

**TERMS OF REFERENCE**

**Conceptual Design of the Plant for Waste-to-Energy Utilization and Sewage Sludge Incineration in Ljubljana, at Locations TE-TOL and RCERO**

Ljubljana, July 2024

Table of Contents

[1 INTRODUCTION 3](#_Toc171058564)

[2 PROJECT LIMITS 3](#_Toc171058565)

[2.1 Modifications of the existing mechanical municipal waste treatment in RCERO and logistics of supply of OEIO 3](#_Toc171058566)

[2.2 Waste to energy plant TEO Ljubljana 3](#_Toc171058567)

[2.3 Waste supply of TEO Ljubljana 4](#_Toc171058568)

[2.4 Waste storage of TEO Ljubljana 4](#_Toc171058569)

[2.4.1 Sewage slufdge drying 5](#_Toc171058570)

[2.5 Off gas treatment 5](#_Toc171058571)

[2.6 Off water treatment 5](#_Toc171058572)

[2.7 Emission limit values 5](#_Toc171058573)

[2.8 Water treatment at location RCERO 5](#_Toc171058574)

[3 SCOPE OF SUPPLY 5](#_Toc171058575)

[3.1 Modifications of the existing mechanical municipal waste treatment in RCERO and logistics of supply of TEO Ljubljana with RDF and sewage sludge 6](#_Toc171058576)

[3.1.1 Phase 1: basic concept of mechanical treatment and storage of waste: 6](#_Toc171058577)

[3.1.2 Phase 2: engineering solution for mechanical treatment of waste, waste storage and logistics of supply of TEO Ljubljana 6](#_Toc171058578)

[3.2 Waste to energy plant TEO Ljubljana 7](#_Toc171058579)

[3.2.1 Phase 1: basic concept of TEO Ljubljana 7](#_Toc171058580)

[3.2.2 Phase 2: engineering solution of TEO Ljubljana 8](#_Toc171058581)

[3.3 Conceptual design of the plant for collection of residues and stabilization of non-recyclabe residues: 9](#_Toc171058582)

[3.3.1 Phase 1: basic engineering solution for collection of residues and stabilization of non-recyclabe residues 9](#_Toc171058583)

[3.3.2 Phase 2: engineering solution of the stabilization plant for collection of residues and stabilization of non-recyclabe residues 9](#_Toc171058584)

[4 EXECUTION OF WORKS 10](#_Toc171058585)

[5 OBLIGATIONS OF THE CONTRACTING ENTITY 10](#_Toc171058586)

[6 REQUIREMENTS OF THE CONTRACTING ENTITY 10](#_Toc171058587)

# INTRODUCTION

The modern waste-to-energy (WtE) plant is planned to be built in the city of Ljubljana in Slovenia, TEO Ljubljana. The WtE plant shall be designed as a combined heat and power plant (CHP) utilizing residues of treated municipal waste and sewage sludge in fluidised bad incinerators with flue gas cleaning and waste water treating lines.

In accordance with the Waste treatment policy of the Republic of Slovenia, RCERO Ljubljana and other committed centres shall supply TEO Ljubljana with pretreated municipal wastes. Waste water treatment facilities from the same areas will aslo supply TEO Ljubljana with dewatered sewage sludge.

The WtE plant Ljubljana shall generate hot water for district heating and electrical power.

The location of TEO Ljubljana shall be selected according to Spatial planning act (ZUREP-3) assessing two locations:

1. TE-TOL: the location next to the existing coal fired combined heat-and-power plant at Zaloška cesta;
2. RCERO: the location at the north side of the largest waste treatment centre in Slovenia, RCERO Ljubljana.

The technical documentation prepared for TEO Ljubljana at location TE-TOL shall be upgraded with additional incineration of sewage sludge. The same technical solution of TEO Ljubljana as for TE-TOL shall also be prepared for RCERO location.

# PROJECT LIMITS

## Modifications of the existing mechanical municipal waste treatment in RCERO and logistics of supply of OEIO

The modifications of mechanical waste treatment in RCERO selected in the preliminary study shall be upgraded in line with decision of RCERO to replace combination of heavy fraction and fugate with digestate, EWC 19 06 04.

The homogenization of both RCERO products, RDF and digestate, will be located in RCERO suppling TEO Ljubljana with only one oven ready waste.

## Waste to energy plant TEO Ljubljana

When built, TEO Ljubljana shall utilize 140.000 t/year of nonrecycklable municipal waste with the following properties:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | IWC code | Quantities | Heating value | Moisture | Ash |
|  | t/leto | MJ/kg | % | % d.m. |
| RDF RCERO | 19 12 12 | 76.000 | 15,6 | 27,75 | 14,90 |
| Digestate RCERO | 19 06 04 | 34.000 | 6 | 36 | 55 |
| RDF other | 19 12 12 | 30.000 | 15,0 | 25 | 20 |
| **TOTAL** |  | 140.000 | 13,14 | 29,16 | 25,73 |

Besides municipal waste, TEO Ljubljana will also consume dewatered sewage sludge from municipal waste water treating plants, IWC 19 08 05 in the expected amount of 50.000 t/year containing between 75 % and 80 % of moisture.

The incineration of sewage sludge shall take place in:

* The separate monoincineration boiler with fluidised bad furnace with corresponding unit for sewage sludge drying, off-gas treatment line and devices for separate collection of solid residues dedicated for phosphorous recovery or further treatment before landfiling.
* As co-incineration with municipal waste in the steam boilers that shall be used in cases of malfunction or maintenance of monoincineration boiler.

The boilers shall generate superheated steam that will be used for power generation and to heat the water from district heating system. Part of the heat shall also be used for sewage sludge drying before entering the monoincineration boiler.

The technological solution of TEO Ljubljana can be equal for both locations, RCERO and TE-TOL.

The natural gas supply lines will be provided at both locations for sturt-up and shut-down procedures.

## Waste supply of TEO Ljubljana

TEO Ljubljana will collect and utilize only:

1. Oven ready municipal waste from RCERO and other centres;
2. Waste from RCERO will be delivered to TEO Ljubljana throughout the entire year;
3. Waste from other centres will be delivered to TEO Ljubljana only when needed – in the heating season;
4. Sewage sludge only from committed area.
5. Frequency of sewage sludge acceptacnce shall be defined in accordance with limitations of storages of TEO Ljubljana and waste water treatment centres.

As selected in the preliminary study, at TE-TOL, the entire quantiy of waste shall be supplied by trucks.

At RCERO site, the waste shall be delivered:

* RCERO waste directly by the pipe conveyor and, in case of conveyor failure, an alternative solution shall be designed.
* RDF from other centres and sewage sludge shall be delivered to TEO Ljubljana by trucks to the tipping hall.

## Waste storage of TEO Ljubljana

The solution for waste storage shall be similar for both locations:

* For municipal wastes as selected in the preliminary study;
* A new storage for sewage sludge shall be designed with the capacity that will allow undisturbed operation of monoincinerator for at least 5 days.

### Sewage slufdge drying

The delivered sewage sludge will contain between 75% and 80 % of moisture. In order to maintain the continous self sustaining incineration process in the monoincinerator, the sewage sludge shall be properly dried before entering the boiler's furnace.

The heat for drying shall be generated mainly by monoincineration.

To prevent the odour emission, the throughair from sewage sludge drying shall be either properly treated or used as a primary air for incineration.

## Off gas treatment

The off-gas treatment system designed in the preliminary study shall be adjusted to composition and mass flows of flue gases from boilers incinerating sewage sludge and municipal waste.

A new flue gas treatment line shall be installed for sewage sludge monoincinerator. The line shall include the combination of dry and wet off gas treatment techniques and shall be able to operate independently.

At the end, it is desired that all three off gas treatment lines provide the same emission values into air.

## Off water treatment

The off-water treatment system designed in the preliminary study shall be adapted to new quatities of water adjusted to incineration of sewage sludge in addition to municipal waste.

## Emission limit values

For emissions in air and in water, the same emission limit values shall be adopted as approved in the preliminary study.

## Water treatment at location RCERO

At location TE-TOL, the demineralized water will be prepared in the existing water treatment plant.

At location RCERO, TEO Ljubljana shall also incorporate the new water treatment plant for boiler water as well as for water for district heating network. The primary source of fresh water shall be the public water supply network of Ljubljana.

# SCOPE OF SUPPLY

The estimated scope of supply shall be divided into two phases:

1. Phase 1: preparation of the basic concept of the study that shall include at least:
   * reassessment of the preliminary study in terms of required modifications for waste treatment in RCERO, waste to energy utilization in TEO Ljubljana, logistics of supply, waste storage and stabilization of solid residues;
   * available quantities and properties of municipal waste and sewage sludge;
   * available space, properties and requirements of the location at RCERO.

The main purpose of the Phase 1 shall be the definition of basic concepts. The confirmed concepts shall represent the bases for further work throughout the entire project.

1. Engineering solutions for waste treatment in RCERO and at both locations: logistics of supply, waste storage, waste-to-energy utilization with off gas and off water treatment, collection and stabilization of solid residues. The engineering solutions should represent the foundation for the preparation of the permitting documents. The clarification of the extent of the permitting work will be done by the local consultants, which will also be responsible to translate the prepared technical reports and to conclude and condition the permitting document according to the requirements of local authorities.

At the end of each phase, the supplier shall prepare a report in either Slovene or English language and mail it to the Contracting Entity in electronic form. The text shall be prepared in MS Word format, spreadsheets in MS Excel and drawings in DWG or Solid Works (3D models) format.

Results of each phase and some intermediate results should also be presented at the meeting / workshop organized by the contracting entity. Dates and locations of meetings shall be mutually agreed by both parties.

## Modifications of the existing mechanical municipal waste treatment in RCERO and logistics of supply of TEO Ljubljana with RDF and sewage sludge

### Phase 1: basic concept of mechanical treatment and storage of waste:

The Phase 1 of the modification of RCERO with logistics of supply shall include the review and reassessment of the solutions adopted in the preliminary study:

1. Revision of solutions approved in the preliminary study:

* Mechanical waste treatment in RCERO Ljubljana;
* Homogenization of RCERO products and their storage in RCERO;
* Despatching of RCERO products and logistics of supply of TEO Ljubljana at each location.

1. Elaboration of options of conceptual solutions of waste treatment in the period of RCERO's reconstruction

### Phase 2: engineering solution for mechanical treatment of waste, waste storage and logistics of supply of TEO Ljubljana

The final engineering solution for mechanical treatment of waste in RCERO , waste storage and logistics of supply of TEO Ljubljana will contain:

1. A block diagram of mechanical treatment of waste after the modification of RCERO;
2. A mass flow diagram and mass balance of mechanical treatment of waste after the modification of RCERO;
3. Homogenization and storage of of products in the existing daily storage of RCERO;
4. Logistics of supply of TEO Ljubljana with RCERO products with regard to location:

* TE-TOL: modification of solutions adopted in the preliminary study, if needed (besides fugate that is omitted);
* RCERO: products will be supplied to TEO Ljubljana continuously using pipe conveyor. A solution for back-up supply of TEO Ljubljana with waste shall also be considered for malfunction of pipe conveyoir.

1. Modification of plans and drawings adopted in the previous study;
2. Technical description of RCERO modification for public and technicians that will allow further and more detailed elaboration of selected modifications: construction design, electrical and mechanical installations, etc. The description shall also include eventual modifications in air conditioning systems.
3. Evaluation of elaborated options of conceptual solutions of waste treatment in the period of RCERO's reconstruction and seslection of the most suitable one. Location specific conceptual design of the selected option.
4. Provisional calculation of investment and operating costs (CAPEX & OPEX) in an xlsx-calculation sheet.
5. Preparation of a provisional overall time schedule (in xlsx-format) for the implementation of the planned measures – considering the fact, that during the modification of RCERO the waste treatmetment shall remain in operation without any major disturbances.

## Waste to energy plant TEO Ljubljana

### Phase 1: basic concept of TEO Ljubljana

1. Definition of mass flows, physical and chemical properties of municipal waste and sewage sludge;
2. Waste delivery and acceptance at TEO Ljubljana at locations:

* TE-TOL: reassessment of solutions approved in the preliminary study;
* RCERO: upgrade of the solution adopted in the preliminary study with pipe conveyor for RCERO products;

1. The capacity of waste storage shall be at least similar at both locations:

* RDF: the capacity can remain the same as designed in the preliminary study;
* sewage sludge: at least 5 days of operation shall be enabled without any additional delivery;

1. Definition of the load diagram:

* of the boiler for municipal waste that shall also be able to utilize required quantities of sewage sludge with expacted properties;
* of the boiler for monoincineration of required quantities of sewage sludge with expacted properties;

1. The expected emission limit values in air and water shall remain at least similar to values adopted in the preliminary study;
2. A brief/basic technical description of TEO Ljubljana and its operation.

### Phase 2: engineering solution of TEO Ljubljana

The phase 2 shlould include the following documents:

1. Calculations of dimensions of main equipment and process steps for both locations:

* Modification of solutions from the preliminary study to co-incinerat sewage sludge with municipal waste in the same boilers;
* Monoincineration of sewage sludge in a separate boiler with sludge drying and separate off gas treatment line, collection and storage of residues appropriate for phosphorous extraction;

1. Technological schemes of TEO Ljubljana with identification of main process parameters and main mas&energy balance points;
2. P&I diagrams with KKS numbers of the main equipment;
3. General technical description for public and technicians for both locations with descriptions of differences for each location.
4. 3D model and 2D drawings for WtE arrangement for each location[[1]](#footnote-1). The drawings shall include at least main pipes and ducts with diameter > 500 mm or comparable dimensions.
5. Component list including essential descriptions and data (bulk mass, electrical power demand, etc.). I different, the list shall be made for each location.
6. The preliminary design and guidance drawings for steel structure as basis for the design of the steel structure by civil engineers. The scale may be selected according to the needs of civil engineers.
7. Mass and energy balances for several operating regimes, for example:

* Waste-to-energy utilization:
  + 100 % load, only RDF;
  + 100 % load, RDF and max. quantity of sewage sludge;
  + Partial load, only RDF;
  + Partial load, RDF and sewage sludge;
* Monoincineration of sewage sludge:
  + 100 % load;
  + Partial load;

1. Expected sources of noise together with basic descriptions of measures adopted in order to prevent their environmental impacts;
2. Odour emission prevention and reduction according to BAT conclusions for waste incineration 2019/2010 that will be able to meet the requirements even at the full stop of TEO Ljubljana;
3. Basic data on maintenance and staff requirements;
4. Cost calculation, CAPEX and OPEX

The technical report of Phase 2 will provide the fundamental information and data for spatial planning process.

## Conceptual design of the plant for collection of residues and stabilization of non-recyclabe residues:

The adopted solution of stabilization and solidification of solid residues of TEO Ljubljana shall be adjusted to modified quantities of residues due to incineration of sewage sludge.

Adjustemnts shall be made for both locations, TE-TOL and RCERO.

### Phase 1: basic engineering solution for collection of residues and stabilization of non-recyclabe residues

Reasessment of the preliminary study solutions in order to find requiremens to their modification.

### Phase 2: engineering solution of the stabilization plant for collection of residues and stabilization of non-recyclabe residues

1. General technical description of stabilization and solidification of residues together with transportation and deposition at landfill. Description shall be made for general public and technicians;
2. Technological scheme and P&I diagrams of residues collection, stabilization and solidification;
3. General component list with basic technical data (bulk mass, electrical power demand, etc.). If different, the list shall be made for each location.
4. General mass and energy balance;
5. OPEX & CAPEX data;

# EXECUTION OF WORKS

The project work is divided in two subsequent phases. The estimated time for each phase is presented in moths and can be reduced in agreement with both parties.

For each completed phase, the tenderer will prepare a report in either Slovene or English language and send it to the Contracting Entity in electronic form. Following, the tenderer wil prepare a presentation thereof at the meeting – workshop. Dates and locations of meetings shall be agreed by both parties.

Text files of the report shall be prepared in MS Word and PDF format. Drawings shall be prepared in DWG or other form compatible format.

The Contracting Entity will review the contractual works of each phase and confirm them in written form at the meeting, or submit substantiated requests for amendments thereat.

For each of the phases, the Contracting Entity will submit the request for the next phase in written form.

After the phase 2, the tenderer will prepare separate technical reports: one for RCERO and one for TEO Ljubljana with stabilization plant. The reports will be submited to the Contracting Entity in electronic form and printed in six (6) copies as three distinctive project files / binders.

The detail work plan is presented in the following table:

| Phase | Title | Conditions for start | Duration |
| --- | --- | --- | --- |
|
| 1 | Basic concepts of waste treatment at RCERO, waste-to-energy utilization in TEO Ljubljana with collection of residues and stabilization of non-recyclabe residues | Contract signature | 6 months |
| 2 | Engineering solution of waste treatment at RCERO, waste-to-energy utilization in TEO Ljubljana with collection of residues and stabilization of non-recyclabe residues | Confirmation of Phase 1 and request for phase 2 | 12 months |

# OBLIGATIONS OF THE CONTRACTING ENTITY

The Contracting Entity will prepare and submit to the selected tenderer the necessary information for the implementation of the task:

1. Plans of both locations in DWG format including the available infrastructure: road connections, pipelines, sewage system, natural gas, electricity, hot water, steam line;
2. Data on available quantities and composition of products of mechanical and biological treatment of municipal waste;
3. Other available information that the selected tenderer will need to successfully complete the task.

# REQUIREMENTS OF THE CONTRACTING ENTITY

The total price is fixed and shall not change.

The execution of the required task shall be paid by phases which the tenderer will define and financially evaluate in his/her tender.

The Contracting Entity may terminate the contract for the implementation of the terms of reference "*Preliminary designof waste-to-energy utilization in Ljubljana*" after the completion of any phase of the project, if at some phase of the project, the Contracting Entity and the tenderer establish, on the basis of a review of the report and its presentation, that the construction of TEO LJUBLJANA at available locations is not possible or reasonable.

In such case, the Contracting Entity shall pay the tenderer for any completed phases of the project.

1. As the advantages and disadvantages of both locations shall be compared, the WtE equipment arrangement shall be the same at both locations. [↑](#footnote-ref-1)