

# THE MISSING CLIMATE DIMENSION IN THE EU AI ACT: PARSING THE WORLD'S FIRST COMPREHENSIVE AI REGULATION THROUGH THE LENS OF THE EUROPEAN GREEN DEAL

STANISLOVAS STAIGVILAS\*

*The European Union's Artificial Intelligence Act (AI Act) marks the first attempt by a major global jurisdiction to establish a harmonised legal framework for artificial intelligence. While commendable in its emphasis on fundamental rights and technological safety, the AI Act is strikingly silent on the climate action. The article interrogates this lacuna in the light of the European Green Deal and the objective of the Union policy to combat climate change enshrined in Article 191(1) TFEU. Through doctrinal analysis of the AI Act's risk-based structure, conformity assessment regime and delegated governance procedures, the article argues that the absence of climate safeguards represents a failure of policy coherence. It critiques the AI Act's inability to classify climate-relevant AI systems as high-risk, its neglect of energy and emissions transparency and its omission of climate due diligence in regulatory sandboxes. Drawing on both legal doctrine and comparative insights, the article proposes regulatory reforms to embed climate-conscious obligations into AI governance, thus realigning the AI Act with the Union's binding climate commitments and broader constitutional identity as a normative green power.*

## 1 INTRODUCTION

The European Union (EU) has historically positioned itself at the vanguard of global regulation in response to disruptive technological developments. Its responses to past waves of technological change – such as the controversies over genetically modified organisms (GMOs) in the 1990s, the adoption of the General Data Protection Regulation (GDPR) in 2016 and the recent Digital Services Act (DSA) and Digital Markets Act (DMA) – demonstrate a consistent regulatory logic: cautious, rights-based and focused on safeguarding public goods in the face of rapid innovation.

Continuing this tradition, the Artificial Intelligence Act – adopted as Regulation (EU) 2024/1689 – represents the world's first comprehensive legislative framework on artificial intelligence, setting a benchmark for global AI governance.<sup>1</sup> It is a horizontally applicable, cross-sectoral regulation that classifies AI systems into four risk tiers (minimal, limited, high, and

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\* Mr. Stanislovas Staigvilas is a legal researcher based in Brussels, specializing in EU law and policy. He holds an LL.M cum laude in European Private Law.

<sup>1</sup> Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (Artificial Intelligence Act) [2024] OJ L2024/1689.

unacceptable) and establishes corresponding obligations across their development, deployment, and post-market stages. It also introduces new governance structures, including the European Artificial Intelligence Office, and lays out detailed requirements for conformity assessments, CE marking and fundamental rights impact evaluations.

Although widely praised for embedding Union values – notably human dignity, privacy and safety – into digital regulation, the AI Act exhibits a profound and consequential omission: it fails to address the climate-related impacts of artificial intelligence. This is particularly alarming in light of the Union’s legally binding climate objectives under the European Green Deal,<sup>2</sup> the European Climate Law,<sup>3</sup> and, additionally, the overarching duty to ensure environmental integration across all policy domains as enshrined in Article 11 of the Treaty on the Functioning of the European Union (TFEU).<sup>4</sup> Notably, the AI Act does not:

- classify energy-intensive, emissions-heavy AI systems as inherently ‘high-risk’ (Annex III);
- incorporate climate-related performance criteria into the conformity assessment procedures, as governed by Article 43 § 5 of the EU AI Act;
- impose any duty of climate due diligence or energy transparency on AI providers or deployers; or
- integrate climate safeguards in regulatory sandboxes or post-market oversight mechanisms.

This regulatory blind spot carries important legal and systemic consequences. As recent scholarship has sharply observed,<sup>5</sup> the EU AI Act reveals a deeper structural misalignment between the Union’s climate strategy and its digital transformation agenda – two pillars of the twin transition. The Act’s risk-based classification model, though robust in its attention to fundamental rights, safety, and transparency, remains climate-wise agnostic. It does not account for the substantial energy consumption, lifecycle emissions or carbon intensity of AI systems and infrastructures. This omission undermines the internal consistency of the EU’s broader legal architecture by perpetuating a siloed approach to governance – where climate law and digital regulation evolve in parallel but uncoordinated regimes. As a result, the AI Act not only fails to reflect the EU’s climate neutrality objective under the Green Deal but also risks weakening regulatory coherence across key sectors such as data, energy, trade, and industrial policy.

Similarly, civil society organisations have also raised concerns about the omissions in respect of climate mitigation in the EU AI Act. AlgorithmWatch, a non-governmental and

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<sup>2</sup> European Commission, ‘Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions: The European Green Deal’ COM(2019) 640 final.

<sup>3</sup> Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 (‘European Climate Law’) [2021] OJ L243/1.

<sup>4</sup> Consolidated Version of the Treaty on the Functioning of the European Union [2012] OJ C326/47, Article 11.

<sup>5</sup> Paulo Carvão et al, ‘Governance at a Crossroads: EU AI Regulation and Environmental Policy’ (M-RCBG Associate Working Paper Series No. 251, Harvard Kennedy School, 2024) <[https://www.hks.harvard.edu/sites/default/files/Final\\_AWP\\_251\\_2.pdf](https://www.hks.harvard.edu/sites/default/files/Final_AWP_251_2.pdf)> accessed 1 September 2025.

non-profit organisation based in Germany which advocates for algorithmic systems that advance justice, democracy, human rights and sustainability, has been particularly outspoken. During the trilogue negotiations, it sharply criticised the AI Act, arguing that it overlooks a critical opportunity to ensure that the development and use of AI systems align with the imperatives of climate sustainability. By neglecting the carbon intensity and resource demands of AI, the Act risks undermining the Union's collective effort to combat climate change and runs counter to the objectives of the European Green Deal and related policy frameworks. Since negotiations are still ongoing, there remains an important window to remedy this omission. A necessary first step would be to recognise the climate risks of AI explicitly, making them a relevant criterion in determining whether systems fall within the high-risk category. Building on this, developers and deployers of AI should be required to monitor the greenhouse gas emissions and energy use associated with their systems, disclose this data transparently and take concrete measures to minimise their climate footprint throughout the lifecycle of AI technologies. It also warned that the current framework risks 'entrenching AI infrastructure that is incompatible with the EU's climate goals'.<sup>6</sup>

This article contends that the AI Act, in its current form, suffers from a systemic deficiency: it fails to meaningfully integrate climate mitigation into the legal governance of Europe's digital transformation. This is not a mere legislative oversight, but a deeper signal of dissonance between the Union's digital ambitions and its Treaty-enshrined climate commitments. The omission fractures the coherence of EU law at a time when its regulatory architecture is being watched – and emulated – globally. As the world's first attempt to comprehensively govern artificial intelligence, the EU AI Act is more than a legal milestone: it is a constitutional moment – a test of the Union's ability to reconcile innovation with planetary responsibility. If that test is to be passed, the Act must evolve beyond its compartmentalised design. What is needed now is a new regulatory paradigm – one that does not treat sustainability as a policy accessory, but as a foundational design principle. Under the shadow of a global climate reckoning, technological ambition must no longer compete with ecological stewardship. It must be its ally.

## 2 MAPPING THE EUROPEAN UNION'S LEGISLATIVE ARCHITECTURE: DIGITAL AND CLIMATE DIMENSIONS IN PARALLEL

In the labyrinthine architecture of European Union law, where directives, regulations, delegated acts, and policy communications proliferate with remarkable velocity, it is vital to pause and apprehend the panoramic structure of the legislative terrain.

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<sup>6</sup> Nikolett Aszódi, 'AI Act Trilogue Ignores Environmental Impact of Artificial Intelligence' (*AlgorithmWatch*, 5 December 2023) <<https://sustain.algorithmwatch.org/en/the-eus-ai-act-dangerously-neglecting-environmental-risks/>> accessed 1 September 2025.

## 2.1 THE EU'S DIGITAL LEGISLATIVE FRAMEWORK: A HORIZONTAL OVERVIEW

Over the past decade, the European Union has enacted a sweeping array of legislative instruments aimed at governing the digital domain. This surge of lawmaking – often described as a case of regulatory or legislative inflation – has produced a multi-layered and densely populated legal ecosystem. The European Strategy for Data,<sup>7</sup> the Digital Decade 2030 policy programme<sup>8</sup> and other flagship pieces of EU digital legislation have together framed digital transformation as a strategic imperative – one that has since been pursued through a rapid and expansive legislative agenda. What has emerged is a horizontal digital rulebook: a framework of interlocking regulations that together shape platform governance, data access, competition, AI deployment and market design.

### 2.1[a] *General Data Protection Regulation (GDPR)*

The General Data Protection Regulation,<sup>9</sup> adopted on 27 April 2016, remains the European Union's foundational legal instrument governing the processing of personal data. As a directly applicable regulation, it harmonises data protection rules across all Member States and reinforces the individual's right to informational self-determination. The GDPR introduced key principles such as lawfulness, fairness and transparency, data minimisation, purpose limitation, and accountability, and it established powerful enforcement tools, including administrative fines of up to 4% of global annual turnover. In addition to its normative weight, the GDPR has exercised significant extraterritorial influence, becoming a global reference point for data protection law. Yet, despite its emphasis on safeguarding fundamental rights in the digital sphere, the Regulation is structurally silent on climate-compatible sustainability. It contains no provisions that address the energy costs of data storage and transfer or the resource intensity of large-scale data processing systems. As such, the GDPR exemplifies a model of digital fundamental rights regulation in which climate considerations are not yet part of the legal calculus – a legacy that persists across the EU's digital legislative landscape.

At the time of writing, the European Commission has proposed targeted reforms to the GDPR as part of the SME Relief Package, following Mario Draghi's recommendations on regulatory agility. The draft introduces new business categories under Article 4, including 'small mid-cap enterprises' (SMCs), defined as organisations with fewer than 750 employees and subject to forthcoming financial thresholds. Article 30(5) raises the record-keeping exemption

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<sup>7</sup> European Commission, 'Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: A European Strategy for Data' COM(2020) 66 final.

<sup>8</sup> European Commission, 'Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: 2030 Digital Compass – The European Way for the Digital Decade' COM(2021) 118 final.

<sup>9</sup> Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation) [2016] OJ L119/1.

from 250 to 750 employees, unless high-risk processing under Article 35 applies. Amendments to Articles 40(1) and 42(1) require that SMCs be formally considered in codes of conduct and certification schemes. While the reform signals a shift toward proportionality, critics warn that relaxed obligations could signal weakened data governance, and that voluntary instruments remain underutilised in practice. Still, the proposal may help ease the regulatory ‘cliff effect’ faced by SMEs moving to mid-cap status – though its impact will hinge on legislative outcomes and enforcement approaches.

### *2.1[b] Data Governance Act (DGA)*

The Data Governance Act,<sup>10</sup> adopted on 30 May 2022, is the first of a series of legislative initiatives intended to create a European Single Market for data. It provides the legal foundation for the reuse of public sector data, data altruism mechanisms, and the establishment of trusted data intermediaries that enable secure and neutral data sharing across borders and sectors. The Act places significant emphasis on trust and neutrality, creating safeguards to prevent conflicts of interest and ensure the voluntary nature of data donations. Nevertheless, the DGA does not introduce climate-related use obligations for data intermediaries or processors, nor does it incorporate sustainability principles into data reuse governance. This is a missed opportunity: data reuse and processing efficiency could be incentivised on climate grounds, contributing to lifecycle optimisation and emissions tracking – objectives left untouched by the Act’s design.

### *2.1[c] Digital Markets Act (DMA)*

The Digital Markets Act,<sup>11</sup> adopted on 14 September 2022, introduces a novel ex ante competition framework aimed at correcting structural imbalances in the digital economy. It designates ‘gatekeepers’ – firms with entrenched intermediation power across core platform services – and imposes specific obligations and prohibitions to preserve market contestability and user autonomy. These include bans on self-preferencing, mandatory interoperability, and constraints on the bundling of services. However, the DMA’s regulatory scope is entirely economic and behavioural. It does not address the carbon cost structures of gatekeepers, even though such actors operate large-scale cloud, AI and infrastructure services whose emissions and energy demands exceed those of some Member States. The omission of climate-related criteria – in an instrument that targets systemic actors in digital infrastructure – reinforces the segmentation of climate and digital law within the EU acquis.

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<sup>10</sup> Regulation (EU) 2022/868 of the European Parliament and of the Council of 30 May 2022 on European data governance and amending Regulation (EU) 2018/1724 (Data Governance Act) [2022] OJ L152/1.

<sup>11</sup> Regulation (EU) 2022/1925 of the European Parliament and of the Council of 14 September 2022 on contestable and fair markets in the digital sector and amending Directives (EU) 2019/1937 and 2020/1828 (Digital Markets Act) [2022] OJ L265/1.

### 2.1[d] *Digital Services Act (DSA)*

The Digital Services Act,<sup>12</sup> adopted on 19 October 2022, constitutes a major reform of the legal framework applicable to digital platforms, hosting services, and online intermediaries across the European Union. Its objectives are to ensure a safe, transparent, and accountable online environment, particularly by mitigating risks related to illegal content, disinformation, and algorithmic amplification. The DSA introduces binding due diligence obligations for ‘very large online platforms’ (VLOPs), including requirements for algorithmic transparency, systemic risk audits, and independent oversight. Importantly, these risks are narrowly defined in relation to societal harms such as electoral integrity, gender-based violence, or public health misinformation. The Act contains no provisions addressing the carbon footprint of platform infrastructure – such as energy-intensive content delivery networks, data storage, or algorithmic training pipelines – despite mounting evidence that platform operations contribute significantly to the digital sector’s carbon emissions profile.

### 2.1[e] *Data Act*

The Data Act,<sup>13</sup> adopted on 13 December 2023, builds on the DGA and represents the EU’s most ambitious attempt to regulate access to industrial data – especially data generated by Internet of Things (IoT) devices. It mandates that manufacturers and service providers make data accessible to users and empowers public authorities to request access in cases of exceptional public interest (e.g. natural disasters or public health emergencies). The Act is heralded as a milestone for horizontal data access rights and is expected to foster data-driven innovation, especially for SMEs and researchers. However, its climate-relevant potential remains unrealised. There are no explicit obligations to disclose or structure industrial data to support emissions tracking or resource optimisation. The Act treats data as an economic resource, not as a climate driver – a framing that reinforces the Union’s prevailing data-as-commodity paradigm.

### 2.1[f] *The AI Act*

The AI Act, adopted on 13 June 2024, is the European Union’s flagship regulatory framework for the development, placement on the market, and use of artificial intelligence systems. It establishes a risk-based regulatory model, classifying AI systems into four tiers – unacceptable risk (prohibited), high-risk (strictly regulated), limited risk (transparency obligations), and minimal risk (largely unregulated). High-risk systems, as defined in Annex III, are subject to mandatory conformity assessments, technical documentation requirements, human oversight, and post-market monitoring. The AI Act is widely seen as the world’s first horizontal regulatory regime for AI, with extraterritorial reach and sectoral breadth. It emphasises human rights,

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<sup>12</sup> Regulation (EU) 2022/2065 of the European Parliament and of the Council of 19 October 2022 on a Single Market for Digital Services and amending Directive 2000/31/EC (Digital Services Act) [2022] OJ L277/1.

<sup>13</sup> Regulation (EU) 2023/2854 of the European Parliament and of the Council of 13 December 2023 on harmonised rules on fair access to and use of data (Data Act) [2023] OJ L2023/2854.

safety, transparency, and trust – yet it omits any binding provisions on climate-compatible sustainability. Despite AI's growing resource and energy footprint, the Act contains no requirement to assess or disclose the climate impact of AI systems, even those requiring extensive computation or data processing. CE conformity assessments (Section 5 of the AI Act) do not include energy consumption, water use, or emissions as metrics of evaluation. As such, the AI Act typifies a regulatory model in which technological governance remains normatively detached from climate imperatives.

It should be noted that in February 2025, the European Commission adopted its first formal guidelines<sup>14</sup> interpreting the prohibitions under Article 5 of the AI Act, offering much-needed legal clarity on the scope and enforcement of unacceptable AI practices. These guidelines aim to ensure the uniform application of the Act's strictest rules, which prohibit AI systems deemed fundamentally incompatible with Union values and fundamental rights, including those that deploy subliminal manipulation, exploit vulnerabilities, conduct social scoring, or enable indiscriminate biometric surveillance. The document outlines how these prohibitions apply not only to AI providers but also to deployers, and clarifies that violations may trigger fines of up to €35 million or 7% of global turnover. Notably, the guidelines also articulate the non-exhaustive and contextual nature of these bans, emphasising the need for case-by-case assessments and offering illustrative examples of impermissible systems. These include AI-enabled emotion recognition at workplaces (except for medical or safety reasons), real-time remote biometric identification in public spaces by law enforcement (subject to narrow exceptions), and AI systems engaging in social scoring across domains. Importantly, while non-binding, the guidelines are a pivotal reference point for national authorities and practitioners navigating the early enforcement phase of the AI Act, and they reflect a broader regulatory intent: to defend human dignity and democratic integrity in an increasingly AI-mediated society. This interpretation represents the Commission's view as of the time of writing, and will evolve in response to emerging technologies and enforcement practice.

Taken together, the EU's digital legislative framework reveals a remarkable density, coherence, and ambition in structuring the digital internal market around values of transparency, accountability, competition, and fundamental rights. Through landmark instruments such as the GDPR, DGA, DMA, DSA, Data Act, and AI Act, the Union has constructed a far-reaching regulatory architecture capable of disciplining powerful platforms, securing data sovereignty, and asserting global normative leadership in emerging technologies. However, a shared structural omission persists across these initiatives: the systematic integration of climate mitigation and adaptation.

## 2.2 THE EU'S CLIMATE LEGISLATIVE FRAMEWORK: A HORIZONTAL OVERVIEW

Over the past decade, and especially since the launch of the European Green Deal<sup>15</sup> in 2019,

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<sup>14</sup> European Commission, 'Commission Guidelines on prohibited artificial intelligence practices established by Regulation (EU) 2024/1689 (AI Act)' C(2025) 884 final.

<sup>15</sup> Commission, 'The European Green Deal' (n 2).

the European Union has pursued a far-reaching legislative agenda aimed at achieving climate neutrality. This legislative mobilisation – widely described as a green transformation – has resulted in an increasingly dense body of climate law, encompassing, inter alia, emissions trading and carbon border mechanisms. It reflects not only the urgency of the planetary crisis but also the Union’s aspiration to lead the global transition toward climate neutrality.<sup>16</sup> Much like the digital rulebook, the climate *acquis* has evolved into a multi-instrumental and sectorally fragmented ecosystem, governed by a combination of regulations, directives, delegated acts, and policy communications.

## 2.2[a] *EU Emissions Trading System (ETS)*

The directive establishing the EU Emissions Trading System (ETS),<sup>17</sup> originally adopted on 13 October 2003, is the cornerstone of the Union’s climate policy and its principal market-based instrument for reducing greenhouse gas emissions. It operates on a ‘cap-and-trade’ principle, setting a progressively declining cap on the total volume of emissions permitted from covered sectors – principally power generation, manufacturing, and aviation – with allowances traded on a regulated carbon market. Under the revised ETS framework, adopted in 2023 as part of the Fit for 55 package,<sup>18</sup> which is a comprehensive legislative package composed of multiple regulations and directives proposed and adopted to meet the EU’s revised climate target of at least 55% net greenhouse gas emission reductions by 2030, the system was significantly expanded in scope and ambition: the cap will decline faster, free allowances will be gradually phased out, and a new ETS II will be introduced for road transport and buildings beginning in 2027. The revised directive also incorporates maritime transport and strengthens the Market Stability Reserve to control supply shocks. Revenues from the sale of allowances are earmarked for the Innovation Fund and Modernisation Fund, supporting green technology deployment and energy system upgrades across Member States. Despite its increasing sophistication, the ETS remains narrowly sectoral in design. Crucially, it does not cover emissions from digital infrastructures, including data centres, large-scale AI training operations, or the rapidly growing ICT sector more broadly. While these sources are becoming major contributors to electricity demand and lifecycle emissions in the EU, their climate impact falls outside the system’s regulatory scope. In this sense, the ETS illustrates the EU’s persistent failure to integrate digital sector emissions into its primary climate governance tools – an omission that undermines the Union’s ability to internalise the full climate-related cost of its technological transformation.

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<sup>16</sup> European Environmental Bureau, ‘The European Green Deal – Knowledge Brief’ (May 2025) <<https://eeb.org/wp-content/uploads/2025/05/The-European-Green-Deal-Knowledge-Brief.pdf>> accessed 22 August 2025.

<sup>17</sup> Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC (EU Emissions Trading System) [2003] OJ L275/32, as amended by Directive (EU) 2023/959 of the European Parliament and of the Council of 10 May 2023.

<sup>18</sup> European Commission, ‘“Fit for 55”: Delivering the EU’s 2030 Climate Target on the Way to Climate Neutrality’ COM(2021) 550 final.

## 2.2[b] *Effort Sharing Regulation (ESR)*

The Effort Sharing Regulation (ESR),<sup>19</sup> first adopted in 2009 as a decision, and significantly revised in 2023 as part of the ‘Fit for 55’ package, is the EU’s primary legislative instrument for governing greenhouse gas emissions in sectors not covered by the ETS, such as road transport, buildings, agriculture, and waste. The ESR sets binding annual emissions reduction targets for each Member State, based on GDP per capita and cost-efficiency criteria. The updated Regulation aims for a collective 40% emissions reduction by 2030, relative to 2005 levels, across these non-ETS sectors. It introduces stricter compliance mechanisms, increases transparency obligations, and expands the flexibility for Member States to trade emission allocations.<sup>20</sup> The ESR operates as a decentralised governance mechanism, empowering national governments to design and implement the policy mix needed to meet their obligations – ranging from subsidies and regulations to taxes and behavioural incentives. Despite its horizontal reach across many sectors of daily life, the ESR does not explicitly address emissions associated with digital infrastructures, even as these become increasingly embedded in transport, buildings, and service delivery. For example, emissions from the operation of cloud services in smart buildings or from digital logistics platforms in road freight fall outside the ESR’s accounting logic. The Regulation reflects a conventional sectoral imagination that has yet to fully register the transversal character of digital technologies as both enablers and drivers of emissions. This blind spot reinforces the analytical and legal separation between the EU’s digital and climate frameworks – an institutional legacy that hinders integrative climate policymaking.

## 2.2[c] *The European Green Deal*

The European Green Deal,<sup>21</sup> launched in December 2019, is the European Union’s flagship political strategy for achieving climate neutrality, restoring biodiversity, and decoupling economic growth from environmental degradation. Presented as a transformative growth agenda, the Green Deal sets out a comprehensive policy roadmap spanning climate action, circular economy, energy efficiency, mobility, food systems, pollution control, and environmental justice. Its declared aim is to make Europe the world’s first climate-neutral continent by 2050, while ensuring that the ecological transition is ‘just and inclusive’.<sup>22</sup> Importantly, it must be underscored that the Green Deal is not a single legislative act, but rather a strategic framework that has triggered a cascade of regulatory initiatives and legislative proposals across virtually every policy domain. It functions as a meta-policy architecture, guiding the legislative priorities of the Commission and serving as the catalyst for an unprecedented wave of regulatory activity – including the European Climate Law, the ‘Fit for 55’ package,

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<sup>19</sup> Regulation (EU) 2023/857 of the European Parliament and of the Council of 19 April 2023 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) 2018/842 (Effort Sharing Regulation) [2023] OJ L111/1.

<sup>20</sup> *ibid* Article 1.

<sup>21</sup> Commission, ‘The European Green Deal’ (n 2).

<sup>22</sup> *ibid* chapter 1 para 3; chapter 2.1.1 para 1.

the EU Taxonomy Regulation, and the Deforestation Regulation. It also initiated the Just Transition Mechanism and shaped key provisions in the Multiannual Financial Framework and Recovery and Resilience Facility. However, the Green Deal's operationalisation has revealed structural tensions: between economic competitiveness and ecological limits; between decarbonisation and biodiversity; and between rapid law-making and implementation capacity. Critically, while the Green Deal frequently invokes the digital transition as a complementary force, it stops short of articulating a coherent framework for governing the carbon footprint of digitalisation. This omission has allowed the digital and climate acquis to evolve along parallel but disconnected tracks, undermining the EU's ambition to deliver a truly integrated twin transition.

### *2.2[d] EU Taxonomy Regulation*

The EU Taxonomy Regulation,<sup>23</sup> adopted in June 2020, establishes a common classification system to determine whether an economic activity can be considered environmentally sustainable. Designed to channel capital flows toward green investments and combat 'greenwashing', the Regulation defines six environmental objectives, including climate change mitigation and adaptation, sustainable use of water and marine resources, circular economy, pollution prevention, and biodiversity protection. To qualify as taxonomy-aligned, an activity must (i) contribute substantially to at least one of these objectives, (ii) do no significant harm (DNSH) to the others, and (iii) comply with minimum social safeguards. The Regulation serves as the foundation for other legislative initiatives, including the Sustainable Finance Disclosure Regulation (SFDR) and the Corporate Sustainability Reporting Directive (CSRD), and applies to financial market participants, large public-interest entities, and Member States developing green bond frameworks or sustainability labels. Despite its systematising ambition, the Taxonomy Regulation has faced significant political and technical challenges, including debates over the inclusion of nuclear energy and natural gas, delayed publication of delegated acts, and low uptake in actual financial reporting. More critically for this analysis, the taxonomy framework does not explicitly recognise the climate-specific sustainability of digital services or AI-related activities. Emissions from large-scale computing infrastructure, energy consumption in training foundation models, and e-waste from rapid device turnover fall outside its definitional core. As such, the Regulation reflects a conception of sustainability grounded in traditional industrial sectors, leaving the carbon footprint of digitalisation largely unclassified and unpriced. The lack of taxonomy criteria for digital operations also complicates the ability of firms to evaluate and disclose the sustainability of their digital value chains under the SFDR and CSRD – reinforcing the regulatory invisibility of the ICT sector's climate impact.

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<sup>23</sup> Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088 (EU Taxonomy Regulation) [2020] OJ L198/13.

## 2.2[e] *European Climate Law*

The European Climate Law,<sup>24</sup> adopted on 30 June 2021, gives legal force to the political commitments articulated in the European Green Deal, transforming climate neutrality from a strategic ambition into a binding legal obligation. It establishes a Union-wide objective of achieving net zero greenhouse gas emissions by 2050,<sup>25</sup> and sets an intermediate binding target of a 55% reduction in net emissions by 2030, compared to 1990 levels.<sup>26</sup> The Regulation introduces a legal mechanism for tracking progress, requiring the Commission to periodically assess alignment with the climate neutrality trajectory and to issue recommendations or legislative proposals where Member States or EU law fall short.<sup>27</sup> It further mandates that all new Union-level policy initiatives must be assessed for their compatibility with the climate targets, and that both the Union and Member States are obliged to improve their climate adaptation strategies.<sup>28</sup> While normatively significant and institutionally binding, the Regulation is primarily architectural rather than operational: it provides an overarching legal framework but delegates implementation to sector-specific instruments such as the EU Emissions Trading System, the Effort Sharing Regulation, and carbon pricing reforms. Notably, the European Climate Law makes no reference to the climate impact of digital technologies, nor does it create accountability mechanisms for emissions associated with AI infrastructures, data centres, or ICT supply chains. It exemplifies the EU's vertical approach to climate governance – ambitious in scope, but still detached from the transversal dynamics of digitalisation.

## 2.2[f] *Carbon Border Adjustment Mechanism (CBAM)*

The Carbon Border Adjustment Mechanism (CBAM),<sup>29</sup> adopted in May 2023, represents a landmark development in EU climate policy, designed to address the risk of carbon leakage and preserve the integrity of the Union's climate ambitions. Operational from 2026, following a transitional phase, CBAM imposes a carbon price on certain imported goods – including cement, iron and steel, aluminium, fertilisers, hydrogen, and electricity – based on the emissions embedded in their production. Importers will be required to purchase CBAM certificates reflecting the carbon intensity of their products, unless they can demonstrate equivalent carbon pricing in the country of origin. The CBAM mirrors the EU ETS in methodology, and its pricing is indexed to the EU carbon market. It is the first mechanism of its kind globally, and signals the EU's willingness to externalise its climate disclosure standards to global trade partners under the principle of regulatory equivalence. While the CBAM is framed as a tool for fair competition

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<sup>24</sup> Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 (European Climate Law) [2021] OJ L243/1.

<sup>25</sup> *ibid* Article 2(1).

<sup>26</sup> *ibid* Article 4(1).

<sup>27</sup> *ibid* Articles 6(1)–(3).

<sup>28</sup> *ibid* Articles 7 and 5.

<sup>29</sup> Regulation (EU) 2023/956 of the European Parliament and of the Council of 10 May 2023 establishing a carbon border adjustment mechanism [2023] OJ L130/52.

and global decarbonisation, its design reveals a narrow focus on industrial commodities, with no provisions targeting digital goods, services, or infrastructures. Embedded emissions in imported electronics, AI-enabled hardware, or cloud-based computing services are not captured under the current scope. This exclusion reflects the broader disconnect between the EU's climate and digital regimes: even as the carbon intensity of imported ICT components rises, the environmental costs of digitalisation remain unpriced at the border. In this sense, CBAM exemplifies the EU's sectorally bounded approach to carbon regulation, which has yet to fully incorporate the climate externalities of digital trade.

It is to be noted that, despite its adoption and scheduled entry into its financial phase in January 2026, at the time of writing of this article CBAM is undergoing significant recalibration. In response to mounting industry pressure – particularly over the administrative complexity and financial burden associated with CBAM certificates – the European Commission has published a legislative proposal to amend the original Regulation. While reaffirming its commitment to the 2026 start date, the Commission has introduced a series of technical adjustments aimed at easing compliance and mitigating risk. Among the most consequential is a proposal to postpone the commencement of CBAM certificate sales until February 2027, due to unresolved issues with IT infrastructure. However, this does not amount to a deferral of financial obligations: importers will still be required to surrender certificates for emissions embedded in 2026 imports by August 2027. Additional reforms include raising the threshold for exempting small importers (now based on a 50-tonne net mass annually), extending declaration deadlines, and easing quarterly pre-purchase requirements from 80% to 50%. At the same time, the proposal significantly tightens enforcement, introducing fines of up to five times the value of unsurrendered certificates for deliberate non-compliance and establishing joint liability across supply chains in cases of circumvention.<sup>30</sup>

Taken as a whole, the EU's climate legislative framework constitutes an ambitious, densely layered architecture aimed at climate neutrality. Its instruments span carbon pricing, carbon taxation on imports entering the EU, CO<sup>2</sup> emission performance standards, etc. – together forming a powerful regulatory arsenal in response to accelerating planetary crisis. Yet, for all its depth and dynamism, this framework exhibits a striking structural feature: its persistent compartmentalisation. Despite frequent rhetorical nods to the 'twin transitions', the climate *acquis* remains technologically agnostic, failing to account for the climate impacts of the EU's digital transformation. Across nearly every major regulation – whether emissions trading, deforestation, or biodiversity recovery – digital infrastructures, AI systems, and computationally intensive technologies are treated as invisible actors, external to climate policy design. This normative detachment not only undermines the coherence of Union law but also renders key climate objectives less attainable in a world increasingly mediated by data and automation.

To conclude this Section, I turn to a critical reflection on the broader regulatory dichotomy

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<sup>30</sup> Giovanni Gijssels and Tom Wallyn, 'The EU Proposes Sharper Carbon Border Rules: EC Proposes Key Amendments Ahead of the 2026 Definitive CBAM Phase' (*PwC News*, 4 March 2025) <<https://news.pwc.be/the-eu-proposes-sharper-carbon-border-rules-ec-proposes-key-amendments-ahead-of-the-2026-definitive-cbam-phase/>> accessed 1 September 2025.

that has emerged between the European Union’s digital and climate legislative frameworks. As I have argued throughout, these two agendas – though rhetorically presented as ‘twin transitions’ – remain institutionally and normatively disconnected. I am a firm proponent of a holistic and complementary approach that recognises the interdependence of digital infrastructures and climate resilience. Only by embedding climate objectives into digital governance, and vice versa, can the Union align innovation with its constitutional commitment to climate neutrality. This vision is well captured by President Charles Michel, who stated in a 2021 speech to the European University Association: ‘This holistic approach will not only power our climate and digital ambitions, it will generate economic prosperity and shore up our resilience’.<sup>31</sup> His words are not just aspirational – they offer a blueprint for legal coherence in a time of intersecting systemic crises. Holistic thinking, in this context, is not optional: it is a structural necessity if the EU is to fulfil its dual ambitions of technological leadership and planetary stewardship.

### 3 NEGOTIATED AWAY: CLIMATE INTEGRITY AND THE POLITICS OF THE AI ACT

While the AI Act has been hailed as a landmark in global technology governance, its final shape reflects not only normative ambition, but also the structural realities of European Union law-making – where competing interests are not peripheral but structurally embedded into the legislative process itself. The EU’s supranational configuration, with its multi-layered institutional architecture and co-decision procedures, inevitably generates legislative outcomes shaped by negotiation, compromise, and sectoral balancing. In this context, inter-service rivalries, political trade-offs, and lobbying influence are not aberrations, but rather systemic features of EU governance. This Section examines how climate considerations – initially present in early drafts and interdepartmental consultations – were ultimately excluded or diluted through a combination of bureaucratic streamlining, legislative compromise, and industry pressure. Drawing on documented trilogue negotiations, stakeholder submissions, and critical policy analysis, the Section traces the mechanisms through which climate provisions were deprioritised, particularly within the European Commission’s internal structure. It contends that the absence of climate-related safeguards in the AI Act is not merely an oversight, but the outcome of procedural dynamics that systematically privilege market and rights-based concerns over climate mainstreaming. Understanding these legislative peripeteia is essential to evaluating the Act’s regulatory integrity – and to imagining a future revision that aligns technological governance with the Union’s climate commitments.

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<sup>31</sup> Charles Michel, ‘Speech by President Charles Michel at the European University Association Annual Conference’ (*Parlementaire Monitor*, 22 April 2021) <<https://www.eumonitor.eu/9353000/1/j9vvik7m1c3gyxp/vli6i7aeziz8?ctx=vhsih95vppua&tab=1>> accessed 1 September 2025.

### 3.1 BALANCING CLIMATE AMBITION WITH STAKEHOLDER CONCERNS

The evolution of the AI Act illustrates the broader challenge of integrating climate objectives into complex regulatory frameworks shaped by multi-actor negotiations, competing priorities, and economic sensitivities. This tension is particularly evident in the treatment of climate provisions during the legislative process. Throughout the legislative negotiations surrounding the AI Act, the European Parliament's Committee on the Environment, Public Health and Food Safety (ENVI) advanced several proposals intended to strengthen the climate dimension of the regulation.<sup>32</sup> Among these were amendments calling for energy efficiency standards in AI system design and the promotion of sustainability practices in data centre operations. These initiatives reflected a growing recognition of the climate externalities associated with AI infrastructures, particularly in terms of energy intensity and resource use. However, many of these proposals did not find their way into the final legislative text. Available evidence suggests that concerns raised by industry stakeholders – particularly regarding innovation capacity, regulatory complexity, and global competitiveness – played a role in shaping the outcome of the trilogue negotiations and the overall regulatory compromise.

The adopted version of the Act includes a limited climate reference in Article 40(2), which obliges the Commission, when issuing standardisation requests, to ensure that they also cover energy and resource efficiency, including requirements on the lifecycle energy consumption of high-risk AI systems and the energy-efficient development of general-purpose AI models.<sup>33</sup> While this provision signals an awareness of climate implications, its scope remains relatively narrow, and it does not impose specific targets or obligations related to emissions and resource efficiency. As a result, some scholars and policy commentators have expressed concern that the AI Act, in its current form, may not fully reflect the climate dimensions of digital transformation. Rather than an intentional omission, this may reflect broader structural dynamics within the EU's legislative process, where competing regulatory priorities and institutional mandates often require complex and politically sensitive trade-offs.

### 3.2 CORPORATE CAPTURE AND THE REGULATORY SCOPE OF THE AI ACT

The legislative trajectory of the AI Act illustrates a broader pattern of corporate influence on digital regulation, often characterised in the academic literature as corporate capture. In this context, large technology companies – including OpenAI, Microsoft, and Google – played a significant role in shaping key provisions of the Act, particularly those related to the

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<sup>32</sup> Committee on the Environment, Public Health and Food Safety, 'Opinion for the Committee on the Internal Market and Consumer Protection and for the Committee on Civil Liberties, Justice and Home Affairs on the Proposal for a Regulation of the European Parliament and of the Council Laying Down Harmonised Rules on Artificial Intelligence (Artificial Intelligence Act) and Amending Certain Union Legislative Acts' COM(2021) 0206 final, C9-0146/2021, 2021/0106(COD) (25 January 2022), PE699.056v01-00, Rapporteur: Susana Solís Pérez <<https://artificialintelligenceact.eu/wp-content/uploads/2022/05/AIA-ENVI-Rule-56-Opinion-Adopted-22-April.pdf>> accessed 1 September 2025.

<sup>33</sup> Green Software Foundation, 'The EU AI Act: Insights from the Green AI Committee' (*Green Software Foundation*, 23 April 2024) <<https://greensoftware.foundation/articles/the-eu-ai-act-insights-from-the-green-ai-committee>> accessed 1 September 2025.

classification and obligations of advanced AI systems. These actors engaged intensively with European policymakers throughout the legislative cycle, advocating for regulatory frameworks that would preserve operational flexibility and minimise compliance burdens.<sup>34</sup>

A notable instance of this influence concerns the treatment of general-purpose AI models. OpenAI, for example, lobbied against the categorisation of its systems as ‘high-risk’, which would have triggered extensive oversight obligations, potentially including climate impact assessments. This lobbying contributed to the creation of a distinct regulatory tier for ‘foundation models’, which, while subject to certain transparency and risk management obligations, fall outside the strictest regulatory framework of the Act. The reclassification of these systems has important implications not only for safety and accountability, but also for climate governance: the lighter regulatory touch afforded to foundation models means that potential climate resilience assessments tied to risk-based obligations were effectively circumvented. As such, the episode reflects a structural feature of EU law-making, where concentrated private sector engagement may shape legislative boundaries – sometimes to the detriment of broader climate or public interest considerations.

### 3.3 MEMBER STATE DISAGREEMENTS AND NATIONAL INTERESTS

During the negotiation and adoption of the EU AI Act, internal disagreements among Member States, particularly Germany, France, and Italy, significantly influenced the shaping of the legislation’s provisions. These countries expressed concerns that stringent regulations could hinder innovation and economic growth, leading to a push for more flexible approaches.

In November 2023, Germany, France, and Italy reached a joint agreement on the future of AI regulation in Europe. This agreement emphasized the need for voluntary commitments that would be binding for both small and large AI providers within the EU. The three governments advocated for rules of conduct and transparency to be binding for all, suggesting that initial sanctions should not be imposed but could be considered if violations occur after a certain period. This stance was seen as a move to balance regulation with competitiveness, aiming to foster innovation while ensuring responsible AI adoption. Furthermore, these countries opposed certain provisions related to the regulation of foundation models, arguing that overly strict rules could stifle innovation and economic growth.<sup>35</sup> Their position contributed to the dilution of some climate-related requirements in the final legislation. The concerns raised by Germany, France, and Italy were eventually addressed, leading to a unanimous vote on 2 February 2024 by all 27 EU Member States at the Council of the European Union to approve the latest draft of the AI Act. This resolution signalled a consensus that balanced the need for regulation with the imperative to support innovation across the EU.

These developments highlight the complex interplay between regulatory ambitions and

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<sup>34</sup> Billy Perrigo, ‘OpenAI Secretly Lobbied the EU to Water Down AI Rules’ (*Time*, 14 June 2023) <<https://time.com/6288245/openai-eu-lobbying-ai-act/>> accessed 1 September 2025.

<sup>35</sup> Amnesty International, ‘EU: France, Germany and Italy Risk Unravelling Landmark AI Act Negotiations’ (*Amnesty International*, 27 November 2023) <<https://www.amnesty.org/en/latest/news/2023/11/eu-france-germany-and-italy-risk-unravelling-landmark-ai-act-negotiations/>> (accessed 1 September 2025).

national interests within the EU, illustrating how internal disagreements can shape the trajectory of significant legislative initiatives like the AI Act.

### 3.4 CIVIL SOCIETY PARTICIPATION IN EU AI GOVERNANCE: SCOPE, LIMITS, AND IMPLICATIONS

The negotiation and adoption of the AI Act demonstrated the structural challenges civil society organizations, particularly those focused on climate mitigation and adaptation, face in influencing high-stakes digital regulation. Although the Act acknowledges the potential climate ramifications of artificial intelligence technologies, civil society's limited access to the legislative process and comparatively modest resources hindered the incorporation of robust climate clauses in the final text.

Access to key decision-making venues during the legislative process was highly asymmetrical. Industry actors, particularly major technology firms, maintained consistent and well-organized engagement with EU institutions through structured consultations, bilateral meetings, and dedicated lobbying. In contrast, many civil society organizations, including climate advocacy organisations, encountered difficulties in gaining visibility within these channels. This access gap limited their ability to present expertise in climate action or advocate for more binding climate policy safeguards during critical phases, such as the trilogue negotiations.

Resource asymmetries further compounded this challenge. In 2024, the top 50 technology companies spent over €200 million on lobbying efforts in Brussels, enabling sustained and technically detailed contributions to the regulatory process. Civil society, by contrast, relies on significantly smaller budgets. The EU's LIFE Programme – the primary mechanism for supporting climate NGOs – allocates approximately €15.6 million annually across the entire Union. Moreover, recent changes to funding eligibility rules restrict the use of EU funds for advocacy activities, further constraining civil society's ability to intervene effectively in policymaking arenas.<sup>36</sup>

Despite these limitations, civil society actors submitted detailed proposals aimed at integrating concrete climate requirements into the AI Act. The Act does include a limited requirement for energy consumption reporting, applicable to general-purpose AI models. Yet, this provision does not extend to broader indicators such as greenhouse gas emissions, resource intensity, or material lifecycle impacts. As such, the climate dimension of AI governance in the EU remains underdeveloped.<sup>37</sup> National preferences also influenced the final outcome. Several large member states – such as Germany, France, and Italy – advocated for a proportionate regulatory framework that would preserve flexibility and competitiveness. Their position contributed to the softening of certain requirements, including those related to climate neutrality, and shaped a consensus that emphasized innovation-friendly governance.

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<sup>36</sup> The Good Lobby, 'The End of NGO Advocacy in Europe? New EU Funding Restrictions Threaten Environmental NGOs' (*The Good Lobby*, 29 January 2025) <<https://thegoodlobby.eu/the-end-of-ngo-advocacy-in-europe-new-eu-funding-restrictions-threaten-environmental-ngos/>> accessed 1 September 2025.

<sup>37</sup> José Renato Laranjeira de Pereira, 'The EU AI Act – A Missed Opportunity?' (*Heinrich Böll Foundation EU Office*, 8 April 2024) <<https://eu.boell.org/en/2024/04/08/eu-ai-act-missed-opportunity>> accessed 1 September 2025.

Looking ahead, a number of philanthropic and civil society actors have called for reforms to strengthen participatory governance in EU digital regulation. These include institutional mechanisms to guarantee meaningful consultation with NGOs, transparent lobbying registers, and targeted funding to support public interest engagement. Such measures may help redress the current imbalance and ensure that future digital legislation is more inclusive of climate and societal concerns.

### 3.5 OPAQUE DYNAMICS AND POLITICAL BARGAINING IN THE EU AI ACT

The legislative odyssey of the EU AI Act also offers a revealing case study in the politics of digital regulation within multilevel governance. Beneath the formal narrative of interinstitutional compromise lies a more complex story – one made partially visible through leaked drafts, prolonged deadlocks, and the strategic opacity of the trilogue process. These unofficial disclosures, while technically outside formal procedural channels, have provided crucial insights into how the normative architecture of the Act was contested, reinterpreted, and ultimately diluted.

The January 2024 leak of the so-called ‘final consolidated draft’ marked a pivotal moment in understanding the inner workings of AI Act negotiations.<sup>38</sup> This draft, circulated ahead of official publication, contained hybrid language reflecting concessions made between the European Commission, the Council, and the European Parliament. It exposed not only how central concepts – such as the definitions of ‘general-purpose AI models’ and ‘high-risk systems’ – were evolving under institutional pressure, but also how core regulatory obligations were being subtly eroded or reworded to secure political consensus. Legal scholars and civil society actors noted that the language in the draft often mirrored lobbying preferences voiced by dominant Member States and industry actors, particularly with respect to the classification thresholds and enforcement flexibility granted to providers of foundation models.

More revealing still was the protracted impasse over the regulation of biometric identification systems, especially remote facial recognition technologies. In December 2023, trilogue negotiations reportedly extended over 22 hours without agreement, with lawmakers deadlocked over the inclusion of narrow public security exemptions versus broader fundamental rights protections.<sup>39</sup> The biometric debate served as a microcosm of deeper unresolved tensions between national security prerogatives and the EU’s own Charter-based commitments to privacy, non-discrimination, and human dignity. Member States such as France and Germany reportedly lobbied for greater leeway for national police forces, while Parliament rapporteurs pushed for categorical bans on real-time facial recognition in public spaces. The resulting compromise – allowing certain uses with judicial authorization – was criticized by digital rights groups as a regression from earlier parliamentary ambitions.

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<sup>38</sup> Hunton Andrews Kurth LLP, ‘Final Draft of EU AI Act Leaked’ (*Privacy and Information Security Law Blog*, 1 February 2024) <<https://www.hunton.com/privacy-and-information-security-law/final-draft-of-eu-ai-act-leaked>> accessed 1 September 2025.

<sup>39</sup> Gian Volpicelli, ‘AI Act Negotiations Enter Their 19th Hour’ (*Politico Europe*, 7 December 2023) <<https://www.politico.eu/article/ai-act-negotiations-enter-their-19-hour/>> accessed 1 September 2025.

These events prompted a growing chorus of concern over the opacity of the trilogue process. Unlike ordinary committee proceedings, trilogues are closed-door negotiations, shielded from real-time public or stakeholder scrutiny. The leaks, then, functioned less as procedural breaches than as de facto transparency mechanisms – exposing not only the fragility of interinstitutional consensus but also the political asymmetries shaping Europe’s flagship digital legislation.<sup>40</sup> The piecemeal and reactive nature of compromise that emerged under these conditions points to a broader institutional pathology: the tendency of EU digital governance to sacrifice normative coherence for speed and symbolic leadership on the global stage.

From a rule-of-law and democratic legitimacy perspective, the procedural irregularities – while not unlawful – raise valid questions about accountability in the shaping of high-stakes technological norms. The AI Act was widely promoted as a rights-based framework. Yet, as the leaked documents suggest, some of its most consequential provisions were brokered away in forums inaccessible to public oversight, often in response to pressure from both Member States and industry stakeholders concerned with competitiveness and administrative burden. The final regulation thus risks reflecting not the EU’s normative ambitions, but the constraints of its procedural pragmatism.

The foregoing analysis suggests that, viewed within its full official and off-the-record context, the legislative trajectory of the AI Act underscores a deeper insight into the structural logic of EU law-making – one shaped less by grand normative declarations than by what may be termed procedural realism. The Act’s final configuration did not result from a simple failure of political will, but rather from the embedded dynamics of a system that prioritises compromise, administrative feasibility, and market stability. Throughout its gestation, the Act was filtered through layers of interinstitutional bargaining, national positioning, and asymmetrical stakeholder access – mechanisms that, while formally legitimate, systematically constrained the integration of climate-related exigencies. What ultimately emerged is a regulation fluent in the grammar of risk, rights, and innovation, yet markedly reticent when it comes to climate – a silence not incidental, but structured.

#### 4 MAPPING THE CLIMATE BLIND SPOT IN THE AI ACT

This Section undertakes a systematic exploration of the structural omissions and regulatory lacunae that characterise the AI Act in its treatment – or, more precisely, its neglect – of climate considerations. Although the Act has been widely acclaimed as a global benchmark for responsible AI governance, its internal architecture fails to meaningfully embed climate metrics or mandatory energy-efficiency obligations. This shortcoming is particularly noteworthy in the context of the European Union’s own policy rhetoric, which consistently frames the digital and green transitions as interdependent vectors of the Union’s strategic future.

Having thus far laid the doctrinal and institutional groundwork in the preceding

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<sup>40</sup> Jedidiah Bracy, ‘EU AI Act Draft Consolidated Text Leaked Online’ (*International Association of Privacy Professionals*, 22 January 2024) <<https://iapp.org/news/a/eu-ai-act-draft-consolidated-text-leaked-online>> accessed 1 September 2025.

Sections – tracing both the expansive digital legislative framework and the fragmented climate acquis – it is now time to delve into the regulatory substrata of the AI Act itself. This Section turns to the textual and structural anatomy of the legislation to identify where, how, and to what extent climate considerations were side-lined in favour of more narrowly construed policy goals. What follows is a granular examination of specific provisions – Annexes, Articles, and institutional instruments – through which the Act operationalises its risk-based model. In so doing, we expose the precise legal and procedural locations in which the climate dimension was either omitted, deprioritised, or rendered legally inert.

#### 4.1 ABSENCE OF CLIMATE RISK IN HIGH-RISK CATEGORIES (ANNEX III)

The cornerstone of the AI Act's regulatory architecture is its risk-based classification system, whereby AI systems are stratified into risk tiers – ranging from 'unacceptable risk' (prohibited) to 'high-risk' (strictly regulated), 'limited risk' (transparency obligations), and 'minimal risk' (largely unregulated). Central to this structure is Annex III, which exhaustively enumerates the categories of AI applications deemed to pose a 'high risk' to fundamental rights, health, and safety. These include biometric identification systems, AI in critical infrastructure, educational and employment systems, credit scoring, law enforcement tools, and systems used in migration and border control.

Yet, conspicuously absent from this taxonomy is any mention of climate risk. Neither carbon emissions, energy intensity, water usage, nor any other climate externality is considered in the determination of high-risk AI systems. This omission is not merely semantic; it is structurally embedded. The legislative text makes no provision for categorising AI systems as high-risk on the basis of their carbon footprint – despite the growing body of evidence on the energy demands of training large-scale AI models and the climate costs of AI-driven infrastructures such as data centres and edge computing systems.

This lacuna is particularly striking given the Union's own rhetorical and policy emphasis on the so-called twin transitions – the simultaneous pursuit of digital and green transformation. If the climate effects of AI systems are not accounted for at the threshold stage of risk classification, then the regulatory framework that follows – conformity assessments, CE marking, post-market monitoring – will also remain climate-wise blind. The absence of climate-related triggers in Annex III thus represents not only a technical oversight but a normative misalignment between the AI Act and the Union's broader climate acquis.

As some scholars have noted, this exclusion risks creating a two-tier governance model in which AI systems with social or human rights risks are subject to oversight, while those with climate implications are effectively exempted from regulatory scrutiny.<sup>41</sup> This is especially troubling given the increasing use of AI in sectors with high climate externalities, such as energy optimisation, industrial automation, and digital agriculture.

Unless and until Annex III is updated to include climate risk categories – whether based on absolute energy thresholds or emissions benchmarks, – the AI Act will remain structurally

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<sup>41</sup> Laranjeira de Pereira (n 37).

unfit to address one of the most pressing dimensions of contemporary technological governance: the climate neutrality of artificial intelligence.

#### 4.2 NO LIFECYCLE EMISSIONS OR ENERGY TRANSPARENCY IN TECHNICAL DOCUMENTATION (ANNEX IV)

Annex IV of the EU AI Act outlines the technical documentation requirements for high-risk AI systems, serving as a cornerstone for the conformity assessment process. However, it notably lacks explicit criteria or obligations pertaining to climate integrity.

Specifically, Annex IV mandates that providers furnish comprehensive details about the AI system's intended purpose, design specifications, data management practices, and risk management strategies. While these requirements encompass aspects such as human oversight, accuracy, robustness, and cybersecurity, they do not address the climate impacts associated with AI systems, such as energy consumption during training and deployment or the carbon footprint of hardware production. This omission is particularly concerning given the substantial carbon footprint of AI technologies. Scholars have highlighted that the AI Act fails to account for the energy consumed during the inference phase of AI operations, which can be significant. This oversight means that a substantial portion of AI's climate impact is not subject to regulatory scrutiny.<sup>42</sup> Furthermore, while the AI Act's recitals acknowledge the importance of climate change mitigation (cf. recitals 40 and 130), these considerations are not translated into binding obligations within the conformity assessment framework. The reliance on voluntary codes of conduct and deferred standardization processes lacks the enforceability needed to ensure that AI systems align with the EU's climate objectives, such as those outlined in the European Green Deal.

In conclusion, the current structure of Annex IV and the broader conformity assessment procedures under the EU AI Act do not adequately integrate climate sustainability criteria. This gap underscores the need for the development of harmonized standards or amendments to the existing framework to ensure that AI systems contribute positively to the EU's climate goals.

#### 4.3 NO CARBON ACCOUNTING STANDARDS IN CONFORMITY ASSESSMENT PROCEDURES

The conformity assessment procedures embedded in the AI Act are designed to ensure that high-risk AI systems comply with the essential requirements set out in Chapter III of the Regulation. These procedures serve as a gatekeeping mechanism, certifying that an AI system adheres to standards related to safety, transparency, robustness, and accountability before it may be placed on the Union market. However, a close reading of Articles 43-51 and Annexes VI–IX reveals a fundamental lacuna: these conformity procedures do not mandate or even encourage the assessment of climate-related risks.

The AI Act outlines a comprehensive process through which high-risk systems are subject

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<sup>42</sup> Kai Ebert et al, 'AI, Climate, and Regulation: From Data Centers to the AI Act' (*JSRN*, 22 November 2024) <[https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=4980340](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4980340)> accessed 1 September 2025.

to ex ante scrutiny, either through internal control or third-party assessments, depending on whether the AI system is covered by harmonised standards. Yet, none of the conformity pathways require providers to evaluate the carbon footprint of the AI systems, including dimensions such as carbon intensity, energy consumption, or the ecotoxicity of hardware supply chains. This is a striking omission given the growing body of evidence demonstrating the climate impact of large-scale AI training and inference models.

From a regulatory design perspective, this exclusion suggests a narrow technocratic conception of risk, limited primarily to social harms and human safety. The climate dimension of AI, by contrast, remains external to the assessment architecture. This disconnect is particularly problematic when considered alongside parallel EU legislation. As the European Commission explains in the Sustainable Products Initiative,<sup>43</sup> ‘Consumers, the environment and the climate will benefit from products that are more durable, reusable, repairable, recyclable, and energy-efficient’. In the same vein, the Ecodesign for Sustainable Products Regulation,<sup>44</sup> empowers the Commission to adopt delegated acts establishing product-specific requirements on climate performance, including carbon footprint (Article 5(1)(o) and imposes a sensitivity analysis covering the avoided greenhouse gas emissions (Annex II, para 8). Similarly, the Corporate Sustainability Reporting Directive (CSRD),<sup>45</sup> provides that the sustainability reporting standards have to specify information that the undertakings are to disclose about climate change mitigation and climate change adaptation (Article 29b(2)(a)(i)–(ii)). Taken together, these instruments embed climate considerations directly into compliance structures, ensuring that greenhouse gas emissions are monitored, reported, and progressively reduced both at the level of products and of corporate governance.

The AI Act, in contrast, embeds no such requirement at the level of regulatory procedure, even for AI systems known to incur substantial energy demands or climate-related costs. Moreover, the lack of integration with the EU Taxonomy Regulation – which expressly establishes climate change mitigation and adaptation as two of its central objectives (Articles 10 and 11) – further isolates the AI Act from the Union’s broader climate governance. This divergence is not only normative but operational: firms subject to both AI compliance obligations and climate reporting may be forced to navigate two parallel compliance regimes, one climate-wise agnostic and the other climate-forward.

In effect, the conformity assessment regime reinforces the AI Act’s climate blindness at the procedural level. Without explicit metrics, thresholds, or requirements concerning climate-linked performance, the AI compliance system provides no regulatory incentive for

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<sup>43</sup> European Commission, ‘Sustainable Products Initiative’ (*Have Your Say Europe*, webpage) <[https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12567-Sustainable-products-initiative\\_en](https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12567-Sustainable-products-initiative_en)> accessed 1 September 2025.

<sup>44</sup> Regulation (EU) 2024/1781 of the European Parliament and of the Council of 13 June 2024 establishing a framework for the setting of ecodesign requirements for sustainable products, amending Directive (EU) 2020/1828 and Regulation (EU) 2023/1542 and repealing Directive 2009/125/EC [2024] OJ L2024/1781.

<sup>45</sup> Directive (EU) 2022/2464 of the European Parliament and of the Council of 14 December 2022 amending Regulation (EU) No 537/2014, Directive 2004/109/EC, Directive 2006/43/EC and Directive 2013/34/EU, as regards corporate sustainability reporting [2022] OJ L322/15.

sustainable AI system design or lifecycle optimisation. As some scholars have observed,<sup>46</sup> this procedural lacuna is not incidental but symptomatic of the sectoral fragmentation of EU regulatory governance, in which digital innovation and decarbonisation pathway are governed on divergent tracks.

#### 4.4 REGULATORY SANDBOXES AND THE ABSENCE OF CLIMATE FILTERS

While the AI Act introduces a novel mechanism to foster innovation – AI regulatory sandboxes – these experimental zones fall short of addressing the European Union’s climate neutrality objectives. Codified in Articles 57 to 61 of the AI Act, regulatory sandboxes are controlled environments where providers and prospective providers can test AI systems before deployment, under the supervision of national competent authorities. However, a close textual analysis reveals a conspicuous omission: the absence of any explicit obligation or framework to assess or promote climate neutrality within these sandboxes.

Despite Recital 139 emphasising that sandboxes are intended to support ‘regulatory learning’ and facilitate ‘compliance of the innovative AI systems with this Regulation and other relevant Union and national law’ the operative provisions make no mention of climate neutrality. Instead, the regulation concentrates on fundamental rights, safety, and data protection, delegating oversight of those domains to relevant authorities. In Article 57(6), for instance, competent authorities are instructed to supervise for risks to fundamental rights, health, and safety – but not climate resilience. This lacuna persists even in Article 58, which mandates the Commission to adopt implementing acts detailing the sandbox framework. While this article provides principles for accessibility, resource allocation, and conformity assessment, it does not incorporate climate-related standards or even general climate-linked criteria as conditions for participation or evaluation. The oversight is all the more striking in light of proposals from the European Parliament during earlier negotiations, which sought to prioritise access to sandboxes for projects demonstrating climate mitigation value. These suggestions, however, were not adopted in the final version. An exception exists in Article 59, which allows for further processing of personal data within regulatory sandboxes for projects serving substantial public interest. Notably, this includes development in areas such as climate change mitigation and green transition. Yet, this clause is narrowly scoped to data processing and does not translate into broader climate-related performance criteria across sandbox operations.<sup>47</sup>

Consequently, the regulatory sandbox framework represents a missed opportunity to embed climate consciousness in early-stage AI experimentation. Without climate filters or climate impact assessments, sandboxes may inadvertently incentivise the development of energy-intensive, ecologically detrimental AI systems under the banner of innovation. As such,

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<sup>46</sup> Sara Garsia, ‘The environmental costs of AI: a shake-up of the EU’s twin transition’ (*Law, Ethics & Policy of AI Blog*, 28 February 2025) <<https://www.law.kuleuven.be/citip/blog/the-environmental-costs-of-ai-a-shake-up-of-the-eus-twin-transition/>> accessed 1 September 2025.

<sup>47</sup> Davide Baldini and Kate Francis, ‘AI Regulatory Sandboxes Between the AI Act and the GDPR: The Role of Data Protection as a Corporate Social Responsibility’ (CEUR Workshop Proceedings vol. 3731, 2024) <<https://cris.maastrichtuniversity.nl/en/publications/ai-regulatory-sandboxes-between-the-ai-act-and-the-gdpr-the-role->> accessed 1 September 2025.

integrating mandatory climate considerations into sandbox eligibility criteria, project evaluation, and supervision mechanisms could form a crucial next step in aligning innovation support instruments with the Union’s climate agenda.

#### 4.5 MISSED OPPORTUNITY FOR CLIMATE-SENSITIVE AI BY DESIGN

Despite the growing recognition of the role that design-phase decisions play in determining the long-term climate ramifications of technologies, the AI Act omits any formal requirement for ‘climate-sensitivity by design’ in the architecture, training, or deployment of artificial intelligence systems. Chapter III of the Regulation, on the high-risk AI systems – delineating requirements on risk management, data governance, technical documentation, and human oversight, etc. – are focused almost exclusively on safeguarding health, safety, fundamental rights, and cybersecurity. Thus, climate awareness is not treated as regulatory priority in the AI Act.

Analogously, this omission is particularly striking given the increasing policy emphasis on sustainability by design in adjacent EU legislative instruments, such as the Ecodesign for Sustainable Products Regulation (Regulation (EU) 2024/1781). In the context of AI, such a principle would require developers to evaluate and mitigate climate-related harms, including greenhouse gas emissions at the earliest stages of system development. However, the AI Act does not include such mandates into its core compliance architecture.

Scholarship explicitly advocating the adoption of climate impact assessments (CIAs) for artificial intelligence remains at an incipient stage. Such an assessment would encompass both the adverse effects of AI on the climate – chiefly arising from energy consumption and emissions embedded in hardware manufacturing – and its positive potential to contribute to climate mitigation by optimising energy systems, advancing clean technologies, and enabling the monitoring of climate phenomena. Emerging frameworks for evaluating AI’s net impact underscore that its contribution can be overwhelmingly beneficial, provided it is deliberately steered towards accelerating low-carbon transitions, while complementary policies are developed to contain and redress its negative externalities. A salient illustration is the written submission by the community-based organisation Climate Change AI in response to the Request for Information on National Priorities for Artificial Intelligence.<sup>48</sup> The submission underscores that AI has significantly accelerated emissions-intensive industries while also driving broader systemic transformations – such as heightened consumption, shifts in information dissemination, the entrenchment of individualised mobility through autonomous vehicles, and accompanying redistributions of social power – that collectively impede progress towards climate objectives. On this basis, it contends that climate change must constitute a central criterion in shaping not only ‘AI for good’ initiatives but the development of AI applications more generally. To this end, the organisation advocates the deployment of policy levers including: the mandatory integration of climate impact assessments into the evaluation of AI projects deemed strategic; the avoidance of direct public funding for AI applications that

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<sup>48</sup> Climate Change AI, Priya L Donti, David Rolnick, Jade E Guisiano, Sara Beery, Lynn Kaack and Sebastian Ruf, Climate Change AI (7 July 2023) <[https://downloads.regulations.gov/OSTP-TECH-2023-0007-0274/attachment\\_1.pdf](https://downloads.regulations.gov/OSTP-TECH-2023-0007-0274/attachment_1.pdf)> accessed 25 October 2024.

contravene climate objectives; and the imposition of reporting and accountability obligations on organisations for the emissions attributable to AI.

The legislative negotiations on the AI Act unfolded as a theatre of competing interests. They reveal,<sup>49</sup> for instance, that the Commission's original proposal did not embed climate risk in the core risk taxonomy or essential requirements; instead, MEPs in ENVI tried to graft climate-specific duties onto the text through add-ons flagging AI's carbon footprint and urging minimisation of climate impacts, and criteria tying 'high-risk' classification to adverse effects on the climate and on meeting EU greenhouse-gas targets. They proposed hard obligations to measure and disclose lifecycle energy use and GHG emissions, to log energy/resource use and GHGs, and to include energy-consumption and carbon-intensity information in technical documentation and even a visible energy/carbon label. ENVI also tabled a 'proportionality framework' to halt model training where the projected carbon footprint outweighed benefits and suggested periodic Commission reviews geared to decarbonising AI technologies by 2050 – all explicitly climate-centred in their nature. Ultimately, climate safeguards (carbon metrics, labels, climate-conditioned risk triggers) surfaced mainly as amendments – recitals, new articles, and annexes appended to a market/safety/fundamental-rights instrument – rather than as structural elements of the baseline proposal. These drafting choices illustrate that the climate perspective was pushed to the margins of the negotiation text, addressed through peripheral compliance add-ons rather than integrated into the Act's core architecture.

In the same vein, proposals for sustainability by design were not absent from the legislative debate. Certain amendments proposed during the European Parliament's deliberations sought to introduce environmental risk assessment requirements for both high-risk AI systems and foundation models. However, these proposals were not retained in the final version of the Regulation. This suggests a broader pattern in which environmental and climate-linked concerns were treated as ancillary rather than integral to the risk framework.<sup>50</sup>

Thus, the AI Act's current architecture misses a critical opportunity to institutionalize climate-sensitive AI by design at the heart of AI governance. This omission limits the EU's ability to ensure that its digital and green transitions advance in concert rather than in conflict. If left unaddressed, it risks embedding climate-wise suboptimal practices into the rapidly proliferating landscape of AI development.

These regulatory omissions do not merely reflect a technical oversight – they underscore a broader disjunction between the EU's AI governance framework and its long-term strategic objectives. By failing to fully account for the climate-related externalities of AI development, the Union risks advancing digital innovation at the expense of its climate commitments. As noted by the Harvard Ash Center,

The EU must also consider how AI investments may conflict with its other long-term objectives. For example, while AI has the potential to make processes more efficient, it can also contribute to environmental degradation due to the energy demands of

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<sup>49</sup> Amnesty International (n 35), Volpicelli (n 39).

<sup>50</sup> Anna Aseeva, 'Liable and Sustainable by Design: A Toolbox for a Regulatory Compliant and Sustainable Tech' (2024) 16(1) Sustainability 228.

large-scale data centers and the environmental footprint of hardware production, undermining the European Green Deal and climate neutrality goals. AI-driven automation could also lead to job displacement, exacerbating inequality and weakening the EU's social cohesion and vision of an 'economy that works for people'.<sup>51</sup>

This observation highlights the need for a governance approach that is not merely risk-based, but integrative – one that aligns AI deployment with Europe's green ambitions.

The preceding analysis has demonstrated that, despite its celebrated ambition and granularity in addressing algorithmic risks, the AI Act consistently falls short in integrating climate considerations across its core regulatory pillars. From the absence of climate risks in the high-risk classification schema (Annex III), to the lack of climate metrics in technical documentation (Annex IV), conformity assessments, and provider obligations, the climate dimension remains peripheral – if not entirely invisible. Regulatory sandboxes, touted as innovation-friendly instruments, likewise neglect climate-related criteria, while the omission of climate-sensitive AI by design forecloses structural incentives for climate-responsible AI development. What emerges is not simply a set of isolated exclusions, but a pattern of regulatory lacunae that systematically sideline the climate change implications of AI. This regulatory architecture reflects a deeper policy disjunction between the EU's digital and green agendas – agendas that are politically interlinked but legislatively estranged. Bridging this gap requires more than rhetorical convergence; it calls for targeted amendments designed to embed climate accountability throughout the entire AI lifecycle.

## 5 TOWARDS CLIMATE-CONSCIOUS EU AI REGULATION – POLICY RECOMMENDATIONS AND LEGAL PATHWAYS

The most rigorous critique, as jurists often observe, is not one that dismantles, but one that reconstructs. In this spirit, the present Section transforms the diagnostic analysis undertaken in Section 4 into a forward-looking framework of remedial action. Rather than merely highlighting deficiencies, it seeks to articulate precise, actionable, and legally coherent interventions that would enable the AI Act to reflect the climate commitments enshrined in the Union's broader legal and policy architecture. Importantly, all recommendations are crafted with the current EU acquis and institutional structure in mind – ensuring that they are not only normatively desirable, but also technically implementable within the bounds of the existing regulatory and procedural ecosystem.

### 5.1 INCORPORATING CLIMATE RISK INTO HIGH-RISK CLASSIFICATIONS (ANNEX III)

The first and most immediate reform should target Annex III of the AI Act, which exhaustively

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<sup>51</sup> Tessel van Oirsouw, 'AI, Digital Sovereignty, and the EU's Path Forward: A Case for Mission-Oriented Industrial Policy' (*Ash Center*, 20 November 2024) <<https://ash.harvard.edu/resources/ai-digital-sovereignty-and-the-eus-path-forward-a-case-for-mission-oriented-industrial-policy/>> accessed 1 September 2025.

defines ‘high-risk’ AI applications. A legislative amendment should introduce an additional risk category explicitly dedicated to climate harm. This could include criteria such as:

- High computational energy intensity (e.g., systems consuming over a set megawatt-hour threshold per year);
- Life-cycle carbon emissions above sectoral benchmarks;
- Significant reliance on rare or ecologically harmful materials;
- Water consumption in data training/deployment phases.

These metrics can be benchmarked against the EU Taxonomy Regulation and incorporated into risk classification guidelines issued by the European Commission. Additionally, delegated acts under Article 7 could be used to periodically update climate risk categories as scientific understanding and technical capacity evolve.

A promising avenue for integrating climate risk into the AI Act’s high-risk classification scheme lies in drawing on the regulatory methodologies already developed in German public policy. Germany has long incorporated climate impact criteria into sectoral governance frameworks – particularly in energy, infrastructure, and finance – in ways that could inform a more climate-wise robust approach to AI regulation. For instance, under the Bundesverkehrswegeplan 2030 (Federal Transport Infrastructure Plan), German authorities apply a structured climate-related scoring system that assesses projects on the basis of CO<sup>2</sup> emissions, biodiversity effects, and ecosystem fragmentation. Similarly, the Erneuerbare-Energien-Gesetz (Renewable Energy Sources Act, EEG 2021)<sup>52</sup> establishes a long-term objective of achieving greenhouse-gas neutrality for electricity generated and consumed in Germany before 2050. To realise this ambition, the act sets out policy goals and support mechanisms, including remuneration schemes, competitive tenders, and priority access to the grid, thereby defining clear expansion pathways for renewable energy. A further innovation concerns green hydrogen: its production may be fully exempted from the EEG surcharge, or hydrogen producers may benefit from the special equalisation scheme – thus embedding a central element of Germany’s national hydrogen strategy within the renewable energy framework and reflecting a broader commitment to integrating climate metrics into ex ante policy planning. At the EU level – where Germany has played an active role – the EU Taxonomy Regulation provides an analogous framework for classifying economic activities based on their climate contributions and compliance with technical sustainability criteria; for instance, under Article 10(1)(a), an economic activity qualifies as contributing substantially to climate change mitigation where that activity contributes substantially to the stabilisation of greenhouse gas concentrations in the atmosphere at a level which prevents dangerous anthropogenic interference with the climate system consistent with the long-term temperature goal of the Paris Agreement through the avoidance or reduction of greenhouse gas emissions or

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<sup>52</sup> Bundesministerium für Wirtschaft und Klimaschutz, ‘Gesetz zur Änderung des EEG und weiterer energierechtlicher Vorschriften’ (*BMWK*, 1 January 2021) <<https://www.bmwk.de/Redaktion/DE/Artikel/Service/gesetz-zur-aenderung-des-eeeg-und-weiterer-energierechtlicher-vorschriften.html>> accessed 1 September 2025.

the increase of greenhouse gas removals, including through generating, transmitting, storing, distributing or using renewable energy. These examples illustrate a best-practice orientation in German regulatory design: one that recognises climate risks as integral to systemic governance. Applying a comparable logic to AI – particularly for resource-intensive or high-emission systems – would not require conceptual innovation, but regulatory transposition. It offers a tested and technically feasible route toward embedding climate risk in the AI Act’s foundational structure.

## 5.2 INTEGRATING CARBON EMISSIONS INTO TECHNICAL DOCUMENTATION (ANNEX IV)

Annex IV should be amended to require climate-linked disclosure within the technical documentation obligations for high-risk AI systems. This may include:

- Disclosure of lifecycle carbon and water footprints (including hardware manufacture, model training, and deployment);
- Energy efficiency benchmarks for inference and training;
- Climate trade-offs for proposed model architectures;

These requirements could be operationalised through implementing acts, aligning Annex IV requirements with the Ecodesign for Sustainable Products Regulation and Corporate Sustainability Reporting Directive. Furthermore, such documentation could be made publicly available in part (e.g. via a registry), enhancing transparency and market-driven sustainability. A compelling example<sup>53</sup> of actionable climate-informed governance in the digital sector is offered by TCO Certified, an internationally recognized sustainability certification for IT products. While voluntary, the scheme has gained broad adoption and mandates comprehensive disclosure and third-party verification of key metrics, including energy consumption and carbon emissions. Notably, TCO Certified applies to product categories such as servers, laptops, and displays – core hardware in AI infrastructure – and sets clear benchmarks for energy efficiency and resource stewardship. Its structured approach demonstrates that it is not only technically feasible but also market-compatible to require climate transparency in digital systems. As such, TCO Certified offers a valuable precedent for extending similar obligations under Annex IV of the AI Act, where climate disclosures could be standardized and integrated through implementing acts and interlinked with broader EU climate legislation.

## 5.3 EMBEDDING CLIMATE METRICS INTO CONFORMITY ASSESSMENT PROCEDURES

Climate compliance should be formally integrated into the conformity assessment architecture of the AI Act. This could be achieved by:

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<sup>53</sup> TCO Development, ‘TCO Certified, Generation 9 for Notebooks: Edition 2’ (TCO Development, 2022) <<https://tcocertified.com/files/certification/tco-certified-generation-9-for-notebooks-edition-2.pdf>> accessed 1 September 2025.

- Mandating third-party assessors to verify climate performance using harmonised standards;
- Aligning conformity assessment modules with standards developed by CEN/CENELEC that include emissions, energy, and material intensity thresholds;
- Requiring AI system developers to demonstrate alignment with climate objectives defined in the Taxonomy Regulation.

Such reforms would ensure that AI systems not only meet social and safety standards but also advance the EU's climate objectives in a measurable and verifiable manner. A promising example of how artificial intelligence can be harnessed to support measurable climate compliance comes from the UK-based climate tech firm CarbonBright.<sup>54</sup> Leveraging AI, CarbonBright's platform enables real-time assessments of the carbon footprints of consumer goods across their entire lifecycle – from production through to end-of-life recycling. This model illustrates the potential of AI systems not merely as sources of climate impact, but as instruments for lifecycle impact transparency and sustainable product governance. In doing so, it provides a compelling blueprint for how AI-based tools could be integrated into conformity assessment frameworks under instruments such as the EU AI Act, particularly if climate criteria – currently absent – were formally embedded in technical documentation or verification processes. The CarbonBright case therefore underscores the feasibility and added value of mandating lifecycle-based climate metrics in AI system evaluation.

#### 5.4 CLIMATE CONDITIONS FOR ACCESS TO REGULATORY SANDBOXES

Regulatory sandboxes should be restructured to prioritise and reward climate-conscious innovation. Specifically:

- Sandbox admission criteria should include climate merit—preference should be given to AI systems that demonstrate measurable contributions to emissions reductions, circularity, or energy efficiency.
- Climate impact assessment templates should be developed as a condition for entry.
- National authorities should be empowered to monitor and report on the climate outcomes of sandboxed projects.

These changes can be implemented via delegated acts or national-level sandbox guidance, supported by the European AI Office and in coordination with the EEA (European Environment Agency).

An instructive example of operationalising climate-related principles within AI governance comes from Australia's Commonwealth Scientific and Industrial Research Organisation

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<sup>54</sup> CarbonBright, 'Using AI for Sustainability: Case Studies and Examples' (Coaxsoft, 2024) <<https://coaxsoft.com/blog/using-ai-for-sustainability-case-studies-and-examples>> accessed 1 September 2025.

(CSIRO), which has developed a dedicated ESG-AI Framework.<sup>55</sup> This tool is designed to assist investors, developers, and policymakers in evaluating the climate, resource efficiency, environmental, social, and governance dimensions of AI systems throughout their lifecycle. Unlike general ESG frameworks, CSIRO's model is tailored to the specificities of AI, addressing both systemic risks and sector-specific challenges such as algorithmic opacity, energy consumption, and social externalities. It enables stakeholders to assess AI technologies not only for compliance, but also for their alignment with long-term climate outcomes. By offering practical indicators and guidance for due diligence, the framework represents a leading model for how climate-aligned assessment protocols can be embedded into AI innovation ecosystems – including regulatory sandboxes. Its structure is particularly relevant for jurisdictions like the EU, where proposals have been made to align conformity assessments and sandbox eligibility criteria with the Union's climate objectives, such as the one proposed by Google in March 2025 in the Policy Roadmap 'The AI Opportunity for Europe's Climate Goals'.<sup>56</sup>

## 5.5 INSTITUTIONALISING NET-ZERO AI BY DESIGN

Under the current version of the AI Act, the climate-aligned development of artificial intelligence remains largely marginalised. To remedy this omission, a dedicated provision introducing a 'climate-compatibility by design' obligation could be envisaged, modelled on analogous frameworks found in the Ecodesign for Sustainable Products Regulation. Such a provision would require, *inter alia*:

- the inclusion of an Climate Impact Assessment (CIA) as part of the AI system's risk management file;
- an obligation to evaluate alternative system designs with a view to climate optimisation; and
- the documentation of energy-saving techniques, such as model pruning, quantisation, or the use of low-power training infrastructure.

These obligations could also be operationalised through voluntary codes of conduct under Article 95, which should be reconfigured as co-regulatory instruments within the framework of soft law governance. The European AI Office, in coordination with the Joint Research Centre and other relevant scientific bodies, could take the lead in developing sector-specific design guidelines to ensure that climate considerations are integrated throughout the AI system lifecycle in a technically robust and legally coherent manner.

A particularly illustrative example of climate-conscious AI by design is CodeCarbon,

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<sup>55</sup> CSIRO, 'Responsible AI and ESG: Aligning AI Use with Environmental, Social and Governance Objectives' (Commonwealth Scientific and Industrial Research Organisation 2023) <<https://www.csiro.au/-/media/D61/Responsible-AI/Alphinity/Responsible-AI-and-ESG.pdf>> accessed 1 September 2025.

<sup>56</sup> Google, 'The AI Opportunity for Europe's Climate Goals – A Policy Roadmap' (March 2025) <[https://static.googleusercontent.com/media/publicpolicy.google/en//resources/europe\\_ai\\_opportunity\\_climate\\_action\\_en.pdf](https://static.googleusercontent.com/media/publicpolicy.google/en//resources/europe_ai_opportunity_climate_action_en.pdf)> accessed 1 September 2025.

an open-source Python package developed by Mila (Quebec AI Institute), BCG GAMMA, Haverford College, and Comet.ml.<sup>57</sup> The tool integrates directly into machine learning workflows to monitor the energy consumption of CPUs, GPUs, and RAM during training and inference. It then cross-references this data with the carbon intensity of the local electricity grid and the geographical location of the computing resources, translating raw energy use into an estimated quantity of CO<sub>2</sub> emissions. Results are logged in real time and can be exported to collaborative dashboards, making the environmental footprint of different models transparent across research teams. Beyond measurement, CodeCarbon functions as a behavioural nudge: by revealing the hidden climate cost of architectural choices, hyperparameter tuning, or deployment schedules, it encourages developers to shift workloads to cleaner energy grids, adopt more efficient hardware, or streamline models. Early use cases suggest that such adjustments can reduce training-related emissions by up to a third, without compromising model accuracy. In this way, CodeCarbon embeds climate accountability into the development process itself, demonstrating how open-source tools can align AI innovation with decarbonisation objectives.

In brief, the preceding suggestions illustrate that bridging the AI Act's climate lacunae does not require legislative reinvention, but targeted recalibration through existing legal instruments, regulatory procedures, and policy frameworks. By harnessing delegated and implementing acts, aligning with parallel EU legislation such as the Taxonomy Regulation and Ecodesign Regulation, and learning from sectoral best practices, the Union can meaningfully embed sustainability within the AI governance ecosystem. The recommendations offered are not aspirational abstractions – they are technically actionable, procedurally compatible, and normatively aligned with the Union's climate and digital objectives. If enacted, they would mark a decisive step toward restoring coherence between the EU's regulatory ambitions and the climate realities of AI development. In this light, climate neutrality must no longer be a collateral consideration in AI governance, but a structural imperative woven into its legal and operational core.

## 6 CONCLUSION

All things considered, the EU AI Act inaugurates a new era in global digital regulation by establishing a comprehensive, risk-based legal framework for the governance of AI technologies. Yet, for all its normative ambition and institutional innovation, it reveals a profound asymmetry at the heart of the Union's regulatory paradigm: the structural exclusion of climate consciousness from the governance of artificial intelligence. In its current formulation, the AI Act enshrines a model of technological oversight that is procedurally sophisticated yet silent on climate considerations—prioritising data protection, transparency and human safety, while rendering the climate costs of AI systems invisible to law.

This regulatory silence is striking given the growing evidence of the carbon footprint of AI infrastructures: from the energy-intensive training of foundation models, to the lifecycle

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<sup>57</sup> CodeCarbon, CodeCarbon: Track and Reduce CO<sub>2</sub> Emissions from Machine Learning Workloads (GitHub, 2023), accessible at: <https://github.com/mlco2/codecarbon>, (accessed 25 October 2025).

emissions of data centres, the extraction of rare earth minerals for AI hardware and the carbon intensity of global computational supply chains. Yet none of these dimensions are captured within the Act's core instruments. High-emission AI systems are not classified as high-risk under Annex III. CE conformity assessments include no AI lifecycle GHG emissions or energy-efficiency criteria. Regulatory sandboxes remain unconditioned by climate filters. Post-market monitoring regimes lack any obligation to report or mitigate climate damages, and the broader ecosystem of AI governance remains disconnected from parallel instruments in EU acts, including the EU Taxonomy Regulation, the Sustainable Products Initiative, the European Climate Law and the CSRD.

The implications of this omission are both legal and systemic. First, it compromises the Union's constitutional obligation under Article 191(1) TFEU, final indent to promote measures aimed at combating climate change. Second, it introduces incoherence into the architecture of EU governance, whereby digital innovation is actively regulated while its climate consequences are treated as externalities beyond the purview of binding law. Third, it weakens the operational capacity of the Union to realise the objectives of the European Green Deal, which commits the EU to climate neutrality by 2050 and explicitly positions digitalisation as a lever – not a liability – for green transformation. And fourth, it undermines the credibility of the Union's geopolitical identity as a normative green power capable of exporting sustainability-oriented regulatory models to the global digital economy ('EU as a standard-setter').

This failure is emblematic of a deeper structural flaw in the Union's twin transition strategy. While the digital and green transitions are rhetorically intertwined, they remain institutionally decoupled in practice. Digital legislation continues to evolve around paradigms of data sovereignty, rights-based protection and economic coordination, with no embedded climate logic. Conversely, the climate acquis, though increasingly ambitious, remains technologically agnostic – failing to account for the enabling role and material impacts of AI, cloud computing and algorithmic infrastructures. This bifurcation sustains a model of siloed governance unfit for the complexity of the climate crisis or the realities of hyperconnected technological systems.

Rectifying this asymmetry requires more than marginal amendments or voluntary net-zero pledges. It necessitates a recalibration of regulatory methodology – one that embeds climate responsibility as a constitutive, not ancillary, element of digital law. High-emission AI systems must be reclassified as high-risk. Lifecycle climate impact assessments must become mandatory components of conformity procedures. Regulatory sandboxes must incorporate binding climate filters. A horizontal integration mechanism must be established to ensure alignment between the AI Act and instruments like the EU Taxonomy Regulation, CSRD, Ecodesign Regulation and the Green Deal Industrial Plan.

In the Anthropocene, the legitimacy of technological governance depends on its ability to reconcile innovation with climate viability. If the EU is to lead by example, it must build a regulatory regime for artificial intelligence that is not only rights-based and risk-informed, but also climate-literate and sustainability-anchored. The AI Act, in its present form, falls short of that standard. But it need not remain static. The path forward lies in legislative reimagination – where digital progress and climate stewardship are not competing agendas, but

co-constitutive pillars of a resilient and just European legal order.

Nevertheless, the horizon is not closed. The architecture of European law is not immutable – it evolves through vision, consensus and democratic resolve. If institutions, lawmakers, civil society and industry converge around a shared commitment to driving decarbonisation, the AI Act can be transformed into a vanguard of climate responsibility. The tools exist, the mandate is clear and the moment is ripe. With unity of purpose and clarity of ambition, the European Union still has the power to lead a digital transition that not only empowers humanity, but safeguards the planet that sustains it.

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