

Emerging Trends in Private Transmission Assets: UK & Europe



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Our latest CleanBridge Energy Current Report examines one of the most consequential infrastructure challenges of the energy transition: electricity transmission. As renewable deployment accelerates across Europe, grid networks are struggling to keep pace, creating structural bottlenecks that constrain decarbonisation and energy-security objectives. This work reflects a valued research collaboration with Alchemy Business Intelligence and Insights, a leading group actively engaged across energy transition markets. The report draws on regulatory frameworks, industry data and policy developments from across the UK and Europe.

The UK stands at the forefront of a broader shift in how transmission infrastructure is financed and delivered. The emergence of the Competitively Appointed Transmission Owner ("CATO") framework represents a significant departure from the traditional regulated monopoly model, introducing project-based competition into onshore transmission and opening new pathways for institutional capital. Underpinned by the Energy Act 2023 and Ofgem's Tender Regulations 2025, CATO builds on the success of the Offshore Transmission Owner ("OFTO") regime, which has attracted over £11.0 Bn of private investment since 2009, and is now being extended to onshore grid assets.

The investment case is compelling but nuanced. The UK is transitioning from a generation-led to a grid-led investment cycle, with National Energy System Operator ("NESO") estimating approximately £60.0 Bn in required network investment. At the same time, the pathway to deployment involves meaningful execution risk — regulatory certainty, planning complexity, pipeline visibility and bid risk will each shape whether CATO delivers on its promise at scale. Across Europe, the adoption of competitive transmission models is likely to be selective, with a hybrid outcome where regulated Transmission System Operators ("TSOs") retain core planning responsibilities while private capital is deployed into clearly defined project categories.

We trust this primer provides valuable insights into an emerging and strategically important area of the energy transition, and we look forward to sharing further updates on emerging energy transition trends in the months ahead.

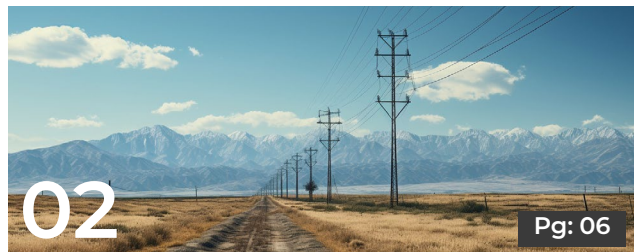
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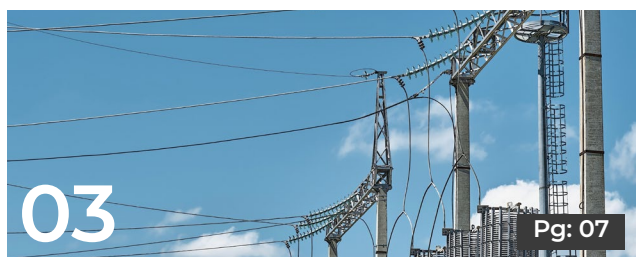
Contents



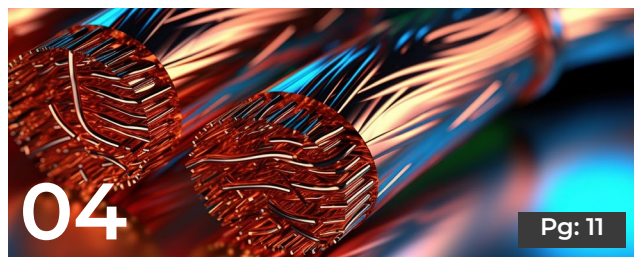
Introduction



Executive Summary



Traditional Transmission Model



Emergence of Competitive / Private Models



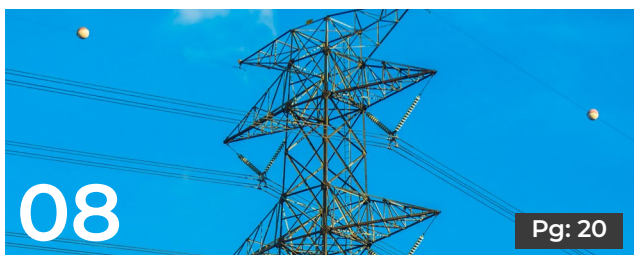
Broader European Landscape



Investment Case Private Transmission Infrastructure



Looking Ahead



Conclusion

A large, black, lattice-structured electricity pylon stands prominently in a snowy landscape. In the background, there are snow-covered mountains and a small cluster of buildings. The sky is overcast. The pylon is the central focus of the left side of the page.

Introduction

Electricity transmission is becoming an increasingly important focus within the energy transition, as network expansion struggles to keep pace with renewable deployment, electrification and rising power demand. In response, policymakers and regulators are exploring new approaches to financing and delivering transmission infrastructure. This report examines the emergence of competitive transmission models, with a particular focus on the UK's CATO framework, and assesses whether similar approaches could scale across Europe.

Executive Summary

Electricity transmission infrastructure has moved from a background utility function to one of the defining strategic priorities of the energy transition. Across Europe, renewable generation capacity has expanded rapidly, but transmission investment has not kept pace with the level of network expansion required to support the next phase of the energy transition. This has created a structural mismatch, making grid infrastructure a critical factor in achieving decarbonisation and energy-security objectives.

The scale of investment required is substantial, with the European Commission estimating €584.0 Bn of grid investment required by 2030 and cross-border transmission capacity needing to double by then. Europe's traditional transmission model has been dominated by regulated TSOs, the entities responsible for owning, operating and maintaining high-voltage electricity transmission networks, supported by regulated asset base frameworks and centralised planning. This model has historically provided stable returns, reliable system coordination and low-risk infrastructure ownership. However, its ability to deliver at the required pace is increasingly constrained by permitting delays, supply-chain bottlenecks and the growing complexity of decentralised generation. In many markets, transmission build-out remains slower than renewables deployment, creating connection queues, curtailment risks and delays to strategic energy projects, prompting policymakers to consider more competitive and private-capital-led models to help accelerate delivery.

The clearest example of this shift is the UK's CATO model, which introduces project-based competition into onshore transmission by allowing private developers to compete for the delivery of specific transmission assets under a regulated framework. This represents a significant departure from monopoly ownership and creates a potential route for institutional capital to participate directly in defined transmission projects.

Competitive frameworks can broaden the investor base, ease the capital burden on incumbent TSOs and improve delivery discipline for clearly defined project categories. However, they are not a complete solution to Europe's grid challenge. Their effectiveness depends on clear project scope, appropriate risk allocation and bankable revenue frameworks, while broader delays linked to permitting, planning approvals, public opposition and cross-border cost allocation are likely to remain.

The scalability of CATO-like models across Europe is therefore likely to be selective across geographies. Countries with mature regulatory systems, experience in public-private partnerships ("PPP") or concession frameworks, and clear investment pipelines are better placed to adopt competitive models. In contrast, markets with stronger state ownership traditions, fragmented regulatory structures or political resistance to private grid ownership may remain largely TSO-led. The likely outcome is not wholesale privatisation of transmission, but a hybrid model in which core grid planning and system operation remain centrally managed, while competition is introduced for clearly defined assets.



Traditional Transmission Model

Structure

While transmission ownership and regulatory frameworks vary across Europe, most markets continue to operate under a broadly similar model characterised by regulated TSOs, centralised network planning and long-term revenue frameworks. The UK provides a useful case study of this traditional approach, given the maturity of its regulatory system and its role as the first European market to actively develop competitive transmission ownership models through frameworks such as OFTO and CATO.

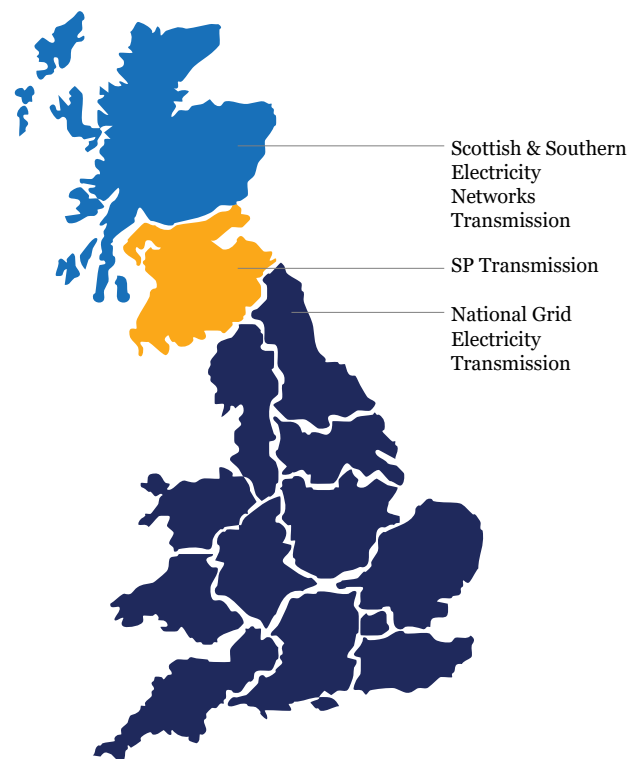
The UK's traditional electricity transmission model has historically operated as a centralised, regulated monopoly framework. Under this structure, major network companies own, develop and operate the high-voltage transmission grid through long-term licences established under the Electricity Act 1989. The model has been designed to provide system reliability, predictable capital recovery and regulated returns, supported by extensive oversight from the Office of Gas and Electricity Markets ("Ofgem").



Core Structure of the Traditional Model

The UK transmission system is led by licensed transmission operators responsible for the ownership, operation and maintenance of the high-voltage electricity network. The key transmission owners include National Grid Electricity Transmission in England and Wales, Scottish Power Transmission in southern Scotland, and Scottish & Southern Electricity Networks ("SSEN") Transmission in northern Scotland.

Historically, the model has been anchored around centralised network planning, monopoly ownership, long-term licence-based regulation and cost recovery through regulated network charges. This has created a stable investment model based on regulated revenues.



Regulated Asset Base Model

The traditional UK transmission framework operates under a Regulated Asset Base model. Transmission owners invest capital into network infrastructure, while Ofgem assesses whether the expenditure is efficient and determines the level of allowed revenues. Approved investments are added to the operator's Regulatory Asset Value, on which the operator earns an allowed return over multi-year regulatory periods.

This framework, currently embedded within Ofgem's 'Revenue = Incentives + Innovation + Outputs' ("RIIO") regime, provides transmission owners with long-term revenue visibility, stable cash flows and relatively low financing risk. As a result, UK transmission assets have historically been viewed as attractive, low-risk infrastructure investments with regulated return profiles.

Key Characteristics

The model has three defining features.

- First, it offers stable and relatively low-risk returns because revenues are primarily determined through regulatory price controls rather than market price exposure
- Second, investment planning is highly centralised, with network needs assessed through system-wide modelling, regulator-led scrutiny and Ofgem-approved funding allowances
- Third, transmission development typically involves long lead times, reflecting multi-stage regulatory approvals, planning consent, environmental assessments, stakeholder consultation and supply-chain procurement requirements.



Limitations

While the traditional model has supported reliable infrastructure delivery, it is increasingly being tested by the speed and scale of the UK's energy transition.

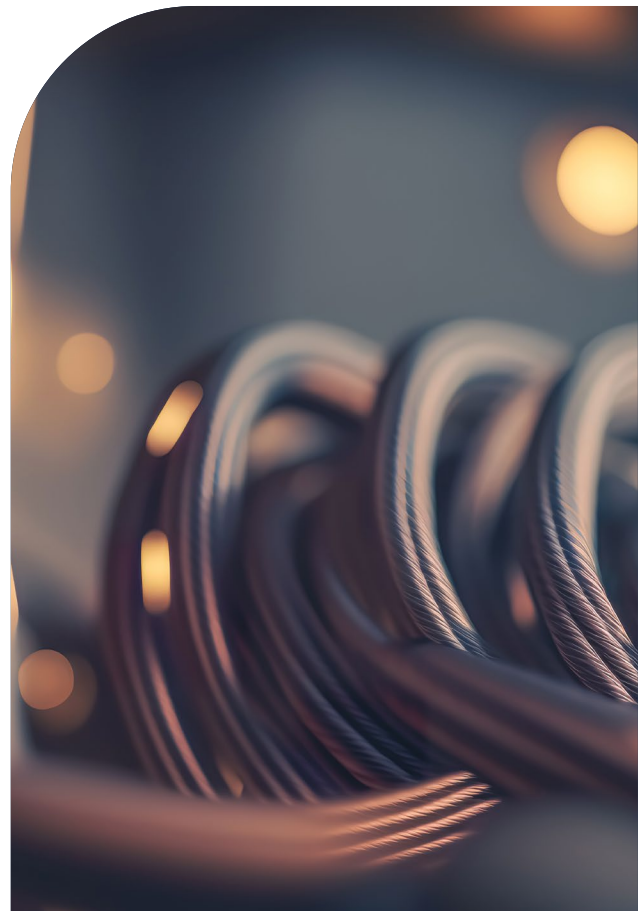
The most significant challenge is the mismatch between transmission build-out timelines and renewable deployment. Prior to the much-needed 'First Ready, First Needed' reforms introduced by NESO, an independent body responsible for planning and operating Great Britain's electricity transmission system, the UK's legacy grid connection queue exceeded 700.0GW. Projects often faced connection timelines of 10–15 years, with many viable renewable and storage assets receiving connection dates well into the 2030s.

Regulated monopoly structures can limit innovation, as returns are primarily linked to approved investment rather than technology risk. Ofgem's RIIO-T3 framework seeks to address this through targeted incentives for more efficient network delivery and operation. A further limitation is the sector's high dependence on regulatory and public capital allocation. Transmission expansion remains closely tied to Ofgem-approved allowances, strategic funding mechanisms and regulated network charges. While this supports bankability, it also means that investment delivery depends heavily on regulatory cycles at a time when grid expansion needs are accelerating.

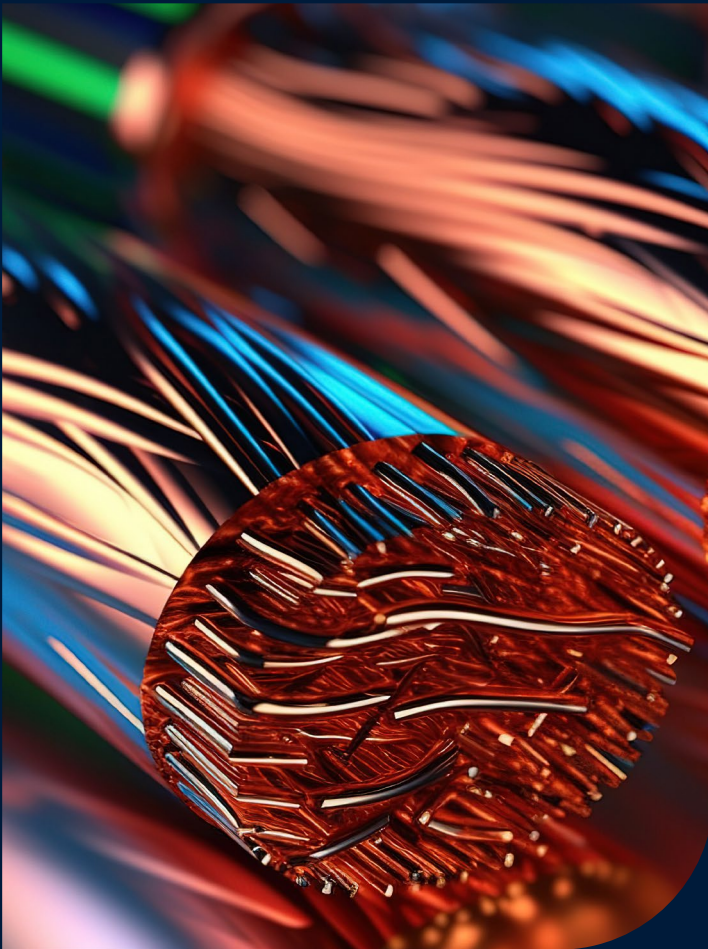
Finally, the existing grid was largely designed around centralised fossil-fuel generation rather than decentralised, variable renewable generation. The growth of distributed clean energy projects, storage and new connection requests has exposed a structural gap between legacy grid planning assumptions and the requirements of a more decentralised energy system. NESO has estimated that around £60.0 Bn of grid investment will be

required to support a clean power system, underscoring the scale of capital deployment needed.

Overall, the UK's traditional transmission model has historically been effective in delivering reliable infrastructure, attracting long-term institutional capital and maintaining system stability. However, the accelerating shift toward renewables, electrification and decentralised generation is exposing the limitations of a purely centralised, regulated model. The UK transmission framework is shifting towards faster delivery, greater investment flexibility and increased use of competitive models.



Emergence of Competitive / Private Models



Across Europe, policymakers are increasingly exploring ways to accelerate transmission investment and delivery while reducing pressure on incumbent TSOs and public balance sheets. Although most markets remain dominated by regulated monopoly structures, the UK has emerged as one of the first European jurisdictions to introduce competition into onshore transmission delivery. As a result, the UK provides a useful case study for how competitive transmission ownership models could develop more broadly across Europe.

What is CATO

The UK transmission sector is gradually moving beyond its traditional monopoly-led, regulated asset model toward a more competitive, project-based delivery framework. This shift is being introduced through the CATO model, which enables private developers, infrastructure investors and utility-backed consortiums to compete for the delivery of selected onshore transmission assets.

Under the CATO framework, eligible transmission projects are no longer automatically allocated to incumbent transmission owners. Instead, specific assets can be tendered competitively, with the selected CATO responsible for designing, financing, constructing, owning, operating and maintaining the asset under a regulated licence. This preserves regulatory oversight and revenue visibility, while introducing private-sector competition into parts of the transmission network.

The model is being implemented under the statutory framework created by the Energy Act 2023 and associated secondary legislation, which created the statutory basis for CATOs. As per Ofgem's Tender Regulations 2025, the NESO has been designated as the delivery body responsible for running competitive processes, including early market engagement and future tendering. The approach supports the UK's Clean Power 2030 objectives by broadening the delivery base for critical grid infrastructure, introducing competitive pressure into selected transmission projects and providing additional routes for infrastructure investors to participate in network expansion.

The new framework will play a key role in opening investment opportunities in onshore networks for new entrants, which will be imperative if the £58.0 Bn of investment needs outlined in NESO's 'Beyond 2030' network design recommendations are to be met.

The UK's OFTO regime provides the closest precedent for CATO, extending a proven model of competitive transmission ownership from offshore assets to selected onshore projects in order to attract private capital and support future grid expansion.

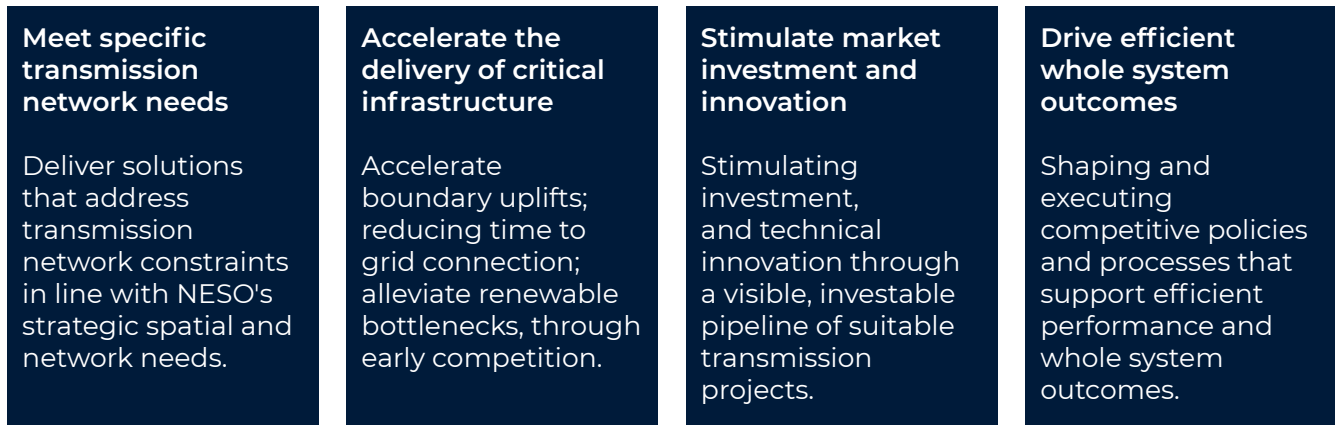
Current Status

While the UK is the most advanced European market in developing competitive transmission ownership models, progress elsewhere remains limited. Most European countries continue to rely on incumbent TSOs and regulated monopoly structures, with private capital participation typically concentrated in interconnectors, PPP-style arrangements and project-level financing structures. As a result, the UK currently serves as the primary test case for the broader applicability of competitive transmission models across Europe.

Early Competition and Market Engagement

CATO is currently at an early implementation stage, but the regime is moving from policy design into practical market engagement. The Early Competition model allows competitive tendering to begin before detailed project design has been completed. This enables the successful bidder to influence design, financing and delivery strategy earlier in the asset lifecycle, with the aim of improving cost efficiency, innovation and execution quality.

The Early Competition Model is Structured to Create Economic and Consumer Value by



End-to-end Process of the UK Early Competition Model for Onshore Electricity Transmission Projects



NESO's Expression of Interest ("EoI") process, launched in March 2026, represents a material step in testing market appetite for early-stage onshore transmission competition. The EoI is not a formal tender or pricing request, but a market-sounding exercise to assess investor capability, financial capacity, relevant

experience, risk appetite and views on project packaging and sequencing. The information gathered will help NESO refine competition design, engage with Ofgem on returns and risk allocation, and shape the future CATO project pipeline.



Broader European Landscape

Current Position

Europe's transmission sector remains dominated by regulated TSOs, with transmission infrastructure continuing to be treated as a strategic national asset and natural monopoly. While European electricity markets have become increasingly integrated through cross-border trading and market coupling, ownership and delivery models remain largely national, regulated and state-influenced. Europe's transmission grid remains largely organised around regulated national TSOs, with limited direct competition in ownership or delivery. TSOs are responsible for planning, building and operating high-voltage networks, and typically function within a monopolistic, regulated business environment. This reflects the treatment of transmission infrastructure as both critical national infrastructure and a natural monopoly.

The central role of incumbent national operators is also reflected in the structure of Europe's system-level coordination. The European Network of Transmission System Operators for Electricity ("ENTSO-E"), represents 40 electricity TSOs across 36 European countries. While ENTSO-E does not own or operate transmission grids directly, it plays an important coordinating role in supporting cross-border electricity trading, market coupling, efficient use of interconnectors, and the development of technical and market rules governing interaction between electricity networks, generators, consumers and market participants across Europe. It also supports the synchronised operation of the continent's power grids, including areas such as the Continental Europe Synchronous Area.

State ownership remains a defining feature of several European transmission markets. In France, the high-voltage transmission network is operated by Réseau de Transport d'Électricité ("RTE"), which is majority-owned

by the French state through Électricité de France ("EDF"). In Sweden, the national grid is owned and operated by the Swedish state-owned authority, Svenska Kraftnät. Similarly, power transmission in the Netherlands is highly centralised and managed by the state-owned TenneT, which acts as the national TSO.

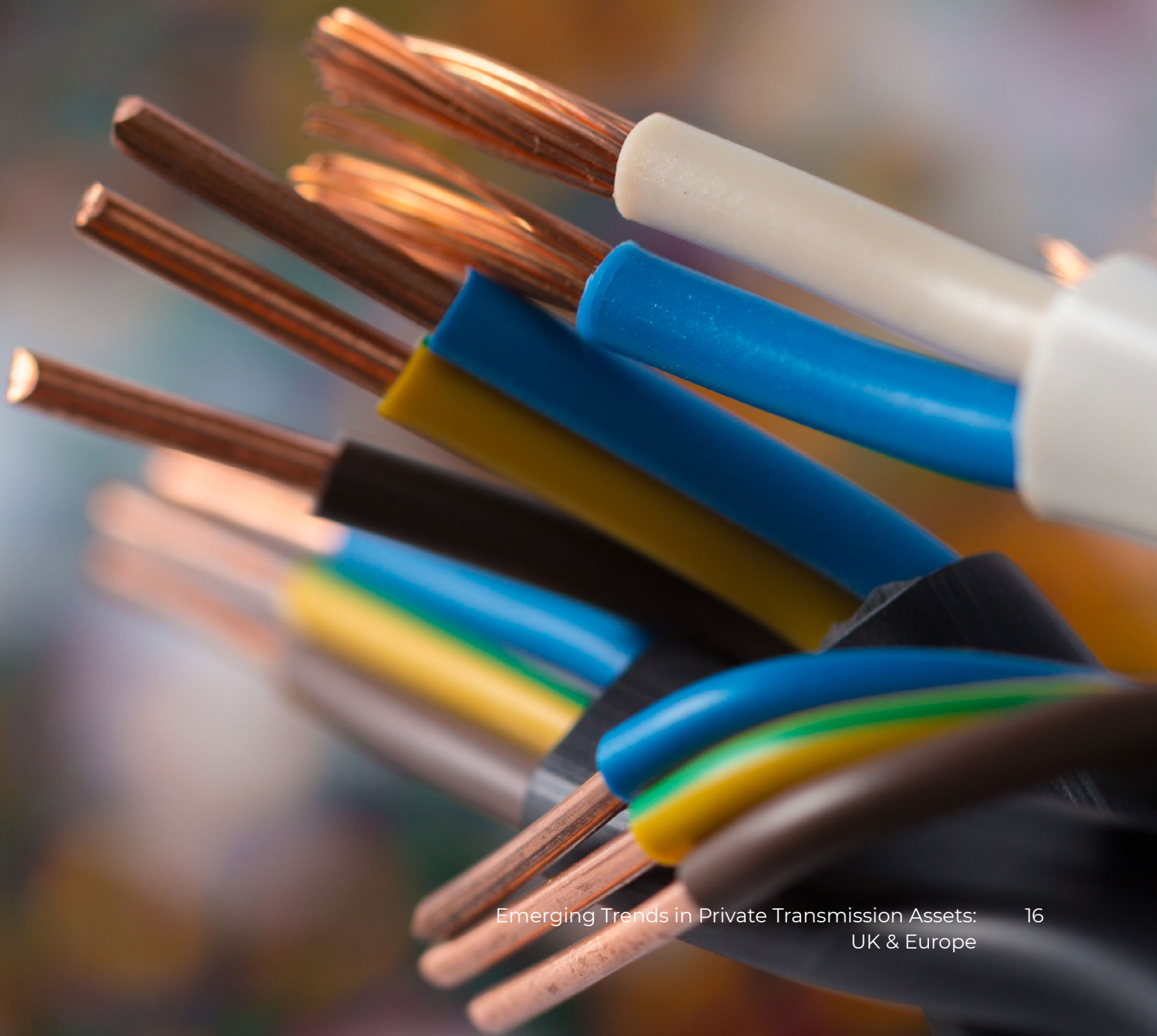
Overall, the European transmission landscape is therefore characterised by regulated national ownership structures, strong incumbent TSO control, and limited competition in core transmission ownership. Although European power markets are increasingly integrated at the operational and trading level, ownership and delivery models remain largely national, regulated and state-influenced.

Signs of Shift in Europe

Growing grid investment requirements are increasing pressure for greater private capital participation. The European Commission estimates that grid investment could require c.€85.0 Bn annually between 2031 and 2050, including c.€28.0 Bn per year for transmission infrastructure.

In response, policymakers are increasingly exploring hybrid financing structures, public-private partnerships and project-level investment models rather than full privatisation of transmission networks. The European Commission's Grids Package and Clean Energy Investment Strategy support this direction through accelerated permitting, stronger cross-border coordination and measures designed to attract private investment.

Investment Case - Private Transmission Infrastructure



Why Investors Care

The investment case for private participation in UK transmission infrastructure is becoming increasingly compelling. The timing is particularly favourable, as the UK power system moves from a generation-led investment cycle to a grid-led investment cycle. This shift is reflected in the scale of planned network investment under Ofgem's RIIO framework.

The demand case is also structural. In 2025, approximately 10.2TWh of renewable power was curtailed, representing a 22.0% increase compared with 2024. The problem is not a temporary market inefficiency. It reflects a fundamental gap between the pace of renewable deployment and the speed at which transmission infrastructure is being built.

What is Attractive

Private participation in transmission infrastructure remains relatively limited compared to generation assets, making it one of the less developed areas of the energy transition investment landscape. Historically, ownership of transmission networks has been concentrated among regulated monopoly operators, limiting direct access for institutional capital despite the sector's attractive characteristics, including regulated revenues, long asset lives and essential-service status.

The emergence of competitive delivery frameworks such as OFTO and CATO is beginning to broaden investor access to transmission infrastructure. These models allow private capital to participate in the financing, ownership and operation of specific transmission assets while maintaining regulatory oversight and system coordination.

As grid investment requirements continue to increase, competitive ownership structures could provide an additional mechanism for mobilising capital into a sector that has traditionally relied on incumbent network operators and regulated balance sheets.

The attraction for investors lies in gaining access to transmission assets that have historically been unavailable to private capital. By introducing competition into project delivery and ownership, CATO creates the potential for investors to earn attractive risk-adjusted returns while supporting the substantial grid investment required for the energy transition.

The UK's OFTO regime provides a practical example of private capital already participating in transmission infrastructure. Since its launch in 2009, the framework has attracted over £11.0 Bn of private investment into offshore transmission assets, demonstrating investor appetite for regulated transmission infrastructure with long-term, predictable cashflows. Looking ahead, the UK's target of up to 50.0GW of offshore wind by 2030, from approximately 16.5GW installed as of 2025, is expected to drive further investment in offshore transmission links, grid connections and associated network infrastructure.

The OFTO regime also provides an important precedent for CATO, demonstrating that competitive ownership frameworks can successfully attract private capital into transmission infrastructure while operating within a regulated environment.

Key Risks

While the investment case is compelling, private transmission infrastructure is not without risk. The central challenge is that the asset class pairs defensive revenue characteristics with significant delivery complexity.

- Regulatory risk is the most material consideration. Allowed returns, cost recovery mechanisms, incentive structures and tender rules will ultimately determine whether private capital finds the sector attractive. Although RII0-3 provides a clearer return environment for incumbent transmission owners, it remains to be seen whether emerging competitive models will offer returns sufficient to compensate investors for the full spectrum of design, construction, financing and operational responsibilities.
- Political risk also warrants attention. Transmission networks are strategic national assets, and governments may be reluctant to cede too much control of core grid infrastructure to private investors. This is likely to constrain the scope of full privatisation and favour more targeted participation models for discrete, project-based assets with clear boundaries and well-defined regulatory oversight.
- Construction and delivery risk is similarly material. Large transmission projects must navigate long planning timelines, environmental approvals, community opposition, supply-chain constraints and shortages of skilled labour. Competitive ownership structures may bring additional capital and delivery discipline, but they cannot fully resolve system-level constraints such as permitting delays and network planning complexity.
- Pipeline visibility presents a further challenge. While the headline investment requirement is substantial, not all of it will be accessible to private capital. Core transmission assets remain largely within regulated transmission owner structures, and newer competitive models are still at an early stage. Investors will therefore need to focus on segments where frameworks are already proven or where the project pipeline is clearly defined.
- Bid Risk: As a competitive tender model, there is no certainty that bidders will secure projects after committing significant time and resources to bid preparation. Returns may also be compressed if competition becomes intense, reducing the attractiveness of successful bids.



Looking Ahead

The UK transmission market is entering a structurally stronger investment phase, driven by increasing grid investment requirements, renewable integration, electrification and the need to modernise network infrastructure. However, CATO remains at an early stage of development, with project identification, tender design, commercial structures and licence arrangements still evolving.

The long-term success of the framework will depend on several factors. First, investors will require greater visibility over the size, timing and technical characteristics of the future project pipeline to determine whether CATO represents a scalable opportunity or a limited set of individual projects. Second, regulatory clarity around revenue recovery, licence obligations, risk allocation and operational incentives will be critical to attracting long-term infrastructure capital. Finally, returns will need to be sufficiently attractive relative to traditional regulated infrastructure investments, given the additional development, construction and delivery risks associated with competitive transmission projects.

If successfully implemented, CATO could broaden private participation in onshore transmission and provide an additional delivery route for network expansion. However, its ultimate role within the UK transmission market will depend on the ability of policymakers and regulators to establish a predictable and investable framework while maintaining effective system coordination and oversight.



Conclusion

Transmission infrastructure is becoming an increasingly important investment theme as renewable deployment, electrification and system flexibility requirements continue to grow across Europe. While regulated TSOs will remain central to network planning and operation, the scale of future investment requirements is creating opportunities for alternative delivery and financing models.

The UK's CATO framework represents an important test case for introducing competition into onshore transmission and broadening access to private capital. However, regulatory fragmentation, political sensitivity and system coordination requirements are likely to limit widespread adoption across Europe.

Can competitive transmission models meaningfully scale across Europe?

They are likely to scale selectively rather than universally. The most probable outcome is a hybrid model in which regulated TSOs retain responsibility for core network planning and operation, while competitive frameworks are applied to clearly defined transmission assets where private capital can complement, rather than replace, the traditional model.



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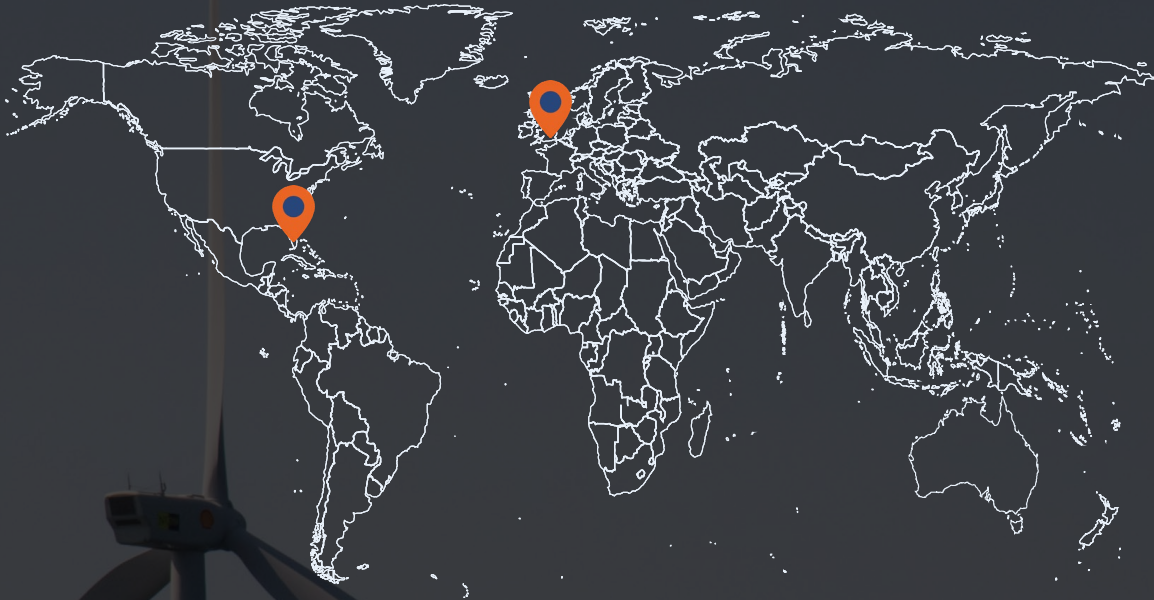
\$1.0 Bn Value

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