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Description of the term “full cost” in relation to EPR in connection with the EU Urban Wastewater Treatment Directive

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Cover letter

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Contributors

The report is prepared by Deloitte Denmark in close collaboration with DANVA, FIWA, Norsk Vann, and Svenskt Vatten. Further, Danish water utilities has been involved in unstructured interviews with the working group and Deloitte Denmark.

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1. Executive summary

The EU Urban Wastewater Treatment Directive (UWWTD) mandates the establishment of a national Extended Producer Responsibility (EPR) system to ensure that producers, particularly from the pharmaceutical and cosmetics industries, cover at least 80 % of the costs associated with quaternary treatment of urban wastewater. This report, prepared by Deloitte Denmark, aims to clarify the concept of "full cost" within the wastewater sector, providing insights for policymakers, industry leaders, and stakeholders. The report draws on examples from EPR implementations in the waste and packaging sectors in Denmark, Norway, and Sweden, and the Danish utilities sector to illustrate the application and implications of the full cost concept.

All information specific to the wastewater treatment processes and technical aspects in this report has been provided in collaboration with a team of contact persons in the wastewater associations in the Nordics – DANVA, FIWA, Svenskt Vatten and Norsk Vann, including members (wastewater companies) already engaged in quaternary treatment projects, and their contacts in the waste sector.

Defining "full cost" in context of EPR implementation due to UWWTD

The term "full cost" encompasses a wide range of direct and indirect costs, including construction, operation, maintenance, and decommissioning of wastewater treatment facilities. By leveraging transfer pricing principles, particularly the cost-plus method, this report provides a structured approach to defining these costs in perspective of the "full cost" term in the UWWTD. This methodology ensures that all relevant costs are accounted for, promoting transparency and fairness in cost allocation.

It is Deloitte Denmark's assessment that the components under "full cost" are defined as the following:

1. Development expenditures (DEVEX): These include costs incurred during the initial stages of a project, from the idea and development phase to design and planning. DEVEX covers a wide range of activities that lay the groundwork for the project's execution.

2. Capital expenditures (CAPEX): These include costs related to the construction of the quaternary treatment facilities, procurement of e.g. machinery and equipment, and installation of components related to e.g. automation systems etc. CAPEX also covers engineering and design fees, permits, project management, and temporary installations during construction. The costs are inclusive of financing costs, and often measured based on the yearly depreciation of the assets.

3. Operational expenditures (OPEX): These encompass the ongoing costs of running the treatment facilities, such as energy consumption, chemical usage, maintenance, and salaries. OPEX also includes costs for monitoring and compliance, consumables, sludge treatment and disposal.

4. Indirect costs: These are overhead expenses incurred to support the operation of the treatment facilities, including administrative expenses, regulatory compliance, insurance, and other necessary costs.

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Takeaways from experience

The concept of "full cost" is central to the effective implementation of EPR systems under the UWWTD. Full cost accounting ensures that all direct and indirect costs associated with wastewater treatment are captured, providing a comprehensive financial picture that supports transparent cost allocation. This report delves into the various components of full cost, including capital expenditures (CAPEX), operational expenditures (OPEX), and indirect costs such as administrative and overhead expenses. By adopting transfer pricing principles, particularly the cost-plus method, the report offers a structured approach to defining full costs, ensuring that all relevant expenses are accounted for.

The examination of EPR schemes in the waste and packaging sectors in Denmark, Norway, and Sweden provides valuable insights into the practical application of cost coverage in the waste sector, relevant to consider in the implementation of the full cost concept under UWWTD. Sweden and Norway have implemented standardised models for cost coverage that enable efficient waste management and aim at a fair compensation for municipalities. Denmark's approach to EPR for single-use plastics involves producers financing the cleaning of littered waste, with fees based on waste analyses and cost assessments. This methodology aims to ensure that producers cover actual waste management costs without generating profit, while promoting transparency and fairness.

Experience from solid waste and packaging sectors on EPR implementation in Denmark, Norway, and Sweden

The examination of EPR schemes in the solid waste and packaging sectors in Denmark, Norway, and Sweden offers valuable insights into the practical application of the EPR scheme in the wastewater sector. These established schemes have demonstrated significant benefits and the promotion of a circular economy. The standardised models for cost coverage in these countries provide useful insights when implementing EPR in the wastewater sector.

In Denmark, the EPR scheme for single-use plastics involves producers financing the cleaning of littered waste, targeting that actual waste management costs are covered without generating profit. The methodology for determining cleanup fees is based on waste analysis and cost assessments, which are conducted objectively by examining both municipal and state costs for maintenance in public spaces. The fees also cover administrative expenses, information initiatives, and data reporting for different categories of single-use plastic products. Stakeholders within the Danish solid waste sector has requested ongoing analyses of the municipalities and the cost-effectiveness of waste collection. It should be noted that the Single-Use Plastics Directive does not use the term “full cost”.

In Norway, Producer Responsibility Organisations (PROs) calculate and set up models for cost coverage, with municipalities responsible for waste collection, contributing to efficient waste management. The Norwegian Environment Agency has reviewed and proposed improvements to existing EPR schemes to enhance their effectiveness and support a circular economy. The Norwegian model allocates costs on each waste fraction, thus not all costs will be covered fully for all utilities/municipalities.

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In Sweden, the EPR schemes involve standardised compensation model for cost coverage, with municipalities responsible for waste collection, which help to ensure efficient waste management. The compensation model was first proposed by Avfall Sverige together with the PRO and then transformed into legislation by the Swedish Environmental Protection Agency and ensures that municipalities are reimbursed according to a standardised model with some adjustment parameters. A single municipality is not guaranteed to be reimbursed for their actual costs and expenses in collecting and processing waste. The standardised model for cost coverage in Sweden ensures confidence in the system, and at the same time it is minimising administration and still promoting transparency and fairness in cost allocation.

Perspectives on cost distribution

The report covers perspectives on the importance of considering various means of cost distribution, emphasising the need for fairness, efficiency, simplicity, and transparency. The choice between utility-level data-driven cost coverage and sector-level standard price cost coverage models both presents distinct advantages and challenges.

The utility-level model can help ensure more exact coverage of 80 % of the full cost for each wastewater treatment company, and equitable distribution between companies. It also involves higher administrative expenses. The model is best suited when actual expenses can be accurately determined, and when additional regulatory requirements are minimal. This model aligns with the principles of cost coverage for the sector, fair distribution, and security of the size of the payment regarding the UWWTD. By calculating full costs based on actual expenses, producers pay for the treatment of pollutants that their products release in accordance with the Directive, effectively implementing the Polluter Pays Principle as outlined in the UWWTD. Actual costs include depreciation, ensuring that the flow of payments matches the expenses incurred.

Conversely, the sector-level model offers low administrative expenses and flexibility but may struggle with fairness and accurate cost coverage under varying conditions. It is best suited when framework conditions are uniform or when the data quality for individual costs is not adequate. This approach involves payments to utilities based on standard rates, such as a variable contribution, e.g. per connected person or per cubic metre of treated wastewater. This model inherently meets the principle of low administrative expenses and predictability.

A hybrid approach, combining elements of the utility-level model and the sector-level model, may in some cases be a feasible solution. This approach would involve using standard rates for basic cost coverage while allowing for adjustments based on actual expenses incurred by individual utilities. A hybrid model can be adapted and designed locally to assign different weight on precise cost coverage or low administrative costs. Deloitte Denmark have not made any conclusions regarding model choice.

Key awareness points

Key awareness points identified in the report include the importance of regulatory compliance, technological advancements, environmental impacts, economic considerations, confidence, transparency, and stakeholder engagement.

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Regulatory compliance: Ensuring compliance with the UWWTD and national regulations is essential for protecting public health and the environment. The Directive sets stringent standards for wastewater treatment, and achieving compliance can be challenging due to varying national regulations and enforcement mechanisms. Awareness of these regulatory differences is crucial for developing effective and harmonised wastewater management strategies across the EU, with room for national differences based on local recipients and implementation in national legislation.

Technological advancements: Technological advancements play a significant role in improving wastewater treatment processes, and awareness of different quaternary treatment technologies and their potential benefits and limitations in local settings is crucial for informed decision-making. Considering the entire lifecycle of treatment processes to develop sustainable wastewater management practices is essential for minimising environmental impacts.

Economic considerations: Economic considerations are also critical regarding wastewater management. The costs of setting up and maintaining wastewater treatment plants can vary significantly depending on factors such as location, plant size, and technology used. Awareness of these cost variations is crucial for developing fair and equitable funding mechanisms. Additionally, understanding the economic implications of regulatory changes across countries is essential for making informed policy decisions.

Stakeholder engagement: Effective stakeholder engagement is essential for the success of wastewater management initiatives. A lot of stakeholders are involved in the process, including government agencies, industry representatives, and the public. Awareness of the diverse perspectives and interests of these stakeholders is essential for developing inclusive and collaborative wastewater management strategies. Additionally, transparent communication and active participation can help build trust and support for wastewater management initiatives.

The UWWTD represents a significant regulatory framework aimed at enhancing the impact and effectiveness of wastewater management across member states. This approach incentivises manufacturers to design more sustainable products and take accountability for their environmental impact, aligning with broader EU environmental policies such as the Polluter Pays Principle enshrined in the Treaty on the Functioning of the European Union (TFEU).

The report's findings underscore the importance of a clear and structured approach to defining and calculating full costs, ensuring that all relevant expenses are accounted for and promoting transparency and fairness in cost allocation.

Round-off and possible future work

This report delves into a broader and highly complex matter. The report outlines certain principles related to defining full cost within the context of EPR schemes in the UWWTD. We recommend further exploration of these principles, focusing on cost statement, technology, and the integration of data to enhance knowledge on quaternary treatment.

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2. Introduction

The EU has finalised the Urban Wastewater Treatment Directive (UWWTD). The UWWTD requires the establishment of national extended producer responsibility (EPR) to ensure that at least 80 % of the full costs for complying with the requirements for the quaternary treatment activity are covered by the producers mentioned in Annex III in the Directive[1].

DANVA, FIWA, Svenskt Vatten and Norsk Vann have a vision for the EPR systems on a national basis being objective, trustworthy, transparent, efficient, and fact-based. Therefore, they have asked Deloitte Denmark to bring forward relevant knowledge that can be used in establishing a common understanding of the term "full cost" as used in the UWWTD.

The concept of "full cost" is used in Article 9, which pertains to EPR concerning the establishment of a fourth treatment stage capable of removing micropollutants (quaternary treatment facilities). The Directive does not include a definition of the term full cost. It is our assessment that the costs should cover the wastewater treatment facilities' costs of implementing and operating of the quaternary treatment.

The producers involved will be manufacturers from the pharmaceutical and cosmetics industries as defined in the Directive's Annex III.

The aim of the report is to ensure that decision-makers in the European Commission, European Parliament and on a national level in the Nordic countries are introduced to the views from the wastewater sector (utility view) on the content of the term "full cost" in UWWTD Article 9, paragraph 1 (a). It is also an objective to provide the same information for possible use for EurEau and its members.

The wastewater sector wishes to present a manageable understanding of the concept of "full cost" as referred to in the UWWTD's regulations on EPR. In this regard, the Nordic wastewater associations has asked Deloitte Denmark to help provide a paper on the "full cost" topic as described in the UWWTD, which refers to the upcoming work on implementing EPR.

The concept of EPR has gained significant traction in recent years as a strategic approach to environmental management. EPR shifts the responsibility for the end-of-life management of products from consumers and public authorities such as municipalities to the producers themselves. This approach incentivises manufacturers to design more sustainable products and take accountability for their environmental impact. This is backed by other existing EU treaties, e.g., the Polluter Pays Principle mentioned in the Treaty of the Functioning of the European Union (TFEU)[2]. The UN Rio Declaration on Environment and Development

[1] Svenskt Vatten, FIWA, Norsk Vann, DANVA. (2024). *Terms of reference: UWWTD implementation – EPR related topic of interest for a study*. Svenskt Vatten, FIWA, Norsk Vann, DANVA.
[2] European Union. (2012). *Treaty on the Functioning of the European Union (TFEU)*. Official Journal of the European Union. Article 191.2, page 86

relates to this, stating that "*in order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities*"[3].

EPR schemes typically involve producers financing the collection, recycling, and disposal of their products. This can be achieved through various mechanisms, such as take-back programmes, recycling fees, or the establishment of producer responsibility organisations (PROs) that manage waste on behalf of the producers. By internalising the costs of waste management, EPR encourages producers to innovate in product design, opting for materials that are easier to recycle or that have a lower environmental impact.

EPR schemes have been developed and implemented in branches of the waste sector. The approach shifts the financial and operational burden of waste management from municipalities and taxpayers to the producers, incentivising them to minimise waste and enhance recycling efforts[4].

By ensuring that producers are responsible for the end-of-life management of their products, EPR policies help to create a more sustainable waste management system[4]. This not only conserves natural resources but also reduces greenhouse gas emissions and pollution, contributing to broader environmental and public health goals.

Overall, EPR represents a transformative approach in handling pollution (waste etc.), fostering collaboration between producers, consumers, and waste management entities to achieve a more sustainable and efficient system. As global environmental challenges intensify, the adoption and enhancement of EPR policies can be prove to be important in driving the transition towards a more circular and sustainable economy.

In the context of the wastewater sector, EPR presents a unique opportunity to address the growing concerns related to water pollution. The wastewater sector is an important contributor to public health and environmental sustainability, yet it faces numerous challenges, including the cleaning of hazardous chemicals, nutrient overloads, and the presence of microplastics. To introduce EPR in the wastewater sector, the UWWTD emphasises that "*the quaternary treatment should be imposed on the basis of the precautionary principle*"[5]. Quaternary treatment is an additional step compared to most current wastewater treatment processes.

The UWWTD requires the establishment of EPR in connection with micropollutants from medical and cosmetics and implements payment of 80 % of the full cost of the quaternary treatment from the pharmaceutical and cosmetics industries. This report aims to explore the term "full cost" within the wastewater sector, in relation to quaternary wastewater treatment (fourth treatment step at wastewater treatment plants aiming to address micropollutants).

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[3] United Nations. (1992). *UN Rio Declaration on Environment and Development. A/CONF.151/26 (Vol. I) Report of the United Nations Conference on Environment and Development*. Principle 15, page 3

[4] Taxually. (2023). *A Guide to Extended Producer Responsibility*. Taxually - A Guide to Extended Producer Responsibility

[5] European Union. (2024). *Directive (EU) 2024/3019 of the European Parliament and of the Council of 27 November 2024 concerning urban wastewater treatment (Urban Wastewater Treatment Directive (UWWTD))*. Official Journal of the European Union. Directive - EU - 2024/3019 - EN - EUR-Lex, page 16.

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It is important to know the scope of the term “full cost”, regardless of the method of choice to ensure cost coverage, as “full cost” is the extent of the cost picture for the utilities.

In describing the term “full cost”, principles from transfer pricing in relation to the definition of cost base for especially the cost-plus model, and cost regulation in the Danish energy and utilities sectors will be included.

By analysing and referencing full cost and market conformity in other energy and utility sectors, the report seeks to provide a comprehensive understanding of how “full cost” in an EPR framework can be integrated into wastewater management practices. We will include perspectives from both sector level and individual treatment plants. This perspectivation is done with input from the Nordic water and wastewater utility associations, DANVA, FIWA, Svenskt Vatten and Norsk Vann.

The report is divided into chapters starting with a description of the full cost concept. Here, we will introduce cost-plus, which is a widely used model within transfer pricing theory. We will follow up with examples of EPR already in place in Denmark, Norway, and Sweden. Rounding off, we will put some examples from the Danish energy and utilities sectors into perspective with especially Energinet’s use of the cost-plus method as a ‘deep dive’ example.

We will follow up with a chapter describing the perspective of cost coverage, going through models of cost coverage at utility level and at sector level. Here, we will also investigate considerations to have in mind when looking at a cost coverage model.

Next, we will look at advantages and disadvantages of the two methods of cost coverage, and then go to further awareness points to have in mind when talking about cost coverage.

This report aims to serve as input to understanding the full cost concept, offering insights for policymakers, industry leaders, and stakeholders.

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3. A description of the term "full cost" and examples of use

A clear description of the term "full cost" is important, as the industry, PRO and regulators need to be clear about what the treatment plants within the wastewater sector can define as their full cost picture with respect to the quaternary treatment related to the UWWTD.

The aim of this report is to help clarify what costs the wastewater utilities can expect the pharmaceutical and cosmetics industries to finance, as they are required to pay *"at least 80 % of the full costs … including investments and the operational costs for quaternary treatment of urban wastewater to remove micropollutants resulting from the products … and for the monitoring of micropollutants"*[6], and for "*the costs for gathering and verifying data on products*"[6], and "*other costs required to exercise their extended producer responsibility"*[6]. This must also cover operational costs of already established quaternary treatment at the date when the UWWTD is implemented and effective in the member states. Also, investment costs of already established quaternary treatment, e.g., depreciation, must be considered.[7]

The Urban Wastewater Treatment Directive does not give further description of the term "full cost".

In general, the term "full cost" encompasses all direct and indirect costs associated with the production and delivery of a product or service[8]. This will be analysed from a wastewater sector perspective, focusing on the quaternary treatment as described in the Directive.

The concept of "full cost" is not the same as "cost coverage" in relation to utilities' regulation. Cost coverage as a methodology is a cost coverage concept, and pertains to the ability of an entity, such as a utility, to generate sufficient revenue to meet its expenses. Cost coverage emphasises ensuring that all incurred costs are fully covered by the income generated[9]. The "full cost" concept is inherently more activity-based compared to the cost coverage method.

This chapter aims to provide a clarification and detailed description of the term "full cost," from a transfer pricing and regulatory perspective. We will describe the various components that constitute full cost, including direct costs – e.g., technical facilities, chemicals and maintenance, and the indirect costs – e.g., overhead, and administrative expenses.

In short, transfer pricing refers to the rules and methods used to determine the prices at which different parts of a company sell goods, services, or intellectual property to each other. Essentially, it is about setting fair, market-based prices for transactions between different divisions or subsidiaries of the same company to ensure that profits are accurately reported.

[6] Urban Wastewater Treatment Directive (UWWTD), PE-CONS 85/24 EB/NT/cc 85 TREE.1.A article 9, point 1.
[7] Urban Wastewater Treatment Directive (UWWTD), preamble 23
[8] Liberto, D. (2021). *What Is Full Costing? Accounting Method Vs. Variable Costsing*. What Is Full Costing? Accounting Method Vs. Variable Costsing
[9] Accounting Tools. (2024). *Full costing definition*. Full costing definition — AccountingTools

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We will begin this chapter with a general introduction to our approach and to the sections below. Then, we will dive into "full cost" and try to describe and clarify the "full cost" term. To do so, we will introduce transfer pricing principles. The transfer pricing principles are introduced, as they are extensively documented, and acknowledged across sectors. Introducing transfer pricing in this report will give a solid starting point for defining full cost within implementation of quaternary treatment facilities in the wastewater sector.

To round off the chapter, we will investigate some examples of full cost from the Danish energy and utilities sectors. The examples will help to clarify the principles and show how they can be practically implemented. To further exemplify the use of cost-plus, Energinet's take on the cost-plus method and their pricing methodology are examined in this chapter.

3.1. "Full cost": An introduction

A lot of cost elements must be considered to have a picture of the full cost regarding quaternary treatment. The definition must encompass all expenses associated with the construction, operation, maintenance, and decommissioning of the plant. Full cost should include both direct and indirect costs in implementing and operating the quaternary treatment.

Deloitte Denmark has conducted a set of unstructured interviews with DANVA and different utility companies from the Danish wastewater sector that have an implementation plan for a quaternary treatment facility. The interviews focussed on what types of costs have been incurred in the process. We must, however, emphasise that the scope of this report has not been an extensive market dialogue, but a more theoretical description of the principles of full cost.

The interviews have shed light on the costs incurred by the wastewater utilities, and which costs to expect when it comes to the implementation of quaternary treatment. Our interviews have shown that there are many different costs involved in the process as well as large differences based on technology selection. There are direct costs only linked to the quaternary treatment, and there are indirect costs which will have an effect across treatment stages, and thus not only linked to the quaternary treatment process.

When defining "full cost", it should be noted that EPR systems may only be held responsible for the costs associated with wastewater treatment related to their obligations for removing micropollutants. This includes covering the costs of quaternary treatment of urban wastewater, the expenses for gathering and verifying data on products placed on the market, and other costs necessary to fulfil their extended producer responsibility, as mentioned in the Directive and in the introduction to this chapter.

3.2. "Full cost" and transfer pricing methodology: A clarification and description

As previously stated, it is relevant to investigate transfer pricing methodology to find common ground defining the full cost of quaternary treatment. Transfer pricing is a widely acknowledged methodology and its use is extensively documented.

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Understanding the methodologies of transfer pricing help us ensure that transfer prices are set at arm's length, complying with tax regulations, and avoiding potential disputes with tax authorities.

In the Danish utilities' regulations, the general rule is that all services and transactions between related companies must cohere to strict regulation on market conformity – very close in description to the transfer pricing regulation known across the EU.

This principle serves as a point of inspiration. Some exemptions do exist where only incurred costs can be included in consumer prices.

In some places, the implementation of the market conformity regulation is a bit more extensive than the general transfer pricing regulation. Hence, when looking into implementation of quaternary treatment and payment for the services through EPR, transfer pricing methodologies are from our perspective a good, common language between the industry and wastewater treatment plants for discussing the extent of full cost as mentioned in Article 9 of the UWWTD.

The cost-plus method is a methodology described within the general transfer pricing guidelines. When cost data is available, the cost-plus method is a straightforward and useful method to use. The cost-plus method is especially well fitting, when there is no market for the specific good or service provided. This is also the case regarding payment for wastewater treatment for micropollutants and chemical compounds as part of the regular water treatment system. We will deconstruct and investigate the cost-plus method in the sections below.

It is our conclusion that full cost should not be defined as the full cost for the full wastewater treatment. Rather, it is the full costs regarding the implementation of the quaternary treatment process. This is what is stipulated in the UWWTD as well. The economic theory backs this, stating that it would only be delivery of the service. Here, the service is to clean the wastewater from pollutants stated in Article 8 in the UWWTD, which is being done in the quaternary treatment process of cleaning.

The "alternative costs" for the cosmetics and pharmaceutical industries would be:

- Either to enforce full water treatment on own facilities to reduce the amount of micropollutants and chemicals in the wastewater originating from their products, or
- Investing in the cost of development of new products which are easily degradable, do not cause micro pollution and which in the long run will substitute the old products above.

This may not be the most efficient solution for the industries.

Furthermore, as the Directive states costs to cover are *"including investments and the operational costs for quaternary treatment of urban wastewater"*, we see no basis for including costs not related directly to quaternary wastewater treatment. However, the costs can be both direct and indirect as described below if they are necessary to run the quaternary treatment step.

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The cost-plus method

The cost-plus method is a transfer pricing method used to determine the appropriate price for transactions between related parties, such as subsidiaries within a national or multinational company. This method focuses on the costs incurred by the supplier of goods or services and adds an appropriate profit margin to these costs to arrive at the market price[10].

The cost-plus method in transfer pricing relies on documentation. This will be a vital discussion regarding the implementation of the method for calculating the full costs for implementation of quaternary treatment facilities. It is expected that there will be a demand for a certain level of documentation, some extra bookkeeping, and general administrative expenses associated with implementing a cost-based method similar to the cost-plus method. The level of documentation, simplicity, administrative requirements, and hence accuracy will be key factors that the wastewater sector must weigh together with the legislators in each country, to determine the best way to move forward in choosing a methodology for setting the full cost for EPR.

The key features of the cost-plus method are as follows[11]:

1. Cost base: The starting point is the total cost incurred by the supplier, including direct and indirect costs.
2. Profit mark-up: An appropriate mark-up is added to the cost base to ensure a reasonable profit margin. This mark-up is typically determined by analysing the profit margins of comparable independent companies.
3. Application: Commonly used for manufacturing, distribution, and service transactions where the cost structure is clear and comparable data is available.

It should be clarified that, in connection with the EPR and the UWWTD, that no profit seems to be included in the pricing (understood as the 'full cost'), as described in the UWWTD's preamble 23, as "*The contributions should cover, but not exceed, the investments and operational costs for the monitoring activities for micropollutants, the collection, reporting and impartial verification of statistics on the quantities and hazardousness of products placed on the Member States market, and the application of the quaternary treatment to urban wastewater in an efficient manner*"[12].

From our extensive knowledge of the economic regulation of the Danish water utility companies, the pricing for consumers does not contain a profit either for the time being, so the companies in Denmark are used to navigating cost-based prices[13]. This is also the case in Norway and Sweden.

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[10]OECD. (2022). *OECD Transfer Pricing Guidelines for Multinational Enterprises and Tax Administrations 2022*. OECD Publishing, Paris, https://doi.org/10.1787/0e655865-en. Part II, section D, pages 106-112.

[11] SKAT Danmark. (2025). *Den juridiske vejledning 2025-1 – Beskrivelse af Cost plus-metoden (C.D.11.4.1.3 Cost plus-metoden)*. C.D.11.4.1.3 Cost plus-metoden - info.skat.dk

[12] UWWTD, preamble 23, page 6.

[13] There is a possibility for rules concerning return on invested capital in Danish legislation through "*Bekendtgørelse af lov om vandforsyning m.v.*" (LBK nr 1149 af 28/10/2024), §52a, stk. 4. However, this legal basis has not yet been used as of the time of this report.

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In Finland, water utilities are permitted to generate profits under the prevailing national legislation. These profits are mandated to be allocated towards new investments, repair expenditures, and the operational costs of the water supply infrastructure. The legislation requires that charges must be reasonable and equitable for the customers, but established practice allows for annual tariff increases of up to 15 %, subject to oversight by the Finnish Competition and Consumer Authority. Fundamentally, the return on capital for Finnish water supply utilities must not compromise the sufficiency of repair investments for the water supply infrastructure. This is stressed even more in the upcoming reform of the Finnish legislation.

Under the current legislation, profits can be transferred to the owners of water utilities. However, if the proposed legislative reform is enacted, this process will become significantly more challenging. In such a scenario, it will be imperative that new investments, repair expenditures, and operational costs of the water supply infrastructure are prioritised and adequately covered before any profit is distributed to the owners.

In respect to the transfer pricing methods, there are both advantages and disadvantages of the cost-plus method. Advantages are e.g. that the model is relatively simple and easy to apply, and the model is applicable whether profits are allowed or not allowed. Disadvantages are e.g. that the cost-plus method may not be suitable if the cost structure is too complex or if comparable data for setting the profit is not available, and that in the cost-plus method, it can be challenging to determine an appropriate mark-up in some industries. As the latter disadvantages are not relevant for the further discussions, we will not elaborate these further.

In conclusion, the cost-plus method is a transfer pricing approach that relies heavily on thorough documentation, making it crucial for calculating the full costs of implementing quaternary treatment facilities. This method involves determining the total costs incurred by the supplier and adding an appropriate profit margin to establish the transfer price.

While it is straightforward and commonly used in manufacturing, distribution, and service transactions, it does come with certain administrative demands, such as extra bookkeeping and documentation.

However, in the context of the Danish water utilities and the broader Nordic region, where pricing for consumers does not include profit, the cost-plus method and transfer pricing principles in general align well with existing cost-based pricing practices. Hence, the cost-plus method would be close to existing practices and not as administratively costly.

Despite some potential disadvantages, such as complexity in cost structures and challenges in determining appropriate mark-ups, these issues are not pertinent to the current discussion and are thus not elaborated further.

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General description of cost elements to be included in the cost base

Table 1 below gives an overview of the cost elements that in our opinion should be included in determining the full cost of quaternary water treatment. We have divided the identified cost elements into three cost types. After the table, we elaborate on the different cost types and elements. The availability, maturity and surrounding circumstances will affect the size of the costs below. We note that not all the costs below may be relevant in all cases and that, depending on circumstances, other cost types can be relevant.

The table below is Deloitte Denmark's summary of cost elements excluding profit elements based on our insights and on the information provided through interviews and available literature. The aim is to create a common starting point for further discussions between the utilities, the pharmaceutical and cosmetics industries, and legislators.

Cost type	Cost element	Cost allocation	Description
	Planning and design		
DEVEX	Design and planning	Direct	Including stages like pre-FEED and FEED studies before beginning the construction with the aim of designing and outlining the best solution for the quaternary treatment.
	Procurement	Direct	Relevant procurement in relation to the construction process.
	Administrative expenses	Direct	Permits and licences, regulatory compliance (specific to a project or product).
	Administrative expenses	Indirect	Often mentioned 'overhead' – costs related to administration, management, bookkeeping, contingency costs, IT, etc.
	Operating expenses		
OPEX	Energy and utilities, chemicals, materials	Direct	Direct costs for the operation and maintenance of the facility necessary to deliver the service.
	Monitoring and measuring	Direct	Costs of monitoring micropollutants in the wastewater and measuring efficiency in the treatment facilities. This is done at utility level by the utilities.
	Maintenance	Direct	Costs for the maintenance of the facility necessary to deliver the service. Where possible, resources used (time and material) related to the quaternary treatment should be recorded on separate work orders related thereto.
	Maintenance	Indirect	Indirect maintenance costs can be in the case where maintenance is not directly recorded to the quaternary treatment steps but to maintenance of the treatment plant in general and allocated through cost allocation.
	Personnel costs	Direct	Salaries and benefits for staff required to operate and maintain the plant.
	Administrative expenses	Direct	Permits and licences, regulatory compliance (specific to a project or product).

	Administrative expenses	Indirect	Often mentioned 'overhead' – costs related to administration, insurance, management, bookkeeping, accounting, contingency costs, IT, etc.
	Testing, optimisation, measurements, surveillance, data management	Direct	Necessary cost for environmental surveillance and testing and optimisation (initial and ongoing), measurement of selected substances in inflow and outflow when relevant, data management of e.g. energy consumption etc.
	Depreciation and capital costs		
CAPEX	Construction of quarter-nary treatment facility	Direct	The cost is considered direct, as it is an expense directly involved in the delivery of the service. Costs are often external, and regarding e.g. contractors and construction management
	Internal time in the construction process	Direct and indirect	If internal hours are utilized in the construction process, the hourly rate should encompass costs related to wages, overhead, and any applicable profit margin. The profit margin is contingent upon the specific regulatory framework of each country.
	Equipment and machinery, parts to the plant	Direct	The cost is considered direct, as it is an expense directly involved in the delivery of the service.
	Financial cost	Direct	If funding the construction (incl. DEVEX) requires external financing, costs of interest can be included in the cost
	Land acquisition	Direct	The cost is considered direct, as it is an expense directly involved in the delivery of the service.
	Abandonment	Direct	The pertinent abandonment costs should be incorporated into the overall cost calculation, as they constitute a component of the expenses associated with the establishment of quaternary treatment. Only the probable costs should be considered; for instance, if there is no requirement for re-establishment, such costs should not be included.

Table 1: Overview of cost elements divided into cost types [14] [15] [16]

In table 1, we have divided cost elements into three cost types. We emphasise that the differentiation should follow the local regulation for either regulatory accounts or annual reporting principles like IFRS or local accounting principles:

[14] The aforementioned elements, which should be included in a 'full cost' description, are often also components of a cost coverage model. Cost coverage as a methodology is a cost coverage concept, and pertains to the ability of an entity, such as a utility, to generate sufficient revenue to meet its expenses. Cost coverage emphasises ensuring that all incurred costs are fully covered by the income generated.

[15] Envidan and Teknologisk Insitut. (2024). *4. Rensetrin – Erfaringer fra udlandet*. Pages 29-32.

[16] For a more detailed table, please see Appendix 1 to this report.

DEVEX is defined as costs spent in the period from idea and development to design and planning[17].

In many cases, DEVEX costs will be part of the total asset costs and included in depreciation over time. In that case, depreciation from the point of commissioning should be used as the cost base for calculating full cost. In some cases, DEVEX will be seen as costs not part of the asset. These costs should be included in the calculation of total costs.

CAPEX is defined as all expenditure in the period of construction up to the date where the wastewater plant is put into operation, and the yearly costs will often be defined as yearly depreciation plus interest related to financing[18].

CAPEX is often easily measured, as it is well defined what constructions relate to delivery of the product – in this case the quaternary treatment process. It should be clarified between the parties whether the cost should be based on actual investments or include adjustments for inflation, making sure that the wastewater companies have money for reinvestments at current prices whenever necessary.

OPEX is defined as costs during the operational period[19].

A cost-true method can involve cost allocation when the service is shared by multiple 'units' and products. Insurance will, for example, rarely be for specific parts of the plant, but for the plant or company in total. As insurance will be more expensive with additional activities.

For OPEX in particular, there will in our opinion be the need for setting clear boundaries for which costs can be included, and how they should be documented. This is, as not all costs can be directly allocated. Indirect costs can and should be included in a full cost calculation, as this is where companies have the possibility to materialise economies of scale, and under free competition earn a higher margin on products. Under cost-based regulation, the services will become less expensive overall.

A relevant example is accounting, where the cost of running the accounting department will not significantly increase from implementing new water treatment, and where the cost is not easily allocated towards different activities. Time recording can help allocate parts of the cost, but e.g. the annual financial audit will not be easily allocated.

Administrative and common expenses should be allocated as accurately as possible. Direct allocation and recording when possible.

[17] Megavind. (2015). *Megavind LCOE Model – Guidelines and documentation. Høgskulen på Vestlandet – HVL Open*. Page 10.
[18] Fernando, J. (2024). Capital Expenditure (CapEx) Definition, Formula, and Examples. Capital Expenditure (CapEx) Definition, Formula, and Examples
[19] Kenton, W. (2024). Operating Expense (OpEx) Definition and Examples. Operating Expense (OpEx) Definition and Examples

In summary, the cost base under full cost can be pictured as follows:

Direct Costs		Indirect costs
DEVEX	These include costs incurred during the initial stages of a project, from the idea and development phase to design and planning. DEVEX covers a wide range of activities that lay the groundwork for the project's execution.	These are overhead expenses incurred to support the operation of the treatment facilities, including administrative expenses, regulatory compliance, insurance, and other necessary costs. Indirect costs will go across DEVEX, CAPEX, and OPEX.
CAPEX	These include costs related to the construction of the quaternary treatment facilities, procurement, construction, installation of components related to e.g. automation systems, cost of financing etc. Costs are measured based on yearly depreciations and paid interest.	
OPEX	These encompass the costs of running the treatment facilities, such as energy consumption, chemical usage, maintenance, and salaries. OPEX also includes costs for monitoring and compliance, consumables, sludge treatment and disposal. OPEX should also cover the necessary administrative costs related to procurement of consumables, bookkeeping, reporting etc.	

Table 2: DEVEX, CAPEX, OPEX, and indirect costs in short.

The cost types have been discussed in terms of costs allocated during wastewater plant implementation of quaternary treatment facilities. The cost types have been mentioned and discussed both in Deloitte Denmark's unstructured interviews with the utility sector and in literature on quaternary treatment in general.

The cost elements mentioned will be met by most utilities regarding their implementation of any type of quaternary treatment facility, but the costs can vary in extent.

Considering all these components, the full costs of a wastewater treatment plant provide a comprehensive financial picture, ensuring that all aspects of the plant's lifecycle are accounted for and adequately funded.

Summing up

The breakdown of cost elements into DEVEX, CAPEX, and OPEX provides a more detailed framework for understanding the full cost of quaternary wastewater treatment. The categorisation ensures that all relevant expenses, from initial planning and design to ongoing operational costs, are accounted for. The inclusion of both direct and indirect costs, as well as the consideration of potential variations in cost relevance and extent, offers a robust basis for financial planning by the utilities.

3.3. Exemplification of the concept of "full cost": Examples from the Danish energy and utility sector

To further elucidate the concept of "full cost," this section will provide exemplifications from within the energy and utility sectors in Denmark.

In the Danish utility sector, the full cost of providing services such as water supply, electricity, and heat includes not only the direct costs of infrastructure, maintenance, and labour but also indirect costs like administrative expenses.

The exemplifications from the current regulation aim to illustrate how the full cost concept can be applied in the energy and utility sectors, providing a more comprehensive understanding of the true costs associated with various activities. Three general examples have been outlined in this section. To round off section 3.3., Energinet's methodology to cost-plus will be examined.

Example 1: Water utilities

For a Danish water utility, the cost of supplying water is the full cost base, but with a revenue cap for how much to charge the consumers. This means that the full cost for a water utility includes both OPEX and CAPEX (incl. interest) and, for example, includes the direct costs of extracting, treating, and distributing water. Also, other direct costs like pipeline maintenance and energy consumption for pumping stations are included. Indirect costs such as administrative overheads are also included.

Example 2: District heating

Companies supplying district heating are regulated under the Danish District Heating Act and will have their pricing rely on a cost base consisting of all necessary costs incurred in suppling the district heating. Heat suppliers in Denmark set their price from a principle of 'self-balancing' ("hvile-i-sig-selv"-princip), which does not include non-necessary cost to supply heat or a profit. This means that all non-necessary costs to supply heat will not be part of the cost base, which means costs not being a direct part of either the production of heat or the distribution of heat to the consumers.

Example 3: Electricity distribution

Electricity distribution (grid companies) in the Danish electricity sector will have a cost base consisting of all necessary costs incurred to operate, maintain, and expand the grid that include OPEX and CAPEX. Grid companies set their price based on a revenue cap principle. The cost base for the revenue cap includes operations, cost of grid loss, maintenance, administration, and depreciation, thus excluding any cost component for interest. Instead of including the actual interest on loans, a standardised rate of return on the asset base is calculated. If the grid company can operate the grid and finance the capital at a lower cost than regulation allows, a profit can be earned.

Energinet's methodology on the use of cost-plus

As a pricing methodology for supplying balancing services to the electricity grid, the Danish TSO Energinet has been authorised to use a methodology to calculate a fair compensation. The methodology used is the

cost-plus method[20]. The methodology has been developed in accordance with Danish regulations, specifically in accordance with section 23(3) and section 24 of the Danish Executive Order on transmission system operation and the use of the electricity transmission grid, etc. (Systemansvarsbekendtgørelsen)[21].

The cost-plus method covers all consumption and production technologies that Energinet may use for actions to ensure security of supply of electricity. The method is also used when there are no bidders for a service, necessitating remedial actions by Energinet. Additionally, parts of the method are used to establish a regulated price when no historical price is available.

Energinet's cost-plus methodology includes a profit element that is different from that the three examples mentioned. This methodology encompasses several key cost components to ensure that compensation covers all relevant costs and provides a reasonable return on invested capital. These components guarantee comprehensive coverage of all costs and include a fair profit margin, thereby maintaining the financial viability of the service provider.

Energinet's methodology takes the following cost components into account[22]:

Cost component	Description
Fuel and start-up costs	- Costs related to fuel consumption and other start-up expenses. - Costs for bringing facilities out of storage and re-conservation. - Costs for required verifications of facility characteristics.
Revenue and costs from electricity and heat sales	- Revenues from electricity sales and system services are deducted from the compensation. - Costs incurred in electricity markets, such as negative market prices and imbalance settlements, are included. - For heat production, if it cannot be separated as a side activity, related revenues and costs are included if they are negative.
Operational and maintenance costs	- All operational and maintenance costs directly attributable to the service. - Costs for preventive or remedial measures necessary to maintain the desired operational state. - Costs for repairs directly related to the desired operational state. - Costs regarding decommissioning of plants.
Administrative expenses and common costs	- Administrative expenses proportional to the period the service is provided for. - Companies can opt for a simplified alternative of 10 DKK/MWh for administrative expenses.
Depreciation and reasonable return	- Depreciation is treated as a fixed cost, based on documentation and calculations. - A reasonable return on invested capital is applied, based on the Danish Utility Regulator's calculations for network companies.

Table 3: Cost components of Energinet's use of the cost-plus method.

[20] Energinet. (2021). *Notat: Cost Plus – Metode*. Energinet.
[21] Systemansvarsbekendtgørelsen (former version was no. 625 of 18 May 2020)
[22] *Notat: Cost Plus – Metode. Energinet*, pages 3-9.

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For the companies to be compensated, they need to provide necessary documentation to Energinet. Energinet will determine a reasonable compensation for the companies. If Energinet so requests, the costs incurred must be documented by a financial audit report.

Compensation is calculated after the service is delivered and is based on actual costs and revenues. Companies must notify Energinet if they believe the costs of cost-plus are higher than historical prices.

The key principles of the methodology[23] are ensuring fair compensation, so that the companies are not financially harmed for providing their service; entitle companies to a reasonable return on invested capital; compensation amount cannot be negative; compensation for a cost or service can only happen once; companies can operate their facilities as they wish, provided this does not affect the service delivery.

Energinet's cost-plus-approach helps ensure transparency and accuracy in compensating companies for their contributions to maintaining electricity supply security. This is followed by a heavy requirement for documenting costs, but also an option for a standardised compensation for administrative expenses to avoid some complexity in calculating the cost base.

To summarise

The concept of "full cost" within the Danish energy and utility sectors encompasses a comprehensive range of both direct and indirect costs. The examples provided illustrate how this concept is applied across different services, including water supply, district heating, and electricity distribution. Each example highlights the inclusion of operational and capital expenditures, as well as the regulatory frameworks that influence pricing and cost allocation.

For water supply utilities, full cost includes all necessary expenses, capped by a revenue cap to ensure affordability for consumers and enforce efficiency through benchmarking. District heating companies operate under a break-even principle, excluding non-essential costs to maintain fair pricing. Electricity distribution companies follow a revenue cap principle, incorporating standardised returns on assets instead of actual interest expenses.

To further exemplify the use of full cost principles, Energinet's cost-plus methodology shows the application of full cost principles, incorporating a profit element to ensure fair compensation for services that maintain electricity supply security. This methodology includes detailed cost components such as fuel, start-up costs, operation and maintenance, administrative expenses, and a reasonable return on invested capital.

Overall, these examples demonstrate the importance of a thorough understanding of full cost accounting to help ensure transparent, fair, and sustainable financial practices within the Danish energy and utility sectors.

[23] *Notat: Cost Plus – Metode. Energinet*, page 5.

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4. Lessons from EPR schemes from the waste and packaging sectors in Denmark, Norway, and Sweden

The implementation of EPR schemes in the waste and packaging sectors of Denmark, Norway, and Sweden represents a significant regulatory framework aimed at promoting sustainable waste management practices. This chapter delves into the methodologies and use of costs within these schemes. The key principle underpinning the EPR framework is to cover actual waste management costs without generating profit, ensuring that producers are held financially accountable for the environmental impact of their products.

We will dive into the EPR schemes used in Denmark, Norway, and Sweden, focusing on methodology and key recommendations. The chapter will be rounded off with a section on general points of awareness regarding the implementation of EPR in the solid waste sector compared to the full cost implementation from the UWWTD.

4.1. EPR schemes in Denmark: Methodology and use of costs

The methodology for the use of costs is integral to the regulatory framework implementing EPR for packaging and single-use plastic products. The key principle is to cover actual waste management costs without generating profit. Note that there is extensive text and new legislation on this subject.

The methodology for the use of costs has been a part of the regulatory framework implementing EPR on packaging and single-use plastic products. The legislators have chosen two different methods for determining the use of costs.

Single-use plastic products

EPR on single-use plastic products is a financial producer responsibility, where producers finance the cleaning of littered waste.

Cleanup fees are determined based on waste analyses and assessments of costs[24]. According to the Danish Ministry of Environment and Gender Equality the cost analysis has been conducted on an objective basis by examining both municipal and state costs for maintenance in public spaces, as well as conducting waste analyses that have mapped the amount of single-use plastic products ending up as waste in public spaces. The fees also cover administrative expenses, information initiatives, and data reporting for the different categories of single-use plastic products. Cleanup fees will be adjusted as necessary and at least every three years based on updated analyses and assessments.

Cleanup fees applicable from 1. January 2025 are based on the analysis and assessment in "Renholds- og omkostningsanalyse"[25], which was conducted in 2023. The determination of cleanup fees is still criticised for its lack of transparency. The Ministry of Environment and Gender Equality has emphasised that the

[24] Fees applicable from 1 January 2025 is based on *"Renholds- og omkostningsanalyse jf. Engangsplastdirektivets oprydningsansvar"* conducted in 2023 Renholds- og omkostningsanalyse jf. Engangsplastdirektiv-ets oprydningsansvar

[25] Fees applicable from 1 January 2025 is based on *"Renholds- og omkostningsanalyse jf. Engangsplastdirektivets oprydningsansvar"* conducted in 2023 Renholds- og omkostningsanalyse jf. Engangsplastdirektiv-ets oprydningsansvar

procedure for determining the costs of cleanup and maintenance, and consequently the Environmental Protection Agency's setting of cleanup fees, is in accordance with the political agreement on this matter, as well as the Single-Use Plastics Directive[26]. It should be noted that the Single-Use Plastics Directive does not use the term "full cost".

Packaging

EPR for packaging is an operational producer responsibility, where producers are accountable for all packaging waste within the covered categories.

The methodology for cost allocation is very complex, as the scheme had to be adapted and incorporated into the Danish waste system. This system is managed by both municipalities and commercial waste collectors, with local variations.

The calculation of costs varies depending on the type of packaging waste collected and the collector. For costs incurred by the municipalities, the Executive Order specifically states examples that can be included in the municipal fees for schemes that involve packaging waste[27].

Examples of costs covered are costs related to the transport of waste, labelling of waste containers, maintenance of, for example, vehicles and waste containers, the establishment, maintenance, and operation of vehicle depots, waste transfer stations, or other facilities necessary to support waste collection, specific planning and administration of waste schemes covered by producer responsibility for packaging, etc.

Costs that can be included in general administrative fees for packaging waste include the administration of producer responsibility for packaging, including setting producer fees, preparing, and publishing fee schedules, preparing reports on producer fees, calculating costs, collecting, and reporting data, participating in meetings with collective schemes, etc.

Examples of costs that can be included in fees for information initiatives and other communication related to packaging waste are costs for the development, production, and distribution of information and communication about waste schemes to citizens and businesses, including campaigns and sorting guides.

Examples of costs that cannot be included in producer fees are preparation of municipal waste plans and waste regulations, servicing boards and political committee, communication activities for kindergartens, schools, and educational institutions etc.

[26] Miljø- og Ligestillingsministeriet. (2024). *Høringsnotat – Lovforslag om ændring af lov om miljøbeskyttelse (Ændring af regler om udvidet producentansvar for emballage og engangsplastprodukter m.v. samt supplerende bestemmelser til batteriforordningen*. Miljø- og Ligestillingsministeriet. Notat. Page 25.

[27] *Bekendtgørelse om visse krav til emballager, udvidet producentansvar for emballage samt øvrigt affald der indsamles med emballageaffald (BEK nr 1706 af 30/12/2024),* appendix 15.

The calculation of costs for the payment of commercial packaging waste is done based on different formulas in the Executive Order. As an example, the payment for each separately collected waste fraction is calculated using the following formula:

*Amount to be paid = number of tonnes * distribution key for packaging share * (key figure for collection + key figure for treatment)*

Key figures for collection and key figures for collection and treatment are determined by the Environmental Protection Agency[28].

The key principle of the methodology is to cover the actual costs of waste management and not to generate profit. Considering this, multiple stakeholders have requested ongoing analyses of the municipalities and the cost-effectiveness of waste collection.

4.1.1. Comparing the actual-cost methodology and the full cost methodology

The actual cost methodology used in the Danish solid waste sector is designed to reflect the actual cost of waste management. However, the method has its shortcomings because of its lack of transparency and its complexity. Costs across many activities – collection, handling, incineration, recycling stations and materials recovery has to be fairly distributed across non-uniform costumers (households, small and large companies).

From a transfer pricing perspective, the full cost methodology aims to ensure that all involved entities are compensated fairly for their contributions. This can lead to more accurate cost allocation and potentially higher fees for producers, as all costs, including profit margins, are considered. In the Danish waste sector, all public entities must be able to provide an account that proves that only costs are covered from the respective fees[29].

In conclusion, while the actual cost method focuses on covering the direct costs, the full cost method offers a more comprehensive approach to cost allocation as it integrates direct and indirect costs. Both methodologies have their advantages and challenges, and choosing one over the other will depend on the specific regulatory and operational context."

4.2. How EPR has been implemented in the Norwegian waste sector

The Norwegian waste and packaging sectors have been working with EPR schemes for some time, hence it can be valuable to draw inspiration from their sector as well.

Producer responsibility means that producers are responsible for their products throughout their lifecycle, including waste management costs, in line with the Polluter Pays Principle. This incentivises producers to create more durable and recyclable products.

[28] *Bekendtgørelse om visse krav til emballager, udvidet producentansvar for emballage samt øvrigt affald der indsamles med emballageaffald (BEK nr 1706 af 30/12/2024),* appendix 12.
[29] From January 2025, waste incineration fees are no longer cost based, but market based

The Norwegian Environment Agency has been tasked by the Ministry of Climate and Environment to review and propose improvements to the producer responsibility schemes in Norway[30 + 31]. The review covers seven existing EPR schemes regulated under the waste regulations, including electrical and electronic products, batteries, vehicles, tyres, packaging (excluding beverage packaging), beverage packaging, and PCB-containing insulating glass units. The goal is to make these schemes more effective, robust, and supportive of a circular economy.

The Norwegian Environment Agency concludes that while the existing EPR schemes in Norway have been successful in achieving their environmental objectives, there are several areas for improvement. These include addressing free riders, clarifying roles and responsibilities, enhancing data collection, and reporting, and ensuring compliance with new EU requirements. The report also suggests exploring the establishment of a common overarching regulation for EPR schemes in Norway to streamline and strengthen the system.

The Norwegian Environment Agency launched in 2022 a "base model" for EPR regulation. According to this, the PROs will be responsible for calculating and setting up the model for cost coverage for the waste management sector. The costs of collection and sometimes the transportation of waste is held by the municipalities but are estimated in the model by the PROs. Municipalities are responsible for the collection of waste from private households, as is the case in Denmark and Sweden.

Municipalities cannot expect to be fully cost compensated, as the legislation and model distinguish between packaging and products. The municipalities can expect to be compensated for the packaging, but not the products, even if made of plastic.

Perspective in the context of wastewater treatment

Based on the Norwegian base model, utilities who have a higher level of wastewater treatment than is required by the UWWTD, will have to cover costs exceeding the levels that are set by the PROs. The utilities can choose technological solutions they consider fit, as they are responsible for deciding which technological solution achieves the best result. Within the packaging sector, municipalities are required to bear the costs for collected waste that is not covered by EPR, as well as for packaging for which no PRO assumes responsibility (free riders). As is the case for Sweden, a higher level of accuracy at utility level will require more administration and lead to higher administrative expenses.

[30] Miljødirektoratet (2021). *Rapport – Gjennomgang av utvidet produsentansvar i Norge*. Miljødirektoratet.
[31] Miljødirektoratet (2022). *Videreutvikling av produsentansvaret i Norge – Svar på oppdrag fra KLD – gjennomgang av produsentansvaret – deloppdrag 2*. Miljødirektoratet.

Key recommendations from report on EPR scheme regarding waste

The key recommendations from the report on the revised waste packaging EPR scheme[31] include the following:

1. *A basic model for producer responsibility*
    - Producers are responsible for product design, reuse, collection, waste treatment, recycling rates, and reporting.
    - Producers should join and pay fees to approved return companies, which fulfil the obligations on their behalf.
    - Fees should be differentiated to promote circular economy practices.

2. *Financing waste management*
    - Producers should cover the necessary costs for sorting, collection, transport, and treatment of waste.
    - Clear guidelines on cost coverage should be established.

3. *Packaging and single-use plastics*
    - New producer responsibility schemes for plastic waste from fisheries, aquaculture, and recreational fishing, as well as for single-use plastic products should be established.
    - Producers should cover costs related to public waste management and litter cleanup.

4. *Data improvement and reducing free riders*
    - Enhance data collection on packaging and waste.
    - Develop a producer register to identify and reduce free riders (producers not participating in the schemes).

5. *Existing schemes*
    - Review and improve existing schemes for electrical and electronic waste, discarded vehicles, tires, batteries, and packaging.
    - Consider removing producer responsibility for certain profitable waste types.

6. *Circular economy and eco-design*
    - Align producer responsibility with EU regulations on eco-design and circular economy.
    - Encourage product designs that facilitate reuse and recycling.

7. *Implementation and compliance*
    - Establish clear regulations and guidelines for producer responsibility schemes.
    - Ensure compliance through monitoring and potential penalties for non-compliance.

The recommendations aim to ensure that producer responsibility schemes are a substantial part of the circular economy, helping to reduce waste and promote sustainable product design and recycling.

4.3. EPR in the Swedish waste and packaging sectors

The waste and packaging sectors in Sweden have been working with EPR schemes since around 1994, working more extensively on the EPR from the beginning of 2007.

The municipalities in Sweden are the primary performing entities in waste collection and waste management. Hence, the industry organisations have come up with a standardised model for cost coverage by the waste PROs. The sectors have set up principles to ensure efficient waste management in the municipalities. The municipalities can choose the best fitting technical solution for their individual waste management situation.

The compensation model is based on a set of principles, and efficient systems of waste management will be beneficial in achieving cost coverage when enhancing the collection of waste fractions.

In November 2022, Avfall Sverige published a report including a description of a compensation model[32]. An initial report on the matter was submitted by the Swedish Environmental Protection Agency (Naturvårdsverket).

The compensation model ensures that municipalities are adequately reimbursed for their efforts and expenses in collecting and processing packaging waste. All municipalities collect all waste fractions. However, many municipalities only collect packaging via recycling stations (public collection points). The compensation model provides higher compensation when more waste fractions are collected near the property. Most significant for compensation is, however, the extent of property-near collection, i.e., the number of connected households. Municipalities with cost factors outside the norm can be compensated for this, e.g. population density. This element was added to the compensation model during a subsequent revision of the model.

The compensation model proposed by Avfall Sverige, and the PROs are designed to cover the costs incurred by municipalities to collect packaging waste. Cost coverage is based on tonnage of collected waste and the number of households connected to property-close collection. This model is based on a detailed analysis of various cost components and aims to provide a balanced approach that considers both fixed and variable costs. The model also considers different types of collection systems, such as property-close collection and public collection points, to provide a comprehensive approach.

[32] Avfall Sverige. (2024). *PM – Förslag till ersättningsmodell för förpackningsinsamling*. Avfall Sverige.

The key components of Avfall Sverige's compensation model are as follows:

1. *Fixed costs:* Costs that do not vary with the amount of waste collected, including:
    - Vehicle and container investments: Costs related to the purchase and maintenance of collection vehicles and containers.
    - Labour costs: Salaries and wages for personnel involved in the collection process.
    - Administrative expenses: Expenses related to the management and administration of the collection system.

2. *Variable costs*: These costs vary with the amount of waste collected, including:
    - Fuel and maintenance: Costs for fuel and regular maintenance of collection vehicles.
    - Service costs: Expenses for the ongoing service and replacement of damaged containers.
    - Project costs: Costs associated with the implementation of new collection projects or systems.

The key considerations regarding the compensation model are as follows:

1. *Cost analysis*: It is essential to conduct a thorough analysis of all cost components to ensure accurate compensation.
2. *Documentation*: Proper documentation of costs and activities is crucial to support the compensation claims and ensure transparency.
3. *Regulatory compliance*: Adherence to local regulations and guidelines is necessary to avoid disputes and ensure that the compensation model is accepted by all stakeholders.

By accurately determining and covering both fixed and variable costs, municipalities can ensure that they are adequately reimbursed for their efforts. As the compensation is based on a model and not on actual costs and local conditions, it cannot be expected to fully compensate for all actual costs incurred.

4.4. Conclusions on EPR in the Nordic waste sector

In summary, the implementation of EPR schemes in the solid waste management and packaging sectors of Denmark, Norway, and Sweden highlights a significant regulatory effort to promote sustainable waste management practices. This chapter has explored the methodologies and cost structures within these schemes, emphasising the principle of covering actual waste management costs without generating profit, thereby ensuring producers are financially accountable for the environmental impact of their products.

In Denmark, the EPR schemes for single-use plastic products and packaging involve complex methodologies for cost allocation, focusing on both direct and indirect costs. The Danish approach ensures that producers cover the calculated costs (actual costs) of waste management, including cleanup fees and administrative expenses, focusing on transparency and fairness in cost determination. It should be noted that the Single-Use Plastics Directive does not use the term "full cost".

Norway's EPR schemes, guided by the Norwegian Environment Agency, aim to enhance the effectiveness and robustness of waste management practices. The introduction of a "base model" for EPR regulation

ensures that producers are responsible for the entire lifecycle of their products, promoting circular economy practices and reducing waste.

Sweden's long-standing EPR schemes have established a standardised compensation model to ensure municipalities are adequately reimbursed for their waste management efforts. The model considers both fixed and variable costs, providing a balanced approach to cost coverage and promoting efficient waste management practices.

Overall, the EPR schemes in these Nordic countries demonstrate a commitment to sustainable waste management by holding producers accountable for the environmental impact of their products. The methodologies and cost structures discussed in this chapter provide valuable insights into the implementation of EPR schemes and their role in promoting a circular economy.

4.5. General points of awareness regarding the implementation of EPR in the solid waste sector compared to the full cost implementation from the UWWTD

Both the EPR schemes in the solid waste sector and the UWWTD with full cost methodologies share common themes of cost-effectiveness, regulatory compliance, stakeholder engagement, and future adaptations. However, the specific focus and challenges differ based on the nature of waste management versus wastewater treatment. The methodology for cost coverage in both contexts aims to ensure comprehensive cost allocation, transparency, economic sustainability, and reduced environmental impact, ultimately supporting the long-term success and compliance of these regulatory frameworks.

General points of awareness for EPR implementation

From the EPR perspective in the solid waste sector, it is important to continuously analyse municipalities and waste collection costs to maintain an efficient and balanced actual-cost method. Similarly, the UWWTD requires ongoing evaluation of wastewater treatment costs, including the efficiency of treatment plants and the financial sustainability of wastewater management systems.

Regulatory compliance from the EPR perspective requires that both the EPR schemes and the UWWTD methodologies adhere to relevant framework conditions, such as the revenue cap regulations that regulates the economy in some countries. Compliance with the UWWTD is mandatory, encompassing the need to meet specific treatment standards, discharge limits, and reporting requirements to ensure environmental protection.

Confidence through stakeholder engagement from the EPR perspective in the solid waste sector involves engaging with multiple stakeholders, including producers, municipalities, and waste management companies, to ensure the successful implementation of EPR schemes. From the UWWTD perspective, we would expect this to also apply, necessitating collaboration between local authorities, wastewater utilities, regulatory bodies, and the public. Achieving a consensus on the choice of model is an important step to reach coverage of a minimum of 80 % of the full costs related to the implementation of quaternary treatment as mentioned in the Directive.

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Considerations regarding the full cost methodology encompass several key aspects. From the EPR perspective in the solid waste sector, the actual-cost methodology is implemented, and actual costs include both direct and indirect costs, aiming to ensure that all entities involved in waste management are compensated fairly. Similarly, from the UWWTD's perspective, the full cost principle will aim to ensure that all costs related to the implementation of quaternary treatment facilities are covered. This includes investments, operational costs, and maintenance.

Transparency and accountability are also critical considerations. From the EPR perspective in the solid waste sector, the cost base may offer greater transparency by providing a comprehensive view of all costs involved on a sector level, based on overall studies. This leads to a fairly accurate cost allocation and contains a reasonable division of tasks. From the UWWTD perspective, transparency in cost allocation and financial management should be equally essential. Cost recovery of a minimum of 80 % of the full cost will help ensuring that users are aware of the true cost of wastewater services (quaternary treatment), promoting accountability and embracing the polluter pays principle.

Another important factor is economic sustainability. From the EPR perspective in the solid waste sector, having accounted for relevant and necessary costs is important to being economical sustainable. This may involve balancing cost recovery with affordability for producers. From the UWWTD perspective, cost recovery of a minimum of 80 % of the full costs from the PROs will help support the economic sustainability of the wastewater services.

Lastly, the environmental impact is a significant consideration. The implementation of UWWTD has to fulfil the aim from the European Parliament of reducing the effect of micropollutants on vulnerable water bodies used as recipients for treated wastewater. "*The revised directive extends the scope to smaller population equivalents, covers more pollutants, including micropollutants, and contributes to energy neutrality*"[33].

Summing up

In summary, both the EPR schemes in the solid waste sector and the Urban Wastewater Treatment Directive with full cost methodologies exhibit common themes of cost-effectiveness, regulatory compliance, stakeholder engagement, and adaptability to future changes. Nevertheless, the specific focus and challenges vary due to the distinct nature of solid waste management and wastewater treatment.

The cost coverage methodology in both domains aims to ensure comprehensive cost allocation, transparency, economic sustainability, and a reduced environmental impact. For EPR schemes in the solid waste sector, this entails ongoing analysis of municipal operations and cost-effectiveness, adherence to relevant legislation, active stakeholder engagement, and adaptation to evolving regulatory landscapes. Similarly, the UWWTD necessitates continuous evaluation of treatment processes, collaboration among stakeholders, and updates to incorporate new scientific findings and technological advancements.

[33] Council of the EU. (2024). Press release - *Urban wastewater: Council adopts new rules for more efficient treatment*. Urban wastewater: Council adopts new rules for more efficient treatment - Consilium

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Key considerations for both methodologies include comprehensive cost allocation to help ensure fair compensation for all entities involved; transparency and accountability to promote efficient resource management; economic sustainability to balance cost recovery with affordability; and environmental impact to encourage sustainable practices and investments in advanced technologies.

Ultimately, these methodologies underpin the long-term success and compliance of their respective regulatory frameworks, ensuring that both solid waste management and wastewater treatment are conducted in an economically and environmentally sustainable manner.

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5. Perspective on and discussion of model for covering the cost of implementing quaternary treatment

The next chapter aims to elucidate and describe the full cost concept as it pertains to the UWWTD. The Directive mandates that the scope of full costs should be fair, measurable, and easy to use and handle. However, achieving these objectives presents several challenges, particularly concerning fairness. This chapter delves into various perspectives regarding financing principles, exploring the complexities and implications of implementing the full cost concept.

5.1. Considerations to have in mind

Based on the knowledge that Deloitte Denmark has gained through the dialogue with the wastewater associations about the EPR scheme with respect to the UWWTD[34], our shared insights into current utilities regulation, and our understanding of the elements of implementing quaternary water treatment, there are a set of principles which should be taken into consideration when deciding on a model for covering the cost of implementing quaternary treatment:

1. Coverage of at least 80 % of the full costs – the pharmaceutical and cosmetics industries cover a minimum of 80 % of the full costs due to implementation of quaternary treatment. This is regulation. Offers security of payment regarding cost coverage of implementation of quaternary treatment facilities.
2. Fair distribution – the individual utilities receive a fair share of the total costs due to the implementation of quaternary treatment covered by the pharmaceutical and cosmetics industries if not paid out based on actual costs.
3. Efficiency – low administrative expenses are generally preferred.
4. Simplicity is preferred and transparency is a must for continued collaboration.
5. Objectivity – to gain objectivity across parameters, a set of controls must be defined and set up. To gain further objectivity, audit of the controls and data would be beneficial.
6. One fee calculation model.
7. Choice of technology can affect cost and should be considered in deciding on the mechanism to ensure autonomy at local level.
8. Framework conditions need to be considered – e.g., if there is land or space enough to expand the treatment facilities.

The above considerations are those that Deloitte Denmark believes should be taken into account, as well as partly reflecting the wishes of the Nordic wastewater associations.

The following are subjects that need to be addressed when discussing distribution of costs:

[34] UWWTD, Article 9.

Full costs: Fairness, and the scope and the magnitude of the full costs

One of the primary concerns is the fairness perspective of the full cost scope. The competent authority will be mandated to draw the line regarding the EPR scope for covering the full costs of implementing quaternary treatment. The variable being that over-implementation or choosing a facility significantly more expensive than the quaternary treatment needed to fulfil the requirement in the UWWTD can introduce distrust between the wastewater treatment plants and the pharmaceutical and cosmetics industries. For a full cost model to be applicable, there needs to be trust that the costs covered are the costs necessary to fulfil all the requirements of quaternary treatment in the UWWTD.

Also, fairness of distribution is a case here, avoiding situations where the individual utilities are not too over- or undercompensated for the full costs of the quaternary treatment. This will help to ensure the implementation of the Polluter Pays Principle at company level in the pharmaceutical and cosmetics sectors.

The scope and the magnitude of full costs is another critical aspect of the fairness discussion. Wastewater treatment plants are expensive to set up and maintain, and the costs can vary significantly depending on location and other factors. From a Danish perspective, these costs can be compared to the economic framework for Danish wastewater companies ("Økonomiske Rammer"). The variability in costs underscores the difficulty in setting a standard price for full costs and compensation calculations.

Efficiency and low administrative expenses

Low administrative expenses are an objective from both the PROs and from the wastewater industry. Efficiency can help keep the level of administrative expenses low. The administrative burden as a whole is going to grow due to the regulation of the revised directives. Being as efficient as possible at wastewater utility level will help ensure a lower level of administrative expenses. This can perhaps be achieved by drawing on other sectors' use of EPR schemes.

Simplicity, objectivity, and transparency

Simplicity and clear procedures will help keeping objectivity high and can help keep administrative expenses low and make it easier to operate the system. This does, however, highly depend on the design. Also, using standardised metrics when calculating costs within the treatment facility and conducting regular independent audits will highlight the transparency in an objective manner. Having regulatory compliance will keep transparency high; ensuring full compliance with relevant regulations and standards will help this point of action.

The utility chooses the technology

The choice of technology will have an impact on the full cost picture. In Appendix 2, we have outlined four technological scenarios of quaternary treatment systems. Any of the scenarios can be chosen and the costs for each vary. Each treatment type has its own cost elements, which must be considered. Some can be more suitable for one wastewater treatment facility than the other, hence management of the companies must choose which way to go to ensure that the quaternary treatment fulfils the requirements in the UWWTD and cost-effectiveness. It would, from our understanding based on discussions with the associations and utility companies, be very inefficient if all treatment plants are forced to opt for a specific technology.

The costs of each component necessary for quaternary treatment, e.g., activated carbon and chemicals, will vary. Variation is due to dosage, electrical consumption, ancillary chemicals, e.g., liquid oxygen (LOX), use of coagulants and polymers, replacement of treatment product and so on. In addition, not two wastewater treatment plants are the same, as the wastewater can have different compositions, and as the national legislation can result in varying treatment intensities, based on, for example, the recipients.

Over-implementation of the UWWTD requirements at national level

The UWWTD sets minimum standards for wastewater treatment, but national authorities may demand higher standards. This variation can significantly influence the costs. For instance, if Danish authorities require better treatment than the UWWTD minimum, the costs could increase. This raises the question of how to account for such discrepancies in cost estimations across different countries. It is our assessment under the circumstances that as long as the over-implementation is through national legislation, it is the costs of fulfilling the national legislation that must be included in the full cost assessment – hence creating discrepancies between countries. To increase transparency and administrative burdens, transnational coordination can be considered. This is already a part of the UWWTD's Article 10.6, stating that "*by 1 January 2025, the Commission shall provide for the organisation of exchange of information, experience and best practices between Member States on the implementation of Article 9 and this Article 10*"[35].

Increased national requirements can also lead to more treatment facilities being made a part of the implementation of quaternary treatment and hence to increased costs for the PROs. This is unavoidable, as the evaluation should be based on the state of the recipients under the Water Framework Directive ("Vandrammedirektivet").

Scheduling is in this regard also a factor. National authorities may set an earlier deadline for implementation of quaternary treatment facilities than that set by the UWWTD.

The above does not in our opinion affect that the costs necessary to comply with the national legislation on EPR for the wastewater sector should be covered by the PROs with a minimum of 80 % of the costs.

The implementation of the quaternary treatment facilities can be driven by the implementation of the UWWTD but can also be driven by the national authorities' level of ambition for treatment of wastewater. Requirements can also vary, as those in the UWWTD are a minimum set of requirements – the national authorities can set a different bar, which wastewater utilities need to live by and implement technologies accordingly but will not necessarily be financed through the full costs of the EPR under the UWWTD.

[35] UWWTD, Article 10.6

5.2. Utility level or sector level

When looking at cost coverage in the wastewater utilities, we can look at cost coverage from a utility perspective and from a sector perspective. Each approach has its own set of advantages and disadvantages.

5.2.1. Utility level – company-specific cost coverage

Cost coverage at the utility level will be based on the actual expenses incurred by individual utilities. This model aligns with the principles of cost coverage for the sector, fair distribution, and security of payment under the UWWTD[36].

The main challenge arises when utilities face additional regulatory requirements beyond those stipulated in the UWWTD. If these additional requirements can be met by scaling up existing technology, such as increased use of activated carbon, the full costs can still largely be based on actual expenses. However, if new technology is required due to extra requirements, this cost coverage approach may need to rely heavily on estimates.

By calculating full costs based on actual costs, producers pay the appropriate amount for the treatment of pollutants that their products release, effectively implementing the Polluter Pays Principle as outlined in the UWWTD. Actual costs include full depreciation, ensuring that the flow of payments matches the expenses incurred.

The key principles are as follows:

Cost coverage

- Financial stability: Ensures that the wastewater utilities remain financially viable by covering all operational, maintenance and capital costs of implementing the quaternary treatment system.
- Comprehensive accounting: Includes all relevant costs, helping to ensure fair compensation to all relevant companies, but at a high administrative expense both at company level, for audits and for controls at the PRO level.

Fair distribution

- Pharmaceutical and cosmetics companies must participate in paying the PROs if substances on the UWWTD list of substances[37] are being sent through.
- If, however, the respective pharmaceutical or cosmetics company only put substances into the EU market which in the UWWTD are defined as easily degradable[38], that company will not have to participate in the payment to the PROs.
- Equitable cost allocation help ensuring that costs are based on the actual pollutants released by each producer, making those who pollute more pay more.
- Incentivises producers to reduce their pollutant output to lower their costs.

[36] DANVA. (2024). *Notat vedr. implementering af Extended Producer Responsibility i Danmark – DANVAs aktuelle budskaber*. DANVA. Pages 2-3
[37] UWWTD Article 8, Annex I, Table 3
[38] UWWTD Article 9.2.b

Security of payment (regarding the UWWTD's 80 % cost coverage)

- Cost coverage regarding the UWWTD: The UWWTD mentions that producers shall cover at least 80 % of the full costs incurred by the wastewater industry in relation to the implementation of quaternary treatment facilities.
- Reliable revenue stream: Help ensuring that utilities receive consistent and reliable payments that match their incurred expenses, providing financial security, but it depends on PROs sharing in on the treatment costs, and setting up an organisation to facilitate communication between the parties.
- Budget predictability: Helps utilities plan and budget more effectively, knowing that their costs will be covered.
- Support from national authorities: There may be a point, where the PROs will challenge the individual utilities at a level risking an inefficient process, e.g., on balances and costs. It may be necessary to have the national authority's support.

Implementing the Polluter Pays Principle

- Cost reflection: By basing costs on actual costs, this principle aims to ensure that the financial burden of pollution is accurately reflected and distributed.

This model entails significantly higher administrative expenses due to the necessity for detailed reporting, comprehensive data collection, meticulous audits, and the potential risk of PROs not approving costs. These measures are crucial to ensure that actual costs are accurately determined, which can impose a substantial burden on utilities and be resource intensive.

If utilities are subjected to additional regulatory requirements beyond the UWWTD, compliance may necessitate scaling up existing technologies or adopting new ones. When new technology is required, the cost coverage approach may heavily rely on estimates, thereby reducing accuracy.

5.2.2. Sector level – a standard price cost covarage

Cost coverage at sector level involves payments to utilities based on standard rates, such as a variable contribution e.g., per connected person or per cubic metre of treated wastewater and in combination with some other parameter such as the size of the wastewater treatment plant. This approach primarily meets the principle of low administrative expenses and predictability. However, improvements can be made to address the principles of cost coverage from a transfer pricing perspective, including both the direct and the indirect costs regarding quaternary treatment and fair distribution, by dividing contributions into various categories, including operational and capital contributions. The data basis for these contributions is not clear, but it would be logical to initially use the full cost results from pioneering utilities.

This approach is best suited when it can account for differences in framework conditions or when the conditions are very similar, or when the data quality of individual costs is not adequate. If the framework conditions are uniform, payment based on the person connected or the volume of treated water can ensure all four principles are met. Each company would receive a payment close to its involving low administrative expenses. Conversely, if the framework conditions vary significantly, some companies may be

undercompensated while others are overcompensated. This can be partially mitigated by taking parameters such as size of the wastewater plants and geographical conditions into account, but significant variation in framework conditions makes the model less suitable to meet the established principles. The sector model needs to be regularly updated and adapted to new knowledge and technology.

This cost coverage approach is not necessarily affected by the chosen treatment technology or intensity, making it easier to manage if the utility needs to provide better treatment than required by the UWWTD or national legislation.

The key principles of this cost coverage system are:

Low administrative expenses

- Simple: Using standard rates simplifies the calculation and bookkeeping processes, reducing the need for detailed data collection and reporting,
- Efficiency: Minimises the administrative burden on the utilities, allowing them to focus resources on operational efficiency rather than complex financial management.
- Budget predictability: Helps utilities plan and budget more effectively, knowing that their costs will be covered.

Flexibility and improved efficiency

- Flexibility and ease of management: This cost coverage approach is not necessarily affected by the chosen treatment technology or intensity. This makes it easier to manage if the specific utility needs to provide better treatment than required under the UWWTD, as the standard rates remain applicable regardless of the technology used.
- Efficiency: The utilities will gain more by being more efficient, hence incentivising optimisation, improvement and making the quaternary treatment process more cost-effective.
-

One fee calculation model

- Uniform conditions: When framework conditions are uniform across utilities, payment based on the connected persons or volume of treated water can ensure that all principles are met,
- Cost alignment: Each utility would receive a payment close to its actual costs incurred, maintaining low administrative expenses, and ensuring fair distribution. Several means of adjustments can be used under the standardised rate, based on sector-wide allocation models.
- Standard rates remain applicable regardless of the technology used by the utilities.

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5.3. To summarise

Both approaches to cost coverage in EPR financing for wastewater exhibit distinct strengths and weaknesses. Cost coverage at the utility level aim to ensure precise cost coverage and equitable distribution but incurs higher administrative costs and potential challenges with additional requirements. Conversely, sector-level cost coverage aims to offer lower administrative costs, security in reimbursement, and flexibility but may struggle with fairness and accurate cost coverage under varying conditions.

Understanding these models is crucial for developing an effective EPR financing strategy that aligns with the principles of cost coverage, fair distribution, secure payment flow, and administrative efficiency.

The utility-level model bases costs on actual expenses incurred by individual utilities, aiming to ensure fair distribution and adherence to the Polluter Pays Principle. However, it has higher administrative costs and potential issues with additional requirements beyond the UWWTD. If additional requirements can be met by scaling up existing technology, costs can still be based on actual expenses. Otherwise, estimates may be necessary.

The sector-wide model bases payments on standard rates, such as per connected person or treated cubic metre of wastewater. It is suitable when framework conditions are similar, aiming to ensure low administrative costs and fair distribution. However, significant variation in conditions can lead to under- or over-compensation, making the model less suitable.

Choosing between these models depends on the specific circumstances and priorities of the utilities and regulatory framework. Interviews with utilities and Nordic wastewater utility associations indicate that a hybrid model may better meet the needs of the UWWTD, pharmaceutical and cosmetics industries, and wastewater utilities.

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6. Awareness points - Points of awareness from a wastewater management perspective

This chapter aims to highlight key awareness points that emerged during the work on this report from the wastewater facilities perspective in the context of the UWWTD. The points stem from discussions and interviews between Deloitte Denmark and the Nordic wastewater associations, thus not being conclusions but rather common observations. These points are important to further understand the complexities and challenges associated with wastewater treatment and for informing future research and policy development. The chapter will cover various aspects, including regulatory compliance, technological advancements, environmental impacts, economic considerations, and stakeholder engagement.

Regulatory compliance

One of the primary awareness points is the importance of regulatory compliance. The UWWTD sets stringent standards for wastewater treatment, and ensuring compliance is essential for protecting public health and the environment. However, interviews have revealed that achieving compliance can be challenging due to varying national regulations and enforcement mechanisms. Awareness of these regulatory differences is crucial for developing effective and harmonised wastewater management strategies across the EU.

Technological advancements

Technological advancements play a significant role in improving wastewater treatment processes. Studies have highlighted four scenarios of quaternary treatment methods, which rely on different technologies[39]. Awareness of these technologies and their potential benefits and limitations is essential for making informed decisions about technology adoption and investment. Additionally, understanding the long-term sustainability and maintenance requirements of these technologies is crucial for ensuring their effectiveness.

Environmental impacts

Wastewater treatment has significant environmental impacts, both positive and negative. While effective treatment can reduce pollution and protect ecosystems, the treatment processes themselves can generate greenhouse gas emissions and other pollutants. The report has covered a holistic approach to wastewater management that considers the entire lifecycle of treatment processes[40]. Awareness of the environmental trade-offs associated with different treatment methods is essential for developing sustainable wastewater management practices.

Economic considerations

Economic considerations are a critical aspect of wastewater management. The costs of setting up and maintaining wastewater treatment plants can vary significantly depending on factors such as location, plant size, and technology used. Awareness of these cost variations is crucial for developing fair and equitable

[39] See Appendix 2: Exemplifying four scenarios for quaternary treatment.
[40] See Appendix 1: A comprehensive overview of costs, divided into cost types.

funding mechanisms. Additionally, understanding the economic implications of regulatory changes and technological advancements is essential for making informed policy decisions.

Stakeholder engagement

Effective stakeholder engagement will be important for the success of wastewater management initiatives. A lot of stakeholders are involved in the process, including government agencies and industry representatives. Awareness of the diverse perspectives and interests of these stakeholders is essential for developing inclusive and collaborative wastewater management strategies. Additionally, transparent communication and active participation can help build trust and support for wastewater management initiatives.

Adaption to climate change?

Climate change poses significant challenges to wastewater management. The wastewater treatment plants must adapt to changing climate conditions, such as increased rainfall and rising sea levels. Awareness of the potential impacts of climate change on wastewater infrastructure is crucial for developing resilient and adaptive treatment facilities. Integrating climate change considerations into planning and decision-making processes is essential for ensuring the long-term sustainability of wastewater treatment systems.

To summarise

To sum up, this chapter has highlighted key awareness points in wastewater management. These points are important to understand the complexities and challenges associated with wastewater treatment and for informing future research and policy development. By raising awareness of these critical issues, this chapter aims to contribute to the ongoing efforts to improve and sustain effective wastewater management practices.

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7. Conclusion

The analysis presented in this report underscores the critical importance of understanding and accurately defining the concept of "full cost" within the framework of the EU Urban Wastewater Treatment Directive (UWWTD). The Directive's mandate for Extended Producer Responsibility (EPR) systems, which require producers to cover at least 80 % of the full costs associated with quaternary treatment of urban wastewater to reduce micropollutants, necessitates a clear and robust methodology for cost calculation and allocation. This report has aimed to highlight what such a methodology must contain to ensure that relevant expenses are included, promoting transparency and fairness in cost allocation.

The term "full cost" encompasses a wide range of direct and indirect expenses, including construction, operation, maintenance, and decommissioning of a quaternary treatment step at wastewater treatment facilities. By leveraging transfer pricing principles, particularly the cost-plus method, this report provides a structured approach to defining and calculating these costs. This methodology aims to ensure that all relevant expenses are accounted for, promoting transparency and fairness in cost allocation. The cost-plus method, widely acknowledged and documented, offers a reliable framework for setting prices that reflect the true costs incurred by wastewater utilities for providing the service under UWWTD – reducing micropollutants.

The examination of EPR schemes in the waste and packaging sectors in Denmark, Norway, and Sweden offers valuable insights into the practical application of cost coverage to use for application of the full cost concept in the wastewater sector. The standardised models for cost coverage in these countries provide useful inspiration for implementing EPR in the wastewater sector. For instance, Denmark's approach to EPR for single-use plastics, which involves producers financing the cleaning of littered waste, ensures that actual waste management costs are covered without generating profit. Similarly, Norway's model, where PROs calculate and set up cost coverage models, and Sweden's standardised cost coverage models aim to ensure efficient waste management and fair compensation for municipalities.

The report also highlights the importance of considering various perspectives on cost distribution, e.g., the need for fairness, efficiency, simplicity, and transparency. The choice between utility-level company-specific cost coverage and sector-level standard price cost coverage models presents distinct advantages and challenges. The utility-level model aims to ensure precise cost coverage and equitable distribution but involves higher administrative expenses. It is best suited when actual costs can be accurately determined and when additional regulatory requirements are minimal. Conversely, the sector-level model aims to offer low administrative expenses and flexibility but may struggle with fairness and accurate cost coverage under varying conditions. It is best suited when framework conditions are uniform or when the data quality of individual costs is not adequate. A hybrid approach combining elements of both models may in some cases be a more feasible solution. A hybrid model can be adapted and designed locally to assign different weight on precise cost coverage or low administrative costs. Deloitte Denmark have not made any conclusions regarding model choice.

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Key awareness points identified in the report include the importance of regulatory compliance, technological advancements, environmental impacts, economic considerations, and stakeholder engagement. Ensuring compliance with the UWWTD and national regulations is essential for protecting public health and the environment. Technological advancements play a significant role in improving wastewater treatment processes, and awareness of different quaternary treatment technologies and their potential benefits and limitations is crucial for informed decision-making. Considering the entire lifecycle of treatment processes to develop sustainable wastewater management practices is essential for minimising environmental impacts. Economic considerations are also critical, such as understanding cost variations and the economic implications of regulatory changes and technological advancements. Effective stakeholder engagement is essential, involving diverse stakeholders in the process to develop inclusive and collaborative wastewater management strategies. Finally, integrating climate change considerations into planning and decision-making processes is crucial for ensuring the long-term sustainability of wastewater treatment systems.

The report's findings underscore the importance of a clear and structured approach to defining and calculating full costs, aiming to ensure that all relevant expenses are accounted for and promoting transparency and fairness in cost allocation. The adoption of a comprehensive understanding of the full cost concept, coupled with insights from various sectors and countries, can help enhance the chance of success. The EPR approach in UWWTD aligns with broader EU environmental policies, such as the Polluter Pays Principle enshrined in the Treaty on the Functioning of the European Union (TFEU), which aims to shift the financial and operational burden of waste management from municipalities and taxpayers to the producers themselves. By doing so, it incentivises manufacturers to design more sustainable products and take accountability for their environmental impact.

In conclusion, this report provides a robust framework for policymakers, industry leaders, and stakeholders to develop, discuss and implement effective EPR systems in the wastewater sector.

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8. Appendices

The two appendices included in this report are derived from a summary of Deloitte Denmark's discussions and unstructured interviews with representatives from DANVA, FIWA, Svenskt Vatten, Norsk Vann, and other sector experts. It should be noted that neither Appendix 1 nor Appendix 2 provide a comprehensive overview and should not be considered representative of the complete list of cost components or quaternary treatment facilities.

8.1. Appendix 1: A comprehensive overview of costs, divided into cost types

To give a summary and a detailed breakdown, the following table has been drawn up, outlining examples of the costs incurred the full lifecycle of a quaternary treatment plant. We emphasize that there can be other costs, based on the chosen technology and circumstances.

Cost type	Cost element	Description
Capital cost	Construction costs	Costs for building the physical infrastructure, including civil works (e.g., tanks, buildings, foundations)
Capital cost	Machinery and equipment costs	Costs for purchasing and installing mechanical equipment (e.g., pumps, mixers, aerators, treatment units)
Capital cost	Electrical and automation costs	Costs for electrical systems, transformers, cables, control systems, and automation equipment
Capital cost	Engineering and design costs	Fees for engineering, design, and consulting services
Capital cost	Permits and regulatory costs	Costs for obtaining necessary permits and complying with regulatory requirements
Capital cost	Project management and supervision costs	Costs for project management, construction supervision, and quality control
Capital cost	Temporary installations	Costs for temporary facilities and installations during the construction phase
Capital cost	Training costs	Costs for training personnel to operate and maintain the plant
Capital cost	Communication and public relations costs	Costs for communication and public relations activities related to the project
Operational costs [Direct costs]	Personnel costs	Salaries and benefits for staff required to operate and maintain the plant
Operational costs [Direct costs]	Piping and pumping costs	Costs for the installation of pipes and pumps to transport wastewater and treated effluent
Operational costs [Direct costs]	Energy costs	Electricity and other energy costs for running the treatment processes and associated equipment
Operational costs [Direct costs]	Chemical costs	Expenses for chemicals used in the treatment processes (e.g., coagulants, disinfectants, activated carbon)
Operational costs [Direct costs]	Maintenance costs	Regular maintenance and repair costs for civil works, machinery, and electrical equipment
Operational costs [Direct costs]	Sludge treatment and disposal costs	Costs for processing, handling, and disposing of sludge produced during treatment
Operational costs [Direct costs]	Consumables costs	Costs for consumable items required for daily operations (e.g., filters, lubricants, spare parts)
Operational costs [Direct costs]	Monitoring and compliance costs	Expenses for monitoring plant performance, environmental compliance, and reporting

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Cost type	Cost element	Description
Indirect costs	Administrative expenses	Overhead costs for administrative support, office supplies, and general management
Indirect costs	Insurance costs	Costs for insuring the plant and its operations against risks and liabilities
Indirect costs	Financing costs	Interest and other costs associated with financing the construction and operation of the plant
Indirect costs	Depreciation costs	Accounting for the depreciation of assets over their useful life
Decommissioning costs	Decommissioning and demolition costs	Costs for safely decommissioning and demolishing the plant at the end of its useful life
Decommissioning costs	Site remediation costs	Costs for cleaning up and remediating the site to meet environmental standards

Table A1: Comprehensive overview of costs, divided into cost types[41] + [42]

The above-mentioned costs have been discussed in terms of costs allocated during wastewater plant implementation of quaternary treatment facilities. The cost types have been mentioned and discussed both in Deloitte Denmark's unstructured interviews with the industry and in literature on quaternary treatment in general.

[41] From perspectives from unstructured interviews with water utilities and Envidan report
[42] Envidan and Teknologisk Insitut. (2024). *4. Rensetrin – Erfaringer fra udlandet*.

8.2. Appendix 2: Exemplifying four scenarios for quaternary treatment

Diving deeper into the plant-specific costs when talking about quaternary treatment, four types of examples of treatment facilities have been identified as possible process steps[43 + 44]:

1. Ozone treatment and sand filter (O_3 + SF)
2. Ozone treatment and activated carbon (granular) (O_3 + GAC)
3. Activated carbon filter (granular) (GAC)
4. Activated carbon filter (powdered) and sand filter (PAC + SF)

The costs for each vary. Each treatment facility type has its own cost elements, which must be considered. Some can be more suitable for one wastewater treatment facility than the other, hence management of the companies must choose which way to go.

Some if the specific costs are mentioned in table A2. The costs will vary in terms of dosage, electrical consumption, ancillary chemicals such as liquid oxygen (LOX), use of coagulants and polymers, replacement of treatment product and so on. The costs do differ for each of the treatment scenarios; generally, ozonation (ozone treatment) followed by sand filtering – Scenario 1 – is the least expensive treatment type, whereas GAC alone is the costliest.

To illustrate this, table A2 below summarises the interviews and what has been found in other reports. An X marking indicates that this type of treatment uses the specified cost element:

Cost element	Cost type	Scenario 1: O3 + SF	Scenario 2: O_3 + GAC	Scenario 3: GAC	Scenario 4: PAC + SF
Electricity	Direct cost	X	X	X	X
Oxygen	Direct cost	X	X		
GAC (new)	Direct cost		X	X	
GAC (reactivated)	Direct cost		X	X	
PAC	Direct cost				X
Polymer (PAC)	Direct cost				X
Iron chloride ($FeCl_3$)	Direct cost				X
Sand	Direct cost	X			X
Liquid oxygen (LOX) tanks	Direct cost	X	X		
Labour (man hours)	Overhead [Indirect cost]	X	X	X	X
Maintenance of buildings	Overhead [Indirect cost]	X	X	X	X
Maintenance of machinery	Overhead [Indirect cost]	X	X	X	X
Maintenance of electricity	Overhead [Indirect cost]	X	X	X	X

Table A2: Overview of costs, comparing four methods for quaternary treatment

As shown, not all cost elements are included in each scenario. Hence, the chosen scenario for treatment will affect which types of cost elements will be encountered by the wastewater utility. These costs will be part of the operational costs.

[43] Envidan and Teknologisk Insitut. (2024). *4. Rensetrin – Erfaringer fra udlandet*.
[44] Mulder, M. (2015). *Costs of Removal of Micropollutants from Effluents of Municipal Wastewater Treatment Plants*. STOWA.