GEODE
The voice of local energy distributors across Europe

Revenue Regulation for Electricity Distribution System Operators

A crucial enabler for the energy transition

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Background

Until recently, the European electricity system used to be a very stable entity generating slow organic growth. While cities expanded with an increased need for electricity, individual customers' usage patterns were stable. For example, an electricity consumer in the 80s had the same needs as a customer in the early 10s, perhaps even a little less due to energy efficiency. However, new technology and policy changes over the past few years have changed this fundamentally.

Distributed solar photovoltaics has transformed many customers in local grids into prosumers requiring additional grid capacity to export their excess solar. Couple this with the electric vehicle boom that is taking off in many European countries, the ongoing switch from gas heating to electric and the shifting residential consumption patterns and meeting the EU's renewable energy target will require a substantial increase in wind and solar power generation. As much as two and a half times by 2030.

This is an entire, root and branch endeavour, affecting electricity grids of all voltages as well as both existing and future customers connecting to it. This grid investment is on a scale and speed not seen since the first electrification in the 20th century.

Integration of renewables and electrification are the most important drivers for the need of distribution grid investments which must be financed and incentivized by sufficient regulatory incentives. Revenue regulation must ensure the necessary cash flow for investments as well as the financial incentives for owning and operating a distribution system operator (DSO) compared to other investments. DSOs also need a long-term planning horizon and reliable economic framework conditions for upcoming necessary investments. Revenue regulation must ensure sufficient investments to serve customers' needs and at the same time drive for efficiencies in networks to ensure grid costs are justified.

This GEODE position paper examines DSO revenue regulation as a tool for enabling grid investments. It highlights several principles that will benefit the development of the next generation of European local electricity grids.

GEODE's 7 Recommended Principles for Revenue Regulation

1. **Long time predictability**
   Operating an electricity grid is a long-term commitment. Regulation must be long term in order to facilitate the most efficient long-term developments of the grid and at the same time there should be flexibility within the regulatory period to adapt quickly to unforeseen changes.

2. **Anticipatory investments**
   DSOs must be incentivised to implement anticipatory investments in-line with their Network Development Plans (NDPs), look beyond immediate needs and proactively address expected developments with sufficient certainty.

3. **Sufficient cash flow**
   Revenue regulation must ensure DSO cash flow is sufficient to allow them to handle investment peaks created by current electrification trends.

4. **Competitive Weighted Average Cost of Capital (WACC)**
   The WACC set in revenue regulation must give a reasonable rate of return on investments and be competitive in comparison to other similar investments. It must give DSOs compensation for relevant risks.

5. **Balanced incentives between Capital and Operational Expenditures (CAPEX and OPEX)**
   Revenue regulation must reward the most efficient solution for customers.

6. **Promote efficient operation while safeguarding consumer interest**
   Revenue regulation must have a fair and transparent way of rewarding efficiency. At the same time, it's important to maintain a balance to ensure efficiency goals do not hamper improvements that would increase customer satisfaction, such as digitalisation and security.

7. **Incentivise innovation**
   It's of crucial importance that the DSO can adopt new technologies and new smart solutions in the years to come. R&D projects and innovation pilots must be incentivised through revenue regulation.

Revenue Regulation for DSO's – The Basics

Electricity networks are seen as a natural monopoly in all European countries because building parallel networks would not be cost efficient. When a DSO is given the right to operate as a local monopoly, it's obvious that the costs and operation of the company need to be strictly regulated. A well-functioning regulatory model provides the monopoly company with necessary incentives to provide their customers with services in a cost-efficient way, while constantly improving and developing for their future needs. However, in the recent past, investments in grids could not follow the enormous speed and the explosive increase of connection requests both from generation and demand, challenging the grids.

Grid investments are driven by regulatory requirements to connect consumers and generation to the grid, and requirements to maintain a certain quality of delivery when distributing energy to connected customers. Revenue regulation decides what income and rate of return DSOs can get from their investments. This makes revenue regulation an important factor in DSO investment decisions.

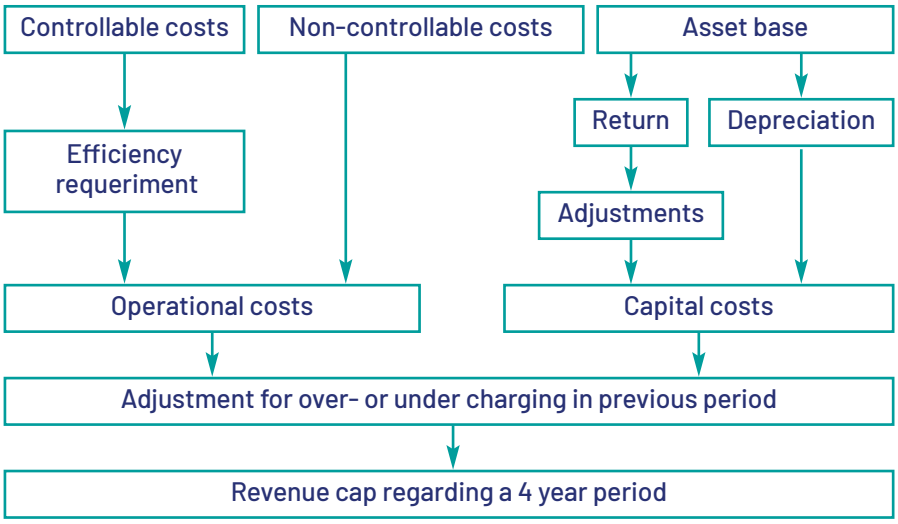
Often revenue regulation is what we refer to as incentive-based regulation. The main goal for National Regulatory Authorities (NRAs) is to make sure that network costs and quality of supply are kept on a reasonable level for customers. The revenue model is therefore often designed to provide an incentive for cost efficiency or other considerations that can contribute to this. Transparency on how NRAs calculate allowed revenues for DSOs is also an important term in the equation as NRAs must ensure they are appropriate and in the interest of network connected consumers.

Although methods vary in detail between member states, the basic principles for calculating the allowed revenue for DSOs in the EU is the same. This is done over a specific time period, usually 3-5 years.[1] Revenue regulation usually sets the DSOs maximum revenue for the period, not the customers individual network charges. Network tariff setting is done in some countries by the DSO within the limits of the set revenue limits (this is the case in the Nordics), while in others government with the advice of the NRA or the NRA itself establishing network tariffs.

[1] CEER Report on Regulatory Frameworks for European Energy Networks 2023, 21 Feb 2024
https://www.ceer.eu/documents/104400/-/-/bd93ab3b-de76-134d-2374-85d3cd5c3125

The following factors are used by most regulators to calculate DSOs revenue:

- Asset base
- Operational costs
- Technical losses
- Efficiency incentives
- Quality adjustments
- WACC



The basic principles of revenue regulation – example from Sweden

ASSET BASE

The asset base is the physical assets owned by DSOs. This includes for instance cables, substations, and switches in the grid, but also spare parts and other equipment needed for maintaining the grid as well as meters, IT-systems, office buildings etc. The NRAs calculate a value for these assets. The methods for this vary between the member states. Some countries use for instance norm prices as the base for the value. Others apply the real value for the investment when it was made. In some countries this is adjusted by NRAs considering the age and value of the asset.

OPERATIONAL COSTS

Operational costs are the costs for operating and maintaining the grid. Personnel, maintenance, security, and customer support are examples of such costs as well as power purchases for distribution losses. Operational costs are, in most countries subjected to efficiency demands and are to be lowered over time. This can be problematic if there are disincentives to respond to the currently increasing new demands and requirements, creating new operational costs in distribution grids. DSOs are expected to make use of new technologies at a fast pace, such as flexibility services, digitalisation, etc. The costs related to these technological developments should be included in the regulation models.

EFFICIENCY INCENTIVES

The revenue model often has some built-in incentives for cost efficiency. The main purpose is to incentive DSOs to make the most cost-efficient choices to secure a reasonable grid tariff for customers. The methods for incentivising cost-efficiency vary in different countries as well as which cost-components are targeted. Some countries target some or all the operational costs while others target the total cost. Some countries include incentives for balancing decisions between grid investments and flexibility or other operational tools. It's also common to compare different DSOs with each other using a benchmarking factor.

QUALITY ADJUSTMENTS

In order to incentivise sufficient grid quality, in some countries, revenue regulations adjust the DSOs income based on outages, power quality and other qualitative aspects. This is sometimes combined with hard regulation, such as the maximum time for outages.

WEIGHTED AVERAGE COST OF CAPITAL (WACC)

Revenue regulation secures DSOs a reasonable rate of return on invested capital if operating the grid efficiently. The regulated rate of return is set based on a WACC model. The WACC is a calculation that shows the average cost of financing a business with both debt and equity. It considers the relative weight of each funding source and provides insight into the minimum return businesses must achieve to satisfy investors and lenders. WACC is calculated based on variables such as markets rents, inflation, and the revenues of comparable businesses with the same risk level. There is no single method in Europe to calculate WACC - it varies between different regulatory models.

GEODE's 7 Principles for Efficient Revenue Regulation

Despite applying all the basic principles described above, revenue regulation differs a lot across Europe. Some national DSO revenue regulations are more focused than others in incentivising DSOs' investments that are crucial for the energy transition. In this paper, **GEODE lists seven principles for revenue regulation that have proven to create a strong foundation for grid investments and other development features such as digitalisation and high security standards, all of them intended to serve customers' needs.**

1. LONG TERM PREDICTABILITY

Grid investments typically have both physical and financial lifespans that stretch over several decades. A newly installed network component can be used for 50 years or even more. The tariffs paid by customers today are financing investments made years ago. And, will at the same time create the cash flow necessary for grid expansion and reinforcements. In such an environment, the variables and incentives in revenue regulation can't be changed every other year but need to be predictable and stable over the long term. This will enable DSOs to plan their investments well in advance with a stable cashflow. It also benefits customers using the network because it creates stability in tariffs helping them to plan their expenses with higher confidence.

In some member states, we have witnessed fast, unpredictable changes in regulation that have affected investors' interest in financing network investments. Several costs such as security, material costs, availability risks for both material and skilled workforce, inflation and the price of electricity needed to cover distribution losses have increased. Therefore, there should also be certain flexibility within the regulatory period to adapt quickly to unforeseen changes in consumers patterns, energy markets or in general within the energy landscape.

2. ANTICIPATORY INVESTMENTS

DSOs are experiencing unusual growth in demand for new connections and new capacity due to exponential growth of renewables and the electrification needed to meet climate goals. In most countries current regulation is focused on investment done when the demand is known. To make sure that the electricity grid is not a barrier to reach climate goals, this focus needs to be changed. Revenue regulation must incentivise DSOs to consider future needs when planning ahead thereby also incentivising anticipatory investments. The economic risk from anticipatory investment represents a challenge for the DSOs, as well as customers. In many countries regulation gives the opportunity, or it's at least claimed, that new connections or new capacity is paid by the demanding customer through connection charges. This is a way of ensuring that the cost of the measure to be taken is paid by the

customer who has requested the measure and not by the existing customers on the network. When looking at changes in regulation to incentivise anticipatory investments it's important that this is seen in connection with the regulation on connection charges.

As mentioned, most current regulations do no encourage anticipatory investments. In Sweden, for example, grid components without active customers are deducted from the capital base thereby reducing DSO revenue. Even though municipal development plans strongly indicate future needs, DSOs are not allowed to include the extra components in their capital base. In addition, today, some European revenue regulation models apply investments caps, such as Spain.

Although contributing to lower grid tariffs, such investment restrictions may be counterproductive in today's energy transition where there is a need to electrify and stay ahead of future customer demand, aligning grid investments with growth in demand. Scarcity of grid capacity will always be more costly for society than a balanced limited overcapacity.

One way to handle this challenge is to allow and incentivise anticipatory investments to a needed degree. Anticipatory investment has recently been defined by Eurelectric as *"one that proactively addresses expected developments, looking beyond immediate needs of generation or demand, assuming sufficient level of certainty that new generation and demand will materialise, notwithstanding potential low utilisation in the short term."*[2]

Of late, important steps have been taken at EU level to recognise the importance and key role of anticipatory investments in strengthening and expanding EU grids. The latest Electricity Market Design Reform directly calls on regulators to include anticipatory investments when calculating grid tariffs.[3]

NDPs that are developed by DSOs considering the needs of local municipalities and customers can constitute a base for anticipatory investments. NDPs should look far enough and include the best available prognosis for needed DSO investments.

Electrification also means, that without incentives to anticipatory investments, the lifespan of grid investment may change rapidly, becoming obsolete as capacity needs increase. Therefore, a DSO, when building the grid, should be allowed to increase the capacity for future anticipated needs.

[2] Eurelectric, position paper "How can DSOs rise to the investments challenge?" March 2024 https://www.eurelectric.org/publications/how-can-dsos-rise-to-the-investments-challenge-implementing-anticipatory-investments-for-an-efficient-distribution-grid

[3] Art. 18,2 Amendment to Electricity Regulation (EU) 2019/943 *"Transmission and distribution tariff methodologies shall provide incentives to transmission and distribution system operators for the most cost-efficient operation and development of their networks including through procurement of services. For that purpose, regulatory authorities shall recognize relevant costs as eligible, including costs related to anticipatory investments, and shall, where appropriate, introduce performance targets in order to provide incentives to transmission and distribution system operators to increase overall system efficiency in their networks, including through energy efficiency, the use of flexibility services and the development of smart grids and intelligent metering system."*

3. SUFFICIENT CASH FLOW

Revenue regulation models can allow for grid investments to be paid for over its lifetime. This is supposed to provide a stable cash flow for DSOs, allowing new investments. However, the slow rate of return can be a challenge that must be reinforced quickly to facilitate the new features such as electric heating. This may require DSOs to increasingly borrow money on the financial markets to keep up with growing demand for grid investments. This could mean higher risks and ultimately higher costs for customers.

There are several ways of adjusting the revenue regulation to increase the immediate cash flow. One example comes from Austria where it has added an additional operational cost factor to handle increased operational costs for the connection of new renewables. Similarly in Germany, the regulation allows a greater rate of return for new assets. This kind of model would secure attractive investment conditions in the green transition with substantial investment needs. Another example of a regulatory incentive that has proven effective is the investment incentive from Finland's previous regulatory period (2016-2023), that would partly enable network companies to make replacement investments even with an accelerating investment need.[4]

4. COMPETITIVE WACC

All countries have a regulated WACC that contributes to a reasonable rate of return for DSOs. How this regulated WACC is incorporated into revenue models differs in the different member states, however.

Once upon a time, DSO operations used to be a relatively low risk business compared to other sectors in society. However, the number of risks have increased of late and in many countries, regulation has changed thereby reducing DSO's ability to plan future investments.

Although local electricity distribution is a regulated monopoly, it usually competes with other investments for funding, resources, and skilled workforce. Therefore, DSOs need competitive revenues to secure the necessary financial capital. The trend in the recent years has been to reduce WACC, significantly affecting investments in the grid. This is the case for example in Spain (pre-tax WACC 2016-2019 is 6.5%; WACC 2021-2025 is 5.58%) and Sweden (pre-tax WACC 2016-2019 is 5.95 %; pre-tax WACC 2020-2023 is 2.35 %). In Austria, in the current regulation period the (pre-tax) WACC for new investments in 2024 is 6.33% and is being renewed annually.

[4] CEER Report on Regulatory Frameworks for European Energy Networks 2023: *The investment incentive consists of its impact of unit prices and the straight-line depreciation calculated from the adjusted replacement value. [...] Together with the net present value (NPV), the incentive impact of the straight-line depreciation calculated from the network operator's adjusted replacement value, directs the operator to maintain its network in accordance with the lifetimes it has selected in actual use as part of the network assets and enables it to make sufficient replacement investments.*

5. BALANCED INCENTIVES BETWEEN CAPITAL AND OPERATIONAL EXPENDITURES (CAPEX AND OPEX)

Today's European models for revenue regulation tend to incentivise investments in traditional grids (CAPEX) as the mean of supplying electricity to the customer. However, today new technology and business models are enabling this to be done differently. Some level of grid capacity can be freed by introducing flexible connections, for example automatically reducing the solar electricity feed into the grid on peak times. Battery solutions can be used to reduce the need for capacity from the transmission system operator. The use of flexibility may lead to reduced CAPEX but on the other hand increases OPEX, which has to be recognized in revenue regulation.

To enable electrification on a large scale, all technical solutions must be considered and able to compete against each other on the same terms. Therefore, the revenue regulation must enable fair competition between technology, business models and other smart solutions.

6. PROMOTE EFFICIENT OPERATION WHILE SAFEGUARDING CONSUMER INTEREST

A regulated entity such as a DSO works in an environment without competition. Therefore, efficient revenue regulation must provide adequate incentives for efficiency while rewarding DSOs that are able to improve cost efficiency.

One way of implementing efficiency requirements is to reduce the allowed revenues year by year (the method and time span granted to DSOs for eliminating individual inefficiencies varies among countries). Some countries set a minimum efficiency score, for example Austria, Germany, and Sweden.

It's important that the efficiency demands are fair and don't create disadvantages to certain DSOs, for example those with special geographical circumstances or those already very efficient.

While cost efficiency is important, certain improvements and thereby costs are desired by society and customers. One such example is security. The demand for higher security of supply is rising in light on the current energy crisis in Europe. There is also an increased threat of both physical and/or cyber attacks to energy infrastructure. However, security costs are usually subjected to efficiency demands in the revenue regulations, that reduce DSOs incentives to actively raise security.

In a commercial unregulated business, such costs are handled by raising the price of the service or product. As this cannot be done by DSOs by choice, revenue regulation must allow certain costs to be at least temporarily raised if it's beneficial for society and customers.

7. INCENTIVISE INNOVATION

By focusing on low grid tariffs for customers, many income regulation models punish DSOs for innovation such as pilot projects. The electricity grid is the customers' physical connection to the electricity market and a prerequisite for new innovative business models and technology. In order to be an efficient neutral market facilitator, DSOs need to engage in innovation. Income regulation models must incentivise innovation, which is not always the case today.

However, a number of good practices are being raised. The Austrian NRA recently introduced a research and innovation factor in its revenue regulation allowing a raise of DSOs' operational cost up to 0.6 percent annually if dedicated to research and innovation activities. In Norway, DSOs are allowed to raise their revenue by 0.3 percent annually of their CAPEX for their R&D projects in order to finance research and development projects. In Finland a new incentive to develop flexibility solutions allows DSOs to record at maximum a share corresponding to 1 percent of their total turnover from network operations in the unbundled profit and loss accounts. DSOs in those countries have an advantage in comparison to others where innovation is not incentivised.

Conclusion

Revenue regulation for DSOs is a very agile and versatile tool for creating efficient grid investments. By adjusting revenue regulation, NRAs can incentivise electricity grid development in-line with societal goals, higher security, digitalisation and stronger and faster grid build.

GEODE's aim with this paper is to highlight the importance of efficient revenue regulation and the principles that can be applied to further strengthen DSO incentives so they can not only take on an active role in making the energy transition a reality but also ensure long term predictability, steady anticipatory investments and cash flow, competitive WACC, balanced treatment of CAPEX and OPEX, efficient operation of the grid, safeguarding of consumer interests and thriving innovation.

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