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ELECTRICITY DISTRIBUTION INVESTMENTS: WHAT REGULATORY FRAMEWORK DO WE NEED?

A EURELECTRIC report - May 2014

Task Force DSO Investment Action Plan
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KEY MESSAGES

European electricity distribution system operators (DSOs) have to cope with demanding investment requirements. These go back to three main drivers: the need to integrate renewable energy sources (RES) into the electricity system, the need to replace existing assets in order to ensure continued quality of supply, and the development of smart grids.

Yet our analysis of DSO accounting statements reveals that this much needed investment is not taking place. In addition, our analysis of regulatory systems in different European countries indicates that **DSOs today are facing lower investment incentives than in 2010**. Both the achievability and the adequacy of the regulated rate of return seem to have decreased since then, as has planning reliability.

Testing and deploying smart grid technologies is indispensable to develop efficient network solutions. But **despite recognising the political will to foster smart grids, most interviewed DSO Directors believe that regulatory incentives for innovation could be better.** In most countries, R&D and pilot projects are treated like any other cost, without any specific compensation for the risks involved in testing new processes and technologies.

Economic regulation of DSOs should be revised in order to incentivise DSOs to make efficient long-term investments. EURELECTRIC recommends:

- defining a long-term policy not only for producers and consumers but also for networks;
- setting the regulated rate of return in a way that is transparent and based on long-term stable cost of capital consistent with the assets' lifetime;
- improving predictability of the regulatory formula;
- removing RD&D from efficiency targets set by the regulator, allowing a higher return on investments and a risk adjusted depreciation period for projects with significant risks and further encouraging financing of large scale smart grid demonstration projects;
- ensuring timely cost recovery of the smart meter roll-out by DSOs.

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INTRODUCTION

Distribution networks are facing substantial investment needs. The so-called 20-20-20 targets[1] as well as further EU decarbonisation ambitions will be among the major investment drivers for the years to come. In addition, maintaining today's high quality of supply will require new grid capacity as well as refurbishment and replacement of existing assets.

In this more dynamic environment, the main challenge for distribution system operators (DSOs) will be to develop and operate their network in a reliable, affordable and sustainable way, while neutrally facilitating the market and customer needs.

Achieving a sustainable and low carbon energy sector requires an efficient long-term regulatory framework and remuneration scheme for distribution networks, allowing electricity distribution to be a sustainable business over the long term.

EURELECTRIC members believe that it is time to put smarter distribution network investments on both the European and the national agendas, as such investments will play a key role in keeping the system stable and costs in check. Regulators should grant DSOs suitable revenues to cover their costs and make necessary investments while providing the required quality of supply.

Against this backdrop, the EURELECTRIC expert Task Force 'DSO Investment Action Plan' reviewed the impact of current European regulatory frameworks on investments in the distribution network, with a focus on smart grids investments and major investment obstacles.

This report presents the main results of our work:

- Chapter 1 assesses **the key investment drivers for power distribution networks**;
- Chapter 2 uses accounting data to analyse **the economic performance of 49 DSOs from 18 European countries;**
- Chapters 3 and 4 analyse the regulatory system, including incentives for innovation: **17 DSO directors have** provided their insight into future DSO challenges and **evaluated the associated risks and the regulation system**. This was complemented by an **expert survey on the design of national economic regulation for investments,** including how such frameworks incentivise smart grids and smart metering;
- A detailed overview of national regulatory schemes is provided in the Annex.

1 To reduce CO_2 emissions by 20%, achieve a 20% share of renewable energy sources (RES) in overall energy consumption, and be 20% more energy efficient in 2020.

1

The increasing need for investments in smart distribution grids

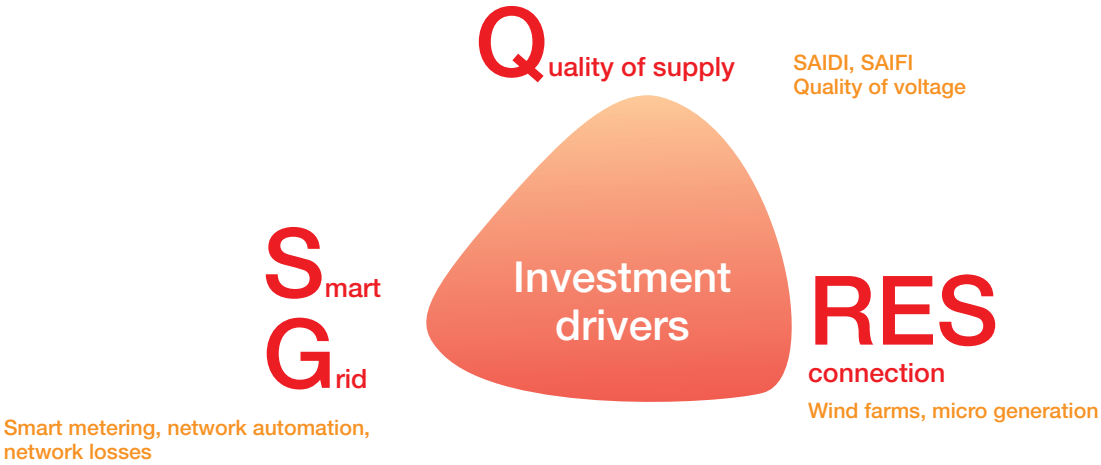
European electricity networks will require €600 billion investments by 2020. Two thirds of these investments will take place in distribution grids. By 2035, the distribution share of the overall network investment is estimated to grow to almost 75%, and to 80% by 2050[2]. European DSOs have to cope with demanding investment requirements, driven by distributed energy resources, quality of supply and smart grids (Figure 1):

1. **Integration of distributed generation:** photovoltaics (PV) and wind installed capacity have increased significantly from 2000 to 2012 (Figure 2 and Figure 3). The greatest amount of this renewable capacity is connected to the distribution grid. Network operators are obliged to perform extension investments, including the connection of renewables without delay, in order to ensure non-discriminatory connection and access to the network.

2. **Maintaining quality of supply:** Assets that were built several decades ago are reaching the end of their investment cycle and need to be replaced. Quality regulation is common in many European countries.

3. **Smart grids and smart metering:** A smart grid is an electricity network that can intelligently integrate actions of all its users to ensure a sustainable, economic and secure electricity supply. Rising shares of distributed generation and other distributed energy resources such as electric vehicles also create new needs to monitor and optimise networks. In addition, DSOs have been mandated to roll out smart metering in most European countries, creating additional investment and expenses for network operators. Finally, growing customer expectations, such as more frequent meter readings, might also require further distribution investments.

Figure 1: Drivers for distribution grid investments



Regulation needs to acknowledge the increasing investment needs. If not, a trend of postponing investments could ensue, eventually leading to deterioration in quality of supply.

2 European Commission 2011, IEA World Energy Outlook 2012 and European Energy Roadmap 2050.

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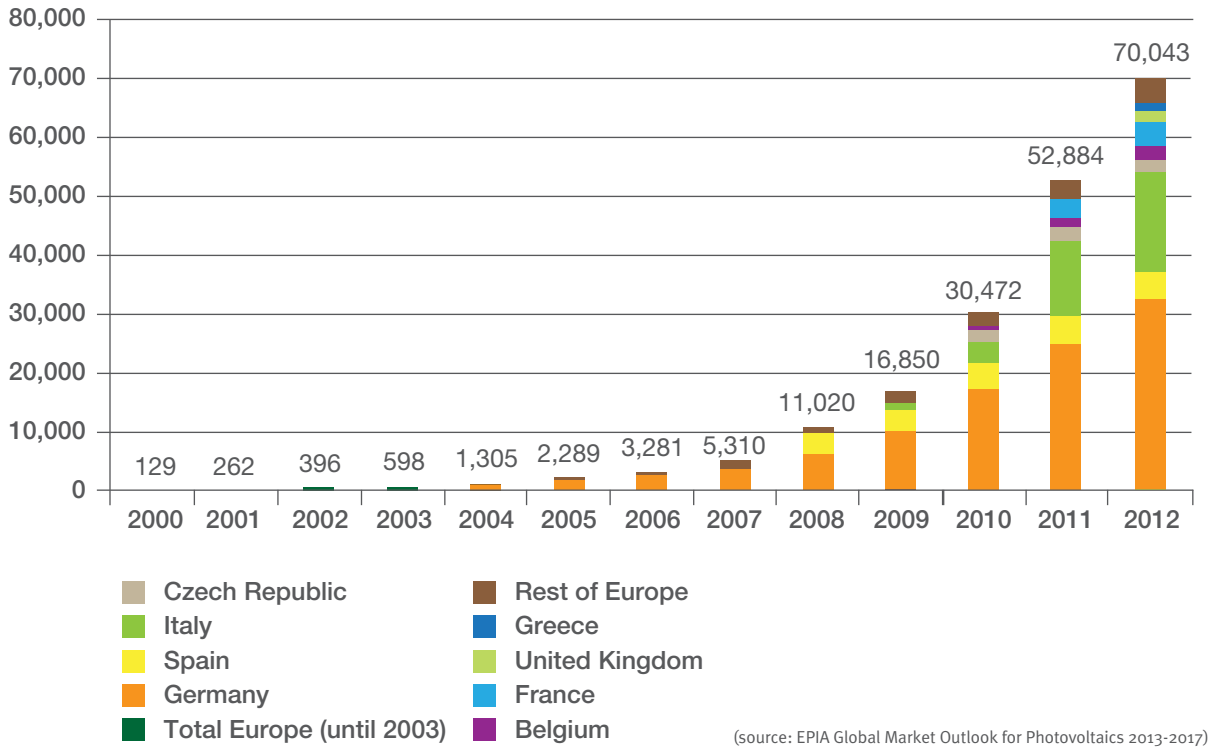
"Traditional technology will be increasingly complemented with smart grid components (mainly ICT enabled functionalities), data management will gain importance."

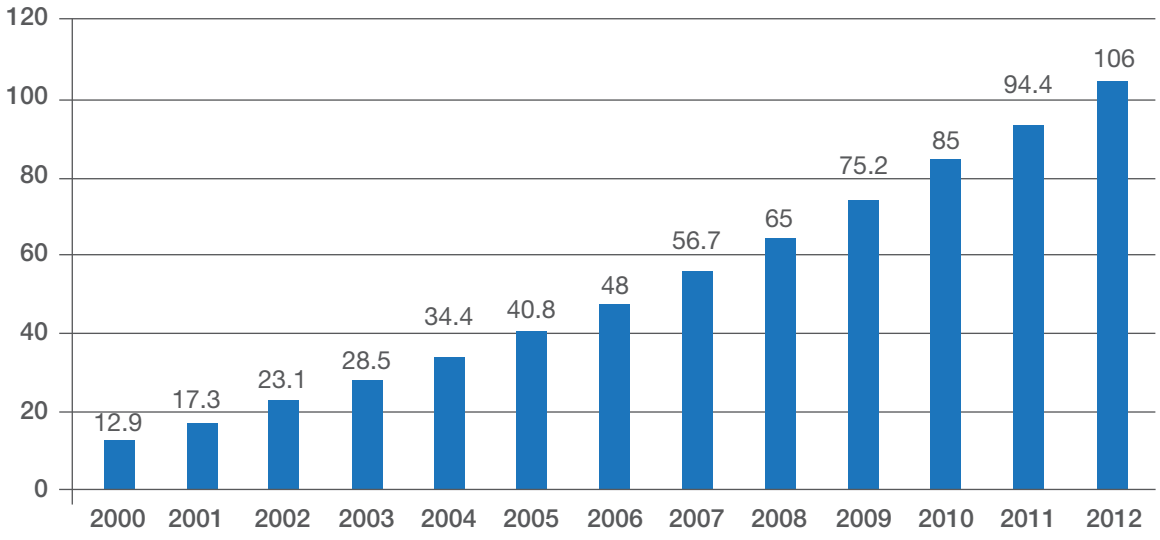
European DSO Director

Figure 2: Evolution of European PV cumulative installed capacity 2000-2012 (MW)



(source: EPIA Global Market Outlook for Photovoltaics 2013-2017)

Figure 3: Evolution of European wind cumulative installed capacity 2000-2012 (GW)



(source: EWEA, Wind in Power, 2013)

Country cases: DSO investment needs

- **Denmark:** A survey of eight DSOs covering around 70% of the electricity distributed in Denmark shows expected distribution network investments of around **€ 1.9 billion (14 billion Dkk) until 2020**[3] **and a further € 6.4 billion (48 billion DKK) until 2040**. In addition Denmark foresees smart metering investments of € 0.3 billion (2.25 billion DKK) until 2020.

- **Finland: DSO investments are supposed to double from 2010 to 2019.** The revised Finnish Electricity Market Act in force from 1.9.2013 upgraded the performance standards for the security of supply in the Finnish electricity distribution system. The law sets a six-hour limit for interruption in cities and 36 hours for all other areas. This would require total investments of € 3.5 billion.[4]

- **France:** UFE (Union Française de l'Electricité) foresees distribution grid investment needs of **€ 99-111 billion by 2030**, depending on the production scenario, and significant financing difficulties. The current trend is around € 3 to 3.5 billion annual capital expenditure costs from 2013 onwards (4 billion including investment by local authorities) compared to € 2.3 billion in 2009 – a rise of more than 40% in less than 5 years.

- **Germany:** The German Energy Agency has concluded that distribution investments of **€ 27.5 – 42.5 billion will be necessary until 2030**. Smart network technologies would have the potential to moderate investment needs. However, market-related load control potentially increases the necessary investments. In addition the proposed roll-out scenario for smart meters is estimated to cost around € 10 billion until 2020.[5]

- **The Netherlands:** The Dutch Association of Energy Network Operators has analysed the future network investments for different types of generation mix (decarbonisation scenarios). A study published in 2011[6] showed that the Dutch network operators currently invest around € 467 million a year. All three decarbonisation scenarios examined would require **substantial additional investments until 2050: € 20 to 71 billion**.

- **Norway: Investments are supposed to rise by nearly 200% between 2010 and 2017.** Figure 4 shows DSO investments from 1973 until 2020. From about 1988 until 2006 investments were low. From 2006 onwards there has been a rise. Plans for the next seven years show a significant increase of planned reinvestments and extension investments. This is due to a rapid growth of distributed generation, the overall network condition, increasing consumption and the roll-out of smart meters planned until 2019.

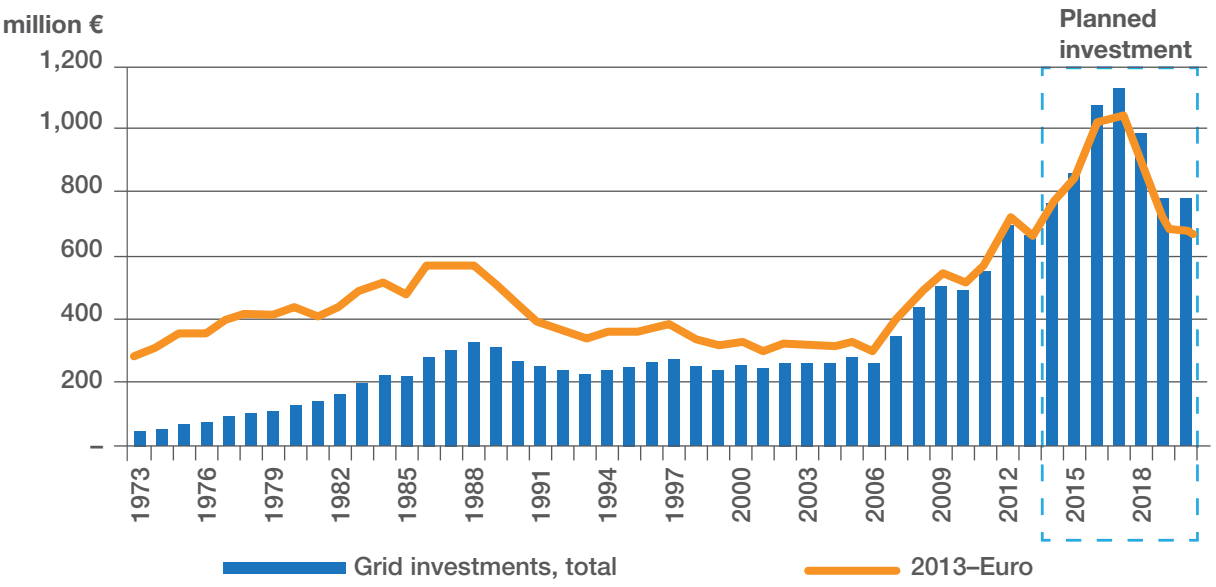
3 Until 2020 the analysis covers reinvestments and new investments, from 2020 to 2040 it only covers reinvestments. The estimation primarily uses an extrapolation of regulatory balance sheets of 8 DSOs (standardized asset lifetimes and asset costs) and when possible also company specific investment plans.

4 Kinnunen, Rajala, paper 0511, CIRED 2013: High interruption figures during serious storms have appeared, as the average distribution network is equipped mostly with overhead power lines.

5 German Smart Meter CBA, Ernst & Young, 2013.

6 Agentschap NL, 2011.

Figure 4: Development of planned investments Norway

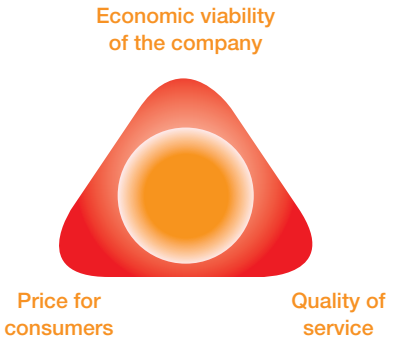


(source: Statistics, Energy Norway)

Incentive regulation must consider adequate investment incentives

DSOs are regulated entities that have to cover their cost through regulated revenues only, which are collected via network tariffs. The described investment requests will not be viable if DSOs are not able to create value on a regular basis. Sustainable and efficient long-term regulation needs to strike a balance between price adequacy for consumers, quality of supply and a viable framework for distribution companies.

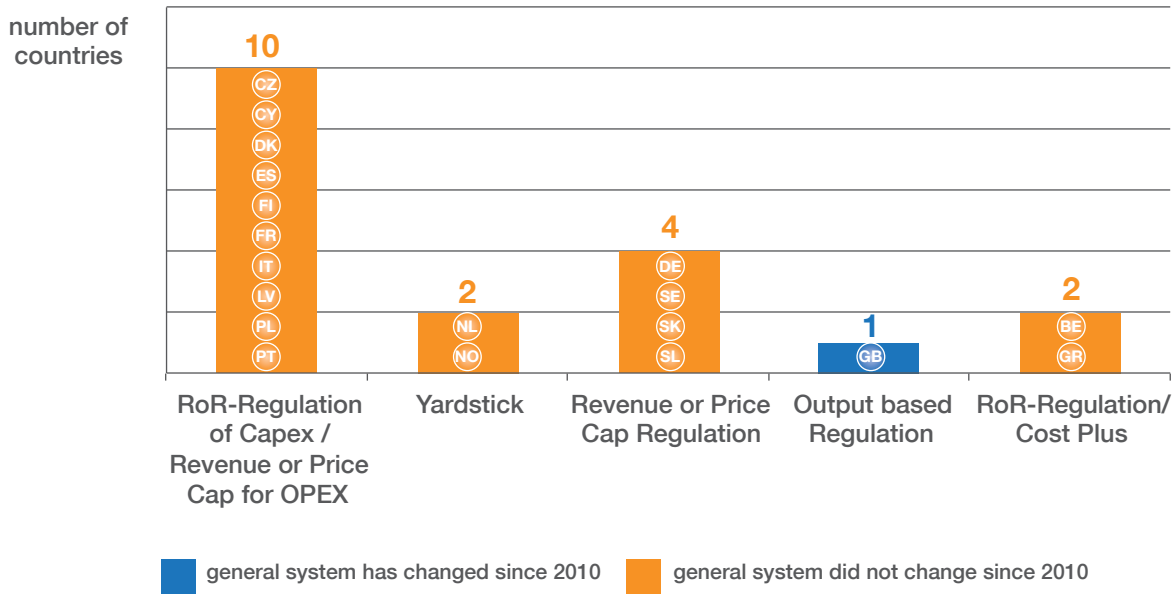
Most regulatory schemes set rules determining the amount of revenues a DSO is allowed to recover. Cost recovery through regulated revenues significantly influences the incentives and business case for investments. As such, it is also the main focus of this report. In most cases, additional regulation specifies the design of network tariffs (revenue recovery).[7]



While the regulatory models in the EU differ, they do contain some common challenges for DSOs which this report aims to clarify. **Incentive regulation and rate of return (RoR) regulation are the most common regulatory schemes in Europe.** Table 1 provides an overview of the main general regulatory approaches. However, specific regulatory approaches as well as instruments differ a lot throughout Europe (Figure 5), making direct comparisons difficult. Compared to 2010, only Great Britain has changed the system towards output-based regulation.

7 The EURELECTRIC report Network tariff structure for the smart energy system analyses this issue. It is particularly important to ensure that network tariffs reflect (pure) network cost. Adding cost components that the DSO is not able to influence to the network tariffs is not transparent.

Figure 5: Regulatory systems in Europe



Independently from the regulatory system most countries have identified rather large investment needs for DSOs. However, **the regulatory approach in most EU member states focuses on cost reduction rather than on investment incentives. In these cases a prioritisation of regulatory goals and incentives is necessary.**

Overview of regulatory approaches

System	Main characteristics	Major strengths and shortcomings
RoR-regulation	▶ Ex post regulation, i.e. revenues in year t depend on the cost in year t-1. ▶ Revenues depend on actual cost considering a regulated rate of return.	▶ Considered to be weak regarding incentives to decrease cost. ▶ High investment incentives as revenues depend on current cost without delay.
Revenue/ price cap regulation	▶ *Ex ante* regulation ▶ Decouples costs from revenues within the regulation period: DSOs rewarded with an extra profit for being efficient.	▶ Strong incentives for reducing cost. ▶ CAPEX-time shift leads to low investment incentives when investment needs increase.
Yardstick regulation	▶ Allowed revenues depend on the industry average performance.	▶ Challenge of comparability due to different operation areas and cost structures. ▶ CAPEX-time shift leads to low investment incentives when investment needs increase.
Output based regulation	▶ Revenues do not only depend on "inputs" (cost) but also on delivered "output" (e.g. quality of supply, smart grid deployment).	▶ Outputs must be measurable and comparable between companies. ▶ High regulatory effort, risk of micromanagement.

2

Economic performance of European DSOs (2008-2012)

How is the economic situation of the electricity distribution business? How has it influenced DSOs' investment activity?

In the first part of our analysis, based on the data from 49 DSOs from 18 European countries, we explored the relationship between DSOs' profitability and investment activity.[8] **Our assessment of the economic performance of European DSOs in the period from 2008 to 2012 shows a clear link between capital expenditure in distribution assets and economic performance.**

The analysis uses the following main concepts:

- **Invested Capital** is calculated by adding the working capital necessary for the distribution business to the net value of fixed distribution assets, i.e. the accounting value of the distribution assets once accumulated depreciation is deducted.
- **Return on Invested Capital (ROIC)** is an indicator of economic performance, showing to what extent the company successfully exploited the assets under its control. It is calculated by dividing the earnings before interests and taxes (EBIT) by the invested capital.
- **Weighted Average Cost of Capital (WACC)** is the weighted calculation of the equity provided by shareholders and the debt provided by external investors. It is used to assess whether a rate of asset return is fair or not. In 2008, the pre-tax WACC was 9.5%.[9]

In 2008, at the beginning of the analysed period, most DSOs were destroying value. Figure 6 analyses the DSO economic performance by looking at v*alue creation/destruction*, measured as ROIC-WACC(%).[10] In all countries but four (red and green shaded bars respectively), the aggregated pre-tax ROIC was lower than the pre-tax WACC of 9.5% . On average, the negative ROIC-WACC relationship amounted to -3.7% when the economic and financial crisis started in 2008.

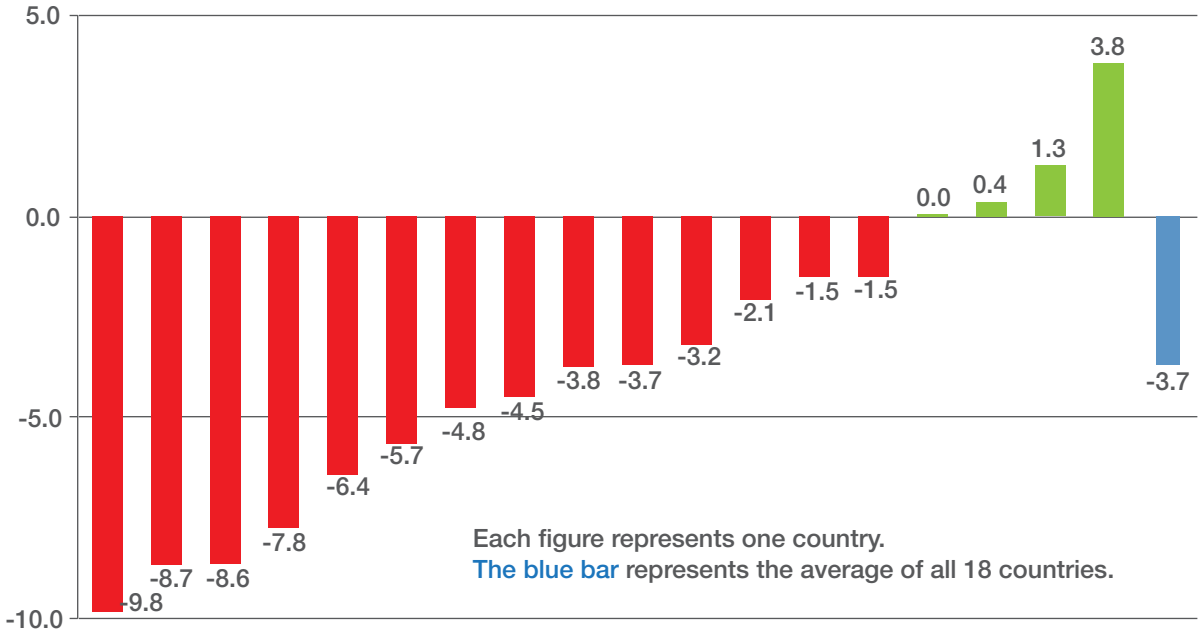
Companies destroying value are not able to profitably exploit their assets because the achieved return on their investment is lower than the cost of capital employed in funding those assets. While destroying value is not necessarily equivalent to making losses in the company's income statement (a company's profit may still be sufficient to cover financial expenses and income tax), it does not provide shareholders with the remuneration they expect and thus discourages investments.

8 Czech Republic, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Italy, Ireland, the Netherlands, Norway, Poland, Portugal, Slovakia, Spain, Sweden and the United Kingdom. As it was not the aim to compare different companies, countries or European regions, the results are presented on an aggregated basis.

9 See EURELECTRIC report *The Financial Situation of the Electricity Industry* (June 2013, April 2012 and December 2010) for a detailed description of the methodology applied to calculate this indicator.

10 It indicates whether a company is creating value (i.e. >0%) or destroying value (i.e. <0%).

Figure 6: DSO value creation / destruction (ROIC-WACC) (%) per country in 2008



Profitability does indeed have an impact on investments, as shown in Figure 7. In it, profitability is expressed as the average ROIC in 2008-2012 (x axis). For comparability reasons, DSO investments in the same period are expressed as a ratio of an average annual capital expenditure to invested capital (y axis). Each square represents one country. The ascending slope of the trend line demonstrates a positive relationship between profitability and investment. In other words, **value destructive performance is counterproductive for an intensive investment growth, particularly under financial constraints**.

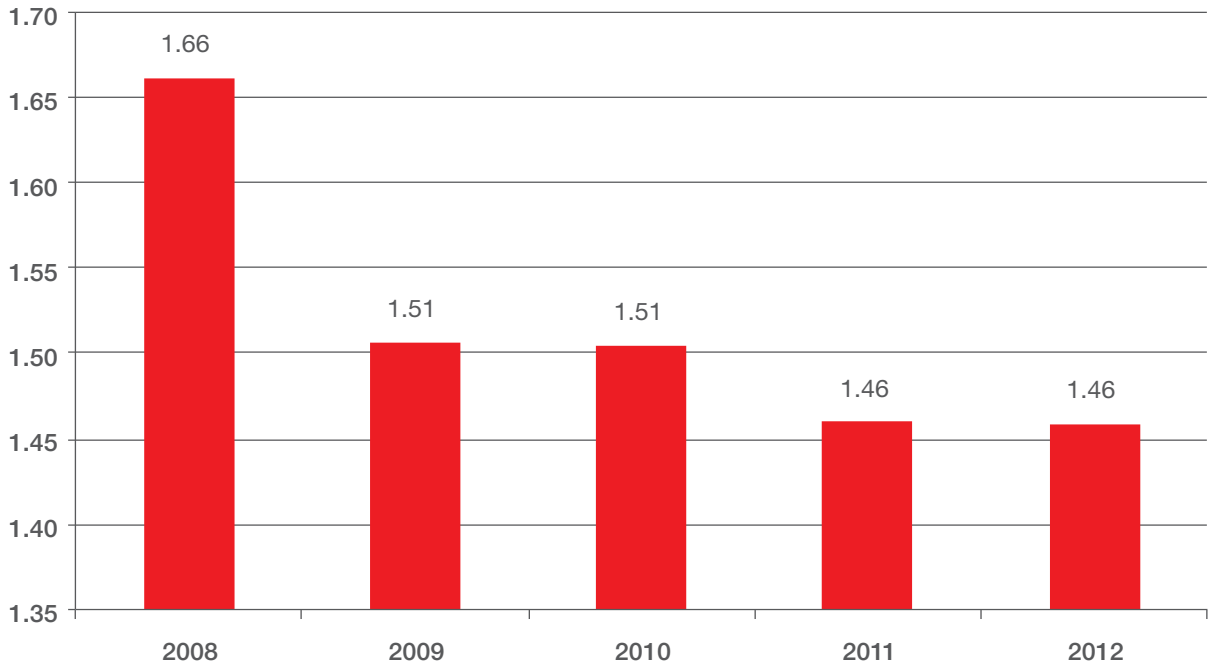
Figure 7: DSO investments and profitability, 2008-2012

2

DSO investments had a tendency to decline

Figure 8 shows the declining DSO investment effort in the period 2008-2012. It uses *capital expenditure/ depreciation ratio* as an indicator of the investment activity. The capital intensive nature of the electricity industry implies that electricity companies have on average higher capital expenditure to depreciation ratios than other sectors. Values well above 1 are not unusual.

Figure 8: DSO investment activity (capital expenditure/depreciation ratio) evolution, 2008-2012



Previous EURELECTRIC reports[11] highlighted how poorer economic performance and pressures from credit rating agencies and equity markets have forced energy companies to spend less on new asset acquisitions. **In comparison to corporate activity and capital spent in non-regulated assets, DSOs have had to maintain a more active investment role.** Regardless of their low returns, DSOs are facing the need to maintain investment, especially to ensure RES connection. They cannot decide to reduce their investments as they are (often legally) obliged to extend the network adequately.

Clearly, such a trend is not a sustainable way to promote viable investments. DSOs must be able to create value on a regular basis. In other words, **a fair return on investments, i.e. higher than the cost of capital incurred, is essential to achieve the major investment needs** described in chapter 1.

11 The Financial Situation of the Electricity Industry. EURELECTRIC, June 2013, April 2012 and December 2010.

The impact of regulation on investments

Does regulation match the growing DSO investment needs?

The second part of our analysis focused on the impact and the major strengths and shortcomings of different regulatory instruments and the planning reliability on DSO investments. The findings of this and the following chapter are based on two surveys in which experts from 19 European countries[12] and DSO directors from 17 European countries[13] participated, respectively. Both surveys were aligned with the survey conducted in 2010 for the report EURELECTRIC Regulation for Smart Grids, allowing us to show trends between 2010 and 2013.

DSOs are facing lower investment incentives compared to 2010

Achievability and adequacy of the regulated rate of return on the one side and ***planning reliability*** on the other side are the most important criteria when evaluating the investment incentives delivered by a specific regulatory regime. Considering these three criteria, our survey shows that the incentives for investments have decreased since 2010.

Figure 9: Regulatory framework – rate of return and planning reliability

2013: in 14 out of 17 countries, investments are subject to rather strong constraints

Achievability of regulated RoR	Status of regulation 2010		
regulatory RoR is achievable	SE	CZ IT	FI GB SL
Achievable RoR considerably below regulatory RoR	PL	PT AT	
Achievable RoR significantly below regulatory RoR	ES NO	DK DE FR SK	NL
	low	moderate	high
	Regulatory and political reliability		

Achievability of regulated RoR	Status of regulation 2013		
regulatory RoR is achievable	CZ GR	IT NO	
Achievable RoR considerably below regulatory RoR	BE GB SE SK	PT	
Achievable RoR significantly below regulatory RoR	ES DK EE FR NL PL	FI DE	
	low	moderate	high
	Regulatory and political reliability		

- Regulatory RoR does not consider an adequate risk premium
- Regulatory RoR does rather not consider an adequate risk premium
- Regulatory RoR does consider an adequate risk premium

* The Netherlands: Situation after 2013 decision for regulatory period as of 2014

12 Belgium, Czech Republic, Cyprus, Denmark, Finland, France, Germany, Greece, Italy, Latvia, Poland, Portugal, the Netherlands, Norway, Slovak Republic, Slovenia, Spain, Sweden and the UK.

13 Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Italy, the Netherlands, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden and the UK.

3

In most countries

1) DSOs take investment decisions under substantial regulatory risk and

2) the Regulated Rate of Return (RoR) is difficult to achieve and/or is not adequate.

Figure 9 reflects the overall evaluation of the regulatory framework comparing 2010[14] and 2013. Companies placed in the upper right-hand corner would face a regulatory framework that fosters investments; companies placed in the lower left-hand corner face rather poor investment conditions.

Regulated Rate of Return (RoR): The colours of the circles in the graph for 2013 show the DSO directors' evaluation of the regulated rate of return (adequacy of the risk premium). A red circle reflects a rate of return that is insufficient, a yellow circle reflects a rate of return evaluated as rather insufficient, a green bubble reflects a rate of return that was evaluated to be sufficient.[15] The y-axis reflects the achievability of the regulated rate of return which is also key for providing DSOs with adequate investment incentives.

Planning Reliability: The x-axis refers to planning reliability, namely political and regulatory risk. Reliable and predictable outcome of regulation is also crucial for efficient incentives. "Black boxes" should be avoided.

Country cases: significant changes of DSO regulation since 2010

- **Denmark:** The benchmarking model applied *ex post* to measure the cost effectiveness of the Danish network operators has been altered a number of times. Its final specification has not been published prior to the regulatory period, causing inconsistency in the regulatory incentive mechanisms. A governmental task force set up to evaluate the regulation of the electricity sector, including DSOs, should deliver its recommendations by the end of 2014. On the one hand, this is a positive signal since the regulation has been considered outdated and inconsistent in many senses. On the other hand, it is most likely that medium to long term regulatory conditions will change significantly. Current investment decisions in the distribution networks are thus taken at a regulatory risk. Overall this has led to a lower planning reliability compared to 2010. In addition, it was estimated that the capital costs for grid companies in Denmark are generally higher than the current maximum rate of return, which is established by a bond of duration of 30 years plus 1 p.p. In 2013, the allowed maximum rate of return was 4.478% (nominal pre-tax).

- **Finland:** Planning reliability and achievability of the regulated rate of return have decreased significantly as a result of a new regulation model which changed asset valuation, reduced the allowed rate of return and has set new strict efficiency targets based on a new benchmarking model. In addition, legislative requirements on hourly metering and quality of supply reduce investment profitability.

14 *Regulation for Smart Grids.* EURELECTRIC, 2011.

15 As this question was not asked in 2010, we are not be able to show a trend in this regard.

- **The Netherlands:** The RoR was evaluated to be adequate and achievable in 2013 but this is currently changing. In October 2013, the Dutch regulator published its decision for the regulatory period 2014-2016, changing not only the values of the parameters, but also the methodology (change of reference periods, one-off to the efficient cost level). This new regulatory framework contains a significant decrease of the regulated rate of return (3.6% compared to 6.2% in 2011-2013). This has already had an impact on the evaluation of planning reliability, which substantially decreased compared to 2010.
- **Poland:** In 2010 the Energy Regulatory Office (URE) changed the rules of calculating operating costs for DSOs. In the regulatory period 2011-2015, there is much higher demand to reduce OPEX and balances losses for all DSOs, which significantly reduced acceptable costs covered by the tariffs.
- **Sweden:** For the regulatory period of 2012-2015, a transition rule was enforced for the new *ex ante* model, meaning that 1/3 of the companies' allowed income will be based on the current model and 2/3 will be based on historical income (2006-2009). This reduced the achievable regulated rate of return from 5.2% to 3.2%. The industry appealed in court, which ruled in their favour (December 2013), concluding that there was a need for a higher WACC (pre-tax 6.5%) and that the transition rule was illegal. The NRA has appealed the decision to the court of appeal, which is expected to deliver a final ruling in one to two years. The regulation model in Sweden has changed almost every fourth year since the deregulation of the market. Considerable changes in the current regulatory model are foreseen for the next regulatory period 2016-2019.

Best practice: Norwegian model delivers good investment incentives

In Norway, the regulation model and the WACC were changed in 2013. Under the new scheme, an average efficient company according to the benchmarking model can achieve the WACC.

The model includes:

- Use of yardstick competition with strong incentives for cost efficiency;
- Acceptable incentives for new investments for efficient companies: DSO income is calibrated on the yearly basis (total costs = total income) and cost shifts at industry level are automatically taken into account;
- Removal of time lag for investments, ensuring a reasonable return on investments for average efficient companies;
- Acceptable investment incentives due to a reasonable WACC level (about 7 % pre-tax as of 2013).

However, the system does not remove time lag for operation and maintenance and "cost of energy not supplied" (CENS). The model is also rather complicated, in particular due to two benchmarking models used. The one that is used for 33-132 kV is being revised and this could lead to better incentives for investing at this level when implemented from 2015 or 2016.

3

3.1 ACHIEVABILITY AND ADEQUACY OF THE REGULATED RATE OF RETURN

Evaluating the adequacy of the regulated RoR depends on several specifics, including the risk premium that adequately reflects the cost of capital.

Achievability of the regulated RoR could be affected by the so-called "CAPEX time shift problem" which leads to delayed and insufficient cash flow. The achievable rate of return also decreases if efficiency requirements are not performable or the regulatory asset base does not reflect the industry capital cost.

The regulated rate of return often does not reflect the industry's capital cost

Regulated RoR should be set in a forward-looking way. The market risk premium and the company specific risk premium should be based on real market trends, not estimated on the basis of historic values, and take into account higher risk of new technology. In addition, the return must be consistent with the long lifetime of distribution assets. The risk-free rate and debt premium should reflect the typical network asset lifetime of 30 to 55 years.[16] For both companies and investors, a transparent, clear and stable methodology that ensures a stable return in the long run is essential. However, many countries do not fulfil these requirements (see box).

"We need a long-term stable WACC definition which is more consistent with an average asset lifetime."

European DSO Director

Country cases: methodologies for establishing regulated RoR

- **Finland:** the risk-free rate of return has been updated during the regulatory period regardless of other parameters. In addition, the regulator reduced the yield on the Finnish government 10-year bond with an "inflation correction" of 1%. As a result, the RoR is set at a level of 3.03 % for 2014 (real after tax). This reflects the good financial situation of the Finnish government whereas the financing costs for Finnish DSOs with high debt premiums are not covered sufficiently.
- **Greece:** The RoR (8%) for DSOs set by the Greek Regulatory Authority is not based on a specific RoR calculation methodology.
- **Spain:** Although the WACC calculation methodology was published by the National Energy Commission, the calculation and the value of parameters used have not been reported. In such cases, DSOs are not able to replicate the calculation. However, the major risk of the RoR comes from the inconsistency of regulation throughout time (regulatory risk). Up to mid-2013 the RoR was based on WACC. The new regulation issued in July 2013 set up the RoR as the Spanish government 10-year bond plus a spread (100 BPS for the second half of 2013 and 200 BPS for 2014). The RoR for 2014, set at 6.5% (nominal pre-tax), is not related to WACC and is inadequate because it is below the WACC calculated according to the abovementioned methodology.
- **Sweden:** The regulator has used a RoR that is not consistent with the long asset lifetime of 30-40 years. The Swedish administrative court has ruled that the rate of return must be calculated with a long time perspective. However, the regulator has appealed this decision.

16 CEER Memo on Regulatory aspects of energy investment conditions in European countries, 2013

Regulatory requirements for efficiency are difficult to fulfil

The ability to fulfil efficiency requirements set by the regulator is crucial for all DSOs (Figure 10). However, DSO directors from 14 out of 17 countries observed a negative effect of the efficiency requirements on the achievability of the regulated RoR.

There is a distinction between general and individual efficiency requirements. General efficiency requirements are determined on the basis of trends, i.e. there is no distinction between companies. Individual efficiency requirements take into account the specific performance of each DSO. As shown in Figure 11, the methods for determining these requirements differ a lot between countries. Benchmarking models requiring comparisons between a minimum number of companies are implemented in countries with many DSOs like Germany, Norway or Finland. By contrast, countries with few DSOs such as France, Portugal or Spain often base efficiency requirements on a specific analysis. In some countries, requirements refer to total cost and therewith reduce capital cost directly. If they refer to operational cost only there can be an indirect effect on the RoR.

"To sustain the DSO asset base, the regulator should provide a sufficient level of allowed revenues in order to secure return on investments at a market rate."

European DSO Director

Figure 10: DSO efficiency - regulatory requirements are crucial

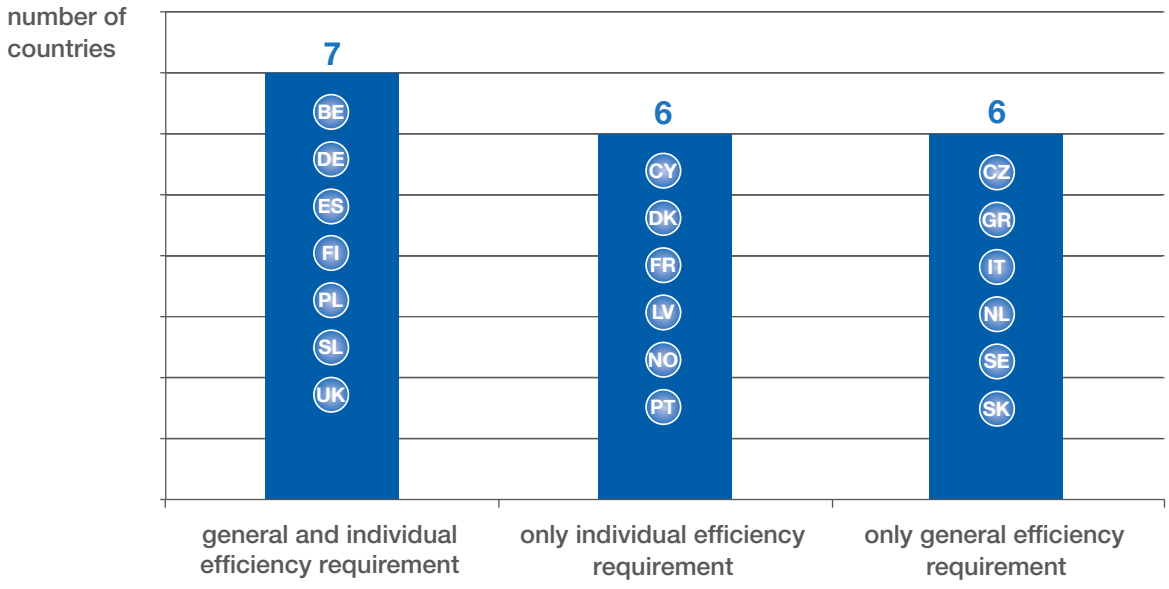


Figure 11: Methods for determination of efficiency requirements

		Individual Requirement	General Requirement
based on…	OPEX	CY, BE, F, FI, LV, PL, PT	does not apply
	OPEX + CAPEX	DE, DK, ES, GB, NO, SL	
referring to …	OPEX	BE, CY, DK, FI, F, LV, PL, PT	BE, CZ, GR, IT, PL, SE, SL
	OPEX + CAPEX	DE, ES, GB, NO, SL	DE, ES, FI, SK, NL

3

Efficiency requirements must take the current challenges and investment needs into account.

This includes a trend towards higher operational expenditure as data handling gains importance. However, efficiency requirements are usually not calculated with regard to the upcoming challenges. Instead, they are often based on historic cost. This leads to inconsistent incentives.

Regulation should also take into account that companies are reaching a common efficiency level.

Country cases: economic efficiency requirements

- **Denmark:** Since 2008, DSOs have implemented significant efficiency improvements, including a real efficiency of OPEX of 3.4%. Nevertheless, the regulator announces each year a new term efficiency requirement of approximately 5% of OPEX. Fulfilling these targets while achieving the allowed RoR is becoming increasingly difficult.
- **Finland:** The StoNed model sets the efficiency for the average company at 90%. On top of that, there is a general efficiency requirement of 2.06%. Combining these two leads to an overall requirement of 3.9%. The cost reference years 2005-2010 contain several years without any severe storms, resulting in a low cost basis. At the same time, costs from new tasks are not adequately treated in the regulation model. Even though there is a €5 compensation for hourly settlement and from 2014 some compensation due to the new legislation, the efficiency target is still very difficult to achieve even for the most efficient companies.
- **Portugal:** From 2007 to 2013, the annual efficiency target in real terms was always at least 3.5%. The compounded effect has been the reduction of the allowed revenue to cover controllable costs by more than 20% (in real terms). An additional 3.6% reduction is planned for 2014 which is becoming increasingly harder to comply with for DSOs.
- **Spain:** The evaluation of efficiency requirements is based on a Reference Grid Model. This computer model cannot be run by anyone outside the regulatory authority. It does not allow the inclusion of a significant part of investment costs in CAPEX. Application of efficiency criteria by the model is not always understandable, making the fulfilment of the CAPEX efficiency requirements difficult. The OPEX allowance is supposed to be based on standard costs at national level. As the standard costs level is not defined by regulation, the OPEX allowance is negotiated with the regulator. This is neither stable nor predictable.

Enhancing robustness of benchmarking results: German example

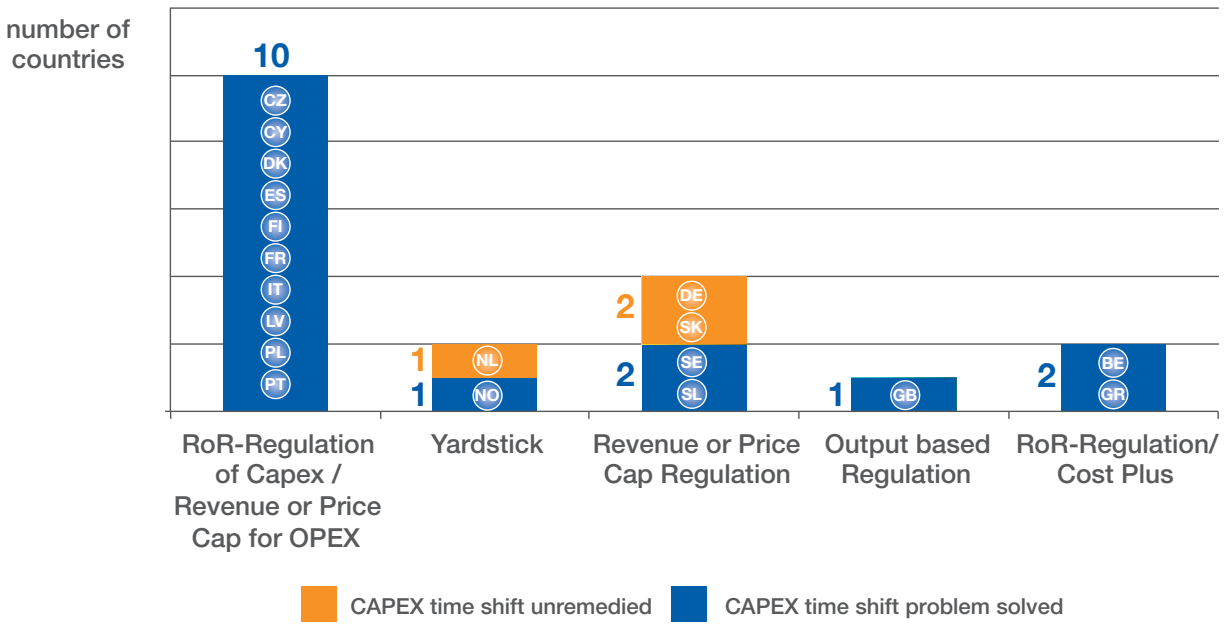
Independently from the specific method used, statistical errors make achieving the efficiency requirements more difficult for many DSOs. The German model recognises this. It uses a combination of two methods with complementary strengths and weaknesses: data envelopment analysis and statistical frontier analysis. In addition, two different methods are used to evaluate the regulatory asset base: linear depreciation and annuities. The individual efficiency requirement is then based on the best result out of the four. This approach substantially reduces the risk that non-influenceable errors lead to requirements that are not achievable.

The CAPEX time-shift needs to be solved to remove investment constraints

The delayed recognition of capital expenditure (CAPEX) when setting allowances for revenues and prices is intrinsic to incentive-based regulation common all over Europe.[17] Pure incentive regulation like yardstick, price or revenue cap regulation is typically characterised by decoupling allowed revenues from current cost reductions. But necessary investments would only be approved with significant delay. According to a study of the German Energy Agency (dena), this CAPEX time-shift significantly lowers the achievable rate of return: DSOs with high investment needs destroy value.

To relieve the CAPEX time-shift problem, most countries use regulatory mechanisms like planning cost approaches (Figure 12). This removes a significant investment constraint.

Figure 12: The CAPEX time shift remains unremedied in three countries



However, the problem is still unremedied in three countries: Germany, Slovakia and the Netherlands. In those three countries, DSO revenues are delayed on average for four years. In Germany, the CAPEX time shift is up to seven years. In the Netherlands, the methodology of the regulatory framework relieved the problem. The Dutch yardstick methodology includes an extrapolation of the historic asset base (including the X-factor) and the Dutch DSOs are allowed to keep extra revenues due to a rise in volumes (in the methodology allowed revenues are calculated based on historic volumes). However, the CAPEX time shift will be a topic on the agenda in the next years as the volume growth is expected not to be that high anymore and Dutch DSOs expect to invest more in electricity cables and gas pipes.

17 Regulation for Smart Grids, EURELECTRIC, 2011.

3

Assets in the regulatory asset base are not always valued in a realistic way

A realistic valuation of the regulatory asset base is crucial. For example, a standard cost catalogue is a widely accepted method in some countries. This method considers a standard replacement value for specific assets. It is essential that the standard cost catalogue reflects the costs for the whole industry and that the standard value is calculated with reference to the investment expenditure within the given regulatory period and considering parameters the DSO is not able to influence.

Country cases: assets valuation

- **Sweden:** The principle described above is accepted by the industry but there is still room for quality improvements for the actual levels in the standard cost catalogue.
- **Finland:** The regulatory update of 2012 changed principles for the valuation of assets. A redefinition of the excavation conditions for cables effectively shifted the standard cost below the average cost of the industry.

3.2 PLANNING RELIABILITY

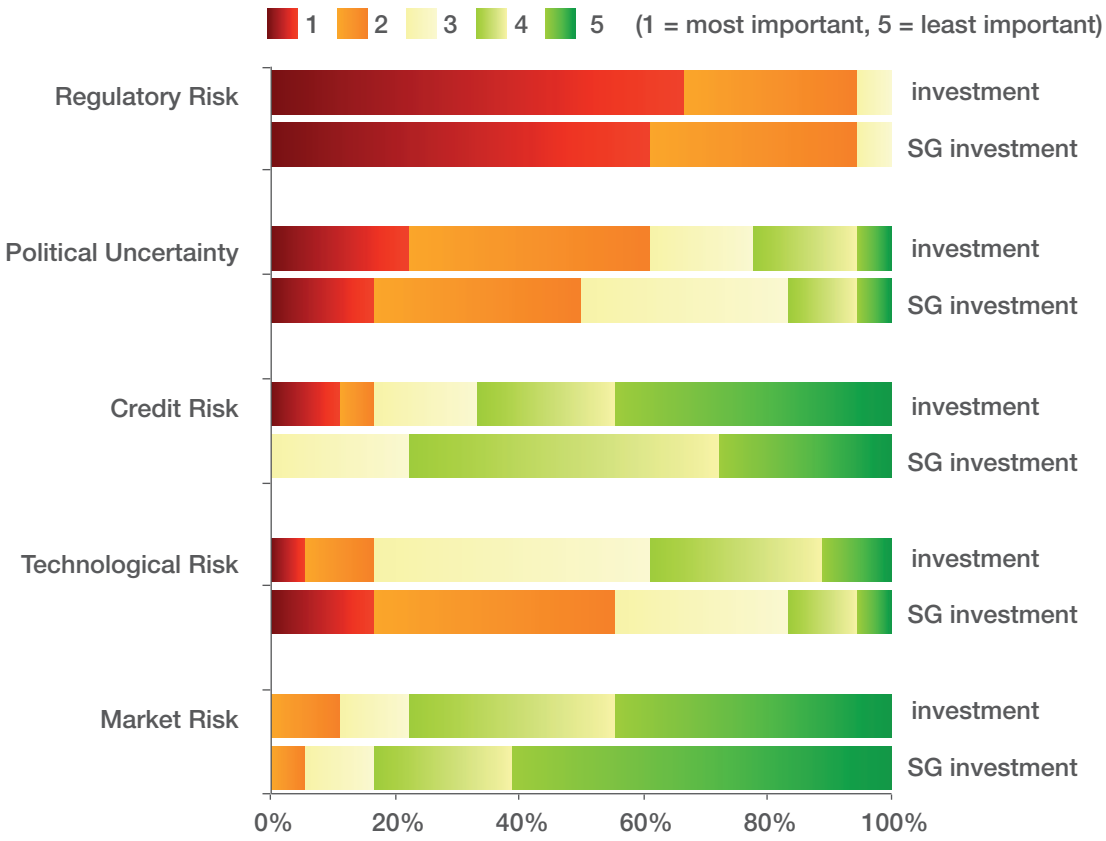
For DSOs as well as for investors, planning reliability is as important as the current regulated rate of return when taking investment decisions. While DSOs still invest in most assets through corporate finance, debt financing is expected to gain importance as investment needs grow.

When making investment decisions, DSO directors ascribe the highest importance to regulatory risk followed by political uncertainty. Figure 13 ranks **regulatory risk** (the risk that regulation does not allow DSOs to cover costs), **political uncertainty** (risk arising e.g. from changes to the legal framework), **market risk** (systemic risk, e.g. recession), **credit risk** (arising when future cash flows might not be enough to meet the needs of borrowers) and **technological risk** (risk of stranded investments) according to the survey results.

"We need higher degrees of predictability and stability in our regulation."

European DSO Director

Figure 13: What risks are the most important when making investment decisions?



The finding that the outcome of regulation was not evaluated as predictable in any country is therefore alarming. Benchmarking was mentioned among the main explanations for this.

A predictable development of regulation includes avoiding significant discontinuity and involving the industry in case of changes. As the environment becomes increasingly dynamic, 're-openers' that recognise changes in the cost-drivers can help regulation to become more flexible.

"Due to regulatory risk, DSOs will face problems if they want to attract debt."

European DSO Director

Example of the investors' perspective: EDF, France

In December 2012, Moody's rating agency deteriorated the outlook of EDF Group from Aa3 stable to Aa3 negative. It followed the decision of the French Conseil d'État to cancel the electricity distribution tariffs for the third regulatory period (2009-2013, known as TURPE 3). This decision was based on the judgment of the regulator (CRE) that the way the distribution tariffs were set added to the challenges faced by the group from rising debt and pressured profitability. In Moody's view, there remained some risk of a negative financial impact on the group, whether from any potential remedy or from the revised methodology which CRE was required to propose by June 2013.

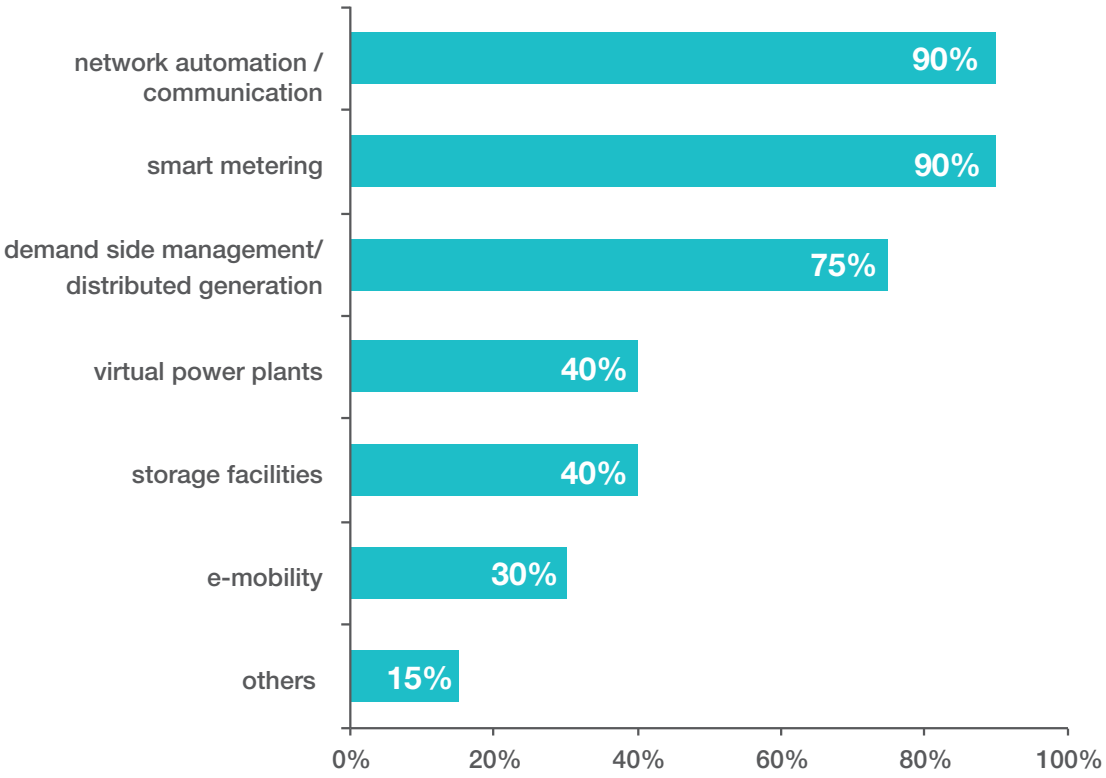
4

Regulation for smart grids

Testing smart grid technology is the backbone for an efficient deployment

Against the backdrop of variable renewables integration and the expected penetration of e-mobility, the ability to monitor the electricity flowing in their grids is becoming increasingly important for DSOs. Smart grids will equip DSOs with new tools to keep the system highly reliable and affordable. They will also create opportunities for customers to become more active and for service providers to package new innovative offers. DSO directors deem smart metering, network automation and investments in demand side management and integration of renewables to be the most important smart grid investments (Figure 14).

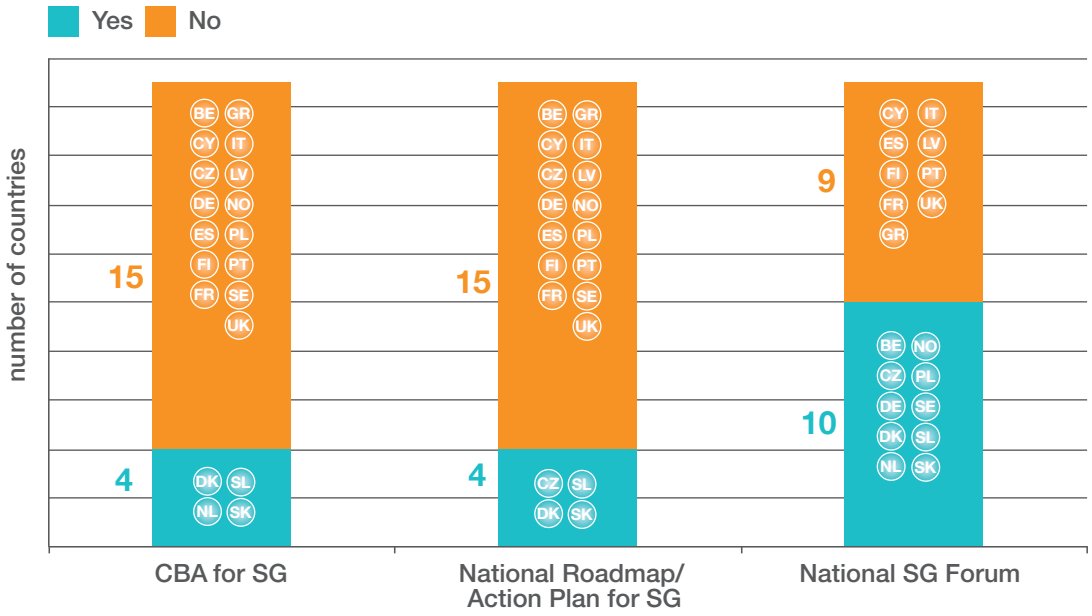
Figure 14: Most important smart grid investments according to DSO directors (%)



DSO directors highlight that technological risk plays a much higher role for smart grid investments than for other investments.

A smart grid cost benefit analysis by the government, a national action plan or roadmap and a national forum for involving stakeholders can enhance planning reliability. Such fora or plans already exist in some countries (Figure 15).

Figure 15: Has a smart grid CBA been conducted or does a national smart grid roadmap or forum exist in your country?



Testing and exploring smart grid technologies is indispensable to deliver the most efficient solution.

DSOs represent a key stakeholder in smart grid projects co-funded by the European research programme (FP7).[18] In some countries (e.g. Germany), there are also several large national funded projects where DSOs play an important role.

Despite this development and the political will to foster smart grids, there is still a big potential for better innovation incentives.

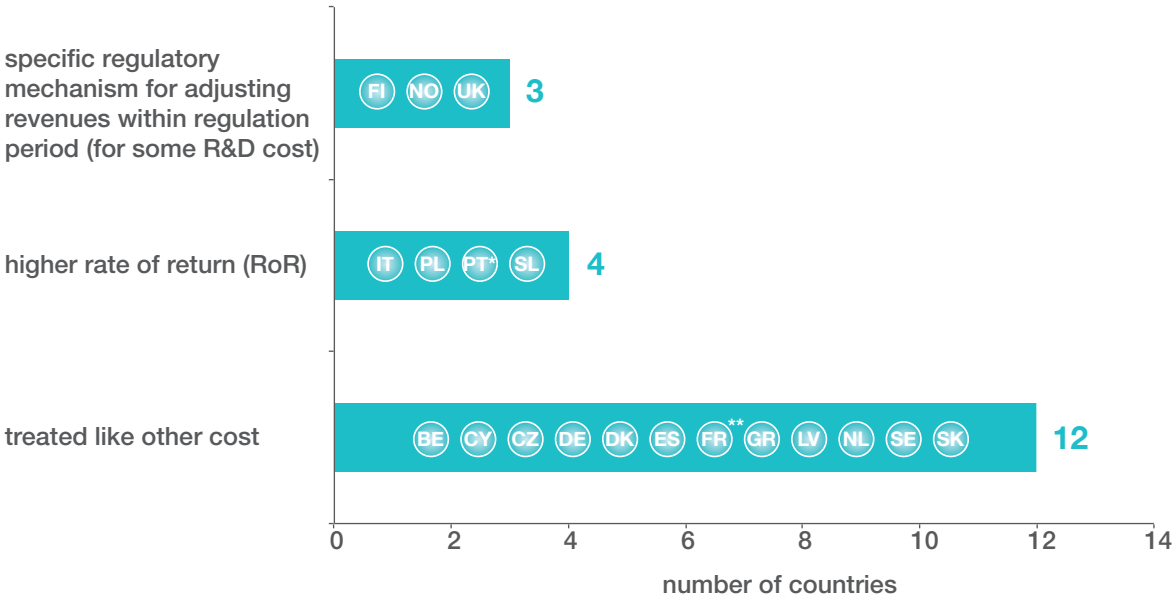
In most countries, R&D and pilots are treated like any other cost, i.e. there is no specific compensation for the risks involved in testing new technologies and processes (Figure 16). While regulation mainly focuses on cost reductions, pilots do not necessarily lead to short-term cost reductions and may have a negative effect on the efficiency benchmarking. Depending on the regulation scheme, costs are thus not or not fully approved by the regulator. The special risk structure would neither be reflected by the regulatory risk premium nor by the depreciation period. Although there are several best practices around Europe (see box below), **most DSO directors believe that regulation still hampers innovation** (Figure 17).

"Smart grids will be an evolution of functionalities corresponding to the local needs: A good understanding of the environment will be crucial as well as a flexible locally oriented design."

European DSO Director

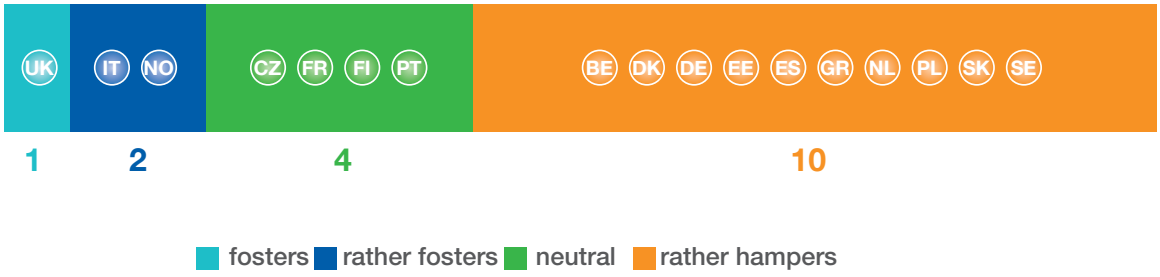
18 Smart Grid projects in Europe: Lessons learnt and current developments. Joint research centre, 2013.

Figure 16: In most countries, regulation treats R&D and pilots like any other cost



*PT: effect of higher RoR negligible due to additional efficiency requirements tied to the extra remuneration
**FR: specific mechansim planned for next regulation period

Figure 17: Most DSO Directors believe that regulation still hampers innovation



Country cases: regulatory hurdles to innovation

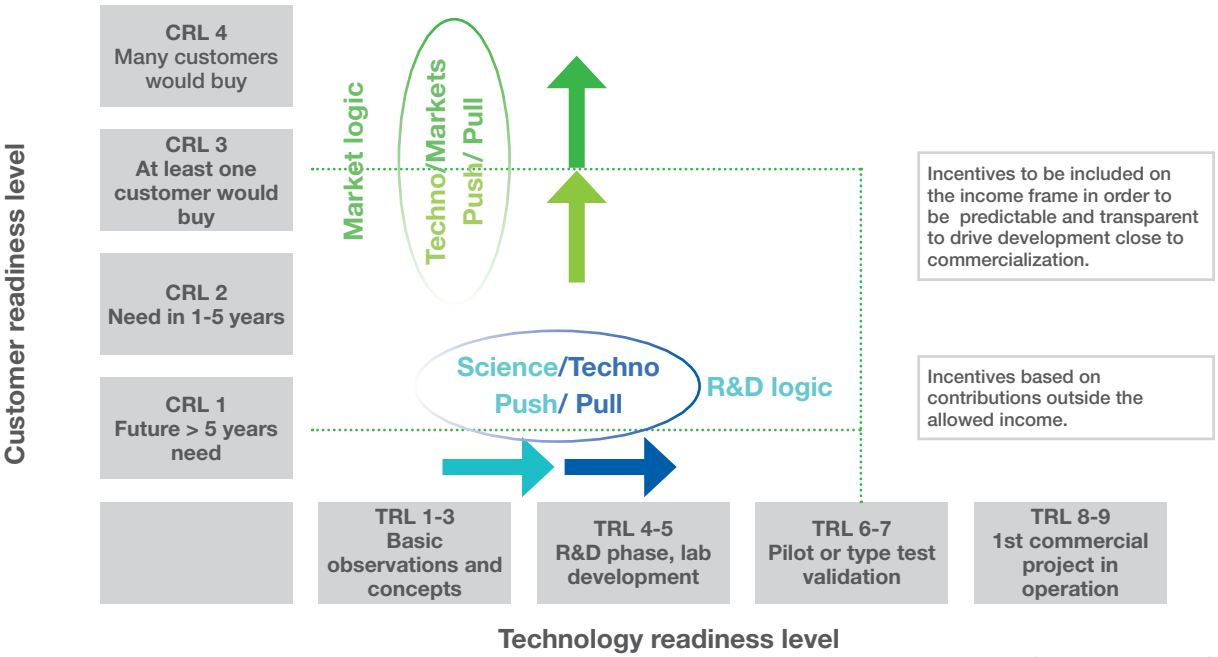
- **Finland:** The R&D compensation is less than €2 million for the biggest DSO. The handling of asset values has a much bigger impact. Regulatory asset values for the new components are based on negotiations with the regulator. When more new components are installed, the 'first-mover' thus faces a significant risk that the asset value will decrease dramatically when the cost catalogue is updated.
- **France:** A new instrument including a dedicated amount for R&D and pilots was issued at the end of 2013. If the DSO spends less than the allowed amount, this amount is returned to the tariff. Spending above the forecasted amount is at the company's risk.
- **Germany:** Only some selected projects would be covered by regulation. The major share of pilots and R&D is usually not approved by the regulator.
- **Poland:** The DSO is rewarded by a higher WACC only for projects related to smart metering. There are no further incentives for R&D and innovations.
- **Portugal:** There is an incentive of an extra 1.5% remuneration on the asset base of innovative projects. This only applies to small R&D/pilot projects and excludes any mass deployment of innovative technology. Furthermore, it requires extra cost-efficiency that more than offsets the extra remuneration of the asset base.

Best practices: regulatory incentives for smart grids

- **Italy:** Eight pilot projects have been selected by the regulator. These projects have been given approval for 2% extra WACC for 12 years.
- **Norway:** Since 2013, regulation allows for passing through of RD&D costs to a certain degree.2 The projects shall be aimed at contributing to an efficient operation, utilisation or development of the electricity network, recommended by the Research Council or similar institution.
- **The UK:** As part of the electricity distribution price control that runs from April 2010 till March 2015, the regulator established the Low Carbon Networks (LCN) Fund. The LCN Fund allows up to £500m to support projects sponsored by the DSOs to try out new technology, operating and commercial arrangements.

Depending on customer and technology readiness level, specific incentives may be favourable (Figure 18). **The revenue regulation should provide specific incentives for R&D to distribution companies where it is aimed to test new solutions that have the potential to provide value to customers in the near future.** This may involve new technologies, including smaller pilots near commercialisation where there is a commercial interest in the solution/service among early adopters. In addition, **new ways of working with mature technology and close to commercialisation should be included in the standard cost catalogue with a customised depreciation schedule** for creating incentives for network companies to develop their business.

Figure 18: Regulatory incentives depending on technology and customer readiness level



(Source: Fortum Sweden)

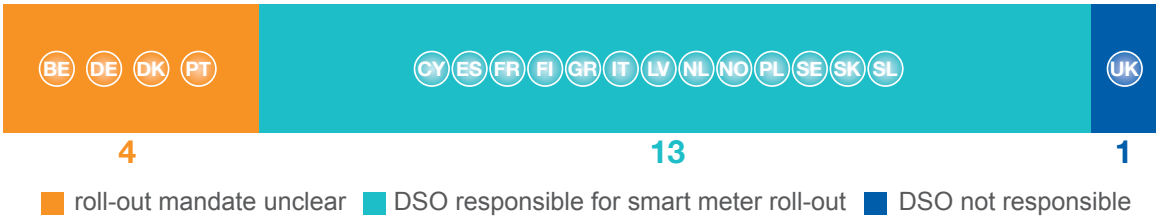
The regulatory framework for the roll-out of smart metering has improved

The EU has called for 80% of citizens to be equipped with smart meters by 2020, subject to a positive national cost benefit analysis. This corresponds to 200 million smart meters in total. To date, a smart metering roll-out for more than 80% of customers has been already mandated in 14 European countries. Others are going ahead with a partial or voluntary roll-out.[19]

In most countries, DSOs have been responsible for metering and they will be also responsible for the smart meter roll-out (Figure 19). While different data handling models are feasible, our survey confirms that in most countries, DSOs will be to some extent in charge of handling smart metering data and thus well-placed to facilitate the market. Ensuring a secure, efficient and transparent framework for data exchange for all parties will be key in this respect.

19 Power Distribution in Europe, Facts and Figures. EURELECTRIC, 2013.

Figure 19: DSOs will be responsible for the smart meter roll-out in most countries



As regulated entities DSOs will be allowed to recover the corresponding cost for the roll-out and data handling through regulated revenues. An appropriate regulatory framework is thus crucial to ensure non-delayed cash flow. In addition, a clear roll-out mandate (who should be equipped until when, who is responsible for the roll-out, who is responsible for the data handling) is needed to give DSOs the necessary planning reliability to start the roll-out.

Figure 20 shows that the framework for the smart meter roll-outs in Europe has improved since 2010, which could lead to increased smart metering penetration in the years to come. While likely to happen in the next years, the progress concerning the smart meter framework is not yet reflected in the roll-out process. Compared to 2010 only Slovenia has moved significantly further (Figure 21). In Italy and Sweden, smart meters have already fully replaced conventional meters.

Figure 20: Overview of smart meter regulation in Europe

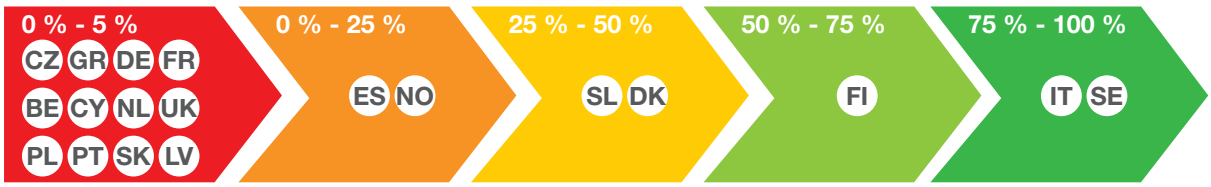
The regulatory framework for smart metering has slightly improved since 2010

clear roll-out mandate	Status of regulation 2010		
yes	FR	ES	FI IT SE SL
partially		NO PL	
no	PT SK DE DK	CZ NL AT	NL
	low	moderate	high
	Possibility to recover costs		

clear roll-out mandate	Status of regulation 2013		
yes		ES SK NO FR	GR FI IT NL SE SL
partially		DE PL	LV
no	PT	DK	BE CY
	low	moderate	high
	Possibility to recover costs		

CZ no roll-out
UK mandate not for DSOs, but for retailers

Figure 21: Status of the smart metering roll-out (2012)



Smart meter penetration (% of customers) in 2012

Country cases: smart metering roll-out

- **Finland:** The transition period for the metering decree from 2009 ended at the end of 2013. This means that 80% of customers are supposed to have hourly metering and hourly settlement. The customers that can be exempted by DSO choice have a maximum 25A fuse size or less than 5,000 kWh of consumption. Introduction of hourly settlement has been slower than anticipated; this has mainly been due to insufficient compensation for the costs for the hourly settlement. Industry estimates the actual cost for collecting the meter data and settling the consumption daily at €10-12 per customer and annum. The regulatory model allows for €5 per year.
- **France:** ERDF should install 35 million meters by 2021. The investment cost of around €5 billion should be amortised over the lifetime of the assets (20 years). In order to be able to finance such an amount of investment, ERDF needs a stable regulatory framework (over more than one tariff period) and an adequate level of return (WACC + premium), which is currently being discussed with the regulator.
- **Germany:** The Ministry for Economics published in July 2013 a smart meter cost benefit analysis that gave better planning reliability concerning mandates as well as roles and responsibilities. However, open questions remain, particularly regarding the cost recovery. The corresponding necessary legislation is planned to be launched in 2014.
- **The Netherlands:** Investment conditions improved thanks to a new ministerial rule applying cost-plus pricing during the entire roll-out period (from 2011 onwards for electricity meters, from 2012 for gas meters).
- **Norway:** Smart meter investments are mandatory for all customers (to be completed by 2019). The investment period is equal for all DSOs and network company costs shall increase at roughly same speed. As a result of yardstick regulation, cost would then be covered. The DSO with the highest efficiency score will have the highest rate of return.

5

EURELECTRIC recommendations for smart distribution network investments

DSOs fulfil an important public duty. Financing risks and income fluctuations should be avoided if DSOs are to play that role successfully. However, in the past years incentives for European distribution network investments have generally deteriorated. This risks delaying the new network investments that will be necessary for the transition towards a low carbon economy with a high share of renewable energy sources (RES).

In order to manage the investment challenge DSOs may increasingly need to turn to external sources of financing. The stability and predictability of regulatory regimes for networks has a strong impact on investors' assessment of DSOs' investability. Investors will not be willing to provide capital or favourable financing conditions to DSOs that have an inadequate or unstable rate of return.

To this end, we recommend that economic regulation is revised as follows:

A. INCENTIVISE DSOs TO MAKE EFFICIENT LONG-TERM INVESTMENTS RATHER THAN FOCUS ON SHORT-TERM OPTIMISATION

A reasonable rate of return as well as a predictable and stable development of the rate of return are essential.

1. Ensure consistency between policy and regulation

Continued RES growth will require support for innovation as well as further investments in more intelligent distribution grids. Long-term policy goals are therefore needed not only for producers and consumers, but also for networks. Energy policy targets, such as higher shares of RES or the roll-out of smart meters, and regulatory goals must not be contradictory. Regulation oriented towards the long term is necessary to accommodate higher investment needs.

2. Secure a return on investments at a market rate. Calculate the regulated rate of return in a transparent way and using long-term parameters

The return on investments should reflect the cost of capital, including the higher risk of new technology. For the distribution business to remain viable, it is key that the regulated return is set in a transparent way and based on a long-term stable WACC which is consistent with the average asset life-time. If that is not the case, DSOs may face deteriorated financial ratios and have problems to attract financing.

3. The overall regulatory formula must remain predictable

The typical investment cycle in the electricity distribution business ranges from 30 to 55 years, depending on the type of investment. Frequent significant changes of the regulatory scheme must therefore be avoided. Modifications to the methodology should be the exception.

Clear rules for adjusting revenues during the regulation period should be defined. In particular regulatory models with delayed recognition of capital and operational expenditure when setting allowances for revenues and prices need to include a compensational element to remove investment barriers.

4. Balance regulatory incentives, provide achievable efficiency requirements

DSOs are already finding it difficult to comply with efficiency targets. Tightening efficiency requirements even further is not compatible with the increased investment expenditure and innovation needs.

Efficiency requirements that are mostly based on historic cost need to be adjusted to take into account the current investment challenge. Methodological distortions when setting efficiency targets may further reduce their achievability and should therefore be eliminated. **DSOs should be relieved of the requirements where appropriate.**

B. REWARD RATHER THAN PENALISE INNOVATION.

Even though testing of new technologies may not always prove successful, hindering RD&D will only lead to higher costs in the long run.

5. Efficiency targets should not hamper innovative solutions. Avoid micromanagement.

Regulation needs to recognise the special character of innovative investments. They should not be subject to the same "tightening" efficiency requirements as conventional requirements. Instead, the evaluation of efficiency should take into account the higher technology risk inherent in such investments.

To this end, **incentives for CAPEX and OPEX should be treated equally**. If the efficiency requirement is calculated on the basis of OPEX alone, DSOs may not have adequate incentives to pursue operational solutions other than "putting copper and iron in the ground". Smart grids and active distribution network management solutions may increase OPEX but can, in certain cases, be more efficient in the long run. However, the fact that only new investments and not the whole regulatory asset base are controllable should be acknowledged.

RD&D by DSOs should be removed from OPEX efficiency targets, thereby encouraging DSOs to innovate. In addition, regulatory incentives such as an innovation fund to support both small R&D and larger demonstration projects should be supported. **The European Commission should develop guidance on smart grid investment incentives and innovation incentives to be used at the national level.**

DSOs should be allowed to achieve a higher return on investments and a risk adjusted depreciation period for projects with significant investment and business risk. Where this is already the case, DSOs should have sufficient autonomy to use the allowance in the best possible way.

6. Remove legal and regulatory barriers for active distribution system management

In many countries, DSOs are obliged to design their networks according to peak demand. As consumption and production patterns change, other solutions might be more cost-efficient. DSOs should be free to consider both the traditional investment solution (building up new capacity) and the flexibility service-based solution, or a combination of the two, depending on what is most efficient.

7. Ensure a timely cost recovery for the smart metering roll-out by DSOs

DSOs must be adequately remunerated for costs related to the roll-out of smart metering. Such costs include both the cost of installing the meters as well as the costs of collecting metering data and settlement. A stable framework over more than one regulatory period is needed in order to finance such large-scale investments. European funding to compensate for the missing cost recovery of smart metering roll-out costs should be considered.

8. Further encourage financing of large-scale smart grid demonstration projects. Revise the criteria for Projects of Common Interest (PCI)

EURELECTRIC has been a strong supporter of EU research and innovation initiatives, including the Strategic Energy Technologies Plan, the European Electricity Grid Initiative and the 7th Framework Programme of Research, and has also actively contributed to the development process of the Integrated Roadmap. We acknowledge and appreciate the support that a majority of smart grid projects in the EU today receive from such programmes.

In order to continue to make the most of EU funding, we recommend that smart grid demonstration and early deployment should be considered as priorities in the future calls for proposals of Horizon 2020, as is already the case in the 2014 and 2015 calls. Coordination between national and EU funding for demonstration projects should be enhanced to make best use of the available financing possibilities.

Finally, the PCI criteria should be revised to make sure that national smart grid projects with a significant cross-border impact can also be eligible for funding.

OVERVIEW: EURELECTRIC RECOMMENDATIONS

A. INCENTIVISE DSOs TO MAKE EFFICIENT LONG-TERM INVESTMENTS RATHER THAN FOCUS ON SHORT-TERM OPTIMISATION

1. Ensure consistency between policy and regulation.

2. Secure a return on investments at a market rate. Calculate the regulated rate of return in a transparent way and using long-term parameters.

3. The overall regulatory formula must remain predictable.

4. Balance regulatory incentives, provide achievable efficiency requirements.

B. REWARD RATHER THAN PENALISE INNOVATION

5. Efficiency targets should not hamper innovative solutions. Avoid micro-management.

6. Remove legal and regulatory barriers for active distribution system management.

7. Ensure a timely cost recovery for the smart metering roll-out by DSOs.

8. Further encourage financing of large-scale smart grid demonstration projects. Revise the criteria for Projects of Common Interest (PCI).

ANNEX – National Regulatory Systems

Table 1: Efficiency requirements

	Regulation System	Regulation Period	Efficiency Requirements		
			General	**Individual**	**Effect of smart grid (SG) Investments**
BE	▪ **Cost plus**	4 years	▪ Yes but details n.a.	▪ **Method**: Legally determined by DEA ▪ **Impact**: Requirement is determined by OPEX and refers to OPEX	▪ **OPEX** related SG expenses have an impact on the efficiency requirement. ▪ **CAPEX** have no impact
CY	▪ **Hybrid:** **Revenue Cap / RoR**	Not fixed	▪ None	▪ **Method**: Negotiations / benchmarking is based on total cost and on OPEX. ▪ **Impact:** Requirement is determined by OPEX and TOTEX but only refers to OPEX.	▪ No specific mechanism
CZ	▪ **Hybrid:** **Revenue Cap / RoR**	5 years	▪ Requirement is defined through OPEX ▪ Efficiency factor 9.75% for the whole period ▪ No DEA / SFA used due to small number of DSOs. Efficiency factor was set by negotiations of NRA with DSOs.	▪ None	▪ None
DE	▪ **Revenue Cap Regulation** (including quality regulation)	5 years	▪ 2009-2013 (first regulation period): 1.25% p.a. referring to total cost ▪ 2014-2019 (second regulation period): 1.5% p.a. referring to total cost	▪ **Method**: DEA / SFA using book values and annuities for capital cost respectively (4 methods). Efficiency score depends on the best result. ▪ **Impact**: Requirement is determined by TOTEX and referring to TOTEX.	▪ Additional cost for SG would usually not be approved by the NRA and would therefore have no negative effect on the benchmarking results.
DK	▪ **Hybrid:** **Revenue Cap / RoR**	1 year	▪ None	▪ **Method**: Specific benchmarking model (reference network) is used to derive the relative efficiency requirement. ▪ **Impact**: Requirement is determined by TOTEX but refers to “adjustable” cost (i.e. OPEX). Extraordinary costs and costs for losses do neither influence the calculation nor does the requirement refer to them.	▪ Smart meters are considered as extraordinary cost (no impact on the efficiency requirement).

	Regulation System	Regulation Period	Efficiency Requirements		
			General	Individual	Effect of SG Investments
ES	▪ **Hybrid:** **Revenue Cap / RoR**	4 years	▪ Coefficient reducing inflation. Difficult estimation as a percentage of the total cost	▪ **Method:** Reference grid model is used to determine CAPEX. OPEX are adjusted due to standard cost and negotiations with the NRA. ▪ **Impact:** Significant adjustment of CAPEX due to reference grid model	▪ Additional costs are currently not taken into account in the reference grid model.
FI	▪ **Hybrid:** **Revenue Cap / RoR** (quality of supply included in the benchmarking)	From 1.1.2016: 4+4 years	▪ 2.06% p.a. referring to TOTEX which is defined as OPEX and the estimated cost for outages for customers.	▪ **Method:** StoNED model (stochastic non-smooth envelopment of data) ▪ **Impact:** Requirement is determined by controllable OPEX and cost of energy not supplied compared to network length, amount of customers and cabling rate of MV grid.	▪ Some R&D costs can be excluded from controllable OPEX, max. 0.5% of turnover.
FR	▪ **Revenue Regulation with target values for investments**	4 years	▪ 1.7% p.a. referring to OPEX	▪ None	▪ n.a.
GB	▪ **Output based regulation: RIIO formula** (RIIO: revenue = incentives + innovation + outputs)	8 years (2015–2023)	▪ None	▪ **Method**: Distribution network operations (DNOs) submit well-justified business plans including outputs to deliver and incentives to encourage delivery. The regulator applies the role of proportionate treatment and in some cases may use “fast tracking”. Under RIIO, the bonus is on the DNOs to demonstrate cost-efficiency and long term value for money of their business plans. There are also efficiency incentive rates applied to TOTEX. ▪ Costs = expected efficient expenditure; allowance for taxation; RAV (carried from previous price control period), capitalisation and depreciation, WACC = baseline revenue allowance, including finance costs. The NRA plans to use benchmarking of historical & forecast data as a means of informing their assessment of DNOs’ forecasts. The NRA is also developing a “toolkit” approach to cost assessment: TOTEX analysis & use of disaggregated approaches. ▪ **Impact**: Basis and relevance: TOTEX	▪ An incremental approach is advocated for smart grids, for example, smart meters will not be completely rolled out before RIIO-ED1 commences. ▪ There is a Low Carbon Network Fund «LCNF» from the existing price review which includes funds for trialing smart technologies. ▪ This will be replaced by the Network Innovation Competition («NIC»). DNOs will join NIC at the start of RIIO-1.There are incentives in RIIO for smart solutions including DSR as efficiency to manage network loads and demands: the smart networks model is not fully known yet but there are uncertainty mechanisms in RIIO.

	Regulation System	Regulation Period	Efficiency Requirements		
			General	Individual	Effect of SG Investments
GR	▪ **RoR**	Not officially defined, currently 1 year	▪ OPEX clearances term in the regulation formula (difference between actual and budgeted OPEX only if this difference exceeds 3%)	▪ n.a.	▪ n.a.
IT	▪ **Hybrid:** **Revenue Cap / RoR** including benefit sharing mechanism	4 years	▪ 2012-2015: 2.8% referring to OPEX	▪ **No individual efficiency requirement but benefit sharing mechanism:** 50% of the difference between OPEX recognised in the tariffs and actual OPEX have to be given back to customers in the first year of the next regulation period. The remaining 50% have to be given back within 8 years.	▪ No impact ▪ Gained efficiency from the smart meter roll-out was reflected in a higher sharing benefit and a higher X-factor for metering activity (7.1% for metering activity vs. 2.8% for distribution activity)
LV	▪ **Hybrid:** **Revenue (price) Cap / RoR**	Not fixed (1-5 years)	▪ None	▪ **Method:** Regulator facilitates detailed OPEX analysis. Cost increase is allowed when it can be proven to be economically necessary. ▪ **Impact:** OPEX are subject for possible cut down if DSO has no documented prove of future cost increase.	▪ Separate investment budgets for smart metering and other SG investments
NL	▪ **Hybrid:** **Yardstick** (regular business) / **RoR** (for exceptional innovative investment/ significant investment rate / rarely applied) (including quality regulation)	3-5 years, until now 3 years are chosen	▪ **Yardstick factor:** calculated as average cost of all DSOs. Each of them gradually moves to the common average. ▪ **General efficiency requirement**: 2011-2013: -1.3% p.a. referring to TOTEX (based on a 3-years average) Draft decision 2014-2016: 0.9% p.a. referring to TOTEX (based on a 8-years average)	▪ None	▪ Costs for pilots etc. are treated like ordinary cost.

	Regulation System	Regulation Period	Efficiency Requirements		
			General	Individual	Effect of SG Investments
LV	▪ **Hybrid:** **Revenue (price) Cap / RoR**	Not fixed (1-5 years)	▪ None	▪ **Method:** Regulator facilitates detailed OPEX analysis. Cost increase is allowed when it can be proven to be economically necessary. ▪ **Impact:** OPEX are subject for possible cut down if DSO has no documented prove of future cost increase.	▪ Separate investment budgets for smart metering and other SG investments
NL	▪ **Hybrid:** **Yardstick** (regular business) / **RoR** (for exceptional innovative investment/ significant investment rate / rarely applied) (including quality regulation)	3-5 years, until now 3 years are chosen	▪ **Yardstick factor:** calculated as average cost of all DSOs. Each of them gradually moves to the common average. ▪ **General efficiency requirement**: 2011-2013: -1.3% p.a. referring to TOTEX (based on a 3-years average) Draft decision 2014-2016: 0.9% p.a. referring to TOTEX (based on a 8-years average)	▪ None	▪ Costs for pilots etc. are treated like ordinary cost.
NO	▪ **Yardstick Regulation** (quality of supply included in the benchmarking	Minimum 5 years	▪ None	▪ **Method**: DEA used for calculating Yardstick factor. DEA includes cost for Energy not supplied. ▪ **Impact:** Requirement is determined by TOTEX and refers to TOTEX.	▪ Pass through of R&D and pilot cost ▪ Projects approved by NVE ▪ Recommended by the Research Council or similar institution ▪ Shall be aimed at contribution to an efficient operation, utilisation or development of electricity network ▪ Limited to 0.3% of RAV per year, use it or lose it
PL	▪ **Hybrid:** **Revenue Cap / RoR**	4 years	▪ ~ 2.5% p.a. referring to OPEX	▪ **Method**: Benchmarking ▪ **Impact**: Efficiency requirement is determined by OPEX and refers to OPEX. Operation and maintenance cost for 2012-2015 were calculated as an actual average cost from 2008-2010.	▪ No impact

	Regulation System	Regulation Period	Efficiency Requirements		
			General	Individual	Effect of SG Investments
PT	▪ **Hybrid:** **Revenue/ Price Cap** (controllable OPEX, non-controllable OPEX: cost pass through)/ **RoR** including quality regulation	3 years	▪ 3.5% p.a. applied to controllable OPEX	▪ **Method:** While various techniques have been used (DEA, COLS, SFA), the NRA has preferred results from DEA model. Due to the lack of comparable players, these techniques have been applied to compare the performance of regional units within the same company. ▪ **Impact:** The efficiency requirement is determined by OPEX and refers to OPEX.	▪ SG pilot cost where included in the allowed revenues through the CAPEX component.
SE	▪ **Revenue Regulation including Standard Cost Approach:** (including quality regulation)	4 years	▪ 1% p.a. referring to influenceable cost (i.e. OPEX)	▪ **Method:** No efficiency requirement but approved CAPEX are based on standard cost approach. ▪ **Impact:** Standard costs refer to CAPEX.	▪ No impact
SL	▪ **Revenue Regulation with target values for investments**	3 years	▪ 3.08% p.a. (2013) to 3.18% p.a. (2015) referring to OPEX ▪ 2.4% p.a. (2013) to 2.15% p.a. (2015) of monitored cost for operation and maintenance	▪ **Method:** DEA and COLS ▪ **Impact:** The efficiency is determined by TOTEX and refers to TOTEX.	▪ Additional cost for SG (like pilots) included in allowed revenues in current regulation period
SK	▪ **Hybrid:** **Price Cap based on allowed revenues**	5 years	▪ 3.5% p.a., but RPI-X cannot be lower than zero.	▪ None	▪ Not applicable

Table 2: Recognition of CAPEX and smart grid projects

	Recognition of Capital Expenditures for Determining Revenues		Treatment of R&D and Pilot Projects
	Mechanism	**Do revenues reflect CAPEX?**	
BE	▪ Revenues are adjusted every 4 year	▪ **Amount:** Fully ▪ **Delay:** Without delay	▪ No specific mechanism
CY	▪ No specific mechanism	▪ **n.a.**	▪ No specific mechanism
CZ	▪ RoR regulation for CAPEX ▪ No other special mechanism	▪ **Amount:** New assets fully / investments before 2010: 60 % of overrated value ▪ **Delay:** No significant delay	▪ No specific mechanism
DE	▪ **Investments in general:** Revenue path is adjusted every 5 years / relevant cost: 2 years before new regulation period ▪ **Special Instruments:** ▪ **Investment budgets** in case of substantial measures referring to a technically necessary restructuring of the grid and (planned) extension investments within the 110 kV level. ▪ **Extension factor:** Considering extension investments including connection of DER but there is no direct link between cost and allowed revenues, they match only by accident.	▪ **Amount:** Partially (efficiency requirements refer to CAPEX) ▪ **Delay:** Up to 7 years for a major part of investments (mainly replacement investments)	▪ Planned: DSOs can apply for the cost recognition of R&D projects, NRA is allowed to approve revenue adjustment in case projects receive public finance and DSO carries 50 % of the cost. ▪ Majority of SG investments would not be approved by the NRA.
DK	▪ **CAPEX in terms of depreciation are covered** (hybrid system and inflation adjustment) ▪ The allowed rate of return is not calculated as WACC, but is derived from a general "building development index" plus 1 percentage point and it changes every year. However, the change is not necessarily compatible with the change in DSO capital costs. Thus, it differs from year to year and company to company if CAPEX is covered or not. Further, there is a deduction in the revenue cap, due to efficiency requirements.	▪ **Amount:** Partially (efficiency requirements refer to CAPEX / depending on "building development index") ▪ **Delay:** See under mechanism.	▪ No specific mechanism
ES	▪ **General mechanism:** reference grid model ▪ Additional investments are not taken into account.	▪ **Amount:** Partially (depending on results from reference grid model) ▪ **Delay:** 1 year	▪ No specific program /mechanism to fund SG pilots. Some basic R&D projects are partially financed in the national and European R&D programs, the current projects are fully funded by the companies developing them.
FI	▪ Investments recognized fully using industry average price	▪ **Amount:** Depending on industry average price compared to companies cost ▪ **Delay:** 0.5- 1 year	▪ R&D costs up to 0.5% of turnover are treated as pass through items

	Recognition of Capital Expenditures for Determining Revenues		Treatment of R&D and Pilot Projects
	Mechanism	**Do revenues reflect CAPEX?**	
FR	▪ Capital expenditures are forecasted at the start of any regulation period. ▪ Real expenditures are fully recognized in the capital revenue calculation (including pass through of depreciation on real accounting basis each year).	▪ **Amount:** Fully except difference between concession and regulation mechanism (municipalities receive revenues which are not included in the tariffs). This reduces achievable RoR significantly. ▪ **Delay:** None (planning cost approach)	▪ In the next regulation period R&D and pilot projects are expected to be excluded from incentive mechanism for cost reduction.
GB	▪ Allowances for business plans ▪ Upfront efficiency incentives, rewards/penalties for delivery of output: rules to adjust revenues in light of company's performance.	▪ **Amount:** Depending on Output regulation ▪ **Delay:** None (planning cost approach)	▪ The future smart grid is not yet known. There are incentives in RIIO for smart solutions & uncertainty mechanisms. It is not anticipated that the "smart grid" will be fully understood before the commencement of RIIO ED- 1. There is a role of "Innovation" within RIIO. There is a longer price control period of 8 years; there is an outputs focus & strong efficiency incentives. The business plan is where DNOs can highlight technology innovation etc. DNOs will need to justify the business case for such innovation where costs are higher. ▪ Currently Low Carbon Network Fund which will be transferred to Network Innovation Competition (NIC). ▪ Network Innovation Allowance (NIA) which will be a limited amount within the DNOs' revenue allowance on a use-it-or-lose-it basis.
GR	▪ **CAPEX clearance term** in the regulation formula which is the difference between actual and budgeted CAPEX.	▪ **Amount:** Fully ▪ **Delay:** Without delay	▪ As other cost
IT	▪ New investments are included in the RAB and sector WACC is applied to them. ▪ RAB is updated each year (year n) taking into account investments from year ▪ (n-2). WACC has been adjusted to take into account the 2 year time delay.	▪ **Amount:** Fully ▪ **Delay:** 2 years but WACC is adjusted to take this into account	▪ Investment made in SG pilots selected by the NRA are treated in the same way as other investment but receiving a premium on the WACC (+ 2%). ▪ SG investments refer to control of generators in DSOs network, storage and devices for active demand.
LV	▪ RoR (based on WACC) regulation for CAPEX ▪ New investments are not included in the RAB in the first tariff year. ▪ RAB asset book value without asset r-evaluation value	▪ **Amount:** Partially (no return on investments made in the first tariff year) ▪ **Delay:** None	▪ As other cost

	Recognition of Capital Expenditures for Determining Revenues		Treatment of R&D and Pilot Projects
	Mechanism	**Do revenues reflect CAPEX?**	
NL	▪ Allowed revenues are based on total cost including CAOEX (see general mechanism); sector wide cost recovery ▪ DSO can apply for special treatment (RoR-Regulation) only in case of exceptional innovative or significant investment.	▪ **Amount:** Depending on industry average compared to companies cost ▪ **Delay:** On average 4 years	▪ No specific mechanism
NO	▪ Companies get paid for the current investment.	▪ **Amount:** Partially (deduction due to yardstick factor) / some compensation with calibration parameter ▪ **Delay:** None for CAPEX	▪ From 2013 on some projects will be accepted by the NRA to receive an extra income up to 0.3% (book value X1,01).
PL	▪ **RoR regulation of CAPEX** ▪ New asset: book value is base for calculation/ old assets (before 2008) 5-6 years path to reach book value	▪ **Amount:** Depending on Output regulation ▪ **Delay:** 2 years	▪ Higher WACC for smart metering investments
PT	▪ New investments are included in the RAB and the RoR determined by the NRA is applied to them is applied to them; DSOs investment in meters is not included in the RAB	▪ **Amount:** Fully ▪ **Delay:** None	▪ 1.5% above ROR awarded to the investment in the traditional grid.
SE	▪ **Investments are accepted to standard cost.** ▪ Due to annuity approach, quality regulation is crucial.	▪ **Amount:** Depending on standard cost/ regulated revenues reflect annuity ▪ **Delay:** None	▪ After special decisions R&D cost can be outside the revenue frame.
SL	▪ **Agreement on CAPEX** at the beginning of each regulatory period / 10 years network development plans	▪ **Amount:** Fully ▪ **Delay:** Without delay	▪ Incentives for SG in 2% of NPV when more than 200,000 EUR invested p.a.
SK	▪ Underperformance in CAPEX may lower the allowed profit (e.g. RAB*WACC*coefficient)	▪ **Amount:** Fully ▪ **Delay:** Time shift (so far regulatory formula fixes OPEX, Depreciation and RAB for the duration of the regulatory period, with only year-to-year adjustments within. So full reflection will not be available until next regulatory period (delay up to 5 years).	▪ No specific mechanism

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ELECTRICITY FOR EUROPE

EURELECTRIC is the voice of the electricity industry in Europe.

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

We Stand For:

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.

Competitive electricity for our customers

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.

Continent-wide electricity through a coherent European approach

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.

EURELECTRIC pursues in all its activities the application of the following sustainable development values:

Economic Development
- Growth, added-value, efficiency

Environmental Leadership
- Commitment, innovation, pro-activeness

Social Responsibility
- Transparency, ethics, accountability

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