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From Paris to practice: an investment-oriented framework for EU sustainability and energy storage

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Abstract

The year 2025 marks a critical juncture in global sustainability governance, coinciding with the tenth anniversaries of the Sustainable Development Goals, the Paris Agreement, and the Task Force on Climate-related Financial Disclosures. Yet, progress remains uneven. Financing gaps, fragmented governance, and weak legal integration between climate and development commitments continue to constrain decarbonization. Energy storage, essential for stabilizing renewable-based power systems, exemplifies this challenge. Despite its recognized role in achieving Paris goals and advancing multiple SDG targets, storage deployment and financing remain ungoverned by binding international or European Union targets, reflecting a gap in the combined mosaic of internal and external commitments. This study extends an original integrative framework—first developed at the Columbia Center on Sustainable Investment for the electric utilities sector—to renewable energy storage in the EU. The methodology combines doctrinal legal analysis, sustainability science, and the policy coherence literature to evaluate how storage investment and regulation align with broader climate and development objectives. Particular attention is given to financial flows, subsidy reform, and enforceability in light of recent developments such as the Draghi Report on EU investment needs and the International Court of Justice Advisory Opinion on climate finance obligations. Findings indicate that while storage has the potential to act as a systemic enabler of policy coherence for sustainable development, incoherence persists where investments, regulation, and justice considerations remain fragmented. Embedding storage policy coherence in binding EU legislative instruments would transform storage into both a lever and a leverage point for aligning the Paris Agreement and the SDGs, moving coherence from discourse to enforceable practice.

Keywords: *policy coherence for sustainable development, renewable energy storage, Paris agreement, sustainable development goals, climate finance, European Union*

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1. Introduction

The year 2025 marks a critical juncture in international sustainability governance, coinciding with the tenth anniversaries of the Sustainable Development Goals (SDGs), the Paris Agreement, and the Task Force on Climate-related Financial Disclosures (TCFD). Taken together, these three milestones underscore the interdependence of social, environmental, and financial dimensions in driving global sustainability transitions. In 2024, at the Summit of the Future, United Nations member states adopted by consensus the Pact for the Future alongside a Global Digital Compact, signaling renewed multilateral commitment to deeper international cooperation, including in the digital domain [1].

The urgency of accelerating climate action is underscored by the Intergovernmental Panel on Climate Change (IPCC), which has emphasized that greenhouse gas emissions must peak before 2025 and fall by 43% by 2030 to remain consistent with a 1.5 °C pathway [2]. Yet, progress across sectors remains uneven. The Sustainable Development Solutions Network (SDSN) has long argued that the SDGs should be understood primarily as an investment agenda, encompassing human capital (education, health, social protection) and physical infrastructure (renewable energy, grids, digital technologies). However, fragmented financing, policy misalignment, and the absence of cohesive international law linking the SDGs and the Paris Agreement continue to hamper progress [3, 4].

The Sustainable Development Goals Report 2025 notes significant advances in health and social protection, but stresses that nearly half of the underlying targets are not moving forward at the required pace, and some are regressing [5, 6]. In the energy sector, the pace of progress toward SDG 7—access to affordable, reliable, sustainable and modern energy—remains insufficient, with energy efficiency improvements described as sluggish [7]. Weak coordination between climate goals and development priorities is also identified as a critical barrier to renewable energy investment [8].

At the same time, new opportunities are emerging. Digitalization, as associated with democratization and decarbonization, is increasingly framed as a lever for sustainable development [9]. The 5th International Forum on Big Data for Sustainable Development Goals in Beijing (September 2025) highlighted the role of artificial intelligence and big data in tackling interconnected challenges, from energy and food to water and biodiversity. These

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developments are consistent with the six SDG transitions outlined by the United Nations Department of Economic and Social Affairs, which include systemic changes in energy, food systems, digital transformation, education, jobs and social protection, and climate-biodiversity action [10].

Finance remains a decisive enabler. Recent regulatory developments, such as the Memorandum of Understanding between the European Securities and Markets Authority (ESMA) and the European Environment Agency (EEA), aim to embed environmental factors into financial supervision [11]. Still, the pace of SDG progress within the European Union between 2020 and 2023 slowed to less than half of the gains achieved in the previous period ([3] p. 5). Data fragility further undermines global monitoring, as illustrated by the suspension of the Demographic and Health Surveys in 2025 following the withdrawal of funding from the U.S. Agency for International Development [5]. Political consensus is also weakening: in 2025, the United States formally rejected the 2030 Agenda and the SDGs, raising questions about the durability of the global development agenda [12], or its end [13].

Against this backdrop, this study develops an original integrative framework that extends the first and only seminal study combining the Paris Agreement and the SDGs at the Columbia Center on Sustainable Investment, initially applied to the electric utilities sector. Here, the framework is extended to renewable energy storage, offering the first combined analysis of the European Union's internal and external commitments, with implications not only for decarbonization but also for broader sustainability. In doing so, it also provides specific insights for EU legislative instruments, positioning renewable energy storage finance as a critical test case for the alignment of international climate and development agendas.

2. Methodology

The multiplicity of international commitments on climate and sustainable development requires coherent analytical tools to assess their combined implications. A structured framework offers a scientifically grounded way to link the Paris Agreement's decarbonization objectives with the SDGs, thus avoiding fragmented or siloed approaches to climate governance [14]. Building on the seminal study developed at the Columbia Center on Sustainable Investment, which first combined the Paris Agreement and the SDGs for the electric utilities industry [15], this article extends the framework to the European Union (EU) context and applies it to energy storage as a test case. Importantly, it should be borne in mind that, unlike the Paris target, the SDGs are not legally binding.

Decarbonization is fundamentally an investment challenge, as it requires replacing emitting capital assets with non-emitting alternatives [16]. This process underscores the centrality of "climate solutions investing," a practice that prioritizes financial flows into projects and technologies most capable of achieving Paris-aligned outcomes [17]. Unlike general climate-themed investment, this approach deploys distinct assessment tools designed to maximize impact in not only reducing emissions, but also enabling sustainability. An integrated framework that combines climate and sustainability objectives therefore provides a foundation for directing capital towards effective solutions, while simultaneously informing regulatory design.

Energy storage was selected as the focal sector for three reasons. First, the Intergovernmental Panel on Climate Change (IPCC) recognizes storage as essential to achieving Paris Agreement goals, given its role in balancing variable renewable energy and enabling flexibility in power systems [18]. Second, battery energy storage systems (BESS) serve as a cross-cutting enabler of sustainability, with evidence suggesting positive contributions to SDG targets, though also potential negative impacts, particularly in environmental and social domains [19]. Finally, energy storage represents both a leverage point and a lever for sustainability pathways, provided regulatory and investment frameworks adequately address raw material supply chains, lifecycle emissions, and equitable access to technology [20].

The methodological approach combines doctrinal legal analysis with insights from sustainability science and policy coherence literature. The study builds on the recognition that fragmented approaches to sustainability risk producing inconsistent or ineffective outcomes. A framework that integrates the Paris Agreement and the SDGs offers a systematic lens through which to evaluate both investment and regulatory strategies in the European Union (EU). This article extends the original Columbia framework by applying it to the case of energy storage, using multiple strands of legal and interdisciplinary literature to ensure analytical robustness.

First, policy coherence constitutes a central dimension of the methodology. Drawing on the OECD's Framework for Policy Coherence for Sustainable Development [21], as well as subsequent refinements in the scholarly literature [22, 23], the analysis shows how internal and external EU energy policies can align with sustainability objectives. This focus reflects the growing recognition that coherence is a catalyst for effective governance in achieving the SDGs.

Second, the study adopts a doctrinal approach in energy law, following Villavicencio Calzadilla and Mauger's analysis of renewable energy and SDG 7 [24]. This perspective enables the assessment of how legal frameworks shape both opportunities and barriers to deploying clean energy technologies, while embedding concerns of energy justice.

Third, the research incorporates the emerging field of corporate sustainability law, which synthesizes legal regimes relevant to corporate conduct and emphasizes transdisciplinary approaches to addressing corporate (un)sustainability [25]. By integrating this doctrinal perspective, the study situates storage investments within the broader regulatory environment governing corporate accountability and sustainability performance.

Fourth, modeling science provides additional grounding for the framework. Recent contributions underscore that SDGs remain underexplored in policy modeling, despite their heavy interconnections and the urgent need for scientifically robust and region-specific insights [26, 27]. These works highlight the importance of embedding sustainability into assessments beyond emissions reductions alone and support the methodological choice of combining sustainability and development goals into a unified framework.

Fifth, the analysis is situated within the literature on earth system law and global governance. As Biermann et al. argue, the SDGs represent a novel form of governance through goal-setting, with implications for law and policy coherence at multiple scales [14].

To translate these global commitments into actionable recommendations, this paper adopts Teubner's theory of responsiveness of law, whereby legal systems achieve adaptability by engaging with autonomous social discourses such as CSR and ESG standards [28]. This conceptual tenet underpins the purpose of the framework: to provide practical recommendations for both policymakers and corporate actors.

The EU provides a particularly relevant jurisdictional focus. Comparative analyses suggest that EU internal energy policy is more coherent than its external policy, raising questions about the Union's global contribution to sustainable energy access [29]. Environmental goals *within* the EU are also characterized by complexity and low coherence, yet they demonstrate fewer trade-offs across policy domains than social and economic goals, implying that gains in environmental coherence may deliver disproportionately rapid sustainability progress [29].

Finally, energy storage is selected as the focal sector for applying the framework. Among different types of storage, battery energy storage systems (BESS) are recognized as enablers of 60 SDG targets (35.5%) but also potential inhibitors of 22 targets (13%) due to social and environmental externalities, including raw material extraction, lifecycle emissions, and inequitable access [19]. By situating storage within sustainability pathways, the methodology follows Chan et al.'s identification of leverage points and levers as entry points for transformative change [20]. This choice reflects not only the technological importance of storage in achieving the Paris Agreement's goals but also its broader implications for policy coherence. By focusing on renewable energy storage, this work offers the first combined implications of the EU's internal and external commitments not only in terms of decarbonization but also of sustainability more broadly. In doing so, it highlights the cogent implications for EU legislative instruments and their practical application in shaping future investment landscapes.

3. Results and discussion

3.1. A gap-filling opportunity

Global capital allocation increasingly reflects the integration of climate objectives with broader concerns. Institutional investors and policymakers alike recognize the financial risks of inaction and the opportunities in low-carbon transitions even though various financial frameworks, such as prescribed capital allocations and index-linked investments, still contribute to ongoing oil lock-ins [30]. Frameworks that link climate agreements and sustainability objectives provide much-needed guidance to align investment flows with international commitments.

Renewable energy storage is emerging as a cornerstone of the EU's energy transition. The variability of solar and wind power makes storage indispensable for system stability, grid flexibility, and market integration [31]. From an investment perspective, storage technologies represent both a challenge and an opportunity. While upfront costs and regulatory uncertainty pose barriers, the potential for long-term returns, system optimization, and risk hedging against volatile fossil fuel prices make storage a strategic asset.

At the policy level, the EU has increasingly emphasized storage in its legislative and financial instruments, from the European Green Deal to the REPowerEU plan and the revision of the Electricity Market Design [32]. However, no study of storage in the combined mosaic of external and internal commitments has been undertaken, leading to the lack of any binding target on storage deployment and financing.

By embedding storage within a broader investment-oriented framework, this project underscores how the EU's dual commitments to the Paris Agreement and the SDGs can be operationalized through legislative tools that are coherent and effective. In practice, this means aligning incentives, de-risking mechanisms, and governance structures to channel capital into projects that deliver on both decarbonization and sustainable development.

3.2. A systemic approach to policy coherence

The adoption of the 2030 Agenda in September 2015, greeted with a standing ovation at the United Nations General Assembly, was not an isolated milestone but the culmination of more than forty years of evolving multilateralism. From the 1972 Stockholm Conference on the Human Environment through successive world summits, the environmental agenda gradually converged with economic and social debates into a single, comprehensive framework for sustainable development [33].

What makes the 2030 Agenda distinctive is its universal and indivisible architecture. Rather than a menu of discrete policy targets, the 17 Sustainable Development Goals (SDGs) are interdependent and anchored in four mutually reinforcing pillars: people, planet, prosperity, and peace, with partnership as the means of implementation [33]. This structure recognizes that tackling climate change, poverty, inequality, and ecological degradation requires treating the goals as a coherent whole, not as isolated objectives to be pursued selectively.

At the same time, it is crucial to recall that sustainable development extends beyond the SDGs themselves. The 17 goals and their 169 targets provide the operational results framework of the Agenda, but they are not a substitute for the Agenda's broader vision. As progress has lagged across multiple domains, the urgency of transformation has become increasingly clear: incremental gains will not suffice in the face of planetary boundaries, rising inequalities, and systemic fragilities [34].

The 2019 Global Sustainable Development Report (GSDR) underscored this point by calling for a departure from business as usual. Its analysis introduced six entry points—human capabilities and well-being, sustainable economic activity, food systems, decarbonized energy, urban development, and global environmental commons—that can unlock change across multiple SDGs simultaneously [35]. Achieving such systemic change depends on mobilizing four levers of transformation: governance, economic and financial systems, science and technology, and individual and collective action. Only in combination, and in context-sensitive ways, can these levers produce the scale of transformation required [35].

Complementary insights from sustainability science further stress that focusing only on direct drivers of unsustainability, such as emissions or deforestation, misses deeper indirect drivers, including governance failures, lock-ins, and structural inequities [36]. Addressing these requires identifying leverage points (the critical places where intervention can shift the trajectory of whole systems) and activating levers (the means of driving those changes). This approach highlights that trade-offs are inevitable but that synergies, which are enabled by policies designed to generate co-benefits across multiple goals, can yield disproportionately positive outcomes [35].

Within this architecture, policy coherence for sustainable development (PCSD) emerges as both a principle and a tool. By seeking to align economic, social, and environmental policies, PCSD reduces the risks of duplication, fragmentation, and unintended harm while amplifying positive spillovers across sectors [35]. It is codified as a target within SDG 17, reaffirming that without coherence, neither the four pillars nor the Agenda's universal promise of "leaving no one behind" can be realized [35].

In short, the 2030 Agenda calls for moving from fragmented, siloed interventions to systemic strategies that integrate people, planet, prosperity, and peace through genuine partnership. This requires not only new policies but also new ways of governing, notably whole-of-government and whole-of-society approaches that can mobilize resources, institutions, and communities around shared transformation pathways.

3.3. A combined policy framework

3.3.1. The CCSI precedent

A central challenge in global sustainability governance is determining under what conditions an investment can legitimately be considered sustainable. The Columbia Center on Sustainable Investment (CCSI) has addressed this by proposing the first and, to date, only framework that systematically aligns the objectives of the Paris Climate Agreement (PCA) with the Sustainable Development Goals (SDGs) in the electric utility sector [15]. This framework is particularly relevant given that utilities stand at the core of the energy transition, as well as renewable energy storage deployment and financing.

The framework is structured around four interconnected dimensions: the product offered by utilities, the sustainability of production processes, the responsibility exercised across the supply and value chain, and the role of companies as corporate citizens. Taken together, these pillars provide an integrated assessment of whether utilities are contributing meaningfully to global climate and development objectives.

The first pillar, concerning the product, examines whether a utility is a leader in zero-carbon electricity generation and whether it is credibly on track to achieve net-zero emissions by 2050 or earlier. The benchmark for this assessment is the 1.5 °C scenario set out by the Intergovernmental Panel on Climate Change (IPCC), which calls for a reduction in global CO_2 emissions of 43% by 2030 and net-zero emissions by mid-century [2]. Utilities can only be considered PCA-aligned if their projected emission trajectories are consistent with these thresholds. To ensure credibility, utilities are encouraged to adopt decarbonization pathways validated by third-parties, disclose and externally verify Scope 1–3 emissions, integrate climate risk into corporate governance and incentive structures, and mobilize capital through financial instruments such as green bonds.

The second pillar, concerning the production process, emphasizes that even if a utility aligns with climate science in terms of decarbonization, it may still undermine other SDGs if its operational processes are socially or environmentally unsustainable. This dimension considers the entire project lifecycle, from design to siting, operation, and closure. Particular attention is given to the growing waste from renewable energy infrastructure. Equally important are siting decisions, which should be based on participatory human rights, social, and environmental impact assessments. Such processes must ensure respect for land tenure rights, avoid competition with agricultural land and water resources, and mitigate the impacts of offshore installations on coastal communities and marine ecosystems. During the operational phase, utilities must prioritize waste reduction, water recycling, and methane leakage prevention. Furthermore, utilities are expected to uphold International Labour Organization standards, adopt gender-sensitive employment practices, and extend energy access to marginalized groups, thereby contributing to equity and inclusion. Decommissioning should also be anticipated, with reclamation and social transition plans designed from the outset.

The third pillar, concerning value chain responsibility, extends the analysis beyond the utility itself to its upstream suppliers and downstream consumers. The electric utility sector functions as an enabler of systemic decarbonization by providing the backbone for electrification across transportation, industry, and urban systems. As such, utilities are expected to collaborate with vehicle manufacturers to accelerate the deployment of electric mobility, with heavy industries to ensure that synthetic fuels and hydrogen are produced using renewable energy, and with local governments to integrate decarbonization into building codes and urban planning. Grid stability is also a major consideration, as increased electrification and reliance on intermittent renewables may create systemic vulnerabilities, which can be mitigated by developing smart grids, supporting distributed renewable generation, investing in innovative storage technologies, and engaging consumers in demand-response programs. Moreover, utilities are expected to measure and reduce Scope 3 emissions along the value chain, a task made necessary by the Greenhouse Gas Protocol, which incorporates these emissions into standard corporate carbon accounting frameworks.

The fourth pillar, corporate citizenship, situates utilities within the broader societal context and evaluates whether they act as responsible corporate actors. Good corporate citizenship implies obligations that extend beyond the interests of investors, employees, or customers, and includes the duty not to undermine global sustainability objectives. This dimension therefore calls on utilities to engage constructively with policymakers, to refrain from lobbying or financing practices that obstruct climate legislation, and to avoid aggressive tax avoidance strategies that erode public revenues. Governance structures should include independent oversight of climate and SDG strategies. Further, the roles of chief executive officer and board chair should be separated to avoid conflicts of interest. In addition, utilities are expected to support gender equality in leadership, invest in education and technology transfer, and engage in public–private partnerships that accelerate the development of sustainable technologies.

Taken together, these four pillars demonstrate that alignment with the Paris Agreement and the SDGs cannot be reduced to technological decarbonization alone. A utility may generate renewable electricity and yet undermine human rights, biodiversity, or equity if its broader practices remain unsustainable. The CCSI framework therefore serves both diagnostic and prescriptive functions. It provides a structured method to assess alignment while simultaneously outlining a normative pathway for utilities to contribute to a just and sustainable energy transition.

3.3.2. A combined framework for storage

The ambition to align investment flows with sustainability goals requires more than voluntary pledges or distant neutrality targets. It demands a policy blueprint capable of bridging capital allocation, regulatory innovation, and social inclusion. Storage, which was described as the "unsung hero of decarbonization," exemplifies this challenge, as its deployment depends not only on technological progress but also on regulatory clarity and targeted financial instruments [9].

A first step is to evaluate investment strategies through the lens of capital planning. As highlighted in the World Energy Investment Report, capital expenditures (CapEx) signal the future trajectory of a company's transition, revealing whether resources are directed toward fossil lock-in or low-carbon substitutes [37]. Unlike emission footprinting, which fluctuates by sectoral conventions, CapEx provides a forward-looking indicator that embeds transition risks into financial value [16]. This avoids the pitfalls of delayed climate targets, such as those set for 2050, and instead grounds analysis in near-term realities, such as companies' five- to ten-year investment choices [16]. Focusing on CapEx also allows investors and regulators to identify the paradox of "good emissions," namely the short-term rise in carbon output associated with scaling hard-technology climate solutions such as storage plants or electrolyzers [16].

Beyond capital allocation, entities must be evaluated against their climate-related objectives and metrics. Initiatives like the Task Force on Climate-related Financial Disclosures (TCFD) have introduced the weighted average carbon intensity (WACI) metric as a proxy for portfolio emissions [38]. While useful, WACI remains only a first step. More sophisticated indicators need to capture systemic objectives, such as financial resilience under anticipated regulation, product lifecycle efficiency, and alignment with specific SDG targets.

A combined policy framework must also address social equity in energy finance. Evidence shows that the energy sector has the lowest share of gender-responsive financing across all development assistance categories: only 18% of bilateral aid integrates gender considerations, compared with 45% across other sectors [39]. This imbalance demonstrates the need for targeted mechanisms, such as preferential loan rates for women-led renewable energy communities or credit guarantees to de-risk participation. Integrating gender-responsive finance would not only advance SDG5 on gender equality but also strengthen uptake of distributed renewable solutions across Europe.

The framework further requires regulatory and institutional coherence. As energy systems become increasingly digitalized and decentralized, static regulation risks lagging behind technological advances. A combined regulatory blueprint of climate and sustainability goals therefore should aim at architectural innovation, embedding adaptability and inclusiveness into institutional design. Such an approach advances SDG16 on strong institutions, while SDG13.2 reinforces the need to embed climate goals into national policy frameworks.

Overall, the EU, by integrating capital planning, performance metrics, social equity, and regulatory adaptability, can move toward a comprehensive investment-oriented policy framework that does not only finance decarbonization but also ensures the inclusiveness and resilience of the transition.

Within this context, energy storage must be situated across the four sustainability pillars identified by the CCSI (*supra* 3.1). Under the first pillar, storage companies must adopt carbon intensity trajectories consistent with science-based targets, disclose climate risk exposure, and integrate ambitious internal carbon pricing. This includes aligning CapEx for storage infrastructure, whether lithium-ion gigafactories or flow battery demonstration sites, with the Paris Agreement benchmarks. By externally verifying Scope 1, 2, and 3 emissions across the battery value chain and linking executive remuneration to decarbonization outcomes, storage providers can embed accountability into their governance models.

The second pillar addresses environmental and social safeguards in storage deployment. This implies robust due diligence on land acquisition, mitigation of competition for arable land and water use, and full recycling plans at early project stages. For flow batteries, many environmental benefits are already inherent. They rely on non-toxic, non-flammable, and non-corrosive active materials, reducing risks to surrounding communities and allowing underground siting in harsh climates [40]. Moreover, adopting inclusive consultations and credible environmental and social impact assessments (ESHIAs) ensures that affected communities can participate in project planning and closure phases. Social equity mechanisms, such as preferential tariffs for marginalized groups and compensation schemes for regions transitioning away from coal, strengthen the legitimacy of storage expansion.

The third pillar highlights the role of storage in systemic integration. Batteries and other storage systems enable smart city models, support e-mobility through charging infrastructure, and enhance demand-side management (DSM). DSM, when embedded into public–private partnerships and enabled by smart meters, allows grid operators to balance supply and demand dynamically, reducing the need for oversized storage and generation assets while empowering prosumers through flexible tariffs [41]. Storage also underpins diversified renewable portfolios, such as solar, wind, and small modular nuclear reactors, enhancing bankability by reducing resource risk.

Finally, the fourth pillar stresses regulatory coherence and institutional accountability. Storage companies must avoid aggressive tax planning and refrain from monetary contributions to political parties, ensuring that policy engagement remains transparent and aligned with climate goals. They should actively participate in and support clean industrial policies such as the EU's Clean Industrial Deal, the Industrial Decarbonization Accelerator Act, and the Circular Economy Act, which embed sustainability into reindustrialization. By fostering board-level independence, ensuring gender and pay equity, and partnering with educational institutions on climate education, storage companies can contribute to stronger institutional frameworks. International technology transfer, particularly for non-lithium battery chemistries and DSM digital tools, can further accelerate adoption in developing countries, ensuring that the benefits of storage extend beyond OECD economies aligning external and internal EU commitments. The four pillars are visualized in the following **Table 1**.

Table 1 • A combined framework aligning sustainability and climate goals for storage companies across four pillars.

Pillar	Application to energy storage
1. Product: Is the utility a leader in zero-carbon electricity generation and is the utility on the path to reach zero carbon emissions by 2050 or earlier?	Storage technologies must align with carbon intensity trajectories consistent with science-based targets and Paris Agreement benchmarks. CapEx for storage infrastructure—whether lithium-ion gigafactories or organic flow battery pilots—should reflect forward-looking transition risks rather than delayed neutrality targets. External verification of Scope 1, 2, and 3 emissions across the storage value chain, disclosure of climate risk exposure, and integration of ambitious internal carbon pricing are central. Linking executive pay to decarbonization outcomes ensures accountability.
2. Production process: Is the utility's production process socially and environmentally sustainable?	Procedural protocols require safeguards on land acquisition, arable land competition, water use, and early-stage recycling planning. Inclusive consultations, credible ESHIAs, and compensation schemes for coal regions are necessary to uphold social legitimacy. Gender-responsive finance and preferential tariffs for marginalized groups further support SDG5 and community equity.
3. Value chain responsibility: Is the utility's supply and value chain aligned with the SDGs and PCA?	Storage enables systemic integration of renewables by supporting diversified portfolios (solar, wind, nuclear) and improving bankability through reduced resource risk. It underpins smart city models, e-mobility infrastructure, and prosumer engagement via DSM. DSM programs, which are often enabled by smart meters and PPPs, balance the grid, reduce oversizing of assets, and empower consumers through flexible tariffs. Scope 3 emissions in storage value chains must be quantified and mitigated, with transparent monitoring of environmental and labor impacts.
4. Citizenship: Does the utility contribute positively to policy, society, and governance?	Storage companies must avoid aggressive tax planning, refrain from political contributions, and ensure transparent participation in policymaking. They should engage with industrial policy frameworks anchoring sustainability in reindustrialization. Governance should include independent boards, gender and pay equity, and board-level oversight of Paris alignment. Partnerships with educational institutions and international technology transfer of advanced chemistries (e.g., flow batteries) and DSM tools help align external and internal EU commitments.

Through this four-pillar lens, storage is both a technological item and a structural enabler of a sustainable energy transition.

3.3.3. Embedding the framework into EU law and policy

If a combined framework provides the architecture for aligning investment with sustainability, the next step is domestication, namely, embedding this architecture into the specific institutional and policy fabric of the European Union. This requires moving from abstract commitments to concrete instruments that govern investment choices, evaluate progress, and ensure responsiveness to changing social and ecological conditions.

A first priority is establishing robust monitoring and evaluation (M&E) mechanisms [16]. Whereas current sustainability frameworks often focus on aggregate reporting or static compliance, effective domestication demands indicators that are dynamic, region-specific, and sensitive to cross-sectoral spillovers. This priority calls for evaluation designs capable of avoiding siloed monitoring, enabling corrective adjustments over time, as well as embedding nexus thinking. The latter assesses the full lifecycle of renewables at the nexus of climate, nature, food, water, and health with the aim to de-escalate resource competition and ecological degradation [42].

Second, domestication involves strengthening coherence between the EU's internal and external energy policies. Research suggests that while the Union shows relatively high levels of internal alignment, its external action—especially regarding energy access in developing countries—remains fragmented [29]. This asymmetry undermines the EU's global credibility, given its dual role as the largest integrated energy market and a normative actor in international governance. A domesticated framework should therefore unify internal and external commitments, ensuring that the EU's financial instruments for storage and renewables apply consistent principles at home and abroad.

Third, the legal dimension plays a constitutive role in domestication. Energy and corporate law must evolve beyond formalistic compliance toward what Teubner describes as the *responsiveness of law*, whereby legal systems engage dynamically with other autonomous social discourses such as corporate self-regulation, ESG standards, or digital governance [19]. Embedding responsiveness implies a governance model that can integrate corporate sustainability law—understood as encompassing all legal domains relevant to corporate (un)sustainability [25]—and earth system law, which situates EU policymaking within global planetary boundaries [43].

Finally, domestication cannot be separated from the social legitimacy of the framework. A system that advances decarbonization while overlooking distributive effects or procedural justice risks reproducing the very inequities the SDGs seek to overcome. Ensuring transparency in raw material supply chains for storage technologies, addressing gender disparities in energy finance, and promoting inclusive deliberation all contribute to embedding the framework within European societies. In this sense, domestication is less about transposing global goals into European law and more about cultivating a reflexive institutional culture that can reconcile investment efficiency with justice.

3.4. The limits and future of the framework

3.4.1. Limits

Despite its conceptual clarity, policy coherence for sustainable development (PCSD) is confronted with practical and structural limits. In the energy sector, one of the most evident bottlenecks is the misalignment between renewable energy deployment and fossil fuel phaseouts. Investment in renewables and storage is frequently delayed, while retirements of fossil plants are postponed, creating a vicious cycle that slows down decarbonization and undermines long-term climate targets. This pattern highlights the inadequacy of relying exclusively on price signals. Market design reforms, including renewable energy storage targets, must be enacted and coordinated with the orderly withdrawal of fossil capacity.

In sustainability governance more broadly, financial analysis reveals that no single metric provides a comprehensive view of a company's current or future performance. Data aggregation initiatives such as Carbon Tracker, which has long used Rystad Energy's data, or PACTA, which compiles information across multiple licensed providers, illustrate both the potential and the gaps of current practice. Companies often classify capital planning details as commercially sensitive, but sustainability and financial professionals alike increasingly recognize that a granular understanding of capital expenditure trajectories is indispensable to assess whether durable assets are viable in a volatile, decarbonizing economy. This creates a tension between the disclosure of emissions, such as Scope 3, and the more fundamental question of how firms plan their future capital allocations. Shifting the focus to capital plans may help bridge the divide between sustainability-oriented finance and conventional investment analysis [16].

Theoretical perspectives add further complexity. Teubner's notion of a "constitutional moment" points to the duality of internal implementation and external controls, underscoring that frameworks such as PCSD are always mediated by both institutional logics and systemic constraints [44]. At the level of EU climate mitigation pathways, model-based analyses show that policies generate both co-benefits and trade-offs that policymakers must anticipate and mitigate through corrective packages. Integrated backcasting approaches compatible with full SDG achievement could provide a more robust tool for identifying SDG-aligned sustainable pathways [26].

Finally, the scale of investment required constitutes one of the most significant limits. The Draghi report, presented to the European Commission in September 2024, emphasized that the long-term prosperity and competitiveness of Europe hinges on an ambitious investment plan and called for additional annual investments of approximately EUR 800 billion, particularly to accelerate the green and digital transitions [45]. The net annual investment need for deploying renewable energy storage in Europe, however, has not been identified yet.

3.4.2. Future

The future evolution of the framework will depend on analytical, operational, and political policy effectiveness [46]. A major turning point came in 2025 with the International Court of Justice Advisory Opinion on climate change, which confirmed that continued fossil fuel subsidies and new exploration authorizations are irreconcilable with the states' human rights obligations in the context of the climate emergency [47]. The Opinion further clarified that climate finance obligations under Article 9 of the Paris Agreement must be interpreted in light of the collective temperature goals in Article 2, thereby transforming what had been treated as political pledges into binding legal duties [47]. Reading through the ICJ's interpretation of the Paris temperature goal, it is argued that industrialized nations have effectively run out of their lawful GHG budget. In this light, the remaining budgets are far tighter than the IPCC's allocations. This conclusion is anchored in Article 2 of the Paris Agreement, in core human-rights protections, and in the precautionary principle, all of which oblige states to reduce the possibility of severe climate harm to the lowest feasible level. Even before the Advisory Opinion, the legal consequences were found to be far-reaching: the 1.5 °C limit becomes a binding normative ceiling; states must pursue it with a high margin of certainty; overshoot pathways and geoengineering approaches generally fall foul of these obligations; and carbon-budget calculations must adopt highly conservative assumptions [48].

At the European level, consistently with the Advisory Opinion, the governance framework already obliges member states to phase out environmentally harmful subsidies, especially for fossil fuels, and to report annually on progress [49, 50]. Yet persistent fossil subsidies and the delayed submission of updated Nationally Determined Contributions reveal significant gaps between ambition and implementation [51].

Several pieces of legislation could also be either reformed or better implemented in light of the proposed framework. For instance, the European Commission's recent infringement proceedings against 26 member states for failing to transpose the Energy Efficiency Directive (EU 2023/1791) highlight persistent gaps in implementation. Such circumstance creates a key window for discussing the proposed framework along the four dimensions of product/technology alignment, production process sustainability, value-chain responsibility, and corporate citizenship. Notably, in the sensitive subject-matter of data center efficiency, the EED now mandates annual public reporting of energy-performance, renewable-energy use, waste-heat recovery, cooling, and water-use metrics for every data center with IT load above 500 kW. The proposed framework would suggest embedding science-based decarbonization goals, full lifecycle and Scope 3 disclosure, equitable resource use, supply-chain due diligence, and transparent governance, including heat reuse, renewable sourcing, and emissions-linked incentives. Accordingly, regulators would ensure that data-center expansion contributes to the EU's 2030 energy-efficiency target and its long-term 2050 neutrality objectives, rather than undermining them.

The proposed framework can also add depth and breadth to several domestic legal systems that already place energy storage at the center of their regulatory strategies, even if primarily within a decarbonization agenda. In Germany, recent amendments to the Energy Industry Act (EnWG) and the Federal Building Code (BauGB) grant large-scale battery storage privileged status in rural zones, streamline permitting, and introduce grid-fee exemptions for utility-scale systems—including multi-use BESS, while addressing the long-standing issue of double charging [52]. Italy likewise demonstrates strong policy momentum. Under the new national MACSE mechanism and related market reforms, Italy has become Europe's most dynamic storage market, with remuneration schemes and capacity tenders accelerating deployment and attracting significant investor interest [53].

Applying the proposed framework to Germany and Italy would encourage these legislations to complement their already storage-friendly policies with explicit sustainability and governance criteria. For instance, beyond permitting and financial incentives, Germany could integrate mandatory lifecycle carbon accounting and Scope 3 emissions reporting for large-scale batteries, while Italy's MACSE remuneration and capacity tenders could embed social safeguards, inclusive stakeholder consultation, and transparent supply-chain oversight. Such measures would ensure that rapid deployment not only accelerates decarbonization but also aligns with SDGs, enhances societal legitimacy, and prepares both markets for future regulatory tightening and EU-level climate targets.

Voluntary governance mechanisms are also under strain. The Science Based Targets initiative (SBTi), after six years of work, suspended the development of an oil and gas standard in 2025 following withdrawals by Shell, Aker BP, and Enbridge [54]. Draft standards would have required companies to cease developing new oil and gas fields by 2027, a condition that triggered industry pushback and highlighted the political economy of climate governance. The suspension illustrates the vulnerability of voluntary standards to corporate influence, weakening credibility at a time when enforceability is paramount.

Taken together, these dynamics suggest that the future of the framework cannot rest on voluntary alignment or fragmented coherence efforts. The shift must be toward binding enforceability, embedding PCSD principles within EU legislation. Only by addressing subsidy reform, mobilizing climate finance at scale, and ensuring transparent transition pathways can the framework move from rhetorical coherence to operational effectiveness.

4. Conclusions

The world's climate policies are lagging behind the pace required to confront worsening climate impacts. To put this in perspective: with 2024 anthropogenic warming already at 1.36 °C, and temperatures rising at about 0.27 °C per decade, staying on our present emissions path would bring us to 1.5 °C in only about five years [55].

Given this urgency, this study has advanced an original integrative framework that extends the seminal work developed at the Columbia Center on Sustainable Investment, which first combined the Paris Agreement and the SDGs in the context of electric utilities. The framework here is applied to renewable energy storage, providing the first combined analysis of the European Union's internal and external commitments in climate and development. Renewable energy storage emerges as a critical test case, particularly given its role in stabilizing decarbonized grids and enabling the integration of intermittent renewables.

The novelty lies in framing policy coherence not as a macroeconomic principle of stability, but as policy coherence for sustainable development, consistent with SDG target 17.14. This orientation reflects a lineage of EU and OECD commitments, beginning with the DAC strategy *Shaping the 21st Century* in 1996, the first formal definition of policy coherence in the OECD's Poverty Guidelines (2001), its codification in the Maastricht Treaty (1992), and its enhancement under the Lisbon Treaty (2009). The European Consensus on Development (2017) reaffirmed PCSD as central to EU external action and emphasized its relevance across all policies under the 2030 Agenda. The 2019 EU Report on Policy Coherence for Development, presented at the High-Level Political Forum, further demonstrated the EU's effort to adapt PCSD reporting to the evolving framework of the SDGs.

Evidence has shown that incoherent policies and fragmented programs not only undermine efficiency but also produce duplication, higher costs, and weaker delivery, while coherence strengthens policy efficiency and sustainability outcomes. Positioning renewable energy storage finance at the center of the next Multiannual Financial Framework would enable the EU to operationalize this integrative agenda, ensuring that internal market reforms, external development policies, and capital mobilization converge on a shared trajectory. In this sense, renewable energy storage becomes the litmus test for whether the EU and its partners can move toward concrete alignment of the Paris Agreement and the SDGs.

Ultimately, the coherence agenda is about systemic transformation. By embedding PCSD in legislation, and by making renewable energy storage investments a strategic enabler for this transformation, the EU has the opportunity to demonstrate that decarbonization and sustainable development can be pursued together, effectively and equitably.

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Conflict of interest

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