

# Biomass potential of organic waste

Cres and Lošinj, Croatia

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# The Clean Energy for EU Islands Secretariat

## Who we are

The launch of the Clean Energy for EU Islands Initiative in May 2017 underlines the European Union's intent to accelerate the clean energy transition on Europe's more than 1,400 inhabited islands. The initiative aims to reduce the dependency of European islands on energy imports by making better use of their own renewable energy sources and embracing modern and innovative energy systems. As a support to the launch of the initiative, the Clean Energy for EU Islands Secretariat was set up to act as a platform of exchange for island stakeholders and to provide dedicated capacity building and technical advisory services.

The Clean Energy for EU Islands Secretariat supports islands in their clean energy transition in the following ways:

- It provides technical and methodological support to islands to develop clean energy strategies and individual clean energy projects.
- It co-organises workshops and webinars to build capacity in island communities on financing, renewable technologies, community engagement, etc. to empower them in their transition process.
- It creates a network at a European level in which islands can share their stories, learn from each other, and build a European island movement.

The Clean Energy for EU Islands Secretariat provides a link between the clean energy transition stories of EU islands and the wider European community, in particular the European Commission.

# Report

EU islands – Cres and Lošinj

## Biogas potential of organic waste on the islands Cres and Lošinj, Croatia

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# Summary

<b>1 Introduction .....</b>	<b>2</b>
1.1 Objective.....	2
1.2 Discussion - focus .....	2
<b>2 Report.....</b>	<b>2</b>
1.1 Input streams.....	2
1.2 Calculations .....	3
1.3 Assumptions .....	4
1.4 Design .....	4
1.4.1 Input.....	4
1.4.2 Feeding system.....	4
1.4.3 Reactor .....	4
1.4.4 Cogen .....	5
1.4.5 Digestate .....	5
<b>3 Constructors for pocket digestors in Belgium.....</b>	<b>5</b>
<b>4 Croatian legislative overview .....</b>	<b>6</b>
<b>5 Biogas related subsidy systems in Croatia.....</b>	<b>12</b>

# 1 Introduction

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## 1.1 Objective

Croatian islands Cres and Lošinj are searching for a solution to use the existing biowaste streams and create an added value from it through the biogas production. At the moment, biowaste is being collected and deposited at a single location, without any further treatment. The current information is that islands have an input of 5.000 tons per year.

The two islands, Cres and Lošinj, have been working on their biowaste and it has been concluded on their side that there is an opportunity to use the biowaste to produce biogas. Two options were considered:

- use the produced biogas in a cogeneration plant with a small cogen unit
- use the produced biogas to produce biomethane that can be utilized in transport.

Since there are two islands, the assumption is that the biomass will be collected and transported to 1 biogas plant.

## 1.2 Discussion - focus

Before starting the analysis, the second option, to produce biomethane should be dropped.

An installation to upgrade biogas to biomethane is very costly (minimum 1 mil. €) and the scale of the project is too small to justify this investment.

Even if there would be a gas grid to connect to (which is not the case), this technology (biomethane for transport) would never be profitable.

This report will focus on the cogen option.

# 2 Report

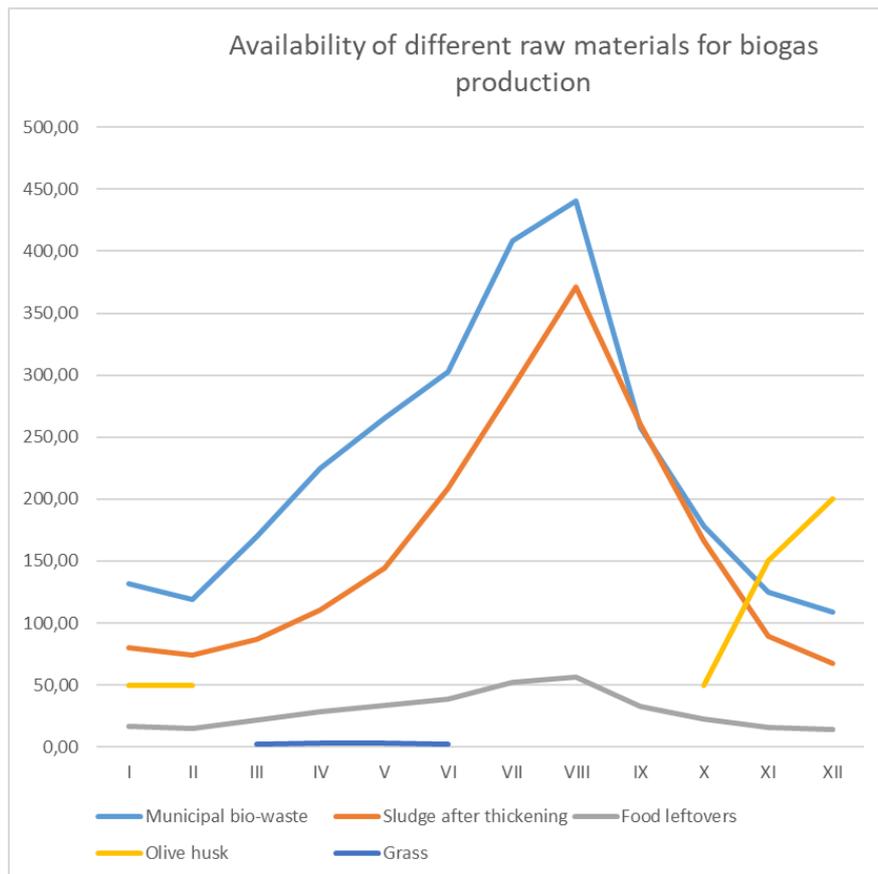
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## 1.1 Input streams

The two islands have a total production of 5.541 tons of biomass per year with a peak production during the tourist season from June to September.

	MONTHLY BIO-WASTE IN TONS												TOTAL
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
<i>Municipal bio-waste</i>	131,77	119,07	169,63	225,08	265,43	302,70	408,28	440,59	257,54	177,92	125,16	109,08	
<i>Sludge after thickening</i>	79,86	74,00	86,57	110,86	144,43	208,43	289,71	371,57	260,57	166,29	89,57	67,29	
<i>Food leftovers</i>	16,88	15,25	21,73	28,83	34,00	38,78	52,30	56,44	32,99	22,79	16,03	13,97	
<i>Olive husk</i>	50,00	50,00								50,00	150,00	200,00	
<i>Grass</i>			2,00	3,00	3,00	2,00							
<b>TOTAL</b>	<b>278,51</b>	<b>258,33</b>	<b>279,94</b>	<b>367,77</b>	<b>446,86</b>	<b>551,91</b>	<b>750,29</b>	<b>868,61</b>	<b>551,10</b>	<b>417,00</b>	<b>380,76</b>	<b>390,34</b>	<b>5 541,42</b>

The availability of the input streams is depicted below.



It should be mentioned that there is a high volatility in the availability of the input streams. This will be a determining factor for the choice of the engine and the storage of the inputs.

## 1.2 Calculations

Calculations		
Biogas produced a year	780330,6	m <sup>3</sup>
Electricity produced a year	1560661,2	kWh
Installed power average	223,0	kW
Installed power minimum	116,2	kW
Installed power maximum	390,9	kW
Engine proposed	MAN 190	
Storage winter	1565	m <sup>3</sup>
Hydraulic residence time	62,0	days
Required active volume	941,0	m <sup>3</sup>
Organic loading rate in kg OM/m <sup>3</sup> d	2,6	kg/m <sup>3</sup> d
Required surface for the disposal of N (limiting factor)	163,0	ha

It's also possible to make all the financial calculations once the local data are delivered. However, this segment of calculation is not the scope of this report.

### **1.3 Assumptions**

Since the availability of the input streams is volatile during the year, biogas plant should invest in storage and the best way is silage. This is specifically the case during the summer period. The inputs available are hard to ensilage due to the low dry matter content.

If possible grass (more than 10 tons actual available) and sludges should be stored to mix with the municipal waste.

If the input streams can be stored a cogen engine of 200 kW will be strong enough (MAN 190) for an average biogas production.

If the input streams should be digested immediately a cogen should be calculated on the top month - August, and it could be a MAN 360 engine.

For the storage of digestate during winter months (November till February) a storage of 1.565 m<sup>3</sup> is needed (production of September – December with 62 days residence time). This can be a simple lagoon or a concrete silo or a combi-bag with gas storage. The last one can also serve as a post digester with 10 % extra gas production.

### **1.4 Design**

#### **1.4.1 Input**

All aforementioned input streams are easily digestible without pre-treatment.

Only the grass part might cause huge problems with pumps and mechanical parts. The sand fraction in grass can be high which can also be harmful for the installation.

We recommend composting the grass fraction (10 tons/year) with 10 tons of solid fraction of digestate.

The biogas potential of different inputs is based on an internal database of 2.000 samples.

We advise to do biogas potential lab tests on the inputs in a further stage of the project.

#### **1.4.2 Feeding system**

The feeding system of the digester: hopper with screw (Triolit) and a pump with maserator (Vogelsang). Liquid input will be directly pumped into the digester, eventually before mixing it in a separate silo.

#### **1.4.3 Reactor**

The required volume of the digester is 941 m<sup>3</sup>.

The best height is 6 m what requires a diameter of 14 m.

We recommend a double membrane for the gas storage with bacterial sulphur reduction with O<sub>2</sub> injection under the membrane.

#### **1.4.4 Cogen**

The cogen should be placed in a pre-installed container with all the technology, steering and PLC. An option could be to separate the cogen in another container to avoid corrosion and for safety reasons.

#### **1.4.5 Digestate**

Since there is only a restraint volume of digestate, the post treatment of digestate is not recommended.

Eventually a screw press could be installed to remove the solid fraction from the storage tank (to avoid sludge in the tank).

The solid fraction of the digestate could be reused in the digester.

The liquid part can be stored in a lagoon with a floating cover, a flexi basin (AB milieusystemen) or a combi-bag (Aligator, Wieffering). Mixer on the floor to be installed.

### 3 Constructors for pocket digestors in Belgium

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## 4 Croatian legislative overview – project preparation

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The administrative procedure of getting permits in the energy related sector is complex and mostly centralized. Below are the institutions authorized for the permitting procedure:

Level	Institution
<b>National</b>	<i>Ministry of Economy, Labour and Entrepreneurship (MINGO)</i>
	<i>Croatian Energy Market Operator (HROTE)</i>
	<i>Croatian Energy Regulatory Agency (HERA)</i>
	<i>Ministry of Environmental Protection and Energy (MZOE)</i>
<b>County</b>	<i>Croatian Electricity Distributer (HEP –ODS)</i>
	<i>Department for spatial planning</i>
	<i>Legal entity for water management</i>
<b>City/Municipality</b>	<i>Croatian Electricity Distributer (HEP –ODS)</i>
	<i>Department for spatial planning</i>
	<i>Legal entity for water management</i>

For the preparation of biogas project and its installation on the field, one must take into account various and elaborate administrative and technical procedure.

The procedure varies from technical and energy permits obtaining to application for grid connection. If simplified, all procedures can be divided into 3 main groups:

1. *Construction permits*
2. *Energy production permits*
3. *Environmental permits*

List of general legislative steps for biogas projects implementation is as follows:

<b>Number</b>	<b>Process steps</b>	<b>Pripremni postupci</b>
<b>1</b>	The energy approval	Ishođenje energetskeg odobrenja
<b>2</b>	Obtaining the documentation for the impact assessment procedure for the ecological network	Ishođenje rješenja o prihvatljivosti zahvata za ekološku mrežu
<b>3</b>	Environmental impact study assessment	Izrada studije o utjecaju zahvata na okoliš
<b>4</b>	Development of the project's conceptual design	Izrada idejnog projekta
<b>5</b>	Application for the location permit	Rješavanje zahtjeva za izdavanje lokacijske dozvole
<b>6</b>	Obtaining the approval for energy production	Ishođenje prethodne elektroenergetske suglasnosti
<b>7</b>	Finalizing the Connection agreement	Finalizacija Ugovora o priključenju
<b>8</b>	Preparation of the justifiability study	Izrada analize opravdanosti izgradnje postrojenja
<b>9</b>	Preparation of the Main project documentation	Izrada glavnog projekta
<b>10</b>	Act on construction permit	Ishođenje akta kojim se odobrava građenje
<b>11</b>	HERA solution on the eligible producer	Rješavanje zahtjeva za izdavanje prethodnog rješenja o stjecanju statusa povlaštenog proizvođača
<b>12</b>	HERA solution on the electrical energy purchase	Rješavanje zahtjeva za sklapanje Ugovora o otkupu električne energije
<b>13</b>	Project detailed design	Izrada izvedbenog projekta
<b>14</b>	Obtaining a connection approval	Ishođenje elektroenergetske suglasnosti
<b>15</b>	Contract on the grid connection	Sklapanje Ugovora o korištenju mreže
<b>16</b>	Test run	Pokusni rad postrojenja
<b>17</b>	Obtaining an operational license	Ishođenje uporabne dozvole
<b>18</b>	Obtaining a water permit	Ishođenje vodopravne dozvole
<b>19</b>	Obtaining a solution on the installation's registration in the Land registry	Ishođenje Rješenja o upisu građevine u zemljišne knjige

It is to be noted that the list of procedure steps as mentioned now is based on the currently active legislative framework. Once the client decides to start with the investment, it is advised to seek for an update of information either via a consultancy company or directly in communication with ministries and agencies involved in the process.

Detailed description of the legislative process steps is indicated below:

#### **4.1. The energy approval**

In order to register the project in the Register of OEIKPP and to build the plant, an energy permit (EO) must be obtained. The approval process is preceded by the construction permit procedure. The project developer is obliged to obtain and submit to the Ministry a building permit for the plant (or a corresponding act) within 12 months from the finality of the EO, otherwise the decision is revoked and the developer is deleted from the Register. The application for EO shall be submitted on the form prescribed in Annex 2 of the Regulations on the use of renewable energy sources and cogeneration.

#### **4.2. Obtaining documentation for the impact assessment procedure for the ecological network**

Final Solution is based on the Main Assessment and Prior Assessment and as such is the most important environmental permit.

#### **4.3. Environmental impact study assessment**

The Environmental Protection Act (Official Gazette, Nos. 80/13, 78/15) and the Decree on Environmental Impact Assessment (Official Gazette, No. 61/14) prescribe a proven procedure for the environmental impact of the intervention.

The assessment procedure is initiated at the written request of the developer, and the content of that request is laid down in Article 80 of the Environmental Protection Act.

#### **4.4. Development of the project's conceptual design**

With accordance to the Law on spatial planning and construction (Off. Gaz. 76/07, 38/09, 55/11, 90/11, 50/12), conceptual design is obligatory when obtaining a location permit. Furthermore, it is considered as a set of coordinated documents which form a functional and technical solution.

#### **4.5. Application for the location permit**

The issuance of location permits shall be initiated at the request of interested parties, which shall be enclosed with at least the preliminary design, special conditions, decision on the acceptability of the intervention for the environment. An integral part of the preliminary design for a location permit that determines the formation of a building plot or the placement of one or more structures on a building plot is a geodetic project, which is made as a separate part of the preliminary design.

#### **4.6. Obtaining the approval for energy production**

According to the Law on spatial planning and construction, the approval for energy production is issued by the HEP OPS or HEP ODS. Installations with an electrical power up to 10 MW are connected to the distribution channel – HEP ODS.

#### **4.7. Finalizing the Connection agreement**

The Contract is made between investor and HEP – OPS/ODS after obtaining the Prior Approval on Energy Production. The Contract is prepared according to the currently valid legislation framework and as such defines the tariff system, deadlines and other non-technical issues.

#### **4.8. Preparation of the justifiability study**

According to the Regulation on RES and CHP installations (Off. Gaz. 88/12), the justifiability study presents basic documentation for obtaining the energy approval and further project development.

#### **4.9. Preparation of the main project documentation**

The Main project documentation is attached to the Request for the construction permit. With accordance to the Law on spatial planning and construction (Off. Gaz. 76/07, 38/09, 55/11, 90/11, 50/12) main project documentation must follow the conceptual design.

#### **4.10. Act on construction permit**

The application for a building permit is submitted by the investor and must be submitted to the competent city or county office, depending on where the construction or reconstruction of the building is planned.

#### **4.11. HERA solution on the eligible producer**

Croatian Energy Regulation agency is the one authorized for issuing the final solution on the status of eligible energy producer. HERA will automatically inform MINGO, HROTE and HEP OPS/ODS.

#### **4.12. HERA solution on the electrical energy purchase**

Based on the approval of the status of eligible producer, one finalizes the solution on the electrical energy purchase. The contract enters the force with obtaining the Final Solution on the eligible energy producer.

#### **4.13. Project detailed design**

The project's detailed design is prepared according to the main project documentation and is the one whose instructions will be followed up during the construction. Prior to the construction works, one must obtain a construction permit or main project approval.

#### **4.14. Obtaining a connection approval**

After the construction works have been finished, investor submits the request for connection approval (HEP ODS/OPS).

#### **4.15. Contract on the grid connection**

After obtaining a connection approval, one must finalize the grid connection contract (HEP ODS/OPS). Contract on the grid connection is the final document issued by the HEP ODS/OPS which enables installation to work within the existing electro-energetic system.

#### **4.16. Test run**

The Law on spatial planning and construction (Off. Gaz. 76/07, 38/09, 55/11, 90/11, 50/12) defines which installations needs to obtain a test run. Furthermore, main project documentation states how long test run will be, while MZOPU verifies the performance of test run.

**4.17. Obtaining an operational license**

Built or reconstructed plant can be put into operation once operational license is issued - according to a special law.

**4.18. Obtaining a water permit**

Water certificate is issued (NN 66/2019) according to the currently active legislative framework.

**4.19. Obtaining a solution on the installation's registration in the Land registry**

After the completion of construction and the issued operating permit, the building can be recorded in the cadaster and land registers.

Overview of the legislative framework that is of relevance for the installation of biogas plant using organic waste is mentioned in the table below.

Law	Description
<a href="#">Law on Sustainable Waste Management (NN 94/13, 73/17, 14/2019, 98/2019)</a>	The law establishes measures to prevent or reduce the harmful effects of waste on human health and the environment by reducing the amount of waste in accommodation and/or production and regulates waste management without the use of risky procedures for human health and the environment, using valuable properties.
<a href="#">Regulation on municipal waste management (NN 50/2017, 84/2019)</a>	The regulation prescribes the content of the decision on the provision of public services, the method of managing municipal waste in connection with the public service of collecting mixed municipal waste and biodegradable municipal waste, as well as separate collection of waste paper, metal, glass, plastic, textiles, problematic waste and large (bulky) waste, the spatial exchange of recycling yards, the method of producing marginal quantities of mixed municipal waste for a certain period, the manner and conditions for determining and calculating the costs for construction of a municipal waste management facility and the method of calculating the incentive fee for reducing municipal waste.
<a href="#">Ordinance on Waste Management (117/2017)</a>	The ordinance lays down the conditions for waste management, operations of the person responsible for waste management and the method of operation of the recycling yard.
<a href="#">Ordinance on by-products and abolition of waste status (NN, br. 117/14);</a>	Prescribes the contents of the application for entry in the Register for the abolition of waste status and the register of by-products, specific criteria for the abolition of the waste status, including limit values for pollutants and the harmful impact of substances or objects on the environment, specific criteria for determining the by-products, the contents of certificates for registration in the Register for revocation of waste status and the by-product register etc.
<a href="#">Specific criteria for termination of waste status</a>	The following specific criteria have been determined: (1.) specific criteria for termination of status waste for: compost, anaerobic digestate, waste oil, waste for biofuel for transport, solid biofuel and construction products; and (2.) specific criteria for disposal of waste status case of use of substance or substance for the purpose of they are manufactured
<a href="#">Regulation on environmental impact assessment (NN, br. 61/14,3/17);</a>	The regulation specifies activities requiring an environmental impact assessment, the content of the environmental impact studies, the environmental impact assessment committee, public participation, conclusions of the commissions and other environmental impact assessment issues.
<a href="#">Environmental permit regulation (NN, br. 8/14, 5/18);</a>	The regulation states activities that can cause exploitable emissions, air, water and more, the requirement and criterion for issuing environmental permits, the manner of submitting data on the environmental emissions requirement, the conditions when the plant needs to be identified new or amended environmental techniques specified in the permitted exceptions to the use of reference documents for best available techniques, the method of establishing emission limit values, the method of applying equivalent parameters and other technical measures, and exemptions from the application of equivalent parameters and other technical measures etc.
<a href="#">The law of construction (NN, br. 153/13, 20/17, 39/19);</a>	The law regulates the design, construction, use and maintenance of buildings and the implementation of administrative and other procedures in this regard to ensure the protection and landscaping in accordance with the regulations governing spatial planning and ensure the basic requirements for the building and other conditions prescribed for buildings by this Act and regulations adopted pursuant to this Act and special regulations. The provisions apply to the construction of all buildings in the area of RH.
<a href="#">Environmental Law (NN 80/2013, 78/2015, 12/2018, 118/2018)</a>	The law regulates principles of environmental protection and sustainable development, protection of environmental components and protection of the environment from the effects of stress, environmental entities, documents of sustainable development and environmental protection, environmental instruments, environmental monitoring, information system, ensuring access to environmental information, public participation in issues environmental protection, access to justice, liability for damages, financing and general environmental policy instruments, administrative and inspection controls.
<a href="#">Law of nature protection (NN, br. 80/13, 15/18, 14/19);</a>	The law regulates the system of protection and complete conservation of nature and its parts with these other issues. Refers to biodiversity, landscape diversity and geo-diversity.

## 5 Biogas related subsidy systems in Croatia

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Renewable energy sources are being subsidized in Croatia through different measures and funds, most important of which are published by the Ministry of Environmental Protection and Energy, The Environmental Protection and Energy Efficiency Fund, Ministry of Agriculture and Paying Agency for Agriculture, Fisheries and Rural Development.

Within the EU subsidy framework of 2014 – 2020, special emphasis has been placed on subsidizing different RES but also improving energy efficiency in private and public sector.

When subsidy calls for the previous period are analyzed, one can conclude that special attention has been placed on supporting projects implementing solar and biogas systems. Moreover, while solar systems are being supported on a level of natural persons and local government units, biogas plants are, at the moment, being subsidized solely for legal entities (SMEs).

Since the investor in the concrete case would be a local government unit – islands Cres and Lošinj, it is important to mention that **there is no currently active calls which would support this type of applicants for construction of biogas plants.**

Since the idea of two islands is to use the waste that has been collected separately, potential subsidies may include application to the **Operative programme “Competitiveness and Cohesion 2014 – 2020” which supports construction of recycling sites** (if islands haven't used it already) that is harmonized with the newest EU standards and which can indirectly support the concrete project through the easier collection of organic wastes on the two islands.

Another opportunity to support the biogas plant project is via **regional calls that are more focused on the development of project documentation.** Both of these islands are geographically located in Primorje - Gorski Kotar County which had a call for islands published in June 2019. One of the goals of the “Public call for co-financing projects for the development of islands from the budget of Primorje – Gorski Kotar County for 2019 ” was to support islands in application of energy efficient solutions and implementation of renewable energy sources. Eligible activities within the call included construction, equipment purchase and services of construction supervision according to the bill of quantities. What was important in the call was that expenses incurred after the January, 1<sup>st</sup> 2019. Other details regarding the maximum budget per application were not mentioned in the call text, but could be checked if further analysis of subsidies is to be prepared. Based on previous calls, it is expected that this call is to be repeated in 2020 as well, meaning that part of the project costs could be applied.

In the table below both of these potential calls are mentioned and basic overview of projects budget range as well as eligible costs are stated.

## Overview of potential tenders and EU funds

Public call	Opening date	Project budget	Eligible costs and activities	Application conditions	Application limitations
<p><b>PUBLIC CALL</b> to co-finance island development projects from the Budget of the Primorje-Gorski Kotar County for 2019 <a href="#">(link)</a></p>	<p>Possibility of opening 07/2020</p>	<p>not specified</p>	<p>a) construction and expert supervision for the purpose of realization of the declared capital project</p> <p>b) Eligible costs for the execution of works, procurement of equipment and supervision services for construction purposes in accordance with the items of the financial plan and project costs incurred after 01 January 2019</p> <p>c) In case the applicant initiates the process of procurement of goods / works / services only after the approval of the funds under this Public Invitation, he shall submit the contract with the selected contractor / contractor / supplier by September 15, 2019 at the latest. The stated deadline is an essential ingredient and termination condition of the co-financing contract, or in the event that this condition is not fulfilled, the co-financing contract is terminated.</p>	<p>local authority units from the Primorje – Gorski Kotar County</p>	<p>this call can co-finance projects for which all legal requirements for the start of construction are fulfilled</p>
<p>Construction and / or equipping of facilities for sorting separately collected waste paper, cardboard, metal, plastic and other materials <a href="#">(link)</a></p>	<p>22.05.2019. - 30.06.2020.</p>	<p>1.000.000,00 - 50.000.000,00 HRK</p>	<p>a) preparing the project documentation required to submit the project proposal</p> <p>b) preparation of documentation required for obtaining a building permit</p> <p>c) preparation and implementation of public procurement procedures for works, services and goods for the construction of sorting facilities in accordance with the Public Procurement Act (OG 20/16)</p> <p>d) construction and / or equipping of sorting facilities which include the execution of construction, mechanical, electrical, craft and other works necessary for putting the plant into operation (preparatory, ground, installation and finishing works, and installation of construction products, devices, equipment and installations ) in accordance with the final location permit, ie the act under which the Applicant may commence the construction of the plant, as well as the necessary activities prescribed by law for the purpose of obtaining a building permit,</p> <p>e) connection to municipal infrastructure and provision of access road solely for the purposes of sorting facilities</p> <p>f) expert supervision of construction works and design supervision</p> <p>h) services of the Occupational Safety Coordinator in the execution phase (Coordinator II)</p> <p>i) technical assistance for project management (engagement of companies in charge of project management and administration and other activities related to project management),</p> <p>j) project information, publicity and visibility activity.</p>	<p>local authority units</p>	



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