CSEI Policy Brief #008

COPENHAGEN BUSINESS SCHOOL
COPENHAGEN SCHOOL OF ENERGY INFRASTRUCTURE I CSEI

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

Tooraj Jamasb [1], Manuel Llorca [1], Leonardo Meeus [2,3], and Tim Schittekatte [2,3]

[1] Copenhagen School of Energy Infrastructure (CSEI), Copenhagen Business School, Denmark

[2] Florence School of Regulation (FSR), Robert Schuman Centre, European University Institute, Italy

[3] Vlerick Business School (VBS), Belgium

Innovation is key to decarbonisation of the energy sector and sustainable development. However, in the post liberalisation period, regulators have found it difficult to incentivise innovation. This policy brief discusses the reasons for the slow uptake of new technologies in energy networks and proposes 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 Green New Deal.

In the wake of the liberalisation of the energy industry in the 1990s, it was believed that the competitive markets and the 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 importance of R&D was downplayed.

A number of economic concepts are relevant for exploring the reasons for the slow pace of innovation in energy networks. These concepts and their implications for the European TSOs and DSOs are summarised in Table 1. As the energy networks are regulated, these concepts should be mainly viewed from the viewpoint of economic regulation of the utilities and sector regulators.

In addition, political, regulatory, and economic uncertainties may affect the level of R&D and innovation efforts in the sector. These include (1) General uncertainty on the national and European political agenda that can affect research, (2) Uncertainty regarding cost recovery in the absence of a predictable framework, (3) Regulatory barriers such as unbundling rules, third-party access and tariffs, and, (4) Uncertainty about market demand and behaviour in the absence of regulatory intervention.

Relevant Economic Concepts	Implications for European TSOs and DSOs
Technological change as a driver of economic growth	Public role to promote R&D efforts
Valley of death in innovation	Focus on widespread application of inventions
Prevalence of market failure in energy R&D	Promotion of open innovation
Increase in consumer surplus and economic and social benefits	Adoption of a 'value-based' approach in innovation funding
Vertical disintegration and relationship between firms' size and R&D	Coordination to organise large R&D project initiatives
Short-term network price controls	Incentive-based rather than cost efficiency approaches

Table 1: Summary of relevant economic issues for the European DSOs and TSOs

In order to encourage innovation in the network utility sector, several EU Member States implement bespoke solutions that are contingent to their particular conditions such as (i) making explicit that TSOs have a duty to consider innovative solutions, (ii) carrying out Social Cost-Benefit Analyses (SCBA) for large projects, (iii) consulting on projects and National Development / Investment Plans with stakeholders, and (iv) considering Opex-based solutions. Nonetheless, we emphasize that the proposed solutions must not be considered in isolation but in a holistic view and consistent with the current legislation establishing an innovation ecology through collective and interactive efforts to facilitate innovation.

In order to ensure the preservation, dissemination, and retention of generated knowledge in innovation, we recommend 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 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. Table 2 summarises the regulatory tools that can be used to stimulate innovation in the energy sector and provides some European examples in which the different approaches are applied.

Finally, we emphasize that we adopt a more '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.

Issue	*Costs for innovation are incurred now while benefits are uncertain and materialise on the longer term (short-term thinking and risk-aversion)*				*Innovation benefits can go beyond grid cost reduction (externalities)*
Approaches (can be combined)	**Input-based**				**Output-based**
	RAB-based	**WACC-based**	**Cost pass-through**	**Competition for funding**	
Explanation	Include R&D and innovation spending in the regulatory asset base of the utility	Increasing the return of the investment to compensate for the risk	Spending on R&D and innovation is a current expenditure	Tender for grants of an innovation fund	Improving outputs can foster innovation as a mean to get rewards

Example	In GB it has been applied to infrastructure projects and discussed for new nuclear projects	In Italy, some smart grid projects receive additional WACC	In Norway DSO R&D expenditures are added to the allowed revenues	In GB, there is an annual Electricity Network Innovation Competition (NIC)	Automation can have an effect on quality-of-service incentives

Table 2: Regulatory tools to stimulate innovation.

References:

Jamasb, T., Llorca, M., Meeus, L. and Schittekatte, T., (2020). Energy Network Innovation for Green Transition: Economic Issues and Regulatory Options (chapter for the book *"Energy Regulation in the Green Transition: An Anthology"*, an initiative led by the Danish Utility Regulator).

Department of Economics, © For the Policy paper #008: by CSEI, 09, 2020, all rights reserved.