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The drive to decarbonise: regulatory shifts and their impact on energy infrastructure projects

Introduction

The global imperative to decarbonise energy production has emerged as a significant driver of infrastructure development. Climate change concerns and energy security considerations, heightened by

geopolitical instability, have prompted governments to pursue ambitious renewable energy targets while grappling with the challenges of maintaining reliable power supplies to meet domestic demand. This tension between sustainability and

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energy pragmatism has produced a complex, rapidly evolving regulatory landscape, creating opportunities and risks for infrastructure projects across the energy sector.

Progress towards decarbonisation has been neither linear nor uniform. Jurisdictions have pursued strategies based on their distinct geographic characteristics, existing energy infrastructure, political considerations and available natural resources. For example, Italy utilises solar and biomethane technologies that can be integrated with its agricultural sector; Germany and the European Union have invested in wind energy; and the United States has witnessed a remarkable resurgence of interest in nuclear power, driven by strong energy demands from data centres and artificial intelligence infrastructure.

The US is experiencing a nuclear renaissance – not so much to meet energy self-sufficiency as to serve the extraordinary energy requirements of data centres and artificial intelligence infrastructure

This article arises out of a panel presentation at the International Bar Association Annual Conference in Toronto in November 2025.¹ It examines how the regulatory shifts across these energy technologies and jurisdictions are shaping infrastructure project development. We identify key regulatory shifts and their impact on projects, including evolving social licence and financial considerations.

Emerging issues in regulating energy technology

Solar and biomethane in Italy

Italy has recently implemented legislative and regulatory changes to accelerate the development of renewable energy, particularly solar and biomethane. These measures are driven by EU targets and the country's National Recovery and Resilience Plan (Piano Nazionale di Ripresa e Resilienza or PNRR).² Key focus areas include simplifying authorisation procedures, introducing new incentives and defining rules for end-of-life management of these plants.

One important driver is the need for energy independence, which became critical with the Russia–Ukraine War, when Italy's

dependence on Russian gas had been approximately 43 per cent.³ To strengthen local sources, Italy has developed technologies integrating energy production and agriculture, which combine agriculture and solar plants in 'agri-photovoltaic' projects, fuel biomethane plants with digested agricultural waste and reuse bio-products as fertiliser.

Wind energy in Germany and the EU

Wind energy stands at the heart of the EU's energy and climate agenda. After nuclear energy, which provides 25 per cent of the EU's electricity, wind is the largest energy source, providing 20 per cent of all electricity consumed across Member States.⁴ It is indispensable to decarbonising the European economy. However, despite stable long-term output, the pace of producing new capacity falls short of what is required for the EU's 2030 binding targets. Only 13 gigawatts of new wind capacity was added in 2024 and 19.1 gigawatts in 2025, making it necessary to increase capacity by more than 30 gigawatts annually in the coming years.⁵ The need to double the growth in capacity heightens both the regulatory urgency and the commercial stakes in the wind energy debate in Europe today.

The challenges are threefold: navigating new EU permitting requirements, overcoming persistent delays in grid connection and stimulating demand-side uptake of renewable electricity among end-users. Each dimension has distinct legal requirements and commercial logic. All have generated regulatory issues at the EU level and in the German domestic regulatory framework that enforces EU standards.

Nuclear power in the US

The US is experiencing a nuclear renaissance – not so much to meet energy self-sufficiency as to serve the extraordinary energy requirements of data centres and artificial intelligence infrastructure.⁶ Technology companies operating large language models require enormous quantities of reliable, baseload power, with large data centres consuming as much electricity as a small city.⁷

Nuclear power is uniquely attractive to this industry. Unlike solar and wind, nuclear plants

produce consistent baseload power, regardless of weather conditions. This reliability is essential for data centre operation, which cannot tolerate service interruptions caused by intermittency. Moreover, nuclear power produces no direct carbon emissions during operation, allowing technology companies to satisfy operational requirements and corporate sustainability commitments – although nuclear waste storage remains a politically sensitive issue.⁸

The US nuclear regulatory environment has been very stringent, particularly after the Three Mile Island disaster in 1979, when the US Nuclear Regulatory Commission implemented extensive safety requirements significantly increasing construction and operation costs. Recent policy shifts signal meaningful change, with the current administration aiming to significantly expand capacity by 2050.⁹

The current nuclear resurgence departs from the traditional approach of constructing massive new plants like the Vogtle nuclear facility in Waynesboro, Georgia.¹⁰ Rather, driven by commercial interest in increasing available electricity, the industry is proceeding along two tracks: recommissioning previously shuttered plants and developing small modular reactor (SMR) technology.

The immediate path to increased capacity involves recommissioning plants closed for economic rather than safety reasons. This eliminates the lengthy process of site selection, environmental review and initial licensing of new construction. Technology companies have entered power purchase agreements (PPAs) with nuclear operators, providing the revenue certainty needed to justify investments.¹¹ However, SMRs are also being introduced. The output of SMRs is typically below 300 megawatts, in contrast with traditional plants, which exceed 1,000 megawatts.¹² Their modular design allows factory fabrication and transport to installation sites, potentially reducing costs and timelines. However, SMR technology remains largely unproven at commercial scale and regulatory procedures designed for large light-water reactors do not translate seamlessly to novel designs.¹³

Impact of regulatory changes

Having identified several trends in the development of carbon-reduced energy sources,

we now turn to some emerging regulatory issues that shape that development.

Wind energy in Germany and the EU

The Renewable Energy Directive (RED), the primary legal instrument governing the EU's approach to wind and other renewable energy, has undergone successive revisions. The core logic – that Member States bear individual responsibility for achieving national targets through support schemes and mechanisms – has remained constant.

However, the current generation of the framework, RED III,¹⁴ sets a binding target of 42.5 per cent renewable energy in the EU energy mix by 2030, with an aspiration to reach 45 per cent. To increase available renewable sources rapidly, RED III has raised the headline target and introduced binding permitting timelines and streamlined procedures. It designates renewable energy deployment as 'overriding public interest' – a classification of direct consequences for weighing competing interests in planning and environmental impact assessment (EIA) proceedings. This resonates with the German approach, where the Renewable Energy Act 2023 (Erneuerbare-Energien-Gesetz) declares electricity generation from renewable sources to be of 'overriding public interest' and a matter of 'public security', with renewables to be treated as a priority consideration.

RED III also introduces provisions on 'Renewable Acceleration Areas' – pre-designated zones where simplified, time-limited permitting applies and where environmental assessment is carried out at the planning stage rather than for individual projects. According to Article 15(c)(1) of RED III, by 21 February 2026, Member States should have ensured that competent authorities adopted one or more plans to meet at least their national contributions towards the overall EU 2030 target.

Solar and biomethane in Italy

Similarly, Italy has introduced legislative and regulatory changes to boost the development of solar and biomethane projects. These measures are driven by EU targets and the PNRR. As in Germany, the key focus areas in Italy include simplifying authorisation

procedures and introducing new incentives. Italy has also regulated end-of-life management in solar and biomethane projects.

SOLAR ENERGY

Italy has streamlined the administrative processes for solar photovoltaic (PV) plants to accelerate their deployment. The recent Renewable Energy Consolidated Act (Testo Unico per le Energie Rinnovabili)¹⁵ reorganises the legal framework to reduce bureaucratic hurdles. For large-scale plants, Single Authorisation¹⁶ consolidates all necessary permits into a single process with stricter deadlines. For smaller-scale projects, the Simplified Administrative Procedure¹⁷ streamlines approval. Further, authorities are defining 'Suitable Areas'¹⁸ for renewable energy installations to simplify permitting.

Three incentives support solar projects from utility-scale to small residential systems. The 'Bonus Fotovoltaico' (Photovoltaic Bonus) provides a tax deduction of up to 50 per cent on installation costs for residential and commercial systems, including storage batteries. The temporary FER X Decree (Transitional) provides incentives for electricity from renewable sources, including solar, with a focus on market-competitive projects. Finally, PNRR Measures¹⁹ allocate significant funds to the development of solar energy, with a focus on agrivoltaics, and the deployment of PV panels on agricultural and industrial buildings, often through capital contributions.

Nuclear power remains significantly more expensive than solar, wind and natural gas generation

To address solar panel end-of-life management, the EU's Waste Electrical and Electronic Equipment (WEEE) Directive has been transposed into Italian law.²⁰ The Gestore dei Servizi Energetici (GSE),²¹ Italy's energy services manager, manages the financial aspects of decommissioning. For plants that receive incentives, the GSE may retain a portion of the incentive payments to cover future disposal costs.

BIOMETHANE ENERGY

Biomethane regulation in Italy incentivises production from agricultural, livestock and

organic waste, promoting a circular economy. The Ministerial Decree of 15 September 2022²² incentivises the production of biomethane for transportation, heating and industrial processes, and simplifies the complex regulatory requirements related to energy, agriculture and waste management, creating a 'Single Authorisation' or similar procedure that involves multiple public entities.

The PNRR also targets the development of biomethane infrastructure. PNRR investments are designed to streamline the administrative process and allocate funds, including capital contributions of up to 40 per cent of eligible investment costs, to convert existing biogas plants and construct new ones. The PNRR also has an incentive tariff on net biomethane production for 15 years. The tariff amount varies based on the plant's production capacity and feedstock type. Incentives are granted through competitive procedures managed by the GSE, with specific deadlines for plant commissioning aligned with PNRR goals.

The decommissioning of biomethane plants follows general environmental and waste management regulations. Key concerns include the safe disposal of all materials and equipment, anaerobic digesters and any associated waste products. The closing and dismantling of biomethane plants must comply with environmental permits and authorisations, and ensure proper soil and water protection. Operators must ensure the safe and environmentally sound disposal of all plant components, and restore the site to its original condition.

NUCLEAR POWER IN THE US

Nuclear power remains significantly more expensive than solar, wind and natural gas generation.²³ This cost disadvantage reflects high capital costs; lengthy construction timelines; and extensive safety systems, redundant components, specialised materials and documentation required by the regulations governing nuclear development and operation – compliance burdens that competing technologies do not face to the same degree.²⁴

The capital requirements for traditional nuclear projects create financing challenges. Large plants can cost tens of billions of dollars and take over a decade to construct. The Vogtle expansion in Georgia, originally estimated to cost US\$14bn, exceeded

US\$30bn as regulatory changes forced expensive modifications.²⁵

The US Nuclear Regulatory Commission's licensing process imposes substantial costs, with the average licensing timelines historically extending well beyond those of other countries.²⁶ More significantly, the US approach lacks fixed timelines and permits requirements to evolve during construction, creating uncertainty that compounds project risks.²⁷ The central question is whether the regulatory framework can adapt quickly enough to support the current window of opportunity created by the surging commercial demand.

Evolving social licence considerations

Despite the powerful drivers to develop carbon-neutral energy sources, every infrastructure project has the potential to affect the local community in which it is built. This section examines features that require community engagement and support, and their corresponding effect on the regulatory environment.

Wind energy in Germany and the EU

Permitting remains the primary bottleneck for wind energy deployment across the EU. Although RED III introduces binding timelines and an 'overriding public interest', implementation at national and subnational level is uneven. EIA requirements,²⁸ directives for species protection obligations²⁹ and habitats,³⁰ and the integration of wind turbines with spatial planning frameworks – all products of the regulatory interest in sustaining social licence – create procedural complexity and lead times of five to ten years for large-scale projects.

In Germany, the Onshore Wind Energy Act 2022 (*Wind-an-Land-Gesetz*) shifts from a negative exclusion planning model to a positive area target system, requiring each state to designate minimum percentages of territory for wind by 2027 and 2032, with a sanction of full outer-zone privilege applying automatically if targets are missed. Priority zones³¹ must simultaneously be designated as acceleration zones, with streamlined environmental rules under the Federal Spatial Planning Law (*Raumordnungsgesetz*).

These initiatives have boosted onshore wind expansion, leading to record-level

licensing in 2024 and 2025. Designating two per cent of Germany's land for wind and streamlining environmental assessments has reduced bureaucratic hurdles and accelerated project planning, but challenges remain at the state level.

In 2024, approximately 14 gigawatts of wind power was approved, a record exceeding the combined approvals of 2017–2020, signalling that acceleration measures are reducing red tape. In 2025, this increased to 20.8 gigawatts. Projects in designated acceleration areas have benefited from reduced EIAs, with authorities conducting reviews using existing data. This has reduced average approval times by 10–20 per cent as of early 2025. Nevertheless, grid connection delays are a structural commercial risk for wind energy operators across the EU. In Germany's offshore sector, the obligation to connect lies with the transmission system operator. Failures to meet the agreed connection date trigger compensation claims.³²

Litigation over the calculation of compensation – including the measurement of wind speed for estimating lost generation, the treatment of shadow effects between turbines and the scope of the grid operator's duty to minimise damages – has generated substantial German case law.³³ More broadly, the pace of onshore grid reinforcement and extension – required to transport wind-generated electricity from production-intensive northern regions to consumption-intensive southern regions – lags behind both onshore and offshore wind installation rates.

A third challenge is demand: despite the need for expanded sources of carbon neutral energy, industrial and domestic energy users are transitioning their consumption to electrified, renewable-sourced supply chains slower than anticipated. This dampens the commercial incentive for accelerated wind investment and makes it harder to justify infrastructure costs.

PPAs between wind energy developers and large corporate buyers have emerged as a partial market-based solution, reducing dependence on public support schemes and creating long-term revenue certainty. However, PPA markets remain underdeveloped in several EU Member States due to regulatory barriers and the difficulty of pricing long-term renewable risk.

Solar and biomethane in Italy

Any new energy infrastructure, including solar and biomethane plants, must face the so-called ‘not in my backyard’ (NIMBY) syndrome. For permitting procedures involving local communities, whether towns/municipalities or regions, community support often requires ‘mitigating measures’, including allocating a budget for public works, renovation of streets, public buildings, schools, public gardens or hospitals, including energy efficiency initiatives.

By designating renewable energy infrastructure projects as projects ‘of public interest’,³⁴ the need to make these commitments for additional public infrastructure to secure the necessary permitting has developed from maintaining community goodwill to essential requirements for project planning.

Nuclear power in the US

Nuclear power has historically faced the most severe social licence challenges of any energy technology. The Yucca Mountain experience illustrates how social licence issues can derail initiatives, even when technical and regulatory requirements are satisfied – despite billions invested in the Nevada waste repository, political opposition prevented the facility from ever opening.³⁵

Nuclear power has historically faced the most severe social licence challenges of any energy technology

Despite this history, recent polling indicates increasing public support for nuclear power, reflecting growing recognition that decarbonisation requires zero-emission baseload generation, concerns about grid reliability and increased confidence in the safety of nuclear energy.³⁶ Corporate endorsements from leading technology companies may also be influencing attitudes, as prominent firms announce nuclear commitments to power data centres. SMRs may offer further social licence advantages through reduced footprints, enhanced passive safety features and the possibility of locating facilities on former coal plant sites.

Financial implications

Regulatory shifts and evolving social licence considerations have contributed to a complex environment for the design and delivery of renewable energy projects, thus increasing the complexity of the financial foundation on which they must proceed.

Wind energy in Germany and the EU

In Germany and the EU, wind energy has grown from a niche technology into a core power generation sector. Offshore wind involves some of the largest infrastructure investments in Europe. The commercial model for onshore and offshore wind in most EU Member States now is based on competitive auctions: developers bid for a support rate (contract for difference or premium tariff), receive a grid connection entitlement upon winning and must commission the facilities within a defined period or face penalties.

In Germany, EEG auctions impose 24-month commissioning deadlines and 30-month deadlines for the lapse of subsidy entitlement, with penalties (*Pönalen*) accruing for delays. Commercial viability remains exposed to risks beyond auction outcomes: supply chain disruptions, grid connection delays causing outages and compensation claims, and costs from complex environmental and planning procedures.

EU wind energy investors must contend with frequently and abruptly changing regulations. In Germany, fundamental legal reforms pose systemic challenges.³⁷ In Spain, Italy and Czechia, retroactive reductions in renewable energy support schemes led to a wave of investor-state arbitrations under the Energy Charter Treaty (ECT). Following the Court of Justice’s judgment in *Achmea* (C-284/16) and *Komstroy* (C-741/19), intra-EU arbitration clauses in the ECT were deemed inapplicable as between EU Member States and EU investors, resulting in another shift in the prospect of a secure basis for financing projects. The German Constitutional Court has confirmed this position from a domestic law perspective.³⁸

Solar and biomethane in Italy

In Italy, regulatory changes have resulted in recalculations of incentives to be awarded on certain plants, and permit and authorisation requirements, disrupting business plans on which investors and their financiers have relied. This has prompted investors and financing banks to consider the risk and mitigate the related disruption to timelines and other features of the project.

Nuclear power in the US

Regulatory uncertainty drives the cost of capital for US nuclear projects above comparable jurisdictions, reflecting perceived risks, including regulatory changes during construction, licensing delays and political shifts that could undermine project economics.³⁹ SMRs face the compounded regulatory uncertainty of unproven technology. The cancellation of the NuScale Carbon Free Power Project – which would have been the first utility-scale US SMR – illustrated these difficulties when cost estimates rose from US\$55 per megawatt-hour to US\$89 per megawatt-hour, undermining the economic case and leaving the project without sufficient subscriber support to proceed.⁴⁰

Achieving financial viability is likely to require regulatory reform; policy support through mechanisms like production tax credits or loan guarantees; and innovative commercial arrangements that transfer risk to creditworthy offtakers. The current environment of strong demand, corporate buyers, political support and reform momentum presents unusual conditions favourable to nuclear expansion. However, whether those factors are sufficient to overcome historical financial obstacles remains an open question.

Conclusion

The drive to decarbonise has produced a complex regulatory landscape for energy infrastructure projects worldwide. Across the three jurisdictions examined, regulatory uncertainty emerges as a central concern – when rules can change during development and construction, investors demand risk premiums that increase costs and slow deployment.

Energy transition will continue to generate novel challenges for infrastructure developers, regulators and host communities. What remains constant is the fundamental tension between the urgency of decarbonisation and the practical difficulties of transforming the systems that power modern economies – a tension that will shape infrastructure development for decades to come.

Notes

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