

European Electricity Transmission Grids and the Energy Transition

Why remuneration frameworks need to evolve



European Network of
Transmission System Operators
for Electricity



About ENTSO-E

ENTSO-E, the European Network of Transmission System Operators for Electricity, represents 42 electricity transmission system operators (TSOs) from 35 countries across Europe. ENTSO-E was registered in European law in 2009 and given legal mandates since then.

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Executive Summary

The present ENTSO-E discussion paper provides an updated recommendation on ENTSO-E's 2015 position paper “Fostering Electricity Transmission Investments”. It is based on the current and future commitments European electricity Transmission System Operators (TSOs) are eager to undertake to make the energy transition a success. The paper highlights the challenges which TSOs are increasingly facing, and the barriers to effectively tackle those challenges posed by currently applied remuneration models. While recognising individual differences across countries, the paper also proposes solutions to allow TSOs to be valuable enablers of the European Green Deal.

Transmission investments are the backbone of the EU Green Deal Strategy

European TSOs are currently engaged in an unprecedented transition in their tasks and duties as they operate in an increasingly complex, digitalised, decentralised, volatile and uncertain environment. This evolution of tasks and challenges is a key building block to achieving the goals of the European Commission's ambitious EU Green Deal.

Currently, most European regulatory frameworks only remunerate capital-related activities. Non capital-related activities – those aimed at system management and market development – are covered at cost in most regulations. These TSO activities will become essential for unlocking the potential of the energy transition, but they also carry increased uncertainties and risks compared to today's situation. Indeed, sustained innovation and the development of digital solutions are required in order to:

- › Provide a level playing field and incentives for innovation to maximise the flexibility available to the system while ensuring security of supply;
- › Enable the integration of considerable amounts of renewable energy resources, empower consumers and encourage new end-uses;
- › Develop breakthrough solutions, creating added value for market participants across Europe; and
- › Deliver on the ambitious decarbonisation goals by placing the electricity system at the core of the transition, away from fossil fuels.

Therefore, these solutions must be encouraged and adequately remunerated. TSOs are eager and ready to take on the challenges they face as one of the most important enablers of this energy transition because it is essential to our customers – the European Society – today and tomorrow. To this end, the regulatory framework should be made fit for purpose.

TSOs will need to continue investing substantially in traditional transmission grid assets, with the aim of further integrating renewable energy resources, increasing cross-border exchanges and strengthening the Internal Energy Market. Notably, the Ten-Year Network Development Plan (TYNDP) 2020 considers over 46 000 km of additional cables and lines that require building until 2035. To finance these vast investments, remuneration of capital is still a main pillar for the TSO business model to access equity and debt, while keeping an excellent credit rating and cheap debt, to generate cash flows and plough back equity into the company while maintaining affordable tariffs for grid users and keeping the transmission business viable for the future.

An updated approach to remuneration frameworks is required

Until now, National Regulatory Authorities (NRAs) have primarily aimed to reduce TSO costs and keep tariffs stable while providing a certain degree of incentive in their individual regulatory frameworks. Consequently, and due to the efficient management of costs by TSOs, grid tariffs have remained affordable, even though TSOs have carried out huge investment programmes. The significant increase of investment efforts projected for the next few decades to achieve climate neutrality by 2050 does however highlight the possible shortcomings of existing regulatory frameworks to adequately remunerate TSO activities. Such shortcomings are further exacerbated by artificially low and still decreasing risk-free rates on financial markets, which have the potential to endanger TSOs.

TSOs are regulated monopolies and their capital remuneration (debt and equity) is bound to the evolution of risk-free rates. Adequate regulated capital remuneration is necessary to maintain attractive financial ratios for debt investors and low debt rates, in increasing equity, to be able to achieve TSOs' investment programmes at low cost for grid users. With the current level of risk-free rates, there is a risk that TSO activities are no longer attractive in comparison to other non-regulated sectors and that TSOs may have difficulties raising sufficient affordable capital. This risk is leading to downgrades of individual company ratings, therefore raising the cost of debt borne by users, along with the increasing difficulty of effectively executing the necessary investment.

Performance and risk-taking are, more than ever, key to the ongoing energy transition

Although the basis remuneration for most TSOs only provides rewards for investment in physical assets, some regulators have complemented this with performance-based incentives, aiming to encourage efficient innovation, quality of service, and stakeholder involvement, to name but a few. These incentives, which can lead to rewards or penalties depending on how TSOs perform against pre-defined key performance indicators (KPIs), encourage more risk-taking behaviour, which is expected to result in tangible benefits for consumers.

Varying degrees of complexity in the design of incentives are available to regulators depending on the maturity of the regulation, the parties involved (TSOs, regulators and

stakeholders) and the amounts at stake. As such, the decision to incentivise more or fewer activities, and how to do so, should carefully follow deliberate considerations.

It is also important to consider the interrelationship between a meaningful incentive regulation and risk. Although TSOs benefit from a fairer output/profit balance with the introduction of incentives, they also face a higher risk. Consequently, models that include financial incentives – as far as they are not optional for the TSO – should always consider the higher risk level and reflect this in the basis remuneration (Weighted Average Cost of Capital [WACC] or Return on Equity [RoE]).

Proposed Solutions:

For the reasons set out above, TSOs are increasingly aware that changes to their respective regulatory frameworks might be required and, aware that particular challenges will soon materialise, suggest opening up a comprehensive discussion about the evolution of regulatory frameworks in the mid and long term. Clearly, such a debate has to consider the individual state of affairs in each country as the immediate need for evolution might vary. Nonetheless, it is widely acknowledged that the overarching objective must be to ensure:

- › Adequate remuneration for investments, such as:
 - determination of a lower bound (floor) of risk-free-rates or WACC/RoE
 - enlargement of the Regulatory Asset Base (RAB) for sustainability and decarbonisation measures
 - Remuneration for certain operational activities (e. g. market facilitation tasks), not just focusing on efficiency targets on operational expenditures (OPEX)

- › Adequate setting of incentives for innovation and performance, such as:
 - budgets for innovation exempted from cost incentives
 - WACC adder for selected, well-defined projects considered of outstanding importance
- › Alignment of incentives with regulators' long-term vision, to provide greater investment predictability for TSOs.
- › A regulatory system adaptable to an ever-evolving environment

Proposals for such adjustments and potential solutions have already been initiated by certain TSOs ("Better Projects" by Amprion or "FOCS" by TenneT) and should be further discussed with European regulators.

Structure of the Paper

The paper is structured as follows:

Chapter 1 highlights the current and future mandates of European TSOs. TSOs are eager to provide their knowledge & skills to enable the transformation required for the European Green Deal.

Based on that analysis, Chapter 2 concludes that TSOs need an adaptable, adequate, fit for purpose and flexible remuneration framework which enables investment but also sets adequate long-term incentives for performance & innovation to achieve the transformation of the energy system.

To enable a better understanding of the current limitations, Chapter 3 explains in more detail how the current capital and risk remuneration might hinder TSOs' investment plans, in the sense that insufficient TSO remuneration will likely prevent the building up of necessary equity & investor remuneration.

Chapter 4 concentrates on the need to incentivise and remunerate TSOs' additional non-capital-intensive tasks and responsibilities. An adequate remuneration in a mature regulation should also be based on performance and relevance to Society.

Finally, Chapter 5 concludes by offering a toolkit of proposed solutions.

1 Electricity Transmission System Operators tasks and challenges

1.1 The Green Deal and TSOs as enablers of the European energy transition and economic recovery

The European Green Deal, with its ambition to **make Europe the first climate-neutral continent by 2050**, represents an unprecedented energy and societal transition involving a massive deployment of large-scale renewable sources, innovative low carbon technologies, deeper electrification but also smart sector integration. On the path to achieving these ambitions, the **power grid has a key role to play with regards to speeding up the deployment of clean energy across the economy and making electricity supply reliable and secure.**

European TSOs contribute to the **completion of the internal energy market while ensuring a continuously high level of European security of power supply and facilitating the clean energy transition beyond EU borders.** They strive to identify and deploy the most appropriate and innovative solutions in system operations, infrastructure development and market design.

In this regard, ENTSO-E and **TSOs play a central role as enablers of the energy transition and provide the necessary technical expertise to inform future decision-making.**

European TSOs are ready to commit their knowledge and skills in network code development, TYNDP development and adequacy assessment to proactively develop a vision of the future energy system, its technology, market- and operations principles.

The COVID crisis has impacted Europe across the board, developing from a major public health crisis into a deep economic recession the likes of which the EU has never seen. With this in mind, the European Council called upon the Commission on 26 March 2020 to develop a “comprehensive recovery plan and unprecedented investment to allow a normal functioning of societies and economies and to promote sustainable growth, integrating inter alia the green transition and the digital transformation”.¹

In that context, the Green Deal implementation is core to the European economic recovery and to achieving the objective of a clean, secure, innovative and competitive European Union.

Considering the ambitious objectives set out by the aforementioned initiatives, **grid infrastructure development is essential to avoid potential delays in the necessary grid adaptations required to accommodate the transformation of the energy sector and the efficient integration of increasing shares of renewable energy.** This means that a timely development of grid infrastructure is key to the EU recovery and the integration of renewable energies, including the **respective potential for job creation and value creation. This can be generated by implementing such large-scale infrastructure projects within the national frameworks.**

TSOs stand ready to support the recovery effort as facilitators of the energy transition by, among others, contributing to the political debate on investment needs and strategic infrastructure projects to be supported through Green Deal Recovery Plan instruments (e. g. InvestEU, Strategic Investment Facility, etc.) and other relevant funding instruments such as Horizon Europe for innovation. Grid infrastructure development, **notably in the areas of integration of offshore renewable energy, existing high renewable energy penetration and better system integration, will accommodate the energy sector transformation as well as the efficient integration of ever-larger shares of renewable energy.**

The European Green deal and the active role of TSOs in enabling the energy transition imply ever increasing tasks in an ever more complex, digitalised, volatile, uncertain and increasingly international environment.

In this regard, the Electricity Regulation (EU 2019/943) already defines the tasks and mission of ENTSO-E in a wider scope. It provides for TSOs to cooperate even more at Union level through ENTSO-E, to promote the completion and functioning of the internal market in electricity and cross-zonal trade and

¹ Joint statement of the Members of the European Council, Brussels 26 March and European Commission press release, Europe's moment: Repair and prepare for the next generation; Brussels, 27 May 2020

ensure the **optimal management, coordinated operation and sound technical evolution of the European electricity transmission network**. In carrying out its tasks, ENTSO-E shall also contribute to the **efficient and sustainable achievement of the climate and energy policy objectives for the period 2020–2030**, in particular by contributing to the efficient integration of electricity generated from renewable energy sources and to improve energy efficiency, while maintaining system security.

ENTSO-E is therefore also called upon to **shape the energy system of the future in an active and visionary manner and to identify the framework conditions necessary for this purpose**.

Looking ahead, 6 key drivers will shape the European power system towards and beyond 2030:

- › Market design will need to evolve to cope with future requirements and challenges.
- › Unleashing the potential of distributed flexibilities in the whole network will require a shift of paradigms, supported by significant changes in the power system.
- › A 'One System View' will be essential to ensure efficient energy system integration

- › Efficient development of offshore renewables and the offshore grid will require a holistic view across time, space and sectors – both onshore and offshore.
- › The migration from traditional AC based to Hybrid AC/DC networks will pose new challenges and needs to be supported by an accelerated pace of innovation.
- › The governance of this pan-European system of systems will involve multiple stakeholders. In this context, TSOs will play a key facilitation role together with Distribution System Operators, supported by Regional Coordination Centres and in dialogue with stakeholders.

This transformation of the power system, relying on both increased cross-border cooperation and stronger adaptation to local needs, also underpins a shift in the tasks of TSOs. Although traditional CAPEX-intensive investments towards expanding and maintaining the grid infrastructure will still predominate, TSOs will face a number of new challenges for which riskier, more OPEX-oriented activities must be adequately considered.

Considering the potential new tasks and role of TSOs in the upcoming energy transition and recovery, it is of the utmost importance that NRAs update the regulatory frameworks to enable an efficient and forward-looking regulation, setting the right long-term incentives for TSOs.

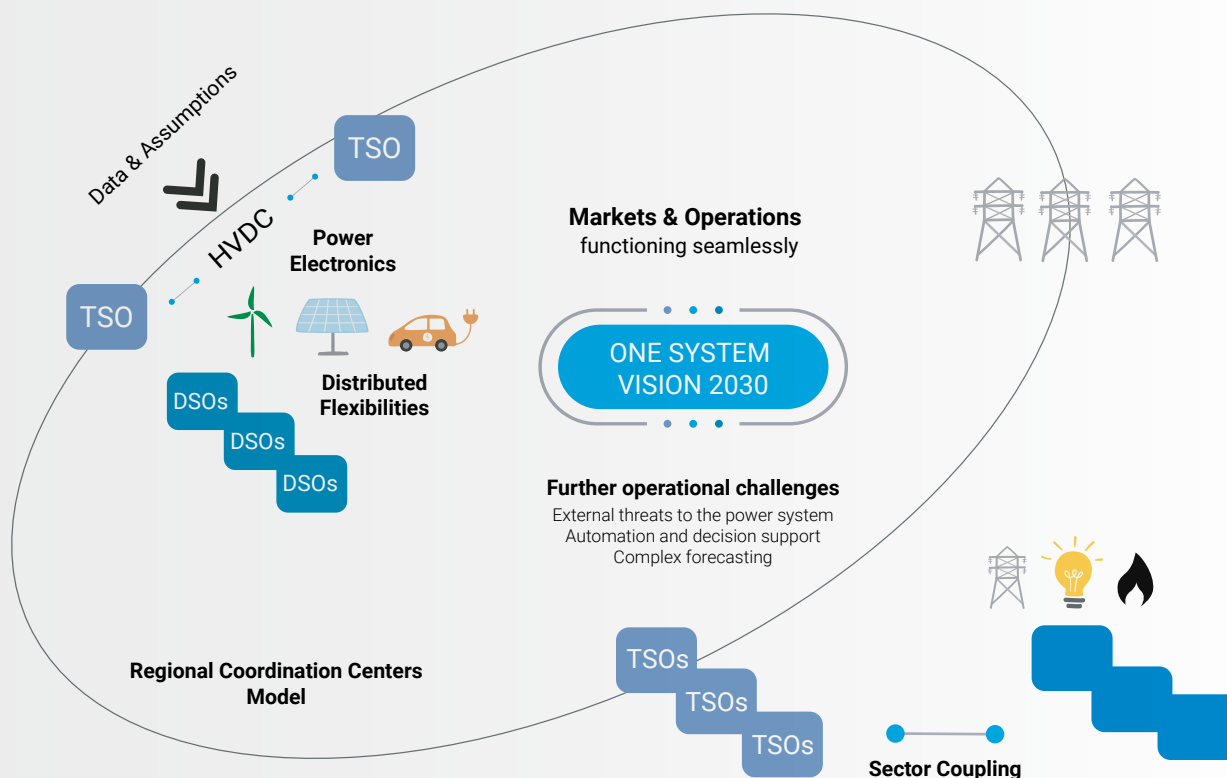


Figure 1: ENTSO-E's System of Systems Vision for the European Energy Transition. Source: ENTSO-E Vision Week

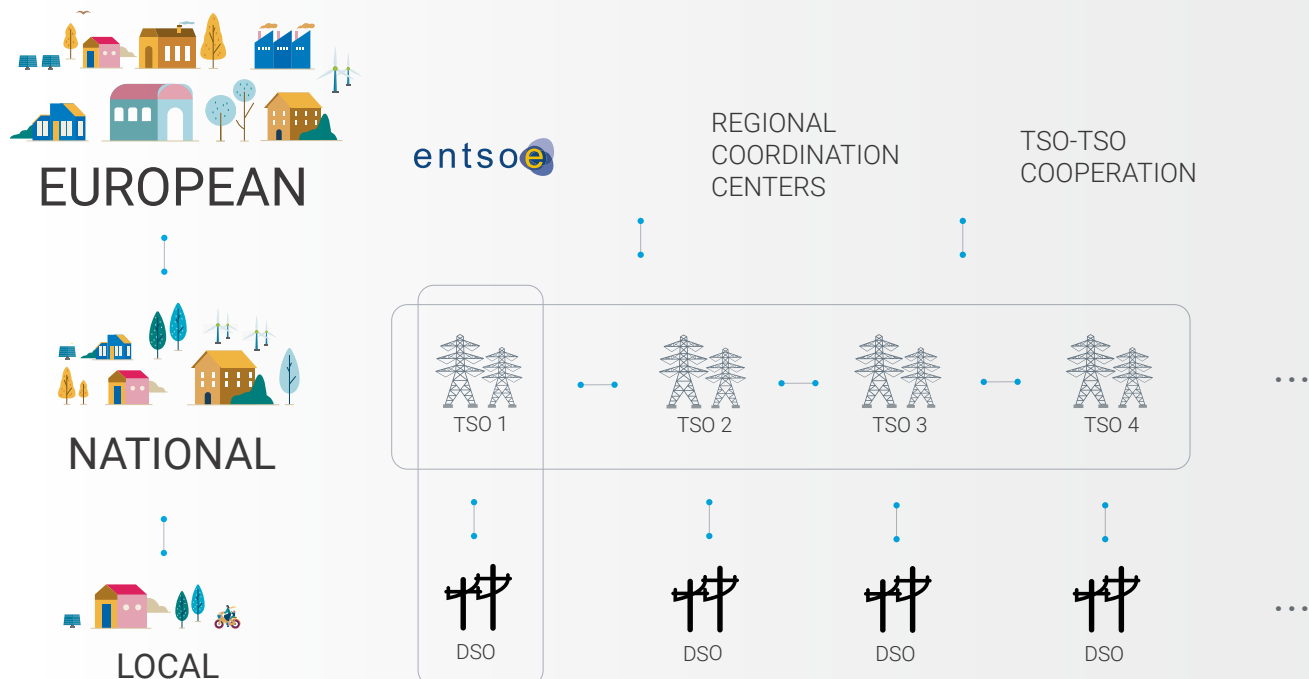
1.2 TSO Investments required for the energy transition

A strong and secure transmission network is a widely recognised prerequisite to enable European energy and climate policy goals. As outlined above, to meet European energy policy goals and the targets of the EU Recovery Plan, massive investments in European infrastructure are necessary: The TYNDP 2020 covers total CAPEX of EUR 153 billion for projects (transmission and storage), and the timing to deliver those new investments is challenging as projects due for commission until 2030 already represent EUR 123 billion.

The size and pace of the investment challenge is unprecedented in and represents a considerable challenge for society in terms of financing. Moreover, the challenge is not limited to Projects of Common Interest (PCI), as TSOs are also required to deliver other significant investments as part of the TYNDP and national development plans. The policy and regulatory focus should, therefore, not stop at PCIs but also consider the entire (wider) investment portfolio.

To increase European coordination and establish a central reference point for European electricity grid development, ENTSO-E is legally obliged to publish a community-wide TYNDP². The TYNDP is supported by stakeholders who contribute actively to its elaboration via open workshops, public consultations, discussions and meetings. The TYNDP 2020 outlines that “the transmission grid acts as the backbone of the pan-European power system” and emphasises that “Europe has engaged on an ambitious path towards decarbonisation” which it will only reach “if the continuous secure access to electricity is guaranteed to all Europeans.”

2 <https://tyndp.entsoe.eu/>



The projects entail the following significant economic and environmental benefits for European society³:

- › Over the last ten years, TYNDP projects have strengthened many new cross-border interconnections, which help to maintain adequacy by allowing countries to import electricity during stressful times. Thanks to these projects, electricity exchanges in the ENTSO-E area have increased from 347 TWh in 2010 to 435 TWh in 2018.
- › During the construction and commissioning of projects projected for the next 10 years 1.7 million jobs could be ensured across Member States.
- › Deploying both offshore wind generation and the necessary infrastructure is estimated to lead to economic benefits between EUR 1.4 bn and 1.6 bn annually (total CAPEX of EUR 65 bn), additional RES integration between 13.5 TWh and 19.2 TWh per year and a reduction of CO₂ emissions between 12,260 Mt and 15,900 Mt by 2030.
- › The new interconnectors offer geographical flexibility to the grid by taking advantage of the difference in weather conditions across Europe. This supports, together with the further grid development, the necessary inclusion of RES generation across the continent to achieve a sustainable supply mix, the decarbonisation of the electricity sector by 2040 and climate neutrality by 2050 in Europe.

It is important to note that a significant share of infrastructure projects have encountered delay.

Although technology and construction are usually under control, the delays result from permitting procedures and intensive stakeholder dialogue to address public and private concerns. Most of the case studies performed have confirmed this fact: public acceptance and permitting processes are considered the main reasons for project implementation delays and cost increase, meaning that projects were re-scheduled or delayed mainly due to “external factors”.

This leads to **missing grid capacity for rapidly increasing RES capacity, which not only severely hinders further RES integration but may, in the longer term, also put system security and sustainability goals at risk. Missing grid capacity inevitably leads to congestions in the grid, which can be mainly resolved via expensive and CO₂-emission intensive redispatch measures.** This might create trade-offs for TSOs with regards to ensuring safety, market efficiency, sustainability and performance, all of which are key to maximising social welfare. It is therefore of the utmost importance to underline that, without the strengthening of the existing transmission grid and **without building new interconnection lines, the climate targets will stay beyond our reach.**

There is an **urgent need to create a stable and fit-for-purpose investment environment** to cope with this huge increase in investments and to **raise sufficient equity and ensure access to credit at the lowest possible cost.** The long run “financeability” of transmission investments is a **key issue for TSOs, NRAs and national and European policy makers to enable the successful energy transition and recovery.**

Apart from the investment challenge, European TSOs under the umbrella of ENTSO-E have also been given numerous important legal mandates to develop the internal market for energy by establishing harmonised principles for efficient market functioning at various timeframes, for secure system operation, for coordinated system development and for R&D. Although ENTSO-E and TSOs are still implementing the 2009 Third Energy Package, work has already begun to implement the new legal mandates stemming from the 2019 Clean Energy Package.

ENTSO-E supports cooperation among its members at European and regional levels. Over the past decades, TSOs have undertaken initiatives to integrate the internal energy market further and increase their cooperation in network planning, operation and market integration, thereby successfully contributing to meeting EU climate and energy targets.

In carrying out its legally mandated tasks, ENTSO-E's key responsibilities include the following:

- › Development and implementation of standards, network codes, platforms and tools to ensure secure system and market operation as well as integration of renewable energy;
- › Assessment of the adequacy of the system in different timeframes;
- › Coordination of the planning and development of infrastructures at the European level (TYNDPs);
- › Coordination of the research, development and innovation activities of TSOs;
- › Development of platforms to enable the transparent sharing of data with market participants.

3 https://eepublicdownloads.blob.core.windows.net/public-cdn-container/tyndp-documents/TYNDP2020/Forconsultation/TYNDP2020_Report_forconsultation.pdf

Our contributions to integrate, develop and safely operate the energy system within an ever more challenging environment

A complete overview of TSO mandatory tasks and their central role in the accomplishment of the internal energy market, while ensuring security of supply and facilitating the clean energy transition, can be found in the Annual Report 2019 or in the Annual Work Programme 2020 of ENTSO-E.

The aforementioned tasks entrusted to TSOs by Network Codes and Guidelines and the recent Clean Energy Package

legislation constitute a substantial legislative framework that directs TSOs' joint efforts towards a more sustainable and reliable electricity system. European TSOs, therefore, require a suitable legislative and regulatory framework to deliver the legally mandated tasks within an adequate timeframe. This is highlighted by the future challenges addressed in the European Green Deal Strategy.

Conclusions

- › TSOs operate in a more complex, digitalised, volatile, uncertain and increasingly international environment.
- › Large-scale investments in the transmission grid will not only create jobs and allow for increased cross-zonal energy exchanges but are the backbone for a decarbonised electricity sector.
- › However, a significant share of these capital-intensive projects face issues regarding permitting procedures and public acceptance, thus leading to project implementation delays and cost increases.
- › The current Green Deal measures and the need for TSOs to provide their expertise to contribute to the successful energy transition show that TSO responsibilities are no longer just restricted to expanding, maintaining and operating the grid in time.
- › Current and Future TSO tasks show that innovative solutions – to develop flexibility potential and ensure an integrated planning between sectors, the digital means to provide a one system view and real time cooperation and coordination – are urgently required to manage the successful transition.
- › Collective knowledge and expertise is key for the integration of energy markets. An increasing part of TSOs' business activities relate to European cooperation and coordination.



2 Shortcomings of remuneration frameworks and the need to evolve

2.1 Ensuring a successful delivery of investments and tasks necessary to enable the transition

As already highlighted in Chapter 1, TSOs are currently experiencing tremendous changes. After pointing out the valuable tasks TSOs have already been fulfilling for society and will also do in the future, attention should be drawn to the fact that there is an **urgent need to enhance a stable and fit-for-purpose investment environment** for TSOs to finance the required investments and tasks with the desired pace and scale.

TSOs are acting and operating within regulatory frameworks set by NRAs who are empowered to allow the coverage of recognised costs (operational and capital expenditures) via grid tariffs. Hence, NRAs should **support TSOs' efficient financial sustainability and promote efficient behaviours of the operators through the introduction of respective incentive measures**⁴. Some regimes already foresee the setting of incentives, but such incentives have not been well received by TSO stakeholders so far.

However, European TSOs have been experiencing regulatory frameworks that are still mainly **driven by cost-reduction incentives** (e. g. X-factor/profit-sharing mechanisms) rather than by providing incentives for the efficient and effective fulfilment of the increasing number of (legally mandated) tasks required while carrying out necessary investments.

The remuneration of capital is the key aspect of the TSO business model to attract investors and maintain affordable⁵ tariffs for grid users. The remuneration of capital provides necessary cash flows for TSO investments and for maintaining solid financial ratings. Further remuneration of capital is required to compensate investors for the capital cost of opportunity as well as for the risk coverage.

In particular, the alarming development of risk-free rates all over Europe – as one of the most important drivers for TSO capital remuneration – can become an increasing barrier for TSOs as they attempt to fulfil their important tasks for society at affordable tariffs for customers.

NRAs should be aware that stakeholder expectations on the capital remuneration of TSOs due to negative risk-free rates might not be reasonable and, therefore, may endanger TSOs' business.

As outlined in more detail in chapters 3 and 4, **the current determination of TSO remuneration reveals various shortcomings which require rectification to account for the new environment TSOs are operating in.**

⁴ Article 18(2), EU Regulation 2019/943 of June 5th, 2019

⁵ ENTSO-E: TTO Report 2019 to be found here: https://eepublicdownloads.entsoe.eu/clean-documents/mc-documents/201209_ENTSO-E%20Transmission%20Tariff%20Overview_Synthesis%202019.pdf (Evolution of Unit Transmission Tariffs – page 24)

2.2 Enabling long-term EU policy goals and new Green Deal measures

In addition, the basic TSO remuneration, which currently considers hardly any reward for the value created by TSOs outside investment in physical assets, TSOs see **value in a remuneration that should also be based on other criteria**.

This is especially important considering the **new tasks and challenges TSOs face in an ever-changing environment**. As outlined in more detail in chapter 4, an energetic, innovative company, concerned about the service to its grid users, attentive to involving stakeholders and communities, active in regional or European initiatives shall⁶ be remunerated for the extra effort in addition to the capital remuneration the network company receives for its basic tasks. Capital-based remuneration does not reward efforts beyond business-as-usual activities but only covers non-capital-intensive activities (operational expenditures) at cost.

First, TSOs consider capital-based remuneration as not fully “adequate” anymore in the context of a natural monopoly. Furthermore, it does not provide any incentive towards agility, creativity and riskier forward-looking behaviour, which are necessary qualities for a network company in the current and ongoing energy revolution.

In the **most advanced incentive regulations, while keeping existing cost-saving schemes, regulators have opted to introduce objectives that are not related to short-term economic efficiency**. Introducing incentives on performance is a good way to ensure the regulated company maintains a balance between limiting costs to the necessary amounts and delivering a sufficient level of outputs/value to consumers. The objectives pursued by performance incentives already in force today include commercial quality of service, continuity of electrical supply, voltage quality and energy loss reduction, among other examples. These outputs usually provide protection against aggressive or excessive cost-cutting strategies, as achieving improved performance may necessitate additional investments and/or increasing operating spending.

Furthermore, these **incentives can be directly linked with long term EU Policy goals such as the Green Deal, thereby directly contributing to enabling the necessary energy transition**.

This current regulatory context, mostly focused on low grid tariffs growth rates, needs to be improved to ensure that TSOs can invest in projects that result directly from the climate and policy targets of the EU.

⁶ Article 18(2) of European regulation 2019/943 of 5 June 2019 states “Tariff methodologies shall reflect the fixed costs of transmission system operators and distribution system operators and shall provide appropriate incentives to transmission system operators and distribution system operators over both the short and long run, in order to increase efficiencies, including energy efficiency, to foster market integration and security of supply, to support efficient investments, to support related research activities, and to facilitate innovation in interest of consumers in areas such as digitalisation, flexibility services and interconnection.”



Conclusions

- › Remuneration of capital is the key point for the TSO business model to attract debt and equity investors.
- › Remuneration of capital provides necessary cash flows for TSO investments and (operational) tasks.
- › TSO capital remuneration is currently primarily based on TSO investments.
- › Certain TSO activities and legally binding tasks have already become less capital-intensive (e. g. market facilitation task as a TSO service). Currently, these kinds of tasks are frequently not rewarded through regulatory regimes and receive only cost coverage.
- › The ongoing digital transformation of the power sector and further application of non-capital incentive solutions due to, for example, innovative solutions are currently not captured and addressed sufficiently within regulatory systems to master the challenge.
- › Risks for TSOs due to the energy transition, new grid technologies, uncertainties in consumption and energy mix, and flexibility are rising and currently difficult to assess but they still need to be treated within capital remuneration.
- › In particular, regulatory incentives for innovation and the deployment of efficient technologies (even if they still need to be established, e. g. P2G) require means and efforts of regulation.
- › Future regulation should provide sufficient incentives to foster EU policy goals and new Green Deal measures.
- › Considerable investments could negatively impact TSO ratings. This needs to be duly considered when fixing the capital remuneration. The described complex challenges lying ahead of TSOs will require additional efforts to be made within the remuneration regime and calls for adequate regulatory solutions.
- › As grid expansion inter alia enhances the cross-border exchanges necessary to share resources across Europe for a reliable, sustainable and economic power supply, the regulatory remuneration should promote financial sustainability.
- › Therefore, an update of the current regulatory system, especially regarding the capital remuneration of TSOs, is necessary. The problems and potential solutions are further outlined in this paper.

3 Capital remuneration model for TSOs

3.1 Regulatory principles of monopoly treatment

TSOs operate in a monopolistic and regulated business environment, which require substantial investments with rather long technical lifetimes (several decades) while managing essential and critical facilities and other legally mandated tasks, as described in chapter 1. TSO shareholders are typically States, government entities, generators (with guarantees of independence), and further state owned or private companies. Some of the European TSOs are listed companies on the stock exchanges.

As already noted, TSOs are acting and operating within regulatory frameworks set by NRAs, who are empowered to allow the coverage of recognised costs which are, in the case of a TSO, operational expenditures (OPEX) and CAPEX (depreciation as well as cost of capital, which is the remuneration of costs of equity and debt).

Cost of capital represents the major share of TSOs' total costs. As TSOs are natural monopolies operating in a regulated sector, the remuneration of capital is not the result of competition in the market but comes from NRA decisions.⁷

From the regulator's perspective, a fair and predictable remuneration framework allows TSOs to attract debt investors, as well as shareholders, with a relevant and risk-adequate remuneration, thus reducing TSO costs and tariffs for the community's benefit. An excessively high remuneration level would penalise the grid users, reduce social welfare, and could lead to inefficient investments. On the other end of the spectrum, insufficient remuneration would not allow TSOs to find debt and equity investors to achieve the necessary investments⁸.

NRAs therefore face the challenge of striking the right balance when determining the remuneration of capital as it represents the main pillar of TSOs' business model: attracting both debt and equity investors on the one hand and maintaining affordable tariffs for grid users on the other. That said, there are several other factors that require consideration, as explained later in this chapter.

⁷ Art. 18-1 of European regulation 2019/943 of 5 June 2019

⁸ Frontier Economics (2020). Electricity Distribution networks and their Contribution to the Energy Transition. Available here: <https://www.frontier-economics.com/media/4355/electricity-distribution-networks-and-their-contribution-to-the-energy-transition.pdf>



3.2 Reasons for an appropriate TSO remuneration of capital

Capital's cost of opportunity

The first obvious reason for an appropriate remuneration of capital is that it is necessary to cover the cost of opportunity: capital (equity or debt) engaged in TSO business cannot be

used at the same time for other means and is no more available during several years.

Risk coverage

The second reason is the coverage of risks: the risk of the activity means that the shareholder, as well as the debt investor, can have a lower remuneration than expected and even lose a piece of capital. The risks can be risks not covered by regulation, risks provided by the regulator's unexpected decisions, or risks partially or totally covered by regulation. Indeed, even if the financial consequences of risks are covered by regulation, there is always a time lag before costs are recovered, as well as a reputational risk.

In addition to the risk of insufficient or inadequate cost recovery, TSO business risks are naturally increasing in scale and scope due to the Green Deal objectives (e. g. the need for more investments, offshore development, digitalisation, development of flexibility tools).

Provide cash-flows to invest

The third reason, more often forgotten, is that the RoE provides cash flows available for investments and retained profit that increase equity. Cash flows generated by TSO business, after paying financial charges and corporate tax, are part of the remuneration of equity not paid out to shareholders (retained profit) and the regulated depreciation of past investments. To keep a reasonable part of debt in the capital, it is necessary to increase equity with non-distributed profit and generate cash-flows to finance a part of investments without issuing debt or increasing equity with external capital and while maintaining a good financial rating. The long economic lifetime of

investments (several decades), the cumulated inflation over decades and the increased need for investments all require high level of cash-flows.

With an insufficient remuneration of equity, either shareholders will not get the remuneration they expect, making it more difficult to raise equity, or equity will increase and available cash flows will be too low to implement the investment programme without an unbearable increase of debt or an external equity contribution.

Increase social welfare

Adequate remuneration is also required to ensure investment decisions fully consider the value for the community through network development plans with comprehensive analyses of their technical and economic impact, even when those decisions do not maximise the size of the RAB for which TSOs are remunerated accordingly.

To minimise the cost of capital, it is considered relevant to have a balanced ratio between equity and debt. The optimal share of equity and debts leads though to discussions.

Although academic theory would indicate that there is no optimal value for determining the relative level of debt to equity (or gearing), the general pragmatic consensus tends to recommend that the normative and actual gearing value be in a range that minimises the cost of capital and avoids two hurdles: firstly, low solvability with lack of equity (difficulties to find debt issuers) and, secondly, low profitability with insufficient debt leverage (difficulties of finding shareholders).

3.3 Currently used capital remuneration models

The Capital Asset Pricing Model (CAPM) methodology⁹ is often used in regulated sectors to assess and set the “appropriate” or “adequate” remuneration of equity.

Currently, the following two types of capital remuneration regulation are mainly considered within European TSO regulations: WACC and RoE, with pass-through criteria for debt allowances (e. g. based on notional or actual debt levels).

Weighted average cost of capital

The WACC is assessed by regulators using the CAPM methodology, which is applied to the RAB in some countries.

The WACC represents the weighted average between cost of equity¹⁰ and cost of debt¹¹ under consideration of a normative structure of capital.

The RAB represents the net invested capital for regulatory purposes, calculated to determine the base remuneration for TSOs’ regulated businesses¹². The RAB represents either fixed assets (historic depreciated/book values), in which case a nominal WACC is applied, or inflated values of assets; in this case, a real WACC is applied. TSOs’ allowed cost of

capital is calculated by multiplying the RAB by the according WACC.

In many countries, regulation period duration for the transmission service lasts from 1–5 years and all parameters of WACC are reassessed only for the following regulatory period. However, assessments of the WACC can be uncorrelated from the change of regulatory period: in Italy the WACC is assessed every 6 years (with a mid-period review after 3 years), and there is an 8-year regulatory period (with a 4-year mid-period review). In Austria, the WACC is currently reviewed and adapted every 5 years, and the regulatory period lasts 1 year. The WACC can be indexed to a market index every year, as in GB.

Return on Equity

In this approach, cost of equity and cost of debt are covered separately¹³. Cost of equity results from the regulated interest rate applied on the actual or regulated equity share, whereas cost of debt results from the actual or normative interest rate

applied on the actual or regulated debt share. With a normative interest rate on debt and a normative structure of capital, this methodology equals WACC methodology.

Treatment of operational expenditures

As already pointed out, TSO remuneration – which is still heavily dependent on TSO investments – is just one driver of TSO costs. Non-capital related activities and tasks – those aimed at system management and market development (e. g. market facilitation) – have been covered at cost in most regulations with hardly any profit margin apart from some applied incentives¹⁴. These same services, in a competitive market operated by private companies, would most likely not be provided at cost but would also include a profit for the company.

In addition to the capital-intensive business of TSOs characterised by long useful asset lifetimes, facilities with shorter lifetime and more operational expenses are also managed by the TSO. Following these trends, it is not only necessary to discuss remuneration of services, but further discussions are also necessary on how incentives could boost innovation and develop efficient technologies as an additional option for TSOs.

Treatment of Innovation

Currently, specific regulatory OPEX allowance, which is partly not subject to efficiency incentives (XGen, Xind), and has to be spent, is currently allowed for R&D and innovation in France, Austria, Germany and the UK. In Belgium, an incentive

on innovation for shareholders, with a bonus, is applied. In general, incentives on innovation should certainly undergo evolution to support the transformation of the energy system and achieve the decarbonisation tasks.

9 CAPM was developed in the early 1960s by William Sharpe (1964), Jack Treynor (1962), John Lintner (1965) and Jan Mossin (1966).

10 risk-free rate + risk premium (beta factor x market premium)

11 risk-free rate + spread covering risk

12 Often, assets that have not been fully depreciated are included in the RAB.

13 Depending on the actual or a target structure of capital

14 Most regulations have positive and negative incentives on controllable OPEX efficiency, with a sharing of over or under performance.

3.4 Assessment of cost of equity and debt

Concerning the cost of equity and debt, a basic risk-free rate index (generally State bonds of a country with good rating) is used and, in a few instances, a country-specific risk premium

is applied. Generally, the same risk-free rate is applied to equity and debt.

Development of European risk-free rates

Since the year 2000, European risk-free rates have experienced severe declines in values. In the chart below – representing the evolution of risk-free rates for Austria, Germany, Belgium, France and the Netherlands – the development becomes obvious.

In 2000, the interest rates ranged from 5.5–5.75 %. By 2008, the beginning of the worldwide financial crisis, the level had already decreased to 4.25 %. The European Central Bank began its Quantitative Easing programme¹⁵ in 2015 with interest rates laying between 0.75 and 1.25 %. Currently, interest rates have even become negative, thus advantaging debt policy within the EU members states, especially during the COVID-19 crisis.

Those low risk-free-rates – as a base for TSO remuneration – have a negative impact on TSOs' financial viability. Even though averages over certain timespans (5–10 years) and maturities are being used by Regulators to assess the risk-free-rates for TSOs, at some point those very low interest rates – if not considered within market risk premium – will influence TSOs' financial viability.

The decline in risk-free rates is also visible in the evolution of TSO WACCs in the following graph. For comparison reasons, only nominal, pre-tax WACCs of TSOs with the same equity share (40 %) are considered. As there are still differences in tax-levels, it is still not possible to compare numbers completely.

All TSOs show declining values in WACCs – even in 2021 a downward tendency remains visible. Even though the numbers presented may seem acceptable, it is important to remember that the cost of debt, taxes and equity need to be borne.

Compared to competitive activities, the WACCs and RoEs for regulated TSOs are lower because of regulatory systems and, therefore, the WACC covers the risk. The specific risks of TSOs, in particular risks not covered by regulatory frameworks or resulting from incentive regulation, are generally considered as non-diversifiable risks.

¹⁵ The aim was to reduce return on risk-free assets to stimulate investors to prefer risky investments

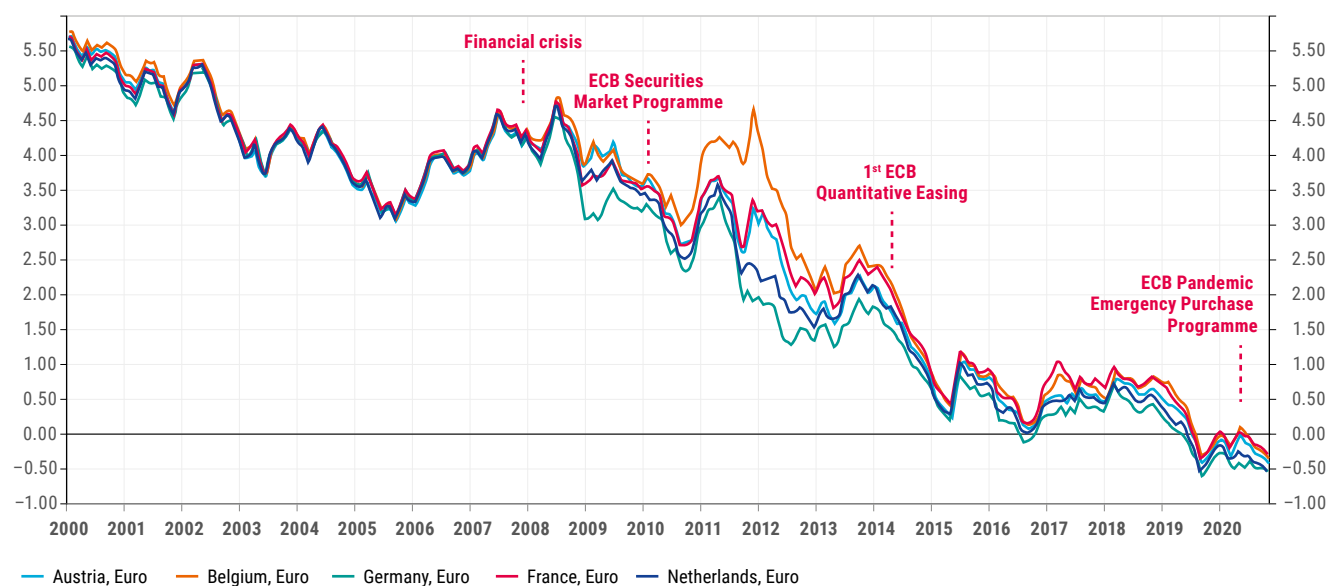


Figure 2: Long-term interest rates (10 years) for five EU countries from 2000–2020. Source: ECB

According to a study performed by KPMG¹⁶ for Swiss, German and Austrian companies, WACC nominal, after tax, conducted for the competitive sectors very clearly highlights the difference between regulated monopolies and companies facing competition. Technology and automotive companies obtained WACCs between 8.3 and 8.0 % in 2018. Real estate showed the lowest profitability with 4.9 %. On average, a WACC after tax of 7 % could be achieved.

These significant differences between the profitability of competitive companies compared to regulated monopolistic companies could be interpreted as TSOs having reached a very low level – perhaps even the bottom of adequate remuneration?

This is important because TSOs not only need the cash-flows to finance investment but also sufficient retained profits to build up equity. Lowering remuneration (WACC or RoE) means not only that equity investors get less remuneration for their

invested capital but also that TSOs are unable to build up the necessary equity. Some TSOs are legally mandated to maintain a certain level of equity, otherwise the WACC will be adapted – which lowers TSO capital remuneration even further.

Furthermore, a correct balance between equity and debt is also necessary to get new loans with low interest rates. If cost of debt is not observed ex post, the means to assess is to retain a risk-free rate published index (generally State bonds of a European country with a good financial rating), with, if necessary, a country-risk premium and a spread to consider the specific risk of the company.

To assess the company spread, different criteria can be used, such as published indexes relative to companies with a specific rating (such as Iboxx), the history of the company's debt issues, expected future values, etc. Frequently, the final value of spread on debt comes from expert evaluations.

16 KPMG: Cost of capital study 2018 page 20, link: <https://assets.kpmg/content/dam/kpmg/ch/pdf/cost-of-capital-study-2018.pdf>

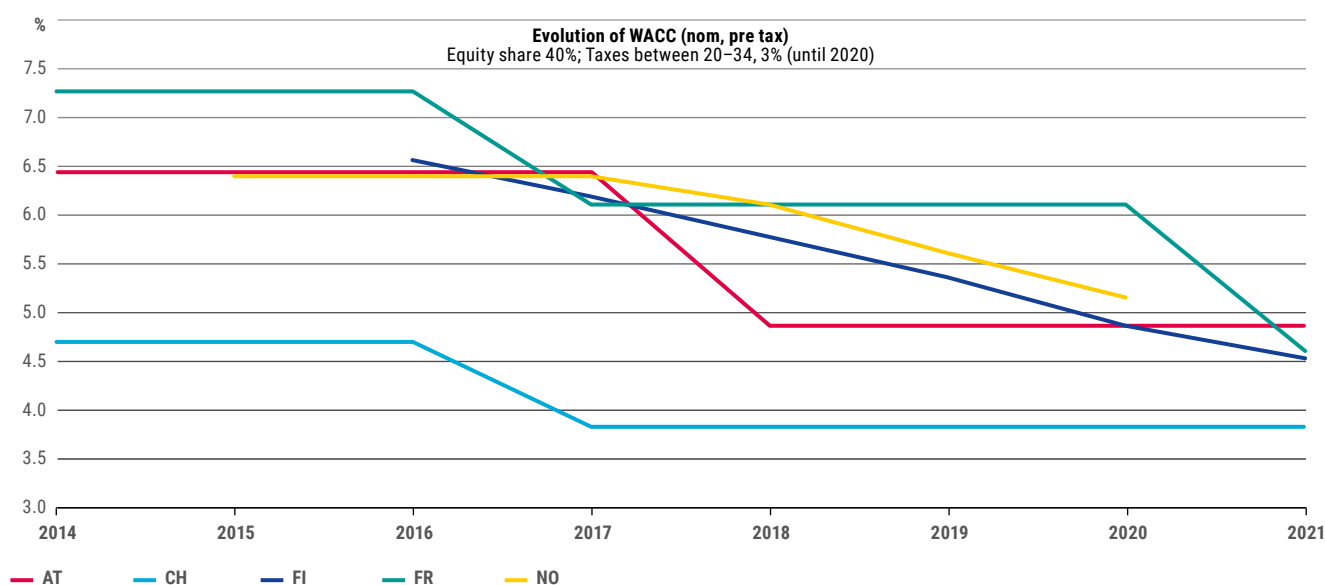


Figure 3: Development of nominal pre-tax WACCs for five TSOs

Market premium and Beta

The market premium, which is another important parameter in the calculation of the capital remuneration (expected return premium to prefer risky investments with non-diversifiable risk on the market instead of State bonds), is generally assessed considering long-run series (over 100 years), with a value currently applied by Regulators between 5 and 6 %. Market (or non-diversifiable or systemic) risk is a risk that cannot be mitigated because all the market is exposed to the same risk.

As the sensibility to the non-diversifiable market risk is not the same for every company, there is a multiplicative equity beta factor applied to market premium. An equity beta factor value of 1 means that the company has the same exposure

to market than the average company. For quite evident reasons, the equity beta of regulated TSOs are generally under 1. Indeed, TSOs are naturally protected against systemic risks because they manage essential infrastructure for the country's economy. Given that the risks of TSO business are increasing with the Green Deal objectives, the asset beta parameter should be set by NRAs at a higher value than in past years to reflect the increased risk exposure.

At the same time, as a critical facility for the community, TSOs must be able, at any time, to access the capital market, to have funding to invest and to have a strong financial position, without any default risk.

Conclusions

- › In general, a fair remuneration of TSOs for capital and risk is necessary to achieve an investment programme which aims at the integration of renewable generation and development of digital solutions, in order to meet European climate objectives and ensure security of supply.
- › TSOs need to build up equity for their large investment programmes (security of supply, integration of renewable energy generation etc.).
- › Not only do TSO need to build up equity but they must also provide an adequate return to their owners and debt investors.
- › This is necessary because even though TSOs are monopolies, they are still in competition for (equity and debt) investors and TSOs are not usually non-profit organisations.
- › Risk-free rates as one of the most important driver of TSO capital remuneration have become (too) low and do not reflect the market and the needs for RoE investors. There might be better investment for their money so, clearly, TSOs are in a competition for capital.
- › A floor for risk-free-rates could be considered to defuse the situation. A negative reference risk-free rate (based on State bonds) should not be the suitable basis for TSO remuneration.
- › The huge European TSOs investment programs are sustainable, if TSOs can raise sufficient cash flows – provided by a fair remuneration of equity- to keep their (sustainable) credit ratings. This way TSOs get debt at a fair rate, with adequate annual return for shareholders.
- › With sector coupling – green hydrogen produced with renewable electricity – competition between energy networks increases (also for investors).
- › Risks are increasing and new risks originating from energy transition, new grid technologies, uncertainties in consumption, energy mix and new flexibility, as well as potential new business segments, are difficult to assess.
- › In addition to the main capital-intensive TSO business with long useful asset lifetimes, investment expenses with a shorter depreciation period and operational costs are also carried out by the TSO. The regulatory framework should ensure that innovation and non-asset-based activities and services are also rewarded.
- › Following the need for additional investments (e. g. digital networks, smart grids, etc.) with shorter facility lifetime or more operational expenses, there is a need for incentives to boost innovation and efficient technologies.

4 Incentives

4.1 A remuneration system that reflects performance...

As described in the previous chapter, in addition to the basis remuneration driven by the level of the RAB as well as WACC/RoE, which does not consider any reward for the value created by TSOs outside investment in physical assets, TSOs see value in a remuneration that would be based on other criteria as well.

An energetic, innovative company, concerned about the service to its grid users, attentive to involving stakeholders and communities, and active in regional or European initiatives should be remunerated for the extra effort made, in addition to the capital remuneration the network company receives for its basic tasks.

A traditional remuneration framework mostly based on capital remuneration hardly provides any incentive to agility, creativity and risk-taking, which are necessary qualities for a network company in the ongoing energy revolution.

Aware of the limitations and unwanted effects of the classic remuneration system, a number of regulators in recent years have opted for the introduction of a performance-based

reward in addition to the return based on the value of assets. In some regulations, a monitoring of the performance was already in place in the form of KPIs¹⁷. Some of those KPIs were kept as an indication merely for the regulator's information. Sometimes, it is mandatory for the TSO to publish them so that the availability to the public of the performance level creates an incentive (a reputational one) for the TSO to improve the results. Nonetheless, both network operators (transmission and distribution) and regulators have shown increasing interest in incentive regulation – understood as coupling performance measurement with a financial reward – as it has proved to be an extremely effective tool.

The underlying philosophy of incentive regulation is that consumers are ready to pay a bonus to the network operator through grid tariffs in return for a tangible (or measurable) benefit. If the performance is good, it means consumers benefit from a good service and they pay the bonus. If the performance is poor, it means the benefit for consumers is reduced and the bonus is reduced accordingly. The bonus can even turn into a penalty if the regulation foresees that incentives work both ways.

4.2 ...and also reflects risks

Financial incentives, as they directly affect the company's profitability, are an opportunity but also an additional source of risk for the company. For that reason, they should be used carefully and their calibration (the rules that govern the indicators and the money that is linked to each of them) should be carried out after a robust analysis from both the TSO and the regulator. The lack of a robust analysis of the expected performance and risks may lead either to excessive losses for the company, which could jeopardise its investments and sustainability, or to windfall profits that would cause a loss of confidence from the community of consumers towards both the regulator and the network company.

The possibility that a network company loses profit in the event, for any reason, it fails to meet the target set by the regulator, is a risk that implies that its basis remuneration needs to be greater than when profit is determined ex-ante and practically predictable. Usually, when financial incentives – as far as they are not optional for the TSO – carry larger amounts and/or work in both directions (reward and penalty), the level of the basis remuneration (the remuneration based on the invested capital) is also higher, to remunerate the risk.

17 Examples of KPIs: power interruption rate, customer satisfaction index, average delay in project commissioning, etc.

4.3 Key criteria for an effective incentive regulation

TSOs that have been subject to incentive regulation for several periods can testify that the effect of financial incentives can be very strong. A well-designed incentive can lead the company to actually adapt its organisation and allocate efforts to the areas subject to the incentive, with a consequent good performance; conversely, a poorly designed incentive can lead to regrettable undesired effects. Therefore, in-depth analysis is absolutely necessary before designing a new incentive, and a number of criteria should be observed.

Academic literature has made recommendations on incentive regulation design. We have gathered below the main criteria usually highlighted as key to the success of an incentive scheme.

Simplicity and measurability

Incentives should be simple and their calculation should be easy and unequivocal. Intricate incentive definitions and complex calculation rules may lead to ambiguity and misunderstanding between the company and the regulator at the time of evaluating the performance and the corresponding financial amounts.

Implementation cost

The regulator, the legislator and the company must ensure the effort to implement the incentive mechanism does not exceed the benefits of the mechanism at large. Implementation costs for the company should be reduced. A reasonable implementation cost implies that the legal and regulatory changes, when required, are moderate.

Fairness

Incentive regulation consists in grid users paying amounts of money to the company in return for improved performance. Incentives should be designed in such a manner that those amounts are a fair win-win reward for effort.

Stability

Incentive regulation must be applied for a sufficient number of years for the regulated entity to be able to set up adequate processes and improvement plans. One-time measures are not efficient.

Technological neutrality

Incentive mechanisms should not discriminate between technologies and, in particular, between CAPEX and OPEX when meeting users' and society's demand for infrastructure

services. Regulation must therefore strive for appropriately balanced incentives for OPEX-intensive activities. The mechanisms should set an incentive to choose the least-cost network development and operating solutions in the long run.

Controllability

Incentives should always be linked to outputs and associated costs upon which the company has sufficient control. If the company does not have control on all the costs or outputs, then the incentive must either include rules that neutralise the effect of external factors, or focus on the means the company has deployed to tend towards the target, not on reaching or failing to reach reaching the target.

Flexibility

Although regulation must be stable, incentives must be designed to consider changes in context and specific situations or unforeseen events. This holds particularly true in an environment that is subject to considerable change, such as the ongoing transformation of the power sector.

Caution

Considering the performance of a given business as the goal to achieve by another business is a very delicate situation. The greatest prudence is recommended when using benchmarking to set targets in the framework of incentive regulation. Data quality, the robustness of the method, transparency and the frequency of measurements must be optimal before the results of a benchmarking can be used. Benchmarking assumes a comparable business environment in structural and regulatory terms, whereas European TSOs operate in very diverse environments.

Room for improvement

The exploitation of efficiency gains or performance improvements is limited. Incentives should cease when the means are exhausted and when no more room for improvement is left.

Dimensioning of financial incentives

To be effective, financial incentives must have a sufficient material significance. However, they should not be overly substantial, otherwise they will affect the risk profile of the company in a manner detrimental to both the company and the community. Regulation should also seek an appropriate balance between all incentives, in order to maintain the required focus on each of the targeted areas.

4.4 Scope of incentives

In the first years of incentive regulation, regulators usually tend to limit the scope of incentives to cost efficiency. This limitation in scope is due to the need for prudence mentioned above. It is also due to the maturity required both on the company's and on the regulator's side. It takes time and experience before the company can assess, in a reliable manner, the areas where it can improve, the resources that are required to reach an increased level of performance and its chances of success. It also takes time and experience before the regulator acquires a good sense of the improvements it can expect from the TSO and of the realistic level of the performance-based targets. The Serbian TSO, for example, is subject to KPIs but no financial incentives are applied. In countries such as France or Belgium, the number of different financial incentives can reach a dozen. Between these 2 extremes, there is a wide range of different situations.

There are 5 models of tariff regulation most commonly applied to network companies:

- › Cost-plus mechanism
- › Price or revenue cap
- › Performance-based regulation
- › Menu of contracts
- › Yardstick competition

A definition of these five models can be found in Appendix 1.

4.4.1 Cost incentives and level of risk

The description of these five regulatory instruments provides insights into their economic features and, in particular, the level of risk each generates for the regulated company.

The regulatory instruments that partially disconnect revenues from costs (e. g. price or revenue cap) are the ones that give the greatest incentive for cost reduction, whereas regulatory instruments that base revenues on cost observation (i. e. cost-plus mechanism or mechanisms that base revenues on intrusive and detailed bottom-up efficiency audits) are those that give the weakest incentive to cost reduction. At the same time, the regulatory instruments that disconnect revenues from costs are the most likely to create/allocate more risks to the company. Indeed, uncertainties affecting costs have no effect on the company's revenue because that revenue is fixed ex-ante. In such a system, any cost overrun is at the expense of the company and materialises in a loss of profit. Obviously, the risks imposed on the network company are smaller with regulatory instruments that base revenues on actual costs.

Through these observations, we aim to stress again the link that must be made between the level of uncertainty created by the incentives applicable to a regulated company and the degree of risk this represents for the business, and consequently the required level of fair remuneration that goes with it.

Because of this uncertainty, a number of regulators and network companies in Europe have agreed to lower the level of risk caused by cost incentives by taking specific groups of costs out of the incentive system, or applying specific rules to those costs that include buffering/safeguard measures.

For example, differentiating controllable OPEX from other OPEX to apply specific efficiency incentives on the controllable category is common practice, although in some regulations an incentive applies on OPEX as a whole (see table below). The Belgian regulatory model also classifies power reserves and grid losses costs in a hybrid category called "influenceable costs", with the rationale that such costs are not completely manageable by the TSO but not completely out of its control. Therefore, an efficiency incentive applies but with a softened effect on the company's profit.

The table below provides an overview of how often and where cost efficiency incentives are implemented in TSO regulation.

	Country or Region
Controllable OPEX	Austria, Belgium, France, Germany, Italy, Lithuania, Portugal, Spain, Finland
All OPEX	Hungary, Norway, The Netherlands, UK
Power reserves	Belgium, Czech Republic, France, Germany, Norway
Grid Losses	Belgium, Czech Republic, France, Germany, Hungary, Norway
CAPEX (general)	Germany, Norway, Spain, The Netherlands, UK
CAPEX (specific projects)	France, Portugal, The Netherlands

Table 1: Countries where incentives on different cost categories apply to TSOs¹⁸

¹⁸ A survey has been conducted among Entso-e about the incentives applicable to TSOs but not all of them have responded. So the countries where the different incentives apply are listed as an illustration but the list is not exhaustive.

4.4.2 Incentives on operational performance

In the most advanced incentive regulations, while keeping existing cost saving schemes, regulators have opted to introduce objectives unrelated to short-term economic efficiency. Introducing incentives on performance is a good way to ensure the regulated company will maintain a balance between limiting costs to the necessary amounts and delivering a sufficient level of outputs/value to consumers. The objectives pursued by performance incentives already in force today include commercial quality of service, continuity of electrical supply, voltage quality, energy losses reduction and timely commissioning of investments, among other examples. These outputs usually provide the necessary counterweight that protects against excessive cost cutting strategies as achieving improved performance may require investing and/or increasing operating expenses. The TSO knows where to draw the line between costs and outputs, rewards and penalties.

Moreover, one of the big fears of regulators is the “gold plating” effect. This means that the TSO would supposedly overinvest because regulation bases profit almost exclusively on the amount of the RAB, thus incentivising essentially grid extension projects, although they are not necessary for the safe operation of the grid. A particularly valid means to move away from remuneration mainly based on the creation of assets is to encourage the network company to also concentrate on the delivery of a number of services at a given quality level. That level is monitored and the achievement of the targets triggers a complementary remuneration (binary or proportionate to the level of performance reached).

In addition, with the increased uncertainty regarding the evolution of network needs, customers’ expectations and the rise of new opportunities, the need for long-run innovation and the build-up of new knowledge has grown among the whole energy industry. That which is true for the outputs of a

network company is also true for innovation: it might conflict with cost reduction ambitions in the short run. In classic incentive regulation focused on cost efficiency, innovation is likely to be the first item the company will cut to achieve its budget targets. We can see that regulators are increasingly attempting to incentivise innovation or, at a minimum, protect cost allowances dedicated to innovation from efficiency measures, in order to save costs in the long run.

The virtue of incentives on performance is that they have practically no limit in scope. One could think of incentives related to any area of the company’s business, based on its core missions (build and maintain the network, operate the system, facilitate market functioning and European integration...). In some instances, additional, non-core tasks assigned to network companies (public service obligations) can also be subject to incentive regulation and not only paid at cost. Regulators define efficiency targets and reward the companies according to the achievement of those targets. In Germany, for instance, the four TSOs are responsible for selling the electricity produced by renewable energy facilities on the market if it is not marketed directly. There is an incentive for the TSO to market the electricity in the most optimal manner.

The only limit to creativity as far as incentives are concerned is that the direction in which the incentive pushes the company must meet general interest. In other words, the community of grid users, by paying a financial incentive through network tariffs, must be assured they will get something in return that represents more value for them than the amount of the incentive; value they would not get without the incentive.

The list on the next page gives examples of performance incentives applicable to TSOs in Europe. The most commonly found are listed first.



› Continuity of supply

Power cuts occur, and their occurrence and duration should be limited as much as possible. Incentives on network downtime are common in Europe. Usually, the objective is to reach or stay below a target AIT (Average Interruption Time) and/or SAIFI (System Average Interruption Frequency Index)

› Innovation

As already mentioned, some regulators have come to the conclusion that a classic incentive regulation driven by cost efficiency frequently leads to innovation being sacrificed for cost reduction (and, ultimately, profit). Indeed, the lack of innovation is detrimental in the long run but has no or little visible effect in the short term. With this in mind, some regulators have chosen to grant cost allowances ex-ante that are not exempted from cost efficiency schemes; others have opted to grant a profit to the network company in return for the achievement of innovative projects. Alternative incentives consist in allowing the company to keep a portion of government subsidies to innovative projects.

› Timely commissioning of new assets

With the aim of accelerating network development or reinforcement, incentives on timely commissioning can take the form of a profit the TSO is allowed to receive in return for the observation of construction/commissioning schedules. Another method is to discourage late commissioning by the application of a reduced rate of return to the value of assets under construction. To protect the TSO against unfair penalties, such mechanisms should ensure delays imposed by external factors (permitting procedures, public opposition, unforeseeable natural events, etc.) have a neutral effect on the TSO's performance.

› Realisation of replacement investments, security investments or other specific investments

With the ageing of networks mostly developed in the 1970–80s, replacement investments have become crucial for the reliability of supply in some countries. Assets that guarantee network security are also key. Giving an adequate level of priority to those investments by means of a financial incentive can be seen as a necessity in some countries. The same goes for cross-border investments that increase market integration, security of supply and social welfare, or investments that solve internal congestions.

› Extension of economic lifetime of assets

In contrast to the above, this kind of incentive aims to prevent the replacement of network assets that have reached the end of their economic lifetime (depreciation period) but for which the technical condition is still good. In a RAB x WACC (or RoE) remuneration system, a fully depreciated asset brings no remuneration as its book value is equal to zero. Moreover, maintenance costs tend to increase towards the end of life. To make up for this, some regulators allow an increased OPEX allowance, which encourages the TSO to delay decommissioning.

› Import/export capacity

Under EU legislation, TSOs must ensure the maximum possibility is given to market parties to exchange electricity with each other throughout the Union. Incentives based on the level of available cross-border transmission capacity reinforce this ambition. In addition, with the increasing penetration of low marginal price renewable energies and the fall in profitability of conventional power plants, a number of EU countries incur a risk of electricity shortages in case of very high consumption. These incentives also aim to reduce this risk by enabling maximal imports when required.

› Timely implementation of specific mechanisms or projects

Such incentives reward the TSO for the development according to the schedule of one or several mechanisms expected to improve market functioning, e. g. to improve system balancing and system reliability, develop flexibility or smart grids.

› Customer satisfaction

The performance can be measured through surveys sent to grid users, for example, and triggers an incentive calculated based on the level of satisfaction.

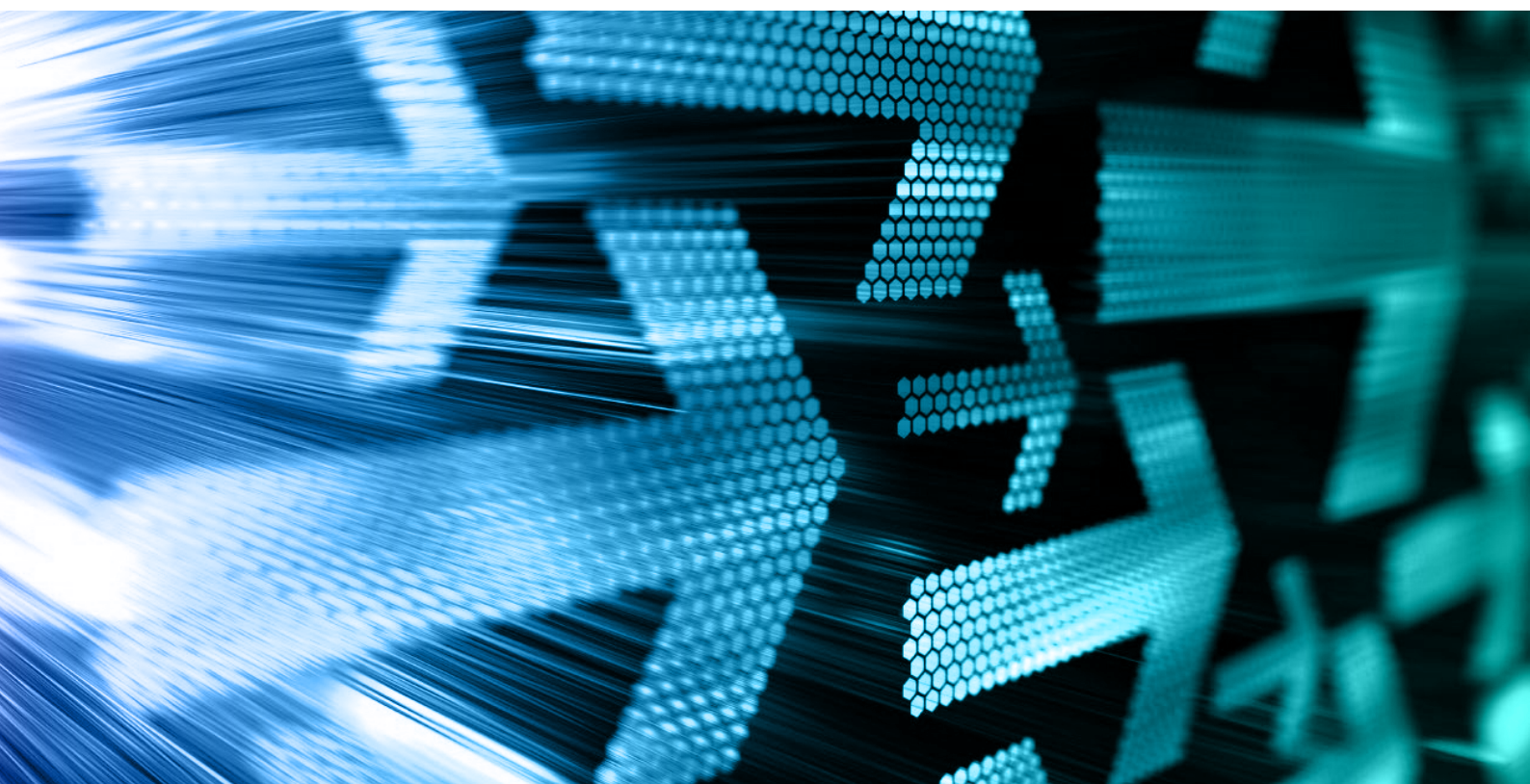
The table below summarises TSO incentive schemes and the countries where they are applied:

	Country or Region
Continuity of supply	Belgium, Finland, France, Italy, Lithuania, Portugal, Spain, UK
Innovation	Austria, Belgium, Finland, France, Germany, UK
Timely commissioning of new assets	Belgium, Czech Republic, France, The Netherlands
Extension of economic lifetime of assets	Portugal, Spain
Realisation of replacement investments	Belgium, Netherlands
Increase of import and/or export capacity	Belgium, Portugal
Timely implementation of specific mechanisms (balancing, flexibility, system reliability, market development)	Austria, Belgium
Realisation of investments aiming at network security	Belgium
Realisation of investments aiming to solve congestions and network constraints	Italy
Realisation of smart grid projects	France
Grid user satisfaction	Belgium

Table 2: Summary of incentive schemes – Source: ENTSO-E

Conclusions

- › In previous chapters, we have drawn attention to the fact that, alongside capital intensive activities, TSOs are expected to assume multiple roles and perform a whole series of tasks that do not involve capital investment and that, under current regulatory models, do not generate remuneration. Nevertheless, performance and risk taking are, more than ever, key in the ongoing energy transition. In the interest of the community of consumers, TSOs must be encouraged to take those risks and to perform to the best extent possible. Introducing financial incentives is a fair way for consumers to reward the TSO for the tangible benefits that result from reaching specific targets.
- › Incentive regulation usually begins gradually, from a few, simple, tried-and-tested incentives to more complex ones. The most common incentives are those on cost efficiency and, to encourage a sustained quality of service in spite of cost reduction targets, incentives on operational performance are usually introduced after a few years. As the regulation becomes more mature, the number of areas incentivised can increase, as well as the amounts at stake.
- › Incentives are a powerful tool and, therefore, they should be designed cautiously and with consideration, in accordance with key criteria. At early stages of incentive remuneration frameworks – and, for some, incentives – allowing only reward would provide less risk for TSOs.
- › Lastly, we should remember that for an incentive to be effective, the reward (and/or the penalty) linked to it must be sufficiently meaningful. For that reason, if incentive regulation ensures a fairer output/profit balance, it is also riskier for the TSO than, for example, a “cost +” model. Consequently, models that include financial incentives – as far as they are not optional for the TSO – should always consider the higher risk level and reflect it in the basis remuneration (WACC or RoE).



5 Toolkit for enhancing capital remuneration regimes

The previous chapters have established that TSOs, facing additional and new challenges, require a regulatory remuneration environment, which allows them to not only effectively and efficiently address those very challenges but also ensures the original and crucial task of ensuring security of supply at all times. This chapter aims to outline the criteria, mechanisms and tools aimed at achieving those goals.

TSOs' business will most certainly remain CAPEX-intensive for the foreseeable future. Consequently, as outlined in chapter 2 and 3, a sufficient remuneration of capital is of utmost importance for TSOs and, by extension, for the grid user and society as a whole.

Unfortunately, as highlighted in chapter 3, equity remuneration, if solely calculated using "classic approaches" relying heavily on multi-year government-issued bond interest rates, will become insufficient at some point: Monetary and fiscal policies – both historic ones in reaction to the 2008 financial crisis and current and prospective ones intended to mitigate the negative effects of the COVID-19 pandemic – have and will continue to distort those interest rates, and thus returns on equity and debt for TSOs, downward and potentially below sustainable steady-state levels for the foreseeable future.

Irrespective of the reasons for raising or lowering interest rates, the current environment of risk-free rates is about to severely limit TSOs in effectively fulfilling their unique and important tasks – current and future ones – with which society has entrusted them. Without the possibility to attract sufficient equity and consequently sufficient debt at low interest rates, the scope for TSOs acting as cutting edge, innovative and highly responsive leaders in their sector would be severely limited.

5.1 Remuneration of investments

Not having a sufficient base capital remuneration prevents TSOs from engaging in an actively forward-looking and innovative business. Consequently, at least some lower bounds (or floor) to equity remuneration (**e. g. on the risk-free rate or WACC itself**) must be introduced – and in fact has been introduced in some (member) states already. Furthermore, a careful application and consideration of financeability tests, as performed, for instance, by rating agencies, could potentially yield insights into how a regulatory authority's decisions on remuneration might be detrimental to the respective TSO's financial situation.

WACC- and RoE-adders applied to selected, well-defined projects considered of outstanding importance (inter alia

those with a direct impact on national or European decarbonisation and sustainability targets or fulfilling other crucial operational objectives) could represent viable means and are actually already implemented in some cases to remedy the detrimental effects caused by an artificial low-interest rate environment until the situation returns to pre-crises steady-state levels.

Such an approach would also be in line with the reasoning expressed in EU regulation 347/2013 (art 13) which foresees that "appropriate incentives" are to be granted to promoters of PCIs if risks for the development, construction, operation or maintenance associated with those are considered higher than those incurred for comparable infrastructure projects.

5.2 Remuneration of operational expenditures

Notwithstanding the CAPEX-intensity of the TSO-business, a number of services provided by TSOs to Society are not CAPEX-intensive and, because of this, are generally not subject to remuneration (inter alia the legally mandated handling of levies or surcharges, the assessment of security of supply, the development of capacity remuneration mechanisms and the role as market facilitator, among others).

Many national regulatory frameworks ensure, at best, recovery of OPEX spent to perform those tasks or, in some cases, even subject them to efficiency incentives. However, not being able to earn at least some remuneration for providing these

services or even facing the risk of incomplete cost-recovery is detrimental for two reasons:

First, it potentially increases the risk of TSOs being ex-ante unable to achieve their allowed levels of return. Second, and arguably even more severe, is the circumstance outlined in chapter 4 that, by not facing positive incentives on the provision of those services, it is not ensured that a TSO's provision of those services aligns in the best possible manner with society's needs. Such incentives could, for instance, take the form of a handling or service fee, which could well consider a verifiable measure of quality of the service provided.

5.3 Potential candidates for smarter incentive schemes

On the most basic level – i. e. before considering how to provide TSOs with effective, fit for purpose incentives which meet the criteria outlined in chapter 4 – the utmost care should be taken to ensure that regulatory frameworks do not provide actual disincentives to TSOs. An institutional- or regulatory setup qualifies as a disincentive if a TSO faces an actual reduction of its allowed revenues or costs where it attempted to maximise social- or grid-users' welfare. In such a situation, a rational TSO will not only have no incentive to pursue such welfare maximisation but, rather, be actively discouraged from doing so. To achieve the objectives of the Green Deal especially, setting incentives **that provide a reward** but no penalty would be a better option for boosting TSO activities.

One area where this is of potential concern is the acquisition of public (EU) funding for certain, eligible projects. A "mild" disincentive in this regard would entail that the regulatory framework provides insufficient means for recovering the non-negligible costs caused by complex application procedures and reporting obligations which are regularly associated with public funding acquisition and handling. A potential

remedy for such a situation would be an opportunity for the TSO to obtain a bonus once certain levels of public funding have been successfully acquired.

A "severe" disincentive for TSOs to acquire public funding exists in the event a successful acquisition results in an actual reduction of a TSO's allowed revenues. Such a situation can occur in those remuneration systems which do not follow a WACC approach but entail a separate treatment of equity and debt. If public funding is not treated as non-interest-bearing debt, but rather as a substitute for equity, allowed returns will decrease. Consequently, a TSO with the intent to act to the benefit of the grid user could only do so by infringing on its own remuneration. Clearly, such a situation would be non-sustainable and should be avoided or corrected, if present.

Although the two mechanisms outlined below are not the only ones to be considered when aspiring to provide some of the incentives outlined in Chapter 4, they do constitute great examples that this can be achieved without having to resort to overly complex schemes.

“Better Projects” by Amprion

A significant share of projects that are essential for meeting the EU’s decarbonisation targets encounters delays in implementation. These delays have two direct consequences for the EU in achieving its carbon reduction targets: the missing grid capacity hinders the further growth and integration of RES, and the resulting grid congestion must be resolved by expensive and, most likely, CO₂-intensive redispatching.

The delays in building the required infrastructure frequently result from fierce public opposition. To gain acceptance, efforts must be made to engage with local citizens and address their concerns and needs, and to jointly develop approaches to protect inter alia nature and human health. An approach we refer to as “better projects” aims to develop locally tailored, transparent and participatory planning processes. A better project should be understood as a process that begins with improved stakeholder engagement and includes the implementation of the additional measures which result from stakeholder input. The “Good Practice of the Year” Award by the Renewables Grid Initiative (RGI) has shown that “better projects” can reduce potential conflicts and the risk of project failure, facilitate timely project implementation and maintain the good reputation of the energy

transition. Although “better projects” may have higher investment costs – mainly to accommodate stakeholders’ interests to a degree which facilitates the swift completion of the project – the overall impact would be financially positive due to timely implementation. As policy makers and regulators have the responsibility to keep the overall costs for customers low, it is therefore necessary to quantify the benefits of this approach to measure its efficacy and cost effectiveness.

Utilising a cost–benefit analysis approach, the RGI has performed a sensitivity analysis as well as an illustrative case study to assess whether the better projects approach does indeed result in higher gains for society even though initial investment costs might be higher. It was, indeed, shown that the costs of a timely commissioned “better project” can reduce the overall costs for the consumer compared to standard projects. In addition to the cost relief for the customer, better projects can also bring value to the local population, support a positive image of the energy transition and reduce conflicts in society. Thus, it is recommended to further investigate such additional measures, their benefits and costs to reflect the different approaches in different countries.

Fixed OPEX/CAPEX Share Joint project by TenneTs¹⁹

The FOCs aims to treat all costs in the same way in terms of activation (capitalisation through the RAB) and expensing, irrespective of whether they are OPEX, CAPEX or SO costs. In doing so, any bias towards CAPEX that may come from it creating a return on capital would be eliminated. Regulated companies would be free to choose the best technical solution, be it OPEX- or CAPEX-based, hence ensuring true technology-neutrality.

In most current regulatory systems, CAPEX is capitalised and creates allowed capital costs and depreciation that are added to allowed revenues. OPEX is expensed directly. Under FOCS, all costs²⁰ would be regarded as total expenditure (TOTEX). That would include costs for investments, maintenance and SO, and for the procurement of flexibility. A fixed share of these costs would then be added to the RAB, creating allowed capital costs and depreciation that are added to the allowed revenue. The balance of the costs would be expensed directly. These new rules would mean that a certain fixed percentage of cash spent on actual capital goods would be added to the RAB. Equally, a similar fixed percentage of cash spent on OPEX – for example, on flexibility measures or other smart solutions – would also be added to the RAB. In doing so, and thereby treating all costs the same, FOCS would ensure that the technology decision of the TSO is not biased by differing treatments of CAPEX or OPEX. A practical example would be

a situation in which some assets are already fully depreciated but have been well-maintained (with maintenance expenditures possibly increasing with the assets’ age) and are thus still fully operational. If the TSO only received a return for its CAPEX, it actually faces incentives to disassemble and replace the fully depreciated assets with new ones, while further maintaining them might actually be the better solution from a social welfare perspective. FOCS would remove any need for the regulator to check whether certain costs qualify as OPEX or CAPEX. In principle, to equalise the incentive between TOTEX and CAPEX, any fixed capitalisation rate could be used.

An instance where the underlying ideas of FOCS are actually being implemented is the UK, where the activities of transmission asset manager (TO) and transmission system operator (SO) are distinct and regulated separately. The British regulator, Ofgem, sets the allowed revenue for each company for the regulatory period. The allowed revenue subject to efficiency incentive (revenue cap) applies on the TOTEX, defined as CAPEX + controllable OPEX. Part of the TOTEX may be capitalised by the company, meaning that the RAB is incremented by both CAPEX and OPEX without distinction.

¹⁹ https://www.tenneT.eu/fileadmin/user_upload/Company/Publications/Case_studies/Oxera_Smart_incentives_for_TSOs_reports_vols_1_and_2.pdf

²⁰ Clearly, great care should be taken to assess the scope to which FOCS should be applied to with regard to cost items considered as “non-influenceable”.

The part of the TOTEX that is capitalised is called slow money as it is depreciated over 45 years. The rest of TOTEX is called fast money as it is covered by tariffs on an annual basis. For the current regulatory period (2013–2021), OFGEM set the ratio between slow and fast money to 85/15 for National Grid as asset owner and to 28/72 for National Grid as system operator. This means that 85 % of TOTEX increments the RAB of NGET and 28 % increments the RAB of NG ESO. Please note that non-controllable OPEX are not subject to the efficiency incentive under the revenue cap. They are passed through to tariffs on a yearly basis.

Clearly, the transition to FOCS-like approaches from existing regulatory frameworks can be a complex task as several aspects have to be carefully addressed (e. g. the treatment of existing asset base, depreciation times of capitalised OPEX etc.). Irrespective of those considerations, FOCS does highlight that any regulatory framework should consider incentives for OPEX which go beyond a mere pass-through treatment in order to foster beneficial outcomes for TSOs and grid users alike.

Conclusions

- › Regulatory frameworks shall not provide disincentives to TSOs with respect to fulfilling their tasks in a welfare-maximising manner.
- › Stakeholder involvement and improved consideration of stakeholders' requests can prove to be an essential tool to reduce delays in the completion of essential grid expansion projects. Additional costs thereby incurred can be expected to be more than offset by social welfare gains due to timely project completion.
- › The regulatory treatment of both CAPEX and OPEX requires a careful and joint consideration to ensure that TSOs receive an appropriate remuneration for performing the tasks entrusted to them by society. Performing these tasks in a sustainable and efficient manner will result in increased social welfare.
- › An introduction of lower bounds (or floor) to equity remuneration (e. g. on the risk-free rate or WACC itself) shall be considered.
- › Selected, well-defined projects as well as new business segments should be examined – based on their importance to national or European decarbonisation targets by receiving specific WACC or RoE adders.
- › Financeability tests might provide useful insights on how a regulatory authority's decisions might affect the financial situation of the concerned TSO.
- › Remuneration of operational TSO services could be incentivised by introducing a service or handling fee.
- › For specific TSO tasks, projects or innovation connected with the achievement of the Green Deal, incentives should only bear reward but no penalty.

Appendix 1 – Most Commonly Used Incentive Models

— Cost-plus

With cost-plus regulation, the regulator allows the network operator to recover its expenses as well as an authorised margin corresponding to a fair return on investment. In that case, the network operator is encouraged to declare its actual costs and consumers avoid paying undue profits due to the monopoly situation. However, as we have noted in the previous sections, it does not encourage the operator to optimise its processes nor improve its performance.

— Price/revenue cap

The regulator sets, ex-ante, a fixed price (price cap regulation) or an allowed revenue (revenue cap regulation) for the service provided by the network company, which is then encouraged to optimise its processes as it has the opportunity to make a profit by reducing its costs. In price cap regulation, the volume of sales is fixed; therefore, the company bears the risk of receiving a lower revenue due to sales volumes smaller than expected. In revenue cap regulation, the revenue is adjusted ex-post to compensate for any difference in sales volume.

— Efficiency sharing or sliding-scale regulation

The regulator defines a rule for the sharing of efficiency gains between the company and grid users. Efficiency gains are assessed by comparing actual costs with budgeted costs. This scheme combines the properties of the cost-plus mechanism with the properties of the revenue cap at a level that depends on the applied sharing rule.

— Menu of contracts

Under this model, rather than imposing a unique performance target, the regulator proposes a menu of options with different levels of incentives corresponding to different levels of costs for the network company. The company can self-select the most appropriate regulatory scheme from its own perspective and according to its own ambitions. The trade-off for the TSO is then between the level of costs it commits to and the level of incentive it receives through the chosen contract. The challenge for the company is to select a reachable cost target while benefiting from a sufficiently attractive incentive.

— Yardstick competition

This model can be used when the same authority regulates several comparable monopolies operating in similar franchised businesses. It can, thereby, compare the costs and the level of efficiency of each monopoly against the performances of the others and fix the company's revenues based on the average or best practice sector performance. Each monopoly can increase its profit if it is more efficient than the average level, which encourages most – if not all – of them to improve their processes. Yardstick regulation is difficult to implement for TSOs because of the reduced number of TSOs and the differences in geographical, technical and legal constraints.

Appendix 2 – Overview of TSO Remuneration (2020)

Country	2014	2015	2016	2017	2018	2019	2020	Current regulatory period	
AT (Austria)	6.42	6.42	6.42	6.42	4.88	4.88	4.88	2018 – 2022	Nominal pre tax
BE (Belgium)	2.40	1.63	2.58 ^[1]	2.85 ^[1]	2.93 ^[1]	2.28 ^[1]	4.68 / 3.1 ^[2]	2020 – 2023	equity (nominal post tax)
BG (Bulgaria)	1.1 / 3.33 ^[3]	1.1 / 3.33 ^[3]	1.1 / 3.33 ^[3]	3.33	3.00	3.00	3.00	2020	Nominal pre tax
CH (Switzerland)	4.70	4.70	4.70	3.83	3.83	3.83	3.83	2020	Nominal pre tax
CY (Cyprus)	not applicable							2017 – 2021	
CZ (Czech Republic)		5.77	7.95	7.95	7.95	7.95	7.95	2016 – 2020	Nominal pre tax
DE (Germany)	9.05	9.05	9.05	9.05	9.05	6.91	6.91	2019 – 2023	equity (nominal before corporate tax, after trade tax assets – assets >=2006)
						5.12	5.12		equity (real before corporate tax, after trade tax assets <2006)
	7.14	7.14	7.14	7.14	7.14				equity (nominal before corporate tax, after trade tax assets <2006)
DK (Denmark)							1.35	2020	Nominal pre tax
	n.a.	1.60	1.60	1.60	1.60	1.60			nominal post tax
EE (Estonia)	6.74	6.74	4.46	4.46	4.46	4.46	4.51	2020	Nominal pre tax
ES (Spain)	6.50	6.50	6.50	6.50	6.50	6.50	5.58	2020 – 2025	Nominal pre tax
FI (Finland)			6.55	6.19	5.78	5.36	4.89	2016 – 2023	Nominal pre tax
	2.97	2.97							Real post tax
FR (France)	7.25	7.25	7.25	6.125	6.125	6.125	6.125	2017 – 2020	Nominal pre tax
GB (United Kingdom)				4.23	4.23	3.96	3.75	2013 – 2021	Real pre tax (Vanilla)
	4.55	4.55	4.55						Real post tax
GR (Greece)		8.50	7.50	7.30	7.00	6.90	6.50	2018 – 2021	Real pre tax
	8.50								Nominal pre tax
HU (Hungary)	6.23	6.23	6.23	4.69	4.69	4.69	4.69	2017 – 2020	Nominal pre tax
IE (Ireland)	5.20	4.95	4.95	4.95	4.95	4.95	4.95	2016 – 2020	Real pre tax

Country	2014	2015	2016	2017	2018	2019	2020	Current regulatory period	
IT (Italy)	6.30	6.30	5.30	5.30	5.30	5.60	5.60	2016 – 2021	Real pre tax
LV (Latvia)							3.31	2020 –	Real pre tax
	6.00	6.10	n.a.	4.43	4.44	4.22			Nominal pre tax
LT (Lithuania)	6.13	5.23	5.23	5.23	5.23	4.94	5.01	2016 – 2020 (extended to 2021)	Nominal pre tax
NL (Netherlands)	3.60	3.60	3.60	3.00	3.00	3.00	3.00	2017 – 2021	Real pre tax
NO (Norway)	n.a.	6.39	6.39	6.39	6.10	5.60	5.15	2020	Nominal pre tax
PL (Poland)	7.286	7.197	5.675	5.633	6.015	6.018	5.507	2020	Nominal pre tax
PT (Portugal)	7.76	5.99	6.13	6.33	5.17	4.88	4.60	2018–2020 (extended to 2021)	Nominal pre tax
RO (Romania)	7.70	7.70	7.70	7.70	7.70	7.70	6.39 / 7.39 ^[4]	2020 – 2024	Real pre tax
RS (Serbia)	6.64	6.64	6.64	6.64	6.64	6.64	6.64	2020	Real pre tax
SE (Sweden)	5.20	5.20	5.85	5.85	5.85	5.85	2.35	2020 – 2023	Real pre tax
SI (Slovenia)	4.13 / 7.14 ^[5]	4.13 / 7.14 ^[5]	4.13 / 7.14 ^[5]	4.13 / 7.14 ^[5]	4.13 / 7.14 ^[5]	5.26	5.26	2019 – 2021	Nominal pre tax
SK (Slovak Republic)	6.03	6.08	6.12	6.47	6.27	6.04	5.81	2017 – 2021	Nominal pre tax

[1][2] Belgium: $[1] \text{ [RFR} + (3.5 \% \times \text{Elia Beta})] \times 1.1$, with floor Beta = 0.53;

[2] $(\text{equity} < 40 \% \times \text{RAB}) / (\text{equity} > 40 \% \times \text{RAB})$

[3] Bulgaria: 2014 – 2016: 1,1 (transmission) \ 3,33 (access)

[4] Romania: New assets

[5] Slovenia: assets < 2011) / assets > 2011

Table 3: Evolution of TSOs' Regulatory Rate of Return from 2014 – 2020. Source: ENTSO-E

Country	Rating	Country	Rating
Elia	BBB+ S&P	Amprion	A3 Moody's
Ceps	Aa3 Stable Moody's	Terna	Baa2 (Moody's), BBB+ (S&P)
Elering	A2 Moody's	Statnett	A+ S&P
Fingrid	AA-S&P	REN	BBB S&P (October 2020)
RTE	A S&P	REE	A-S&P
		Swissgrid	Low AA (Crédit Suisse)

Table 4: TSOs' financial ratings

Appendix 3

Abbreviations

CAPEX	Capital Expenditures	P2G	Power-to-Gas
CAPM	Capital Asset Pricing Model	RAB	Regulatory Asset Base
ECB	European Central Bank	RGI	Renewable Grid Initiative
ENTSO-E	European Network of Transmission System Operators for Electricity	RoE	Return on Equity
FOCS	Fixed OPEX and CAPEX Share	TOTEX	Total Expenditures
KPI	Key Performance Indicator	TYNDP	Ten-Year Network Development Plan
NRA	National Regulatory Authority	WACC	Weighted Average Cost of Capital
OPEX	Operational Expenditures		
PCI	Project of Common Interest		

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