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Review Article

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Instrument Mix in Climate Change Law Legal Design, Regulatory Interaction and the Architecture of Decarbonisation

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Abstract

Climate change law is no longer organised around the choice of a single optimal regulatory instrument. Contemporary legal orders combine emissions trading, carbon taxation, performance standards, renewable-energy obligations, energy-efficiency duties, planning rules, subsidy regimes, disclosure requirements, border measures, public investment and social compensation. This study examines that combination as an instrument mix: a legally structured set of interacting regulatory tools directed toward common climate objectives. It argues that the central legal question is not whether one instrument is intrinsically superior, but whether the ensemble is sufficiently effective, coherent, proportionate, administratively workable and distributively defensible. The European Union provides the most developed contemporary example. Its climate architecture combines binding economy-wide targets, two emissions-trading systems, national effort-sharing obligations, land-use and removals rules, renewable-energy and energy-efficiency legislation, a carbon border adjustment mechanism, climate governance duties and social compensation. The study analyses the benefits and risks of overlap, explains how judicial review increasingly scrutinises the adequacy and consistency of climate frameworks, and proposes legal design principles for managing instrument interactions under conditions of technological uncertainty, distributional conflict and long investment horizons.

Keywords: Climate Change Law, Instrument Mix, Policy Mix, Emissions Trading, Carbon Pricing, EU ETS, CBAM, Energy Law, Climate Governance, Regulatory Coherence

1. The Regulatory Problem: from Instrument Choice to Instrument Architecture

Climate change is a regulatory problem of unusual breadth. Greenhouse-gas emissions arise from electricity, industry, transport, buildings, agriculture, land use, waste and consumption, while the relevant investment decisions operate on different time horizons and through different markets. No single legal instrument can address all of these sources, barriers and institutional settings. The legal architecture of mitigation therefore consists of multiple instruments operating simultaneously, often at several levels of governance. This practical reality has displaced the older debate over whether environmental law should rely primarily on command-and-control rules or on economic instruments. The more difficult question is how legally heterogeneous instruments should be combined and coordinated [1].

The term instrument mix should be distinguished from the broader concept of policy mix. In the sustainability-transitions literature, the policy mix includes not only interacting instruments but also the strategic objectives, policy processes and characteristics that determine their evolution. An instrument mix is narrower: it is the combination of concrete regulatory tools and the interactions among them. This distinction is legally useful because it permits analysis of the normative structure of each instrument while keeping the focus on cumulative and interactive effects [2]. The regulatory case for mixing instruments rests on three propositions. First, climate mitigation involves several market failures and non-market barriers at once: the external cost of emissions, innovation spillovers, information asymmetries, capital constraints, infrastructure lock-in, split incentives and coordination failures. A carbon price can internalise part of the emissions externality but cannot, by itself, reliably eliminate each of these barriers. Second-

ly, decarbonisation is dynamic. Law must influence not only current abatement choices but also investment, innovation, infrastructure and the retirement of carbon-intensive assets. Thirdly, climate law is distributive. The same carbon constraint can impose sharply different burdens across households, sectors, regions and Member States. Instruments aimed at effectiveness therefore interact with instruments designed for affordability, competitiveness and fairness.

2. Legal Taxonomy of Climate Instruments

2.1. Quantity Instruments and Price Instruments

The core economic distinction is between quantity-based and price-based regulation. Emissions trading fixes, directly or indirectly, a quantitative ceiling and permits regulated entities to trade allowances. Carbon taxation fixes a price per unit of carbon content or emissions and leaves the resulting quantity response to market behaviour. In legal terms, both require a dense institutional framework: rules on scope, monitoring, reporting, verification, surrender or payment, enforcement, exemptions, revenue use and review. The apparent simplicity of pricing instruments should therefore not obscure their dependence on administrative law and enforcement capacity.

The EU Emissions Trading System illustrates the point. Directive 2003/87/EC, as repeatedly amended and substantially revised by Directive (EU) 2023/959, combines a declining cap, auctioning, benchmark-based free allocation, monitoring and verification duties, a market stability mechanism and sector-specific rules. The 2023 reform also created a distinct emissions-trading system for fuel combustion in buildings, road transport and additional sectors, with compliance obligations scheduled to apply from 2028 subject to the Directive's safeguards [3].

2.2. Prescriptive Standards, Technology-Forcing Rules and Sectoral Mandates

Command-and-control instruments remain indispensable where a price signal is too diffuse, where infrastructure is path-dependent, or where minimum technical performance must be guaranteed. Vehicle standards, building codes, product requirements, industrial emissions rules and planning constraints can reduce emissions independently of the short-term carbon price. Such instruments can also be technology-forcing when they progressively tighten performance requirements and thereby alter the feasible set of technologies available to regulated actors.

Renewable-energy and energy-efficiency legislation perform a related function. Directive (EU) 2023/2413 requires Member States collectively to ensure that renewable energy reaches at least 42.5 per cent of Union gross final energy consumption in 2030, while the Union is collectively to endeavour to reach 45 per cent. Directive (EU) 2023/1791 requires a collective reduction of energy consumption of at least 11.7 per cent in 2030 compared with the 2020 reference-scenario projections. These instruments do not merely duplicate carbon pricing; they target deployment, energy demand, infrastructure and investment conditions that a general carbon price may influence only imperfectly or too slowly [4,5].

2.3. Fiscal, Financial, Informational and Procedural Instruments

Climate instrument mixes also rely on subsidies, contracts, public investment, tax expenditures, green public procurement, disclosure obligations, sustainable-finance classification systems and procedural duties. Their legal significance lies in the way they reshape capital allocation and administrative decision-making. Public finance can de-risk technologies whose social value exceeds their private return, while disclosure and taxonomy rules can reduce information failures and create common classifications. Procedural instruments, including planning duties, national climate plans, reporting and public participation, operate at a different level: they coordinate the mix itself.

Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action exemplifies this coordinating function. It establishes integrated national energy and climate plans, progress reporting, Commission assessment and an iterative process intended to improve consistency among national and Union measures. The Regulation expressly requires attention to interactions and consistency between existing and planned policies and measures within and among the dimensions of the Energy Union [6].

3. International Climate Law as a Framework for Domestic Instrument Mixes

International climate law does not prescribe one universal regulatory technique. The Paris Agreement instead combines collective temperature goals, nationally determined mitigation commitments, progression, transparency, periodic stocktaking and international cooperation. Article 4 requires each Party to prepare, communicate and maintain successive nationally determined contributions and to pursue domestic mitigation measures with the aim of achieving them. This architecture leaves States substantial discretion over domestic instruments while tightening procedural expectations and the direction of travel over time [7].

That discretion is central to the instrument-mix model. International law establishes objectives and procedural disciplines but ordinarily allows each Party to select the domestic combination of carbon prices, standards, subsidies, land-use rules and other measures. The resulting flexibility can support experimentation and accommodate institutional diversity. It can also produce under-specification: formally ambitious targets may coexist with domestic measures that are insufficient, internally inconsistent or excessively dependent on uncertain future removals. The legal quality of the domestic mix therefore becomes a principal determinant of whether internationally stated ambition is credible.

The Paris architecture also encourages interaction among instruments across borders. Article 6 provides frameworks for cooperative approaches and a mechanism capable of supporting mitigation and sustainable development. Even where international transfers are not used, domestic carbon-pricing systems increasingly interact through trade, supply chains, disclosure rules and border measures. Climate law is consequently developing from a collection of nationally bounded instruments into a network of mutually conditioning regulatory systems.

4. The European Union as a Mature Climate Instrument Mix

4.1. Climate Targets as Framework Norms

The European Climate Law, Regulation (EU) 2021/1119, converts long-term climate objectives into binding Union law. It requires Union-wide greenhouse-gas emissions and removals regulated in Union law to be balanced at the latest by 2050 and establishes a binding 2030 target of at least a 55 per cent net domestic reduction compared with 1990. In 2026 Regulation (EU) 2026/667 amended the Climate Law by adding a binding 2040 target of a 90 per cent reduction of net greenhouse-gas emissions compared with 1990. These framework targets do not themselves determine the distribution of reductions among sectors or technologies. Their legal function is architectural: they provide the benchmark against which the surrounding instrument mix must be calibrated and reviewed [8,9]. Framework targets reduce one form of regulatory uncertainty while increasing the importance of inter-instrument coherence. A target can be legally binding yet practically weak if sectoral instruments do not generate a trajectory capable of attaining it. Conversely, overly rigid sectoral rules can impose unnecessary cost if they disregard cheaper abatement opportunities elsewhere. The role of climate framework legislation is therefore not to replace sectoral law but to discipline the relationship between the overall objective and the instruments designed to achieve it.

4.2. The EU ETS as a Cornerstone Instrument

The EU ETS remains a cornerstone of Union mitigation law because it places an explicit scarcity constraint on emissions from major stationary installations and aviation, with maritime transport progressively integrated through the recent reform. Its legal advantage is the combination of an aggregate environmental constraint with decentralised compliance choices. Firms can reduce emissions, alter production, invest in lower-carbon processes or acquire allowances. This flexibility is the principal efficiency claim for emissions trading.

Yet a cornerstone instrument is not a solitary instrument. The ETS operates alongside renewable-energy mandates, energy-efficiency law, industrial regulation, innovation funding, State aid control and sector-specific infrastructure policy. The legal issue is therefore whether these measures reinforce or distort the cap-and-trade mechanism. Under a fixed cap, additional policies in covered sectors may change allowance demand and prices without automatically reducing cumulative emissions below the cap. That classical waterbed effect is weakened where the system contains mechanisms that adjust allowance supply, but the broader lesson remains: the environmental effect of one instrument cannot be evaluated without examining the rules governing the others.

EU case law demonstrates that emissions trading is not insulated from general principles of Union law. In Arcelor Atlantique, the Court of Justice reviewed the differentiated sectoral coverage of the ETS under the principle of equal treatment and accepted that, in a field involving complex legislative choices, the Union legislature enjoys broad discretion subject to proportionality limits. In Air Transport Association of America, the Grand Chamber upheld the inclusion of aviation activities against challenges based on international law. In Borealis Polyolefine, the Court reviewed the methodology governing free allocation and the cross-sectoral correction factor. These judgments confirm that instrument design remains subject to legality, equality and proportionality even where the legislature is granted substantial technical discretion [10-12].

4.3. Effort Sharing and Land-use Regulation

The ETS does not cover the entire economy. Regulation (EU) 2018/842, as amended by Regulation (EU) 2023/857, allocates binding national reduction obligations for sectors outside the principal ETS and LULUCF framework. The amended regime aims at a 40 per cent reduction in covered-sector greenhouse-gas emissions by 2030 compared with 2005. Its legal logic differs from the ETS: responsibility is allocated to Member States through annual emission allocations and flexibilities rather than directly to installations through tradable allowances [13].

Land use, land-use change and forestry requires a separate regulatory logic because emissions and removals are biophysical, inventory-dependent and subject to significant natural variability. Regulation (EU) 2018/841, as amended by Regulation (EU) 2023/839, establishes a Union target of 310 million tonnes of CO2 equivalent in net removals for 2030, accompanied by national targets and accounting rules. The LULUCF framework thus complements industrial and energy mitigation while raising distinct questions concerning permanence, measurement and the extent to which removals should substitute for gross emission reductions [14].

4.4. Border Adjustment and Carbon Leakage

The Carbon Border Adjustment Mechanism adds a trade-related instrument to the internal decarbonisation mix. Regulation (EU) 2023/956 establishes a mechanism that links the carbon cost of specified imports to the EU carbon-pricing framework. Its central legal function is to address carbon-leakage risk while the Union strengthens domestic pricing and progressively reduces free allocation in relevant sectors. CBAM therefore cannot be understood in isolation: its justification, calibration and distributive effects depend on the design of the ETS, the treatment of exporters and importers, the recognition of carbon prices paid abroad and compatibility with the Union's international obligations [15].

This interaction illustrates a general feature of climate instrument mixes. When domestic ambition becomes stringent, supporting instruments often migrate outward: border adjustments, product standards, methane requirements and supply-chain due-diligence rules seek to prevent domestic regulation from merely relocating emissions. The stronger the internal climate constraint, the greater the legal pressure to manage external competitiveness and leakage effects without converting environmental regulation into arbitrary or disguised trade restriction.

4.5. Social Compensation and the Second Emissions-Trading System

The expansion of carbon pricing to buildings and road transport intensifies distributive concerns because household energy and mobility expenditures are politically and socially salient. The Union responded by pairing the new trading system with Regulation

(EU) 2023/955 establishing the Social Climate Fund for 2026 to 2032. The Fund is designed to support measures and investments benefiting vulnerable households, micro-enterprises and transport users affected by the extension of emissions trading [16]. This pairing is a paradigmatic instrument interaction. The carbon-price instrument is justified primarily by mitigation and efficiency; the social-fund instrument addresses incidence, capacity to invest and political durability. A legally mature instrument mix does not treat distributional correction as external to climate law. It incorporates compensatory design into the architecture because unequal ability to respond to price signals can undermine both fairness and effectiveness. The relevant question is not whether compensation weakens pricing, but whether it is targeted in a way that preserves mitigation incentives while enabling vulnerable actors to reduce exposure to fossil-energy costs.

5. Criteria for Legal Evaluation of an Instrument Mix

5.1. Environmental Effectiveness and Additionality

The first criterion is whether the mix is capable of delivering the legally prescribed emissions trajectory. Evaluation must distinguish nominal coverage from actual additionality. Two instruments may address the same emissions but produce little additional mitigation if one merely changes the compliance pathway under a binding cap. Conversely, overlap may be justified where the second instrument addresses innovation, infrastructure, information or distributional barriers that the first instrument cannot adequately reach. Legal analysis should therefore identify the causal role assigned to each instrument rather than infer redundancy from overlapping subject matter.

Effectiveness also requires attention to time. A measure that is cost-effective over one compliance period may entrench infrastructure that is inconsistent with the 2040 or 2050 target. Climate law increasingly requires trajectory-based assessment rather than static assessment. The 2030, 2040 and 2050 targets in Union law make this temporal dimension explicit, transforming regulatory durability and lock-in into legal design concerns.

5.2. Consistency, Coherence and Comprehensiveness

Consistency concerns whether the instruments point in mutually compatible directions. A subsidy for fossil-fuel consumption can undermine a carbon price; permissive planning rules can frustrate renewable deployment; an efficiency obligation can reduce allowance demand and thereby alter ETS prices. Coherence concerns the quality of the processes through which these interactions are identified and managed. Comprehensiveness concerns whether the mix covers the relevant emissions sources, market failures and transition barriers. These criteria are analytically distinct. A highly comprehensive mix can still be internally inconsistent, while a coherent decision-making process can govern a deliberately selective set of instruments [17].

The Governance Regulation is important precisely because it institutionalises a coherence function. By requiring integrated national plans, progress reports and Commission recommendations, it creates a legal forum in which interactions among energy security, decarbonisation, efficiency, the internal market and innovation can be examined. The mechanism remains softer than direct harmonisation in several respects, but it recognises that climate effectiveness depends on coordination across legal silos [18].

5.3. Proportionality, Equality and Legal Certainty

Instrument mixes multiply the occasions on which proportionality and equality problems can arise. A regulated entity may face a carbon price, a technology standard, reporting duties and sectoral levies at the same time. The legal assessment cannot simply add the burdens mechanically, because different instruments may pursue distinct objectives. Nevertheless, cumulative regulatory burden matters where overlapping measures produce manifestly excessive costs, discriminatory treatment or instability unrelated to environmental benefit. Courts generally accord legislatures a broad margin in technically complex environmental policy, but that margin does not remove the requirements of objective justification, rational design and respect for fundamental rights.

Legal certainty also has a specifically dynamic dimension in climate regulation. Long-lived investments depend on credible future constraints. Frequent reversals can raise capital costs and delay transition, while excessively rigid rules can prevent adaptation to technological change. The most defensible approach is often a stable trajectory combined with pre-defined review mechanisms, adjustment criteria and transparent data. The objective should be predictable adaptability rather than either permanent rigidity or discretionary volatility.

5.4. Administrative Feasibility and Information Architecture

Every additional instrument imposes monitoring, reporting, verification and enforcement demands. Complexity is not inherently defective: a complex problem may require differentiated rules. The legal concern is unmanaged complexity. Multiple instruments should, where possible, share definitions, emissions data, registries, verification standards and reporting cycles. Otherwise the instrument mix may generate inconsistent datasets, duplicative compliance and enforcement gaps.

The risk of administrative overload is particularly acute where climate policy is layered across Union, national, regional and local authorities. The design task is therefore institutional as well as substantive. Competence must be allocated to bodies capable of collecting information and enforcing obligations, while coordination mechanisms must prevent fragmentation. Instrument choice without institutional design is incomplete legal engineering.

5.5. Distributional Justice and Legitimacy

Climate instruments distribute costs and benefits unevenly. Carbon pricing is often criticised for regressive household effects, industrial standards can affect employment in concentrated regions, renewable infrastructure can generate local land-use conflict, and fiscal support can shift costs to taxpayers. These effects do not automatically render an instrument unlawful or undesirable, but they affect proportionality, political durability and the practical capacity of regulated actors to comply.

A sophisticated instrument mix therefore includes distributive instruments rather than treating fairness as a subsequent political correction. Revenue recycling, targeted transfers, renovation support, public transport investment and transition assistance can change the incidence of a carbon price while preserving its marginal incentive. The Social Climate Fund embodies this logic at Union level. More generally, the legal quality of climate governance increasingly depends on whether burdens are allocated transparently and whether affected groups have realistic pathways to adjust.

6. Managing Interactions: when Overlap is Beneficial and when it becomes Regulatory Conflict

6.1. Carbon Pricing and Renewable-Energy Support

Carbon pricing and renewable support can be complementary when they address different failures. The carbon price penalises emissions across covered activities; renewable support can correct innovation spillovers, financing constraints, network barriers and early-stage scale disadvantages. The interaction becomes problematic when support is poorly targeted, persists after the relevant market failure has receded, or causes large redistributive transfers without additional deployment. The legal design response is periodic calibration rather than categorical preference for one instrument.

In a cap-and-trade system, renewable deployment may depress allowance demand and prices. Whether this reduces cumulative emissions depends on the rules governing allowance supply. For that reason, reform of allowance-market architecture can be as important as reform of the renewable-support scheme. Instrument interaction is thus endogenous: lawmakers can redesign one instrument to accommodate the effects of another.

6.2. Carbon Pricing and Energy-Efficiency Obligations

Energy-efficiency law can also complement carbon pricing. Split incentives between landlords and tenants, limited access to capital, imperfect information and behavioural barriers can prevent cost-effective efficiency investments even where energy prices incorporate carbon costs. Minimum energy-performance standards and renovation obligations can overcome these barriers but may impose high upfront costs. The appropriate mix therefore combines standards with financing, information and social support. A price signal without investment capacity may be ineffective; a standard without financing may be inequitable or under-enforced.

6.3. Free Allocation, CBAM and Industrial Decarbonisation

The interaction between free allocation and CBAM is especially sensitive. Free allocation historically addressed carbon leakage within the ETS, but extensive free allocation weakens the carbon cost faced at the margin for some production decisions and can create windfall effects. CBAM offers an alternative leakage response by applying a carbon-related adjustment to covered imports. The legal transition from one instrument to the other must be coordinated to avoid double protection, preserve incentives for industrial decarbonisation and maintain defensibility under trade law. The instrument mix is therefore transitional as well as simultaneous: one tool may be designed to phase down as another phases in.

6.4. Removals and Gross Emission Reductions

Carbon removals add another layer of interaction. Net-zero frameworks necessarily recognise removals, but excessive fungibility between removals and fossil emissions can delay structural decarbonisation and expose targets to reversal or measurement risk. The European Climate Law already limits the contribution of net removals to the 2030 target, and the LULUCF regime separately regulates land-sector removals. This separation reflects an important design principle: instruments governing uncertain or reversible removals should not automatically be treated as perfect substitutes for permanent reductions in fossil carbon emissions [19].

6.5. Adaptation within the Mitigation Mix

Mitigation and adaptation instruments pursue different immediate objectives but interact legally and financially. Infrastructure standards, water policy, land-use planning and disaster-risk rules may increase resilience while also affecting emissions. Poorly designed adaptation can lock in high-carbon infrastructure, while mitigation projects can create maladaptation if they ignore heat, drought, flood or biodiversity risks. Climate instrument mixes should therefore be screened for cross-objective effects rather than organised into entirely separate legal compartments.

7. Judicial Review and the Emerging Duty of Framework Adequacy

Climate litigation has increasingly shifted from challenges to individual regulatory instruments toward scrutiny of the adequacy of the overall legal framework. This development is highly relevant to instrument-mix analysis because it asks courts to assess whether the State has adopted and implemented a coherent body of measures capable of meeting legally significant climate objectives.

In Urgenda, the Supreme Court of the Netherlands upheld an order requiring the State to reduce greenhouse-gas emissions from Dutch territory by at least 25 per cent by the end of 2020 compared with 1990, grounding the duty in Articles 2 and 8 of the European Convention on Human Rights and the State's positive obligations. The judgment did not prescribe a specific regulatory instrument; it left the State discretion over the means while requiring an adequate mitigation result [20]. The Grand Chamber of the European Court of Human Rights developed this logic further in Verein KlimaSeniorinnen Schweiz and Others v Switzerland. It held that Article 8 encompasses a right to effective protection by State authorities from serious adverse effects of climate change and found critical lacunae in the Swiss regulatory framework, including failures concerning quantified national emission limitations and timely, consistent implementation. At the same time, the Court recognised a wide margin of appreciation regarding the choice of means. This combination is central to instrument-mix legality: courts may avoid selecting instruments while still reviewing whether the framework as a whole is sufficiently concrete, timely and consistent [21].

This jurisprudential approach has two implications. First, governmental discretion over instrument choice is not equivalent to discretion to maintain an inadequate ensemble. Secondly, proce-

dural and evidentiary quality becomes legally important. Carbon budgets, trajectories, monitoring systems, review mechanisms and reasoned explanations provide the connective tissue between high-level targets and individual instruments. Judicial review is therefore likely to focus increasingly on the credibility of this connective tissue rather than on a judicial preference for taxes, trading or standards as such.

8. The Limits of Instrument Accumulation

The case for instrument mixes should not be confused with a case for unlimited regulatory accumulation. Each additional measure can create administrative cost, conflicting incentives and political opacity. Dense climate packages can become difficult for regulated entities, citizens and courts to understand. The risk is an instrument mess in which individual measures are defensible in isolation but the combined system lacks a clear causal structure [22].

Three forms of accumulation deserve particular scrutiny. The first is duplicative accumulation, in which two instruments pursue the same objective through the same behavioural channel without a distinct rationale. The second is contradictory accumulation, in which one instrument subsidises or permits conduct that another seeks to discourage. The third is compensatory accumulation, in which new instruments are repeatedly added to correct defects created by existing instruments instead of reforming the source of the defect. Good climate law should tolerate useful overlap but resist these forms of unmanaged layering.

Sunset clauses, periodic reviews and mandatory interaction assessments can reduce this risk. Legislatures should require the competent authority to identify the specific market failure, regulatory barrier or distributive problem addressed by each instrument, assess its interaction with existing measures, and explain why amendment of an existing instrument would not be preferable. Such requirements would improve both substantive rationality and the record available for judicial review.

9. Design Principles for a Legally Coherent Climate Instrument Mix

A first principle is target hierarchy. Economy-wide targets should operate as framework norms, with sectoral instruments calibrated to trajectories consistent with those targets. The hierarchy should not imply mechanical sectoral quotas in every case, but it should permit a reasoned demonstration that the aggregate package is sufficient.

A second principle is functional differentiation. Each instrument should have an identifiable regulatory function: pricing an externality, setting a minimum performance floor, accelerating innovation, financing infrastructure, correcting information failures, protecting vulnerable groups, preventing leakage or coordinating governance. Where two instruments share a field of application, the legislature should articulate their distinct functions and expected interaction.

A third principle is adaptive stability. Climate investment requires predictable long-term direction, while technology and market conditions require adjustment. Legislation should therefore combine durable targets and core obligations with transparent review intervals, objective adjustment criteria and data-based recalibration. This is preferable to both ad hoc intervention and legally frozen design.

A fourth principle is integrated distributional design. The costs of decarbonisation should be examined at the point of instrument design rather than after implementation. Carbon-pricing revenues, public finance and social policy should be coordinated so that households and firms with limited adjustment capacity can invest in lower-carbon alternatives. Distributional measures should reduce vulnerability rather than permanently subsidise fossil-fuel consumption.

A fifth principle is common information infrastructure. Monitoring, reporting and verification should be interoperable across instruments wherever possible. Shared emissions data, registries, definitions and reporting cycles reduce compliance costs and improve the ability of regulators to detect interaction effects. The same information architecture should support public transparency and judicial accountability.

A sixth principle is external coherence. Domestic climate instruments increasingly affect trade and foreign regulatory systems. Border measures and product requirements should be designed with transparent methodologies, opportunities to recognise equivalent foreign carbon constraints, and careful attention to non-discrimination. External coherence is not merely a trade-law constraint; it is necessary to prevent fragmentation of emerging global carbon regulation.

A seventh principle is review of cumulative burden and cumulative effect. Proportionality analysis in climate law should not examine each measure as though it existed alone. Regulators and courts should be able to identify the combined compliance burden imposed on a sector and the combined environmental effect produced by the package. Cumulative assessment is particularly important where several Union and national measures apply to the same activity.

An eighth principle is institutional responsibility for the mix as a whole. Fragmented ministries and agencies tend to optimise their own instruments rather than the system. Climate framework legislation should assign a body or procedure responsibility for assessing cross-instrument interactions, identifying gaps and contradictions, and reporting publicly on whether the ensemble remains consistent with statutory climate targets. The European governance framework moves in this direction, but the need for explicit interaction management will grow as the 2040 target drives deeper sectoral transformation.

10. A Legal theory of Instrument Interaction

The legal analysis of an instrument mix begins where ordinary instrument-by-instrument review ends. A climate measure may be

valid, proportionate and administratively workable in isolation yet produce a defective regulatory result when combined with other measures. The relevant object of inquiry is therefore relational. The lawyer must identify how one instrument changes the legal, economic or institutional conditions under which another operates. This perspective is consistent with the environmental-policy literature on smart regulation and with later work on policy mixes, but it requires a specifically legal translation: interactions must be located in rules on scope, allocation, compliance, sequencing, institutional competence, revenue recycling, review and remedies [23].

Four types of interaction are especially important. Complementarity exists where one instrument corrects a limitation of another, as when a carbon price is combined with infrastructure investment that makes low-carbon substitution technically possible. Reinforcement exists where separate instruments act through different channels but increase the probability of the same legally defined outcome, as when energy-efficiency duties reduce demand while an emissions cap constrains the remaining carbon content of supply. Redundancy exists where two measures address substantially the same conduct without a distinct regulatory function. Conflict exists where one measure weakens the incentive or legal obligation created by another, for example where a subsidy prolongs fossil-fuel use while a carbon-pricing regime is intended to induce its retirement.

These categories are not fixed properties of instruments. The same pair of measures may be complementary in one period and conflicting in another. Support for renewable generation can correct learning externalities and capital-market barriers during early deployment, while an unchanged support scheme can later distort market signals once technologies become mature. Free allocation in emissions trading may reduce leakage risk during an initial phase, yet become increasingly difficult to reconcile with stronger carbon-price incentives and a border adjustment mechanism. Interaction analysis is therefore temporal as well as functional.

Legal design must also distinguish interactions at the level of objectives from interactions at the level of implementation. Two measures may pursue compatible objectives but rely on inconsistent definitions, reporting cycles or administrative authorities. Conversely, instruments that look economically duplicative can have distinct legal functions. A product standard may guarantee a minimum level of performance that cannot be displaced by price volatility, while an emissions price continues to reward improvements beyond the minimum. The legal question is whether the combination has an intelligible division of regulatory labour.

A further distinction concerns hard and soft coupling. Hard coupling arises where the operation of one instrument is legally conditional upon another, as in the phase-down of free allocation for CBAM goods. Soft coupling arises where two instruments influence the same regulated conduct without formal legal dependency. Soft coupling is more difficult to supervise because its effects are often visible only through cumulative market behaviour and administrative practice. For that reason, impact assessment and periodic review assume a constitutional and administrative significance that is greater than in a single-instrument regime.

The regulatory literature also demonstrates that sequencing can be as important as simultaneous combination. Innovation support, infrastructure investment and sectoral mandates may create constituencies, technologies and physical capacity that later permit stronger carbon pricing. At the same time, sequencing can generate path dependence and rent protection if temporary support becomes politically entrenched. Climate law therefore needs rules for entry, escalation, review and exit. A mature instrument mix should not merely accumulate measures; it should contain an internal theory of transition [24].

11. Constitutional and Treaty Foundations of the European Instrument Mix

The European instrument mix operates within a constitutional framework that constrains both the ambition and the form of climate regulation. Article 191 TFEU sets environmental objectives that include preserving, protecting and improving the quality of the environment, protecting human health, prudent and rational utilisation of natural resources, and promoting international measures to deal with regional or worldwide environmental problems, in particular climate change. Article 192 TFEU provides the principal legal basis for Union environmental action, while Article 193 preserves the possibility of more stringent national protective measures subject to the Treaties. These provisions make regulatory plurality legally foreseeable rather than exceptional [25].

Climate measures nevertheless intersect with internal-market law, energy law, competition law, trade policy, transport, agriculture and fiscal competence. The choice of legal basis therefore matters. It determines the legislative procedure, the role of Member States and the permissible degree of harmonisation. A complex instrument mix can only remain coherent if each component is adopted on a legally appropriate basis and if the resulting package respects the allocation of competences. The climate objective does not suspend the constitutional structure of Union law; it operates through that structure.

The principles of subsidiarity and proportionality perform an additional coordinating function. Subsidiarity is particularly relevant where emissions are transboundary and where fragmented national measures could distort the internal market, but national and local authorities retain important competence over buildings, planning, transport systems and land use. Proportionality requires that the intensity and design of a measure be suitable and not exceed what is necessary in relation to its legitimate objective. In an instrument-mix setting, proportionality should not be reduced to a bilateral comparison between a single measure and its objective. The cumulative burden created by overlapping Union and national obligations can be legally relevant, especially where regulated entities face several reporting, investment and surrender duties directed at the same activity.

Legal certainty and legitimate expectations also condition the ar-

chitecture of transition. Deep decarbonisation requires rules that alter investment decisions over decades, yet climate legislation must also respond to technological change, price shocks and new scientific evidence. The solution is not immutability but structured adaptability. Long-term targets, announced trajectories, review clauses and objective adjustment criteria can provide a stable direction while preserving the capacity to recalibrate instruments. Unstructured retroactivity and abrupt reversal, by contrast, weaken both investment incentives and the credibility of the mix.

Equality concerns arise when climate instruments differentiate between sectors, installations, fuels or products. The Court of Justice has accepted that complex environmental legislation may differentiate where situations are not comparable or where differential treatment is objectively justified. In the EU ETS context, Arcelor remains a central illustration of judicial deference to a staged legislative approach while preserving the requirement that distinctions be rationally connected to the regulatory objective. The lesson for instrument-mix design is that differential sequencing is legally possible, but the reasons for it must remain visible and reviewable [26].

12. Carbon Pricing as the Spine of a Broader Regulatory Architecture

Carbon pricing is often described as the central or economy-wide instrument of mitigation, but the European experience shows that it functions as the spine of a much broader regulatory architecture rather than as a self-sufficient mechanism. The EU ETS combines a declining quantity constraint with auctioning, free allocation, benchmarking, monitoring and verification, market-stability rules, innovation finance and increasingly close links to border adjustment. Each of these components is itself regulatory. The system is therefore better understood as a nested instrument mix within the wider climate mix [27].

The cap creates scarcity and gives the allowance price its legal foundation. Yet the effectiveness of the cap depends on accurate monitoring, the integrity of registries, enforceable surrender obligations and penalties. Market stability provisions address a different problem: the temporal accumulation of surplus allowances and the risk that external shocks undermine the scarcity signal. The Market Stability Reserve therefore illustrates a broader point. An apparently market-based system often requires administrative devices that manage the conditions under which the market can perform its intended function.

The second emissions-trading system for buildings, road transport and additional sectors further demonstrates how instrument choice is shaped by administrative feasibility. ETS2 regulates upstream fuel suppliers rather than imposing direct allowance obligations on every household and driver. This design reduces the number of regulated entities but transmits a carbon cost through fuel prices. Because the distributional consequences are more immediate than in industrial emissions trading, the legal architecture links pricing to the Social Climate Fund and to revenue-use obligations. The pricing instrument and the compensatory instrument are thus institutionally connected from the outset [28].

The interaction between ETS2 and the Effort Sharing Regulation is especially important. The same broad sectors remain subject to national emission-reduction obligations under effort sharing while fuel suppliers face a Union carbon price. The two instruments operate at different regulatory levels: ETS2 constrains and prices covered fuel emissions across the Union, whereas the Effort Sharing Regulation allocates national responsibility for aggregate emissions in covered sectors. This overlap can be productive because Member States retain incentives to adopt building, transport and behavioural measures that respond to local conditions. It also means that evaluation of national compliance cannot treat the carbon price as a substitute for domestic policy.

Price containment and social safeguards introduce another dimension. A carbon market that is legally committed to environmental scarcity must nevertheless contain mechanisms for extraordinary price developments and orderly market functioning. Such safeguards should be designed so that they address instability without dissolving the long-term decarbonisation signal. The distinction between temporary volatility management and structural weakening of the cap is therefore central. A legal regime that repeatedly intervenes whenever the carbon price becomes politically salient risks undermining the very investment expectations that pricing is intended to create.

Revenue use also converts carbon pricing into a fiscal and distributive instrument. Auction revenue can finance energy transformation, innovation, household support and industrial decarbonisation. The legal rules governing revenue use are therefore not ancillary. They influence political acceptability, dynamic efficiency and the distribution of transition costs. Carbon pricing becomes more defensible where its revenues are visibly connected to the investment and social measures needed to make lower-emission choices available.

13. CBAM, free Allocation and the Legal Management of Carbon Leakage

Carbon leakage is a paradigmatic instrument-mix problem because it arises from the interaction between climate ambition and exposure to international trade. The Union initially addressed leakage within the ETS primarily through free allocation. The Carbon Border Adjustment Mechanism introduces a different regulatory technique, requiring an adjustment for the embedded emissions of specified imported goods. The legal transition between the two tools is deliberately coordinated, with the CBAM factor reducing free allocation for covered products until free allocation for those products is phased out [29].

This sequencing matters for both climate integrity and trade defensibility. Maintaining full free allocation while applying a full border adjustment would risk over-compensation. Removing free al-

location before a functioning border measure is established could intensify leakage concerns and political resistance. The staged relationship therefore exemplifies the use of one instrument as a transitional bridge to another. It also reveals why climate instrument mixes cannot be assessed solely at a fixed point in time.

CBAM expands the regulatory perimeter of EU climate law beyond territorial installations. Its methodology requires information about embedded emissions and, where relevant, carbon prices effectively paid in the country of origin. This creates incentives for foreign producers and governments to develop monitoring systems and climate policies that can be recognised within the mechanism. Border adjustment thus has an external regulatory effect even where it does not formally impose EU law on third countries.

The legal risks are correspondingly broader. The design must remain compatible with international trade obligations, general principles of Union law and the internal coherence of the ETS. Non-discrimination, transparent calculation methods and meaningful recognition of carbon prices paid abroad are therefore not secondary technicalities. They determine whether the external dimension of the instrument mix can be justified as climate regulation rather than disguised protectionism.

The combination of CBAM with industrial support also requires scrutiny. If border adjustment protects against unequal carbon constraints while subsidies simultaneously de-risk low-carbon industrial investment, the mix can accelerate technological change. Excessive or poorly conditioned support, however, can insulate incumbents from competitive pressure and socialise transition costs without securing corresponding emissions reductions. The legal architecture should therefore connect industrial support to measurable transformation obligations and avoid treating competitiveness as a free-standing reason for indefinite exemption from climate constraints.

14. Renewable Energy, Energy Efficiency and Infrastructure Regulation

Renewable-energy and energy-efficiency measures are sometimes portrayed as redundant once emissions are capped or priced. That view understates the different barriers addressed by these instruments. Carbon pricing changes the relative cost of high- and low-carbon choices. Renewable-energy law addresses deployment, permitting, grid connection and investment certainty. Energy-efficiency law targets demand, information failures, split incentives and organisational practices. Infrastructure rules address physical constraints that can prevent actors from responding to prices. The legal functions are therefore distinct even when the instruments contribute to the same emissions trajectory.

The revised Renewable Energy Directive illustrates a shift from simple target setting toward a denser deployment framework. In addition to the Union-level 2030 share, the regime contains sectoral provisions and permitting reforms intended to reduce administrative delay. The instrument mix therefore combines an outcome-oriented target with procedural acceleration. This is significant because renewable investment can be constrained less by operating economics than by grid access, spatial planning and permit duration. A carbon price cannot itself grant a permit or build a transmission line [30].

The Energy Efficiency Directive similarly establishes an efficiency-first logic that affects public bodies, energy savings and consumption trajectories. Efficiency duties can lower the amount of renewable and network capacity needed for a given level of energy service. They can also reduce household exposure to carbon prices. In this sense, efficiency regulation has a distributive function as well as an environmental one: it reduces the quantity of priced energy that vulnerable consumers require.

Buildings demonstrate the need for especially dense combinations. Renovation decisions are affected by tenancy relations, access to finance, property-law constraints, information problems and long asset lives. The recast Energy Performance of Buildings Directive adds building-level obligations and trajectories to the broader carbon and efficiency framework. Its effectiveness depends on financing, skilled labour, national implementation and the availability of heating alternatives. A building standard without finance can be socially regressive; finance without minimum performance requirements can subsidise marginal improvements that are inconsistent with long-term decarbonization [31].

Electricity infrastructure creates related coordination problems. Electrification of transport, heating and industry only reduces emissions if generation and networks decarbonise at sufficient speed. Grid planning, interconnection, storage, demand response and permitting therefore function as enabling instruments. Climate law increasingly regulates not only emissions but the infrastructure through which compliant behaviour becomes technically possible. This is a major reason why the contemporary instrument mix is better described as transformation law than as pollution control alone.

15. Sectoral combinations: transport, buildings, industry and agriculture

Sectoral analysis reveals why an economy-wide climate target cannot be implemented through a uniform legal technique. Transport combines vehicle performance standards, fuel regulation, carbon pricing, charging infrastructure, public investment, urban planning and taxation. Each instrument addresses a different margin of behaviour: vehicle efficiency, drivetrain choice, fuel carbon intensity, kilometres travelled and modal substitution. An effective mix must therefore avoid assuming that technological substitution alone will solve congestion, land-use effects or transport poverty.

Union CO2 performance standards for new cars and vans operate as a technology-forcing measure alongside fuel pricing. The amended framework sets fleet-wide reduction requirements that lead toward a 100 per cent reduction target for the average emissions of new cars and vans from 2035, subject to the legal structure of the Regulation. The Alternative Fuels Infrastructure Regulation addresses a distinct bottleneck by requiring infrastructure deploy-

ment. Together, these measures demonstrate complementarity between a product standard and an enabling network obligation [32].

Buildings present a different regulatory structure. Emissions result from fuel use, construction materials, inefficient envelopes and heating systems, while investment decisions are fragmented among owners, landlords, tenants, lenders and local authorities. ETS2 supplies a price signal, but performance regulation, renovation planning, finance and social protection determine whether that signal can be acted upon. The legal problem of split incentives is particularly important: a landlord may bear the investment cost while a tenant receives the energy saving, or the reverse depending on rent and utility arrangements. Instrument design must therefore account for private-law allocation as well as public regulation.

Industrial decarbonisation requires still another combination. The ETS constrains direct emissions and raises the cost of carbon-intensive production. Product standards, permitting law and industrial-emissions regulation establish performance and pollution requirements. Innovation funding, contracts and State aid can address the capital cost and technology risk of first-of-a-kind projects. CBAM addresses leakage in selected sectors. Public procurement can create lead markets for low-carbon materials. The regulatory mix is effective only if these instruments converge on the same technological direction rather than preserving incompatible production pathways.

Agriculture and land use expose the limits of conventional carbon pricing. Emissions include methane and nitrous oxide from diffuse biological processes, while land can function as both source and sink. Monitoring is more uncertain, permanence is a central concern, and policy must interact with food production, biodiversity, rural livelihoods and the Common Agricultural Policy. The LULUCF framework therefore relies heavily on accounting, national targets and land-sector governance rather than a simple installation-based trading model. This sector illustrates why the architecture of climate law must remain plural.

The sectoral perspective also clarifies the role of local government. Urban form, building permits, public transport, waste systems and local infrastructure can determine emissions for decades. National climate targets therefore require vertical coordination with municipalities and regions. Where higher-level law imposes ambitious targets but leaves subnational authorities without finance, competence or planning tools, the instrument mix contains an implementation gap even if its formal legislation appears comprehensive.

16. Industrial Policy, State aid and Public Finance in the Climate Mix

The return of industrial policy has altered the centre of gravity of climate regulation. Decarbonisation now depends not only on constraining emissions but on accelerating investment in clean technologies, manufacturing capacity, grids, storage, hydrogen, electrification and carbon management. Public finance therefore operates alongside regulation as a constitutive element of the transition. The central legal issue is not whether subsidies are climate instruments, but how they should be conditioned and coordinated with binding decarbonisation obligations.

EU State-aid law provides the framework for a substantial part of this support. The Climate, Environmental Protection and Energy Aid Guidelines set compatibility criteria for categories of aid that may advance climate and environmental objectives. State-aid control can improve the instrument mix by limiting unnecessary distortions, requiring proportionality and preserving competitive processes. At the same time, a highly fragmented subsidy race among Member States can undermine cohesion and shift investment according to fiscal capacity rather than climate efficiency. Union-level financing and common criteria therefore have a coordinating role [33].

The Net-Zero Industry Act adds a supply-side dimension by seeking to strengthen manufacturing capacity for specified net-zero technologies and by addressing permitting, procurement and resilience. Its significance for instrument-mix analysis is structural. Climate policy increasingly combines demand creation through carbon constraints with supply-side measures intended to ensure that the technologies needed for compliance are available within a resilient industrial base [34].

Innovation policy requires careful treatment of uncertainty. Early-stage and first-of-a-kind technologies may generate knowledge spillovers that private investors cannot fully capture. Grants, competitive auctions, carbon contracts for difference and Innovation Fund support can therefore have a distinct rationale. Yet technology support should not hard-code one pathway where credible alternatives remain available. Competitive selection, milestone-based funding and periodic review can reduce the risk that public finance creates long-lived technological lock-in.

Public procurement is another underused climate instrument. Public authorities purchase large volumes of construction materials, vehicles, buildings and services. Procurement criteria can create predictable demand for low-carbon products and help establish standards for embodied carbon. Under Union procurement law, environmental characteristics can be incorporated into award criteria and life-cycle costing where the legal requirements are satisfied. Procurement thus links market creation with administrative purchasing power rather than relying solely on prohibitions or taxes [35].

The legitimacy of public finance depends on additionality and accountability. Where an activity would have occurred without support, subsidies can transfer public resources without producing additional climate benefit. Where support is necessary, contracts should specify measurable performance, reporting and clawback mechanisms. The instrument mix should therefore treat public money as a conditional regulatory relationship, not merely as expenditure.

17. Information, Disclosure and Sustainable Finance as Supporting Instruments

Information instruments occupy an ambiguous position in climate law. They are less coercive than emissions caps or performance standards, but they can affect investment decisions, corporate governance and market discipline. Their effectiveness depends on the quality, comparability and legal consequences of disclosed information. Disclosure is therefore best understood as supporting regulation whose value arises from interaction with prudential rules, investment mandates, corporate duties, consumer protection and capital markets.

The EU Taxonomy Regulation establishes a classification framework intended to identify environmentally sustainable economic activities under specified conditions, including substantial contribution, do-no-significant-harm requirements and minimum safeguards. The taxonomy does not itself prohibit investment in activities that fall outside its criteria. Its regulatory effect arises through interaction with disclosure regimes, financial products, public policy and market practice. This is a clear example of an instrument whose influence depends on institutional coupling rather than direct command [36].

Corporate sustainability reporting similarly expands the information infrastructure of the instrument mix. Emissions inventories, transition plans and risk disclosures can make inconsistencies between corporate strategy and public climate targets more visible. Reporting obligations, however, should not be treated as substitutes for substantive regulation. A perfectly disclosed high-emission business model remains high-emission. The legal function of disclosure is to reduce information asymmetry, support enforcement and enable market and governance responses.

Data interoperability is particularly important where several climate instruments apply to the same entity or product. Separate reporting systems can create high compliance costs and inconsistent emissions figures. Common definitions, digital registries and compatible verification standards can reduce administrative burden while improving oversight. The quality of the instrument mix therefore depends partly on a shared informational infrastructure that is rarely visible in high-level target legislation.

Information instruments also raise questions of reliability and liability. Green claims, transition plans and sustainability labels can influence consumers and investors only if misleading representations are controlled. The supporting framework must therefore include verification, supervisory powers and remedies. Otherwise, disclosure can create an appearance of climate governance without changing conduct.

18. Distribution, Energy Poverty and the Social Climate Fund

Climate regulation redistributes costs and opportunities even where distribution is not its express purpose. Carbon prices are particularly visible because they can increase household expenditure on heating and mobility before lower-carbon alternatives are accessible. Standards can impose upfront capital costs. Subsidies can favour households able to co-finance investments. Land-use measures can change asset values. Distributional analysis must therefore be integrated into instrument design rather than added after political resistance emerges.

The Social Climate Fund represents an explicit attempt to connect a new carbon-pricing instrument with social compensation and investment. It supports measures and investments for vulnerable households, micro-enterprises and transport users affected by the extension of emissions trading to buildings and road transport. Its legal importance lies in the recognition that the acceptability and effectiveness of pricing depend on the practical capacity of affected actors to reduce fossil-energy use [37].

There is a crucial distinction between compensation that preserves vulnerability and investment that reduces it. Temporary income support can cushion price shocks, but long-term reliance on fuel subsidies weakens the incentive to decarbonise and leaves households exposed to future volatility. By contrast, building renovation, clean heating, public transport and access to zero-emission mobility can reduce both emissions and recurring energy costs. A coherent social-climate instrument mix should therefore prioritise structural reduction of exposure while retaining targeted temporary support where necessary.

Distribution also has a territorial dimension. Coal and carbon-intensive regions can experience concentrated employment and fiscal effects even when the aggregate economy benefits from transition. Regional development, skills policy and infrastructure investment therefore interact with climate instruments. The Just Transition Mechanism and related cohesion instruments demonstrate that decarbonisation has become intertwined with regional policy. The legal question is whether transition funding is connected to credible diversification and emissions-reduction pathways rather than to indefinite preservation of declining carbon-intensive activities.

Procedural justice is equally relevant. Communities affected by renewable infrastructure, transmission lines, extraction of transition minerals or industrial conversion should have access to information, participation and review. Faster permitting cannot simply mean weaker environmental assessment or reduced procedural rights. A mature instrument mix must reconcile acceleration with legality by improving administrative capacity, parallelising procedures and setting clear timelines without emptying participation of practical effect.

19. Fundamental Rights, Climate Litigation and Review of the Mix as a Whole

The most important development in climate litigation is the movement from review of isolated administrative decisions toward review of the adequacy of the regulatory framework. This shift directly corresponds to the concept of an instrument mix. Courts increasingly ask whether the ensemble of targets, budgets, measures and implementation mechanisms provides a legally sufficient response, while generally leaving governments discretion over the precise choice of instruments.

The German Federal Constitutional Court gave this framework perspective a distinctive intertemporal dimension. In its order of 24 March 2021, it held that insufficient specification of post-2030 reductions could disproportionately shift severe mitigation burdens into the future and thereby threaten future freedom. The Court did not design a carbon tax, trading scheme or sectoral standard. It required the legislature to structure the reduction pathway with sufficient foresight. The constitutional defect therefore concerned the temporal architecture of the mix rather than the absence of one preferred instrument [38].

The French Conseil d'État adopted a different but related approach in Commune de Grande-Synthe. It examined the trajectory of emissions reductions and required additional measures where the existing trajectory was insufficient to meet the applicable objective. Again, judicial supervision focused on the adequacy of governmental action relative to a legally defined pathway rather than on judicial selection of a regulatory tool [39].

Urgenda and KlimaSeniorinnen reinforce the same structural lesson at the level of human rights. The State ordinarily retains a margin concerning means, but that margin does not remove the duty to maintain an effective framework. A climate target without sufficiently concrete measures can therefore become legally vulnerable even where each individual measure is formally lawful. The law increasingly distinguishes discretion as to means from accountability for the adequacy of the overall response.

This form of review creates methodological challenges. Courts are not regulatory agencies and should be cautious in resolving contested modelling assumptions or selecting technologies. They can nevertheless examine whether the government has identified a legally relevant target, adopted a transparent pathway, relied on current evidence, addressed material implementation gaps, and provided mechanisms for monitoring and correction. These are questions of legality, rationality and procedural adequacy rather than economic optimisation.

Instrument-mix litigation may also arise from the opposite direction: regulated entities can challenge cumulative burdens as disproportionate, discriminatory or contrary to legitimate expectations. Judicial review must therefore remain symmetrical. Climate urgency justifies strong action but does not abolish general principles of law. The quality of legislative reasoning, impact assessment and interaction analysis becomes especially important where several instruments converge on the same sector.

20. Multilevel Governance and National Climate Framework Laws

The Union instrument mix is implemented through a multilevel system in which European targets and legislation interact with national climate laws, energy plans, taxation, planning and administrative enforcement. This structure allows adaptation to national circumstances but creates risks of fragmentation, delay and responsibility shifting. An effective climate framework must therefore allocate not only substantive targets but also responsibility for implementation and correction.

Regulation (EU) 2018/1999 provides the principal procedural architecture through integrated national energy and climate plans, progress reporting, Commission assessment and recommendations. Its importance grows as the substantive mix becomes more complex. A planning instrument can reveal gaps between legally binding Union targets and the aggregate effect of national measures before formal non-compliance occurs. Governance law thus performs an anticipatory function that ordinary infringement proceedings cannot easily provide [40].

National framework laws can strengthen this architecture by translating long-term objectives into domestic budgets, sectoral trajectories or institutional duties. Their design varies. Some rely on sectoral annual targets, others on economy-wide budgets combined with planning duties. The German constitutional litigation demonstrates the importance of sufficiently specified future pathways, while French litigation demonstrates the capacity of administrative courts to compare governmental action with legally recognised emission trajectories.

Independent advisory bodies can improve credibility by separating technical assessment from short-term political incentives. Their value depends on access to data, institutional independence and a clear mandate to assess progress and policy sufficiency. They do not replace democratic decision-making. Instead, they create an evidentiary benchmark against which legislative and executive choices can be explained and reviewed.

Vertical coordination with regions and municipalities is equally important. National governments may be formally responsible for international and Union obligations while crucial implementation powers are decentralised. Climate framework legislation should therefore specify planning interfaces, financing responsibilities and data flows across levels of government. Without such mechanisms, the legal allocation of responsibility can diverge from the administrative capacity to deliver reductions.

21. International Cooperation, Article 6 and the External Dimension of the Mix

International cooperation adds another layer to the instrument mix. Article 6 of the Paris Agreement allows cooperative approaches and establishes mechanisms through which mitigation outcomes can be transferred or generated under international rules. These mechanisms can lower compliance costs and support investment, but they also introduce risks of double counting, weak additionality and uneven environmental integrity. Domestic law must therefore determine how international units interact with domestic reduction obligations [41].

The 2026 amendment to the European Climate Law makes this issue particularly concrete for the Union. The binding 2040 target is a 90 per cent reduction in net greenhouse-gas emissions compared with 1990, while the amended framework permits, from 2036 and subject to its conditions, a limited contribution from high-quality

international credits up to 5 per cent of 1990 EU net emissions. This corresponds to a domestic reduction of net greenhouse-gas emissions of at least 85 per cent compared with 1990 levels by 2040 [42].

This design transforms the distinction between domestic reduction and international cooperation into a legal question of instrument interaction. International credits can provide flexibility, but excessive reliance can weaken domestic investment signals and delay structural transformation. Quality criteria, quantitative limits and transparent accounting are therefore essential. The legal architecture should ensure that international flexibility complements rather than substitutes the domestic transition required for climate neutrality.

Trade measures, supply-chain rules and climate finance also shape foreign incentives. CBAM can encourage measurement and carbon pricing abroad; clean-technology support can alter global manufacturing patterns; climate finance can expand mitigation capacity in developing countries. The external instrument mix should be assessed against equity and differentiated capabilities as well as environmental effectiveness. A system that protects domestic competitiveness without supporting global decarbonisation risks moving emissions and industrial activity rather than reducing them.

The international dimension also creates a problem of regulatory interoperability. Multiple emissions-trading systems, tax regimes, product standards and carbon-intensity methodologies can impose significant transaction costs on cross-border commerce. Mutual recognition and common measurement standards may therefore become increasingly important. The long-term development of climate law is likely to involve not uniformity of instruments but greater compatibility among different national mixes.

22. Ex Ante Assessment of an Instrument Mix

A legally disciplined instrument mix requires a method of ex ante assessment. The first step is to identify the legally binding objective and its temporal horizon. A measure that is suitable for a 2030 milestone may be inconsistent with a 2050 neutrality objective if it creates long-lived carbon lock-in. Impact assessment should therefore examine compatibility with the full statutory trajectory rather than only the next compliance period.

The second step is functional mapping. Each proposed instrument should be linked to a specific regulatory problem: emissions externality, innovation spillover, information failure, infrastructure deficit, distributional vulnerability, leakage risk or administrative coordination. This prevents the common tendency to add measures because they are politically available rather than because they address a defined failure.

The third step is interaction mapping. Regulators should identify which existing measures apply to the same actors, products, emissions or investment decisions. The assessment should state whether the expected interaction is complementary, reinforcing, redundant or conflicting, and whether the effect changes over time. Where the interaction is uncertain, the legislation should include monitoring indicators and a review trigger.

The fourth step is cumulative proportionality. Administrative burden, investment cost, reporting obligations and distributional effects should be assessed cumulatively for the relevant regulated group. This is not an argument for weaker climate policy. A more coherent mix can often achieve greater environmental ambition with lower unnecessary complexity. Cumulative review helps distinguish the cost of decarbonisation itself from avoidable cost created by fragmented regulatory design.

The fifth step is institutional mapping. Each instrument should have an identifiable competent authority, data source, enforcement mechanism and relation to other authorities. Overlapping jurisdiction can be useful where it provides checks and balances, but it can also create contradictory guidance and enforcement gaps. Coordination duties should be explicit where more than one institution supervises related obligations.

The sixth step is distributional mapping. The analysis should identify who pays, who receives benefits, who can alter behaviour and who cannot. Where vulnerable actors lack feasible alternatives, complementary investment or temporary support should be designed at the same time as the primary constraint. This sequence is superior to imposing a cost first and attempting to repair political damage later.

The seventh step is legal stress testing. The package should be examined for compatibility with competence rules, fundamental rights, equality, proportionality, legitimate expectations, State-aid law, procurement law and international trade obligations. Because legal challenges often focus on boundaries between regimes, cross-specialist review is essential for complex climate packages.

23. Ex Post Evaluation, Review Clauses and Adaptive Correction

No instrument mix can be designed perfectly ex ante because technology, prices, behaviour and political conditions evolve. Ex post evaluation is therefore part of substantive climate governance rather than an administrative afterthought. The central question is whether the ensemble is delivering the emissions pathway and transformation expected when the legislation was adopted.

Evaluation should distinguish outcome failure from implementation failure. Outcome failure occurs where properly implemented instruments do not generate sufficient reductions. Implementation failure occurs where the legal design may be adequate but permitting, enforcement, funding or administrative capacity is deficient. The remedy differs: the first may require stronger or redesigned instruments; the second requires institutional correction.

Review clauses should be linked to measurable indicators. Emissions trajectories, investment rates, technology deployment, energy poverty, carbon-price levels and permitting times can reveal

whether assumptions remain valid. A review that merely requires a report without decision criteria can become ritualistic. Effective adaptive law identifies conditions under which the authority must consider recalibration and requires reasons where it decides not to act.

Sunset clauses are appropriate for some transitional measures, especially temporary subsidies, exemptions and compensatory mechanisms. Their purpose is not automatic deregulation but reversal of the presumption: once the transitional period ends, continuation should require a new justification. This is particularly useful where political economy makes benefits difficult to withdraw.

Ex post evaluation must also account for induced interaction. The introduction of one measure can change the relevance of another. Widespread electrification may reduce the emissions covered by fuel-based regulation while increasing electricity demand and grid constraints. Stronger product standards can reduce allowance demand in a trading system. Review should therefore examine the changing role of instruments rather than measuring each against its original assumptions.

24. The 2040 Target and the Post-2030 Architecture

The legally binding 2040 target changes the context in which the entire European instrument mix must now be assessed. Regulation (EU) 2026/667 amends the European Climate Law by establishing a 90 per cent reduction in net greenhouse-gas emissions compared with 1990 by 2040. This intermediate target is not merely an additional numerical milestone. It compresses the period available for deep industrial, infrastructure and land-use transformation between 2030 and climate neutrality in 2050 [43].

A more stringent intermediate target increases the importance of regulatory sequencing. Investments made during the 2020s and early 2030s will determine whether the 2040 pathway is feasible without abrupt later restrictions. The legal system therefore has to scrutinise new fossil infrastructure, industrial assets and building renovations for consistency with the post-2030 trajectory. Lock-in becomes a legal-design concern because assets with long economic lives can pre-commit future emissions.

The 2040 framework also intensifies the debate about removals. Net targets necessarily combine emission reductions and removals, but the two are not equivalent in permanence, measurability or technological maturity. Separate governance of land removals, industrial removals and gross fossil reductions can preserve clarity about the contribution of each component. The law should resist accounting structures that allow uncertain future removals to justify avoidable present emissions.

The limited role for international credits after 2036 creates a further design challenge. International cooperation can support cost-effective mitigation, but domestic industrial transformation requires predictable demand for low-carbon technologies inside the Union. The legal cap on the contribution of international credits therefore performs an industrial and credibility function as well as an environmental-integrity function.

Post-2030 reform will also require re-examination of the division of labour among ETS1, ETS2, effort sharing, LULUCF and sectoral standards. As emissions fall, the marginal importance of hard-to-abate sources will increase and interactions will become more consequential. A regulatory structure that was adequate for a 55 per cent 2030 target may need different flexibilities, sector boundaries and review mechanisms for a 90 per cent 2040 target. The appropriate response is not wholesale replacement of the existing acquis, but systematic recalibration against the new legal benchmark.

25. A Framework for Legal Quality in Climate Instrument Mixes

The legal quality of a climate instrument mix can be assessed through a set of criteria that are more demanding than ordinary instrument validity. The first is environmental sufficiency: the ensemble must be capable, on a reasoned evidentiary basis, of delivering the legally binding trajectory. Sufficiency concerns the aggregate effect of measures and therefore cannot be established merely by listing adopted legislation.

The second criterion is functional coherence. Each instrument should have a defined role and its interaction with neighbouring instruments should be intelligible. Useful overlap is acceptable where measures address different barriers or provide resilience against uncertainty. Unexplained duplication and contradictory incentives are signs of poor design.

The third criterion is temporal coherence. Entry into force, phase-in, review, escalation and sunset provisions should align with investment cycles and target dates. Transitional protection should decline when the rationale for it declines. Long-term direction should remain stable even when technical parameters are adjusted.

The fourth criterion is distributive defensibility. The package should identify foreseeable burdens on vulnerable households, workers, regions and firms, and should provide adjustment mechanisms that preserve the decarbonisation incentive. Distributional policy is part of climate effectiveness because actors who cannot respond to a regulatory signal cannot deliver the behavioural change on which the signal depends.

The fifth criterion is administrative executability. Targets that exceed permitting, inspection, grid, data or enforcement capacity can create a gap between formal ambition and real implementation. Administrative capacity is therefore a component of legal design. Legislatures should assess staffing, digital systems, verification capacity and institutional coordination at the same time as substantive obligations.

The sixth criterion is transparency. A dense package needs a public account of how its components fit together, which authority is responsible for each function, what indicators are used to monitor performance and how corrective decisions will be taken. Trans-

parency reduces compliance uncertainty and improves democratic and judicial accountability.

The seventh criterion is adaptability without arbitrariness. Climate law must evolve, but changes should occur through predefined procedures, evidence and reason giving. Structured adaptability reconciles scientific and technological uncertainty with rule-of-law expectations.

The eighth criterion is external compatibility. The mix should account for trade effects, cross-border infrastructure, foreign carbon constraints and international cooperation. Domestic ambition that simply relocates emissions or creates incompatible measurement systems is weaker than a framework that promotes genuine international decarbonisation.

These criteria show why instrument mix is not a secondary topic within climate law. It is the form in which modern climate law actually exists. The central challenge is to convert a large number of individually plausible measures into a legally coherent system that can sustain increasingly stringent targets while remaining administratively workable, economically transformative and consistent with constitutional and international constraints.

Selected Authorities and Literature Cited in the Footnotes

The footnotes contain the principal treaties, EU legislative acts, national and European judgments, and academic sources relied upon throughout the study. The legal references and current Union targets have been checked against official or publisher sources available as of September 2026.

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26. Case C-127/07, Société Arcelor Atlantique et Lorraine and Others v Premier ministre and Others, Judgment of 16 December 2008, ECLI:EU:C:2008:728, especially paras 57-61 and 73-74.
27. Directive, E. U. (2023). 959 Amending Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading within the Union and Decision (EU) 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading system; 2023. *EU Directive*.
28. Directive 2003/87/EC, as amended by Directive (EU) 2023/959, Chapter IVa, Articles 30a-30k, establishing emissions trading for buildings, road transport and additional sectors; Regulation (EU) 2023/955 establishing a Social Climate Fund, OJ L 130, 16.5.2023, 1.
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30. Directive (EU) 2023/2413 as regards the promotion of energy from renewable sources, OJ L, 31.10.2023, including the amendment of Article 3 of Directive (EU) 2018/2001 and the accelerated permitting framework.
31. European Parliament and Council. (2024). Directive (EU) 2024/1275 on the Energy Performance of Buildings.
32. Regulation (EU) 2019/631 setting CO2 emission performance standards for new passenger cars and for new light commercial vehicles, as amended by Regulation (EU) 2023/851, OJ L 110, 25.4.2023, 5; Regulation (EU) 2023/1804 on the deployment of alternative fuels infrastructure, OJ L 234, 22.9.2023, 1.
33. Communication from the Commission, Guidelines on State aid for climate, environmental protection and energy 2022, OJ C 80, 18.2.2022, 1.
34. Ambroziak, A. A. THE NEW APPROACH TO EU INDUSTRIAL POLICY. THE CASE OF THE NET-ZERO INDUSTRY ACT AND POTENTIAL CONSEQUENCES FOR POLAND. *POLAND IN THE EUROPEAN UNION*, 69.
35. Directive 2014/24/EU on public procurement, OJ L 94, 28.3.2014, 65, in particular Articles 67 and 68 on award criteria and life-cycle costing.
36. Regulation (EU) 2020/852 on the establishment of a framework to facilitate sustainable investment, OJ L 198, 22.6.2020, 13, in particular Articles 3, 9 and 17.
37. Regulation (EU) 2023/955 establishing a Social Climate Fund, OJ L 130, 16.5.2023, 1, Articles 1-4. The Fund operates for 2026-2032 and is directed toward vulnerable households, vulnerable micro-enterprises and vulnerable transport users affected by the new emissions-trading system.
38. Federal Constitutional Court of Germany, Order of the First Senate of 24 March 2021, 1 BvR 2656/18, 1 BvR 78/20, 1 BvR 96/20 and 1 BvR 288/20, ECLI:DE:BVerfG:2021:rs20210324.1bvr265618. The Court required a sufficiently structured post-2030 reduction pathway and emphasised the intertemporal protection of freedom.
39. Galanis, P. (2026). Instrument Mix in Climate Change Law. *Available at SSRN 7449659*.
40. Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action, OJ L 328, 21.12.2018, 1, especially Articles 3, 9, 17, 29 and 34.
41. Paris Agreement, Articles 6.2-6.4, establishing frameworks for cooperative approaches involving internationally transferred mitigation outcomes and the mechanism to contribute to mitigation and support sustainable development.
42. Regulation (EU) 2026/667 amending Regulation (EU) 2021/1119 as regards a Union intermediate climate target for 2040, OJ L, 2026/667. The amended Article 4 sets a 90 per cent reduction in net greenhouse-gas emissions by 2040 compared with 1990 and provides for a limited contribution from high-quality international credits from 2036 under the conditions laid down in the Regulation.
43. Regulation (EU) 2026/667, Article 1, amending Regulation (EU) 2021/1119. See also European Commission, 2040 climate target, updated 7 April 2026, describing the legally binding 90 per cent headline target, at least 85 per cent domestic reduction and the limited role of international credits.

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