HOOP OPEN MARKET CONSULTATION PROSPECTUS

The EU Bioeconomy Strategy sees cities becoming major circular bioeconomy hubs, where biowaste is a feedstock for safe and sustainable bio-based products.

LIPOR – Municipalities Association for Sustainable Waste Management of Greater Porto – is committed to developing a circular economy strategy in alignment with European and national policies, such us the European Circular Economy Action Plan, Circular Economy Action Plan for Portugal and the 2030 Agenda for Sustainable Development. LIPOR strongly advocates that "waste" should be managed as a "resource", which would see waste material regenerated and restored, becoming part of the value chain. However, the availability of fit-for-purpose and efficient technologies is still a major gap.

Therefore, LIPOR intends to take action to optimize the anaerobic digestion for urban biowaste (mainly kitchen waste) and the related wastewater treatment facility to treat the effluent in a way that the liquid fraction from the dewatered digestate (effluent), that is not to be recirculated to the anaerobic digestor, is treated to both comply with the discharge requirements and to recover phosphorus and ammoniacal nitrogen, producing a marketable product. As a secondary objective, the capacity of the nutrient recovery module would even be extended to the entire liquid fraction of the dehydrated digestate (including the effluent that recirculates towards the anaerobic digester) to improve the control of the digestion process, particularly regarding nitrogen. Both nitrogen and phosphorus are valuable nutrients essential for fertiliser products. This is of interest for regional agriculture. Similar anaerobic digestion plants have a wastewater treatment facility to treat the effluent. However, wastewater treatment facilities in similar plants remove but don't recover ammoniacal nitrogen and phosphorus.

OPEN MARKET CONSULTATION

LIPOR intends to investigate the state-of-the-art, to find out whether technologies are commercially available or under development and the level of coverage of the desired functionalities and performance requirements.

The market consultation involves the proactive analysis of technology offerings and on-going developments and will provide crucial input to the investment plan. The market consultation aims to:

- *find out whether technologies are commercially available and acquire information about the advantages and disadvantages and the level of fulfilment of the desired functionalities, in order to confirm the assumption for the innovation procurement scope;*
- *identify market risks that may endanger business goals and supplier performance;*
- *provide an overview on the intended contract objectives, the tendering process and the main clauses of the contract.*

The open market consultation will be held in the form of:

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- *open meet-the-market event managed in hybrid form after at least 60 days from this notice (the registration to the events will be made available at the HOOP project website https://hoopproject.eu) ;*
- *on-line market survey (that will be made available at the HOOP project website within 40 days of this notice) to be completed by filling and submitting a questionnaire (under a non-disclosure agreement, the collected info will not be revealed in public during event and/or meetings), dates and deadlines will be announced on the HOOP project website https://hoopproject.eu;*

All information regarding the open market consultation including additional meetings, the questionnaire and the information provided during the consultation as well as other background information will be published in due time at the project website (https://hoopproject.eu) and LIPOR's website (https://www.lipor.pt/en/).

The Challenge description

The aim of the intended procurement is twofold: to build an anaerobic digestion plant (with a capacity of 60000 ton per year) and to build a wastewater treatment facility capable to both recover phosphorus and ammoniacal nitrogen from the effluent to make a marketable product and treat the wastewater to comply with discharge criteria.

The desired solution should optimize the trade-off between high nutrient recovery system and compliance of wastewater treatment with discharge requirements.

Baseline information about the operational setting, are provided below:

- Every year, LIPOR treats about 500,000 tons of municipal solid waste (MSW) that are produced by about 1 million inhabitants.
- The future anaerobic digestion plant will have a capacity of 60,000 tons per year. It is expected that this unit will receive a fraction of biowaste (food waste) from a separate collection.
- The anaerobic digestion plant will produce biogas/biomethane and a raw liquid digestate.
- The produced raw liquid digestate is expected to be about 160,000 tons per year
- The raw liquid digestate will be dewatered. The solid part will be composted and used as fertiliser/soil amendment. The liquid part (effluent) will need to be recirculated and/or treated.
- The maximum estimated amount of liquid part (effluent) is around 150,000 m^3/y (cubic meters per year). The open market consultation will concern a treatment capacity module of 25,000 t/year (basic solution which only refers to the excess effluent stream) and a module of 150,000 t/year (solution which refers to the entire liquid fraction of digestate)
- Most of the nitrogen in the effluent is in form of ammoniacal nitrogen (NH4-N).
- LIPOR plans to recirculate a large part of the effluent back to the anaerobic digestor (estimated 125,000 m^3/y).
- High concentrations of ammoniacal nitrogen can inhibit the anaerobic digestion.

- *The untreated effluent (liquid part - effluent) in similar plants has an ammoniacal nitrogen content of 3000 – 4500 mg NH4-N/L.*
- *The untreated effluent (liquid part - effluent) in similar plants has a total phosphorus content of 50 – 250 mg/L (milligrams per litre).*

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The challenge promoted by LIPOR is aimed at identifying a solution to treat an effluent with similar characteristics to the one in Table 1 so that it complies with the requirements in Table 2. As a first goal, the area where the innovation should be adopted is the treatment of the liquid fraction from the digestate after dewatering (effluent), that is not recirculated to the anaerobic digestor, in order to both comply with the discharge requirements and recover nutrients (phosphorus and ammoniacal nitrogen) to make a marketable product. Both nitrogen and phosphorus are valuable nutrients essential for fertiliser products. This is of interest for regional agriculture.

- *The treated effluent needs to have a total nitrogen content lower than 40 mg/L.*
- *The treated effluent needs to have an ammoniacal nitrogen content lower than 30 mg NH4-N/L.*
- *The treated effluent needs to have a total phosphorus content lower than 20 mg/L.*

The expected parameters for the effluent are as follows (Table 1)

Parameter	Unit	Average	Range
pH	Sorensen	8.3	7.8 – 8.8
BOD5 20°C	mg/L O2	3200	1500 – 7800
COD	mg/L O2	15200 (11300)	5400 – 25300 (3000 – 20100 disolved)
TS	%	1.8	0.6 – 2.4
VS	%	56.4	45 – 75
TSS	mg/L	0.9	0.1 – 1.2
Conductivity	µS/cm	24200	8800 – 27600
Nitrogen total	mg/L N	2700	700 – 4600
Nitrogen - ammoniacal	mg/L NH4	3600	1200 – 5000
Phosphorus total	mg/L P	200 (130)	75 – 585 (55 – 350 dissolved)
Alkalinity	Mg CaCO3/L	11500	2300 – 14700
Carbonates	Mg CaCO3/L	720	100 – 2000
Bicarbonates	Mg HCO3/L	13400	2800 – 16700

The innovation need or challenge can be itemised in two elements:

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- functional requirements, that are the basic elements of a needed solutions and describe the original intent, purpose, operation that a solution must be able to perform. These requirements are mapped to the different solution life cycle phases.

- the performance requirements include the measurable KPIs or targets to be achieved implementing a specific function.

TYPE MUST HAVE / NICE TO HAVE	LISTS of functional requirements	RELATED performance requirements
	MUST BE ABLE TO TREAT AN EFFLUENT WITH THE CHARACTERISTICS IN TABLE 1	MUST COMPLY WITH THE PARAMETERS IN TABLE 2
	MUST RECOVER SOME NITROGEN AMMONIACAL	NICE TO RECOVER AT LEAST 40% OF AMMONIA NITROGEN IN THE EFFLUENT
	MUST RECOVER PHOSPHORUS	NICE TO RECOVER AT LEAST 15% OF PHOSPHORUS IN THE DIGESTATE
	MUST ALLOW THE RECIRCULATION OF LIQUID DIGESTATE	
	SHOULD PROVIDE A MARKETABLE PRODUCT CONTAINING THE RECOVERED NUTRIENTS, PREFERABLY A FERTILISER WHICH SHOULD COMPLY WITH ONE OR MORE OF THE CATEGORIES IN FERTILISER PRODUCT REGULATION 2019/1009 AND WITH THE PORTUGUESE FERTILISER LEGISLATION DL 30/2022 AND P185/2022	
	SHOULD BE ECONOMICALLY SUSTAINABLE, BOTH IN TERMS OF INVESTMENT SIZE (CAPEX) AS IN TERMS OF OPERATIONAL COSTS (OPEX). THE DESIRED SOLUTION NEEDS TO OPTIMIZE THE OPEX FOR NUTRIENT RECOVERY ALONG THE ENTIRE LIFE-CYCLE.	TRANSMIT GUARANTEED PERFORMANCES IN TERMS OF ENERGY CONSUMPTION (KWH/M3 OF TREATED EFFLUENT) TRANSMIT GUARANTEED PERFORMANCES IN TERMS OF

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TYPE MUST HAVE / NICE TO HAVE	LISTS of functional requirements	RELATED performance requirements
		CONSUMABLES (TONS OR M3 / M3 OF TREATED EFFLUENT)
	THE DESIRED SOLUTION SHOULD IDEALLY NOT CREATE NEW WASTE STREAMS	

The identified and listed requirements have been validated in comparative terms and prioritized, based on their expected impacts and trends.

The effluent must comply with the following parameters for admission in a wastewater treatment plant (Table 2)

Parameter	Unit	Limit accepted value
pH	Sorensen	6.0 – 9.0
BOD5 20°C	mg/L O2	≤ 500
COD	mg/L O2	≤ 1000
TSS	mg/L	≤ 500
Conductivity	µS/cm	≤ 2000
Nitrogen total	mg/L N	≤ 40
Nitrogen - ammoniacal	mg/L NH4	≤ 30
Nitrates	mg/L NO3	≤ 50
Phosphorus total	mg/L P	≤ 20
Sulphates	mg/L SO4	≤ 2000
Sulphites	mg/L SO3	≤ 1
Sulphides	mg/L S	≤ 1
Chlorides total	mg/L Cl	≤ 150

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Available residual chlorine - free	mg/L Cl2	≤ 0.5
Available residual chlorine - total	mg/L Cl2	≤ 1
Aldehydes	mg/L	≤ 1
Phenols	mg/L C6H5OH	≤ 0.5
Oils and fats	mg/L	≤ 100
Mineral oils	mg/L	≤ 15
Detergents	mg/L	≤ 20
Hydrocarbons total	mg/L	≤ 50
Cyanides total	mg/L CN	≤ 0.5
Aluminium	mg/L Al	≤ 10
Iron – total	mg/L Fe	≤ 2
Manganese – total	mg/L Mn	≤ 2
Arsenic - total	mg/L As	≤ 1
Lead -total	mg/L Pb	≤ 1
Cadmium – total	mg/L Cd	≤ 0.2
Chromium – total	mg/L Cr	≤ 2
Chromium (VI)	mg/L Cr (VI)	≤ 0.1
Mercury – total	mg/L Hg	≤ 0.05
Copper - total	mg/L Cu	≤ 1
Nickel - total	mg/L Ni	≤ 2
Selenium – total	mg/L Se	≤ 0.05
Tin	mg/L Sn	≤ 1
Heavy metals – total	mg/L	≤ 10

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