fleurbaey & Hammond, 2004). Second, its reliance on discounting undervalues long-term environmental sustainability and intergenerational justice (Hepburn, 2007). Third, it assumes that efficiency can be assessed independently of governance capacity, which is unrealistic in politically contested transitions (Hahn & Dudley, 2007). These critiques have prompted calls for complementary frameworks that explicitly address justice, legitimacy, and institutional dynamics (Sovacool, Axsen, & Sorrell, 2018; Rogge & Reichardt, 2016).

## **2.3 Index and Scoring Methods**

Index-based approaches emerged in the 1970s to provide alternatives to monetized CBA. The Battelle Environmental Evaluation System (Dee et al., 1973) pioneered weighted scoring for environmental impacts, while Data Envelopment Analysis (DEA) was later applied to evaluate regulatory or utility performance through input–output comparisons (Charnes, Cooper, & Rhodes, 1978; Marques, 2010). More recent innovations include fuzzy multi-criteria and ELECTRE methods for handling uncertainty and qualitative variables (Mardani et al., 2015). Belgium’s Kafka method stands out, offering a simplified rating system that produces efficiency scores to evaluate reforms (De Jong & Zanger, 2011; OECD, 2015). These approaches make trade-offs more transparent but still privilege efficiency metrics, often overlooking distributive or governance concerns that are central to energy transitions.

## **2.4 Event Study and Econometric Approaches**

Event study methodologies assess regulatory impacts by analyzing abnormal changes in outcomes following policy announcements (MacKinlay, 1997). They have been widely applied in finance and increasingly in energy markets, for example in analyzing investor responses to renewable subsidies or carbon pricing reforms (Ahelegbey, Giudici, & Hadji-Misheva, 2019). While powerful in data-rich contexts, event studies face limitations in energy transitions, where effects unfold over decades and are shaped by institutional and social

dynamics. Their reliance on market signals excludes non-market effects such as social legitimacy, distributive justice, or spatial inequalities, making them insufficient for evaluating governance in complex transitions.

## **2.5 Multi-Criteria Decision-Making (MCDM)**

Multi-Criteria Decision-Making (MCDM) frameworks were developed to address the narrowness of CBA by explicitly acknowledging multiple objectives. Approaches such as Analytic Hierarchy Process (AHP), Weighted Sum Models, and hybrid methods allow regulators to balance efficiency, equity, and sustainability (Belton & Stewart, 2002). MCDM has been widely applied in environmental and energy contexts where transparent trade-offs are required (Huang, Keisler, & Linkov, 2011). While these methods are valuable for structuring complex choices, they often remain technocratic: weighting criteria is itself a political act, and without strong governance mechanisms, MCDM risks reproducing power asymmetries rather than challenging them.

## **2.6 Qualitative and Hybrid Approaches**

Qualitative approaches have emerged to address governance complexity, legitimacy, and contested values that quantitative methods often overlook. In the UK, for example, RIAs emphasize stakeholder consultation and narrative-based assessments (Allio, 2009; Lodge & Wegrich, 2012). Hybrid models combining qualitative and quantitative methods are increasingly advocated, especially in domains like energy, where uncertainty and socio-political contestation are pervasive (Broughel, 2019). Belgium's Kafka method illustrates how qualitative scoring can be integrated into efficiency assessment. However, qualitative approaches often lack systematic integration with distributive or environmental criteria, highlighting the need for more comprehensive governance frameworks.

## **2.7 Political Economy and Governance Perspectives**

Recent work emphasizes that RIAs must be viewed as governance processes rather than technical tools. Political economy analyses show that RIA outcomes reflect power relations, institutional capacities, and ideological orientations (Radaelli & De Francesco, 2010). Political ecology perspectives extend this by critiquing how appraisal frameworks can depoliticize contested reforms, obscure inequalities, or legitimize neoliberal restructuring (Castro, 2007; Bakker, 2007; Swyngedouw, 2015). For energy transitions, these insights are especially salient. Distributive justice and spatial equity have proven central to public acceptance of renewable expansion, grid infrastructure, and cost allocation (Fitch-Roy, Benson, & Woodman, 2019; Sovacool et al., 2018). Without integrating governance, legitimacy, and justice into appraisal, RIAs risk becoming exercises in efficiency that fail to secure social support.

## **2.8 Identified Gap**

Across these diverse literatures, RIA has been analyzed through multiple lenses: CBA, scoring, event studies, MCDM, qualitative methods, and political economy critiques. Each provides valuable insights, yet they remain siloed. Few studies integrate efficiency, equity, and sustainability within a single evaluative framework that explicitly foregrounds governance. In the context of energy transitions, this omission is particularly problematic. Germany's Energiewende has been extensively studied for its technological and economic impacts, but less attention has been given to how RIAs incorporate distributive equity, stakeholder participation, and legitimacy. This paper addresses that gap by developing and

applying the Triple-E Institutional Reform Framework (TEIRF), which situates efficiency within broader governance processes and integrates equity and environmental sustainability as core evaluative pillars.

### **3. Methodology**

#### **3.1 Research Design**

This study employs a qualitative and exploratory research design, consistent with the aim of investigating how regulatory impact assessment (RIA) practices in Germany's Energiewende have incorporated scenario-based planning, stakeholder consultation, and distributive equity. These questions are not amenable to hypothesis testing or econometric estimation, which presuppose quantifiable variables and generalizable causal claims. Instead, they require an interpretive methodology capable of unpacking institutional dynamics, governance arrangements, and contested meanings. The absence of formal hypotheses is therefore deliberate: the study seeks to generate insights into how governance mediates appraisal practices under conditions of deep uncertainty. This approach is consistent with Creswell and Poth's (2018) emphasis on qualitative inquiry for exploring complex institutional processes, as well as with regulatory governance scholarship that views RIA as embedded within political, institutional, and socio-cultural contexts (Radaelli & De Francesco, 2010; Baldwin, Cave, & Lodge, 2012).

#### **3.2 Data Sources**

To enhance credibility through triangulation, the empirical material is drawn from multiple sources. The core dataset consists of official monitoring and assessment reports produced by the Federal Ministry for Economic Affairs and Energy (BMWi, 2015, 2018), which provide systematic documentation of progress under the Energiewende. These are complemented by independent analyses and scenario studies from Agora Energiewende (2017), an influential policy think tank that has shaped debates on cost distribution and equity. European Commission guidelines (European Commission, 2014) supply supranational standards for regulatory appraisal, situating the German case within a broader European governance framework. In addition, peer-reviewed scholarship on energy transitions and regulatory governance (Fitch-Roy, Benson, & Woodman, 2019; Rogge & Reichardt, 2016) provides a scholarly perspective that enables critical triangulation with policy documents. Following Bowen (2009), document analysis is employed here as a primary qualitative method, capable of generating insights into both institutional architectures and the discursive framing of reforms.

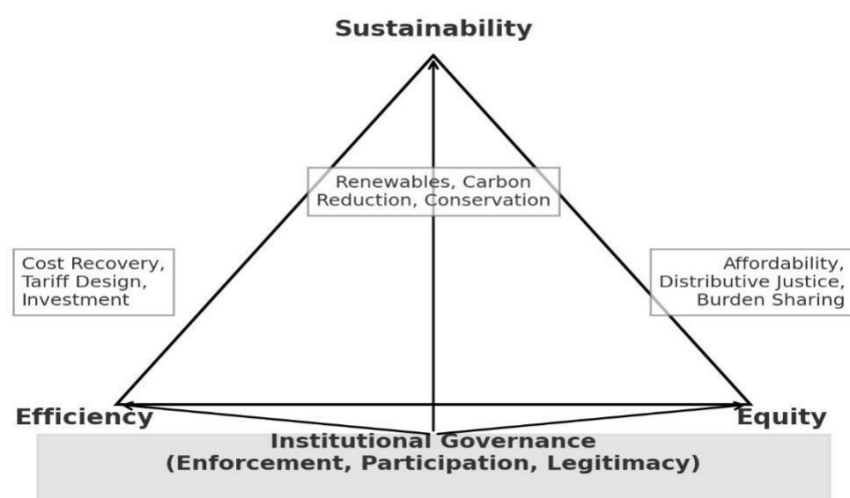
#### **3.3 Analytical Framework and Coding**

The Triple-E Institutional Reform Framework (TEIRF), developed in this paper as an evaluative model that integrates three outcome pillars— efficiency, equity, and environmental sustainability — anchored by institutional governance as the enabling foundation, guides the analysis. TEIRF was operationalized through systematic document analysis. Texts were first coded deductively against the four TEIRF categories: efficiency (e.g., cost recovery, tariff design, mobilization of investment), equity (e.g., affordability, distributive justice, burden-sharing), sustainability (e.g., renewable integration, carbon reduction, conservation incentives), and governance (e.g., regulatory enforcement, transparency, stakeholder participation, legitimacy). Alongside this deductive coding, inductive strategies were applied to capture emergent themes such as sequencing, spatial justice, and legitimacy crises. Coding proceeded iteratively, with categories refined as new patterns were identified. This combined

deductive–inductive strategy follows best practice in qualitative content analysis (Krippendorff, 2018; Miles, Huberman, & Saldaña, 2019) and ensured that TEIRF remained theoretically grounded while remaining responsive to the data.

Figure 1 below is a schematic representation of TEIRF with efficiency, equity, and sustainability as the three outcome pillars, institutional governance as the foundational base, and the operationalization of each dimension into coding categories.

**Figure 1. TEIRF Framework and Coding Operationalization**



### 3.4 Comparative Dimension

Although Germany constitutes the focal case, the study situates its findings within a comparative frame to avoid insularity and to test the broader applicability of TEIRF. Belgium’s Kafka method (De Jong & Zanger, 2011) is included as an alternative diagnostic that highlights efficiency through scoring but neglects governance trade-offs. The United Kingdom’s RIAs, emphasizing consultation and procedural legitimacy (Allio, 2009; Lodge & Wegrich, 2012), provide a counterpoint to Germany’s more technocratic orientation. Spain is incorporated as a cautionary reference, where weak fiscal governance during the renewable boom produced tariff deficits and subsequent instability (Pérez-Arriaga, 2014). These comparative references are not treated as full case studies but as strategic benchmarks, allowing the German findings to be contextualized and highlighting TEIRF’s diagnostic capacity across diverse governance settings.

### 3.5 Validity and Reliability

Trustworthiness was established through adherence to Guba and Lincoln’s (1989) criteria. Credibility was enhanced by triangulating across governmental, independent, and scholarly sources. Transferability was supported by providing thick description of Germany’s institutional and policy environment, enabling readers to assess applicability in other contexts. Dependability was ensured by maintaining a transparent coding protocol and applying it consistently across all documents (Miles et al., 2019). Confirmability was strengthened by grounding interpretations in direct textual evidence and cross-checking with secondary literature, thereby minimizing researcher bias. Collectively, these measures align the study with recognized standards of rigor in qualitative research.

### 3.6 Limitations

As a document-based qualitative study, the analysis is subject to certain limitations. Official reports may reflect strategic framings that privilege governmental narratives, while the absence of interviews restricts access to informal negotiations and stakeholder perspectives. The focus on Germany constrains generalizability, though the inclusion of Belgium, the United Kingdom, and Spain provides external points of reference. Moreover, while TEIRF has been applied qualitatively, future research could extend its operationalization through mixed-methods approaches, for example by pairing qualitative coding with quantitative indicators of efficiency, equity, and governance quality. Such extensions would enable larger-N comparisons and further validate the framework's applicability across diverse political economies. Nevertheless, the qualitative orientation adopted here is well suited to the study's exploratory objective of understanding RIAs as governance processes within contested energy transitions.

#### **4. Case Application: Germany's Energiewende**

Germany's Energiewende is one of the most ambitious energy transition programs globally, combining long-term decarbonization with industrial policy, innovation strategies, and social commitments. It offers a particularly rich case for examining how regulatory impact assessment (RIA) operates under uncertainty, contested governance, and high political stakes. The Triple-E Institutional Reform Framework (TEIRF) provides a useful lens to analyze how German regulators have navigated efficiency, equity, and sustainability while confronting persistent governance challenges. Each dimension reveals how policy instruments achieve legitimacy—or falter—when embedded in broader institutional contexts.

##### **4.1 Scenario-Based Planning and Policy Uncertainty**

Scenario-based planning has been central to Germany's regulatory approach. The Federal Ministry for Economic Affairs and Energy (BMWi, 2015, 2018) and agencies such as the German Energy Agency (DENA, 2017) routinely publish energy scenarios projecting different mixes of renewable generation, grid expansion, and efficiency pathways. These scenarios form the basis for regulatory appraisals, allowing policymakers to compare options across dimensions such as cost recovery, carbon mitigation, and system stability.

Yet the process illustrates TEIRF's insight that efficiency and sustainability cannot be reduced to technical scores. The uncertainty surrounding technology costs, energy demand, and public acceptance means outcomes cannot be monetized in conventional cost-benefit terms. Instead, German regulators increasingly rely on multidimensional indicators, such as renewable penetration rates, emissions trajectories, and the geographic distribution of network expansion (Fitch-Roy, Benson, & Woodman, 2019). This approach contrasts with Spain's experience, where weaker scenario planning and fiscal safeguards led to tariff deficits and abrupt subsidy cuts (Pérez-Arriaga, 2014). TEIRF highlights that Germany's scenario planning functions less as prediction and more as stress-testing governance capacity under uncertainty, sequencing reforms in line with institutional readiness.

##### **4.2 Stakeholder Consultation and Legitimacy**

Stakeholder consultation has become institutionalized in the Energiewende, particularly through the Federal Network Agency (Bundesnetzagentur). Public hearings, online platforms, and parliamentary debates provide opportunities for utilities, industry associations, municipalities, NGOs, and citizen groups to shape policy decisions on grid expansion and tariff design (Knopf et al., 2015).

However, consultation outcomes reveal persistent legitimacy challenges. Opposition to transmission corridors—often framed as “Not In My Backyard” (NIMBY)—also reflects deeper distributive and spatial justice concerns (Moss, Becker, & Naumann, 2015). While formal procedures enhanced transparency, critics argued that consultations sometimes appeared tokenistic, especially when local opposition was overridden by national objectives. Within TEIRF, these dynamics illustrate governance as both enabler and mediator: where consultation is perceived as credible, reforms gain legitimacy, but when processes lack responsiveness, efficiency and sustainability goals are undermined. By contrast, the UK’s RIA practice has embedded consultation more deeply, though without fully resolving distributive inequities (Lodge & Wegrich, 2012). Germany thus demonstrates both the value and the limits of consultation when distributive conflicts remain unresolved.

### **4.3 Distributional Equity and Regional Burden-Sharing**

Distributional equity is perhaps the most contentious dimension of the *Energiewende*. The renewable energy surcharge (EEG-Umlage), which financed feed-in tariffs, imposed annual costs of roughly €25–28 billion, translating into about 6–7 eurocents per kWh for households by the mid-2010s (Agora *Energiewende*, 2017). While energy-intensive industries were granted exemptions covering nearly 20% of national electricity consumption, small consumers and households bore the largest financial burden. This regressive structure sparked debates over fairness and affordability, with particular concern for low-income groups.

Regional disparities compounded these inequities. Northern *Länder* shouldered disproportionate grid expansion costs and land-use impacts, while southern industrial centers benefited from cheaper electricity and investment inflows (Moss et al., 2015). From a TEIRF perspective, these outcomes reveal how efficiency goals, such as financial stability and renewable deployment, can undermine equity when cost distribution is skewed. German regulators responded with partial redistributive measures—caps on household surcharges, greater tariff transparency—but these adjustments only partially mitigated tensions. The persistent disparities demonstrate how equity remains the most fragile pillar of transition governance, requiring stronger institutional mechanisms to align efficiency with fairness.

### **4.4 Governance, Sequencing, and EU Oversight**

The *Energiewende* unfolds within a multi-level governance system shaped by European Union directives on renewables, emissions trading, and state aid. EU oversight has reinforced German regulatory capacity by embedding principles of transparency, cost recovery, and sustainability into national law (European Commission, 2014). This supranational framework provided external accountability that strengthened domestic institutions.

Yet even under strong governance, sequencing challenges persisted. Early emphasis on rapid renewable deployment achieved sustainability gains but strained affordability and grid stability, leading to corrective reforms such as the 2014 EEG amendment. TEIRF underscores that these difficulties are not merely technical but governance-driven: institutional capacity must adapt to escalating ambition. Spain’s experience demonstrates the risks of failing to align ambition with governance, while Belgium’s Kafka method shows the pitfalls of focusing narrowly on efficiency scores without embedding them in governance processes (De Jong & Zanger, 2011). Germany illustrates that even in high-capacity systems, sequencing remains the central governance challenge of ambitious transitions.

## **5. Results and Discussion**

The application of the Triple-E Institutional Reform Framework (TEIRF) to Germany’s *Energiewende* reveals how efficiency, equity, and sustainability outcomes were mediated by

governance quality, sequencing, and legitimacy. Rather than restating descriptive evidence from the case, this section interprets outcomes through the comparative and theoretical lens of TEIRF, highlighting why successes and failures occurred and what they imply for transition governance.

### **5.1 Efficiency and Governance Capacity**

Germany's Energiewende delivered major efficiency gains in mobilizing investment and scaling renewable deployment. Feed-in tariffs, guaranteed grid access, and priority dispatch created stable incentives that attracted private capital and drove down technology costs (BMW, 2018; Fitch-Roy, Benson, & Woodman, 2019). Crucially, these instruments were sustained by Germany's strong regulatory institutions and EU oversight, which provided credibility and reduced investor risk.

By contrast, Spain's renewable expansion of the late 2000s lacked similar fiscal safeguards. Tariff deficits accumulated as subsidies outpaced cost recovery, forcing abrupt reversals that undermined investor confidence (Pérez-Arriaga, 2014). TEIRF explains this divergence: efficiency gains are not simply the result of tariff design but of governance quality. Germany's strong institutional capacity allowed efficiency to be maintained, while Spain's weaker fiscal governance eroded outcomes.

### **5.2 Equity and the Limits of Redistributive Mechanisms**

Equity outcomes diverged sharply from efficiency successes. The EEG surcharge financed the transition but imposed disproportionate costs on households and small consumers, while energy-intensive industries received extensive exemptions (Agora Energiewende, 2017). This regressive burden undermined social legitimacy and produced distributive tensions that partial reforms—such as caps on surcharges—only partially alleviated.

Comparative insights sharpen this point. In the United Kingdom, stakeholder consultation and affordability assessments are embedded into RIAs, helping to anticipate distributive tensions (Lodge & Wegrich, 2012). Although these measures do not eliminate inequities, they enhance procedural legitimacy. TEIRF highlights that Germany's efficiency and sustainability achievements were undermined by insufficient attention to distributive justice. The framework shows that without equity safeguards, even technically successful reforms risk eroding legitimacy and public support.

### **5.3 Sustainability and Sequencing Challenges**

Germany achieved substantial sustainability gains, reducing carbon emissions and increasing renewable penetration in line with EU climate objectives (DENA, 2017). Yet the sequencing of reforms revealed governance constraints. Rapid deployment created affordability pressures and grid integration challenges, requiring corrective interventions such as the 2014 EEG amendment and delays in coal phase-out (Geels, 2014).

TEIRF clarifies that sustainability cannot be pursued in isolation from governance capacity. Spain's experience underscores this lesson: ecological ambition without fiscal safeguards produced unsustainable outcomes. Belgium's Kafka method, while efficient in scoring reforms, overlooks ecological and distributive dimensions, reinforcing the importance of integrating governance into sustainability assessments (De Jong & Zanger, 2011). Germany's case demonstrates that sustainability goals can be achieved, but only when adaptive sequencing aligns ambition with institutional readiness.

### **5.4 Governance as the Mediating Foundation**

Governance emerges as the decisive factor linking all three pillars of TEIRF. Germany's institutional strengths—regulatory autonomy, EU oversight, and consultation mechanisms—enabled efficiency and sustainability achievements. Yet governance limitations persisted, particularly in distributive justice and spatial legitimacy. Opposition to grid expansion revealed that formal consultation does not automatically translate into perceived fairness (Moss, Becker, & Naumann, 2015).

Comparatively, the UK demonstrates that deep institutionalization of consultation enhances legitimacy, while Belgium illustrates the risks of technocratic efficiency measures that ignore broader governance dynamics. TEIRF thus adds explanatory power by showing that governance is not an external condition but the foundation on which efficiency, equity, and sustainability outcomes depend.

### 5.5 International Lessons and Theoretical Contribution

The German Energiewende, interpreted through TEIRF, yields lessons with international relevance. For high-capacity systems, it shows that strong governance structures can sustain efficiency and sustainability but must anticipate distributive and spatial tensions to preserve legitimacy. For lower-capacity systems, it underscores the need to sequence reforms according to institutional readiness rather than transplant complex tariff models.

Theoretically, TEIRF demonstrates that RIA in energy transitions should be understood not as a narrow efficiency exercise but as a governance process embedded in political economy. By integrating efficiency, equity, and sustainability into a single evaluative model, mediated by governance, TEIRF provides a more comprehensive framework for understanding why transitions succeed, falter, or generate contestation.

Table 1 below provides a comparative overview of the four cases, evaluated through the four TEIRF pillars of efficiency, equity, sustainability, and governance.

**Table 1. Comparative assessment of Germany, Spain, the UK, and Belgium through the TEIRF framework (Efficiency, Equity, Sustainability, Governance).**

| Country/Case                  | Efficiency                                                                                                                        | Equity                                                                                                         | Sustainability                                                                                                                     | Governance                                                                                                               |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| <b>Germany (Energiewende)</b> | High: feed-in tariffs and priority dispatch mobilized private investment; fiscal stability preserved through credible regulation. | Weak: large household surcharges regressive; broad industrial exemptions.                                      | Strong: rapid renewable EEG penetration and emissions decline; integration and affordability pressures required later corrections. | Strong capacity and formal EU oversight; legitimacy contested where burdens concentrated and consultation felt symbolic. |
| <b>Spain (Renewable boom)</b> | Initially high, then collapsed; retroactive changes undermined investment.                                                        | Weak: abrupt policy reversals shifted risks to consumers and small investors; limited distributive safeguards. | Fragile: fast build-out stalled by fiscal instability.                                                                             | Weaker governance and regulatory credibility; sequencing and cost recovery insufficiently planned.                       |

| Country/Case                         | Efficiency                                                            | Equity                                                                                    | Sustainability                                                                 | Governance                                                                                                    |
|--------------------------------------|-----------------------------------------------------------------------|-------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
|                                      | Moderate: steady                                                      | Moderate:                                                                                 |                                                                                |                                                                                                               |
| <b>United Kingdom (RIA practice)</b> | but ambitious scaling; consistent evaluative routines.                | less affordability and consultation embedded; fewer regressivity complaints than Germany. | Limited: slower renewable uptake, though broadly aligned with climate targets. | Strong consultative procedures and appraisal discipline; distributive analysis present but not comprehensive. |
| <b>Belgium (Kafka method)</b>        | Narrow: transparency via efficiency scores; limited systemic insight. | Largely neglected: distributive outcomes integral scoring.                                | Minimal: ecological goals not central to method.                               | Technocratic emphasis on measurement; public legitimacy and participation underweighted.                      |

This comparative overview makes visible how governance capacity conditions the interaction between efficiency, equity, and sustainability. Germany’s case demonstrates that strong governance can sustain ambitious ecological and efficiency outcomes, but distributive inequities can still undermine legitimacy. Spain reveals how weak fiscal and regulatory credibility destabilizes both efficiency and sustainability, creating abrupt reversals that damage trust. The United Kingdom underscores how consultative governance enhances legitimacy and equity, yet may temper ecological ambition and efficiency gains. Belgium exemplifies the limitations of technocratic, measurement-driven approaches that neglect justice and sustainability in favor of narrow efficiency metrics.

Taken together, these cases confirm TEIRF’s value as a diagnostic and sequencing tool. By explicitly embedding governance as the enabling foundation, the framework explains why technically similar instruments yield divergent results across contexts. For high-capacity systems such as Germany, TEIRF emphasizes the importance of anticipating distributive conflicts even when efficiency and sustainability are advancing. For weaker governance environments such as Spain, it underscores the need to sequence reforms according to fiscal and institutional readiness. For countries that emphasize procedural legitimacy, like the UK, the framework highlights the trade-offs between consultation and transformative ambition. Finally, Belgium’s Kafka method demonstrates the risk of reducing appraisal to efficiency metrics, a risk TEIRF avoids by integrating efficiency, equity, and sustainability into a single governance-centered model.

Through this comparative lens, TEIRF contributes to international debates on regulatory appraisal and energy transition governance. It shows that tariff reforms and transition policies cannot be transplanted wholesale, but must be tailored to institutional capacity, distributive context, and political legitimacy. By reframing RIA as a governance process rather than a purely technical tool, TEIRF provides a transferable framework for policymakers and scholars to reconcile efficiency with equity and sustainability in contested transitions worldwide.

6. Policy Implications

The application of TEIRF to Germany’s Energiewende highlights that regulatory impact assessment (RIA) must evolve from a narrow technical exercise into a governance-oriented

process that balances efficiency, equity, and sustainability. The following policy lessons flow directly from this analysis.

### **6.1 Embedding RIA in Governance Processes**

RIA should be embedded within broader governance frameworks that prioritize institutional credibility, transparency, and stakeholder trust. Germany's experience shows that efficiency and sustainability gains are sustainable only when governance mediates trade-offs effectively. This aligns with the OECD's Principles on Water Governance, which emphasize legitimacy and accountability (OECD, 2015). Without these safeguards, even technically sound reforms generate contestation, as seen in resistance to grid expansion projects.

### **6.2 Addressing Distributional Equity**

The regressive burden of household surcharges demonstrates that distributive justice is the most fragile pillar of transition governance. Future RIAs should integrate affordability indices and equity-weighted metrics to anticipate distributive tensions. While the United Kingdom's emphasis on consultation did not eliminate inequities, it institutionalized procedural safeguards that enhanced legitimacy (Lodge & Wegrich, 2012). Embedding distributive analysis directly into RIAs is thus critical for ensuring that vulnerable groups share in the benefits rather than bear disproportionate costs.

### **6.3 Managing Spatial Justice**

Uneven regional outcomes, particularly in grid expansion, underscore the importance of spatial justice in energy transitions. TEIRF suggests that appraisal must extend beyond aggregate efficiency to address how burdens and benefits are distributed geographically. Transparent scoring methods, such as Belgium's Kafka approach (De Jong & Zanger, 2011), can highlight disparities but must be combined with participatory processes to ensure legitimacy. RIA frameworks that incorporate spatial equity will help secure community acceptance and prevent localized resistance from derailing national goals.

### **6.4 Sequencing and Adaptive Policy Design**

Germany's experience confirms that sequencing is a governance challenge, not a purely technical one. Rapid renewable deployment achieved sustainability but created affordability and system integration pressures, necessitating corrective reforms. Spain's fiscal instability illustrates the risks of poor sequencing (Pérez-Arriaga, 2014). Policymakers should embed sequencing logic into RIAs by using phased reforms, pilot projects, and adaptive monitoring to align ambition with institutional readiness.

### **6.5 International Relevance**

The lessons extend beyond Germany. For low- and middle-income countries, TEIRF provides a diagnostic tool to identify institutional preconditions and to adapt reforms to local contexts rather than transplanting complex models. For advanced economies, Germany demonstrates that even strong governance systems must anticipate distributive and spatial conflicts to sustain legitimacy. TEIRF therefore offers a governance-centered framework that is both globally relevant and adaptable to diverse contexts (UN-Water, 2019).

### **6.6 Limitations and Future Research**

This study's reliance on document analysis limits insight into informal practices, and its focus on Germany constrains generalizability. Comparative references to Spain, the UK, and

Belgium provide some validation, but future research should extend TEIRF through mixed-methods designs that integrate qualitative governance analysis with quantitative indicators across multiple countries. Such work would strengthen TEIRF as a practical tool for both scholars and policymakers.

Together, these policy implications demonstrate that the future of RIA lies in reframing it as a governance process. TEIRF shows that efficiency, equity, and sustainability are inseparable and must be sequenced through credible governance to ensure legitimacy. By embedding distributive justice, spatial equity, and adaptive sequencing into appraisal, RIAs can move beyond efficiency metrics to frameworks capable of reconciling technical ambition with social legitimacy in contested transitions worldwide.

## 7. Conclusion

This study has examined how regulatory impact assessment (RIA) practices within Germany's Energiewende reflect the interdependence of efficiency, equity, and environmental sustainability, and how these outcomes are conditioned by governance capacity. Applying the Triple-E Institutional Reform Framework (TEIRF) shows that energy- and water-pricing reforms cannot be reduced to technical instruments of cost recovery or ecological ambition. Rather, they must be understood as governance processes shaped by institutional credibility, distributive choices, and social legitimacy. The German case illustrates that strong institutions can sustain ambitious efficiency and sustainability targets, yet distributive inequities and spatial burdens remain persistent sources of contestation. Comparative insights from Spain, the United Kingdom, and Belgium reinforce this point, demonstrating that fiscal weakness, narrow efficiency metrics, or procedural consultation alone are insufficient to resolve the trade-offs of contested transitions.

The theoretical contribution of this paper lies in advancing RIA scholarship beyond its efficiency bias. By embedding efficiency, equity, and sustainability within a governance foundation, TEIRF provides an integrated framework that connects technical appraisal to political economy and institutional analysis. This reframing positions RIA as a governance practice that structures negotiation, sequencing, and legitimacy, thereby bridging technocratic models and critical perspectives through a coherent diagnostic tool.

From a policy perspective, the findings highlight the importance of incorporating distributive equity, spatial justice, and adaptive sequencing into appraisal frameworks. For high-capacity systems, this means anticipating legitimacy challenges even where efficiency and sustainability goals are met. For low- and middle-income countries, TEIRF underscores that reforms must be sequenced in line with institutional readiness rather than imported wholesale from advanced economies. In both contexts, TEIRF provides a flexible and context-sensitive diagnostic that can guide policymakers in aligning ambition with governance capacity, ensuring reforms that are not only efficient but also socially legitimate and environmentally resilient.

Like all qualitative studies, this research has limitations. Reliance on document analysis risks privileging official narratives, while the focus on Germany constrains generalizability. Nevertheless, by situating findings within international debates and drawing on comparative references, the study offers insights of broader applicability. Future research should extend TEIRF through mixed-methods designs that combine qualitative governance diagnostics with quantitative efficiency scores, econometric modeling, and stakeholder perspectives across diverse political economies.

In conclusion, the future of RIA lies in moving beyond narrow cost–benefit logic toward a governance-centered framework capable of reconciling efficiency, equity, and sustainability. TEIRF provides a pathway for this transformation, ensuring that regulatory appraisal can meet the dual challenge of technical ambition and democratic legitimacy in the governance of global energy transitions.

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