Organisation for Economic Co-operation and Development

ENV/EPOC/WPBWE(2022)7

Unclassified

English - Or. English

14 December 2022

ENVIRONMENT DIRECTORATE
ENVIRONMENT POLICY COMMITTEE

Cancels & replaces the same document of 13 December 2022

Working Party on Biodiversity, Water and Ecosystems

Performance Indicators for wastewater collection and treatment services

This document reports on indicators to enhance the transparency of service provision for wastewater collection and treatment.

The draft will be presented and discussed at a stakeholder consultation workshop, to be convened on 31st January 2023.

The document does not necessarily reflect the opinions of the OECD or its member countries.

Xavier.leflaive@oecd.org; Harry.smythe@oecd.org

JT03509899

Table of contents

Tables

Figures

1 Introduction

This work aims to provide insight on performance indicators for wastewater services, as part of the OECD's work with the European Commission DG-Environment. The OECD is tasked with proposing a set of criteria to structure the list of indicators and populate the list with indicators derived from - and inspired by - the experience of EU members.

The rationale is that urging all wastewater operators to track performance against a set of indicators can drive performance. Communicating some of that performance monitoring to the external environment can further contribute to driving performance. The expected benefits of (enhanced) monitoring of performance indicators also allow overseeing bodies to have clarity performance with tools for comparison and tracking improvements, with the use of a standard set of performance indicators, e.g., identify underperforming wastewater operators where marginal improvements would have the greatest effect and identify wastewater operators that are performing well to understand what the best practices are that might be implemented elsewhere. Furthermore, adopting harmonized measures across wastewater operators and networks will allow comparability of data and support wastewater operators in optimizing performance. The motivation informing these indicators is not to replace compliance reporting requirements, of the Urban Wastewater Treatment Directive (UWWTD), but to augment with indicators that would inform key dimensions laid out in the revised UWWTD.

1.1. State of play of benchmarking the performance of wastewater operators

The selection of relevant performance indicators will depend on the initial intention and objective of benchmarking. These objectives are clustered around three main goals[1]:

- Performance assessment (also referred to as "metric benchmarking"): data is mostly collected at utility level, with limited level of details (approx. 100 – 150 input values; compare to other goals below); facilities are seen as cohesive entities and data is not disaggregated at smaller scale ("one piece of treatment plant"); economic values are often based on profit and loss statements and balance sheets. This is the only benchmarking being used to compare performance between countries.
- Performance improvement (also referred to as "process benchmarking"): data is broken down at process-level (e. g. sewer O&M) and underlying tasks (e. g. inspection, cleaning, pumping stations, rodent control) , with high level of details (approx. 500 – 800 input values); facilities are broken down (e.g. for a treatment plant: mechanical, biological treatment, aeration, energy production, sludge dewatering); economic values based on actually used expenditures (working hours, payments without overhead and benefits, or else); the intention is to extract improvement proposals.
- Information of the public / stakeholder: indicators remain quite basic, with low level of details (approx. 30 input values).

Reflecting on experience, one observer suggests that matured, accepted, meaningful performance benchmarking systems share some common features: they were developed in collaboration with the water industry and have remained stable over time; they support decision making (to further characterise

performance, share experience, or develop improvement proposals); the level of ambition and design matches the resources allocated to collect, process, and communicate data. Supporting service providers in data collection can enhance the engagement and the quality of data collected; this can be done through automated data collection; quality assurance of collected data could be considered.

1.2. Main data sources

The OECD has reviewed public information published on the performance of water services, with a focus on wastewater. The Association of European Water Regulators (WAREG) has compiled several good practices for benchmarking across Europe, with a focus on efficiency of water services. With reference to Scotland, and England and Wales, WAREG notes that a thorough analysis of efficiency may require econometric models that factor in cost drivers when comparing costs across wastewater operators and countries. The International Water Association has compiled a set of 172 indicators to characterise the performance of water service providers; they can be clustered around personnel (or staff), physical, operational, quality of service, economics and finance.

Three sources stand out.

- The database most often used for utility statistics is IBNet at the World Bank; more precisely the New IBNet, which is a major revamping of the pre-existing database, with the view to add value to both utilities and regulating agencies. For the dual purposes of referencing a widely used and accepted database, and allowing the interoperability of data, some performance indicators will be drawn from definitions and metadata from IBNet, including the “Start-up Indicators” at IBNet.
- The Portuguese regulator ERSAR released a report, *Sector Characterization of Water and Waste*. This report details the state of play in Portugal and frames several indicators that are important to the regulator and that also would inform thinking on performance indicators, particularly as many of them align with several important dimensions of performance highlighted in the considerations for a revision to the UWWTD.
- A similar report for assessment of Scottish Water’s performance was also analysed. The Scottish Water publication informs this paper’s analysis of performance indicators, particularly around the governance and social dimensions.

The European Benchmarking Co-operation (EBC) (https://www.waterbenchmark.org/) offers drinking water & wastewater utilities in Europe and beyond, an improvement and knowledge exchange programme. Since 2007, EBC organises annual benchmarking exercises for drinking water and wastewater utilities in Europe and beyond, with a view to assist utilities in their efforts to improve their services by benchmarking and learning from each other. An annual report shows ranges and median values of 24 key indicators for drinking water and wastewater services.).

1.3. Objectives of the revised UWWTD and key dimensions of performance indicators

Based on the impact assessment of the revised UWWTD, the EU intervention has four objectives to draw upon:

Two main general objectives:

1. To protect EU citizens and ecosystems from the remaining sources of insufficiently treated wastewater;
2. To provide a predictable framework for the sector, improve its transparency and governance and align it to “a Europe fit for the Digital Age”.

and two complementary objectives:

3. To align the sector to the objectives of the Green Deal and the recently adopted Communication 'Repower EU', regarding in particular the 2050 goal of climate neutrality in synergy with the environmental - social - governance (ESG), transition to circular economy, zero pollution and a restoration of biodiversity;
4. To use wastewater health related parameters as a support for public health and to improve 'adequate and equitable sanitation and hygiene for all' in line with SDG 6.

1.3.1. In relation to objective 1

- Contribute to identifying and then preventing pollution reaching wastewater treatment plants with particular attention to pollutants difficult to treat in these plants;
- Further reduce pollution from the 'remaining sources' (storm water overflows, urban runoff, smaller agglomerations and IAS);
- Further reduce nutrient (N and P), micro-pollutants and micro-plastics pollution from urban sources;
- Reinforce the coherence with key EU water legislations (such as the Bathing Water, Water and Marine Framework Directives and the Drinking Water Directive);
- Encourage investment and innovation in wastewater management.

1.3.2. In relation to objective 2

- Ensure high level of transparency and access to information;
- Ensure that investments are taking place 'where it makes sense' for environmental or health reasons (based on clear criteria);
- Promote a solid financing strategy while ensuring affordability of water tariffs and better applying the 'polluter pays' principle besides household users;
- Modernise, simplify and adapt monitoring and reporting obligations.

1.3.3. In relation to objective 3

- Move towards energy neutrality of wastewater sector;
- Create the conditions for increasing water reuse and better managing sludge and waste, in close synergy with the new Water Reuse Regulation, the Sewage Sludge Directive and the EU waste acquis.

1.3.4. In relation to objective 4

- Improve access to sanitation particularly for vulnerable and marginalised people;
- Ensure that health relevant information from wastewaters is fully used;
- Improve the dialogue between health and wastewater competent authorities;
- Better monitor the spreading of antimicrobial resistance (AMR) in wastewaters and prevent its dissemination.

The four general and specific objectives track well with the key dimensions of relevant performance indicators. The specific objectives that are most directly correlated and addressed in the proposed performance indicators are bolded. The key dimensions of the Performance Indicators are:

- Governance: transparency, efficiency.
- Environment: compliance with the UWWTD, energy use, greenhouse gas emissions.

- Operational: biogas production, heat energy production, electricity production.
- Economic: Prices/tariffs/bills vs. inflation.
- Social: quality of service provision, staff-related data.

1.4. Technical issues

1.4.1. Issues of scale

In this paper, some thought is given to the appropriate level of disaggregation, i.e. deciding between agglomeration, wastewater operator, and plant level disaggregation. Ultimately the operator level seems to make the most sense for three reasons: 1) most data sources, such as IBNet disaggregate to the utility level, and a further benefit of collecting this data would be the interoperability with other datasets; 2) monitoring and evaluation costs would benefit from economies of scale; larger operators can measure across their portfolio of wastewater treatment plants and smaller operators can measure across wastewater treatment plants; and 3) if targets or goals for indicators are placed at the wastewater operator level, larger operators may be able to more efficiently meet those targets by targeting their worst performing wastewater treatment plants for larger marginal gains, and smaller wastewater operators will require smaller capital improvements.

1.5. Normalisation Factors

Accompanying metrics allow users to put the wastewater operator in context of others. These are normalising factors and while not performance indicators, they feed into many performance indicators and allow for the normalising of indicators reported.

Table 1.1. Normalising Factors

Factor
Population served (p.e.)
Number of connections (domestic and services)
Number of households (nb)
Volume of water sold (m3)
Length of network (km)
Volume of wastewater collected or treated (m3)
Population equivalent (load in p.e.)

1.6. Performance Indicators: Governance

When considering Governance Performance Indicators, the focus is on the efficiency and transparency of wastewater operators. Annex A covers in detail the process indicators from IBNet that most reflect the effectiveness of governance. Such detail on one indicator is beyond the scope of this paper, but it is included to illustrate the depth of which many of these indicators could be further explored.

1.6.1. Transparency

The first indicator answers the question: Are the data being collected in a timely and efficient manner? From examining the data, it appears to be the case that data is often intermittently collected, and inefficiently reported. For this indicator, the focus is on the frequency wastewater operators collect data,

and make the data available. Frequency issues persist throughout wastewater operators. In many instances, it is difficult to find data on wastewater operators from within the last 5 years. Similarly, an operator may collect the data, but fail to report it through a channel that gets appropriate reach. An ideal scenario would see a wastewater operator collect data and make it available via a centralized database[2].

Indicator	Units	Intention?
Are data available and reported to the national regulator?	Yes/No	The timeliness likely varies by indicator, but are data being reported?

1.6.2. Efficiency

Efficiency in wastewater operators can be compared by how much it costs an operator to treat a unit of wastewater. It is likely not the case that across Europe the costs should be similar. However, wastewater operators within countries, operating in similar environments (urban, rural), or operators of a similar size could likely have similar costs, and discrepancies in costs could highlight best practices. To examine efficiency on the treatment plant side, treating wastewater in terms of m^3 captures efficiency discrepancies between wastewater operators.

Indicator	Units	Intension
Average cost to treat wastewater	EUR/m^3	Total annual operational expenses/Total annual volume treated.[3]

1.7. Performance Indicators: Environment

Climate change mitigation is relevant to benchmark the performance of wastewater operators. The environmental performance indicators listed below cover three areas: compliance with the revised UWWTD, greenhouse gas emissions, and energy use (per unit of wastewater treated).

It is assumed that the water footprint of an operator – here defined as impacts on water quality - is captured by the indicator on compliance with the UWWTD. However, a more robust assessment of the performance of wastewater operators would characterise the impacts of released wastewater on water bodies downstream of the facility / wastewater operator. This could also be used as a basis to characterise the benefits for the public or the community, which would be in line with latest developments in benchmarking exercises.

1.7.1. Compliance with the UWWTD

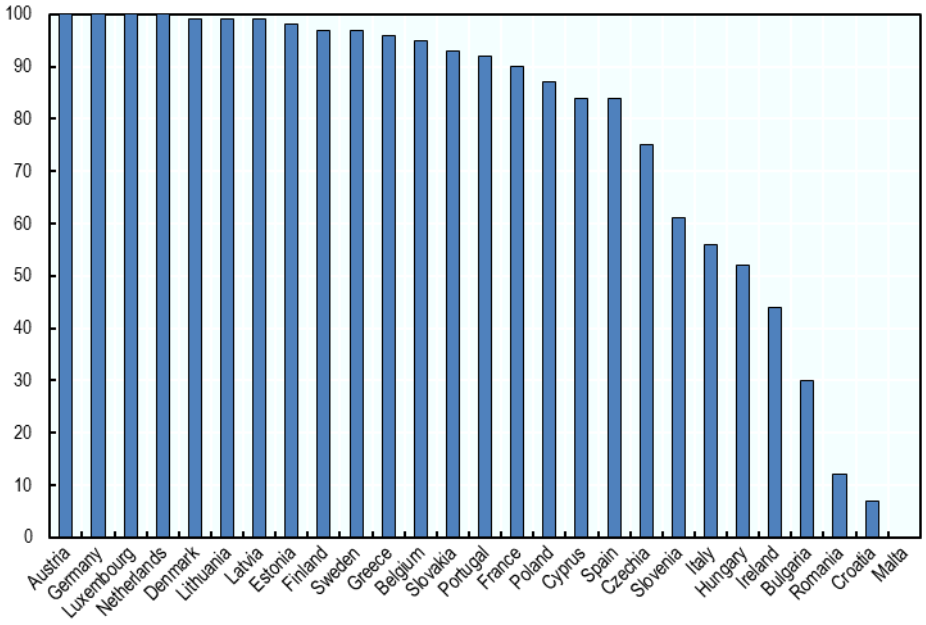
Under the Urban Wastewater Treatment Directive, wastewater treatment is currently reported as per Article 15 and 17. While data is being shared with the European Commission (Other options include removal efficiency, as defined by the EEA.

Figure 1.1.), it may not be available nationally. And there is a 2-3 year time lag before the data can be analysed and used. Additionally, the p.e. load served by IAS could help to further understand how distance to compliance is achieved.

Indicator	Units	Intension
IAS	p.e.	p.e. load served by IAS
Collecting systems	%	Population with sewerage services (direct service connection)/total population under utility's notional responsibility, expressed in percentage.
Compliance with UWWTD Articles 4, 5	YES/NO	Reported as per Article 17[4]

Other options include removal efficiency, as defined by the EEA.

Figure 1.1. Rate of compliance (reported data from 2018)



Source: EU Commission: Country profiles on urban wastewater treatment (europa.eu)

1.7.2. Greenhouse gas emissions

To consider the carbon, methane, and Nitrous Oxide footprints of wastewater operators, indicators associated with CO_2, CH_4 and N_2O are relevant. Scotland uses a similar indicator, divided by the number of connected properties served by Scottish Water. Note that the three indicators could be combined, using the notion of CO_2 equivalent (as reported by EBC).

Indicator	Units	Intension
Carbon Footprint	Tons of CO_2 produced/year	How much CO_2 does the wastewater operator produce in a year.
Methane Footprint	Tons of CH_4 produced/year	How much CH_4 does the wastewater operator produce in a year.
Nitrous Oxide Footprint	Tons of N_2O produced/year	How much N_2O does the wastewater operator produce in a year.

1.7.3. Energy use

Energy usage here is considered to be the energy required to run the wastewater operator.

Indicator	Units	Intension
Energy required to treat wastewater	kWh/m^3	How much energy required to treat a unit of wastewater.

1.8. Performance Indicators: Operational

Operational indicators cover costs and production of secondary material (in addition to volume of wastewater treated).

1.8.1. Production

Turning waste into useful economic outputs further enhances a plant's economic and environmental viability. A 2021 paper by EurEau expresses what gases/energy could be produced at WWTPs (Eureau 2021).

Indicator	Units	Intension
Biogas Production	m^3/year	Annual Biogas Production
Heat Energy Production	GWh/year	Annual Heat Energy Production
Electricity Production	GWh/year	Annual Electricity Production

1.8.2. Costs

In addition to the performance indicators of governance above, the unit cost (as per volume of water sold or population served) is an additional operational and efficiency factor to consider.

Indicator	Units	Intension
Unit Operational Cost	EUR/m^3 sold	Total annual operational expenses/Total annual volume treated.
Unit Operational Cost	EUR/WW p.e. served	Annual wastewater operational expenses/ Population served.

1.8.3. Sewer Efficiency

Two sets of data can characterise sewer efficiency, characterised as reliable delivery of service. One relates to blockages. It can be defined as below.

Indicator	Units	Intension
Sewer System Blockages	blockages/100 km/year	Total number of blockages per year expressed per 100 km of sewers

The other one relates to combined sewer overflow (CSO). Scotland measures the percentage of properties suffering sewer flooding due to inadequate capacity or other reasons. EBC reports on flooding from combined sewers (No./100 km sewer). However, that dimension of performance remains incomplete: assuming the number of episodes can be accurately monitored and reported (for instance based on customers reporting significant flooding in public areas), it may not be relevant for the operator or the regulator, as the volume of untreated wastewater released in the environment may vary. Unless that volume can be measured and reported with accuracy, there does not seem to be a practical way to report CSO in a meaningful way across countries.

1.9. Performance indicators: Economic

Prices charged to customers by operators for treatment of wastewater are often regulated. However, tracking the changes in price vs inflation or other economic variables can account for the impact the affordability of treatment has on those served.

1.9.1. Prices

The GWI tariff database suggests that wastewater tariffs are not readily singled out in water bills. They can be subsumed under tariffs for water supply (GWI 2022). This explains why aggregate expenditures for water supply at national level are often overestimated while expenditures for wastewater collection and treatment are likely to be underestimated (OECD, 2020).

Moreover, when the wastewater component is identified in a customer bill for drinking water and wastewater services, it may reflect different choices in terms of tariff structure: connection fee, flat tariff, increasing block tariff, tariff that reflects the toxicity of effluents (for industrial purposes).

The table below presents several features of water bills, which could be used to inform users and regulators on the performance of service providers. In practice, considering the above, it is unlikely that any standard indicator can be relevant at EU level, without in depth explanation or qualification of the context and tariff policy.

Indicator	Units	Intension
Residential fixed component of tariff - wastewater	EUR/connection/year	Any fixed component of the residential tariff (total amount).
Residential average bill	EUR/connection/year	The average wastewater bill of a residential user
Industrial/commercial fixed component of tariff - wastewater	EUR/connection/year	Any fixed component of the Industrial/commercial tariff (total amount).
Industrial/commercial average bill	EUR/connection/year	The average wastewater bill of an Industrial/commercial user.

1.9.2. Price vs. Inflation

With the performance indicators of governance, the profitability or cost recovery of wastewater operators is an additional factor. The proposed indicators below can characterise the economic performance of a wastewater operator and its sustainability over time.

Indicator	Units	Intension
Annual % change in average price for a unit of wastewater treated – charged to end users	%	Compared to the previous year, the average percentage change in a unit of wastewater treated.
Price change/inflation	Ratio	The change in wastewater treatment prices vs inflation expressed as a ratio.

Another valuable indicator measures recovery of operating costs. It can be defined as below.

Indicator	Units	Intension
Operating Cost Coverage	%	Total annual operational revenues/Total annual. operating costs

1.10. Performance Indicators: Social

Social indicators consider the quality of service, the number of employees, and the salaries of employees by gender and position. Affordability of wastewater services is a relevant indicator monitored by EBC. However, as a standard indicator, the concept raises a number of practical issues: as discussed above, costs for consumers may be inaccurately captured; moreover, data on households' income may not be available at the appropriate level of disaggregation. These data would have to be collected in order to make the best of use of the indicator.

1.10.1. Quality of service

Quality of service comprises two aspects: the level of service being provided, and the feedback received about that service. The table below presents the quality of service according to the level of treatment. However, this could be considered redundant with the previous indicator on compliance with the UWWTD.

Indicator	Units	Intension
Access	%	The percentage of resident population in the service area of the wastewater operator that is connected to the sewer system managed by the operator. Excluding IAS.
Wastewater – at least primary treatment[5]	%	Proportion of collected sewage that receives at least primary treatment.
Wastewater primary treatment only[6]	%	Proportion of collected sewage that receives primary treatment only.
Wastewater secondary treatment or better[7]	%	Proportion of collected sewage that receives at least secondary treatment.

The indicator on complaints captures customers' satisfaction, which can depend on the level of treatment and on a range of other variables, such as flooding, odour, or aesthetic pollution.

Indicator	Units	Intension
Complaints about wastewater services	No./1000 inhabitants/year	Total number of wastewater complaints per year compared to the size of the population in the service area

1.10.2. Staffing Levels

Staffing levels is a valuable indicator, it can capture resource allocation (in)efficiencies, but its interpretation can be complex. In some countries or contexts, over-staffing reflects a situation where the wastewater service provider is seen as providing labour opportunities for low skill personnel, potentially at the expense of productivity or investment. An alternative way to capture a similar level of performance is through labour costs.

Indicator	Units	Intension
Staff WW/'000 WW conn	#/'000 WW conn	Total number of staff expressed as per thousand connections.
Staff WW/'000 WW pop served	#/'000 WW pop served	Total number of staff expressed as per thousand people served.
Labour Costs vs Operational Costs	%	Total annual labour costs (including benefits) expressed as a percentage of total annual operational costs.
*Disaggregated by gender.		

Staffing Salaries

Staff salaries by gender captures some important features of the labour policy or biases of the service operator. A ratio of the first two indicators reflects gender balance and equity of treatment.

Indicator	Units	Intension
Average Annual Salary	EUR/year	The average salary paid to staff.
Average Women Salary	EUR/year	The average salary paid to women.
Revenue per staff	EUR/person/year	The revenue of the wastewater operator per number of staff working at the wastewater operator.

Annex A. Process indicators used by IBNet

Below is IBNet's survey for process indicators related to governance.

Table A A.1. Process indicators

INDICATOR	CATEGORIES
What best describes the utility's planning process?	Setting budgets for next year A multi-year plan that identifies targets and resources for change and improvement Neither of the above (Describe....)
The management of your utility undertakes the following: - Has a skills and training strategy for all staff? - Has an annual appraisal and target setting system for managers? - Has an annual appraisal and target setting system for all staff? - Has a reward and recognition programme for all staff? - Has the ability to recruit and dismiss staff (within an agreed plan)?	 Yes / No Yes / No Yes / No Yes / No Yes / No
- Who has general oversight of the utility's services and prices?	Local, regional or national government department Independent board of stakeholders Independent service & price regulator Other (Describe....)
What are the main sources of finance for investment? - Grants or Government transfers to the utility? - Borrowing from International Financial Agencies (multi or bi laterals)? - Government owned banks? - Commercial banks or bond holders?	 Yes / No Yes / No Yes / No Yes / No
- Does the utility offer more than one level of service for household or shared water supplies?[1] - Does the utility offer more than one level of sanitation or sewerage service/ technology for households?[2] - Does the utility offer a flexible / amortized repayment option to spread the costs of connection to the water and/or sanitation network? - How does the utility find out the views of its customers? - Letters, telephone calls etc. from customers - Inviting customers' views through radio, TV or other publicity - Questionnaire Survey - Other	Yes / No / Not applicable Yes / No / Not applicable Yes / No / Not applicable Yes / No Yes / No Yes / No Yes / No (Describe...)

Note 1. Excluding free standpipes
Note 2. Excluding free public toilets

References

EU Commission, Country profiles on urban wastewater treatment (europa.eu), https://water.europa.eu/freshwater/countries/uwwt

Eureau (2021), Europe's water in figures.

GWI (2022), tariff database

OECD (forthcoming 2022) Transparency and the performance of wastewater collection and treatment services

Notes

[1] Based on a personal communication from Torsten Franz, project manager, Aquabench GmbH

[2] IBNet would be the authors' choice of database, but the key message is that the utilities report data to their national regulator where it can be made available.

[3] Preferred indicators appear in bold.

[4] Data collected at facility level could be compiled at utility level.

[5]IBNet: Involving settlement with the intention of removing solids, but not biological treatment. Both lagoon and mechanical treatment can be included, where appropriate

[6] IBNet: Involving settlement with the intention of removing solids, but not biological treatment. Both lagoon and mechanical treatment can be included, where appropriate.

[7] IBNet: Removing oxygen demand as well as solids, normally biological. Both lagoon and mechanical treatment can be included, where appropriate.