

# Energy Network Innovation for Green Transition: Economic Issues and Regulatory Options

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Innovation is key to decarbonisation of the energy sector and sustainable development. However, in the post liberalisation period, sector regulators have found it difficult to incentivise innovation. We explore the reasons for the slow uptake of new technologies in energy networks and discusses remedies to promote research and innovation in the EU energy networks and infrastructure.

The existing technologies need to develop further in order to achieve the ambitious decarbonisation objectives. We argue that technological innovation coupled with economic incentives and behavioural changes are necessary to achieve the goals of the European Green Deal. In the wake of the liberalisation of the energy industry in the 1990s, it was believed that competitive markets and private sector would efficiently determine the appropriate amount and type of Research and Development (R&D). However, as the primary objective of the reforms was to improve cost efficiency, the long-term importance of R&D was downplayed.

We examine several economic concepts to delve into the reasons for the slow pace of innovation in energy networks. As the energy networks are regulated, the concepts discussed are mainly viewed from the viewpoint of economic regulation of the utilities and sector regulators. In order to ensure the preservation, dissemination, and retention of generated knowledge in innovation, we consider the establishment of a European research hub. A collaborative approach could compensate for the diminishing economies of coordination in the sector resulting from unbundling in terms of a vertical separation into competitive (generation and retail) and regulated (transmission and distribution networks) segments.

The collaborative approach of a research hub contrasts with the alternative of funding models such as Ofgem's Low Carbon Network Fund (LCNF), where the utilities and their projects 'compete' for their own and others' share of R&D allowance. In competition-based mechanisms for funding the most promising research and innovation efforts, utilities allocate a specified share of their revenue to a collective innovation fund. The companies subsequently take part in a competitive process in order to secure funding for their proposed innovation projects.

From a regulatory standpoint, the focus of European energy network economic regulation has traditionally been on short-term cost-efficiency improvements, whereas R&D and innovation have not been explicitly promoted to the same extent. Given that innovation can be costly at the pilot phase and only resulting in significant efficiency gains in the long-term, the suggestion arises for regulatory models to adopt long-term goals. From a risk perspective, it is also important that incentive mechanisms consider the risk profile of innovation to avoid a focus on low-risk normal efficiency improvements. Furthermore, innovation in energy networks is often perceived to have high costs and risks, as well as high sunk costs.

Input-based mechanisms that are commonly used to promote R&D and innovation include:

(i) Regulated Asset Base (RAB) models to overcome the issue of financing long-term low-carbon generation assets with low funding costs, an approach that includes innovation expenditure in the regulatory asset base of the utility,

(ii) Weighted Average Cost of Capital (WACC) approaches that attempt to distinguish between the capital used in innovation and other forms of capital to fairly reflect the perceived higher risk of

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innovation investments. Note that both approaches assume that the capital spent on innovation is in the form of equity or debt,

(iii) a cost pass-through approach to innovation-spend, which implies that spending on R&D is a current expenditure funded by rate payers through charges or prices.

Finally, we emphasize a 'value-based' approach to innovation funding and incentives rather than a cost-efficiency approach. Not only because the value of the benefits of green energy increases with our dependence on these, but because the value goes beyond the energy sector to also benefit social and economic objectives. Thereby, it makes economic sense to adopt a long-term view that regards innovation spending as opportunities for the future economy rather than one-off spending musts.