

Innovation incentives for DSOs - a must in the new energy market development

A EURELECTRIC paper

July 2016

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We speak for more than 3,500 companies in power generation, distribution, and supply.

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Carbon-neutral electricity by 2050

We have committed to making Europe's electricity cleaner. To deliver, we need to make use of **all low-carbon technologies**: more renewables, but also clean coal and gas, and nuclear. Efficient electric technologies in **transport and buildings**, combined with the development of smart grids and a major push in **energy efficiency** play a key role in reducing fossil fuel consumption and making our electricity more sustainable.

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We support well-functioning, distortion-free **energy and carbon markets as** the best way to produce electricity and reduce emissions cost-efficiently. Integrated EU-wide electricity and gas markets are also crucial to offer our customers the **full benefits of liberalisation**: they ensure the best use of generation resources, improve **security of supply**, allow full EU-wide competition, and increase **customer choice**.

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Europe's energy and climate challenges can only be solved by **European – or even global – policies**, not incoherent national measures. Such policies should complement, not contradict each other: coherent and integrated approaches reduce costs. This will encourage **effective investment to** ensure a sustainable and reliable electricity supply for Europe's businesses and consumers.

Innovation incentives for DSOs - a must in the new energy market development

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KEY RECOMMENDATIONS FOR EU POLICY MAKERS

- Distribution Systems Operators (DSOs) play a key role in implementing innovative ideas to improve the functioning of electricity distribution networks and to develop smart energy systems with the ultimate goal of benefiting customers. Because DSOs are natural monopolies and regulated businesses, they have to develop innovative concepts under a certain regulatory framework that incentivises them.
- All market players should recognise that DSOs need more innovative investments to succeed in the new EU electricity market and support their request to achieve regulatory frameworks incentivising innovation;
- Policy makers should encourage national regulatory authorities (NRAs) to give DSOs appropriate incentives to implement the necessary innovative initiatives that support the transformation of the DSOs' business models. It is also important that NRAs monitor whether DSOs achieve scheduled goals;
- Regulators should ensure that cost reductions given to today's consumers are not at a disproportionate expense to future consumers (e.g. if innovation today isn't incentivised). Therefore, the remuneration of the expenses due to the implementation of innovative initiatives should be guaranteed.
- The implemented specific regulatory mechanisms should be predictable and stable in the outcome. They should include incentives for both CAPEX and OPEX, acknowledging the shift from a higher share of CAPEX to OPEX in the deployment of new innovative network technologies.
- Implement an (EU-wide) knowledge sharing system of Research and Development (R&D) results with additional monetary incentives if possible. Other DSOs and their customers could participate in the system and benefit from it.
- Regulators should bear in mind the degree of customer and technology readiness that could determine what design and level of incentive is best suitable for the stage of innovation needed. In general, the regulatory framework should give the DSO the freedom of choice to adopt the most efficient solution.

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Chapter 1 – Introduction: What is innovation and why it is important for the New Energy Market and DSOs

Innovation is vital to European competitiveness in the global economy. Acknowledging the need to push for new technology and business models and to move innovation forward is an important step towards a successful low-carbon energy transition. The European Commission (EC) recognizes that innovation is one of the key pillars of the Energy Union. The Energy Union Communication, adopted on 25 February 2015, dedicates one of its five dimensions to research, innovation and competitiveness. With the objective of implementing the fifth pillar of the Energy Union strategy, the initiative “Accelerating the European energy system transformation- An integrated Strategic Energy Technology (SET) Plan” plays a key role in a new European Energy Research & Innovation (R&I) approach designed to accelerate the energy system transformation.

In the SET plan, innovation is a broad topic and it is considered in three areas:

1. Fundamental research, knowledge science, required to firmly anchor the bridge;
2. Technology development;
3. Product development including process, technology and prototype development.

Distribution Systems Operators (DSOs) play a key role in implementing innovative ideas to improve the functioning of electricity distribution networks with the ultimate goal of benefiting customers. Because DSOs are natural monopolies and regulated businesses, they have to develop innovative concepts under a certain regulatory framework that incentivises them.

The growth of distributed generation presents a challenge for DSOs especially as it affects their ability to maintain and upgrade their grid infrastructure. DSOs have an important role to play in the EU energy transition, as they are responsible for the deployment of smart grids and contributing to the development of smart energy systems, whilst maintaining the smooth operation of the networks. This challenging job requires increasingly innovative solutions. Together with other market parties, more focus on innovation is needed to understand how to make the best use of new technologies opportunities to maintain high levels of security of supply at the most efficient cost.

Innovation is also important due to the increasing need for investments in the ageing European distribution networks. Investments in electricity distribution networks are often long-lived and irreversible. To ensure that the required investments are done, innovation is urgent.

Most DSOs have to change their business models and internal processes in order to implement innovative solutions and technologies, to help the transition to the new energy market. The SET Plan sets out the implementation of an innovative and market uptake programme and describes actions for fostering the market roll-out of innovative solutions. It includes actions addressing the removal of regulatory, financial, market and behavioural barriers. Incentivising DSO investment in innovative technologies may also limit the extent to which direct public funding is required and co-funding from established funding schemes could alleviate DSOs from high-risk pressure.

Additionally, Research and Development (R&D) represents a critical part in the innovation process. It is an investment in technology, which develops new competitive advantages through the transformation of ideas in new products, processes and services. Innovation includes two main components, which are knowledge and technology. R&D directly supports the development of both, because it develops the knowledge which can be used to implement successful technology.

An example of technology and product development through an investment in innovation is the deployment of smart meters. The roll out of smart meters and the management of the data available, the potential storage technologies and demand response provide ample scope for innovation and further development of smart grids.

The total costs of business-as-usual management of distribution networks will likely increase in the event of increased distributed generation. Investments are required to connect all distributed generation to the grid, and to develop the necessary ICT infrastructure to control the higher volatility of flows and peak demand fluctuations. Innovation is also needed to ensure quicker, more efficient customer service, for example for new connections or fixing faults.

Networks have different characteristics across EU Member States. Therefore, there is a wide range of regulatory models in place to better adjust to the particularities of the grids and the DSOs. The regulation of DSOs (independently of its characteristics) should stimulate innovative solutions to distribute electricity to network customers in a sustainable and cost-efficient way.

Research for innovation is being developed with the objective of assessing how DSOs can further contribute to the society or the energy transition in the long-term.

Why is innovation important for DSOs?

As the discussion on the role of the DSO in the future gains momentum, it is important to develop the necessary capabilities within DSOs to integrate new technologies and operate under smart(er) grid oriented regulatory frameworks. Innovation oriented policies can directly contribute to this by motivating DSOs to be actively engaged in the shift towards smarter and sustainable network management, whilst ensuring the security and high quality of the distribution service. Fostering innovation at the DSO level remains an essential strategy.

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Chapter 2: What are the challenges and barriers for DSOs to innovate?

DSOs face many challenges ahead of the maturity of smart grids, when large scale distributed generation would be integrated, with high numbers of electric vehicles (EVs) connected to the grid, and many prosumers interacting in the market. DSOs will still need to keep on optimising network operation, regulating the voltage and the power flows and reducing technical power losses. More active grids will also require a more advanced monitoring and management of the grid, for which innovation technologies are needed. New technologies not only give the opportunity to new players (aggregators, Energy Service Companies) to enter the market and to offer new products (shift load, energy efficiency), but also empower customers encouraging them to be active (enabling flexibility and demand response).

Are DSOs already allowed to innovate in some Member States?

Historically, national regulatory authorities (NRAs) have not funded DSOs to take risks. In fact, they were financed to do the opposite in order to keep borrowing costs low. How to encourage innovation in network design and operation, in anticipation of the incoming challenges, is still an open question in distribution regulation and currently only few Member States are designing regulatory schemes to incentivise innovation. These regulatory schemes become even more important as a means of managing revenues and removing barriers to adoption of the required technology alternatives.

EURELECTRIC conducted a survey amongst experts on incentives for innovation within each national regulatory framework. It should be noted that the deployment of smart meters is not included as innovation in this survey. Figure 1 shows which Member States have already implemented specific incentives for innovation in the economic regulation. It also outlines the changes in the national regulatory frameworks from 2014 to 2016 by comparing the results of the recent survey with the results from another one conducted in 2014. Each circle stands for the regulatory framework of a specific Member State.

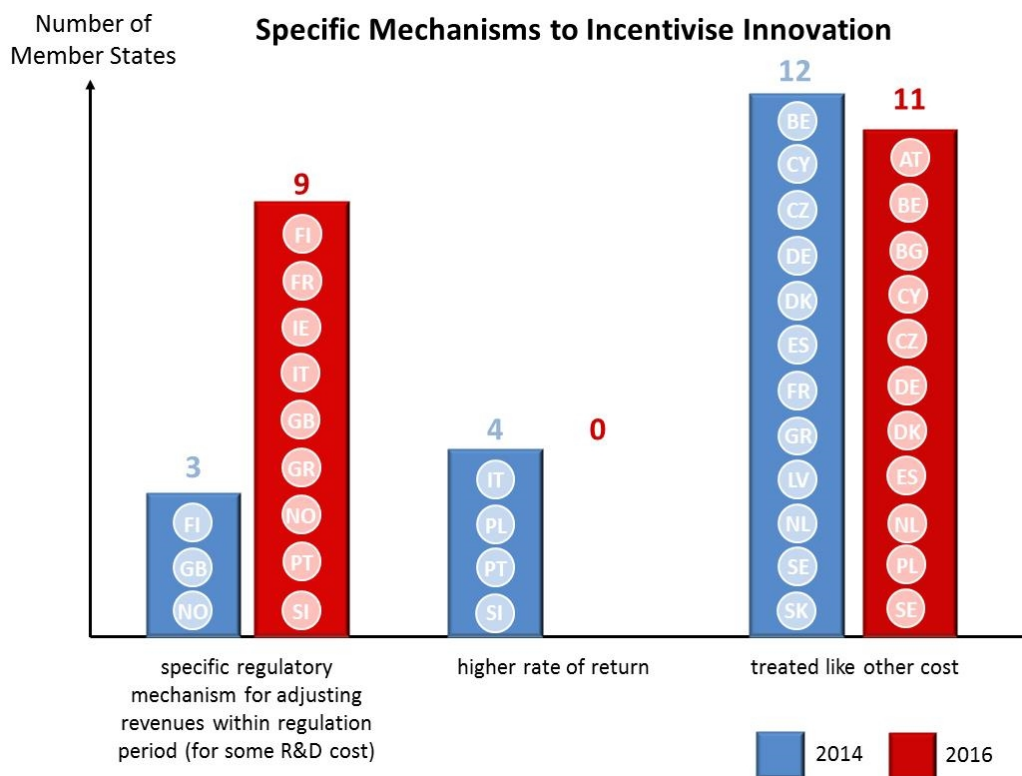


Figure 1: Number of Member States with or without a specific mechanism to incentivise innovation

Source: EURELECTRIC, July 2016

In 2016, more than half of the Member States questioned for this survey (11 out of 20) have not introduced an incentive mechanism for expenditures for R&D and/or pilot projects. Those costs are treated like any other costs. Meanwhile, nine Member States have already introduced incentives for R&D and pilot projects within their regulatory frameworks:

- From 2017 onwards, the approved budget for R&D and pilot projects will be added to the annual allowed revenues in Greece;
- In Norway, expenditures for R&D and pilot projects are added to the allowed revenues (max. 0.3% of regulated asset base);
- The Slovenian regulatory framework acknowledges 3% of the book value for smart grid investments;
- In the current French regulatory period, R&D and pilot projects' operating costs are covered by a specific part of the distribution network tariff. These costs are excluded from efficiency requirements;
- In Great Britain, DSOs can recover money for pilot projects through an innovation stimulus under the RIIO model and are incentivised to roll out innovative projects through the regulatory framework re RIIO.

In contrast to 2014, in 2016 there is no regulatory framework which sets incentives for R&D or pilot projects by establishing to a higher rate of return (RoR). This is not necessarily needed to encourage innovation, as shown in GB with RIIO where Ofgem grants with extra TOTEX the innovative initiatives. However, in Portugal, the DSO will receive the minimum between a higher regulatory RoR and 50% of the system benefits. The extra rate is 0.25% in the first year and rises 0.1% each year, until it reaches 0.75% in the sixth year. Hence, projects should allow for an OPEX reduction, which will be accounted as part of the system benefits; otherwise the DSO may receive a lower incentive.

An increasing number of Member States – all in all 9 – have introduced R&D incentives in their regulatory framework.

Since 2014, six Member States – France, Greece, Ireland, Italy, Portugal and Slovenia – have implemented a new specific regulatory mechanism to promote R&D and/or pilot projects.

EURELECTRIC Members have been asked to categorise the level of fostering innovation within their own regulatory frameworks. Figure 2 also shows the comparison with the results of the 2014 survey.

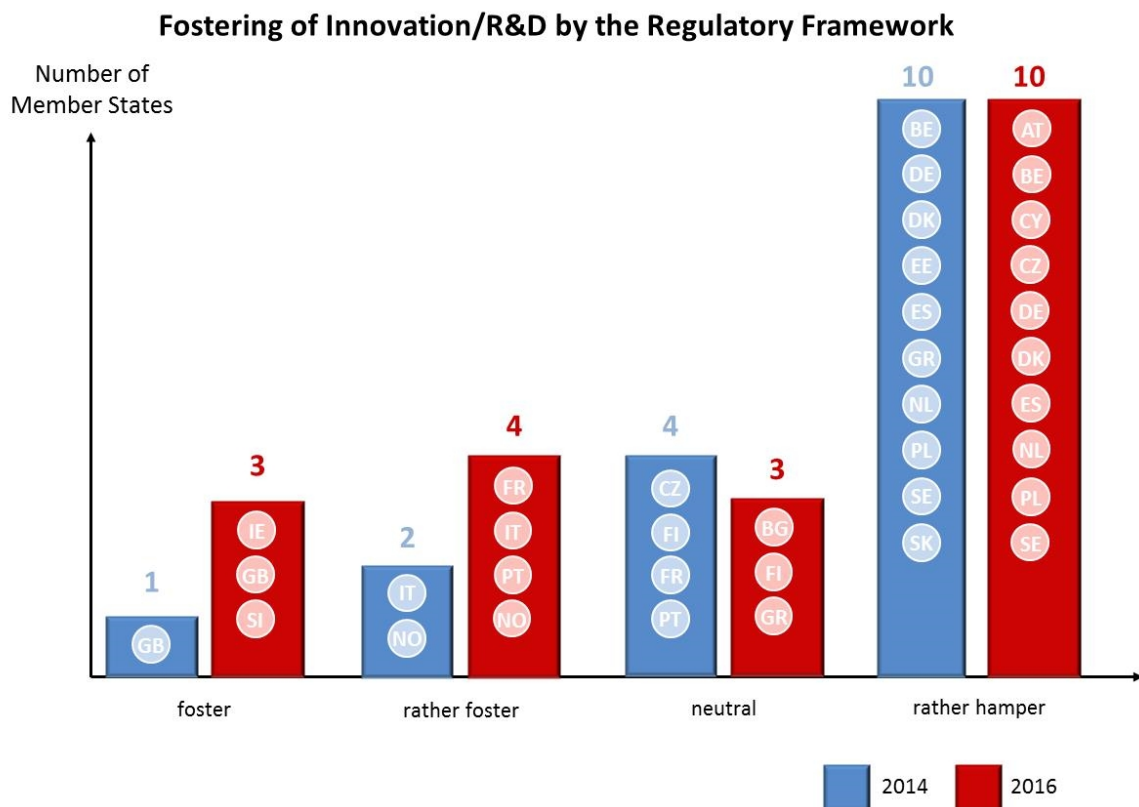


Figure 2: Categorisation of regulatory frameworks concerning the level of fostering innovation
Source: EURELECTRIC, July 2016

In the majority of Member States (13 out of 20), the regulatory framework is either neutral or still hampers innovation/R&D. Only seven out of 20 countries have a regulatory framework that fosters or rather fosters innovation/R&D.

In 2016, four DSOs (from France, Ireland, Portugal and Slovenia) considered that their regulatory frameworks fosters or rather fosters innovation/R&D. Greece has recently implemented a new specific mechanism to promote innovation, therefore it has not been properly evaluated yet and is categorised as neutral. In Denmark, the regulatory framework rather hampers innovation/R&D; however, in some cases Smart Grid costs may be subtracted from the cost base for the benchmarking.

The combination of the outcomes of Figures 1 and 2, results into the graph below. The horizontal axis shows whether there is a specific mechanism within the regulatory framework. The vertical axis displays the evaluation of the regulatory framework according to the profitability of smart grid investments.

Innovation/R&D in the Context of the Regulatory Framework

Impact of regulatory framework on profitability of Smart Grid investments	fosters			IE GB SI 3
	rather fosters			FR IT NO PT 4
	neutral	BG 1		FI GR 2
	rather hampers	AT BE CY 10 CZ DE DK ES NL PL SE		
		treated like other cost	higher rate of return	specific regulatory mechanism for adjusting revenues within regulation period (for some R&D cost)
Are there incentives for R&D or pilots in the regulatory framework?				

Figure 3: Innovation/R&D in the context of the regulatory framework

Source: EURELECTRIC, July 2016

In 2016, no Member State has an incentive mechanism for R&D or pilots guaranteeing a higher rate of return.

Italy, Great Britain and Slovenia have specific regulatory mechanisms that significantly foster innovation/R&D.

If a specific mechanism has been implemented, there is a positive impact on investments/costs for innovation/R&D in most cases. However, if the regulatory framework treats costs for innovation/R&D like any other costs, the system rather hampers innovation.

Regulation that efficiently incentivises DSOs to engage in active system management has to consider the changing OPEX and CAPEX structures to find the optimal balance between using distributed generation and building new infrastructure, and how to incentivise DSOs to be innovative and find solutions (e.g. for ICT, data handling, but also system services) in-house or by outsourcing.

Due to the increasing importance of operational expenditures, the survey has also covered the question whether there are any incentives for OPEX related to innovation.

Incentives for OPEX related to innovation

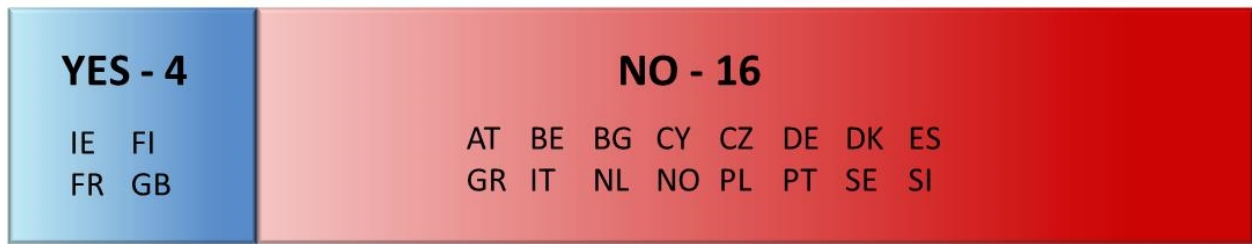


Figure 4: Incentives for OPEX related to innovation
Source: EURELECTRIC, July 2016

The vast majority of Member States have no mechanism that also takes OPEX into account.

DSOs should try out innovative ideas in particular areas in which they could be more efficient. Regulatory mechanisms should facilitate this process and avoid an undue bias towards CAPEX. Traditional forms of regulation would give rate or return on CAPEX, but regulators should look at new ways of incentivising DSOs.

Only four out of 20 Member States (Finland, France, Ireland and Great Britain) have an incentive mechanism for smart grid related OPEX:

- In Finland, there are only incentives for OPEX. CAPEX for R&D and pilot projects are treated as any other costs. OPEX incentives for R&D are approved if they do not exceed 1% of the allowed revenues.
- In France, costs for R&D and pilot projects are covered within the distribution network tariff. These costs are excluded from the benchmarking.
- In Ireland, the regulator can provide OPEX allowances for R&D projects. Separately, there is also an “Innovation OPEX Fund” for projects. If they succeed, they would strategically innovate and change how the DSO operates.
- The RIIO model in the UK does not differentiate between CAPEX and OPEX. OPEX for funded pilot projects will be recognised in the allowed revenues as well.

A partial or complete absence of R&D costs recognition of during the regulatory period can hamper innovation. Moreover, R&D programs can put a strain on efficiency requirements. There is also a matter of social acceptability of such expenses: consumers may not accept the tariff increases which can derive from high R&D investments. Regulators need to find appropriate solutions, such as the use of specific mechanisms or the allocation of subsidies. Eventually, the delay between investments and their long-term recovery through tariffs can cause significant financing issues for DSOs. Their ability to advance cash for such investments depends on the regulatory and contract stability, and on the capital remuneration level. Regulators should make sure that cost reductions given to today’s consumers don’t happen at a disproportionate expense of future consumers.

Chapter 3: Best Practices from around Europe

EURELECTRIC collected best practices from different European countries regarding their R&D- schemes to incentivise DSOs.

The current R&D-scheme for Norwegian DSOs

Background

The current R&D-scheme for Norwegian DSOs was implemented on 1 January 2013. The scheme allows for specific and pre-qualified R&D-project costs up to 0.3% of each DSO's invested grid capital, to be recovered directly through the grid tariff (i.e. outside the revenue-cap regulation scheme).

The R&D-scheme process

In order for DSOs to get R&D-projects included in the scheme, DSOs must go through a four-stage approval process:

1. The DSO applies for project approval from a grant institution

The DSO applies for project approval from a grant institution such as The Research Council of Norway, Innovation Norway, [Enova](#) or EU's different funding bodies. The R&D-project must have a clear socio-economic value creation potential, such as more efficient grid operations or other efficiency gains for the DSO. The NRA prefers proposals that have a connection to the Research Council of Norway's research program [ENERGIX](#), but does approve projects from other grant institutions.

2. The DSO receives an approval/rejection from the grant institution

The grant institution assesses the R&D-projects relevance, the degree to which it can lead to efficiency gains and the innovative/research value. If the R&D-project is found to be relevant/innovative, the grant institution approves the project.

3. The DSO applies for project approval from the NRA

Only if the DSO receives an approval from the grant institution, can the DSO apply to the NRA to include the project in the R&D-scheme.

4. The DSO receives an approval/rejection from the NRA

The NRA approves or rejects the R&D project proposal. The NRA also provides a publically available list of all approved projects on their web page.

The R&D-scheme – other questions

- Depending on the grant institution and the complexity of the project (typically the number of partners involved), the approval process takes between two and twelve months.
- The R&D-scheme covers all the DSO's costs, limited to the R&D projects' budget. Both internal and external costs may be included.
- Ongoing R&D-projects that have previously been approved by a grant institution may also be included in the R&D-scheme. However, only costs (internal or external) that have occurred after 1.1.2013 may be included.

R&D-scheme spending in 2013 and 2014

In 2013, 25 out of 148 DSOs had 103 R&D-projects approved under the R&D-scheme. The total budget for these R&D-projects was close to 2.3 MEUR. In 2014, 31 companies had 162 R&D-projects approved under the R&D-scheme. The total budget for these R&D-projects was close to 4.9 MEUR. Under the R&D-scheme, these DSOs could have applied for 22 MEUR and 24 MEUR in 2013 and 2014 respectively.

Current projects under the R&D-schemes include projects related to tariff design, technology development such as smart energy systems, new cable technologies, and reliability and monitoring. Two concrete projects have been briefly described below:

The DeVID project (2012-2014) involved 17 DSOs. The project aimed at developing and testing methods related to how smart meters provide opportunities for better grid operations, developing methods for using demand response and guaranteeing personal information security.

The DGnett project (2014-2017) involves 5 DSOs. The project aims to identify alternative solutions to reducing costs related to strengthening the grid, voltage regulation, reactive and active power control when integrating distributed production.

Conclusion

The Norwegian system works well and it provides funding for R&D projects as planned. However, there are many companies that do not participate in the scheme, meaning that there is a potential to increase the R&D amount.

The current R&D-scheme for GB Grid Distribution companies

Background

RIIO is the framework for setting price controls in Great Britain (GB) and within this model innovation is a key element. Ofgem, the GB regulator, developed RIIO (Revenues = Incentives + Innovation + Outputs) to encourage investment in networks to maintain a reliable and secure network at a fair price for consumers. The model puts more emphasis on incentives to drive the innovation needed to deliver a sustainable energy network at value for money. The performance based RIIO model sets out network companies' price controls, which are eight years long, with a provision for a mid-period review of the outputs that companies are required to deliver. The current price control for electricity distribution companies began in 2015 and will end in 2023.

The RIIO Model

The RIIO Model encourages companies to innovate through two means:

1. **The Innovation Stimulus Package** – Providing partial financing for innovation related to the delivery of a sustainable energy sector through an electricity networks innovation stimulus. Funding is provided through customer bills where DSOs can recover money for innovation through tariffs. However, if companies do not use this money, they lose it.
2. **Stimulating innovation with the price control package** - The longer-term, outputs-led, incentive-based, ex ante price controls will provide their own incentives to innovate, by giving companies commitment around the potential reward that they can earn from successful innovations and committing to not penalise them for unsuccessful innovations. Companies must report their performance for different outputs to the regulator and they will receive higher revenue if they exceed their targets and a lower one if they fail to meet them. The rewards and penalties are specific to each incentive, and designed to

reflect the marginal value to customers. For example, if companies solve problems such as grid congestion by using innovation, e.g. demand response, instead of costly grid reinforcements, companies are rewarded with a percentage of these savings.

The Innovation Stimulus Package

Ofgem have introduced a time-limited (at least up to 2023) innovation stimulus package within the RIIO framework to provide an additional incentive to companies and to facilitate innovation as part of business as usual. The innovation stimulus comprises of three components:

1. The Network Innovation Competition (NIC)

- An annual opportunity for electricity network companies to compete between themselves for funding for the development and demonstration of new technologies, operating and commercial arrangements¹.
- The final decision about which projects are rewarded funding is made by Ofgem, supported by three independent expert panels.
- It is primarily focussed on funding large scale, complex innovative projects; however there is no restriction on the size.
- All types of innovation, including commercial, operational and technical are eligible for funding so long as the project has the potential to deliver benefits to network consumers.
- Up to £90 million (EUR107.4 million) per annum is available across electricity distribution and transmission. Close to £500 million (EUR596.7 million) of funding has been awarded since 2010.
- Funding is recovered through the price control and by network tariffs. Since the learning from projects is valuable to all GB consumers, each consumer pays an equal share. It is not a loan.
- In 2015 and 2016, the NIC funded eight electricity projects from five companies. The funding received from NIC totalled £63.4 million (EUR75.6 million) and projects included: creating a new type of electricity pylon which is smaller, better for the environment and provides savings to customers; developing a new way of managing temperatures in substations – increasing their operational capacity and lifespan; and increasing network capacity through converting an existing AC circuit to DC.

2. The Network Innovation Allowance (NIA)

- Unlike the NIC, where companies compete for funding, the NIA is a set allowance each network company receives as part of their price control allowance. Network companies submit their innovation strategy to Ofgem alongside their business plans at the beginning of RIIO-ED1. The NIA is set based on the quality and content of the innovation strategy.
- The NIA aims to fund small-scale innovation projects and companies are required to publish their Project Registration Information and regular updates on all projects on the ENA portal: Smarter Networks Portal².
- Value of the NIA awarded to each DSO defaults to 0.5% of allowed revenues, unless companies excel in demonstrating a well thought through innovation plan and then it is up to a maximum size 1% of allowed revenue.
- The NIA provides limited funding to network companies to use for two purposes:

¹ Commercial arrangements such as contracts directly with customers for flexibility/demand side response.

² <http://www.smarternetworks.org>

- Fund smaller technical, commercial or operational projects directly related to the network companies that have the potential to deliver financial benefits to the network company and its customers; and or
- Fund the preparation of submissions to the NIC.

3. The Innovation Roll-out Mechanism (IRM)

- The IRM is a ‘Revenue Adjustment Mechanism’ that enables network companies to apply for additional funding within their price control period for the roll-out of initiatives with longer term benefits.
- The DSO must submit a business case to Ofgem showing how the benefits of these initiatives outweigh additional costs of implementing for customers. The funding is awarded ex ante.
- The IRM is intended to facilitate the roll-out of proven innovations, which will provide long-term value for money to customers, in advance of the next price control period. To qualify roll-outs must demonstrate cost savings or deliver carbon and/or environmental benefits.

Encouraging Innovation with the price control package

An incentives-based regime gives networks both a profit and reputational motive to innovate by giving them the confidence that they will gain commercial benefits from doing so. Ofgem will set a company a specific target which is based on historic performance, for example 100 customer minutes lost (CML)³. This is what the company should be able to achieve. If they miss this target and exceed 100 CML, they will be penalised £1m (EUR1.2 million) for every unit exceeded. However, if they beat this target and manage to reduce the number of CML, they receive £1m (EUR1.2 million) for every unit reduced. This influences a company’s investment decisions and can make it worth their while to invest in new technology. So, if we go back to our example of CML, a company may decide that it is worth investing in a new technology costing £5m (EUR5.9 million) which will reduce the number of CML by 10. This will mean that the company will be rewarded £10m (EUR12 million) for achieving 90 CML with the implementation of the new technology. Therefore, despite investing £5m (EUR5.9 million), they will still make a saving of £5m (EUR5.9 million).

TOTEX Approach

With the TOTEX approach, companies are incentivised to try and find innovative solutions to problems rather than spending capital as they get to keep a proportion of the savings, with the rest passed on to consumers. Instead of having debates on what is classed as CAPEX and OPEX with different treatment in the price control, it is assumed that regardless of whatever they spend, a fixed percentage is CAPEX and the remainder is OPEX. This removes the disincentive to innovate. For example, a company may decide to implement demand side response to reduce congestion on the grid instead of expensive grid reinforcement.

TOTEX Incentive Mechanism (TIM)

TIM encourages companies to use innovation to decrease their costs, receiving in return around 60% of the savings⁴, with the remainder being shared with consumers. TIM applies adjustments to the TOTEX figure.

³ Please note this is just a theoretical example to demonstrate how this could work.

⁴ Although this varies for each company depending on their view of forecast costs in its business plan submission compared to the NRAs view. Put simply the closer to the NRA’s view, the higher the percentage of savings a company is allowed to retain.

The outputs approach, TOTEX approach and TIM work in tandem to encourage innovation. Companies are encouraged to innovate to deliver (or beat) outputs at lowest cost and the price control approach is agnostic over the tools (operational or investment) which companies use to do this.

Conclusion

The energy mix is changing and the way the electricity networks operate needs to change as well. The RIIO framework allows companies to develop innovative projects which can make the grid smarter, allow faster integration of low carbon energy generation and help reduce consumer bills. GB network companies are satisfied with the framework, and have and will continue to develop innovative projects to deliver outputs for their customers.

The current R&D-scheme for Italian Grid Distribution companies

The Italian Regulatory Authority (AEEGSI) started in 2010 to focus on incentive schemes for smart grids investments performed by DSOs. The initial approach, based on an input regulation, was to test smart grids functionalities on pilot projects, with the aim to define specific incentive regulation taking into account the results of pilot projects.

The AEEGSI then selected eight smart grids pilot projects with the Resolution 39/10 and incentivised them with an increase of 2% WACC remuneration for 12 years; for Enel Distribuzione, Project Carpinone (Isernia region) was selected.

Also for specific Storage pilots both on TSO and DSO network, the AEEGSI extended this kind of incentive to pilot projects to be selected from a Commission appointed by the Italian Regulator (AEEGSI) jointly with the Ministry of Economic Development. As regards the DSO side, these pilots were never selected.

After the completion of the pilots, and based on their results, in 2015 the AEEGSI, with the Resolution 646/2015 on Smart distribution systems shifted its approach to an Output-based incentive regulation. This new bonus mechanisms will be implemented on a selection of investments to incentivise, based on the benefits deriving from them, to be shared between the distributor and the system. According to the AEEGSI the Output-Based regulation will streamline the process, allowing DSOs to evaluate and quantify benefits once the targets have been reached.

The first application of the new output based regulation is currently limited to two specific technologies:

- Network observability: that aims at improving the management of the distribution network with reference to Distributed Generation and voltage regulation; this will first be realized through a data exchange between the TSO and the DSO, and then providing accurate estimation of generation and consumption.
- Voltage control on MV networks: enabling the increase of the hosting capacity of the distribution network to connect new DG units without the need of grid reinforcement.

Output based incentives will be introduced starting from 2016 for voltage control; so far, the amount of the incentives has not been defined yet and further evaluations and test phases are needed in order to quantify the expected impact of this new regulation.

The Resolution 646/2015 contains also proposals to incentivise further smart city pilot projects specifically focused on demand response, customer awareness, and innovative solutions for low voltage networks. These projects will be selected taking into account the costs and the benefits for the whole system and the replicability level and they will be incentivised through a *una-tantum* forfeit contribution and an annual contribution for two years.

Furthermore, in the mid-term, the Italian Regulator is evaluating whether to introduce, from 2020, a TOTEX approach in order to balance incentives and benefits provided by each innovative investment to the system.

The first application of this approach will be the remuneration of the second generation smart meters.

The AEEGSI already defined the technical requirements of the new smart meter and will conduct a Cost Benefit Analysis (CBA) in order to quantify the externalities deriving from the whole project linked to the remuneration mechanism of this investment.

Conclusion

The new incentive scheme regarding research and innovation in Italy cannot be evaluated at this stage because the new regulatory period is just in its early days. Companies have not submitted their business plans, including innovative solutions, at this stage, and they will only do it later this year. For this reason, the regulator is not in a position yet to evaluate the effects of the new regulatory scheme.

The current R&D scheme for French Grid Distribution companies

General treatment of expenditures in TURPE 4 (2014-2017)

In France, in the current TURPE 4⁵ period, capital expenditures are recognised in the regulated asset base (RAB) even if they were not included in the *ex-ante* cost trajectory, and their amortisations are covered in pass-through. A specific account, the “compte de régulation des charges et produits” (CRCP), recognises all differences between the initial asset depreciation trajectory and the actual one for future tariff computations.

Although this scheme is quite favourable towards R&D investments, two hurdles remain:

- The need for DSOs to advance cash since amortisations are only covered by the tariff in the long run (30-40 years);
- And the need to keep the tariff level stable over time, in order to keep some sustainability for customers.

On the other hand, CRE (Commission de Régulation de l’Energie, the French regulator) sets efficiency requirements for OPEX. If OPEX are lower than the efficiency targets defined *ex-ante*, ENEDIS keeps 100% of the additional productivity gains, but if OPEX are higher, ENEDIS bears 100% of productivity losses. With this “symmetry principle”, any additional R&D costs would significantly hamper efficiency requirements, since they often incur higher costs in the beginning, which will be recovered later on. This is why CRE set up a special scheme for R&D and innovation.

⁵ TURPE stands for tarifs d’utilisation des réseaux publics d’électricité (tariffs for using public electricity networks). They were created in 2000 to remunerate electricity distribution and transmission companies.

Treatment of R&D and innovation expenditures in TURPE 4

CRE elaborated a rather innovative treatment of R&D operating expenditures for TURPE 4, where all OPEX relative to research, innovation, and smart grids demonstration programs are put in a specific budget which is not concerned by efficiency requirements.

ENEDIS presented the following R&D OPEX previsions for the TURPE 4 period, broken down into three themes:

In current M€	2014	2015	2016	2017	Total
Theme "improve the efficiency of distribution sector professions"	16	16	17	17	66
Theme "prepare the evolution of distribution professions"	15	16	19	19	69
The <i>Smart grid</i> demonstration program	19	23	24	24	90
R&D operating expenses	50	55	60	60	225

Source: Deliberation of the French Energy Regulatory Commission of 12 December 2013 concerning decision on the tariffs for the use of a public electricity grid in the HVA or LV voltage range, p. 29

In exchange, CRE introduced a follow-up of ENEDIS innovation projects, in form of a report that ENEDIS has to send to CRE each year, including the following elements:

- A description of the projects carried out with the associated expenses and results obtained;
- A list of projects in progress and future projects with the expected outcomes;
- The expenses for the past year;
- The forecast expenses for each year up to the end of the tariff period;
- The number of full-time equivalents associated with R&D programs.
- The support and subsidies received.

Any annual differences between the actual and forecasted trajectory will have to be justified by ENEDIS within the framework of the annual report sent to CRE.

CRE will review, at the end of the tariff period, the sums actually spent by ENEDIS and will return to users, via the CRCP mechanism, the difference between the forecasted and actual trajectory. However, any costs higher than expected in this budget won't be covered by CRE.

Eventually, and for the record, investments in R&D and innovation, particularly in the Smart grids field are entirely passed through, like other ENEDIS investment expenditure.

Every two years, the regulator publishes a public report on his website on innovation projects, based on ENEDIS reporting.

Efficiency of this incentive

The first advantage of such a mechanism is to secure funding for R&D activities over the whole tariff period, without taking the risk to hamper efficiency requirements. The general 4-year budget is defined ex ante, but the budget per annum, as well as the distinction between the three themes, is for information purposes only. Consequently, ENEDIS has to explain the differences between what was announced and what was achieved every year, but the general assessment will occur at the end of the regulatory period.

This incentive scheme also contributes to improving ENEDIS's image as an innovative company for network users. Historically, research at ENEDIS has always been spread out over different entities, so general R&D objectives were not clear for everyone. The need to publish an annual report on R&D activities caused ENEDIS to take a step back and brainstorm on all gains that were expected from the different innovation programs. This led to a global synthesis of R&D and a better management of research programs, as well as a better communication towards users.

Eventually, this mechanism allows to increase R&D under ENEDIS project management (statement of requirements, identification of main results, financial monitoring), and to vary R&D providers.

Risks of this incentive

One of the main risks identified by ENEDIS concerns the privacy of information made public by CRE. The company has to be very watchful on the information given in order to insure a protection of the intellectual property rights.

Renewal of R&D scheme in TURPE 5

In the TURPE 5 current discussions, ENEDIS asked for a similar treatment of R&D expenditures, and presented updated cost trajectory for its R&D program. The only difference being that ENEDIS asked for a symmetrical mechanism, where ENEDIS doesn't have to pay for additional OPEX in case the total budget is higher than expected.

Conclusion

All these mechanisms contribute to investing in innovation in order to improve or maintain, in the long run, DSO's quality of operations. This global efficiency is monitored by the regulator through an "incentive regulation" mechanism which focuses on quality of supply, quality of service, reduction of grid losses, and the monitoring of investments under ENEDIS management.

How should innovation be financially incentivised within the regulatory framework?

Financial incentives for innovation should be designed to trigger the necessary adaptation for DSOs to incorporate new technologies and activities. The emphasis should be in fostering a sustainable transition in their roles. This can be achieved by increasing R&D support targeted to technological innovation for the DSOs to operate as smart grid service enablers, whilst ensuring its neutral market facilitation responsibility. In addition, innovation incentives must also support the indispensable evolution of industry practices, focusing on the development of new skills and organisational structures for DSOs, given that the shift to new roles beyond the regulatory and technical adaptation calls also for an internal change of their organisational dynamics.

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Chapter 4: Conclusions and Recommendations

After reviewing the current situation in 20 Member States, we may conclude the following:

- There is an increasing need for innovation by European DSOs to contribute to long-term efficiency of European networks.
- DSOs are responsible for the deployment of smart grids, contributing to developing smart energy systems. This task requires increasingly innovative solutions, which should be stimulated by regulatory frameworks.
- The implementation of innovation incentives should target the reduction of financial risk for DSOs while increasing their participation in pilot projects and innovative programs. All categories included in the SET Plan should be incentivised, although it could be done via different incentive schemes.
- Depending on the type of innovative solutions, funding could be through allowed revenue and/or direct public funding. The results of the funded innovation projects should be publically available to promote transparency.
- In addition to financial support, and since much of the needed innovation will take the form of setting up new market roles and business processes, NRAs and governments should take an active stance towards creating the conditions for DSOs to experiment in uncharted territory. This should be done even if it requires temporarily and/or locally overriding the prevailing regulation to enable pilots with duly approval of the regulatory authority.
- In 2016, nine EU Member States had already introduced incentives for R&D and pilot projects within their regulatory frameworks, five of which have been implemented in the past two years. In contrast to 2014, no regulatory framework sets explicit higher RoR in 2016 for R&D or pilot projects.
- If a specific mechanism has been implemented, there is a positive impact on investments/costs for innovation/R&D in most cases. However, if the regulatory framework treats costs for innovation/R&D like any other costs, the system rather hampers innovation because usually DSOs, as regulated entities, tend not to risk and continue business as usual.
- Seven out of 20 Member States have a regulatory framework that fosters or rather fosters innovation and R&D. This is an improvement from 2014, when only three countries had regulatory frameworks which included innovation incentives, but there is still a lot to be done in the rest of the Member States.
- The vast majority of Member States have no mechanism that also takes OPEX into account. Only four out of 20 Member States (Finland, France, Ireland and Great Britain) have an incentive mechanism for smart grid related OPEX.
- France, Italy, Norway and the UK are setting concrete examples on specific schemes that fund R&D and/or innovation for DSOs. They propose different approaches to remunerate R&D or innovation investments, but they all seem to be designed to trigger the adjustment to incorporate new technologies.

How can regulators help DSOs to innovate?

Innovation investments for smart grids have several characteristics in common:

- They are hard to predict before the establishment of a regulatory period;
- They can lead to technological deadlocks and stranded assets for DSOs;
- They depend highly on the regulatory scheme, which is constantly evolving;
- A lot of R&D and innovative projects have to be conducted – only a few of these technologies will lead to commercial introduction on the market;

Regulators should also bear in mind that the degree of customer and technology readiness could determine what design of incentive is best suitable for the stage of innovation needed.

- **Stage 1: R&D:** share of DSO turnover. A suitable model would be a compensation based on a percentage of the total revenue, allowing the DSOs to decide how to invest/spend it.
- **Stage 2: Piloting:**
 - Immediate costs compensation. The incentive could handle the costs without efficiency requirements as uncontrollable cost (which in the Swedish regulation is a pass through item) and investments could be valued in the regulatory asset base (RAB) after re-purchasing value. The risk of lost capital compensation with early phase-outs of new technology could be handled by treating the scrapping costs as uncontrollable costs.
 - Qualification criteria. Clear and simple criteria defined by the authority before the beginning of the project (e.g. decrease grid losses, enable better integration of RES). It would be advisable to limit the required reporting to encourage also innovation for the smaller DSOs.
- **Stage 3: Introduction:**
 - Immediate costs compensation.
 - Investments – evaluated by “procurement value”.
- **Stage 4: Commercial:**
 - Costs compensated in coming regulatory periods.
 - Investments – included in ordinary regulation.
 - Benefits from innovative investments should remain (at least partially) with the DSOs.

To foster smart grid innovation, the national regulatory frameworks should fulfil the following **“Innovation Criteria for modern Regulatory Frameworks”**:

- Innovation in DSOs is related to business transformation- new business models will emerge and existing business models will fade out. Adequate remuneration mechanisms should support these transformations of DSOs’ business models;
- The specific regulatory mechanism implemented should be predictable and stable in the outcome in the long run;
- These mechanisms should be simple, with no or as few bureaucratic obstacles as possible;
- The remuneration of the expenses should be guaranteed;
- Such mechanisms should also include incentives for OPEX since the roll-out of innovative network technologies has the tendency to have a higher share of OPEX;
- In general, the regulatory framework should give the DSO the freedom to choose how to meet the outputs through the most efficient investment (copper vs. smart);
- Implement a national and/or EU-wide knowledge sharing system of R&D results if possible with additional monetary incentives. Especially smaller DSOs and their customers could also participate and benefit.

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