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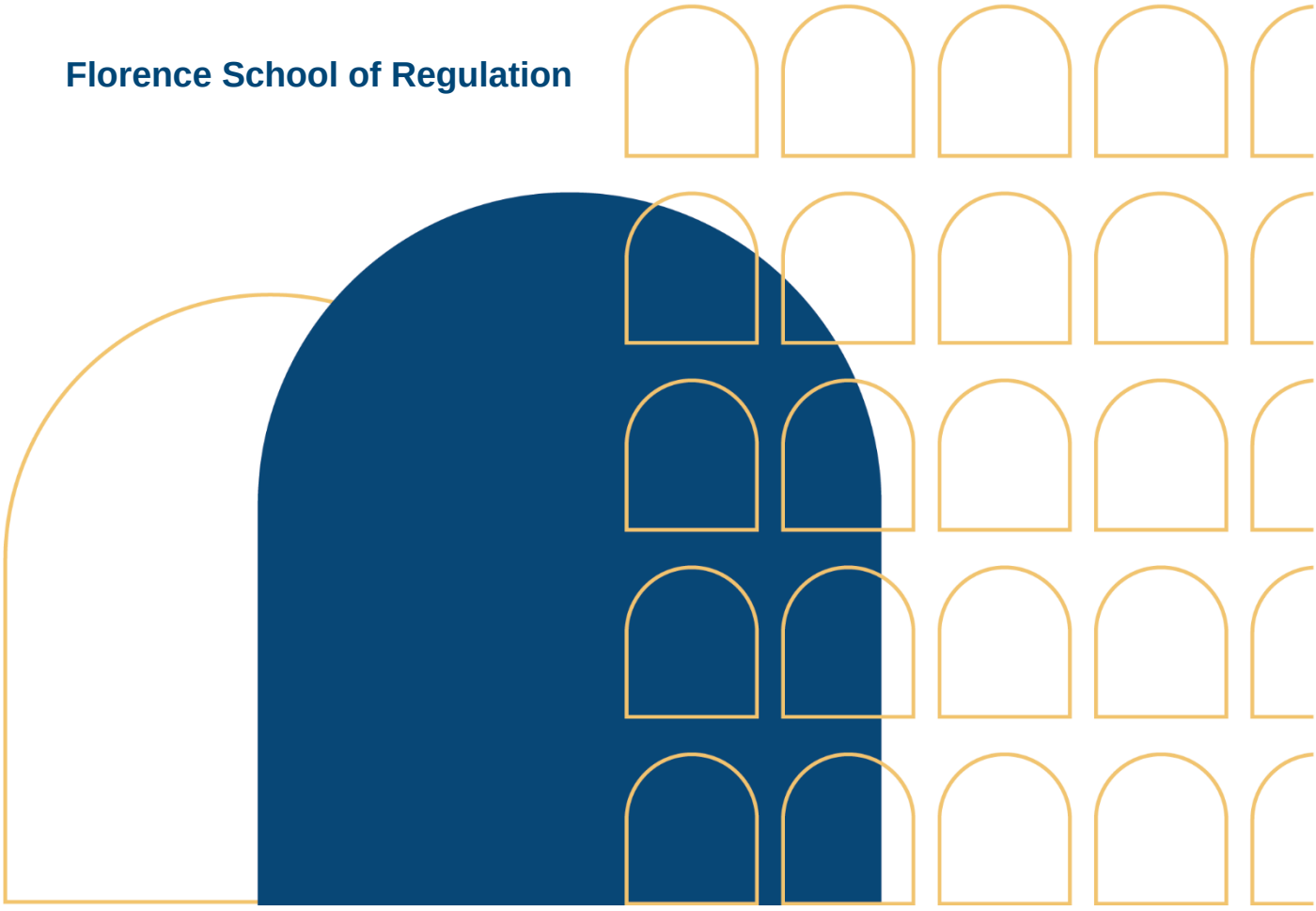
Benefit-based incentive regulation to promote efficiency and innovation in addressing system needs

Florence School of Regulation



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Benefit-based incentive regulation to promote efficiency and innovation in addressing system needs

Florence School of Regulation

Final Report

June 2023

1. Introduction

The EU Agency for the Cooperation of Energy Regulators (ACER) commissioned the Florence School of Regulation (FSR) at the European University Institute to outline a benefit-based incentive scheme for (electricity) transmission infrastructure and present its main features at the Copenhagen Forum in June 2023.

The energy transition imposes new challenges, *inter alia*, to the networks, such as the impact of the integration of massive quantities of renewable energies, with the need for investments in new lines (and pipes) and of new processes and technologies. Here, the right adjustments and the implementation of incentives are needed to prepare the networks for their new and/or changed tasks.

The need to improve the current regulatory framework by considering benefit-based incentive schemes was already signalled by ACER in its Position Paper of November 2021[1]. In that Paper, ACER took stock of the results presented in a report commissioned by the European Commission[2] and two Status Review Reports from the Council of European Energy Regulators (CEER)[3], assessing the way in

[1] ACER (2021), *Position on incentivising smart investments to improve the efficient use of electricity transmission assets*, November 2021, available at: https://acer.europa.eu/Official_documents/Position_Papers/Position%20papers/Position%20Paper%20on%20infrastructure%20efficiency.pdf.

[2] European Commission, Directorate General for Energy, *Do current regulatory frameworks in the EU support innovation and security of supply in electricity and gas infrastructure?*, March 2019, available at: https://op.europa.eu/en/publication-detail/-/publication/6700ba89-713f-11e9-9f05-01aa75ed71a1/language-en/format-PDF/source-96288082.

[3] CEER (2020), *CEER Status Review Report on Regulatory Frameworks for Innovation in Electricity Transmission Infrastructure*, Ref: C20-INF-74-03, 27 October 2020, available at: https://www.ceer.eu/documents/104400/-/-/8c2aace7-5601-8723-4d45-337073af38d5; CEER (2020), *Status Review Report on Regulatory Frameworks for Innovation and Security of Supply in Gas Transmission Infrastructure*, Ref: C20-GI-63-03, 21 December 2020, available at: https://www.ceer.eu/documents/104400/7006065/Status+Review+Report+on+Regulatory+Frameworks+for+Innovation+and+Security+of+Supply+in+Gas+Transmission+Infrastructure+-+21+December+2020/dee0bbd8-59db-0992-574a-94cede1623ff.

which the current regulatory framework stimulates innovation. On the basis of the results presented in these documents and of its own assessment, ACER concluded that there are two aspects of the current regulatory setting in need of improvements:

- the capital expenditure (CAPEX) bias, which is the result of differences in the regulatory treatment of operational expenditure (OPEX) and capital expenditure, creating a favourable environment to invest in CAPEX-heavy solutions; and
- the lack of incentives for TSOs to opt for cheaper solutions, including those at minimal cost.

The need to improve the regulatory approach to incentivise the most efficient use of the transmission (and distribution) system(s) – rather than the current bias towards CAPEX – is also identified by the Commission in its proposal to improve the Union's electricity market design of March 2023[4]. More specifically, in Recital (22), the Commission stresses that "*Network tariffs should incentivise transmission and distribution system operators to use flexibility services through further developing innovative solutions to optimise the existing grid and to procure flexibility services, in particular demand response or storage. For this purpose, network tariffs should be designed so as to take into account the operational and capital expenditures of system operators or an efficient combination of both so that they can operate the electricity system cost-efficiently. This would further contribute to integrating renewables at the least cost for the electricity system and enable final customers to value their flexibility solutions*." As a result, the following amendments to Regulation (EU) 2019/943 are proposed (emphasis added):

- article 18(2): "*Tariff methodologies shall reflect the fixed costs of transmission system operators and distribution system operators and shall consider both capital and operational expenditure to provide appropriate incentives to transmission system operators and distribution system operators over both the short and long run, including anticipatory investments, in order to increase efficiencies, including energy efficiency, to foster market integration and security of supply, to support the use of flexibility services, efficient investments including solutions to optimise the existing grid and facilitate demand response and related research activities, and to facilitate innovation in the interest of consumers in areas such as digitalisation, flexibility services and interconnection*."
- article 18(8): *"Transmission and distribution tariff methodologies shall provide incentives to transmission and distribution system operators for the most cost-efficient operation and development of their networks including through the procurement of services. For that purpose, regulatory authorities shall recognise relevant costs as eligible, shall include those costs in transmission and distribution tariffs, and shall introduce performance targets in order to provide incentives to transmission and distribution system operators to increase efficiencies in their networks, including through energy efficiency, the use of flexibility services and the development of smart grids and intelligent metering systems."*

In its Position Paper, ACER also mentioned that:

- despite the fact that the majority of TSOs have already deployed innovative solutions in most fields of their work, the implementation of innovative investments is still not extensive enough to unlock their entire potential to network users and society in general;

[4] Proposal for a Regulation of the European Parliament and of the Council amending Regulations (EU) 2019/943 and (EU) 2019/942 as well as Directives (EU) 2018/2001 and (EU) 2019/944 to improve the Union's electricity market design, Strasbourg, 14.3.2023 COM/2023/148 final.

- on the basis of its survey of TSOs and national regulatory authorities (NRAs), 35% of the responding NRAs indicated that they deploy monetary incentives to their regulated TSO(s) for advanced and innovative solutions that reduce total expenditures (TOTEX) compared to traditional solutions achieving the same benefit;
- as the TSOs' expected profit is many times higher for a conventional infrastructure investment (e.g. an overhead line) compared to an innovative solution achieving the same benefit (e.g. dynamic line rating), the profit gap seems too wide for existing incentives to bridge it. In one example provided in the ACER survey, the return on capital was more than seven times higher for conventional infrastructure investment than for innovative solutions.

In the Position Paper, ACER identified two dimensions of the preference of TSOs for network investments vis-à-vis lower-cost, operational solutions:

- as already mentioned, CAPEX and OPEX are typically treated differently from a regulatory perspective. Incentive-based regulation is typically applied to OPEX, with the regulated company expected to improve the efficiency of its operations according to a predefined factor (the 'X factor' in the most commonly used 'RPI-X' approach). If the regulated company beats the predefined efficiency target, it can obtain higher margins; however, the company always runs the risk of under-performance and therefore lower or negative margins. Instead, 'rate of return' or 'cost-plus' regulation is typically applied to CAPEX; this means that, once the new investment is approved by the regulator and included in the Regulatory Asset Base (RAB), the regulated company is guaranteed recovery of the investment, including an appropriate return on the invested capital. Therefore, the larger the investment, the higher the allowed return-on-capital allowance, which means that higher-cost solutions generate larger profits;
- investing into smart, innovative solutions, which increase the (efficient) use of existing assets typically leads to an increase of the utilisation of the system, approaching its actual physical limits. In these circumstances, more attention to all system parameters (i.e. further sophisticating the system operator tasks) is required. The resulting increased risk of faults and the need to mitigate them further discourage TSOs from implementing efficiency-oriented solutions.

On the basis of the above considerations, ACER concludes that the attractiveness of innovative solutions, which are usually of lower (total) costs and often more OPEX intensive, is currently far from optimal for the TSOs and needs to be adequately increased.

To address these issues, ACER proposes to link incentives to measurable benefits. In their views, this should guarantee that innovation is focused where its effects are determinable. According to their proposal:

- such incentives should be set in a way to ensure the investment's value to the network user (i.e. not increasing the overall electricity cost);
- the rules and parameters to set the incentives should be defined *ex-ante* to avoid any potential dispute and to allow predicting the economic impacts and, as far as feasible, avoid exogenous parameters impacting the results;
- TSOs would then get, as an incentive, a share of the monetised benefits the investment brings to society. Such a reward would be paid to the TSO *ex-post*, i.e. after the benefits are achieved (e.g. increased congestion income or reduced energy not served);
- such incentives should be reassessed over time and the new performance level, once structurally achieved, should become a standard expectation, at which time the benefit sharing would stop.

An additional aspect, beyond those identified by ACER, which could be addressed by an improved incentive scheme for (electricity) transmission infrastructure, is the timely implementation of projects, to avoid delays in delivering benefits to EU energy consumers.

A few considerations seem relevant with respect to ACER's proposed approach.

- While ACER refers to the opportunity of introducing benefit-based incentive regulation, most of the highlighted issues concern costs and the way in which they are allowed and rewarded under the current regulatory framework.
- A comparison between costs and benefits is the regular and traditional regulatory test for any investment or process in a regulated environment. The regulator should be satisfied that any investment or process proposed or undertaken by the regulated entities, and which is paid through the allowed revenues recognised to such entities, delivers positive net benefits to consumers, present and future.
- It is however often true that benefits are more difficult to identify and uncertain, as they depend on the future state of the world and of the system, and therefore are more difficult to estimate and monetise. Costs are typically easier to define. However, in approving new investments or processes, and the related allowed revenues, regulators can limit themselves to assess whether benefits exceed costs; they do not need to come to a precise assessment of the level of net benefits (unless financial constraints require some sort of ranking of investments and processes based on their net benefits).
- At some stage, the regulators should 'take a view' as to the beneficial nature of the proposed investment or process and approve it. At that point, the costs of the proposed investment or process are included in the allowed revenues, as depreciation and return on capital, in the case of investments, and/or as allowed revenues to cover OPEX, in the case of processes. In this way, the TSO(s) would have a cost-recovery guarantee and the risk of the world turning in a way of making the investment or process no longer beneficial is transferred from the TSO(s) to the system. Leaving such a risk with the TSO(s) would increase the cost of capital[5]. The system is better placed to absorb such a risk.
- It seems to be too strict a regulatory approach to focus only on those system needs where benefits are easily quantifiable and monetizable. There might be other system needs which, if addressed, would be greatly beneficial for consumers, even though the benefits might not be easily quantifiable, let alone monetizable. However, these difficulties do not seem a good reason to neglect them.
- Since, as indicated above, benefits are difficult to estimate, translating them into a metric to define monetary incentives for the TSO(s) might be generally challenging. Moreover, ACER seems to suggest that the relevant benefits would be the one accruing *ex-post*. This would leave the above-mentioned risk – the risk of an investment becoming no longer 'used and useful' – with the TSO(s).
- Finally, there is an asymmetry of information between TSOs and regulator(s) and the latter would have heavily to rely on the former for the assessment of the benefits to be delivered by the different possible investments and processes. There might therefore be a propensity for TSO(s) to over-estimate the benefits if such an assessment were to be used for determining the level of monetary incentives awarded to them.

[5] It is true, though, that low-cost investments typically involve a limited risk and processes might have a low share of sunk costs.

Therefore, one could consider whether the same goal identified by ACER – i.e. promoting the most efficient solution to system needs, and not the most expensive investment –- could be achieved by avoiding reference to benefits, *ex-ante* or *ex-post*. Or, phrased it differently, whether the notion of 'benefits' to be used for this purpose could avoid the uncertainties highlighted above.

Against this background, the present report is structured in two further sections. In Section 2 we present the academic thinking regarding ways of promoting innovation at the electricity TSO level and overcoming the CAPEX bias; we also provide an overview of the experience of different European countries in this area. In Section 3 we outline a proposal for an incentive-based regulatory scheme that pursues ACER's objectives, as well as promoting the timely implementation of the investment and processes which address the identified system needs.

2. Academic thinking and international experience

The promotion of innovation and the adoption of new, and possibly less CAPEX-intensive, solutions by electricity network companies constitute an important field of research. Various academic contributions recognise the decline in R&D-related expenditures by European network companies after the liberalisation of the electricity sector and the conservative approach of network companies towards the deployment of more innovative solutions[6]. Although various factors may play a role in the decisions of network companies with regard to innovation, scholars agree on the importance of the regulatory framework for electricity networks in explaining this 'cautious' attitude towards innovation[7]. By framing the way network companies are remunerated for the services they provide, regulation inevitably favours the selection of certain solutions over other ones. Classical in this regard is the so-called Averch-Johnson (A-J) effect[8]. Although empirical evidence is less clear-cut and regulatory practice is generally more sophisticated than what represented in the basic mathematical formulation of the model[9], the A-J effect suggests that it is rational for a profit-maximising regulated company to spend more on capital than what would be efficient, whenever the company is guaranteed the recovery of its costs and a return on the invested capital. As a result of that, in case the regulated company is subject to a cost-plus or rate of return regulatory framework, it will use more capital and

[6] A seminal paper on the matter is Bauknecht D. (2011), 'Incentive regulation and network innovation', *EUI Working Paper*, RSCASC 2011/02. For a more recent overview with an important list of references, see Jamasb T., M. Llorca, L. Meeus and T. Schittekatte (2023), 'Energy network innovation for green transition: economic issues and regulatory options', *Economics of Energy and Environmental Policy*, Vol. 12, No. 1.

[7] Glachant J.-M. (2021), 'New business models in the electricity sector', in J.-M. Glachant, P. Joskow and M. Pollitt (ed. by), *Handbook on Electricity Markets*, Edward Elgar Publishing: Cheltenham, UK, pp. 443-462. Some empirical evidence from 12 European countries is provided by Biancardi A., M. Di Castelnuovo and I. Staffel (2021), 'A framework to evaluate how European Transmission System Operators approach innovation', *Energy Policy*, 158, 112555. The authors of this paper find a correlation between the involvement of electricity TSOs in innovative projects and the extent to which the national regulatory framework is favourable, neutral or not favourable to innovation. Where the regulatory framework is favourable to innovation, TSOs tend to be more active in innovative projects and test more disruptive technologies. Nonetheless, the same authors highlight the need for more empirical research on the matter.

[8] Averch J. and L. Johnson (1962), 'Behavior of the firm under regulatory constraint', *American Economic Review*, Vol. 52, No. 5, pp. 1052-1069.

[9] Joskow P. and R. Noll (1981), 'Regulation in theory and in practice: an overview', in G. Fromm (ed. by), *Studies in Public Regulation*, MIT Press: Cambridge, Massachusetts, pp. 10-14.

less labour (or other factors involving operating costs) than what the most cost-effective combination would entail.

Different incentive mechanisms have been proposed and discussed in order to foster innovation and remove the CAPEX bias[10]. In this context, it is generally argued that the choice of the best mechanism to promote innovation depends on the specific type of activity that the regulator or the public authority wants to target. Indeed, the promotion of innovation can be interpreted as a set of different tasks with different characteristics from a regulatory perspective, in particular with regard to the level of uncertainty and observability of its outcomes. Innovation whose outcome is more uncertain and less observable is more suitable to be promoted via public grants and cost pass-through, which ensure the recovery of the cost borne by the network company. On the contrary, the mass deployment of more mature innovative technologies can be promoted via incentive mechanisms that can be either input or output-based. An extra-remuneration of the capital invested in an innovative solution belongs to the first category, while a set of rewards and penalties based on the achievement of a certain performance, such as the increase in the network hosting capacity in a given area, belongs to the second category. The choice between input- and output-based mechanisms can be justified on the basis of the relative observability of inputs and outputs. Irrespective of this choice, the regulator requires important resources to be able to set the parameters of the incentive mechanism properly, a condition that cannot be given for granted, especially for the smaller and less well-funded regulators[11].

Regulatory practice in Europe has been gradually evolving over the past years and national regulators have tested various approaches to promote innovation and address the CAPEX bias.[12] Among the solutions considered, there is the move away from separate CAPEX and OPEX regulation, and the adoption of the so-called TOTEX approach, whereby both capital and operational expenditures are subject to the same regulatory treatment. In the context of the regulation of distribution system operators, CEER, in its 2018 Conclusion Paper[13], recognised the advantage of the TOTEX approach, as it "*incentivises companies to choose the most efficient combination of resources to achieve several regulatory aims, which could be less capital-intensive innovative expenses (higher OPEX in the short term) instead of network investments*" and, in fact, proposed a "*technology-neutral approach towards innovative solutions, that may be hindered, inter alia, by different treatment of costs*". In this regards, CEER suggested that regulators "*consider, where feasible, an output-based approach for setting incentives, because this approach has the advantage of considering what is important to customers letting DSOs free to find optimal solutions*" and "*adopt a whole system approach*" (WSA). The latter involves distribution system operators considering the societal net benefit for the entire system, being encouraged to take into account consequences of their decisions on other actors of the value chain

[10] Beyond the already mentioned contribution by Jamasb et al. (2023), see, among others, Poudineh R., D. Peng and S. R. Mirnezami (2020), 'Innovation in regulated electricity networks: incentivizing tasks with highly uncertain outcomes', *Competition and Regulation of Network Industries*, Vol. 21, No. 2.

[11] As a result of that, the choice of the best regulatory tool in a certain context depends on both the characteristics of the regulated task and the characteristics of the regulator. See Rious V. and N. Rossetto (2018), 'Continental incentive regulation', in L. Meeus and J.-M. Glachant (ed. by), *Electricity Network Regulation in the EU: The Challenges Ahead for Transmission and Distribution*, Edward Elgar Publishing: Cheltenham, UK, pp. 28-54.

[12] Lo Schiavo L., M. Delfanti, E. Fumagalli and V. Olivieri (2013), 'Changing the regulation for regulating the change: Innovation-driven regulatory developments for smart grids, smart metering and e-mobility in Italy', *Energy Policy*, Vol 57, pp. 506-517.

[13] CEER, *Incentives Schemes for Regulating Distribution System Operators, including for innovation, Conclusion Paper*, Ref: C17-DS-37-05 19 February 2018, available at: https://www.ceer.eu/documents/104400/-/-/1128ea3e-cadc-ed43-dcf7-6dd40f9e446b.

and possibly being rewarded by these other actors if these decisions benefit them. The Conclusion Paper also described the TOTEX approach adopted in the UK and Germany, but other regulators have experimented with this type of approach as well.

However, the latest CEER Report on Regulatory Frameworks for European Energy Networks[14] confirms the persistently different regulatory treatment of OPEX and CAPEX. In fact, "*a majority of CEER regulators in electricity and gas focus on cost saving on the OPEX side*". More than 50% of European NRAs who took part in the CEER annual survey apply an X factor to the allowed revenues to cover OPEX, while efficiency requirements on CAPEX are applied only by 20% of the respondent NRAs[15]. Looking more specifically at the case of electricity transmission, a survey conducted by ACER at the beginning of 2023[16] reveals that only Portugal, among the 25 EU Member States who answered the survey, applies (since 2022) the TOTEX approach. Italy will introduce this approach in multiple phases from 2024 onwards, while Sweden is considering a potential transition towards a TOTEX regulation in the future. The other countries regulate separately CAPEX and OPEX, although often under a similar regime, that is by applying to both of them either a form of cost-plus/rate of return regulation or a form of incentive regulation, typically a revenue or price cap. The survey by ACER also confirms that *"in several Member States the TSOs receive benefit-based incentives (including penalties and rewards) targeting one or more specific objectives, such as cost efficiency, energy efficiency, market integration, security of supply, innovation, RES integration, etc."*. These incentives, which come on top of the economic regulation of productive inputs and the risk-mitigation mechanisms that such regulation provides, usually take the form of a higher return or bonus for high-value investments or the form of a reward/penalty for the over-/under-performance of a specific target set in advance. This target can be linked to the cost of a certain project or more directly to the benefits that such project is expected to generate for the system.

An assessment of these national experiences, which would require the careful consideration of all the interdependent and interacting elements of the regulatory framework in order to derive general conclusions or identify some lessons learnt, goes beyond the scope of this document. An overview of the RIIO approach in Great Britain and the premium for the expansion of the cross-zonal transfer capacity in Italy will suffice to give a flavour of current developments in regulatory practice.

The introduction of 'Revenue = Incentives + Innovation + Outputs' (RIIO) in Great Britain was heralded in 2010 as a major revolution in the economic regulation of energy networks, which was necessary to

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[14] CEER (2023), *Report on Regulatory Frameworks for European Energy Networks 2022*, Ref: C22-IRB-61-03 19 January 2023, available at: https://www.ceer.eu/documents/104400/-/-/2a8f3739-f371-b84f-639e-697903e54acb.

[15] More specifically, at the electricity TSO level, incentives that improve the interconnection between separate countries play an important role. For both electricity and gas TSOs, incentives for a better quality and security of supply are also applied. The CEER Report mentions the examples of Finland and Spain. In Finland, the quality incentive is based on "*a quality bonus method in which rewards and sanctions are defined on fixed steps, and where undelivered energy is used as a quality indicator. Annual undelivered energy is benchmarked against the TSO's reference level, which is determined by undelivered energy over eight years. The target level and upper and lower quarters determining rewards and/or sanctions are derived from the reference level*". In Spain, the regulatory framework applicable to electricity TSOs includes "*incentives not to exceed investments eligible for remuneration, incentives to promote adequate economic and financial capacity, suitable capitalisation and a sustainable debt structure, and incentives to extend the useful remuneration lifetime of assets in order to avoid incurring unnecessary investment costs in the electricity system*."

[16] ACER (2023), *Report on Investment Evaluation, Risk Assessment and Regulatory Incentives for Energy Network Projects*, June 2023, available at: https://acer.europa.eu/Publications/ACER_Report_Risks_Incentives.pdf.

deliver value for network users and support the transition to a decarbonised energy system[17]. RIIO addresses the CAPEX bias by implementing a TOTEX-based approach to the calculation of allowed costs. Independently from the actual expenditures of the regulated company, a fixed share of the total cost, set *ex-ante* by the regulator, is treated as CAPEX and contributes to the formation of the RAB, while the rest is treated as OPEX and remunerated within the book year[18]. In addition to the move away from a differentiated treatment of CAPEX and OPEX, RIIO departs from the classical input-based regulation towards a more output-based regulation, where the remuneration of the network companies is linked, to a more significant extent than in the past, to the achievement of certain outputs, to which benefits for the system and for network users are associated.

In 2021, RIIO-1 for electricity transmission came to an end and a new regulatory period started (RIIO-2). Early assessments of the results of RIIO-1 somewhat downsize the revolutionary nature of the regulatory reform and highlight the difficulties that have emerged in its implementation[19]. First, it is clear that the departure from the traditional input-based regulation has been much smaller than anticipated. The vast majority of the revenues of the network companies are still linked to the remuneration of the capital invested on the basis of a rate of return defined by the regulator and an *ex-ante* approved investment plan. The total value of the output-based rewards still represents a small fraction of the overall revenues. Second, early assessments of RIIO-1 suggest that the outputs to be used to regulate network companies are difficult to evaluate precisely, especially in a highly dynamic context, and that regulated companies generally have easily achieved the targets, getting higher than expected returns. Moreover, the adoption of multiple targets may have reduced global efficiency, as it has introduced multiple constraints in the equalisation of marginal costs and benefits. Third, the complexity of RIIO has not significantly reduced the information asymmetry which penalises the regulator, while diminishing the transparency of the regulatory framework and the possibility to learn important lessons and ensure incremental improvements of the regulatory framework itself over time; separating the effects of the various schemes and taking into account all their interactions is a difficult and burdensome task. Finally, the long duration of the regulatory period (eight years) has made any forecasting exercise by the regulator and the same network companies more difficult and uncertain, thereby increasing the risk of over- or under-incentivising the network companies.

Italy has introduced output-based regulation for electricity transmission in 2015[20]. Among the outputs identified by this new regulatory framework, there is the increase of the cross-zonal transfer capacity

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[17] See https://www.ofgem.gov.uk/energy-policy-and-regulation/policy-and-regulatory-programmes/network-price-controls-2013-2023-riio-1. For an overview of the evolution of the regulatory framework in Great Britain, see Rious V. and N. Rossetto (2018), 'The British reference model', in L. Meeus and J.-M. Glachant (ed. by), *Electricity Network Regulation in the EU: The Challenges Ahead for Transmission and Distribution*, Edward Elgar Publishing: Cheltenham, UK, pp. 3-27.

[18] The properties of a 'fixed OPEX-CAPEX share' (FOCS) have been investigated with the use of formal models, confirming its usefulness to address the CAPEX bias when CAPEX and OPEX are substitute and OPEX-intensive activity represents a source of additional risks for the regulated company. See Brunekreeft G. and M. Rummersdorfer (2020), 'OPEX-risk as a source of CAPEX-bias in monopoly regulation', *Competition and Regulation of Network Industries*, Vol. 21, No. 1.

[19] See Brunekreeft G., J. Kusznir, R. Meyer, M. Sawabe and T. Hattori (2020), 'Incentive regulation of electricity networks under large penetration of distributed energy resources – selected issues', *Bremen Energy Working Papers*, No. 33; Jamasb T. (2021), 'Incentive regulation of electricity and gas networks in the UK: from RIIO-1 to RIIO-2', *Economics of Energy & Environmental Policy*, Vol. 10, No. 2. Particularly critical with the outcomes of the reform is Thomas S. (2023), 'A perspective on the RIIO formula: Old wine in new bottles', *Utilities Policy*, 80, 101450.

[20] See https://www.arera.it/it/schedetecniche/15/653-15st.htm (in Italian only).

that the TSO makes available to market parties. In order to promote in a cost-efficient manner the integration of the various market zones, both within Italy and cross-border, two dedicated incentives are offered, on an experimental basis and until the end of 2023, to the TSO. On the one hand, the TSO is rewarded if it is able to expand the transfer capacity up to a certain level, which has been approved by the regulator on the basis of an assessment of the system needs and technical studies conducted by the TSO. On the other hand, the TSO receives a further reward if the solution adopted is 'capital-light', that is if it entails a smaller capital expenditure than a reference value set by the regulator for each border. By implementing a series of capital-light solutions, such as new protection schemes and dynamic line rating, in 2020the Italian TSO was able to increase the cross-zonal transfer capacity by 1450 MW at very low cost (roughly 5.5 million euro), generating an expected benefit for the system of more than one billion euro. Based on these results, the Italian regulator has awarded a premium of roughly 143 million euro: 103 million linked to the increase of the transfer capacity and 40 million euro linked to the use of capital-light solutions[21].

3. A possible way forward

As discussed in Section 1, while ACER, in its Position Paper, suggested that, especially for low-cost investments, the CAPEX bias could be addressed by benefit-based incentive regulation, most of the issues highlighted in that Paper concern costs and the way in which they are allowed under the current regulatory framework. We have also commented on the uncertainty generally surrounding the valuation of benefits and the difference between the role that they play in the typical 'positive-net-benefit' regulatory test and the more precise valuation which would be required if monetary incentives for system operators were to be based on benefits.

Therefore, what we propose, to overcome the CAPEX-bias, is a scheme which focuses on total cost minimisation, in particular through innovative solution, in addressing system needs. The scheme could be outlined as follows.

- The regulator identifies the system needs to be addressed. This should be a general rule, as new investments or processes should always aim at addressing an identified need[22]. The TSO may bring the need to the attention of the regulator, but it is ultimately the latter that should confirm it.
- The regulator defines a standard efficient way of addressing each identified system need or set of needs. The consideration of sets of needs recognises the fact that some of such needs could be interlinked, and addressing them as a set could be done at lower costs than aiming at the same needs separately.
- The regulator would then come up with the costs related to the standard efficient way of addressing the need or set of needs and the period over which the corresponding allowed revenues would be awarded[23]. These costs would include OPEX and CAPEX.

[21] See https://www.arera.it/it/docs/22/023-22.htm (in Italian only).

[22] In the output-based or performance-based regulation, system needs are typically framed in terms of measurable output or performance. In the proposed scheme we prefer the more general reference to system needs.

[23] This could be according to the standard regulatory practices, for example of allowed revenues to cover CAPEX to be awarded for the length of the economic life of the assets.

- The regulator would also require the TSO(s) to come up with a more efficient way of addressing the need(s), together with an estimate of the associated costs, which is presented to the regulator and is endorsed by it.
- Allowed revenues would then be set to:
    - cover the costs of the TSO's proposed, more efficient solution, as defined by the TSO in advance and approved by the regulator;
    - include an incentive, represented by a share of any positive difference, in net present value terms (NPV), between the cost associated with the standard efficient way of addressing the need(s) identified by the regulator and the cost of the preferred way identified by the TSO(s), where this difference is assessed over a time horizon equal to the economic life of the longest-living asset in the standard efficient way of addressing the system need(s).

  Allowed revenues would be capped at the cost of the standard efficient way of addressing the need(s) identified by the regulator.

If the regulator also wants to incentivise the timely deployment of the new investments or processes, the scheme could be calibrated so that the incentive is reduced in case of delays in commissioning the new investments or in implementing the new processes.

Algebraically, for each system need or set of needs, the approach can be described as follows:

(1) $allowed\ revenues\ (in\ NPV\ terms) = Min\ (C, C^*) + \alpha\ Max\ [(C^* - C), 0]$,

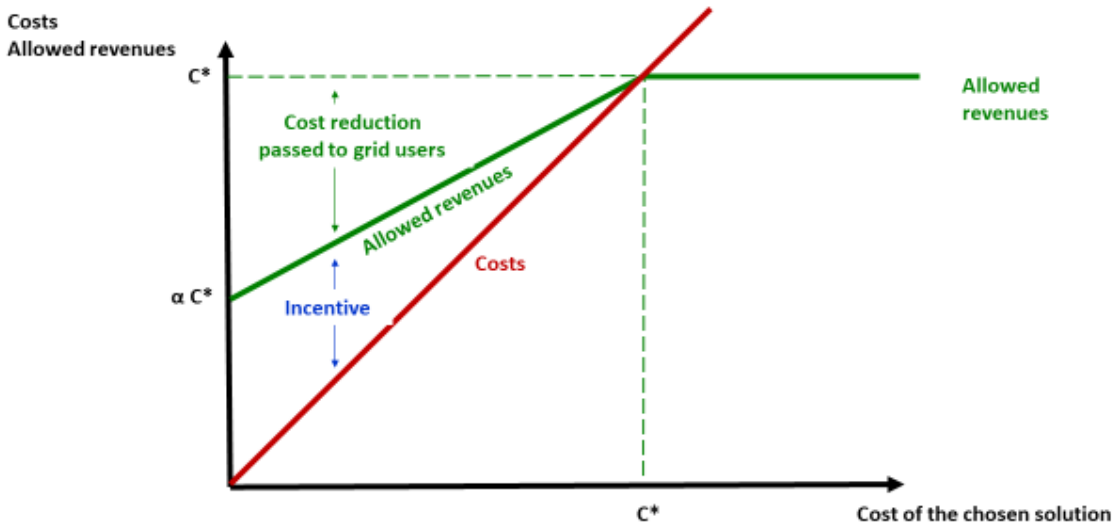
where C* is the NPV of the total cost of the standard efficient way of addressing the system need or set of needs, C is the NPV of the total cost of the more efficient way of addressing the same need or set of needs as proposed by the TSO(s), and α is a benefit sharing factor, with $0 < \alpha < 0$. The higher the value of α, the larger is the incentive for the TSO(s) to identify more efficient ways of addressing the need or set of needs.

If $C < C^*$, i.e. the more efficient way to address the need or set of needs proposed by the TSO(s) is cheaper than the traditional way, then formula (1) can be simplified as follows:

(2) $allowed\ revenues\ (in\ NPV\ terms) = C + \alpha(C^* - C)$.

The scheme can also be presented graphically, as in Figure 1.

Figure 1 – the TSO costs and allowed revenues according to the proposed scheme



The cost of the more efficient solution proposed by the TSO(s) is measured on the horizontal axis. The vertical axis shows the allowed revenues granted to the TSO(s) (the green line), split between the coverage of costs of the proposed solution (the red 45° line) and the incentive (the difference between the green line and the red line). It is clear that the lower the cost of the more efficient solution proposed by the TSO(s), the larger the incentive for the TSO(s).

With respect to the proposed scheme, it is worth noting that:

- The incentivising properties of the scheme crucially depend on:
    - the regulator defining in advance the standard efficient way of addressing the identified need(s) and the related costs and not adjusting them in response to the choices of the TSO;
    - the degree of benefit sharing determined by the regulator (the α factor).

  In particular, the higher the costs defined by the regulator for the standard efficient way of addressing the identified need(s) and the higher the share of the cost differential awarded to the TSO(s) as an incentive, the stronger the inducement for the latter to seek lower-cost, more efficient solutions.
- There are several similarities between the implementation features and challenges of the proposed scheme and those of other regulatory approaches, including the most traditional RPI-X approach. For example:
    - Identifying the standard efficient way of addressing each need or set of needs and the corresponding costs might be difficult, as it will be further commented below, but it is somewhat analogous to setting the allowed revenues at the beginning of a regulatory period in the more traditional RPI-X regulation.
    - The trade-off that the regulator faces in defining the cost-differential sharing factor (α) is similar, for example, to the trade-off – between stronger incentives for the regulated entities to improve their efficiency and the delay with which consumers benefit from the resulting efficiency gains – the regulator faces in many 'profit-sharing'

regulatory approaches or in determining the length of the regulatory period in the more traditional RPI-X regulation.

- Awarding the TSO higher allowed revenues than the actual *ex-post* cost of addressing the need(s) could attract criticism ('why should TSOs be incentivised to do their job?'), but it is analogous to leaving any cost saving beyond the X factor to the TSO until the end of the regulatory period in the traditional RPI-X approach.

- As with other incentive-based approaches, such as RPI-X regulation, the proposed scheme could also be used to prompt TSOs to reveal the most efficient way of addressing the identified needs. Eventually, this way may become the standard efficient way of addressing the need used as a reference by the regulators in subsequent regulatory periods.

In implementing the proposed scheme, the regulator would need to determine the following design features:

a) the system needs to be addressed by the TSOs. This is the starting point of any regulatory or planning approach;
b) the standard efficient way of addressing the identified need or set of needs. As already mentioned, this could be a very demanding and difficult task and not all regulators in the EU might be properly equipped to perform it. However, reference to the way in which similar needs were addressed in the past could be used to determine the standard efficient way of addressing each need or set of needs. Likewise, network planning might be used as a reference. TSOs may also assist regulators in such an identification, even though they might have an incentive to propose costlier solutions;
c) the allowed costs associated with such a standard way of addressing each of the needs or sets of needs. Standard unit costs for individual infrastructure assets provided by ACER could be used for this purpose;
d) the way in which the incentive would be defined, as a share of the cost-differential, and the way in which it will be paid to the TSO.

In relation to the last feature and as already indicated, it is proposed that the incentive is set equal to a share, to be determined in advance by the regulator, of any positive difference, in NPV terms and considering a time horizon equal to the economic life of the longest-living asset in the standard efficient way of addressing the need or set of needs identified by the regulator, between the cost of such a solution and the cost of the preferred way identified by the TSO.

Once the NPV of the incentive is defined in this way, there could be different time profiles according to which it is paid out to the TSO(s). At one end of the spectrum, the incentive might be paid at a higher rate over a shorter period of time. At the other end of the spectrum, it could be paid at a lower rate over a longer period of time. In deciding on the profile to be implemented, the regulator would be likely also to consider its impact on the tariffs paid by grid users[24], and might want to ensure that paying the incentive would not result in an increase of such tariffs[25].

[24] Transmission charges are typically a minor share of the overall tariffs paid by consumers, though.

[25] It is unescapable that the awarding of incentives to the TSO delays the moment in which consumers can benefit from the greater efficiency achieved by the TSO. However, the argument is usually made that incentivising TSOs to improve their efficiency delivers, over time, greater efficiency gains and, therefore, that consumers benefit more in this way.

The choice of the profile according to which the incentive is paid could also be left to the TSO(s). In particular, the TSO(s) could be presented with a menu of different profiles, all broadly equivalent in NPV terms, from which to choose.

The proposed scheme could be seen as belonging to the family of performance-based methods, since the system needs could be expressed in terms of performance indicators[26].

Moreover, while the proposed scheme does not use net benefits to set the incentives for the TSOs, thus avoiding the problem of having accurately to measure benefits, it could still be referred to as a benefit-based approach, as TSOs are incentivised to deliver greater net benefits to consumers, by reducing the costs of addressing the identified system needs.

There is however one case in which at least some of the benefits could be measured and, in fact, partly monetised accurately: it is through the congestion income in the case of the expansion of the interconnection capacity between different (neighbouring) market zones. A case could therefore be made, and it has been made, for TSOs to be rewarded by being assigned (a share of) the congestion income related to the additional interconnection capacity, delivered through investments in the network or changes in operational processes. However, the congestion income might be quite variable, from one period to the next, depending on the price differential between the two zones, and therefore, in this case, TSOs would be exposed to the risk that their incentivising reward ends up being lower than expected. It is far from obvious that TSOs are the parties best placed to absorb this risk. It is true that if the incentive, in the form of (a share of) the congestion income, were paid over a short period of time, the risk might be limited[27]. However, in general, it might be better to incentivise the TSOs through the sharing of the benefits in terms of lower costs of the chosen solution to address the system needs. Such a benefit would be under the control of the TSOs to a much greater extent and directly linked to their actions.

Always in connection with the use of the congestion income to incentivise TSOs, the point has been made that this approach would provide incentives to the TSOs without resulting in higher tariffs for consumers. While the argument might have some communication appeal, it is of all evidence that such a use of the congestion income prevents or delays, *ceteris paribus*, the congestion income being passed on to consumers (in terms of lower tariffs or through the financing of other activities which otherwise would have to be covered by tariffs[28]).

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[26] As an example, a system need might be defined as connecting a certain capacity of renewable-based generation over a geographical area. This can also be seen as an indicator of performance, or output.

[27] As the price differential between market zones is easier to predict over a shorter horizon.

[28] According to Article 19(2) and (3) of Regulation (EU) 2019/943 of the European Parliament and of the Council of 5 June 2019 on the internal market for electricity, the congestion income shall be used, primarily, to guarantee the actual availability of the allocated capacity and for maintaining or increasing cross-zonal capacities through optimisation of the usage of existing interconnectors by means of coordinated remedial actions, where applicable, or covering costs resulting from network investments that are relevant to reduce interconnector congestion. To the extent that the above priority objectives have been adequately fulfilled, the congestion income may be used as income to be taken into account by the regulatory authorities when approving the methodology for calculating network tariffs or fixing network tariffs, or both. In the proposal to amend Regulation (EU) 2019/943, presented on 14 March 2023 (COM(2023) 148 final), the European Commission envisaged the use of congestion income also for "*compensating offshore generation plant operators in an offshore bidding zone if access to interconnected markets has been reduced in such a way that one or more transmission system operators have not made enough capacity available on the interconnector or the critical network elements affecting the capacity of the interconnector, resulting in the offshore plant operator not being able to export its electricity generation capability to the market*".