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PART 5: WWTP ENERGY ASSESSMENT
METHODOLOGY AND ASSESSOR
REQUIREMENTS
(REVISED VERSION)

CLIENT

Ministry of Agriculture of the Czech
Republic



MINISTERSTVO ZEMĚDĚLSTVÍ

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VYSOKÁ ŠKOLA
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SDRUŽENÍ OBORU VODOVODŮ A KANALIZACÍ ČR



UNICORN

National Implementation Programme for the Urban Wastewater Treatment Directive

Part 5: WWTP ENERGY ASSESSMENT - METHODOLOGY AND ASSESSOR REQUIREMENTS

Client: Czech Republic - Ministry of Agriculture



Contractors: Czech Technical University in Prague



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1 Executive Summary

This part of the National Implementation Programme presents a proposed national framework for carrying out energy assessments of urban wastewater treatment plants and their associated collecting systems under Article 11 of Directive (EU) 2024/3019 of the European Parliament and of the Council. Energy audits are to be carried out every four years and are to identify cost-effective opportunities to reduce energy consumption, increase the use and generation of energy from renewable sources, produce biogas, and recover and use waste heat while reducing greenhouse gas emissions.

Energy assessment of wastewater treatment plants requires not only general expertise in energy but also detailed knowledge of wastewater treatment technology, sludge management, the operation of collecting systems, and measurement and control systems. The proposal therefore assumes that the process component of the energy audit will be prepared or professionally supervised by a person who meets the specified requirements for education and professional experience in the field of wastewater treatment plants.

The methodology defines the minimum scope of the assessment, input-data requirements, the method for evaluating energy consumption and generation, analysis of process control, the determination of energy indicators, and requirements for proposing measures. The assessment covers both the wastewater treatment plant and the associated collecting system. The depth of the assessment shall be proportionate to the size, technological complexity and energy significance of the individual facilities.

The assessment should result in a transparent and verifiable report containing an energy balance, identification of the main energy consumers and sources, an evaluation of energy efficiency, and proposed technical, operational and organisational measures. The proposed measures shall be evaluated in terms of capital and operating costs, energy savings, increased generation of energy from renewable sources, the impact on greenhouse gas emissions, and life-cycle costs.

The proposal also addresses cases of divided ownership of treatment plants and collecting systems, the unavailability of some operational data, and the transfer of selected results to the VÚPE system. The objective is to establish a uniform framework that is technically sufficient, administratively practicable and usable not only for compliance with the Directive, but also for preparing specific investment and operational measures.

2 Introduction and Purpose of the Document

This document presents draft legal provisions and an associated technical methodology for carrying out energy audits of urban wastewater treatment plants and their associated collecting systems under Article 11 of Directive (EU) 2024/3019 of the European Parliament and of the Council concerning urban wastewater treatment.

The document is a technical proposal intended for further legislative and methodological development. In particular, it proposes the division of responsibilities between an energy specialist and a qualified expert familiar with wastewater-treatment processes, the professional-qualification requirements for that expert, the minimum scope of the audit, and rules for carrying out an audit where the treatment plant and associated collecting system have multiple owners or operators.

The proposed methodology supplements the general criteria for energy assessment with requirements specific to the operation of wastewater treatment plants. In addition to assessing energy equipment, it includes analysis of treatment processes, operational control, sludge management, biogas production, the use of waste heat, renewable energy sources, and energy-significant equipment within the collecting system.

3 Draft Legal Framework - Energy Assessments of WWTP Balancing Units

§ 1

Subject Matter

(1) This part of the Act (Decree) lays down the professional-qualification requirements and the procedure for maintaining a list of persons authorised to provide the process expertise required for energy assessments of the process component of WWTPs and WWTP balancing units (hereinafter an "energy assessment") under Article 11 of Directive (EU) 2024/3019 of the European Parliament and of the Council concerning urban wastewater treatment.

(2) Where a wastewater treatment plant forms part of an energy management system for which an energy audit is prepared under Act No 406/2000 Coll. on Energy Management, as amended, the energy assessment of the WWTP process component under this Decree shall form part of that energy audit. The process component shall be prepared within the scope and with the particulars specified in Annex 1 and shall be provided by a person authorised to carry out energy assessments who meets the requirements of Section 2.

§ 2

Eligibility of the Qualified Expert Carrying Out the Energy Assessment

(1) An energy assessment may be carried out by a natural person entered in the list of persons authorised to carry out energy assessments maintained by the Ministry of Agriculture.

(2) A natural person may be entered in the list if that person:

- a) has a university degree in a technical field and at least five years of experience in the design, operation, development, testing or technical supervision of wastewater treatment plants; or
- b) has completed secondary technical education with a school-leaving examination and has at least ten years of experience as specified in point (a).

(3) The natural person referred to in subsection (1) shall carry out the energy assessment personally.

Application for registration and assessment under a procedure equivalent to that applicable to technical auditors

§ 3**List of Qualified Experts Authorised to Carry Out Energy Assessments**

(1) The Ministry of Agriculture shall maintain a public list of natural persons authorised to carry out energy assessments who have met the requirements of Section 2 and have been entered in the list.

(2) An applicant for entry in the list under subsection (1) shall submit to the Ministry a written application containing:

- a) the applicant's given name or names, surname, date of birth and residential address, or residential address abroad, where applicable;
- b) a copy of a document evidencing the education attained;
- c) documents evidencing the professional experience required under Section 2(2);

(3) The Ministry shall enter in the list an applicant who meets the requirements of Section 2.

(4) The Ministry shall update the list referred to in subsection (1) regularly and publish it in a manner allowing remote access.

§ 4**Removal from the List**

The Ministry shall remove from the list a person authorised to carry out WWTP energy assessments where:

- a) a serious error in carrying out or preparing an energy assessment has been demonstrated; or
- b) the person requests removal.

§ 5**Commissioning the Energy Assessment, Cooperation and the Costs of Its Preparation**

(1) The WWTP owner shall commission the energy assessment from a person authorised under Section 2 and coordinate its preparation, unless the owners of the facilities included in the balancing unit agree to appoint another coordinator.

(2) The owners and operators of facilities included in the balancing unit shall provide the coordinator and the person carrying out the energy assessment with the data and access to the facilities necessary for its preparation.

(3) The costs of preparing the energy assessment shall be borne by the owners of the facilities included in the balancing unit. Unless otherwise agreed, each owner shall bear the costs directly attributable to the assessment of the part owned by that owner. The costs of activities common to several parts of the balancing unit shall be allocated in proportion to the average annual final energy consumption of the facilities owned by the respective owners over the last three complete calendar years. Where this consumption is not metered separately, a qualified estimate by the person carrying out the energy assessment shall be used.

§ 6**Completion, Submission and Review of the Energy Assessment**

(1) Where the necessary data are not provided, the person carrying out the energy assessment shall determine the energy consumption of the affected part by means of a qualified estimate. Failure to provide data or access to a facility shall not prevent completion and submission of the energy assessment.

(2) The energy assessment shall be deemed completed when it is submitted to the coordinator by the person authorised under Section 2. The consent or approval of all owners or operators of facilities included in the balancing unit shall not be a condition for completion or validity of the energy assessment.

(3) Relevant data from the energy assessment shall be transferred to VÚPE.

(4) The Ministry of Agriculture may review completed WWTP energy assessments.

Annex 1 - Minimum Requirements for Energy Assessments of Urban Wastewater Treatment Plants

A. Objective of the Energy Assessment

The energy assessment of the process component of urban wastewater treatment plants (hereinafter the "energy assessment") is a systematic procedure for obtaining sufficient knowledge of the energy-consumption profile of a wastewater treatment plant, identifying and quantifying opportunities for cost-effective energy savings, identifying the potential for cost-effective use or generation of energy from renewable sources, and reporting the findings. The energy assessment includes identification of the potential for cost-effective measures to reduce energy consumption and increase the use and generation of energy from renewable sources, with particular emphasis on identifying and exploiting the potential for biogas production or the recovery and use of waste heat, either on site or through a district energy system, while reducing greenhouse gas emissions. In addition to the wastewater treatment plant itself, the assessment shall include the associated collecting system.

B. Scope of the Energy Assessment

The energy assessment shall cover:

1. The wastewater treatment plant - all treatment and auxiliary processes from the wastewater inlet through the final effluent and sludge processing, including supporting equipment such as pumps, blowers, mixers, dewatering equipment, heating, instrumentation and control.
2. The associated collecting system - pumping stations, transfer facilities and other equipment where these are operationally or energetically connected to the WWTP.
3. Energy sources and consumers - biogas production, combined heat and power generation, heat pumps, photovoltaic systems, heat recovery, building heating and similar systems.
4. Control and automation systems - operational strategies, control systems, sensors, and control based on water quality, time cycles or loading.
5. The energy assessment shall cover the last three complete calendar years.

C. Minimum Content of the Energy Assessment

The energy assessment shall contain at least the following sections:

1. Identification Data and Definition of Boundaries
 - identification of the facility, its capacity and loading;
 - definition of the system boundaries, including the collecting system;
 - definition of the scope for which the balancing framework will be established;

- a list of the owners and operators of the parts of the collecting system and the WWTP included in the balancing unit.
2. Analysis of Energy Consumption and Equipment Efficiency
 - an overview of all major energy uses by process unit, including the aeration system and collecting system;
 - the efficiency and condition of machinery and equipment, including pumps, blowers, mixers, sludge-dewatering equipment and heating systems;
 - an assessment of equipment-upgrade options, such as variable-speed drives, frequency converters and replacement of machinery with more energy-efficient units.
 3. Analysis of Energy Generation and Renewable Energy Sources
 - biogas, heat and electricity generation, energy recovery, photovoltaics and the potential for additional generation;
 - an assessment of the potential use of sludge, waste heat, heat pumps and other sources.
 4. Analysis of Process Control
 - operational strategies and control, including dissolved oxygen, recirculation, loading, retention times, SBR phases and aeration distribution;
 - identification of inefficient or excessively energy-intensive operating modes;
 - proposed alternative operating parameters and control methods capable of reducing energy consumption without impairing effluent quality.
 5. Evaluation of Energy Efficiency and Self-Sufficiency
 - calculation of the principal energy indicators, for example kWh·PE⁻¹·year⁻¹ and kWh/m³;
 - assessment of energy efficiency against reference values and comparable facilities;
 - evaluation of energy self-sufficiency as the ratio of generation to consumption.
 6. Proposed Improvement Measures
 - a list of recommended technological, mechanical, organisational and operational measures;
 - for each measure: a description, capital cost, benefit (reduced consumption, increased energy generation and quantified GHG reduction), payback period, contribution to the energy-neutrality milestones, and life-cycle cost of the measure.
 7. Final Report
 - a summary of the main results, recommendations and priorities;
 - a proposed boundary for the balancing framework used to calculate energy neutrality;
 - a list of indicators and recommendations for monitoring development over time;

- a list of the parts of the balancing unit for which complete supporting information was not obtained and whose energy consumption was determined by qualified estimate.

D. Quality and Proportionality Requirements

The energy assessment shall be:

- based on actually measured or credibly determined data;
- transparent and verifiable, including identification of data sources and calculation methods;
- understandable to both the owner and operator, including a summary and visual overview of the results;
- proportionate to the size and complexity of the facility;
- prepared so as to provide a basis for planning measures and for the energy-neutrality balancing calculations.

The depth of the energy assessment shall be proportionate to the size and complexity of the facility; however, even a simplified energy assessment shall contain the minimum scope specified in Part C.

Where supporting information is unavailable, an ownership-defined part of the connected collecting system may be assessed in a simplified manner using a qualified estimate, provided that its average annual final energy consumption does not exceed 5% of the total average annual final energy consumption of all energy-consuming facilities in that collecting system. The combined consumption of all parts assessed in this manner shall not exceed 20% of that total consumption.

Where neither the consumption of the affected part nor the total consumption of the collecting system is metered separately, it may be determined by a qualified estimate. The estimate shall be based in particular on installed power and operating hours, pumped volume and pumping head, operating records, design parameters, or data for a comparable facility.

A part assessed in a simplified manner shall not be excluded from the boundary of the balancing unit. Its estimated consumption shall always be included in the total energy balance and in the calculation of the relevant energy indicators.

Where the share of a single part exceeds 5%, or the combined share of parts assessed using substitute data exceeds 20%, the energy assessment shall nevertheless be completed within the applicable deadline. The report shall identify this circumstance as a significant uncertainty and specify the data and facility components that are to be verified subsequently.

E. Recommended Methodologies

The following methodologies, in particular, shall be considered to meet the requirements of this Annex:

- DWA-A 216:2020 "Energy Assessment of Wastewater Treatment Plants";
- CWA 17357:2018 (ENERWATER);
- TNI CEN/TR 17614.

Another methodology may be used provided that it ensures a comparable level of detail and assessment quality.

F. Energy Assessment Deliverable

The deliverable of the energy assessment shall be a report that:

- contains the assessment results under Parts A to E;
- summarises the recommendations and proposed measures, including their benefits and costs;
- contains a proposed boundary for the balancing framework used to calculate energy neutrality;
- provides an overview and the sources of the principal indicators, efficiencies and benchmarks;
- is understandable and suitable for decision-making by the owner or operator.

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4 Concluding Summary and Relationship to European Methodologies

The proposed framework responds to the requirement of Article 11 of Directive (EU) 2024/3019 that energy audits (assessments) of urban wastewater treatment plants and their associated collecting systems be carried out at least once every four years. The purpose of the assessment is not merely to compile an energy balance, but above all to identify technically feasible and cost-effective measures to reduce energy consumption, increase the use and generation of energy from renewable sources, exploit the potential of biogas and waste heat, and reduce greenhouse gas emissions.

General energy-assessment requirements must be supplemented by a process evaluation of wastewater treatment. WWTP energy consumption is significantly affected by the required treatment level, loading, aeration method, sludge management, process control and the characteristics of the associated collecting system. For this reason, the involvement of a qualified expert with demonstrable experience in WWTP design, operation or optimisation is proposed.

The proposal builds in particular on the general energy-audit criteria under Directive (EU) 2023/1791, Czech legislation on energy audits, the DWA-A 216 methodology, and CEN/TR 17614, which is based on the ENERWATER project. These sources provide a suitable framework for data collection, boundary definition, benchmarking and identification of the principal energy uses, but they do not replace a detailed process assessment of the specific WWTP.

The JRC materials used demonstrate the significance of energy consumption in the European wastewater-treatment sector and the potential for reducing it, but do not provide a separate binding methodology for carrying out audits under Article 11. EWA materials and technical activities are an important source of European experience and interpretations of the new Directive; however, the binding minimum scope of the audit must be based primarily on the relevant directives, national legislation and applicable technical standards.

The proposed thresholds for simplified assessment of separately owned parts of a collecting system constitute a national methodological rule. Their purpose is to prevent the unavailability of partial data from making it impossible to complete an audit, not to exclude the relevant parts from the energy balance. Before these thresholds are definitively established, their applicability should be verified using a set of collecting systems of different sizes and ownership arrangements.

Before the legislative framework is finalised, it will be necessary to define precisely the relationship between the energy specialist under Act No 406/2000 Coll. and the qualified expert responsible for the WWTP process component, responsibility for the final report, the quality-control procedure, the scope of data transferred to VÚPE, and the link between audits and the planning and subsequent evaluation of implemented measures.

5 Sources and References

1. **Directive (EU) 2024/3019 of the European Parliament and of the Council** of 27 November 2024 concerning urban wastewater treatment, in particular Article 11.
2. **JRC**: technical materials under preparation or available for the implementation of Article 11 of the UWWTD.
3. **Directive (EU) 2023/1791 of the European Parliament and of the Council** on energy efficiency, in particular Article 2(32), Article 11 and Annex VI.
4. **Act No 406/2000 Coll. on Energy Management**, as amended.
5. **Decree No 140/2021 Coll. on Energy Audits**.

6. **DWA-A 216:2015-12.** *Energy Check and Energy Analysis – Instruments to Optimise the Energy Usage of Wastewater Systems.*
7. **CEN/TR 17614:2021.** *Standard method for assessing and improving the energy efficiency of waste water treatment plants.*
8. **Longo, S. et al. (2019).** *ENERWATER – A standard method for assessing and improving the energy efficiency of wastewater treatment plants.* Applied Energy, 242, 897–910.
9. **Pistocchi, A. et al. (2019).** *Opportunities to improve energy use in urban wastewater treatment: a European-scale analysis.* JRC.
10. **European Water Association.** *Position Paper on the Urban Waste Water Treatment Directive and related technical outputs of the Energy Neutrality Working Group.*