Feasibility study and cost-benefit analysis of replacing the existing energy source and different variants of using seawater as an energy source within the thermotechnical system of the City Palace of the City of Poreč

December, 2021

D4.3.1: Feasibility studies for Coastal Energy projects in pilot areas

Project acronym	COASTENERGY
Project ID number	100445844
Project title	Blue Energy in ports and coastal urban areas
Priority axis	Blue innovation
Specific objective	3 – Assess feasibility of pilot coastal energy projects in target areas
Work Package number	4
Work Package title	Creating multi-level Hubs to define joint strategies & local actions supporting coastal Blue Energy
Activity number	3
Activity title	Defining pilot projects
Partner in charge	IRENA
Partners involved	IRENA
Status	Final
Distribution	Public

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1. SUMMARY

Preliminary mechanical design of thermotechnical installations for the needs of reconstruction of the engine room (power plant) and replacement of the existing energy source has been prepared. The building in question is currently heated via an extra light fuel oil boiler and cooled via an existing water cooler. Hot or cold water in the building is distributed through a steel pipeline. The existing pipeline is laid visibly or flush. The heat transfer system in the building is solved by fan coil units. Investors were required to solve the heating / cooling system in this way in such a way that the installation of a heat pump is envisaged as a new source of heat or cooling energy.

Preliminary design includes 3 variant solutions:

1. Direct capture of sea water from a nearby port,
2. Coastal seawater abstraction through wells,
3. Indirect use of sea water through well exchangers (closed system).

The feasibility study in question analyzes the feasibility, financial and socio-economic aspects of each of these variants.

Criteria for evaluating variant solutions were selected based on their distinctive elements. These are the following criteria:

1. Technical-technological,
2. Financial,
3. Socio-economic.

The criteria are defined in accordance with the following objectives of the study:

1. Selection of the optimal variant solution from the technical-technological, financial and socio-economic perspective,

2. Assessment of the impact of variant solutions on the financial performance of the City of Poreč-Parenzo (primarily on the reduction of energy costs),

3. Potential and risks of variant solutions and standard projects in general when applying for tenders for grants from EU funds.

It is important that the selected criteria are clear and measurable, i.e., that what is measured or evaluated can be unambiguously stated and determined, and methodologically consistent. The selected variant solution is performed on cp no. 568, c.m. Poreč, at the address Grad Poreč-Parenzo, Obala maršala Tita 5/1, 52 440 Poreč.

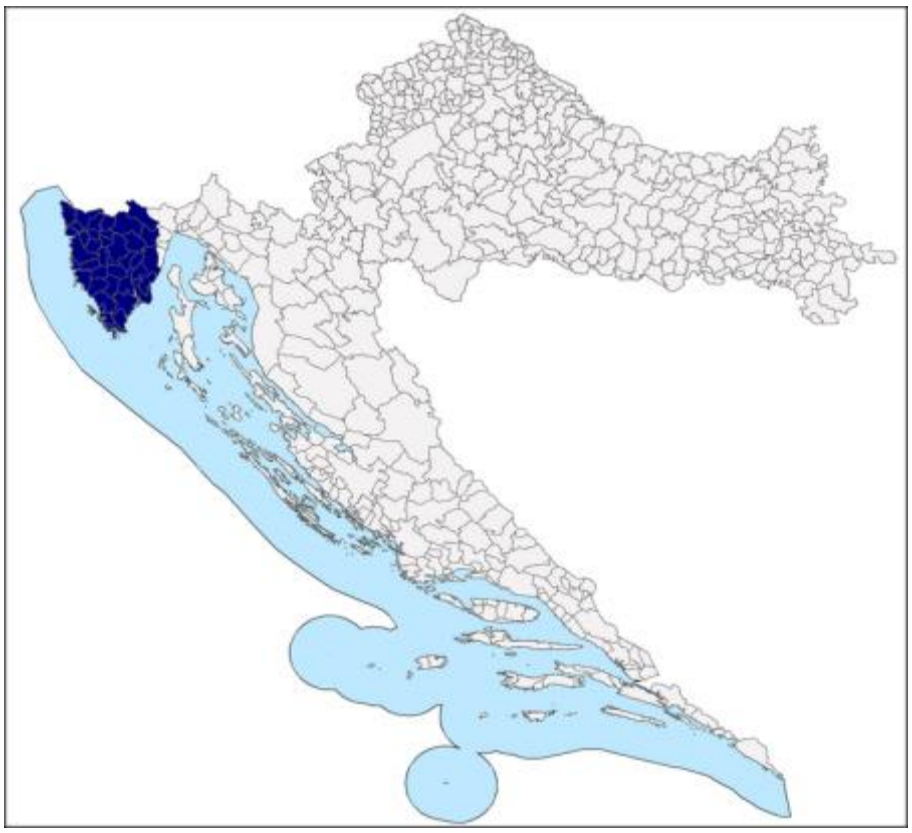
2. SOCIO-ECONOMIC CONTEXT

2.1. Basic characteristics of the socio-economic context

2.1.1. Space and natural features

Istria County covers most of Istria - the largest Adriatic peninsula. The westernmost point of the Republic of Croatia is in the County of Istria (Bašanija, Cape Lako) at 45 ° north latitude. Located in the northeastern part of the Adriatic Sea, Istria is surrounded on three sides by the sea, and the northern border with the mainland is the line between the Gulf of Milje (Muggia) near Trieste and Preluk Bay, near Rijeka. With such a favorable geographical position, almost in the heart of Europe, halfway between the equator and the North Pole, Istria has always been a bridge connecting the Central European continental area with the Mediterranean.

Figure 1: Geographical position of Istria County



Source: www.istra-istria.hr/index.php?id=263

Area - The Istrian peninsula covers an area of 3,476 square kilometers. This area is shared by three countries: Croatia, Slovenia and Italy. A very small part of Istria, only the northern side of the Milje Peninsula, belongs to the Republic of Italy. The Slovenian coast with the Bay of Koper and part of the Piran Bay to the mouth of the Dragonja River is part of the Republic of Slovenia. The largest part, or 3,130 square kilometers (90% of the area), belongs to the Republic of Croatia. Most of the Croatian part of the peninsula is located in the County of Istria, with an area of 2,820 square kilometers, which is 4.98% of the total area of the Republic of Croatia. The rest of the administrative-territorial belongs to the Primorje-Gorski Kotar County[1].

[1] www.istra-istria.hr/index.php?id=263, retrieved on 30.10.2019.

Administratively, the Istria County is divided into 41 local self-government units, i.e., 10 cities and 31 municipalities.

- Cities: Buje-Buie, Buzet, Labin, Novigrad-Cittanova, Pazin, Poreč, Pula, Rovinj-Rovigno, Umag-Umago and Vodnjan

- Municipalities: Bale, Barban, Brtonigla-Verteneglio, Cerovlje, Fažana, Funtana, Gračišće, Grožnjan-Grisignana, Kanfanar, Karojba, Kaštelir - Labinci, Kršan, Lanišće, Ližnjan, Lupoglav, Marčana, Medulin, Motovun, Oprtalj-Portole, Raša, Sveti Lovreč, Sveta Nedelja, Sveti Petar u šumi, Svetvinčenat, Tar-Vabriga, Tinjan, Višnjan, Vižinada, Vrsar and Žminj

General information about Istria County:

- Area of Istria - 2,820 km²;
- Population - 208,055 inhabitants, which is 4.85% of the total population of the Republic of Croatia (Census of the Republic of Croatia 2011);
- Length of the coast - 445.1 km (indented coast is twice as long as the road);
- The west coast of Istria is 242.5 km long, with islands 327.5 km;
- The eastern coast of Istria is 202.6 km long, with its islands 212.4 km;
- Administrative center - Pazin (8,638 inhabitants);
- Economic Center - Pula (57,460 inhabitants).

The town of Poreč is located on the west coast of the Istrian peninsula and covers an area of 142 km^2. The length of the sea coast with islands is 37 km, and includes the island of Sv. Nikola and 6 cliffs: Barbaran, Karbula, Regata, Jontuja, Butaceja and Altijez.

Figure 2: Administrative division of Istria County

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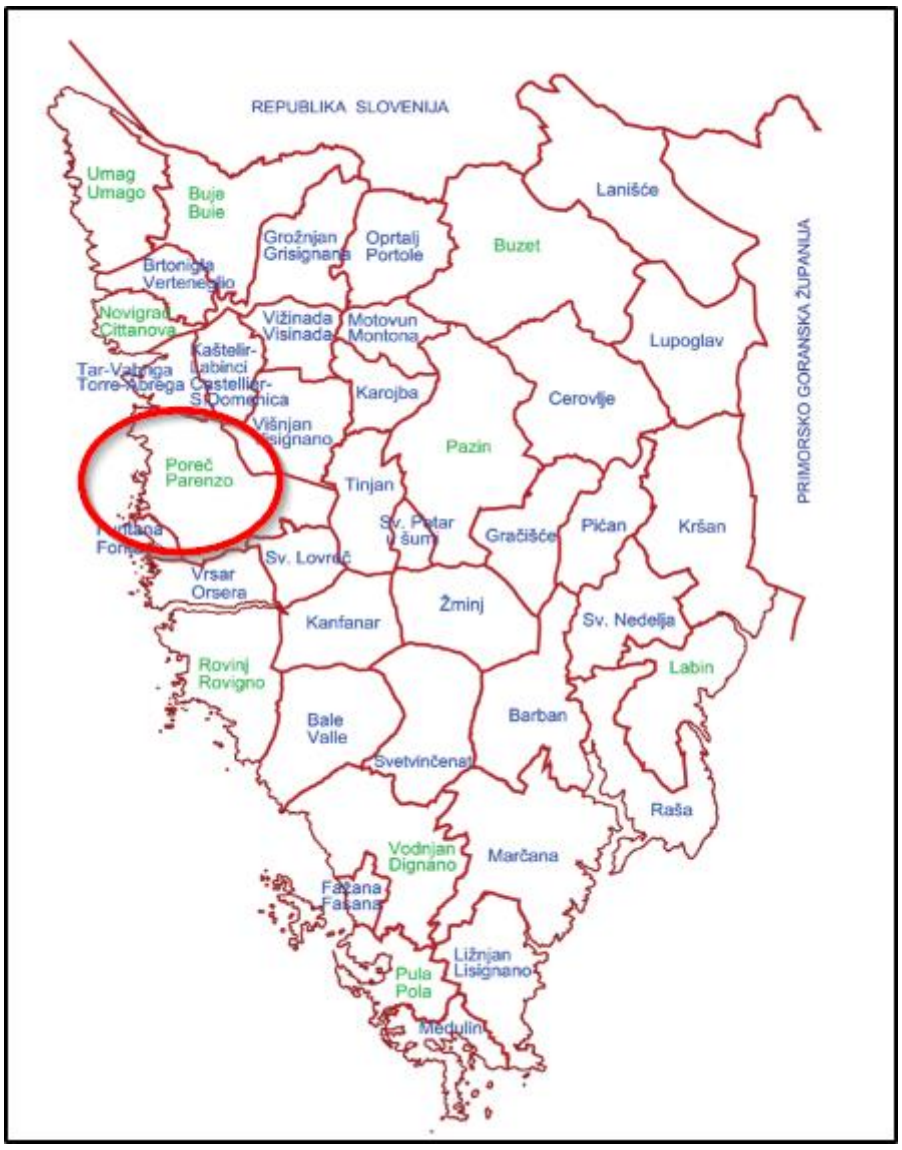


Source: http://www.zpuiz.hr/index.php?id=2560

The area of the City of Poreč includes 53 statistical settlements: Antonci, Baderna, Banki, Bašarinka, Blagdanići, Bonaci, Bratovići, Brčići, Buići, Cancini, Červar - Porat, Červar, Čuši, Dekovići, Dračevac, Filipini, Fuškulin, Garbina, Jakići Gorinji, Jasenovica, Jehnići, Jurići, Kadumi,

Katun, Kirmenjak, Kosinožići, Kukci, Ladrovići, Matulini, Mičetići, Mihatovići, Mihelići, Montižana, Mugeba, Musalež, Nova Vas, Poreč, Radmani, Radoši kod Žbandaja, Rakovci, Rupeni, Ružići, Stancija Vodopija, Starići, Stranići kod Nove Vasi, Šeraje, Štifanići, Šušnjići, Valkarin, Veleniki, Vrvari, Vežnaveri i Žbandaj.

Landscape

Visually and superficially in the area of the settlement of Poreč, the sea prevails as a landscape of natural features. A significant contrast to the natural landscape, i.e., the sea, is the landscape of anthropogenic features: a dense network of buildings and streets within the historic center of Poreč, sports port and marina and the waterfront as the main promenade and public area. Landscaped green areas on the waterfront are unnatural, planted with ornamental plant species and complemented by urban equipment. Moles and breakwaters are anthropogenic elements: piers in the marina are anthropogenic elements built of artificial materials, and breakwaters are built of natural stone, so they fall into the category of prenatural elements. All these natural, pre-natural and anthropogenic elements, due to the proximity of the location of the project, affect the creation of a landscape image of the space. The landscape peculiarity of the area of the city of Poreč is the indented coast with a number of islands and reefs, which form a spatial environment of high ecological and visual aesthetic value, which is a recognizable basis to be considered in landscaping and shaping the city.

Soil and relief

The city of Poreč is located on a limestone complex as well as limestone dolomite sediments. In the area of the City of Poreč, the soil is covered with red soil, of different thicknesses in certain zones. Arable and other land contains masses of stone in various sizes and shapes, with occasional characteristics of difficult to pass rocky. The narrower coastal belt is characterized by pine forests (extremely valuable group of pines in the area of Stancija Červar) and other conifers (valuable coniferous forests on the islands of Sveti Nikola and Regata), and the characteristic macchia stretches from the coast and Vranići. The protection of landscapes, i.e., areas of

greenery in the narrower coastal zone, and extremely valuable groups of greenery in the area of Brula, Plava and Zelena Laguna and Materada, is especially important.

Climate

The basic feature of the climate of the Istrian peninsula is given by the Mediterranean climate, which due to the cold air flowing from the mountains and the proximity of the Alps, gradually changes inland and becomes continental. The main features of the Mediterranean climate are hot and dry summers, with an average of close to 2,400 hours of sunshine per year. Winters are mild and pleasant, and snow is rare. The annual average air temperature along the northern part of the coast is about 14 ° C, and in the southern area and islands 16 ° C. January is the coldest month with an average temperature mostly around 6 ° C, and July and August are the warmest months, with an average temperature around 24 ° C. The period when the daily mean air temperature is higher than 10 ° C lasts approximately 260 days a year, and hot weather, with a daily maximum above 30 ° C, lasts a maximum of twenty days. The amount of precipitation is increasing from the west coast towards the interior. Characteristic winds are bora, jugo and maestral. The bora blows from north to south and brings dry and clear weather. The warm south wind brings rain, and the gentle mistral blows in summer from the sea to the mainland. The sea temperature is the lowest in March when it ranges between 9 and 11 ° C, and with 24 ° C the highest in August. Icing of the coastal edge in small and shallow bays is a very rare occurrence. According to Köppen's classification, the coastal area of the City of Poreč belongs to the warm temperate rainy subhumid climate marked Cfsax.

Temperature

Due to its position in the northern Adriatic, the City of Poreč has an average temperature during January of 4.9 ° C, while in August it is 22.0 ° C. The average annual air temperature is 13.4 ° C. Frost is present on average about 25 days a year, when the average air temperature is below 0 ° C. The average monthly air temperature in the period from 1990 to 1994 was above 10 ° C for eight months of the year, which confirms the claim that the city area is influenced by the Mediterranean climate, and the proximity of the sea significantly affects the mitigation of temperature amplitude.

Precipitation and wind

Measurements of average monthly precipitation show that most precipitation falls during September, October and November. In these months, the amount of precipitation is above 100 mm. The driest period of the year is winter, especially February and March. During this period, the average monthly rainfall is not more than 40 mm. The most frequent wind is from the first quadrant, while the strongest winds in the average year from the second quadrant are 7 beavers, and from the third and first quadrants 6 beavers.

Table 1 shows the average monthly air temperatures and precipitation in the area of the City of Poreč.

Table 1: Average monthly air temperatures and precipitation in the City of Poreč

Table 1: Average monthly air temperatures and precipitation in the City of Poreč

Month	1	2	3	4	5	6	7	8	9	10	11	12	Avg.
Temperature (°C)	4,5	4,9	7,6	12,1	16,7	20,3	23,2	22	19,4	14,3	9,7	6,4	13,4
Precipitation (mm)	56	62	54	50	71	69	56	64	84	114	101	78	71

Source: DZS, 2019.

2.1.2. Demography

The activities and characteristics of the population in a particular area form the basis of its development and are a central element in determining the strategic direction.

Demographic trends in Croatia are determined by low fertility rates and population aging. The conducted census in 2011 well reflects the basic demographic trends in Croatia. According to these data, the total population did not decrease significantly, but there were significant structural differences and changes in the demographic pyramid. The population under the age of

15 decreased by approximately 80,000, and between the ages of 15-24 by an additional 65,000. The population aged 25 to 49 has shrunk by more than 30,000. On the other hand, the number of residents aged 50 to 64 increased by about 100,000, and the number of people over 65 by about 65,000.

Table 2 shows the number of inhabitants by Croatian counties, the share of population in the total population, the number of cities, the number of municipalities and settlements.

Table 2: Population by counties of the Republic of Croatia

County	Population	Share of population	Number of cities	Number of municipalities	Number of settlements
Grad Zagreb	790.017	18,44%	1	-	70
Splitsko-dalmatinska	454.798	10,61%	16	39	368
Zagrebačka	317.606	7,41%	9	25	694
Osječko-baranjska	305.032	7,12%	7	35	263
Primorsko-goranska	296.195	6,91%	14	22	510
Istarska	208.055	4,86%	10	31	655
Vukovarsko-srijemska	179.521	4,19%	5	26	85
Varaždinska	175.951	4,11%	6	22	302
Sisačko-moslavačka	172.439	4,02%	7	12	456
Zadarska	170.017	3,97%	6	28	229
Brodsko-posavska	158.575	3,70%	2	26	185
Krapinsko-zagorska	132.892	3,10%	7	25	423
Karlovačka	128.899	3,01%	5	17	649
Dubrovačko-neretvanska	122.568	2,86%	5	17	230
Bjelovarsko-bilogorska	119.764	2,80%	5	18	323
Koprivničko-križevačka	115.584	2,70%	3	22	264
Međimurska	113.804	2,66%	3	22	131
Šibensko-kninska	109.375	2,55%	5	15	199
Virovitičko-podravska	84.836	1,98%	3	13	188
Požeško-slavonska	78.034	1,82%	5	5	277
Ličko-senjska	50.927	1,19%	4	8	255
Republika Hrvatska	**4.284.889**	**100%**	**127**	**429**	**6.756**

Source: DZS, 2019

According to Table 2, Istria County with 208,055 inhabitants makes 4.86% of the total population of the Republic of Croatia.

According to the 2011 census, there were 16,696 inhabitants in the City of Poreč (52.16% women and 47.84 men). The largest number of inhabitants lives in the area of statistical settlements: Poreč (58.64% of the population), Vrvari (4.74% of the population), Červar Porat (3.16% of the population), Kukci (2.99% of the population) and Nova Vas (2,87% of the population).

Table 3 shows the population structure of the City of Poreč according to population contingents.

Table 3: Population structure of the City of Poreč by population contingents

Gender	Total	0 – 6 years	0 -14 years	0 -17 years	0 -19 years	Women of childbearing age		Working age population (15 – 64 years)	60 and over	65 and over years	75 and over
						(15 – 49 years)	of which 20-29 years				
M	7.987	618	1.253	1.499	1.670	-	-	5.690	1.586	1.044	379
W	8.709	577	1.204	1.453	1.628	3.962	1.100	6.097	1.993	1.408	651

Source: DZS, 2011.

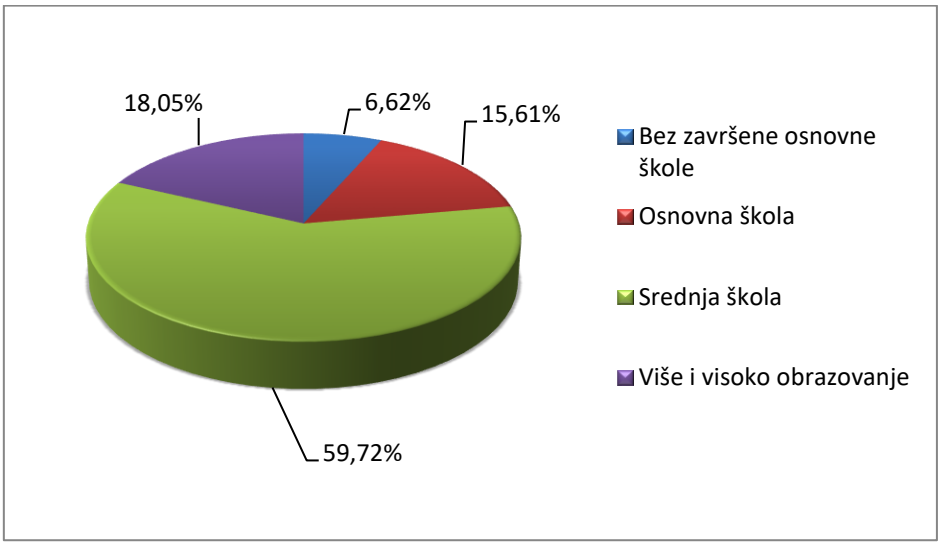
The share of children of nursery and kindergarten age in the total population is 7.16%, and the share of the working age population is 70.59%. The age coefficient is 21.4 and the aging index is 108.5. The average age of the population in the area of the City of Poreč is 41.2 years, which is slightly lower than the county average of 42.8 years.

According to the 2011 census, there were 6,252 households in the City of Poreč, and there was an average of 2.66 people in one household. The largest number of households are households with two members (27.30%). It is followed by single households with a share of 23.49%, households with three members with 21.83%, households with four members with 19.32%, and households with five or more members with 8.04%.

The analysis of the educational structure of the population together with the analysis of the age structure represents a significant demographic feature relevant for determining future strategic

directions of development, and especially the development of certain economic and social activities, and social needs. The educational structure of the population older than 15 years is shown in Graph 1.

Graph 1: Educational structure of the population in the area of the City of Poreč



Source: DZS, 2011.

The analysis of the educational structure of the population shows that 22.23% of the population does not have an adequate level of education, i.e., education. The share of residents who have completed high school is 59.72%, while the share of residents who have completed professional and university studies is 18.05%. Although it is a relatively unfavorable educational structure of the population, compared to the national (9.40% without completed primary school, 21.30% with completed primary school, 52.60% with completed secondary school and 16.4 with completed higher and / or higher education) and county average (7.94% without completed primary school, 19.50% with completed primary school, 55.80% with completed secondary school and 16.5 with completed higher and / or higher education) City However, Poreč records a significantly better educational structure of the population.

2.1.3. Socio-cultural elements

Social and economic service activities, i.e., central service functions, are directed towards its users, i.e., towards raising the quality of life of residents and individual independent settlements in their area of influence and gravity. They are an expression of the administrative - political - territorial, judicial and religious structure and manner of governance in this island area. The quality of these functions raises the educational, cultural and scientific level, health culture and standard of the entire population in the gravitational area of these functions. They contribute to the increase of social care provided to the population in order to eliminate existing social problems and differences, ensure unhindered participation in sports activities and technical culture, realize the possibility of recreation and leisure of the population and ensure many other long-term goals in this area.

Poreč has been inhabited since prehistoric times. During the 2nd century BC, the Roman castrum was built on a small peninsula, which was 400 m long and 200 m wide, and on which today stands the core of the old city. During the reign of Emperor Augustus in the 1st century, the castrum was officially declared a city and included in the Roman colony of Colonia Iulia Parentium. In the time of Rome, Poreč got its first walls, the whole city was walled except for the west side or the top of the peninsula where the Temple of Neptune or Jupiter was located. In the 3rd century the city already had an organized Christian community and an early Christian church complex. The Christian community almost completely disappeared during the reign of Emperor Diocletian, when the martyrs of Poreč, St. Mauro and St. Eleutherias. Sv. According to tradition, Eleutherius was tied to a stone and thrown into the sea in Peškera Bay. Today, right next to the bay is the church of Sv. Eleutheriums from the 15th century. In the following centuries, numerous turbulent historical events occurred, which resulted in today's rich cultural tangible and intangible heritage in the area of the City of Poreč. The most famous protected cultural asset of the City of Poreč, and at the same time one of the symbols of the city is the Euphrasian Basilica. This magnificent basilica was completed around the middle of the VI. century and today is the seat of the Poreč-Pula diocese. It is an episcopal complex (early Christian building) consisting of a three-nave Euphrasian Basilica, an atrium, a baptistery, a memorial chapel and a bishop's palace. Extremely important artistic value has been given to floor and wall mosaics with numerous figures, especially for the reason that many realistically depict scenes from the Bible. The Euphrasian

Basilica complex has been on the UNESCO World Heritage List since 1997, and is adorned with the epithet "the best-preserved early Byzantine monument in the Mediterranean".

Figure 3 shows the registered cultural assets in the area of the City of Poreč.

Figure 3: Registered cultural assets in the area of the City of Poreč

Oznaka dobra	Mjesto	Naziv	Vrsta kulturnog dobra
Z-2434	Poreč	Gotička kuća, Decumanus 5	Nepokretno kulturno dobro - pojedinačno
Z-2433	Poreč	Istarska sabornica (bivša crkva sv. Franje)	Nepokretno kulturno dobro - pojedinačno
Z-2432	Poreč	Kompleks Eufrazijeve bazilike	Nepokretno kulturno dobro - pojedinačno
N-4	Poreč	Kompleks Eufrazijeve bazilike	Nepokretno kulturno dobro - pojedinačno
RRI-113-1967.	Poreč	Kompleks rimske vile na Punti Sorni	Nepokretno kulturno dobro - pojedinačno
Z-2435	Poreč	Kuća "Dva sveca", Sv. Maura 16	Nepokretno kulturno dobro - pojedinačno
Z-2544	Poreč	Kulturno - povijesna cjelina Poreča	Nepokretno kulturno dobro - kulturno – povijesna cjelina
Z-2436	Poreč	Palača Sinčić (Zavičajni muzej Poreštine), Decumanus 9	Nepokretno kulturno dobro - pojedinačno
RRI-110	Poreč	Podmorska arheološka zona (6 zona)	Nepokretno kulturno dobro - kulturno – povijesna cjelina
RRI-109	Poreč	Podmorske arheološke zone (2)	Nepokretno kulturno dobro - kulturno – povijesna cjelina
Z-876	Poreč	Sklop zgrada Palače Vergottini, Eufrazijeva ulica	Nepokretno kulturno dobro - pojedinačno
Z-2429	Poreč	Vila Polesini, Marafor	Nepokretno kulturno dobro - pojedinačno
Z-4516	Poreč	Zavičajni muzej Poreštine - muzejska građa	Pokretno kulturno dobro - muzejska građa

Source: Register of Cultural Heritage, 2019.

For the management of culture in the City of Poreč, the City has established three cultural institutions: the Poreč Public Open University, the Poreč Homeland Museum - Museo del territorio parentino and the Poreč City Library. There are two galleries within the Poreč Public Open University: the gallery in the Zuccato Palace and the Small Gallery.

There are no national parks and / or nature parks in the area of the City of Poreč. Among the protected natural areas in the area of the City of Poreč are:

- ✓ Monument of park architecture: 1st group of trees-alleys of pyramidal cypresses in the cemetery in Poreč and a group of cedars, wild chestnuts and pines at the entrance to the cemetery in Poreč, 2nd group of trees around the church of St. Ana near Cervar.
- ✓ Monument of nature: 1. Baredine cave, 2. maple tree at the Bašarnik station.

In addition, the coastal area of the City of Poreč has the status of a Bird Conservation Area (POP).

The City of Poreč regularly finances the work of numerous civil society organizations according to the social areas of their activities;

- ✓ sports clubs and associations,
- ✓ cultural associations,
- ✓ associations for the care of vulnerable groups in society,
- ✓ youth associations, etc.

2.1.4. Economic aspects

In the last 70 years, the economy of the Istrian County has undergone a transformation, first from predominantly agricultural and fishing to industrial, and then to a service economy. In the 1990s, social and political changes took place, which also affected the economy, so Croatia moved from the socialist economic concept to the concept of a free market economy. This transformation of the economic concept was accomplished through transformation and privatization, which resulted in the collapse of a number of market-uncompetitive economic entities that employed thousands of workers. Although relatively slow, there has been an economic recovery in the meantime, largely based on strengthening tourism and SMEs. It is important to point out that a significant number of Istrians used to be employed in large socialist production and / or processing companies and hotel companies. stagnation of agricultural production and the transition of farmers to other activities (tourism, crafts, etc.). With the development and strengthening of tourism, which determines the higher demand for agricultural products, in the last ten years there has been a revitalization of agriculture through increasing demand generated by strengthening tourism, especially rural tourism.

The basic indicator of the development, state and trends of the economy of a country is the gross domestic product. Gross domestic product is published at the state level and at the county level. The last GDP by counties in Croatia was published for 2016.

Table 4: GDP by counties

Gross domestic product, thousand EUR	Nominal		Index	GDP *per capita*		Index
NKPJS 2012 - 2nd level and county	2014.	2016.	2016./2014.	2014.	2016.	2016./2014.
Republic of Croatia	43.455.969	46.663.725	107,38	10.259	11.184	109,02
Continental Croatia	29.529.885	31.716.178	107,40	10.427	11.402	109,35
Grad Zagreb	14.613.964	15.685.273	107,33	18.303	19.546	106,79
Zagrebačka	2.499.674	2.701.364	108,07	7.854	8.595	109,44
Krapinsko-zagorska	857.580	951.614	110,97	6.595	7.448	112,93
Varaždinska	1.480.714	1.619.906	109,40	8.541	9.497	111,20
Koprivničko-križevačka	968.458	1.018.550	105,17	8.529	9.180	107,64
Međimurska	983.329	1.068.370	108,65	8.697	9.537	109,67
Bjelovarsko-bilogorska	797.158	861.502	108,07	6.903	7.703	111,59
Virovitičko-podravska	459.308	489.435	106,56	5.598	6.190	110,59
Požeško-slavonska	436.957	455.948	104,35	5.830	6.346	108,84
Brodsko-posavska	870.231	931.389	107,03	5.654	6.292	111,28
Osječko-baranjska	2.388.747	2.560.316	107,18	8.011	8.834	110,29
Vukovarsko-srijemska	1.007.390	1.086.365	107,84	5.823	6.563	112,71
Karlovačka	951.003	1.023.240	107,60	7.675	8.501	110,77
Sisačko-moslavačka	1.215.371	1.262.907	103,91	7.422	8.042	108,36
Adriatic Croatia	13.926.084	14.947.547	107,33	9.918	10.747	108,36
Primorsko-goranska	3.734.688	3.875.650	103,77	12.715	13.390	105,31
Ličko-senjska	380.714	399.710	104,99	7.840	8.532	108,83
Zadarska	1.415.513	1.545.276	109,17	8.263	9.112	110,28
Šibensko-kninska	858.938	902.863	105,11	8.147	8.772	107,67
Splitsko-dalmatinska	3.599.996	3.912.015	108,67	7.918	8.654	109,29
Istarska	2.688.338	2.937.249	109,26	12.920	14.120	109,29
Dubrovačko-neretvanska	1.247.898	1.374.783	110,17	10.202	11.272	110,49

Source: DZS, 2019.

Differences between counties can be seen in the table above. The average GDP per capita in the Republic of Croatia in 2016 was 11,184 Euros.

The highest amount of this indicator is recorded by the City of Zagreb 19,546 Euros, and the lowest in Virovitica-Podravina County 6,190 Euros, which is only 31.7% of Zagreb's GDP in that year. GDP per capita in the County of Istria in 2016 amounted to 14,120 Euros, which indicates that the County of Istria is the second most developed and economically strongest county in Croatia. According to the NUTS 2 regional division of the EU, Croatia consists of two regions: Continental Croatia (approx. 2.96 million inhabitants) and Adriatic Croatia (approx. 1.47 million inhabitants). These data confirm the continuation of the trend of unfavorable ratios between counties, i.e., large differences in development between counties.

In 2017, according to the number of processed annual financial statements, 1,305 entrepreneurs of legal and natural persons liable to pay income tax operated in Poreč. Observed at the level of Poreč, this group of entrepreneurs operated with a net profit of HRK 441.3 million. In the total number of entrepreneurs, counties participate with 12.8%, in the number of employees with 16.4%, in total revenues with 15.0% and in the profit for the period with 22.5%. Entrepreneurs in Poreč had 8,315 employees in 2017, which is 16.4% of the total number of employees in the County of Istria and 0.9% of employees of entrepreneurs in the Republic of Croatia. They generated total revenue in the amount of HRK 5.1 billion, which is a share of 15.0% in the total revenue of entrepreneurs in the County of Istria and 0.7% of the total revenue of entrepreneurs in the Republic of Croatia[2].

Table 5 below shows the number of entrepreneurs, employees, the amount of total income and the average monthly net salary in a seven-year period in the City of Poreč.

[2] http://www.porec.hr/prva.aspx?stranica=3025&pid=39

Table 5: Selected economic indicators of the City of Poreč in the period from 2011 to 2017 (in thousands of HRK)

Year	Number of entrepreneurs	Number of employees	Total income	Total expenditures	Profit period	Loss period	Consolidated financial result - net profit	Investments in new fixed assets [2]	Trade balance (exports minus imports)	Average monthly net salary per employee
2011.	1.205	5.998	2.930.219	2.865.323	158.836	131.421	27.415	283.797	877.404	4.417
2012.	1.272	6.221	3.222.767	3.084.591	267.240	149.479	117.761	396.013	1.006.519	4.701
2013.	1.258	6.832	3.474.556	3.351.737	280.320	157.090	123.230	347.527	1.092.875	4.527
2014.	1.261	6.966	3.850.029	3.664.221	243.581	86.254	157.327	460.625	1.329.522	5.087
2015.	1.279	7.464	4.216.843	3.951.454	297.098	85.238	211.861	743.734	1.469.518	5.359
2016.	1.260	7.704	4.733.330	4.279.232	575.620	90.314	485.307	448.272	1.821.223	5.574
2017.	1.305	8.315	5.063.176	4.582.208	509.847	68.504	441.343	601.651	1.940.037	5.864

Source: http://www.porec.hr/prva.aspx?stranica=3025&pid=39

In 2017, entrepreneurs in the city of Poreč generated total revenue of HRK 5.1 billion, which is HRK 608.9 thousand per employee, which is lower compared to 2016, when it amounted to HRK 614.4 thousand, but higher than to 2011 in which the income per employee amounted to HRK 488.5 thousand. The role of the private sector is dominant in the business results of entrepreneurs in the city of Poreč. In that sector in 2017, there were the most employees, 4,953 of them employed, which is 59.6% of the total number of employees in the city of Poreč. In the structure of the economy of the city of Poreč in 2017, according to the criterion of the number of employees, the dominant role is played by entrepreneurs in the activities of providing accommodation and food preparation and serving, wholesale and retail trade and construction. The city of Poreč is on the 2nd place within the Istria County in the number of entrepreneurs, and on the level of the Republic of Croatia it is on the 10th place. According to the number of employees at the level of the Republic of Croatia, it is on the 15th place, and according to the total income on the 17th place.

Entrepreneurs of the city of Poreč in 2017, compared to 2016, generated higher total revenue by HRK 686.2 million, or an increase of 15.7%. The consolidated financial result (net profit) decreased compared to the previous year by 6.9% and HRK 32.5 million, respectively.

The realized net profit in 2017 in the amount of HRK 441.3 million is the result of the work of 8,315 employees at 1,305 entrepreneurs in the city of Poreč, who with a total revenue of HRK 5.1 billion, achieved total expenditures of HRK 4.6 billion, and thus the profit for the period with 792 gainful entrepreneurs in the amount of HRK 509.8 million and the loss for the period with 513 entrepreneurs in the amount of HRK 68.5 million.

In 2017, entrepreneurs in the city of Poreč made a net profit of HRK 441.3 million, while entrepreneurs in the Istria County made a net loss of HRK 309.7 million, and entrepreneurs in the entire Republic of Croatia made a net profit of HRK 219.3 million. 9 billion.

In addition to entrepreneurs, corporate taxpayers, excluding banks, insurance companies and other financial institutions, the city of Poreč has 15 budget users, 59 non-profit organizations and 58 craftsmen, corporate taxpayers, whose results are included in the results of entrepreneurs in Poreč in 2017 because they are obliged to compile the annual financial report. Data on craftsmen in the income tax system and their financial operations at the individual and aggregate level are not available. Namely, craftsmen, taxpayers of income tax, report their financial results only in the attachment to the income tax return, which they submit to the Ministry of Finance, the Tax Administration, but they are not publicly available[3].

2.1.4.1. Employees and unemployment

According to the records of the Croatian Pension Insurance Institute on 31.12.2018. in the area of Istria County, a total of 85,443 insured persons were registered on various grounds, and this figure can be equated with total employment. Out of the total number of employees in legal entities, there were 69,595 employees, 13,693 employees in crafts, 760 farmers and 1,002

[3] http://www.porec.hr/prva.aspx?stranica=3025&pid=39

employees in independent professional activities. The share of men in the total number of employees is 53.53%, and women 46.47%.

Table 6 shows the number of employees in the Istria County by activities on 31.12.2018. years.

Table 6: Number of employees in the Istria County by activities as of 31.12.2018.

Areas	National Classification of Activities - NCA 2007	Number of employees
A	Agriculture, forestry and fishing	2.667
B	Mining and quarrying	89
C	Manufacturing	13.239
D	Electricity, gas, steam and air conditioning supply	615
E	Water supply, wastewater disposal, waste management and environmental remediation	1.846
F	Construction	7.693
G	Wholesale and retail trade, repair of motor vehicles and motorcycles	13.380
H	Transport and storage	3.125
I	Accommodation and food service activities	12.197
J	Information and communication	1.887
K	Financial and insurance activities	1.992
L	Real estate business	666
M	Professional, scientific and technical activities	4.419
N	Administrative and support service activities	3.435
O	Public administration and defense; compulsory social security	4.260
P	Education	5.630
Q	Health and social work activities	4.453
R	Arts, entertainment and recreation	1.700
S	Other service activities	2.031
T	Activities of households as employers; the activity of households producing different goods and performing different services for their own needs	40
U	Activities of extraterritorial organizations and bodies	0
Unknown		79
ALL ACTIVITIES TOTAL		85.443

Source: HZMO, 2019.

The largest number of employees in the Istria County is employed in the activity (G) Wholesale and retail trade (15.66%), repair of motor vehicles and motorcycles, activities C Manufacturing (15.49%), activities and activities I Accommodation activities and food preparation and serving (14.27%).

The registered unemployment rate in the Republic of Croatia on 31 December 2017 was 11.3% and represents a decrease of 2.9 percentage points compared to December 2016, while the average rate for the same comparable period decreased by 2.7%. The average registered unemployment rate in 2017 in the Istria County was 4.6%, which is a decrease in unemployment of 1.5% compared to 2016. During 2017, an average of 4,144 unemployed persons were registered in the Istria County. As in previous years, seasonal employment in tourism had an impact on the movement of unemployment and the number of registered unemployed persons in the Croatian Employment Service of the Pula Police Administration. At the beginning of the year, the registered unemployment was higher, and with the approach of the tourist season, there was a gradual decline and unemployment decreased further. Such a trend has been recorded in the Istria County for years. At the end of the tourist season, unemployment is on the rise again. Thus, in 2017, the highest number of registered unemployed was recorded in January (6,651), and the lowest in July (2,658).

In 2016, an average of 563 unemployed persons were registered in the Poreč branch office, which represents 10.4% of the unemployed in the total number of unemployed in the Istria County. The following year, 2017, 453 unemployed persons were registered in the area of the Poreč branch office, i.e., 19.5% less than in 2016. The Poreč branch office covers a somewhat wider area than the administrative area of the City of Poreč, so Table 7 shows the movement of the number of unemployed persons in the area of the City of Poreč in the period from 2015 to 2017.

Table 7: Trends in the number of unemployed persons in the Istria County and the City of Poreč in the period from 2015 to 2017

Year/Gender	Istrian County	City of Poreč	Share of unemployed (City of Poreč/IC)
2015	6.665	441	6,62%
Men	3.002	192	6,41%
Women	3.662	249	6,79%
2016	5.404	365	6,76%

Men	2.421	154	6,35%
Women	2.983	212	7,10%
2017	4.144	287	6,93%
Men	1.826	118	6,47%
Women	2.317	169	7,30%

Source: HZZ, 2019.

In the area of the City of Poreč in 2017, an average of 287 unemployed persons were registered.

According to the shown trend in the number of unemployed, a decrease in their number during the reference period is visible at both statistical levels. However, although not to a greater extent, there is a slight increase in the share of the unemployed in the City of Poreč in the total number of unemployed in the Istria County. This indicates that the number of unemployed in the City of Poreč is declining more slowly than the county average. Differences within the Istria County exist not only in scope, but also in the structure of unemployed persons, so in 2017, on average, women had a higher representation among registered unemployed persons in all branches. Although women make up more than 50% of the total registered unemployment in all branches, the smallest share of women (53.1%) was recorded in the Labin branch, and the largest in the Poreč branch (59.8%). Of the average number of registered unemployed persons in 2017, 2,317 (55.9%) are women and 1,826 persons (44.1%) are men. Compared to the 2016 average, the percentage reduction in average unemployment in 2017 is higher for men (24.6%) than for women (22.3%). The average number of registered unemployed in 2017 compared to 2016 decreased in all age groups. The largest decrease was recorded in the age group of 15 to 19 years (35.3%), followed by the age group of 20 to 24 years (31%) and 45 to 49 years (29%). The smallest decrease was recorded in the age group of 60 and over (11.3%). The average number of registered unemployed in 2017 compared to 2016 decreased in all levels of education. The largest decrease was recorded in persons with completed primary school (26.9%) and the smallest in persons with completed faculty, academy, master's degree and doctorate (15.8%).
Table 8 shows the movement of the number of unemployed in the City of Poreč in the period from 2015 to 2017 towards education.

Table 8: Movement of the number of unemployed in the City of Poreč in the period from 2015 to 2017 by education

Year/ Gender	(18) ISTRIA						Total
	(0) No school and unfinished primary school	(1) Completed primary school	(2) High school	(3) First degree college, professional study and college	(4) Faculty, academy, master's degree, doctorate	(18) ISTRIAN	
2015	30	75	270	30	36	441	441
Men	16	33	121	11	11	192	192
Women	14	42	149	19	24	249	249
2016	22	62	220	23	39	365	365
Men	11	27	96	6	14	154	154
Women	11	35	124	17	24	212	212
2017	17	41	178	19	33	287	287
Men	7	18	76	6	11	118	118
Women	10	23	102	13	22	169	169

Source: HZZ, 2019.

According to the presented structure of the unemployed by sex, in the area of the City of Poreč there is a decrease in the number of unemployed in all observed groups.

2.1.4.2. Development Index and Entrepreneurship 19

The above data on the business of entrepreneurs, the number of SMEs, the number of employed and unemployed, are indicators that indicate the need to strengthen communal, entrepreneurial and social infrastructure in the City of Poreč, which are the basis for strengthening the competitiveness of the local economy. Namely, according to the international GEM (Global Entrepreneurship Monitor) research and indicators of entrepreneurial activity published in the material "What makes Croatia a (non) entrepreneurial country?", Croatia lags significantly behind the countries to whose development group it belongs. According to all indicators of

entrepreneurial activity, Croatia lags behind the countries to whose development group it belongs. The decline in the perception of opportunities from 44.4% in 2008 to 18.3% in 2011 was halted in the period from 2012 to 2015. However, in 2015 there were only 22.3% of adults in Croatia who see an opportunity for an entrepreneurial venture (which positions Croatia at the back of the EU). Unlike Croatia, one third of the adult population in the EU sees a business opportunity, which indicates a large difference in the potential that determines the entrepreneurial capacity of the country. At the same time, Croatia is at the top of the EU in terms of expressed entrepreneurial intentions, which indicates a greater participation in starting business ventures out of necessity, and not because of the perceived opportunity. Croatian entrepreneurial activity measured through the "beginner" - TEA index (up to 42 months of activity) and "adult" (more than 42 months of activity) shows two worrying situations. In the period from 2012 to 2015, Croatia returned to the level of about 8% of people who have a business venture not older than 42 months, but this return was the result of strengthening entrepreneurial activity out of necessity, not because of perceived opportunities. The Motivation Index (ratio of TEA due to perceived opportunity and TEA due to emergency) in 2014 was 1.1, which means that the number of those who enter entrepreneurial activity by their choice due to perceived opportunity and those forced to do so is almost equal. which they found themselves. According to the motivational index, Croatia is at the bottom of the EU, and in 2014 and 2015 it was in last place. The difference in the capacity for entrepreneurial activity shows a comparison with the average motivation index for the EU, which was 4.0 in 2015, which means that in other EU countries four times more start-up entrepreneurs enter a business venture because of the opportunity. The TEA index (Level of entrepreneurial activity measured by the number of entrepreneurs per 100 inhabitants) amounted to 7.32% in 2015, which ranks Croatia in 37th out of 55 places among the observed countries. The average of the observed countries is 13.97%, which shows that the level of entrepreneurial activity is twice lower than the average. Measurement distinguishes the incentive to enter entrepreneurship - business opportunity or necessity. Indicators for Istria, Primorje and Gorski Kotar show that out of 8.57%, 7.2 was generated on occasion, and 4.6 by necessity, which gives a motivation coefficient (opportunity / necessity ratio) of 1.6. The average of the Republic of Croatia is 1.5, while the average of all observed countries is 3.43. This indicates that among 55 countries, 3.43 times more entrepreneurs enter the venture because they see an opportunity than out of necessity. Extremely poor values of the index are also conditioned by the lack of quality entrepreneurial

infrastructure. Croatia continuously (from 2012 to 2015) has lower ratings of the quality of the component of the business environment (business zones, development agencies, incubators, etc.), than the EU average. Thus, in 2015, the average quality of the business environment in the EU was 3.1, and in Croatia 2.6. With this result, Croatia is in the group of 5 worst EU countries in terms of the quality of the business environment.

Observed according to key indicators of development, Istria County with the value of development index of 108.97 is the second most developed county in Croatia. The City of Poreč with the value of the development index of 113,998 is the eighth most developed unit of local self-government in Croatia. Table 9 shows the values of the development index indicators for the County of Istria and the City of Poreč.

Table 9: Values of development index indicators for Istria County and the City of Poreč

Indicators	Istria County	City of Poreč
Basic indicators		
Average income per capita	35.191,17	37.539,78
Average source income per capita	5.535,63	6.820,12
Average unemployment rate	0,0654	0,0492
General population trends (2016/2006)	101,17	105,81
Aging Index (2011)	136,8	108,5
Degree of education (VSS, 20-65) (2011)	0,225	0,2345
Standardized indicators		
Average income per capita	113,17	120,57
Average source income per capita	118,37	122,59
Average unemployment rate	117,11	113,19
General population trends (2016/2006)	112,79	110,47
Aging Index (2011)	90,84	103,49
Degree of education (VSS, 20-65) (2011)	106,28	115,79
Development index value	108,97	113,998
Development group	4	8

2.1.5. Infrastructure

2.1.5.1. Communal and transport infrastructure 21

Water supply system

Drinking water supply is provided from three main sources managed by the Istrian Waterworks. The springs are Sveti Ivan in Buzet, Gradole and the Butonega reservoir. The western part is supplied from the main pipeline of the Gradola system and is part of the regional water supply system of Istria. The Ø700mm main pipeline passes through the eastern side of the City of Poreč and is also the transport and supply pipeline of the cities of Rovinj and Pula. Considering the position of the City of Poreč, the water supply regime of the city itself directly affects the water supply regime of the entire associated regional system. Four water reservoirs are connected to the regional constitution of Gradola for the needs of water supply of the area within the boundaries of the city, from which water is gravitationally delivered to consumers. The local water supply system is completely gravitational.

The eastern part is supplied from the St. Ivan system through the main supply pipelines of the Air Force. Višnjan - VS. Facinka (Poreč) and Baderna - VS. St. Martin, and the main line DN 300 towards Sv. Lovreč and Bale.

Organized and controlled water supply exists in almost all settlements except in secluded hamlets. The population that is not connected to the public water supply system is supplied mainly from rainwater collection tanks. Within the Poreč subsystem, there is no device for water conditioning, but already treated water is taken from the regional system.

Butoniga water supply system - water can be directed to Poreč if necessary. The most important water supply and water management facilities are:

- Kufci reservoir
- Gulići reservoir
- Fazinka reservoir

- Mugeba Reservoir
- Baderna Reservoir
- Veznaveri reservoir
- main pipeline Ø 700 of the Gradola regional system
- main pipelines Ø 150, 200 and 300 of the regional system Sv. Ivan - wastewater treatment plant Poreč north and south.

Electricity and ICT infrastructure

There are a total of 543.5 km of transmission lines and low-voltage electricity networks in the city area, as well as 324 substations. The most important power facilities are: - transformation stations of voltage 110 / 20kV Kukci and - distribution transmission line 110kV Rovinj - Poreč - Buje.

There are 3 (three) operators in the mobile network I in the area: T-Mobile, VIP-net and TELE 2, where the subject operators use a total of approximately 150 stationary repeaters in the Istria County. The fixed network operators are T-Com and Optima-Telecom, where: Optima-Telecom uses 4 (four) regional and 11 local telephone exchanges, mainly in larger centers. Of the telecommunication lines, the optical line in the Rijeka-Poreč direction is mainly used.

Transport infrastructure

The total length of state, county and local roads in the area of the City of Poreč is 85.55 km, of which 15.7 km are state roads, 31.65 km are county roads and 38.2 km are local roads. List of roads in the city:

- A9 Umag junction (D510) - Kanfanar - Pula junction (D66
- DC48 junction Baderna (A9) - Pazin - junction Rogovići (A8)
- DC302 Poreč (D75) - Baderna hub (A9)
- DC75 D200 - Savudrija - Umag - Novigrad - Porec - Vrsar - Vrh Lima - Bale - Pula (D400)
- ŽC5209 Kaštel (D510) - Buje - Vižinada - hub Medaki (D9) - Vrh Lima (D75)
- ŽC5198 St. Vodopija (D75) - Poreč (D302)

- ŽC5039 Ulika - Červar - D75
- ŽC5041 Insects (Ž5042) - Brnobići - Vižinada (Ž5209)
- ŽC5042 Špadići (D75) - Višnjan - Diklići - Karojba (Ž5007)
- ŽC5072 Žbandaj (D302) - Sv. Lovreč (F5209)
- ŽC5116 Green Lagoon - D75
- LC50044 Cervar (Ž5039) – Materada
- LC50046 Frata (D75) - Gedici - Antonci - Porec (F5198)
- LC50050 Visnjan (Ž5042) - Žbandaj (D302)
- LC50088 Vrvari (D302) – Veleniki
- LC50089 D302 – Musalež
- LC50090 Žbandaj (Ž5072) - Radmani - Dračevac - Fuškulin (L50091)
- LC50091 D75 - Mugeba - Fuskulin - Flengi (D75)
- LC50093 Dračevac (L50090) - Montižana.

There is no railway infrastructure in the area of the City of Poreč.

Maritime traffic takes place through the following seaports:

- seaport of special (international) economic interest: port of Poreč;
- seaport of county importance: port of Poreč;
- nautical tourism ports: marinas Cervar Porat, Molindrio and Parentium;
- sports ports in tourist resorts;
- permanent border maritime crossing of the II category Poreč.

In the area of the City of Poreč, there is no infrastructure for air traffic, so it takes place through Pula Airport, about 50 km away. In the immediate vicinity of the city of Poreč is the runway for small aircraft Crljenka in Vrsar.

2.1.5.2. Social infrastructure

Educational institutions

Kindergarten and preschool education programs in the City of Poreč are implemented in 3 educational institutions. The founder and owner of the largest institution, Radost Kindergarten, is the City of Poreč. The activity of pre-school education DV Radost is carried out in the home kindergarten and in the regional kindergartens:

- DV "Radost I" Poreč, R. Končara 7,
- PV "Radost II" Poreč, O.Keršovanija 14,
- PV Kaštelir, Kaštelir, Brnobići 39
- PV Vizinada, Vizinada, C.Grisi 48 b
- PV Sv.Lovreč, Sv. Lovreč, Gradski trg 1
- PV Baderna, Baderna 4

There is a 10-hour regular program in the city nursery and kindergarten, a total of 5 educational groups from 1 to 3 years of age and 12 educational groups from 4 to 6 years of age. In PV "Radost II" in one educational group there is a 10-hour regular program enriched with the contents of Catholic religious education. The kindergarten has the consent of the Ministry for the implementation of this program. There are 6- and 10-hour regular programs in all regional kindergartens. In the Regional Kindergarten in Kaštelir, two educational groups were formed, in Sv. Lovreč one educational group and in Baderna one nursery and one kindergarten educational group. The Vižinada Regional Kindergarten runs a 6- and 10-hour regular program enriched with English language content. The kindergarten has the consent of the Ministry for the implementation of this program. Two educational groups were organized. The kindergarten also organizes a preschool program for children in the year before starting primary school who are not included in the regular preschool education program.

Kindergarten and preschool education programs in Italian are conducted in the kindergarten-Scuola dell infanzia "PAPERINO"

In addition to the listed public institutions in the area of the City of Poreč, kindergarten and preschool educational programs are also implemented by two private kindergartens:

- Kindergarten and nursery 101 Dalmatians (Nova Vas)
- Crvenkapica Kindergarten and Nursery (Poreč)

Table 10 shows the movement of the number of institutions, the number of employees and the number of enrolled children by pedagogical years in the period from 2016/2017 to 2018/2019 in the City of Poreč.

Table 10: Movement of the number of institutions, the number of employees and the number of enrolled children by pedagogical years in the period from 2016/2017 to 2018/2019 in the area of the City of Poreč

Pedagogical year	Number of institutions	Children in total	Employees total
2016/2017	11	759	147
2017/2018	11	747	154
2018/2019	10	779	147

Source: DZS, 2019.

In the pedagogical year 2018/2019, 779 children attended kindergarten and preschool programs in the area of the City of Poreč.

Primary school education programs in the City of Poreč are implemented in four institutions:

- Elementary school Poreč,
- Finida Elementary School,
- Italian Elementary School Bernardo Parentin,
- Poreč Art School.

Table 11 shows the movement of the number of institutions, the number of employees and the number of enrolled children by school years in the period from 2016/2017 to 2018/2019 in the City of Poreč.

Table 11: Movement of the number of institutions, the number of employees and the number of enrolled children by school years in the period from 2016/2017 to 2018/2019 in the area of the City of Poreč

School year	Number of schools	Students	The teachers
2016/2017	5	1.188	106
2017/2018	5	1.199	103

2018/2019	5	1.249	114

Source: DZS, 2019.

In the 2018/2019 school year, 1,249 children attended primary school education programs in the City of Poreč. The trend of increasing the number of children in primary schools is also visible during the observed period.

Secondary education programs in the area of the City of Poreč are implemented in two institutions;

- Mate Balota High School
- Antun Štifanić High School of Catering

It is possible to attend the following educational courses at Mate Balota High School:

- general grammar school
- language high school
- economist
- commercialist
- seller
- agricultural technician - general

It is possible to attend the following educational courses at the Antun Štifanić Secondary Catering School:

- hotel and tourism technician
- tourist-hotel commercialist
- waiter
- chef
- confectioner

Table 12 shows the movement of the number of institutions, the number of employees and the number of enrolled children by school years in the period from 2016/2017 to 2018/2019 in the City of Poreč.

Table 12: Movement of the number of institutions, the number of employees and the number of enrolled children by school years in the period from 2016/2017 to 2018/2019 in the area of the City of Poreč

School year	Number of schools	Students	Teachers
2016/2017	4	729	83,29
2017/2018	4	697	81,87
2018/2019	4	673	81,91

Source: DZS, 2019.

In the 2018/2019 school year, 673 children attended high school education programs in the City of Poreč. Also, during the observed period, a decreasing trend in the number of children in secondary schools is visible.

Higher education programs in the area of the City of Poreč are implemented in the Agricultural Department of the Poreč Polytechnic of Rijeka. Students are provided with education through the following study programs:

- Professional study of Winemaking,
- Agricultural study of Mediterranean agriculture,
- Specialist professional graduate study of winemaking.

The Poreč Institute of Agriculture and Tourism also operates in the City of Poreč. The Institute has:

- Department of Agriculture and Food,
- Institute for Economics and Development of Agriculture,
- Institute for Tourism,
- Trial farm.

Students from the City of Poreč attend study programs throughout Croatia and Italy, and mostly in Pula, Rijeka, Zagreb and Trieste.

Table 13 shows the movement of the number of students from the City of Poreč in the academic period from 2015/2016 to 2017/2018 academic year.

Table 13: Trends in the number of students from the City of Poreč in the academic period from 2015/2016 to 2017/2018 academic year

Academic year	In total	High schools	Polytechnics	Faculties professional study	Faculties university study	Art academies
2015/2016	549	42	78	36	384	9
2016/2017	493	17	60	45	361	10
2017/2018	526	20	69	48	379	10

Source: DZS, 2019.

In the observed period, an average of 523 students per year from the area of the City of Poreč attended study programs. Students from the City of Poreč prefer the study programs of the faculties of university studies (71.68% of enrolled students), and the least interested in the study programs of art academies (1.85% of enrolled students).

Health and social work

The basic bearer of primary health care in the area of the City of Poreč are the Istrian Health Centers - Poreč Branch Office. Within the Poreč Health Center there are:

- family medicine practices,
- dental practices,
- general medicine practice for tourists,
- dental practice for tourists,
- emergency medical care (Institute of Emergency Medicine of the Istria County, Poreč Branch Office),
- specialist surgeries and services: physical therapy, laboratory, X-ray, internist, orthopedist, pediatrician, radiologist, gynecologist, urologist, occupational medicine specialist, pulmonologist, ophthalmologist, psychiatrist.

In the last ten years in the area of the City of Poreč, an increasing number of private dental practices and polyclinics (Dr. Jerković, Rakovac, etc.) has been noticed.

In the area of the City of Poreč, there is a Poreč Branch Office of the Institute of Public Health of the Istrian County at the address Ul. Dr. Mauro Gioseffi 1.

Of the pharmacies, there are four pharmacies in the area of the City of Poreč;

- Central Pharmacy (Health Center),
- City Pharmacy,
- Private pharmacy Tomaško i
- Private pharmacy Červar-Porat.

The citizens of the City of Poreč receive secondary health care through the use of health services of the General Hospital Pula, Hospital for Orthopedics and Rehabilitation Prim. Dr. Martin Horvat in Rovinj, Clinical Hospital Rijeka and numerous private (poly) clinics from Istria and Primorje-Gorski Kotar County.

2.2. Institutional and political aspects

Since 1 July 2013, the Republic of Croatia has been a member state of the European Union. The accession process was long and demanding, and relations between Croatia and the European Union began with the international recognition of the Republic of Croatia as an independent and sovereign state on January 15, 1992. The intensification of relations at the end of 1999, and especially at the beginning of 2000, led to the signing of the Stabilization and Association Agreement (SAA) on 29 October 2001. Croatia was the second country to sign a Stabilization and Association Agreement (SAA) with the EU, and this agreement represents the first official contractual step in institutionalizing Croatia's relations with the EU. The agreement entered into force on February 1, 2005.

Following the submission of applications for membership in the European Union on 21 February 2003 in Athens, the Council of the EU gave the European Commission a mandate to draft an opinion on Croatia's application for membership. Based on the positive opinion of the European Commission on this request, the European Council in June 2004 granted the Republic of Croatia the status of a candidate country for membership in the European Union. After successful

negotiations, EU member states decided to conclude accession negotiations with Croatia on 30 June 2011, at a special ceremony preceding the European Council session on 9 December 2011. in Brussels led to the signing of the EU Accession Treaty with Croatia.

If we look at the impact of Croatia's accession to the European Union from an institutional point of view, it is important to emphasize that the EU encourages regional development and decentralization in its guidelines. The development of the member states should go in the direction of "bottom-up", which for JL (R) S means taking responsibility for defining and implementing development strategies that are coherent in their ultimate goals with the strategies of higher levels of government. However, in addition to taking responsibility, the EU allows the use of various financial programs and instruments in order to strengthen the institutional capacity of local and regional levels of government. In the past period, the County of Istria has launched a series of activities to acquaint municipalities and cities, as well as the general public with the process of European integration in the Republic of Croatia. Also, great attention is paid to the development of bilateral cooperation with the regions in the immediate and wider environment, as well as the activities of the County of Istria in programs and projects implemented with the financial assistance of the European Union.

The functional bearers of the development of the Istrian County are its development agencies, and the umbrella is the Istrian Development Agency - IDA d.o.o. It was founded on December 14, 1999. as the first regional development agency in the Republic of Croatia and as a key operational body for the implementation of development programs of the County of Istria. The founders of IDA are the Istria County and all 10 Istrian cities: Buje, Buzet, Labin, Novigrad, Pazin, Poreč, Pula, Rovinj, Umag and Vodnjan. Summarizing the project successes so far, IDA has implemented 50 EU projects with a total value of HRK 500 million since its establishment, of which HRK 54 million has been approved for IDA. Currently, 10 current projects are being implemented, with a total value of HRK 95 million, of which a total of HRK 8 million has been approved for IDA. Several projects are currently in the candidacy phase within various international cooperation programs, and a significant strategic project COWORKING Pula is being actively prepared, which will be financed within the ITU mechanism of the urban area of Pula. IDA's development activities have developed gradually over the years in accordance with the needs of entrepreneurs in the field and are focused today on:

- providing financial support through targeted credit lines and a guarantee fund

- development of entrepreneurial infrastructure (COWORKING center Pula, Business incubator "CHALLENGE" and Technology incubator Pula, Network of business incubators and coworking spaces of the Istrian County, Entrepreneurial zones and clusters)
- Attracting and promoting investments
- preparation and implementation of EU projects
- implementation of trainings for the private and public sector
- strategic planning as a basis for development (consulting on the preparation and evaluation of development strategies, branding of the Istrian County through the IQ (Istrian Quality), investing in research, innovation and development through the established Center for Materials Research of the Istrian County METRIS, IstraLab network and Center for Popularization of Science and Innovation of the County of Istria)
- informing and advising entrepreneurs and promoting entrepreneurship in public[4].

Of the other development agencies of the Istrian County, it is certainly worth mentioning the Istrian Development Tourist Agency - IRTA d.o.o., the Agency for Rural Development of Istria - AZRRI d.o.o. and the Istrian Regional Energy Agency - IRENA d.o.o., which is also the holder of the project.

IRENA - Istrian Regional Energy Agency d.o.o. Labin, was founded in 2009 by the Istrian County. According to the Intelligent Energy Europe (IEE) program, IRENA was established as an independent non-profit organization, providing public advisory services in the form of information, awareness raising, training and the like to local public and private energy decision makers, households and citizens. In addition to conventional energy sources, we encourage energy in Istria by promoting energy efficiency, with the possibility of using renewable energy sources and cogeneration. The development of the company, as well as its work are closely related to the development and quality of living conditions. We want to be a quality link in the functioning of all branches of energy in the County of Istria. Activities in terms of educating our citizens on energy efficiency, the use of renewable energy sources and cogeneration are a special challenge and are necessary given the rising energy prices on the world market and the problems caused by global warming. Today, there are around 400 regional and local energy agencies in the EU. The main goals of IRENA are:

[4] Available at: https://ida.hr/hr/tn/o-nama/

- ✓ Promoting energy efficiency
- ✓ Energy savings in the public and private sectors
- ✓ Use of renewable energy sources
- ✓ Cogeneration
- ✓ Environmental protection

IRENA's areas of activity are:

- ✓ Promoting the use of innovative materials and technologies in energy saving
- ✓ Education on the use of local energy resources
- ✓ Conferences, meetings, workshops and contacts, cooperation and joint appearance and partnership with EPEEF, UNDP and EU funds
- ✓ Cooperation with ministries, funds, agencies and regions in the country and abroad
- ✓ Implementation of national energy programs
- ✓ Preparation, development and implementation of programs and projects in the field of energy efficiency and renewable energy sources
- ✓ Proposing the improvement of living conditions in rural areas by creating a market for renewable energy sources
- ✓ Promoting social awareness of responsible energy use, from contacts with public and private sector representatives and individuals, to organized meetings and conferences
- ✓ Promotion of energy efficiency and the use of renewable energy sources and cogeneration[5].

2.2.1. Sources of financing

In the present study, for each of the alternative solutions, the sources of financing are grants from EU funds and investors' own funds. Regardless of the value of the investment and the eligibility status of the costs, the assumption is used that the total cost of the alternative solution is 100% of the eligible costs, i.e., that there are no ineligible project costs. The share of co-

[5] Available at: http://www.irena-istra.hr/index.php?id=3329

financing from EU funds is 85% of the value of the investment, while the remaining 15% is provided by the City of Poreč-Parenzo from its own budget.

2.2.2. Administrative and procedural obligations

The subject project is contained in finding the optimal technical and technological solution for the use of sea water to meet the energy needs of the City Palace of the City of Poreč-Parenzo.

For the purposes of this study, a preliminary design has been prepared, and after selecting the optimal solution, the main design will be prepared, including a detailed elaboration of the cost estimate.

During the preparation of the main project and in the further process of preparation and implementation of the selected variant solution, all necessary permits and approvals will be obtained.

All works are carried out in the area that administratively belongs to the City of Poreč-Parenzo.

The City of Poreč-Parenzo is obliged to apply regulations in the field of public procurement, public finance, accounting, so regardless of the chosen variant solution, all project activities will be carried out in accordance with applicable regulations. Taking into account the rich experience so far in the preparation and implementation of investment projects, the acquired knowledge and experience are a guarantee of successful implementation of the project and its long-term sustainability.

3. IDENTIFICATION OF THE CURRENT SITUATION AND NEEDS AND ASSESSMENT OF FUTURE TRENDS

3.1. Description of the current situation

The City of Poreč-Parenzo is a unit of local self-government that performs tasks defined by relevant regulations, primarily the Law on Local and Regional Self-Government (OG 33/01, 60/01, 129/05, 109/07, 125/08), 36/09, 36/09, 150/11, 144/12, 19/13, 137/15, 123/17, 98/19, 144/20).

Figure 4: City Palace of the City of Poreč-Parenzo

Therefore, the City in its self-governing scope performs activities of local importance that directly meet the needs of citizens, especially tasks related to landscaping and housing, spatial and urban planning, utilities, child care, social welfare, primary health care, education and education, culture, physical culture and sports, consumer protection, protection and improvement of the natural environment, fire and civil protection, traffic in its area, maintenance of public roads, issuance of construction and location permits, other acts related to construction and implementation of spatial planning documents and other activities in accordance with special laws.

In accordance with the prescribed tasks as well as in accordance with the applicable legal provisions, the internal organization of the City has been established, so that administrative departments and services have been established in the city.

The City of Poreč-Parenzo has the following organizational units for the management and performance of activities of importance to the city:

Administrative Department for General Administration - The Administrative Department for General Administration consists of:

- ✓ Department for professional affairs of city bodies,
- ✓ Department for General Affairs and Local Self-Government, which includes the Office Department and the Public Procurement Department.

The Administrative Department for General Administration performs legal, protocol, advisory and administrative tasks related to the scope of work of the City Council and the Mayor, as well as their working bodies, editing and publishing the official gazette of the City, communicating with the public on behalf of the City. and with twinned and other units of local self-government, and coordination of major events in the city, general and personnel affairs for city administrations, local and local self-government affairs, office affairs, as well as affairs related to national minority councils, civil protection, public procurement and others similar jobs.

Administrative Department for Finance - The Administrative Department for Finance performs activities related to the cutting and collection of revenues belonging to the City of Poreč, preparation and execution of budgets, bookkeeping, financial operations, payment transactions, financial operations (placements and loans), management local treasury system, fulfillment of

obligations and repayment of public debt, financial management and control, implementation of procedures related to borrowing of the City and issuing guarantees, financial and bookkeeping activities related to the management of companies owned by the City and other related activities.

Administrative Department for Social Activities - The Administrative Department for Social Activities performs the following tasks:

- ✓ ensuring public needs: in the field of pre-school education, education and science, sports and technical culture, culture, health and social care,
- ✓ ensuring financial and material conditions for the work of institutions in the aforementioned areas of which the City is the founder and monitoring their operations,
- ✓ preparation of proposals for determining the program of education above the state and pedagogical standard to be financed from the city budget,
- ✓ monitoring the work of associations and encouraging the development of civil society in order to meet the interests and needs of the population in areas under the jurisdiction of the Administrative Department,
- ✓ protection and improvement of the quality of life and improvement of health care and veterinary services for public needs in the area of the City of Poreč-Parenzo,
- ✓ proposing and participating in the development of strategic documents in the areas within the competence of the Department,
- ✓ other similar jobs.

Administrative Department for Communal System - The Administrative Department for Communal System performs settlement arrangements, improvement of housing quality, construction and maintenance of communal facilities, communal and other service activities, construction and maintenance of local infrastructure, communal supervision and other related activities. Jobs include management of communal infrastructure and public areas, management of residential and business buildings owned by the City of Poreč-Parenzo.

Administrative Department for Spatial Planning and Environmental Protection - The Administrative Department for Spatial Planning and Environmental Protection performs activities to ensure conditions for rational and efficient management of the City of Poreč - Parenzo through

preparation, preparation and monitoring of spatial plans, land preparation for construction, disposal and management / purchase, exchange, easement rights, etc./ real estate, records of city property, recording of GIS system data, environmental protection, protection of cultural heritage and other related activities. The Administrative Department for Spatial Planning and Environmental Protection consists of:

Department of Spatial Planning and Urbanism - with the following tasks:

- ✓ preparation and preparation of spatial plans and other spatial planning documents related to spatial and urban planning and landscaping of the city,
- ✓ monitoring the implementation of spatial plans, the situation in space and the area of spatial planning,
- ✓ preparation and preparation of project, conservation and other documentation for the arrangement of cultural property,
- ✓ implementation of procedures for the protection of cultural heritage and cooperation with competent bodies and institutions on the protection and regulation of cultural property,
- ✓ records of city property, formation of a database and updating of geographic information system (GIS) data,
- ✓ other similar jobs.

Department of Construction Preparation and Environmental Protection - with the following tasks and duties:

- ✓ property-legal affairs related to the sale, purchase, exchange, establishment of easements and other disposal and management of real estate owned by the City,
- ✓ property and legal affairs related to the management of maritime assets,
- ✓ preparation and preparation of environmental protection documents, and implementation of environmental impact assessment procedures,
- ✓ activities of cooperation with competent bodies and institutions for the purpose of collecting, recording, assessing, processing and applying data on natural heritage and the environment,
- ✓ other similar jobs.

Administrative Department for Economy and EU Funds - Administrative Department for Economy and EU Funds consisting of:

- ✓ *Department of Economy and Agriculture* - The Department of Economy and Agriculture performs activities related to encouraging economic development within the planning of spatial and infrastructural conditions in the City, related to promoting growth and development of entrepreneurship, local economy, agriculture, tourism and sustainable development. Then determining the interests and needs of entrepreneurship, providing initial funds for the development of entrepreneurship and helping entrepreneurs to implement certain entrepreneurial programs, encouraging and developing the investment environment and improving the entrepreneurial infrastructure. Activities in the sphere of economy within the competence of the City, consumer protection, recording and keeping documents on companies, institutions and other legal entities in full or partial ownership of the City of Poreč-Parenzo, documents on the right to shares, stakes and the like. The Department also works on drafting criteria and criteria for the use of business premises, property - legal affairs related to the lease of business premises and lease and use of apartments owned by the City, affairs related to the improvement and development of agriculture, supporting programs of farmers' associations, implementation of measures and activities related to the management of state agricultural land, property and legal affairs related to the sale of state agricultural land, monitoring the situation and keeping records of agricultural land and agricultural policing, affairs related to the development and improvement of tourism. The Department is also in charge of defining and drafting strategic documents for the city, preparation, implementation and development of programs and activities in the field of sustainable development and activities related to the City Development Strategy and other similar activities.
- ✓ *Department for EU Funds and Development Projects* - The Department for EU Funds and Development Projects prepares and prepares projects and cooperation programs with entities from the European Union in accordance with regulations, and prepares proposals for cooperation agreements. The department organizes bilateral and other cooperation with regions abroad, implements and participates in international programs, performs activities related to membership in international organizations in the context of using EU funds and activities arising from membership, obtains and distributes information on

potential sources of funding, prepares, applies for and implements projects within the EU and other tenders and funds, establishes and maintains databases on the EU and other projects of the City co-financed from other sources, monitors the implementation of grants, cooperates with international and national institutions and bodies and development agencies in planning, prepares and implements development programs and projects, and performs other similar tasks.

Administrative Department for Physical Planning and Construction - Pursuant to the decision of the County Assembly of the Istrian County and the decision of the City Council of Poreč - Parenzo with the consent of the Central State Office for the entrustment of matters Department of Physical Planning and Construction of the City of Poreč - Parenzo. The construction and use of buildings is regulated by laws and other regulations in the field of construction and physical planning. Published regulations are available on the website of the Ministry of Construction and Physical Planning.

Figure 5: City Palace of the City of Poreč-Parenzo (2)

Users of the services of the City of Poreč-Parenzo who visit the building of the City Palace are:

- ✓ citizens,
- ✓ entrepreneurs,
- ✓ Representatives of private and public institutions / organizations.

The number of service users staying in the City Palace varies throughout the year, according to the needs of citizens, entrepreneurs and other stakeholders. In the last two years, due to the COVID-19 pandemic and the introduction of indoor restrictions on public institutions, the number of visitors has decreased significantly, and most services are provided using digital solutions.

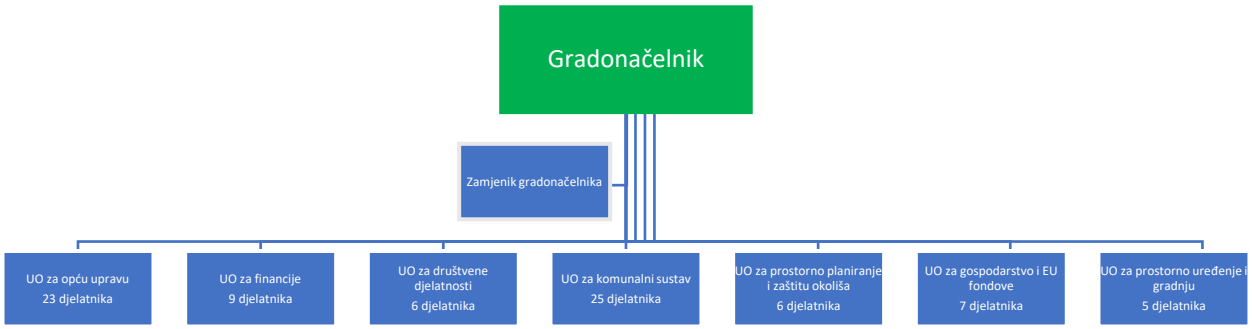
During the past two years, on several occasions, part of the City's employees performed work activities from home, and consequently the number of users of the City Palace space was reduced.

Since the COVID-19 pandemic is an extraordinary event, the study uses the assumption that the number of regular users is the same during all years of the reference period, as well as the fluctuation of visitors / users of services.

The public services provided by the City of Poreč-Parenzo in accordance with legal regulations and its own rules / procedures, according to the organizational structure, have been previously explained.

Organization chart 1 shows the number of employees of the City of Poreč by organizational units.

Chart 2: Number of employees of the City of Poreč by organizational units



Source: City of Poreč-Parenzo - http://www.porec.hr/prva.aspx?stranica=56&pid=54&j=CRO, 2021

According to the presented organizational structure in the City of Poreč-Parenzo, 83 employees are employed[6].

The city administration is located in two locations. An average of 34 employees lives in the building of the City Palace of the City of Poreč-Parenzo, which is the focus of the study analysis.

3.2. Assessment of future trends and, accordingly, assessment of growth in demand for services

To assess the demand of this specific sector, it is necessary to analyze public policies and announced public administration reforms, which will reflect on the long-term energy needs of the City Palace and consequently the cost-effectiveness of the project.

[6] According to the official website of the City of Poreč-Parenzo (Available at: http://www.porec.hr/prva.aspx?stranica=56&pid=54&j=CRO)

Within the framework of the Recovery and Resilience Mechanism, the EU Council approved the Croatian National Recovery and Resilience Plan 2021-2026, worth 6.3 billion. euros, with an advance of around 6.1 billion expected by the end of 2021. HRK, i.e., 13% of the total secured grant. The payment will, of course, be based on the performance indicators defined by the Plan. The Government has therefore instructed "all competent authorities to intensify work on the implementation of activities and implementation" of the Plan. According to goal C2.2. R4 Functional and sustainable local self-government of the National Plan, one of the biggest reform challenges is the reform of local public administration. Local and regional self-government in Croatia is the organization of government and management at the local and regional level for the purpose of autonomous organization and management of public affairs that are important for the local population. This system faces the challenge of insufficient administrative and fiscal capacity to provide quality services to the citizens for which they are responsible, as well as a lack of transparency in the spending of budget funds. This leads to the fact that in many units' certain public needs are not adequately met, and citizens are not satisfied with the functioning of individual units. As local units solve local problems and provide public services to citizens, the effectiveness of this system depends on how it is organized.

In judging the functionality and sustainability of a system, the whole needs to be considered. Judging only the level of economic and financial development of units, the issue of employment in administrative bodies or irrational spending of budget funds, is not enough to draw a conclusion about the necessary reduction in the number of units. It is necessary to take into account other facts and basic assumptions of the organization of local and regional self-government. The size of the area, transport location, social and natural resources, historical and cultural heritage and other potentials should also be considered in the context of judging the functioning of LRUs.

In the context of the analysis of the number of LGUs (R) S, it is necessary to take into account the geographical characteristics of Croatia. Namely, on a relatively small area of 56,594 km2 in Croatia there are three main spatial-relief units, which can be roughly divided into lowland (Pannonian) area in the north, Mediterranean (Mediterranean) area along the Adriatic Sea and its immediate hinterland, as well as island areas and mountainous area. Thus, given the geographical structure, the system of local and regional self-government is very complex.

Consequently, it is important to note that the efficiency of the system does not depend on the number of units but on the way the system is organized in terms of delivery of quality and standardized services and the best solution will be found in terms of achieving efficiency. Therefore, the cooperation of units will be encouraged and a system will be created to finance the joint execution of individual tasks of the LRU (R) S.

Also, in order to mitigate the negative tendencies that could arise from the aforementioned characteristics of the system of local and regional self-government, the legislator seeks to encourage decentralization and equal development of all units through continuous measures. In this regard, in order to reduce and rationalize costs and improve efficiency, the entry into force of the Law on Amendments to the Law on Local and Regional Self-Government reduced the number of local officials or deputies elected together with mayors, mayors and counties from 671 to 103. This will reduce the financial burden of LRUs (R) S, which have weaker financial capacity, reducing the number of local officials in the context of financial savings will benefit most small units (of which there are many in Croatia).

Given that there are different conditions in which individual areas have developed, LRUs (R) S differ in the degree of economic development and revenue collection opportunities in their area. The aim of the legislator is to alleviate fiscal inequalities arising from the uneven economic development of certain areas, in order to ensure the minimum required level of public services in all units. Guided by this goal, within the framework of comprehensive and comprehensive tax reform, the legislator regulated the fiscal equalization of LRUs (R) S and the financing of decentralized functions by the Law on Financing of Local and Regional Self-Government Units.

Also, the provisions of the Budget Act stipulate that LRUs are obliged to follow the principle of transparency when adopting and executing the budget, which primarily includes the publication of the budget in the official gazette or the unit's website. At the same time, annual and semi-annual reports on budget execution are also published in the official gazette or on the website of the unit. Transparency of LRU (R) S is also incorporated in the Law on Local and Regional Self-Government, which in Article 68a prescribes the obligation of municipalities, cities and counties to publicly publish information on budget spending on their websites so that this information is easily accessible and searchable.

Given the above, the National Plan in the coming period *aims to establish a quality and efficient system of local and regional self-government through functional connection of units to establish efficient, quality and transparent provision of services to citizens, so that citizens have equal opportunities to meet their needs and interests, no matter where they live.*

In order to achieve this goal, **a system will be created for financing the joint execution of individual tasks of local units - tasks from their self-governing scope, as well as for the execution of other professional tasks that units perform for their own needs. Through cooperation, units can more easily overcome the problem of insufficient capacity, improve the quality and quantity of services provided and make more efficient use of available funds and resources.**

Joint execution of tasks will be encouraged by co-financing units for a specific job, ie joint performance of that work. The criteria for determining the amount of co-financing will depend, among other things, on the number of tasks that the units perform together, and will be determined by a special law. **Co-financing of organized joint execution of tasks should result in a larger number of units that would be involved in the joint performance of tasks**. An individual unit will be entitled to additional funds, i.e., co-financing, if it is involved in the joint performance of certain listed tasks, for which at least one task is performed together with another or other units. **In that case, it would be entitled to a certain percentage of co-financing of its budget expenditure incurred for that purpose in the previous year. For each additional task, the amount of co-financing would be increased by a certain percentage (up to a certain total amount of co-financing).** In cooperation with MFIN, co-financing will be provided in the equalization fund and planned in the state budget for the current year with projections for the next two years depending on the expressed and identified needs of units that decide on functional or actual merger.

The exact criteria, manner and possibility for co-financing the joint performance of certain tasks and the status of employees in the bodies that will perform tasks for several local units will be determined. At the same time, although the current legislative framework provides for the possibility of actual merging of units, the fact is that there is not much interest from units for the same. Therefore, the potential of the units for the actual merger will also be analyzed and assessed, which will also be financially encouraged during the implementation of these activities.

Units that are actually or functionally merged will be obliged to send impact reports to the MFIN, the state administration body within whose scope the work is performed jointly, and the MPU. The submission of impact reports to the competent authorities will take place through the System for Support of Functional and Actual Connection of Units, the establishment of which is described in more detail in section C2.2. R4-I1 of the National Plan. Successful implementation of the process of actual or functional merger, joint performance of certain tasks and submission of reports on the same will be a prerequisite for the allocation of additional funds, or co-financing. In doing so, the units that decide to merge functionally, in order to exercise the right to co-financing, will be obliged to perform the work / tasks together for a minimum period of 5 years.

Within the development of the model, several possible models of financing joint performance will be determined, taking into account the scope of units determined by law and the expressed needs of units for joint performance. The initial parameters for the development of the model would be: the stated needs of the units, budget and fiscal capacities of the units, the number of inhabitants of the unit, the number of potential users of services in performing local affairs and the durability of certain local services. **Furthermore, the functional or actual merging of units will have a positive impact on the award of grants from EU funds and co-financing from EU funds.** In order to support the units that decide to merge in real or functional terms, an Interdepartmental Working Group will be established, which will consist of experts from state administration bodies. In addition to supporting reform activities of actual and functional mergers, one of the tasks of the interdepartmental working group will be to evaluate the implementation of the process of actual or functional mergers, to clearly identify financial and other effects of mergers and monitor only the establishment of a quality and efficient system of local and regional self-government.

The estimated cost of these activities amounts to HRK 21,612,415.00 and is insured in the National Plan. The estimated time for the implementation of activities is until the middle of 2025[7].

It is important to point out that socially, economically and culturally and historically, Poreč has a much wider area than the one currently administratively covered by the City of Poreč-Parenzo.

[7] National Recovery and Resilience Plan 2021-2026

Thus, in the period from 1965 to 1990, the then Municipal Assembly of Poreč administratively covered a much larger area, and consisted of the following settlements: urban settlements Poreč and Vrsar, Antonci, Anžići, Babići, Bačva, Baderna, Bajkini, Baldaši, Banki , Barat, Barići, Bašarinka, Baškoti, Begi, Benčani, Blagdanići, Bonaci, Bralići, Bratovići, Brčići, Brig, Brnobići, Bucalovići, Bajkini, Bukari, Cancini, Cerjon, Crklada, Cvitani, Čandeti, Čehići, Červa, Ćuki , Danes, Deklevi, Deklići, Dekovići, Delići, Diklići, Dračevac, Dvori, Fabci, Farini, Ferenci, Filipini, Filipi, Flengi, Frata, Frnjolići, Funtana, Fuškulin, Gambetići, Grbina, Gedići, Gradina, Grubići, Heraki, Ivići , Jadruhi, Jakići, Jasenovica, Jehnići, Jurcani, Jurići, Kadumi, Kapovići, Kaštelir, Katun, Kirmenjak, Kloštar, Knapići, Kočići, Kolombera, Kontešići, Korlevići, Kosinožići, Košuti, Kovači, Kranjčići, Kurći, Krćići , Labinci, Lim, Ladrovici, Lakovici, Lasici, Legovici, Lovrec, Majkusi, Mali Maj, Marasi, Markovac, Markovići, Materada, Matulini, Medaki, Medvidići, Mekiši near Kloštar, Mekiši near Vižinada, Mišetići, Mihatovići, Mihelići, Milanezi, Muntižana, Mugeba, Musalež, Narducći, Nova Vas, Ohnići, Orbani, Pajari, Perini , Prašćari, Prhati, Pršurići, Radići, Radmani, Radoši near Višnjan, Radoši near Žbandaj, Rafaeli, Rajki, Rakovci, Rapavel, Rogovići, Rojci, Rošini, Roškići, Rupeni, Ružići, Selina, Sinožići, Smolici, Srebrnići, Staniši, Starići , Sveti Ivan, Stranići near Lovreč, Stranići near Poreč, Strpačići, Šeraje, Špadići, Štifanići, Štuti, Šušnjići, Tadini, Tar, Tarska Vala, Vabriga, Valentići, Valkarin, Vejaki, Veleniki, Velići, Veli Maj, Višnjan, Vižinada, Voštena, Vranići near Poreč, Vranići near Višnjan, Vranići near Vižinada, Vranje Selo, Vrbani, Vrhljani, Vrh Lasići, Varvari, Vežnaveri, Zoričići, Žgrabljići, Žbandaj, Ženodraga, Žikovići, Žudetići and Žužići[8].

[8] P. ŽUŽIĆ, Territorial-administrative structure in the area of today's Istria County from 1945 to 1990 / VIA volume 14 - 16

Figura 6: City of Poreč-Parenzo

If we take into account the benefits and incentives that will be offered to neighboring municipalities and once an integral part of the City of Poreč-Parenzo, in terms of voluntary merger and possible association with the City of Poreč-Parenzo, in the coming period in a strictly conservative scenario can expect the same number of employees. Although the announced digitalization of local public administration will increase the number of services currently provided exclusively in the premises of the City Administration, due to the expected increase in the coverage of the City of Poreč-Parenzo, no significant reduction in visitors / users of the City Palace is expected.

Given the above, at least in terms of the number of employees and the number of visitors / users of the City Palace, in the coming period is not expected to reduce demand, and consequently the energy needs of the City Palace of Poreč-Parenzo.

4. FEASIBILITY ANALYSIS AND OTHER POSSIBILITIES

4.1. Identification and analysis of other possibilities

Instead of the standard analysis of other possibilities according to alternatives:

1. No change (BAU, Business as Usual)
2. Do the Minimum
3. Do Something Else

For the needs of the project in question, a preliminary design was ordered in which alternative solutions for the use of sea water as an energy source to meet the energy needs of the City Palace of Poreč-Parenzo were analyzed in detail.

The selection of the optimal variant solution is based on the results of the analysis of the following thematic areas for each of the alternatives:

- ✓ Technical-technological performance and technology features,
- ✓ Financial analysis,
- ✓ Cost-benefit analysis.

The explanation of the chosen variant solution can be found in Chapter 8. Evaluation of variant solutions.

4.1.1. Project location

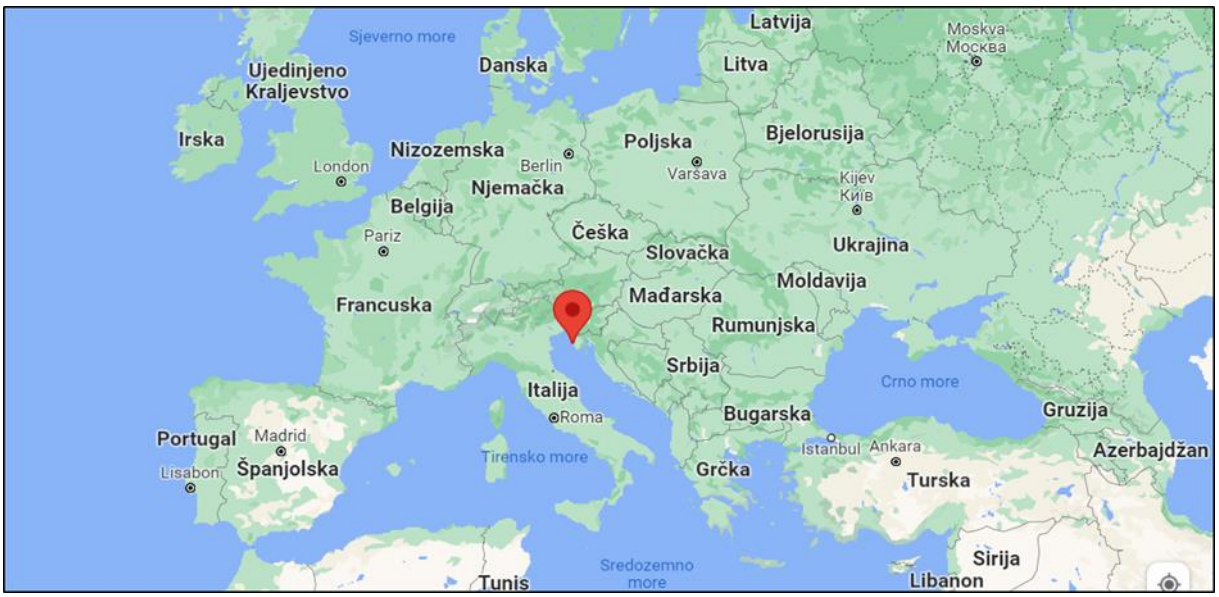
The project is being carried out on cp no. 568, k.o. Poreč, at the address Grad Poreč-Parenzo, Obala maršala Tita 5/1, 52 440 Poreč.

Due to its extraordinary geographical position, and natural and cultural beauties, today it is one of the strongest tourist centers in Croatia. The main economic branch is tourism, with which trade, construction and agriculture have a positive correlation.

Figure 7: Poreč-Parenzo Castle - Location

In addition to the mentioned natural beauties, clean sea, cultural and historical heritage and favorable climatic conditions, the development and turnover of people, goods and services Poreč-Parenzo is influenced by good transport connections and accessibility to the emitting markets Poreč-Parenzo and Istria.

Figure 8: City of Poreč-Parenzo - Location (2/2)



4.2. Technical-technological variant solutions

Preliminary mechanical design of thermotechnical installations for the needs of reconstruction of the engine room (power plant) and replacement of the existing energy source has been prepared. The building in question is currently heated via an EL LU boiler and cooled via an existing water cooler. Hot or cold water in the building is distributed through a steel pipeline. The existing pipeline is laid visibly or flush. The heat transfer system in the building is solved by fan coil units. Investors were required to solve the heating / cooling system in this way in such a way that the installation of a heat pump is envisaged as a new source of heat or cooling energy.

Preliminary design includes 3 variant solutions:

1. Direct capture of sea water from a nearby port,
2. Coastal seawater abstraction through wells,
3. Indirect use of sea water through well exchangers (closed system).

4.2.1. Description of the current situation

The boiler room on EL LU is used as the main source of heat energy in the heating system of the building in question. The boiler room is located in a building located northeast of the building that is the subject of the project. Inside the boiler room there are two installed boilers with associated burners on EL LU. The EL LU tank is located outside the boiler room. Within the existing boiler room, there is a VIESSMANN boiler type VITOPLEX 200 SX2A, power 560 kW, and as a second boiler TOPLOTA type TH 80 TV from 1989, power 1000 kW. Boiler TOPLOTA type TH 80 TV is located inside the boiler room but is no longer in use.

In addition to the boilers in the space there is all the necessary safety fittings. Distribution of heating water to the building was performed using pumps mounted on a pipeline made of steel pipes. As a source of cooling energy used for the needs of cooling the building of the City of Poreč, the existing air / water cooler located in the open space is in use. It is a water cooler type RIELLO type RSA B / 0252, Qh = 62.6 kW, R407C.

4.2.2. V1 - Direct abstraction of seawater from a nearby port

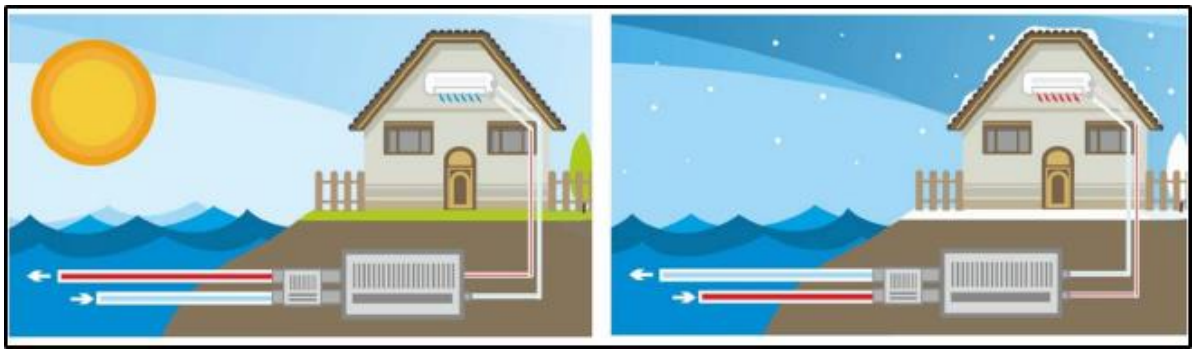
Within this chapter of the project documentation, the use of a water / water heat pump is envisaged as the main source of heating or cooling energy. The newly designed heat pump with all its necessary fittings and tanks will be located within the space of the existing power plant. The existing HEAT boiler, as well as all existing associated fittings, will be dismantled. On the primary side of the heat pump, seawater will be used as the heat sink, while on the secondary side, the existing installation of fan coil heating / cooling systems will be used.

Seawater heat pump systems are systems in which the heat pump uses the sea as a source and sink of heat, i.e., a heat tank. In the heating mode, the system uses the heat energy of the sea as a renewable heat source, while in the cooling mode it transfers the heat taken from the space to the sea as a heat sink. Due to the corrosivity property of seawater, seawater does not go directly to the heat pump evaporator, but previously transfers heat to the corrosion-resistant heat exchanger.

The heat on the evaporator is then transferred to the refrigerant and rises to a higher energy level, and then transferred to the heated space. The reverse process applies to the operation of the heat pump in cooling mode.

This chapter of the project envisages an open implementation of seawater abstraction, i.e., seawater is pumped directly from a certain depth through a pipeline laid into the sea and is returned by it.

Figure 9: Model of direct seawater abstraction



Source: Preliminary design, 2021.

For these needs, the project envisages the construction of a coastal building on the sea / land border. A pump for water intake and distribution in the primary circuit of the heat pump would be installed inside it. The pressure pipeline of the primary circuit leading from the coastal structure to the position of the existing power plant would be conducted in a common energy channel with the gravity pipeline for the return of water to the sea.

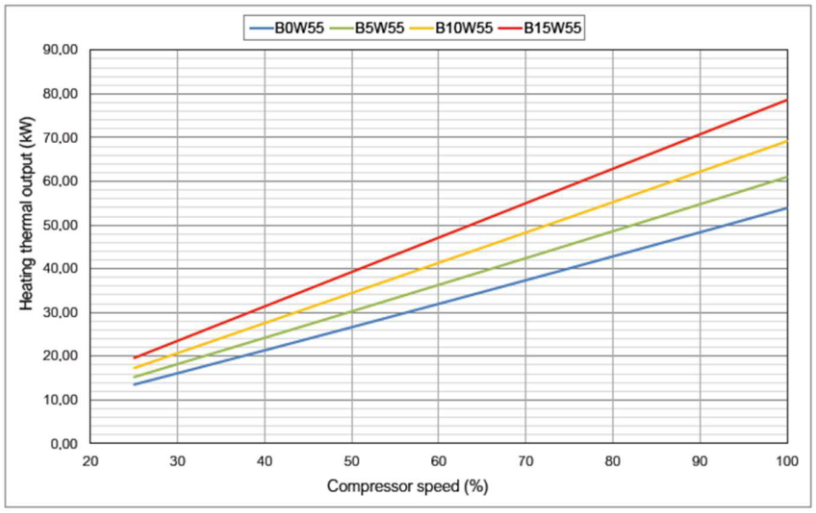
The seawater catchment itself would be carried out at a distance of approximately 50.0 meters from the shore. The inflow of water from the suction basket to the coastal structure is envisaged through the HDPE pipe d315, which needs to be additionally anchored to the seabed. In order to protect the suction pipe for water intake from the formation of algae, it is necessary to perform a chlorination system. The chlorination system is located in a separate facility near the AB manhole inspection shaft.

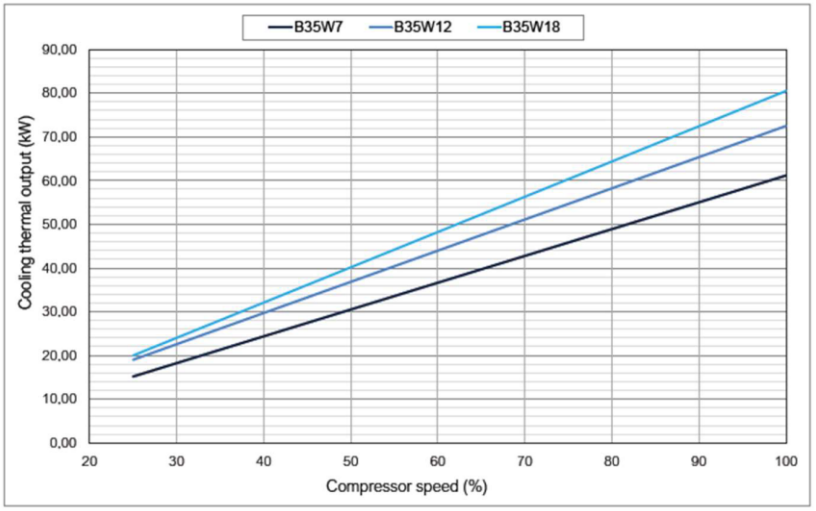
The heat pump is dimensioned in such a way that it covers all the needs of the building in the cooling mode, and in the heating mode it covers losses up to an outdoor temperature of + 2ºC.

It was defined by the project client during the preparation of project documentation that the heat pump itself will not be dimensioned to cover 100% of heat losses but that the rest of the capacity will be covered using the existing boiler on EL LU which remains in use.

Reviewing data on air temperatures at the location of the city of Poreč through the years 2018, 2019, 2020, it can be concluded that the addition (boiler on EL LU) to the newly designed heating system (heat pump) will have to work in 16% of the heating season. Of the total required "kWh" for heating the building from an alternative source (boiler on EL LU) will need to hand over 12% of total energy. The selected heat pump is a device such as Ecoforest type ecoGEO HP 15-70 which has a heat capacity in the heating mode of 17.1 to 59.6 kW in conditions B0W35, and 15.1 to 61.5 kW in cooling mode in temperature conditions B35, W7. The exact capacity of the crane in the heating or cooling mode depends on the temperature of the thermal sink located on the primary side.

Figure 10: Heating / cooling mode





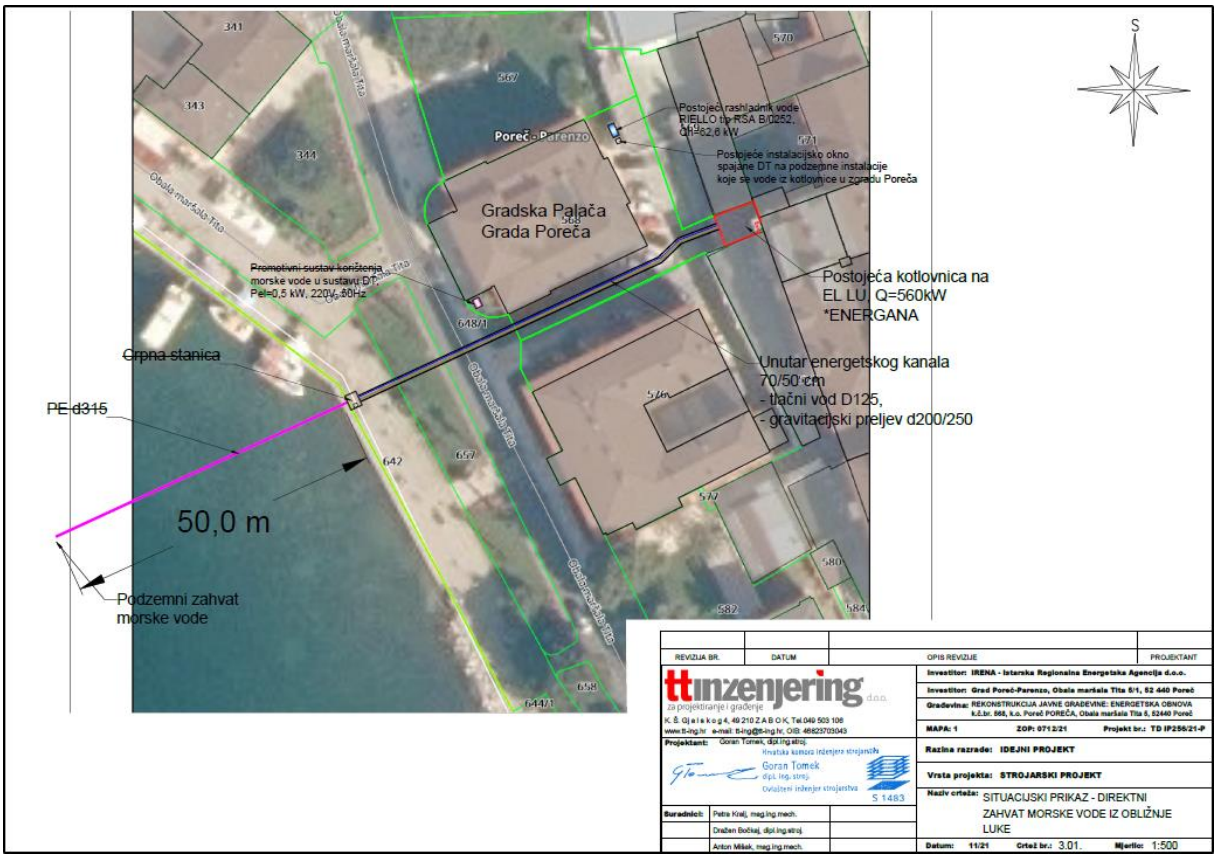
Source: Preliminary design, 2021.

Previously softened water will be used as the heating medium in the secondary part of the heating / cooling system. Before commissioning the heat-pump and using the heating system itself, it is necessary to thoroughly clean the existing part of the heating / cooling system, which consists of the distribution of steel pipes and fan coils mounted on the building. For the needs of

water circulation in the primary and secondary part of the heating / cooling system, it is necessary to choose circulation pumps with speed control.

Figure 11 shows the design in space of the variant solution in question.

Figure 11: V1 - Performance in space



Source: Preliminary design, 2021.

The implementation of the subject variant solution by the preliminary design is divided into 2 parts:

1. Sea intervention,

2. Power plant installation.

The following table shows the activities for the implementation of a variant solution according to the listed units.

Table 14: Implementation activities of the variant solution by units

V1 - DIRECT ACCESS OF SEAWATER FROM A NEARBY PORT		
1.	SEA INTAKE	AMOUNT (HRK)
1.01.	Ensuring traffic during the construction of the pipeline and the energy channel under the road and the parallel running of the pipeline in the protection zone of the road and roads. The item includes the preparation of a project of temporary traffic regulation, all necessary preparatory actions (obtaining the necessary permits, informing the public, etc.), work on the implementation of temporary traffic regulation during the pipeline such as installation and removal of temporary traffic signs and signals and all other actions ensuring safe traffic during the execution of works. The project of temporary traffic regulation is the subject of a special project and must be provided by the contractor. Calculation of all complete.	5.000,00
1.02.	Arranging the construction site and ensuring the smooth flow of vehicle and pedestrian traffic. The item includes delivery, commissioning, dismantling and removal of all devices, plants, accessories, construction machinery, means of transport, formwork, stiffening, supply devices, premises for accommodation and management of works described in the project. The item further includes the arrangement of the construction site and the restoration of the areas of the sites used as work and storage areas. These works include the renovation of all used accesses and roads to the construction site, the use of temporary landfills, water and electricity connections, etc. In case of damage, the contractor bears the cost of restoring the original condition. Calculation of completely performed all works of the item.	8.500,00
1.03.	Construction of the necessary temporary wooden bridges for the needs of pedestrian traffic during the period of works. The item includes the installation, relocation and removal of bridges in accordance with the progress of construction works, and according to the decision of the supervisory service.	4.000,00
1.04.	Preparation of a study of the staking out of the route of the canal and associated buildings, staking out and ensuring the staking out of the route of the seawater intake from the nearby port. The paper covers all geodetic measurements by which the data from the project are transferred to the field, securing the axis of the stalked route, profiling, renewal and	5.000,00

	maintenance of stakes in the field for the entire period of construction or until the handover of works to the investor. The contractor is obliged to secure all points in position and height so that they can be easily restored during or after the work. Prior to the start of the excavation, the contractor is obliged to submit the stated staking plan to the supervising engineer for inspection in order to control the correctness of the procedure. The contractor must not start work before obtaining the approval of the supervising engineer for this documentation. The staking out of the route should be carried out on the basis of data from the project. Inclusion of the working or compensation belt is also included. Site staking as well as geodetic monitoring of construction should be carried out on the basis of project data.	
1.05.	Locating and protecting existing utility installations and other connections (electricity lines, gas pipelines, oil pipelines, telecommunication lines, water mains, sewerage, etc.). During excavation, pay special attention to damage to the installation. Enter the data in the geodetic survey of the existing condition. Perform works in the presence of a representative of the competent operator	2.000,00
1.06.	Geodetic monitoring of all works on the construction of the water intake system network, including the stationing of all points in the field. Calculation per m´.	3.500,00
1.07.	Preparation of a geodetic survey of the derived state of the network, including the preparation of the Study, and implementation in the Cadastre.	3.900,00
1.08.	Breaking and removing the existing asphalt or concrete pavement structure. The item includes machine breaking of the existing pavement structure, loading into the means of transport and transport to the landfill provided by the contractor. Before demolition and removal, it is necessary to perform machine cutting at the place where the object will be demolished, so as not to damage the rest of the object that remains. Dispose of construction waste in accordance with the Ordinance on conditions for waste management	
	Asphalt cutting	8.800,00
	Breaking asphalt, approx. d = 10 cm	5.600,00
1.09.	Dismantling of existing stone pavers on the pipeline route. Careful dismantling of stone pavers so that the necessary excavation can be carried out in the project area. The price includes temporary deposit. After the works are completed, the equipment must be returned to its original position or out of profile at the same road station. The price includes all works and materials needed for the execution of works, excavation for the foundation, concreting and reassembly, i.e., return to the original condition. Calculation by type of artificial object.	2.280,00
1.10.	Dismantling of existing stone slabs of unknown dimensions on the pipeline route. Careful dismantling of the stone cubes so that the necessary	4.800,00

	excavation can be carried out in the project area. The price includes temporary deposit. After the works are completed, the equipment must be returned to its original position or out of profile at the same road station. The price includes all works and materials needed for the execution of works, excavation for the foundation, concreting and reassembly, i.e., return to the original condition. Calculation by type of artificial object.	
1.11.	Dismantling of existing curbs in the project area. Careful dismantling of concrete curbs so that the necessary excavation can be carried out in the project area. The price includes temporary deposit. After the works are completed, the equipment must be returned to its original position or out of profile at the same road station. The price includes all works and materials needed for the execution of works, excavation for the foundation, concreting and reassembly, i.e., return to the original condition. Calculation by type of artificial object.	1.425,00
1.12.	Backfilling, backfilling in the pumping manhole construction zone (relative to elevation -0.20 from the upper edge of the cover) in the hinterland of the coastal stone cerclage. Plan the embankment of pure stone chips and compact it to the compressibility modulus Ms = 60 MPa. Calculation per m3 of embankment made of stone material in compacted state	23.800,00
1.13.	Supply of materials and production of stone cladding with stone slabs in everything adapted to the existing condition. The stone slabs are roughly carved from wear-resistant limestone, homogeneous without veins, solid and frost-resistant, with average dimensions B / L = 30-45 / 60-90 cm, average 0.30 m2 / piece, and thickness approx. 20 cm with one face. Possible deviations from the average dimensions cannot exceed 15% in all respects. They are laid in cement mortar CM 1: 3, joint thickness 2-3 cm. Calculation per m2 of coated area.	18.840,00
1.14.	Supply of materials and grouting of the walking surface made of stone blocks with CM 1: 3 cement mortar made of fine sea sand. Clean the joints with a jet of water under pressure to remove loose parts, algae and other impurities, and then blow out with compressed air, moisten and grout. The joints have a compact cross-section of average dimensions b / h = 2-3 / 4-5 cm, while the face of the joint is lower than the level of the stone cladding by 2-3 mm. The joint must not be outside the compact cross-section in a thin layer over the unevenness of the stone block. Calculation per m^2 of jointed walking surface.	3.250,00
1.15.	Dismantling of existing "masts" for hanging flags. Masts about 10.0 m high. The price includes temporary deposit. After the works are completed, the equipment must be returned to its original position or out of profile at the same road station. The price includes all works and materials needed for the execution of works, excavation for the foundation, concreting and reassembly, i.e., return to the original condition. Calculation by type of artificial object.	7.500,00

1.16.	Dismantling of the existing stone cladding around the water access. The item includes the dismantling of the entire stone aggregate in the project area. The price includes temporary deposit. After the works are completed, the equipment must be returned to its original position. The price includes all works and materials needed for the execution of works, excavation for the foundation, concreting and reassembly, i.e., return to the original condition. Calculation by type of artificial object.	15.000,00
1.17.	Mechanical excavation of a trench for laying pipelines, construction of a construction pit, construction of an energy channel in the "A" category soil, with proper cutting of the sides and bottom. Depth, width of excavation and slope of trench sides according to longitudinal profile and details. All possible damage due to unimplemented protection and unprofessional work will be borne by the contractor. The excavated material is transported to a permanent landfill, which is calculated by the item of removal. The unit price of the item includes all necessary transports, work and materials, equipment and aids for complete performance. The unit price includes the removal of crushed material in the pit at any stage of work or due to bad weather and pumping of groundwater, sea or incoming water (it is necessary to provide pumps for sea water to ensure dry work). The category of land is included in the estimate according to the previous assessment, but the right category is determined only during the execution of works for the installation of pipelines in the soil. The dimensions of the excavation should be according to the designs given in the project. Proper trenching and bottom alignment are included. Included and possible pumping of groundwater and atmospheric water. Dispose of the excavation material 1.0 m from the edge with collapse protection. The calculation is made per m^3 of excavated material.	95.000,00
1.18.	Manual excavation regardless of soil category according to project provisions. This work includes manual excavation in places where it is mandatory or impossible to perform mechanical machinery for safety reasons. Carry out the works with the utmost care and preparation, in order to unconditionally ensure the smooth functioning of the existing lines. The item is calculated for work in difficult conditions. The contractor is obliged to visit the route and get acquainted with the situation on the ground before submitting a bid. The calculation is performed per m3 of excavation actually performed in a fused state, regardless of category.	2.000,00
1.19.	Supply, delivery and installation of PE (PEHD) sewer pipes for the purpose of overflowing water back into the sea, circumferential stiffness SN 8 HRK / m^2, made according to EN 13476-2. The price includes all the necessary preparation (cutting pipes, processing the ends, etc.) as well as all other necessary work and materials. Connect the pipes by electrofusion welding according to the manufacturer's instructions. It includes the purchase, all work and delivery of PE pipes, couplings, seals, and all additional materials	25.200,00

	and accessories, unloading, temporary disposal, storage, laying pipes, lowering into the trench, installation, connection and all work to achieve watertightness.	
1.20.	Supply, delivery and installation of PE (PEHD) pipes for the supply of seawater to the suction pump located in the coastal building (inspection shaft), The price includes all necessary preparations (pipe cutting, end treatment, etc.) as well as all others required work and material. Connect the pipes by electrofusion welding according to the manufacturer's instructions. It includes the purchase, all work and delivery of PE pipes, couplings, seals, and all additional materials and accessories, unloading, temporary disposal, storage, laying pipes, launching, installation, connection and all work to achieve watertightness. The pipes are laid under the sea with the help of a diver.	75.000,00
1.21.	Supply and installation of a suction basket for the needs of seawater inflow into the pipeline. Production of suction basket with a diameter of 400 mm, height 500 mm from stainless steel material resistant to sea water with protection against the entry of larger elements into the pipeline. Connection to the end of the suction PE pipe. The suction basket is placed under the influence of the sea with the help of a diver.	3.500,00
1.22.	Supply, delivery and installation of PE (PEHD) pipes PN10 for distribution of water to the power plant. The price includes all the necessary preparation (cutting pipes, processing the ends, etc.) as well as all other necessary work and materials. Connect the pipes by electrofusion welding according to the manufacturer's instructions. It includes the purchase, all work and delivery of PE pipes, couplings, seals, and all additional materials and accessories, unloading, temporary disposal, storage, laying pipes, lowering into the trench, installation, connection and all work to achieve watertightness.	27.360,00
1.23.	Breaking the existing AB plate in the power plant for the needs of introducing the energy channel in it. The item includes careful cutting of the AB floor slab, breaking and excavation, removal of waste material at the landfill.	1.350,00
1.24.	Concreting of the AB manhole at the boundary of sea water intake, dimensions 250x200 cm, H = approx. 3.5 m. The item includes the construction of a complete watertight manhole made of concrete C30 / 37, partly made of water. Formwork for reinforced concrete works is performed as a double-sided smooth formwork. Depth of manhole is approx. 3.5 m. Walls and bottom of manhole 20 cm thick are made of concrete C30 / 37 with at least 350 kg of cement per 1 m^3 of concrete mixture with the addition of additives to achieve complete watertightness of concrete and resistance to aggressive waters (sea water). Concrete should be installed in layers up to 30 cm and compacted with pervibrators. The inner surfaces of the manhole are smoothed with cement mortar, and close any cracks and nests in the concrete, including making a waterproof	80.000,00

	coating resistant to evaporation of sewage and the inside of the manhole plastered with cement plaster in two layers (2 cm + 1 cm) with waterproofing. Cover with filling dimensions 600 x 600 mm with a load capacity of 250 HRK with installation in cement mortar as well as cast iron duct steps are also included in the price. The shaft has light dimensions of 250x20 cm with walls and a bottom 25 cm thick, depth according to the elevation of the exit channel. The cover is waterproof, with a surface for inserting the final surface coating. Everything according to the detail in the project. The calculation is performed per piece of fully completed audit shaft. Concrete must comply with class V4 in terms of water resistance according to HRN U.M. 015 and must be resistant to sea water, frost and salting. The price includes the purchase, delivery and installation of all the above material, cleaning and preparation of the upper surface of the base, i.e., formwork, preparation, delivery and installation of concrete, levelling to the designed level, protection and care of concrete, quality control and compaction of concrete, installation of reinforcement, steps and covers.	
1.25.	Planning the bottom of the ditch with an accuracy of +/- 2 cm. All irregularities should be repaired, cavities and cavities should be filled with excavated material, and the excess should be removed from the ditch. Calculation per m^2 of planned area.	1.260,00
1.26.	Construction of an energy channel that will lead from the existing power plant to the shaft in which the seawater intake will be performed. The item includes concreting of the AB underground channel, dimensions 70x50 cm, L = approx. 67 m. The item includes the construction of a complete watertight energy channel made of concrete C30 / 37. Formwork for reinforced concrete works is performed as a double-sided smooth formwork. The walls and bottom of the energy channel 15 to 20 cm thick (according to static calculation) are made in concrete C30 / 37 with at least 350 kg of cement per 1 m3 of concrete mixture with the addition of additives to achieve complete waterproofing and resistance to aggressive water (sea water). Concrete should be installed in layers up to 30 cm and compacted with pervibrators. The inner surfaces of the manhole are smoothed with cement mortar, and any cracks and nests in the concrete are closed, including the production of a waterproof coating resistant to evaporation of sewage. Four (4) filling covers measuring 600 x 600 mm with a load capacity of 250 HRK (included in the price) are made on the channel. Everything according to the detail in the project. Concrete must comply with class V4 in terms of water resistance according to HRN U.M. 015 and must be resistant to sea water, frost and salting. The price includes the purchase, delivery and installation of all the above material, cleaning and preparation of the upper surface of the substrate, i.e., formwork, preparation, delivery and installation of concrete, levelling to the designed level, protection and care of concrete, quality control and	130.000,00

	compaction of concrete, installation of reinforcement, steps and covers. The unit price includes the removal of crushed material in the pit at any stage of work or due to bad weather and pumping of groundwater, sea or incoming water (it is necessary to provide pumps for sea water to ensure dry work).	
1.27.	Procurement, delivery and concreting of the underlying concrete for the concrete base of the energy channel according to the draft from the graphic appendix, rehabilitation of the coastal part and the like. Calculation per m^3 of installed concrete, including the required formwork and reinforcement.	
	C16/20 (cc 50 kg/m^3)	7.500,00
	C35/45(cc 80 kg/m^3)	18.000,00
1.28.	Filling the energy channel, pumping station with a mixture of gravel and stone. The required gravel and stone are included in the item.	
	4-16 mm	2.500,00
	16-32 mm	10.600,00
	32 - ... mm	9.450,00
	32 - ... mm	9.450,00
1.29.	Removal of excess soil material from the excavation, to a landfill at a distance of up to 5 km. Loading, unloading, transport, spreading and partial compaction included.	23.100,00
1.30.	Supply and installation of water / water plate heat exchanger made of titanium, seawater resistant, with included brackets, thermal insulation, NO80 / 100 connections with a power of 70.0 kW at dT 5ºC. Nominal pressure 25 bar.	35.000,00
1.31.	MEASURING ELEMENTS	
	Supply and installation of mercury glass thermometer in brass tube, angle with tap NO15 NP16, measuring range 0-130 ° C	400,00
	Supply and installation of manometer fi 100 mm radial connection NO 15 complete with manometer tap NO 15 NP 16, measuring range 0-6 bar	400,00
1.32.	Supply and installation of an automatic vent pot, NO15 (placed at the highest points of the heating installation in the boiler room.)	1.332,00
1.33.	Supply and installation of vapor barrier insulation of pipelines.	
	Thermal insulation is performed by vapor-tight plate insulation, closed cell structures with a steam dam, the coefficient of resistance to water diffusion is m≥ 10000, l≤ 0.036 W / mK-	
	The subject insulation is made of flexible sponge material based on synthetic rubber, as a highly flammable material, flammability class B1, according to HRN DIN 4102, part 1, or class 1, according to HRN.U. J1.060.	
	The item also includes pre-prepared parts for insulating all fittings, elbows, branches and the like, as well as special glue and original self-adhesive tape for sealing seams. Seal all joints carefully by diffusion.	

	Pipe insulation or plates of thickness according to the following:	
	d= 13 mm pipes DN 15 do DN 25	690,00
	d= 32 mm pipes DN 80 do DN 100	1.014,00
1.34.	Coating with aluminium sheath with sealing of joints against weather penetration.	1.920,00
1.35.	Supply and installation of flow meters - water meter for medium temperatures up to 90 ºC. Complete with counter flanges, screws and adapter for pulse measurement and sending pulses to CNUS. Small and consumables included.	5.500,00
1.36.	Repair of asphalt curtain 7 + 3 cm thick with preliminary construction of the base. After laying the pipe and burying the pipe to the height of the post. of the buffer layer, it is necessary to renew the buffer layer according to the valid regulations, apply it in the layers and compact it well, so as to achieve the required compaction modulus and to prevent possible subsequent subsidence. The bituminous gravel layer and the wear layer are applied by hand and rolled well. All damages caused by subsequent subsidence of the road due to unprofessionally performed works are to the detriment of the contractor.	14.700,00
1.37.	Supply and installation of flange butterfly valve PN16, together with counter-flanges, seals and screws.	1.520,00
1.38.	Supply and installation of flange non-return valve PN16, together with counter-flanges, seals and screws.	340,00
1.39.	Supply and installation of branch shut-off and measuring valve with the possibility of flow pre-regulation, with pre-regulation, two measuring connections, flange connection, max. diff. valve pressure 1.5bar, max. temp. water 130 ° C. The item must include a one-time flow adjustment using the original measuring instrument, and a record of the flows achieved. PN 16, dimension and quantity:	4.800,00
1.40.	Supply and installation of a frequency-controlled submersible pump made of ALSi material with the addition of titanium. The pump is suitable for pumping high-salinity groundwater, without solid particles or fibres. All steel components are made of stainless steel, EN1.4539 / AISI 904L, which provides high corrosion resistance and seawater environment. The motor is a 3-phase motor with a sand guard, fluid-lubricated bearings and a pressure equalization diaphragm.	42.000,00
1.41.	Supply and installation of chlorination system of the ear canal system to prevent the formation of algae and the like. N = 4.0 kW, U = 380V, V = 6-8 m3 / h, G = 40 g / h chlorine, S = 0.2. The item includes the complete supply, connection and distribution of the required PE chlorinator pipeline. The chlorination system is located in a separate facility near the AB manhole inspection shaft. The cladding of the equipment will be made of stone in accordance with the provisions of the conservator.	105.000,00
1.42.	Landscaping and planting of plant material (low and high greenery). It is necessary to specify the fertile soil material in a layer 40 cm thick, spread	1.200,00

	out and plan a belt width according to the project. The item includes landscaping and supply, transport, spreading and planning of humus, if necessary, moistening the fertile soil, planting low and high greenery. Return of green areas to their original state.	
1.43.	Production of concrete lining with C35 / 45 concrete for protection against buoyancy, in conditions of underwater concreting. The price includes the production of formwork, preparation, delivery and installation of concrete, protection and care of concrete, removal of formwork and waste disposal. The item includes supply, transport, installation under the influence of the sea and care of concrete. Perform work analogously. Working in difficult conditions under the influence of the sea with the help of a diver. Calculation per m3 of installed concrete cladding.	5.700,00
1.44.	Derived condition study.	6.500,00
1.45.	Performing pressure tests, leak testing, logging and the like.	5.800,00
1.46.	Control of correctness of constructed sewage pipelines by CCTV inspection (optical inspection by camera). Recording of robot - camera sewer pipelines after the completion of each section, and before the execution of the final layers. Presentation of the recording via a submitted written study with a video recording. Condition detection according to HRN EN 13508-2 / AC. The unit price of the item includes all the necessary field and office work to make a complete shot. Deliver the processed channel recording on DVD media in mpeg2 format to the investor. Calculation per m '.	1.260,00
TOTAL		879.541,00
TOTAL (+VAT)		1.099.426,25
2.	ENERGY INSTALLATION	
2.01.	Dismantling of the existing fittings, boiler, pump and the like in the existing power plant in order to be able to install a new heat pump. The item includes dismantling, cutting and removal from the construction site. Deposit in accordance with the Rules of the Profession.	
	Disassembly and removal of the existing hot water boiler TOPLOTA TH80, Q = 1000 kW with associated burner. Including duplication from other installations.	7.500,00
	Dismantling and removal of the existing technological water preparation system	200,00
	Dismantling and removal of existing heating system pumps	1.000,00
	Dismantling and removal of existing membrane expansion vessels with a volume of 500 l	800,00

	Disassembly and removal of existing valves, 4xx valves, non-return valves, filters and the like	1.280,00
	Dismantling and removal of existing pipelines within the space of power plant NO15 - NO25	400,00
	Dismantling and removal of existing pipelines within the premises of power plant NO32 - NO50	408,00
	Dismantling and removal of existing pipelines within the space of power plant NO65 - NO80	4.704,00
2.02.	Supply and installation of a venting vessel made of DN 150 steel pipe, complete with automatic venting valve NO 20 (R 3/4 ") PN 16, as well as connecting pipes NO 10 approx. 2 m long each with ball valve NO 15 (R 1/2 ") PN 16 for manual venting. Connected to drainage. Everything is protected against corrosion and finished with varnish. Vessel size 0.5 L.	8.250,00
2.03.	Supply and installation of automatic vent pot, DN15 (installed at the highest installation points).	4.000,00
2.04.	Supply and installation of tanks - Cooling and heating water accumulators	
	Standing steel storage tank for heating or cooling water. With integrated water stratification system without insulation and auxiliary material.	14.500,00
2.05.	Supply and installation of cooling / heating water tank equipment.	6.500,00
2.06.	Supply and installation of automatic single water softener q = 1.5 m^3 / h for continuous production of softened water. The item must include all small and consumables needed for the installation of the device.	17.550,00
2.07.	Supply and installation of electric boiler for central heating 28 kW.	8.200,00
2.08.	Supply and installation of plate heat exchanger	4.800,00
2.09.	Supply and installation of plate heat exchanger	18.500,00
2.10.	Supply and installation of a heat pump with a water-cooled condenser, intended for indoor installation. The device is factory tested and tested on the designed parameters, and the correct one is delivered in one piece.	172.596,00
2.11.	Supply and installation of a professional well water filter with integrated pressure sensor that activates self-cleaning, dimensions DN 80.	7.500,00
2.12.	Commissioning of the heat pump, adjustment to operation according to design parameters and zero service.	3.500,00
2.13.	Supply and installation of a high-efficiency electronic pump for the heating system. The item must include all small and consumables needed for the installation of the device. Circulation pump, wet rotor version, with frequency converter mounted on the pump motor terminal box and permanent motor magnet rotor. Differential pressure sensors installed in the pump housing. An insulating set of the heating pump is supplied with the pump. Small and consumables included.	25.700,00
	Electronic pumps of energy class A (frequency control - with variable speed) and communication cards for connection to CNUS of the following types, characteristics and quantities:	
	DN50-H100 flange, 230V; 50Hz; 1ph, water	25.700,00

	DN65-H150 flange, 230V; 50Hz; 1ph	21.500,00
	DN65-H80 flange, 230V; 50Hz; 1ph	29.000,00
	DN 25-H60 threaded, 230V; 50Hz; 1ph	3.500,00
	DN 25-H80 threaded, 230V; 50Hz; 1ph	5.900,00
2.14.	Supply and installation of storage tank in heating / cooling systems with a volume of 300 litres with NO80 connections	4.800,00
2.15.	Supply and installation of three-way mixing valve DN80, kvs = 100m3 / h	4.800,00
2.16.	Supply and installation of overflow valves NO15	180,00
2.17.	Supply and installation of NO40 overflow valves	480,00
2.18.	Supply and installation of expansion vessel HV = 18 l, pmax = 10bar 3/4 ". Item includes service valve for opening with key R 3/4"	560,00
2.19.	Supply and installation of expansion vessel HV = 35 l, pmax = 10bar 3/4 ". Item includes service opening valve with key R 3/4 "	550,00
2.20.	Supply and installation of expansion vessel HV = 50 l, pmax = 10bar 3/4 ". Item includes service opening valve with key R 3/4 "	1.130,00
2.21.	Supply and installation of expansion vessel HV = 300 l, pmax = 10bar 3/4 ". Item includes service opening valve with key R 3/4 "	2.450,00
2.22.	Supply and installation of branch shut-off and measuring valve with the possibility of flow pre-regulation, with pre-regulation, two measuring connections, flange connection, max. diff. valve pressure 1.5bar, max. temp. water 130 ° C. The item must include a one-time flow adjustment using the original measuring instrument, and a record of the flows achieved. PN 16, dimension and quantity:	
	DN20	650,00
	DN80	28.800,00
2.23.	Supply and installation of a rubber flange compensator for connecting the heat pump to the system. Seals, screws and counter-flanges included in the price.	
	DN 50	700,00
2.24.	Supply and installation of non-return water damper PN16, threaded.	
	DN25	180,00
2.25.	Supply and installation of water filter PN16, threaded.	
	DN25	225,00
2.26.	Supply and installation of non-return water valve PN16, flange, together with counter-flanges, seals and screws.	
	DN80	1.440,00
2.27.	Supply and installation of water impurity trap PN16, flanged, together with counter flanges, seals and screws.	
	DN80	850,00
2.28.	Supply and installation of flange butterfly valve PN16, together with counter-flanges, seals and screws.	

	DN100	1.800,00
	DN80	7.992,00
2.29.	Supply and installation of ball screw valve PN16.	
	DN25	1.680,00
2.30.	Supply and installation of 1/2 "drain valve with pipe connection	1.650,00
2.31.	Supply and installation of high-efficiency safety valve Psv = 3.0 bar, PN 16 SE = R1 / 2 "	350,00
2.32.	Supply and installation of high-efficiency safety valve Psv = 3.5 bar, PN 16 SE = R1 ", SE = 11/2".	2.400,00
2.33.	Supply and installation of mercury glass thermometer in brass tube, angle with tap NO15 NP16, measuring range 0-130 ° C	3.600,00
2.34.	Supply and installation of manometer fi 100 mm radial connection NO 15 complete with manometer tap NO 15 NP 16, measuring range 0-6 bar	3.600,00
2.35.	Supply and installation of steel seamless pipes for central heating systems tested for leaks, laid surface-mounted, including all auxiliary material for connections and fittings, sealing and fastening. The stated price of a long meter of pipe includes all fittings and transition pieces, elbows, T-pieces, suspension and the like. The item must include all small and consumables required for the installation of equipment of the following dimensions:	
	DN100	820,00
	DN80	8.000,00
	DN65	452,00
	DN50	672,00
	DN40	300,00
	DN25	636,00
	DN20	810,00
	DN15	1.140,00
2.35.	Rust cleaning of pipelines and double coating with primer.	1.380,00
2.36.	Supply and installation of vapor barrier insulation of pipelines.	
	Thermal insulation is performed by vapor-tight plate insulation, closed cell structures with steam dam, coefficient of resistance to water vapor diffusion is m≥ 10000, l≤ 0.036 W / mK- The subject insulation is made of flexible sponge material based on synthetic rubber, as highly flammable fuel class B1, according to HRN DIN 4102, part 1, or class 1, according to HRN.U. J1.060. The item also includes pre-prepared parts for insulating all fittings, elbows, branches and the like, as well as special glue and original self-adhesive tape for sealing seams. Seal all joints carefully by diffusion.	
	d= 13 mm pipes DN 15 to DN 25	1.150,00
	d= 19 mm pipes DN 32 to DN 40	125,00
	d= 25 mm pipes DN 50 to DN 65	715,00

	d= 32 mm pipes DN 80 to DN 100	4.394,00
2.37.	Supply and installation of nameplates and self-adhesive labels for markings of equipment and plant elements.	1.500,00
2.38.	Preparation of instructions for operation and maintenance of the plant with delivery in 2 sets, functional schemes framed, glazed and hung on the wall and training of personnel for handling equipment.	2.000,00
TOTAL		462.749,00
TOTAL (+VAT)		578.436,25
OVERALL		1.342.290,00
OVERALL (+VAT)		1.677.862,50

According to Table 14, the cost of project activities of the variant solution of direct seawater abstraction from the seaport amounts to HRK 1,677,862.50.

4.2.3. V2 - Coastal seawater abstraction by wells

Within this chapter of the project documentation, the use of a water / water heat pump is envisaged as the main source of heating or cooling energy. The newly designed heat pump with all its necessary fittings and tanks will be located within the space of the existing power plant. The existing HEAT boiler, as well as all existing associated fittings, will be dismantled. On the primary side of the heat pump, seawater will be used as the heat sink, while on the secondary side, the existing installation of fan coil heating / cooling systems will be used.

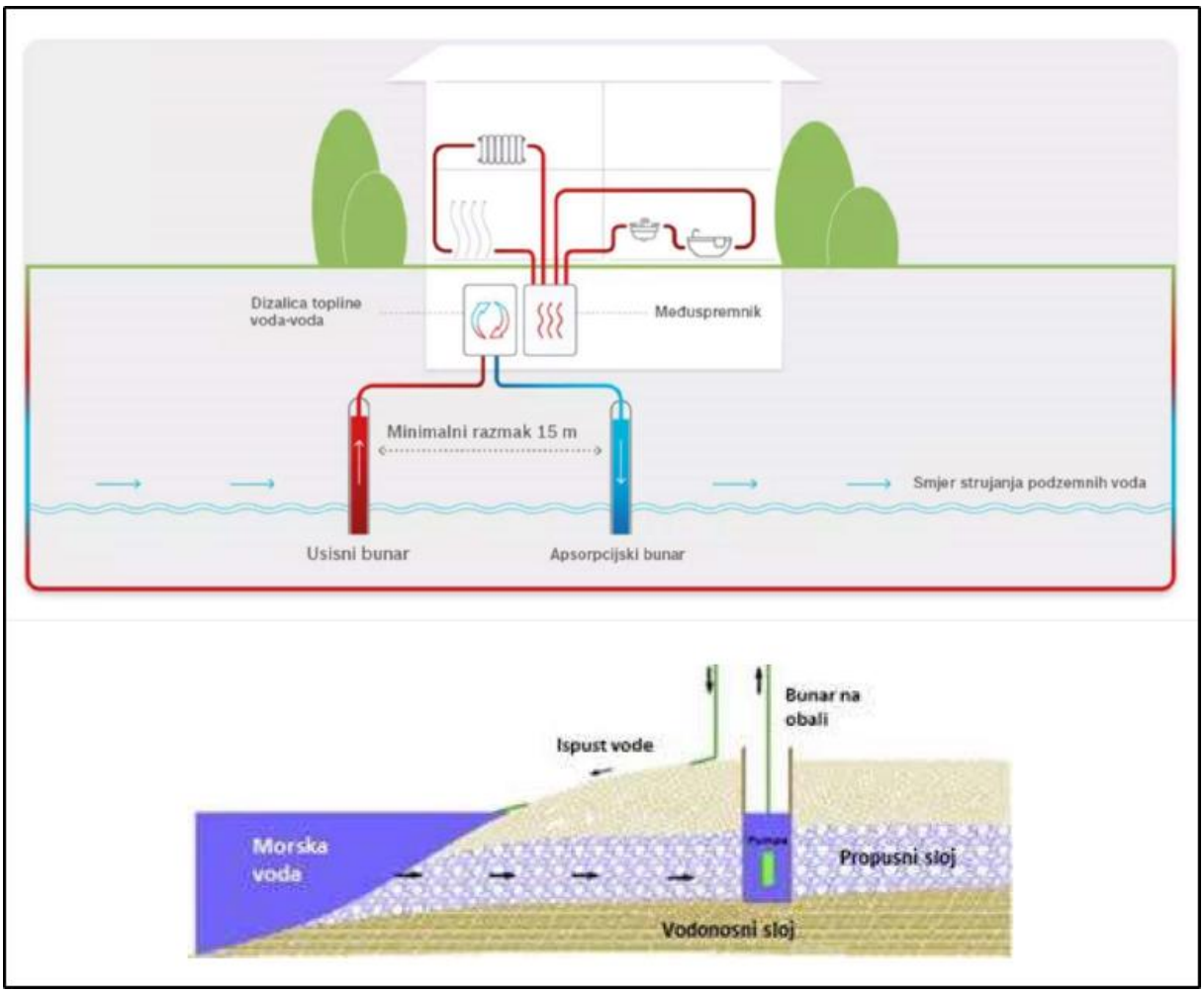
Seawater heat pump systems are systems in which the heat pump uses the sea as a source and sink of heat, i.e., a heat tank. In the heating mode, the system uses the heat energy of the sea as a renewable heat source, while in the cooling mode it transfers the heat taken from the space to the sea as a heat sink. Due to the corrosivity property of seawater, seawater does not go directly to the heat pump evaporator, but previously transfers heat to the corrosion-resistant heat exchanger.

The heat on the evaporator is then transferred to the refrigerant and rises to a higher energy level, and then transferred to the heated space. The reverse process applies to the operation of the heat pump in cooling mode.

For the needs of sea (brackish) water, drilling of exploitation (one piece) or absorption wells (two pieces) is planned. The wells will be drilled as vertical wells up to 20.0 m deep. After the construction of the wells, a submersible frequency-controlled pump will be installed in the production well. Only the drilling of a well with a diameter of Ø = 250-325 mm is performed by the impact-rotational drilling method with the use of a depth hammer and removal of the drilled material by air. As the pumped water is brackish water (brackish water at the inflow of groundwater into the sea - a characteristic of karst aquifers) technical construction of the exploitation well B-1 consists of "blind" stainless steel or PVC pipes (extremely resistant to increased corrosion caused by salt water, which ensured long service life of wells). The design of the production wells consists of an external supporting steel pipe D219 / 209mm, L = 0.5m, which is mounted on the outlet well PVC D180 / 153mm PVC pipe.

The steel pipe is lowered into the opening at the bottom of the water meter shaft and concreted in the gap for fixing. A base flange is welded to the support pipe, on which the upper steel plate is bolted with a seal. The flange steel plate of the wellhead at the bottom has a male thread coupling for mounting a flexible hose BORELINE 3 "(diameter of the outer coupling 140 mm) for installation of submersible pumps, and at the top a knee of steel pipe D88.9mm with flanges at both ends. version EN1.4539 / AISI 904L The wellhead steel plate must have a power cable gland, a pump protection cable gland (probe level), a pull-out grip and a control window for measuring groundwater level and temperature.

Figure 12: Water/water heat pump operation model



Source: Preliminary design, 2021.

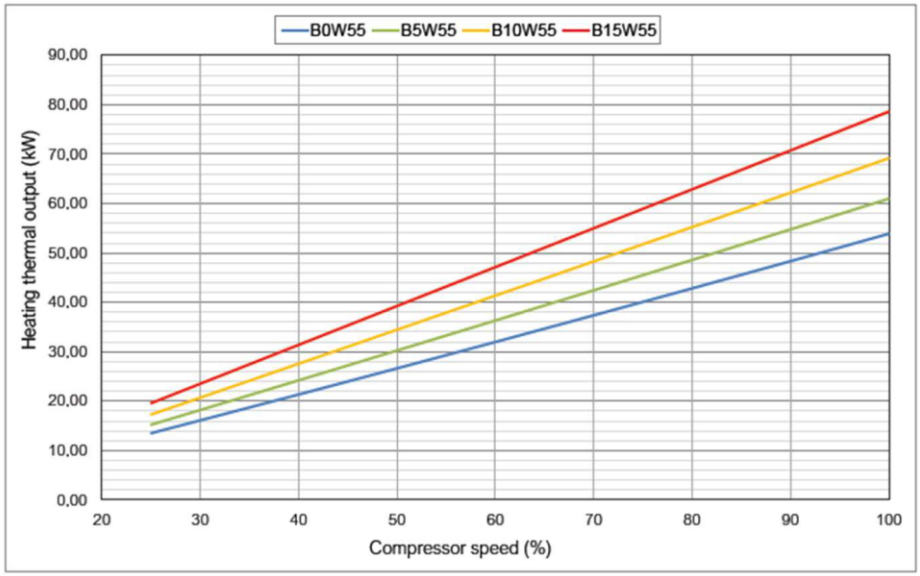
The basic parameters of the aquifer, transmissibility and coefficient of hydraulic conductivity are usually determined by processing the data of experimental pumping of the well by the method of constant test, which at this time of preparation of project documentation were not available. In order for the heating and cooling system to function properly, the wells must be revitalized every year. Regular maintenance is very important for the functionality and smooth operation of the entire system. The heat pump is dimensioned in such a way that it covers all the needs of the building in the cooling mode, and in the heating mode it covers losses up to an outdoor

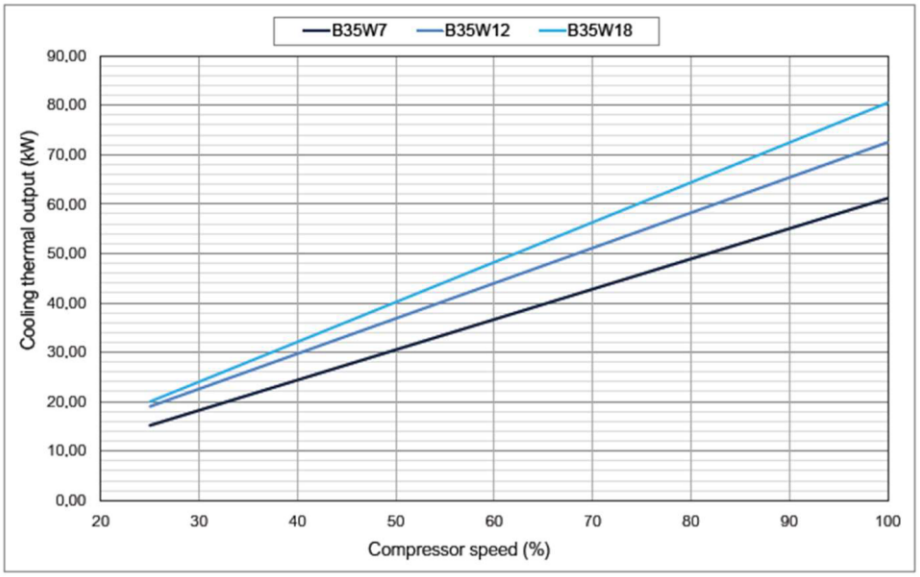
temperature of + 2ºC. It was defined by the project client during the preparation of project documentation that the heat pump itself will not be dimensioned to cover 100% of heat losses but that the rest of the capacity will be covered using the existing boiler on EL LU which remains in use.

Reviewing data on air temperatures at the location of the city of Poreč through the years 2018, 2019, 2020, it can be concluded that the addition (boiler on EL LU) to the newly designed heating system (heat pump) will have to work in 16% of the heating season. Of the total required "kWh" for heating the building from an alternative source (boiler on EL LU) will need to hand over 12% of total energy. The selected heat pump is a device such as Ecoforest type ecoGEO HP 15-70 which has a heat capacity in the heating mode of 17.1 to 59.6 kW in conditions B0W35, and 15.1 to 61.5 kW in cooling mode in temperature conditions B35, W7. The exact capacity of the crane in the heating or cooling mode depends on the temperature of the thermal sink located on the primary side.

Figure 13: Heating/cooling mode

Figure 13: Heating/cooling mode





Source: Preliminary design, 2021.

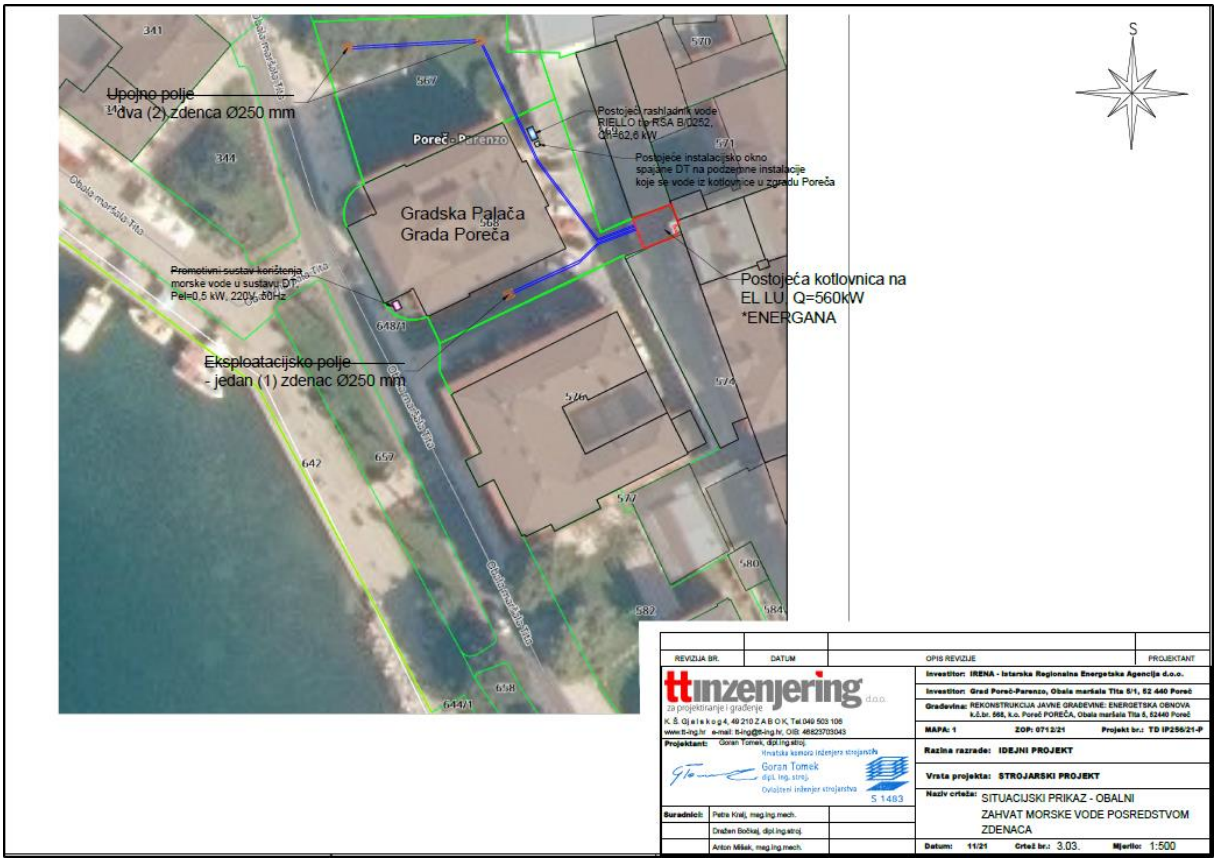
Previously softened water will be used as the heating medium in the secondary part of the heating / cooling system. Before commissioning the heat-pump and using the heating system

itself, it is necessary to thoroughly clean the existing part of the heating / cooling system, which consists of the distribution of steel pipes and fan coils mounted on the building.

For the needs of water circulation in the primary and secondary part of the heating / cooling system, it is necessary to choose circulation pumps with speed control.

Figure 14 shows the design in space of the variant solution in question.

Figure 14: V2 – Performance in space



Source: Preliminary design, 2021.

The implementation of the subject variant solution by the preliminary design is divided into 3 parts:

1. Making wells,
2. Collection circle of wells,
3. Power plant installation.

The following table shows the activities for the implementation of a variant solution according to the listed units.

Table 15: Implementation activities of the variant solution by units

V2 - COASTAL SEAWATER INTAKE THROUGH WELLS		
1	WELLS CONSTRUCTION	AMOUNT (HRK)
1.01.	Preparatory works - Transport of drilling rigs, compressors, other equipment accessories, materials and tools to the construction site	15.000,00
1.02.	Drilling - Construction of ONE exploration - exploitation well for groundwater abstraction as a renewable water source and TWO absorption wells for recovery of abstracted water. Impact drilling with a rotary technique with a diameter of Ø = 250-325 mm, and individual depths of 20 m.	51.000,00
1.03.	Installation - Procurement and installation of blind over filter PVC pipes with diameter Ø = 180 / 162mm (6 1/2 "), PN10, length per well 5m, Product according to DIN 4925 standard, pipe connections without thickening (flush joint). 5m long Tube density 1.4 g / cm3, tensile strength 555 kg / cm2 Product as Pancera PVC or equivalent.	10.500,00
1.04.	Procurement and installation of slotted PVC filter pipe / sieve well 3 mm, diameter Ø = 180/162 mm (6 1/2 "), PN10, openness interval 12%, flow 7.0 m3 / h / m, Product according to DIN 4925 standard, flush joint pipe sections, available in pieces of 5 m in length, pipe density 1.4 g / cm3, tensile strength 555 kg / cm2, product as Pancera PVC or equivalent	21.750,00
1.05.	Procurement and installation of blind PVC pipes for production wells with diameter Ø = 180 / 162mm (6 1/2 ") to accommodate the submersible pump, PN10, length in the production well 2m, place the pipe between two sections of filter pipe below and above the pump. The product according to DIN 4925, flush joint pipe, sections in 1 m length, pipe density 1.4 g / cm3, tensile strength 555 kg / cm2, product such as Pancera PVC or equivalent.	4.200,00
1.06.	Procurement and installation of sedimentation tanks - PVC pipes with diameter Ø = 180/162 mm (6 1/2 "), PN10. Length per production well 3m. Product according to DIN 4925 standard, pipe connections without thickening (flush joint). 3m in length Tube density 1.4 g / cm3, tensile strength 555 kg / cm2 Product as Pancera PVC or equivalent.	6.300,00

1.07.	Installation of a protective steel cap with a padlock at the wellhead, protection of the well until the connection of the collecting system	5.000,00
1.08.	Tamponing of the above-filter section with quality clay and bentonite, and graveling of the filter section with backfill of double-washed quartz gravel with a grain size of 4-8 mm. For granular gravel, the contractor should present a quality certificate of gravel composition and granulometric curve of gravel. The various gravel fractions must be uniform in percentage.	12.000,00
1.09.	Conquest and trial pumping - Conquest of the well will be performed by routine procedure which will include: rinsing with clean water, conquering with open airlift with shooting (variable compressor operation) and rinsing, conquest by sector airlift along sections of the well screen with shooting and rinsing, cleaning of sedimentation tank. Conquest of wells by air lift 8-12 m^3 / h until complete clarification and criteria for solids content <50 g / m^3 of water.	67.200,00
1.10.	Experimental pumping with a depth pump in steps (step-test) 3x3 hours on each well to determine the equation of all wells and aquifer parameters. During the test, the steady state of the dynamic PV level must be reached at each step. If the steady state in a particular condition is not reached, continue pumping and calculate according to the time actually spent.	23.400,00
1.11.	Test pumping with the selected constant amount (constant test) on the production well for 12 hours and in parallel perform the absorption test on the injection well on the particle. Monitor the dynamic groundwater level at the injection well throughout the test.	15.600,00
1.12.	Taking and laboratory processing of water samples - the so-called abbreviated analysis of water, extended to HCO3, Cl, SO4, Na, K, Ca, Mg, Fe, and Mn.	5.000,00
1.13.	Preparation of reports on performed works on exploration wells and absorption well and existing absorption piezometer with all technical data and parameters (study + CD) with the necessary graphic and numerical interpretation of productivity and absorption of wells.	12.000,00
TOTAL		248.950,00
TOTAL (+VAT)		311.187,50
2.	COLLECTION CIRCLE OF WELLS	
2.01.	Preparation of a study of the staking out of the route of the canal and associated buildings, staking out and ensuring staking out of the route of the seawater intake from the wells. The paper covers all geodetic measurements by which the data from the project are transferred to the field, securing the axis of the stalked route, profiling, renewal and	5.000,00

	maintenance of stakes in the field for the entire period of construction or until the handover of works to the investor. The contractor is obliged to secure all points in position and height so that they can be easily restored during or after the work. Prior to the start of the excavation, the contractor is obliged to submit the stated staking plan to the supervising engineer for inspection in order to control the correctness of the procedure. The contractor must not start work before obtaining the approval of the supervising engineer for this documentation. The staking out of the route should be carried out on the basis of data from the project. Inclusion of the working or compensation belt is also included. Site staking as well as geodetic monitoring of construction should be carried out on the basis of project data.	
2.02.	Locating and protecting existing utility installations and other connections (electricity lines, gas pipelines, oil pipelines, telecommunication lines, water mains, sewerage, etc.). During excavation, pay special attention to damage to the installation. Enter the data in the geodetic survey of the existing condition. Perform works in the presence of a representative of the competent operator.	3.000,00
2.03.	Geodetic monitoring of all works on the construction of the water intake system network, including the stationing of all points in the field. Calculation per m´.	5.000,00
2.04.	Preparation of a geodetic survey of the derived state of the network, including the preparation of the Study, and implementation in the Cadastre.	6.000,00
2.05.	Breaking and removing the existing asphalt or concrete pavement structure. The item includes machine breaking of the existing pavement structure, loading into the means of transport and transport to the landfill provided by the contractor. Before demolition and removal, it is necessary to perform machine cutting at the place where the object will be demolished, so as not to damage the rest of the object that remains. Dispose of construction waste in accordance with the Ordinance on conditions for waste management.	
	Asphalt cutting	11.000,00
	Breaking the asphalt, approx. d = 10 cm	4.800,00
2.06.	Dismantling of existing curbs in the project area. Careful dismantling of concrete curbs in order to perform the required excavation in the project area. The price includes temporary deposit. After the works are completed, the equipment must be returned to its original position or out of profile at the same road station. The price includes all works and materials needed for the execution of works, excavation for the foundation, concreting and reassembly, i.e., return to the original condition. Calculation by type of artificial object.	570,00
2.07.	Breaking the existing AB plate in the power plant for the needs of introducing the energy channel in it. The item includes careful cutting of	1.350,00

	the AB floor slab, breaking and excavation, removal of waste material at the landfill.	
2.08.	Planning the bottom of the ditch with an accuracy of +/- 2 cm. All irregularities should be repaired, cavities and cavities should be filled with excavated material, and the excess should be removed from the ditch. Calculation per m^2 of planned area.	1.800,00
2.09.	Removal of excess soil material from the excavation, to a landfill at a distance of up to 5 km. Loading, unloading, transport, spreading and partial compaction included.	3.300,00
2.10.	Supply and installation of water / water plate heat exchanger made of titanium, seawater resistant, with included brackets, thermal insulation, NO80 / 100 connections power 100/150 kW at dT 5Cº. Nominal pressure 25 bar.	35.000,00
2.11.	MEASURING ELEMENTS	
	Supply and installation of mercury glass thermometer in brass tube, angle with tap NO15 NP16, measuring range 0-130 ° C	400,00
	Supply and installation of manometer fi 100 mm radial connection NO 15 complete with manometer tap NO 15 NP 16, measuring range 0-6 bar	400,00
2.12.	Supply and installation of an automatic vent pot, NO15 (placed at the highest points of the heating installation in the boiler room.)	1.332,00
2.13.	Supply and installation of vapor barrier insulation of pipelines. Thermal insulation is performed by vapor-tight plate insulation, closed cell structures with steam dam, coefficient of resistance to water vapor diffusion is m≥ 10000, l≤ 0.036 W / mK- The subject insulation is made of flexible sponge material based on synthetic rubber, as highly flammable flammability class B1, according to HRN DIN 4102, part 1, or class 1, according to HRN.U. J1.060. The item also includes pre-prepared parts for insulating all fittings, elbows, branches and the like, as well as special glue and original self-adhesive tape for sealing seams. Seal all joints carefully by diffusion. Pipe insulation or plates of thickness according to the following:	
	d= 13 mm pipes DN 15 do DN 25	690,00
	d= 32 mm pipes DN 80 do DN 100	1.014,00
2.14.	Coating with aluminium sheath with sealing of joints against weather penetration.	1.920,00
2.15.	Supply and installation of flow meters - water meter for medium temperatures up to 90 ºC. Complete with counter flanges, screws and adapter for pulse measurement and sending pulses to CNUS. Small and consumables included.	
	Connection: DN50	5.500,00
2.16.	Repair of asphalt curtain 7 + 3 cm thick with previous production of 20 cm thick substrate. After laying the pipe and burying the pipe to the height of the post. of the buffer layer, it is necessary to renew the buffer	12.600,00

	layer according to the valid regulations, apply it in the layers and compact it well, so as to achieve the required compaction modulus and to prevent possible subsequent subsidence. The bituminous gravel layer and the wear layer are applied by hand and rolled well. All damages caused by the subsequent subsidence of the road due to unprofessionally performed works are to the detriment of the contractor.	
2.17.	Supply and installation of flange butterfly valve PN16, together with counter-flanges, seals and screws.	
	DN80	1.520,00
2.18.	Supply and installation of flange non-return valve PN16, together with counter-flanges, seals and screws.	
	DN80	340,00
2.19.	Landscaping and planting of plant material (low and high greenery). It is necessary to specify the fertile soil material in a layer 40 cm thick, spread out and plan a belt width according to the project. The item includes landscaping and supply, transport, spreading and planning of humus, if necessary, moistening the fertile soil, planting low and high greenery. Return of green areas to their original state.	4.500,00
2.20.	Supply and installation of the head system of MANUFACTURING wells consisting of external bearing steel pipe D219 / 209mm, L = 0.5m, which is mounted on the outlet well PVC D180 / 153mm PVC pipe. The steel pipe is lowered into the opening at the bottom of the water meter shaft and concreted in the gap for fixing. A base flange is welded to the support pipe, on which the upper steel plate is fastened with screws with a seal. The flange steel plate of the wellhead at the bottom has a male thread coupling for mounting a flexible hose BORELINE 3 "(diameter of the outer coupling 140mm) for installation of submersible pumps, and at the top a knee of steel pipe D88.9mm with flanges at both ends. version EN1.4539 / AISI 904L The steel well head plate must have a power cable gland, a pump protection cable gland (probe level), a pull-out grip and a control window for measuring groundwater level and temperature. tap and then a flange to the access piece made of steel on the PE D63 pipe. PVC pipes and installation of the well head. Include in the price all consumables necessary to complete the installation (seals, filling holes, connecting a two-part shaft, etc.)	14.000,00
2.21.	Supply and installation of the head system of MANUFACTURING wells consisting of external bearing steel pipe D219 / 209mm, L = 0.5m, which is mounted on the outlet well PVC D180 / 153mm PVC pipe. The steel pipe is lowered into the opening at the bottom of the water meter shaft and concreted in the gap for fixing. A base flange is welded to the supporting pipe, on which the upper steel plate is bolted with a seal. The flange steel plate of the wellhead at the bottom has a male thread coupling for mounting a flexible hose BORELINE 3 "(diameter of the outer coupling 140mm) for installation of submersible pumps, and at the top a	28.000,00

	knee of steel pipe D88.9mm with flanges at both ends. version EN1.4539 / AISI 904L The steel well head plate must have a power cable gland, a pump protection cable gland (probe level), a pull-out grip and a control window for measuring groundwater level and temperature. tap and then flange to the transition piece of steel on PE D63 pipes.	
2.22.	Supply and installation of the system of IMPRESSION wells, which consists of an external supporting steel pipe D219 / 209mm, L = 0.5m, which is mounted on the outlet well PVC D180 / 153mm PVC pipe. The steel pipe is lowered into the opening at the bottom of the water meter shaft and concreted in the gap for fixing. A base flange is welded to the supporting pipe, on which the upper steel plate is bolted with a seal. The wellhead flange steel plate at the bottom has a male threaded coupling for mounting stainless steel pipes D88.9 (3 ") L = 15m for water injection, and at the top a knee of steel pipe D88.9mm with flanges at both ends. All steel in EN1.4539 / AISI 904L The steel wellhead plate must have a pull-out grip and a control window for measuring the groundwater level and temperature. The elbow with the flange connection is connected to the shut-off valve and then with the flange to the steel transition piece on the PE D63 pipe. Include in the item a seal on the penetration of PE pipes into the manhole, STEEL PIPES, and closing the penetration around the steel pipe, all transitions and all prefabricated and small consumables until the manhole is ready.	28.000,00
2.23.	Supply and installation of a flexible hose with submersible pump suspension function, complete with threaded couplings for connection to the suspension segment of the well head, and a submersible pump. Diameter: d76mm (3 "), burst pressure 60 bar, tensile strength 7000kg A product like HoseSOlutions, type Boreline	
	A total of 2x20 m according to the constructed well construction	9.000,00
2.24.	Steel stainless steel pipe AISI 904L for injection well, D88.9 mm, which is threaded to the borehole head. Include the construction of a centralizer every 5 m to center the pipes inside the PVC column.	
	Total 2x15	75.000,00
2.25.	Supply and installation of a frequency-controlled submersible pump made of ALSi material with the addition of titanium. The pump is suitable for pumping high-salinity groundwater, without solid particles or fibres. All steel components are made of stainless steel, EN1.4539 / AISI 904L, which provides high corrosion resistance and seawater environment. The motor is a 3-phase motor with a sand guard, fluid-lubricated bearings and a pressure equalization diaphragm.	84.000,00
2.26.	Supply and installation of a ball flange tap for well water production and injection well. Valve housing and ball made of stainless steel, NP16, supplied with seals and screws, of the following sizes and quantities:	
	DN80 3"	10.000,00

2.27.	Combined excavation and burying of a trench or machine-manual trench for laying PE water pipes in earthen soil with a width of at least 0.50 (m), depth of at least 1 m, including proper cutting of trench sides, rough levelling of the bottom, ejection of excavated material at 1.0 (m) from the edge of the trench so that there is a free path between the trench and the ejected material 0.5 (m) wide. It is calculated per (m^3) of excavated material measured in the natural state (25 x 1.0 x 0.5) m.	40.000,00
2.28.	Combined excavation or machine-manual trench for laying two pieces of water meter concrete shaft in earthen soil W1100 x D1500 x H1280 mm, including proper cutting of trench sides, rough levelling of the bottom, ejection of excavated material from the edge of the trench so that there is a free path between the trench and ejected material 0.5 (m) wide. It is calculated by (m^3) of excavated material measured in the natural state.	
	Total 4x2,5 m^3	4.000,00
2.29.	Making a sand bed 10.0 (cm) thick for laying PE D63 collecting water pipe inside the cable duct pipe. The price includes the purchase and delivery of materials and the production of the placenta. Calculation per (m^3) of made placenta (100 x 0.1 x 0.5) m.	6.000,00
2.30.	Burying PE D63 of the collecting pipe with sand up to 10.0 (cm) above the top of the pipe after laying and testing. The price includes the supply and delivery of materials as well as the production of backfill. Backfilling in the pipeline zone should be performed with a light compactor. Calculation per (m^3) of buried trench (100x 0.15 x 0.5) m.	4.000,00
2.31.	Burying the remaining part of the trench with excavated material (choose finer material). Backfilling is done in layers of 30 cm with machine compaction and, if necessary, the addition of new material. During compaction, the embankment should be watered to prevent subsidence. Calculation per (m^3) of buried trench (100 x 0.75 x 0.5) m. It is necessary to make an overhang on the green surface due to possible subsidence.	32.000,00
2.32.	Loading and removal of excess residual material from excavation (with rehabilitation of the terrain) to the planner or spreading around the environment. Loose material is included in the quantity.	100.000,00
2.33.	HDPE high density polyethylene manifold, according to ISO 4437, quality PE 100, class SDR-11 (ISO S5), dimension D63, certified, delivery in a coil, with all necessary interconnectors, product such as PIPELIFE or similar	9.000,00
2.34.	Free flange PN16 made of high-density polyethylene, class ISO 7005, quality PE 100, with metal core, PP-M, D63, PN16, including flange sleeve PE100 SDR17 D88,9, for connecting shut-off taps and collecting pipes in water meter shaft, product like PIPELIFE or similar	1.500,00
2.35.	Electrical coupling PE100 D110 SDR11, for connecting collecting pipes D63 and flange sleeve in water meter shaft, product as PIPELIFE or similar	1.350,00
2.36.	Kabuplast pipe PEHD D125 / 107mm for mechanical protection of collecting polyethylene D63 pipes in trenches and prevention of thermal interference according to EN50086-1, manufacturer PIPELIFE or similar	4.500,00

2.37.	Supply and installation of a sealing ring for the watertight entrance of PE pipes into the building, dimensions:	
	Ø63 (for D63 PE100 pipe)	180,00
2.38.	Small consumables related to the installation (oxygen, gas, welding wires, silver, screws, nuts, seals, fittings, etc.) and suspension accessories for guiding pipes (steel clamps with rubber washer).	5.000,00
2.39.	Supply and installation of equipment and materials specified by items, up to full operational capability, including leak testing (cold and hot pressure test). After the installation of the complete installation, perform a test run of the installation for 48 hours, thoroughly ventilate the complete installation, perform regulation and balancing with a written report on the achieved parameters, including training of personnel in operation.	40.000,00
2.40.	Costs of transport and storage of material specified by items, from the place of purchase to the site, costs of transport and removal of tools needed for installation, and removal of remaining material from the site.	3.000,00
2.41.	Continuous cleaning of the construction site from the remaining material and various packaging, as well as protection of installed and installed equipment from the impact of works on the facility (protection from dust, damage, etc.)	1.000,00
2.42.	Derived condition study.	4.000,00
2.43.	Collection and obtaining of all necessary declarations of conformity of equipment and certificates from authorized houses, required during the technical inspection of the facility.	2.000,00
2.44.	Derived condition study.	3.000,00
2.45.	Performing pressure tests, leak testing, logging and the like.	2.500,00
TOTAL		618.066,00
TOTAL (+VAT)		772.582,50
3.	POWER PLANT INSTALLATION	
3.01.	Dismantling of the existing fittings, boiler, pump and the like in the existing power plant in order to be able to install a new heat pump. The item includes dismantling, cutting and removal from the construction site. Deposit in accordance with the Rules of the Profession.	
	Disassembly and removal of the existing hot water boiler TOPLOTA TH80, Q = 1000 kW with associated burner. Including duplication from other installations.	7.500,00
	Dismantling and removal of the existing technological water preparation system	200,00
	Dismantling and removal of existing heating system pumps	1.000,00

	Dismantling and removal of existing membrane expansion vessels with a volume of 500 l	800,00
	Disassembly and removal of existing valves, 4xx valves, non-return valves, filters and the like	1.280,00
	Dismantling and removal of existing pipelines within the space of power plant NO15 - NO25	400,00
	Dismantling and removal of existing pipelines within the premises of power plant NO32 - NO50	408,00
	Dismantling and removal of existing pipelines within the space of power plant NO65 - NO80	4.704,00
3.02.	Supply and installation of a venting vessel made of DN 150 steel pipe, complete with automatic venting valve NO 20 (R 3/4 ") PN 16, as well as connecting pipes NO 10 approx. 2 m long each with ball valve NO 15 (R 1/2 ") PN 16 for manual venting. Connected to drainage. Everything is protected against corrosion and finished with varnish. Vessel size 0.5 L.	8.250,00
3.03.	Supply and installation of automatic vent pot, DN15 (installed at the highest installation points)	4.000,00
3.04.	Supply and installation of tanks - Cooling and heating water accumulators. Standing steel storage tank for heating or cooling water. With integrated water stratification system without insulation and auxiliary material.	14.500,00
3.05.	Supply and installation of cooling / heating water tank equipment	6.500,00
3.06.	Supply and installation of automatic single water softener q = 1.5 m^3 / h for continuous production of softened water. The item must include all small and consumables needed for the installation of the device.	17.550,00
3.07.	Supply and installation of electric boiler for central heating 28 kW. Power: 28 kW	8.200,00
3.08.	Supply and installation of plate counter heat exchanger characteristics:	4.800,00
3.09.	Supply and installation of plate counter heat exchanger characteristics:	18.500,00
3.10.	Supply and installation of a heat pump with a water-cooled condenser, intended for indoor installation.	172.596,00
3.11.	Supply and installation of a professional well water filter with integrated pressure sensor that activates self-cleaning, dimensions DN 80.	7.500,00
3.12.	Commissioning of the heat pump, adjustment to operation according to design parameters and zero service.	3.500,00
3.13.	Supply and installation of a high-efficiency electronic pump for the heating system. The item must include all small and consumables needed for the installation of the device. Circulation pump, wet rotor version, with frequency converter mounted on the pump motor terminal box and permanent motor magnet rotor. Differential pressure sensors installed in the pump housing. An insulating set of the heating pump is supplied with the pump. Small and consumables included. Electronic pumps of energy class A (frequency control - with variable speed) and communication	

	cards for connection to CNUS of the following types, characteristics and quantities:	
	DN50-H100 flange, 230V; 50Hz; 1ph, water	25.700,00
	DN65-H150 flange, 230V; 50Hz; 1ph	21.500,00
	DN65-H80 flange, 230V; 50Hz; 1ph	29.000,00
	DN 25-H60 threaded, 230V; 50Hz; 1ph	3.500,00
	DN 25-H80 threaded, 230V; 50Hz; 1ph	5.900,00
3.14.	Supply and installation of storage tank in heating / cooling systems with a volume of 300 litres with NO80 connections	4.800,00
3.15.	Supply and installation of three-way mixing valve DN80, kvs = 100m3 / h	4.800,00
3.16.	Supply and installation of overflow valves NO15	180,00
3.17.	Supply and installation of NO40 overflow valves	480,00
3.18.	Supply and installation of expansion vessel HV = 18 l, pmax = 10bar 3/4 ". Item includes service opening valve with key R 3/4 "	560,00
3.19.	Supply and installation of expansion vessel HV = 35 l, pmax = 10bar 3/4 ". Item includes service opening valve with key R 3/4 "	550,00
3.20.	Supply and installation of expansion vessel HV = 50 l, pmax = 10bar 3/4 ". Item includes service opening valve with key R 3/4 "	1.130,00
3.21.	Supply and installation of expansion vessel HV = 300 l, pmax = 10bar 3/4 ". Item includes service opening valve with key R 3/4 "	2.450,00
3.22.	Supply and installation of branch shut-off and measuring valve with the possibility of flow pre-regulation, with pre-regulation, two measuring connections, flange connection, max. diff. valve pressure 1.5bar, max. temp. water 130 ° C. The item must include a one-time flow adjustment using the original measuring instrument, and a record of the flows achieved. PN 16, dimension and quantity:	
	DN20	650,00
	DN80	28.800,00
3.23.	Supply and installation of a rubber flange compensator for connecting the heat pump to the system. Seals, screws and counter-flanges included in the price.	
	DN 50	700,00
3.24.	Supply and installation of non-return water damper PN16, threaded.	
	DN25	180,00
3.25.	Supply and installation of water filter PN16, threaded.	
	DN25	225,00
3.26.	Supply and installation of non-return water valve PN16, flange, together with counter-flanges, seals and screws.	
	DN80	1.440,00
3.27.	Supply and installation of water impurity trap PN16, flanged, together with counter flanges, seals and screws.	

	DN80	850,00
3.28.	Supply and installation of flange butterfly valve PN16, together with counter-flanges, seals and screws.	
	DN100	1.800,00
	DN80	7.992,00
3.29.	Supply and installation of ball screw valve PN16.	
	DN25	1.680,00
3.30.	Supply and installation of 1/2 "drain valve with pipe connection	1.650,00
3.31.	Supply and installation of high-efficiency safety valve Psv = 3.0 bar, PN 16 SE = R1 / 2 "	350,00
3.32.	Supply and installation of high-efficiency safety valve Psv = 3.5 bar, PN 16 SE = R1 ", SE = 11/2".	2.400,00
3.33.	Supply and installation of mercury glass thermometer in brass tube, angle with tap NO15 NP16, measuring range 0-130 ° C	3.600,00
3.34.	Supply and installation of manometer fi 100 mm radial connection NO 15 complete with manometer tap NO 15 NP 16, measuring range 0-6 bar	3.600,00
3.35.	Supply and installation of steel seamless pipes for central heating systems tested for leaks, laid surface-mounted, including all auxiliary material for connections and fittings, sealing and fastening. The stated price of a long meter of pipe includes all fittings and transition pieces, elbows, T-pieces, suspension and the like. The item must include all small and consumables required for the installation of equipment of the following dimensions:	
	DN100	820,00
	DN80	8.000,00
	DN65	452,00
	DN50	672,00
	DN40	300,00
	DN25	636,00
	DN20	810,00
	DN15	1.140,00
3.36.	Rust cleaning of pipelines and double coating with primer.	1.380,00
3.37.	Supply and installation of vapor barrier insulation of pipelines. Thermal insulation is performed by vapor-tight plate insulation, closed cell structures with steam dam, coefficient of resistance to water vapor diffusion is m≥ 10000, l≤ 0.036 W / mK-Subject insulation is made of flexible sponge material based on synthetic rubber, as a highly flammable building fuel class B1, according to HRN DIN 4102, part 1, or class 1, according to HRN.U. J1.060. The item also includes pre-prepared parts for insulating all fittings, elbows, branches and the like, as well as special glue	

	and original self-adhesive tape for sealing seams. Seal all joints carefully by diffusion.	
	Pipe insulation or plates of thickness according to the following:	
	d= 13 mm pipes DN 15 do DN 25	1.150,00
	d= 19 mm pipes DN 32 do DN 40	125,00
	d= 25 mm pipes DN 50 do DN 65	715,00
	d= 32 mm pipes DN 80 do DN 100	4.394,00
3.38.	Supply and installation of nameplates and self-adhesive labels for markings of equipment and plant elements.	1.500,00
3.39.	Preparation of instructions for operation and maintenance of the plant with delivery in 2 sets, functional schemes framed, glazed and hung on the wall and training of personnel for handling equipment.	2.000,00
TOTAL		462.749,00
TOTAL (+VAT)		578.436,25
OVERALL		1.329.765,00
OVERALL (+VAT)		1.662.206,25

According to Table 15, the cost of project activities of the variant solution of direct seawater abstraction from the seaport amounts to HRK 1,662,206.25.

4.2.4. V3 - Indirect use of seawater via well exchangers (closed system)

Within this chapter of the project documentation, the use of a water / ground heat pump is envisaged as the main source of heating or cooling energy. The newly designed heat pump with all its necessary fittings and tanks will be located within the space of the existing power plant. The existing HEAT boiler, as well as all existing associated fittings, will be dismantled. To obtain shallow geothermal energy from the ground using a ground-to-water heat pump, it is planned to build a well field system consisting of eight (8) vertically drilled wells, with a unit depth of 130 m, and equipped with heat exchangers.

On the primary side of the heat pump, the borehole field will be used as the heat sink, while on the secondary side, the existing installation of the fan coil heating / cooling system will be used. Works on the well field are performed with a suitable dedicated drilling set for geothermal systems. The set uses drilling with a protective column and drill pipes, and the drilled material is brought to the surface by compressing and injecting air (the process of blowing with a compressor). As a rule, a mud injection system (a mixture of water and bentonite clay) is not used to remove debris, as is the case with deeper drilling for oil, gas or deep groundwater exploration. In this way, by using only compressed air to remove debris, no chemicals are introduced into the underground, and there is no negative impact on the environment.

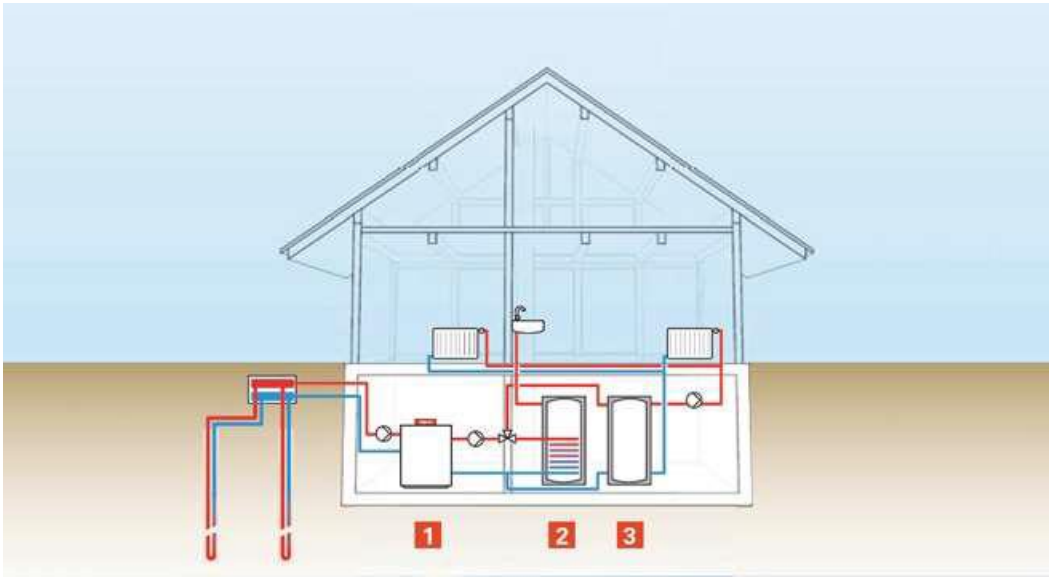
The diameter of the planned drilling is 152 mm, and the diameter of the working protection columns is 130 mm. As a geothermal heat exchanger, a closed single U-loop pipe made of wear-resistant polyethylene material of PE100 RC specification and density according to DIN 8074/8075 is installed in the wells. The RC designation of these pipes means that they are more resistant to stress cracking than standard PE100 water pipes in construction. When lowering the exchanger into the wellbore, the pipes are filled with water to maintain the hydrostatic back pressure relative to the external pressure acting on the pipe. All geothermal heat exchangers are classified as PN16, which means that they can withstand an external pressure of 16 bar before bursting. The pipes are grooved on the inner wall / Turbulator effect / in order to achieve a higher state of heat energy transfer from the fluid to the ground to help the earlier formation of turbulent flow.

The tightness of polyethylene heat exchangers is checked by a pressure test in the factory before delivery, which is confirmed by the manufacturer, but the test itself is performed on the pipes before installation in the well (air pressure test) and after descent into the well. The entire system of tightness control is conducted in accordance with the German guidelines Verein Deutscher Ingenieure (VDI 4640 Part 1-4), entitled Thermal of the underground - Fundamentals, approvals, environmental aspects. When lowering a geothermal well exchanger (1U loop), a dedicated centralizer with two pipe holders can be installed in the well every 5 meters, if necessary, to maintain the distance between supply and return pipes in the well and prevent entanglement of pipes and torsional force.

After installing the exchanger, the well was filled from top to bottom with a mixture of bentonite, cement and water by installing an auxiliary pipe to the bottom of the well and gradually extracted

by the process of filling the well with cement. Particular attention is paid to the possibility of loss of the mixture during cementation into possible fractures in the rock. After grouting and hardening of the cement mixture, it is necessary to fill the well with the mixture to the top of the well if necessary.

Figure 15: Model of indirect use of sea water via well exchangers (closed system)



Source: Preliminary design, 2021.

Testing of well yield and thermal conductivity of the soil will be performed by a combination of the classical thermal response test (TRT) and the extended step test of stabilized thermal response of the soil (TRST). The testing will be performed by a dedicated apparatus that contains a set of electric heaters with a maximum output power of 8kW, a circulation pump, a data recorder of temperature, flow and power housed in a thermally insulated aluminum housing. TRT measurement starts only after the temperature recovery of the well to static soil temperature conditions, i.e., at least two days after the end of drilling on the first exchanger. The first part of the test by the classical TRT procedure will be performed with a peak thermal condition of approximately 4-6 kW lasting a minimum of 72-96hr until the establishment of a semi-steady or steady state of heat transfer to the ground. From this period, the thermogeological parameters of the surrounding soil (thermal conductivity of the soil, well resistance) will be determined by

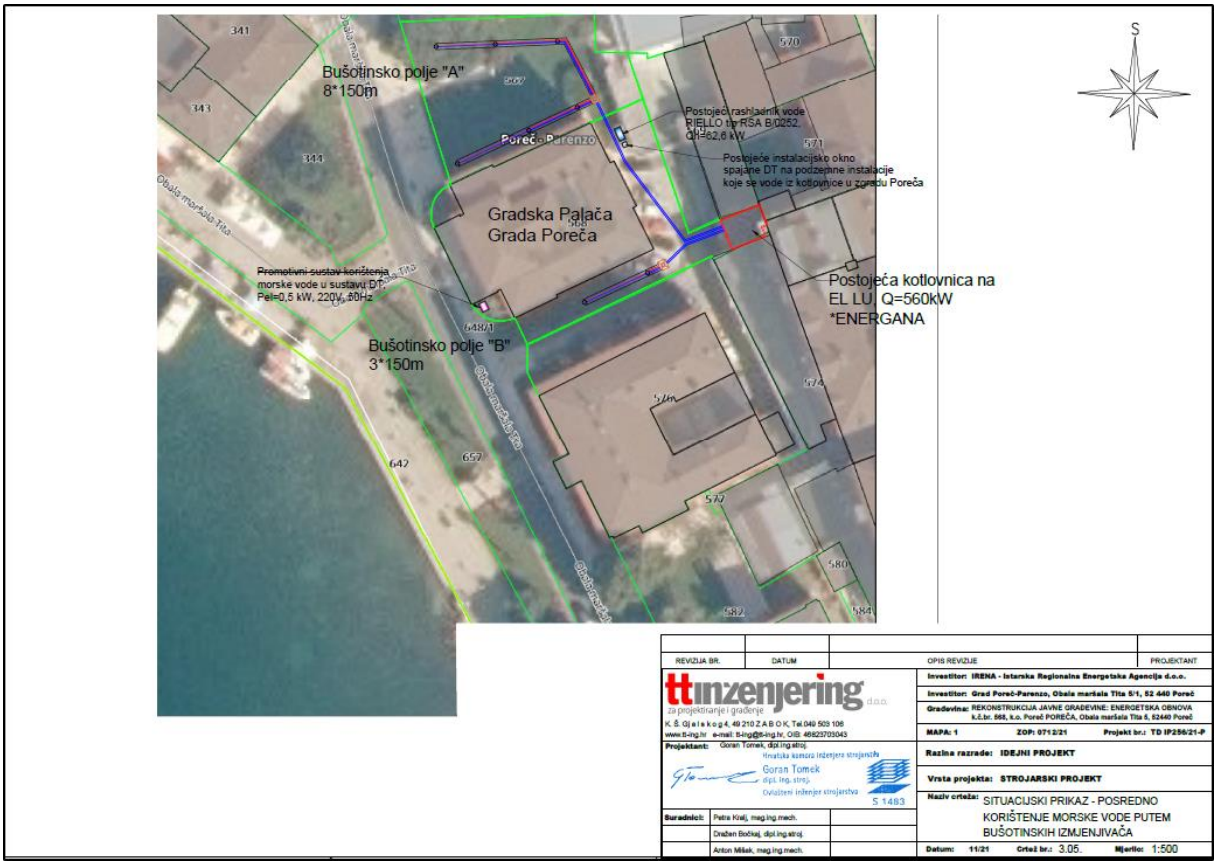
known mathematical solutions for thermal transfer of thermal energy and testing of well exchangers according to IGSHPA guidelines. This data is necessary to prove the efficient operation of the well field and the optimal COP on the heat pump. The initial transient period of borehole heat exchanger operation that is not relevant for determining the thermogeological parameters of the soil will be precisely determined by the method of derivation curves where the change in temperature over time as a function of total time is observed. Experientially, in clay and marl deposits this period usually lasts between 10 and 15hr. The results will also be presented by the inversion curves of the measured data in order to observe the temperature regime in the soil subcooling cycle. After 72-96hr measurements with a constant heat pulse of 4-6 kW, the measurement on the borehole exchanger will continue with a special step method of soil heat response test (TRST) with a series of three smaller heat pulses to establish a steady state of heat transfer from well to surrounding soil in each period. In thermal conditions, the power of the heater will be proportionally reduced (so-called falloff test) and the temperature recovery will be measured 24-36hr for each condition, i.e., until the appearance of a pure steady state of heat transfer in each condition. Using the obtained points of stabilized thermal energy transitions for different values of thermal power, the yield diagrams of well exchangers as a function of outlet temperatures in the heating, active or passive cooling mode will be constructed. This step test is used to accurately determine the yield of a well heat exchanger in W / m as a function of the desired temperature from the exchanger. The application of this test determines the minimum temperature of the well fluid that will occur during peak periods of heat loads during the coldest days in January. Measured data on thermogeological characteristics of the soil with dedicated software packages Earth Energy Designer - EED and Ground Loop Design - GLD will simulate the operation of the well field for many years and include in the analysis and thermal interference between individual wells. In accordance with the main and detailed mechanical design, the monthly output temperatures for the entire designed field will be determined as a function of the required thermal energy for heating and cooling the building and peak consumption. The potential of the well field for the needs of heating and cooling of the facility in accordance with EN14511 will be determined and the geothermal source will be optimized. All data will be submitted in the form of a written Report on the results of measurements and certain thermogeological parameters and a simulation of the operation of the well field. Along with the Report in PDF format, complete measured data from the data recorder in PDF and XLS format

(input and output temperature from TRT, voltage and strength of electricity, flow) will be submitted.

All 8 wells must be connected to the central busbars in such a way that the 1-loop in each well is connected to the auxiliary collecting pipes leading to the main busbars by means of electric couplings of the reduction elbow.

Figure 16 shows the design in space of the variant solution.

Figure 16: V3 - Performance in space



Source: Preliminary design, 2021.

The implementation of the subject variant solution by the preliminary design is divided into 3 parts:

1. Drilling works - well field
2. Collection system - well field
3. Power plant installation.

The following table shows the activities for the implementation of a variant solution according to the listed units.

Table 16: Implementation activities of the variant solution by units

V3 - INDIRECT USE OF SEAWATER THROUGH WELL EXCHANGERS (CLOSED SYSTEM)		
1.	DRILLING WORKS - DRILLING FIELD	
1.1.	Execution of drilling works and installation of borehole heat exchangers with dedicated set and rotary drilling with removal of debris by compressed air by blowing. Drilling takes place with a chisel diameter of 152 mm to a depth of 100 m. A total of 12 standard wells of equal depth are planned to be drilled at the site. The cost of drilling includes transport to the location and installation and dismantling of equipment. The cost of drilling includes the installation of a heat exchanger and the subsequent filling of the well with a mixture of bentonite, cement and water or gravel fraction 0-4mm. Include in the cost of drilling the pressure test of all heat exchangers before and after installation in the well.	353.600,00
1.2.	Supply of well heat exchangers consisting of a single U-loop (1U) polyethylene pipes with wear protection (PE100 RC). The pipes must have an outer diameter of 45 mm with a wall thickness of 4.0 mm and a nominal pressure of 16 bar. The inner shell of the pipe must be grooved in order to achieve an increased coefficient of heat transfer, turbulent flow and Reynolds number at lower flows (so-called pipe turbulator). The pipes are delivered in a roll of 150 m, with factory-welded U-joints and weight holders. The pipes must be factory tested to the nominal pressure. The wellbore turbulator turbine must be ready for direct installation in wells. Pipes must be made according to the INSTA CERT SBC 12201 EN 12201: 2003 standard or equivalent. Product like Muovitech TC45 Turbocollector.	37.600,00
1.3.	Thermal response test for two drilled wells, with 3 thermal conditions (SS-TRST Steady State-Thermal Response Step Test), Report on thermogeological parameters of soil (thermal conductivity of soil, well resistance, effective initial soil temperature, capacity at steady state thermal transition for 0 / -3 ° C condition). Analysis of measured values and project values - a comparative model in the software package GLD (Ground Loop	15.000,00

	Designer). The first condition min 72h, the other three conditions min 24h each.	
UKUPNO		406.200,00
UKUPNO (+PDV)		507.750,00
2.	COLLECTION SYSTEM - WELL FIELD	
2.01.	Preparation of studies of staking out the route of the canal and associated buildings, staking out and ensuring staking out of the route. The paper covers all geodetic measurements by which the data from the project are transferred to the field, securing the axis of the stalked route, profiling, renewal and maintenance of stakes in the field for the entire period of construction or until the handover of works to the investor. The contractor is obliged to secure all points in position and height so that they can be easily restored during or after the work. Prior to the start of the excavation, the contractor is obliged to submit the stated staking plan to the supervising engineer for inspection in order to control the correctness of the procedure. The contractor must not start work before obtaining the approval of the supervising engineer for this documentation. The staking out of the route should be carried out on the basis of data from the project. Inclusion of the working or compensation belt is also included. Site staking as well as geodetic monitoring of construction should be carried out on the basis of project data.	5.000,00
2.02.	Locating and protecting existing utility installations and other connections (electricity lines, gas pipelines, oil pipelines, telecommunication lines, water mains, sewerage, etc.). During excavation, pay special attention to damage to the installation. Enter the data in the geodetic survey of the existing condition. Perform works in the presence of a representative of the competent operator.	3.000,00
2.03.	Geodetic monitoring of all works on the construction of the water intake system network, including the stationing of all points in the field.	6.250,00
2.04.	Preparation of a geodetic survey of the derived state of the network, including the preparation of the Study, and implementation in the Cadastre.	7.500,00
2.05.	Breaking and removing existing asphalt or concrete pavement structures. The item includes machine breaking of the existing pavement structure, loading into the means of transport and transport to the landfill provided by the contractor. Before demolition and removal, it is necessary to perform machine cutting at the place where the object will be demolished, so as not to damage the rest of the object that remains. Dispose of construction waste in accordance with the Ordinance on conditions for waste management.	
	Asphalt cutting	11.000,00

	Breaking asphalt, approx. d = 10 cm	4.800,00
2.06.	Dismantling of existing curbs in the project area. Careful dismantling of concrete curbs in order to perform the required excavation in the project area. The price includes temporary deposit. After the works are completed, the equipment must be returned to its original position or out of profile at the same road station. The price includes all works and materials needed for the execution of works, excavation for the foundation, concreting and reassembly, i.e., return to the original condition. Calculation by type of artificial object.	570,00
2.07.	Breaking the existing AB plate in the power plant for the needs of introducing the energy channel in it. The item includes careful cutting of the AB floor slab, breaking and excavation, removal of waste material at the landfill.	1.350,00
2.08.	Planning the bottom of the ditch with an accuracy of +/- 2 cm. All irregularities should be repaired, cavities and cavities should be filled with excavated material, and the excess should be removed from the ditch. Calculation per m2 of planned area.	2.250,00
2.09.	MEASURING ELEMENTS	
	Supply and installation of mercury glass thermometer in brass tube, angle with tap NO15 NP16, measuring range 0-130 ° C.	400,00
	Supply and installation of manometer fi 100 mm radial connection NO 15 complete with manometer tap NO 15 NP 16, measuring range 0-6 bar.	400,00
2.10.	Supply and installation of an automatic vent pot, NO15 (placed at the highest points of the heating installation in the boiler room.)	1.332,00
2.11.	Supply and installation of vapor barrier insulation of pipelines. Thermal insulation is performed by vapor-tight plate insulation, closed cell structures with a steam dam, the coefficient of resistance to water vapor diffusion is m≥ 10000, l≤ 0.036 W / mK- fuel class B1, according to HRN DIN 4102, part 1, or class 1, according to HRN.U. J1.060. The item also includes pre-prepared parts for insulating all fittings, elbows, branches and the like, as well as special glue and original self-adhesive tape for sealing seams. Seal all joints carefully by diffusion. Pipe insulation or plates of thickness according to the following:	
	d= 13 mm pipes DN 15 do DN 25	690,00
	d= 32 mm pipes DN 80 do DN 100	1.014,00
2.12.	Coating with aluminium sheath with sealing of joints against weather penetration.	1.920,00
2.13.	Repair of asphalt curtain 7 + 3 cm thick with preliminary construction of the base. After laying the pipe and burying the pipe to the height of the post. of the buffer layer, it is necessary to renew the buffer layer according to the valid regulations, apply it in the layers and compact it well, so as to achieve the required compaction modulus and to prevent possible subsequent subsidence. The bituminous gravel layer and the wear layer are applied by hand and rolled well. All damages caused by subsequent subsidence of the	12.600,00

	road due to unprofessionally performed works are to the detriment of the contractor.	
2.14.	Supply and installation of flange butterfly valve PN16, together with counter-flanges, seals and screws.	
	DN80	1.140,00
2.15.	Supply and installation of flange non-return valve PN16, together with counter-flanges, seals and screws.	
	DN80	340,00
2.16.	Supply and installation of circulating pump 50-120 or similar. Frequency controlled pump. The motor is a 1-phase motor, with fluid-lubricated bearings and a pressure equalization diaphragm. Nominal flow per pump: 5 l / s Nominal height 20m, Pump output: Rp 2 ½	35.000,00
2.17.	Landscaping and planting of plant material (low and high greenery). It is necessary to specify the fertile soil material in a layer 40 cm thick, spread out and plan a belt width according to the project. The item includes landscaping and supply, transport, spreading and planning of humus, if necessary, moistening the fertile soil, planting low and high greenery. Return of green areas to their original state.	6.500,00
2.18.	Supply and installation of electric coupling elbow PE100 D45-40 / 90 ° SDR11 for connecting 1U loop D45 from boreholes to auxiliary collecting pipe D40, with sockets for electric welding on all extensions, according to DIN8075 or equivalent, as MUOVITECH.	2.080,00
2.19.	Supply and installation of collector pipe PE100 SDR11 D40, winding of 200m for better efficiency, for connecting wells with busbar, according to standard HRN EN 12201-2 or equivalent, as PIPELIFE	3.600,00
2.20.	Supply and installation of electrical coupling PE100 D40 SDR11 for connecting collector pipes D40 and inlet bus D40, and additional couplings for connecting unequal pieces of pipe, such as PIPELIFE.	1.210,00
2.21.	Supply and installation of busbar for connecting 12 hydraulic circuits of well exchangers: material: HDPE with waterproof cover DN1600 or equivalent (H1200); flow cumulatively up to 30 m^2 / h; the primary connection of the connector and the main bus body is PE100 D110 SDR17; secondary circuits D40 PE100; each circuit with flow meter 1 "1/4 capacity 5-42 L / min and balancing valve; connection for filling and venting wells on the collector / manifold; 60 cm surface opening for maintenance and hydraulic adjustment as MUOVITECH GEOTHERMAL CHAMBER DN1600.	39.000,00
2.22.	Supply and installation of electrical coupling PE100 D110 SDR11 for connecting D110 busbars and D110 inlet busbars and non-uniform pieces of pipes.	1.000,00
2.23.	Supply and installation of the main collecting pipe PE100 SDR17 D110, from the busbar to the entrance to the building, according to the standard HRN EN 12201-2, 12m rod, as PIPELIFE	1.440,00
2.24.	Supply and installation of elbow connection PE100 D110 90 ° SDR11 for connecting the main collecting pipe at right angles from the trench to the	1.000,00

	penetration into the building, with sockets for electric welding on all extensions, according to DIN8075 or equivalent, as MUOVITECH.	
2.25.	Supply and installation of capped plastic pipes PEHD D63 / 52mm for mechanical protection of polyethylene D40 pipes in trenches and prevention of thermal interference according to EN50086-1 or equivalent, as PIPELIFE	3.000,00
2.26.	Supply and installation of cable duct pipes PEHD D200 / 172 mm for mechanical protection of collecting polyethylene D63 pipes in trenches and prevention of thermal interference according to EN50086-1 or equivalent, include in the price 4 couplings for cable duct, such as PIPELIFE.	3.060,00
2.27.	Supply and installation of propylene glycol for filling borehole exchangers, 100% glycol concentrate, for mixing with water and reaching freezing point down to -5 ° C. The mixing ratio is 15% propylene glycol, 85% water, as MUOVITECH MUOVICOOL GLYCOL	14.000,00
2.28.	Supply and installation of collecting and collector pipes in excavations, electric welding of all electrical joints, pressure testing of all circuits, filling the network with glycol mixture. Report on the work performed. Collecting pipes lead to the engine room without breaking into the building	45.000,00
2.29.	Making a sand bed 10.0 (cm) thick for laying PE D63 collecting water pipe inside the cable duct pipe. The price includes the purchase and delivery of materials and the production of the placenta. Calculation per (m^3) of made placenta (100 x 0.1 x 0.5) m.	7.500,00
2.30.	Burying PE D63 of the collecting pipe with sand up to 10.0 (cm) above the top of the pipe after laying and testing. The price includes the supply and delivery of materials as well as the production of backfill. Backfilling in the pipeline zone should be performed with a light compactor. Calculation per (m^3) of buried trench (100x 0.15 x 0.5) m.	5.000,00
2.31.	Construction machine excavation of trenches / channels for the installation of main and auxiliary collecting pipes from individual wells to both collectors and from both collectors to the location of the breakthrough into the building. Construction machine backfilling of all trenches / channels after installation of collecting pipelines. Spreading excess soil material on the surrounding terrain in agreement with the supervising engineer or removal of excess soil material from the site and its disposal. Calculation according to the quantities actually performed.	18.000,00
2.32.	Burying the remaining part of the trench with excavated material (choose finer material). Backfilling is done in layers of 30 cm with machine compaction and, if necessary, the addition of new material. During compaction, the embankment should be watered to prevent subsidence. Calculation per (m^3) of buried trench (100 x 0.75 x 0.5) m. It is necessary to make an overhang on the green surface due to possible subsidence.	44.000,00
2.33.	Loading and removal of excess residual material from excavation (with rehabilitation of the terrain) to the planner or spreading around the environment. Loose material is included in the quantity.	2.640,00

2.34.	Continuous cleaning of the construction site from the remaining material and various packaging, as well as protection of installed and installed equipment from the impact of works on the facility (protection from dust, damage, etc.)	1.000,00
2.35.	Derived condition study.	4.000,00
2.36.	Collection and obtaining of all necessary declarations of conformity of equipment and certificates from authorized houses, required during the technical inspection of the facility.	2.000,00
2.37.	Derived condition study.	3.000,00
2.38.	Performing pressure tests, leak testing, logging and the like.	3.300,00
TOTAL		307.886,00
TOTAL (+VAT)		384.857,50
3.	POWER PLANT INSTALLATION	
3.01.	Dismantling of the existing fittings, boiler, pump and the like in the existing power plant in order to be able to install a new heat pump. The item includes dismantling, cutting and removal from the construction site. Deposit in accordance with the Rules of the Profession.	
	Disassembly and removal of the existing hot water boiler TOPLOTA TH80, Q = 1000 kW with associated burner. Including duplication from other installations.	7.500,00
	Dismantling and removal of the existing technological water preparation system.	200,00
	Dismantling and removal of existing heating system pumps.	1.000,00
	Dismantling and removal of existing membrane expansion vessels with a volume of 500 l.	800,00
	Disassembly and removal of existing valves, 4xx valves, non-return valves, filters and the like.	1.280,00
	Dismantling and removal of existing pipelines within the space of power plant NO15 - NO25.	400,00
	Dismantling and removal of existing pipelines within the premises of power plant NO32 - NO50.	408,00
	Dismantling and removal of existing pipelines within the space of power plant NO65 - NO80.	4.704,00
3.02.	Supply and installation of a venting vessel made of DN 150 steel pipe, complete with automatic venting valve NO 20 (R 3/4 ") PN 16, as well as connecting pipes NO 10 approx. 2 m long each with ball valve NO 15 (R 1/2 ") PN 16 for manual venting. Connected to drainage. Everything is protected against corrosion and finished with varnish. Vessel size 0.5 L.	8.250,00

3.03.	Supply and installation of automatic vent pot, DN15 (installed at the highest installation points).	4.000,00
3.04.	Supply and installation of tanks - Cooling and heating water accumulators. Standing steel storage tank for heating or cooling water. With integrated water stratification system without insulation and auxiliary material.	14.500,00
3.05.	Supply and installation of cooling / heating water tank equipment.	6.500,00
3.06.	Supply and installation of automatic single water softener q = 1.5 m^3 / h for continuous production of softened water. The item must include all small and consumables needed for the installation of the device.	17.550,00
3.07.	Supply and installation of electric boiler for central heating 28 kW.	8.200,00
3.08.	Supply and installation of plate heat exchanger.	4.800,00
3.09.	Supply and installation of plate heat exchanger.	18.500,00
3.10.	Supply and installation of a heat pump with a water-cooled condenser, intended for indoor installation.	172.596,00
3.11.	Commissioning of the heat pump, adjustment to operation according to design parameters and zero service.	3.500,00
3.12.	Supply and installation of a high-efficiency electronic pump for the heating system. The item must include all small and consumables needed for the installation of the device. Circulation pump, wet rotor version, with frequency converter mounted on the pump motor terminal box and permanent motor magnet rotor. Differential pressure sensors installed in the pump housing. An insulating set of the heating pump is supplied with the pump. Small and consumables included.	
	DN50-H100 flange, 230V; 50Hz; 1ph, water	25.700,00
	DN65-H150 flange, 230V; 50Hz; 1ph	21.500,00
	DN65-H80 flange, 230V; 50Hz; 1ph	29.000,00
	DN 25-H60 threaded, 230V; 50Hz; 1ph	3.500,00
	DN 25-H80 threaded, 230V; 50Hz; 1ph	5.900,00
3.13.	Supply and installation of storage tank in heating / cooling systems with a volume of 300 litres with NO80 connections.	4.800,00
3.14.	Supply and installation of three-way mixing valve DN80, kvs = 100m3 / h	4.800,00
3.15.	Supply and installation of overflow valves NO15	180,00
3.16.	Supply and installation of NO40 overflow valves	480,00
3.17.	Supply and installation of expansion vessel HV = 18 l, pmax = 10bar 3/4 ". Item includes service opening valve with key R 3/4 "	560,00
3.18.	Supply and installation of expansion vessel HV = 35 l, pmax = 10bar 3/4 ". Item includes service opening valve with key R 3/4 "	550,00
3.19.	Supply and installation of expansion vessel HV = 50 l, pmax = 10bar 3/4 ". Item includes service opening valve with key R 3/4 "	1.130,00
3.20.	Supply and installation of expansion vessel HV = 300 l, pmax = 10bar 3/4 ". Item includes service opening valve with key R 3/4 "	2.450,00

3.21.	Supply and installation of branch shut-off and measuring valve with the possibility of flow pre-regulation, with pre-regulation, two measuring connections, flange connection, max. diff. valve pressure 1.5bar, max. temp. water 130 ° C. The item must include a one-time flow adjustment using the original measuring instrument, and a record of the flows achieved. PN 16, dimension and quantity:	0,00
	DN20	650,00
	DN80	24.000,00
3.22.	Supply and installation of a rubber flange compensator for connecting the heat pump to the system. Seals, screws and counter-flanges included in the price.	
	DN 50	700,00
3.23.	Supply and installation of non-return water damper PN16, threaded.	
	DN25	180,00
3.24.	Supply and installation of water filter PN16, threaded.	
	DN25	225,00
3.25.	Supply and installation of non-return water valve PN16, flange, together with counter-flanges, seals and screws.	
	DN80	1.440,00
3.26.	Supply and installation of water impurity trap PN16, flanged, together with counter flanges, seals and screws.	
	DN80	850,00
3.27.	Supply and installation of flange butterfly valve PN16, together with counter-flanges, seals and screws.	
	DN100	1.800,00
	DN80	7.326,00
3.28.	Supply and installation of ball screw valve PN16.	
	DN25	1.680,00
3.29.	Supply and installation of 1/2 "drain valve with pipe connection	1.650,00
3.30.	Supply and installation of high-efficiency safety valve Psv = 3.0 bar, PN 16 SE = R1 / 2 ".	350,00
3.31.	Supply and installation of high-efficiency safety valve Psv = 3.5 bar, PN 16 SE = R1 ", SE = 11/2".	2.400,00
3.32.	Supply and installation of mercury glass thermometer in brass tube, angle with tap NO15 NP16, measuring range 0-130 ° C.	3.600,00
3.33.	Supply and installation of manometer fi 100 mm radial connection NO 15 complete with manometer tap NO 15 NP 16, measuring range 0-6 bar.	3.600,00
3.34.	Supply and installation of steel seamless pipes for central heating systems tested for leaks, laid surface-mounted, including all auxiliary material for connections and fittings, sealing and fastening. The stated price of a long meter of pipe includes all fittings and transition pieces, elbows, T-pieces,	

	suspension and the like. The item must include all small and consumables required for the installation of equipment of the following dimensions:	
	DN100	820,00
	DN80	8.000,00
	DN65	452,00
	DN50	672,00
	DN40	300,00
	DN25	636,00
	DN20	810,00
	DN15	1.140,00
3.35.	Rust cleaning of pipelines and double coating with primer.	1.380,00
3.36.	Supply and installation of vapor barrier insulation of pipelines.	
	Thermal insulation is performed by vapor-tight plate insulation, closed cell structures with steam dam, coefficient of resistance to water vapor diffusion is m≥ 10000, l≤ 0.036 W / mK-Subject insulation is made of flexible spongy material based on synthetic rubber, as highly flammable flammability class B1, according to HRN DIN 4102, part 1, or class 1, according to HRN.U. J1.060. The item also includes pre-prepared parts for insulating all fittings, elbows, branches and the like, as well as special glue and original self-adhesive tape for sealing seams. Seal all joints carefully by diffusion. Pipe insulation or plates of thickness according to the following:	
	d= 13 mm pipes DN 15 do DN 25	1.150,00
	d= 19 mm pipes DN 32 do DN 40	125,00
	d= 25 mm pipes DN 50 do DN 65	715,00
	d= 32 mm pipes DN 80 do DN 100	4.394,00
3.37.	Supply and installation of nameplates and self-adhesive labels for markings of equipment and plant elements.	1.500,00
3.38.	Preparation of instructions for operation and maintenance of the plant with delivery in 2 sets, functional schemes framed, glazed and hung on the wall and training of personnel for handling equipment.	2.000,00
TOTAL		449.783,00
TOTAL (+VAT)		562.228,75
OVERALL		1.163.869,00
OVERALL (+VAT)		1.454.836,25

According to Table 16, the cost of project activities of the variant solution of direct seawater abstraction from the seaport amounts to HRK 1,454,836.25.

4.3. Proposal of organizational structure

To assess the required staff, their competencies and employment dynamics, it is necessary to define the optimal model of facility management and planned facilities.

The City of Poreč-Parenzo already has a functionally organized organization to meet all needs, and a caretaker is employed in the management of the boiler room and heating / cooling system. If necessary, external associates or authorized service technicians are hired for regular annual maintenance and repairs.

Considering that the subject analysis refers exclusively to the selection of a new heating / cooling system, we believe that it is not necessary to hire additional staff to manage and regularly maintain the new system.

It is recommended to educate existing employees (in the case of janitors) where they will acquire the necessary basic knowledge of system management, information on system risks, identifying possible failures, fault reporting procedures and the like.

4.4. Time plan for project preparation and implementation

Project preparation began in 2021 with the elaboration of the project concept. So far, the following project preparation activities have been carried out:

- ✓ Preliminary design of variant solutions has been prepared.

The following project preparation activities are planned to be completed by the end of 2021:

- ✓ Preparation of the feasibility study in question,

- ✓ Preparation of the main project with accompanying cost estimates, selected variant solution.

According to the available information of investors, it is planned to obtain the necessary permits and approvals by the end of 2022, and to apply for the project as a whole in a public call for funding from grants from EU funds. If the necessary funds from EU funds are provided, the implementation of the project would begin in the first quarter of 2023.

Gantt chart 3: Dynamics of the project implementation by key activities

Activity	2023											
	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
1. Development of a project idea												
1.1. Expert group meetings												
1.2. Project conceptualization												
2. Development of a preliminary design												
2.1. Preliminary design												
3. Preparation of a feasibility study												
3.1. Preparation of a feasibility study												
3.2. Expert group meetings and selection of a variant solution												
4. Development of the main project												
4.1. Development of the main project												
5. Applying for a project												
5.1. Preparation of project application and submission to the tender												

5.2. Signing a co-financing agreement	**X**											
6. Project implementation												
6.1. Public procurement	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**	**X**			
6.2. Construction and craft work				**X**	**X**	**X**	**X**	**X**	**X**			
6.3. Equipment installation and system certification						**X**	**X**	**X**	**X**	**X**	**X**	
6.4. Grand opening												**X**

5. ENVIRONMENTAL IMPACT

The contractor is obliged to install only construction products for which their usability has been proven in accordance with the Construction Products Act (OG 76/13, 30/14), and to perform works in accordance with the Construction Act (OG 153/13, 20/17). The contractor is obliged to comply with all applicable regulations, norms and standards for the execution of works, and in particular is obliged to install quality materials provided by the project, as well as adhere to cost descriptions and rules of the profession when performing works. If it is established that the quality of the installed material and performed works does not meet the required conditions, the investor or designer may request additional tests other than those specified in the general conditions. If deficiencies are found in the quality of the works and the installed material, all repair costs shall be borne by the contractor.

For the purposes of performing works and storing materials and equipment, the contractor must form appropriate landfills at the location of the building. In terms of the Construction Act, environmental regulation refers to the arrangement of a construction site after the construction itself. Regarding the arrangement of the environment, after the construction is performed, the works of cleaning the construction site should be performed, i.e., bringing the construction site into a condition of usability. Thus, the arrangement of the environment, in terms of arranging the construction site after the completion of construction, provides for:

- ✓ remove all temporary structures built as part of the preparatory works as well as construction site equipment,
- ✓ remove excess construction material from storage space,
- ✓ clean the landfill of rubbish and waste,
- ✓ dismantle temporary electrical installations for propulsion and lighting of certain places on the construction site,
- ✓ clean the construction site and the route of the access road from garbage and all waste, and residual construction materials,
- ✓ humus and grass areas if provided by the project,
- ✓ All possibly felled trees must be neatly stacked on the construction site or along the route

- ✓ green land (vegetation and vegetation) damaged by construction should be covered with grass and vegetation,
- ✓ all fence walls, curbs, stairs, etc. damaged during construction should be repaired,

After the completion of all works, the construction site must be thoroughly cleaned of waste material and surplus material, which can only be temporarily, i.e., during the works, disposed of next to the construction site in positions envisaged by the construction site organization project. Excess material will be taken to a construction material landfill in agreement with the supervising engineer. Depositing will be done by spreading in layers. After the removal of construction materials, the landfill will be arranged by planning, and the area of the landfill will be brought to the level of the appearance of the rest of the environment.

Hazardous waste does not appear when performing works on the subject building.

6. FINANCIAL ANALYSIS

One of the most important elements of any investment project is its financial analysis. Based on the financial analysis, a decision is made on the investment in terms of financial profitability or profitability. Each project requires certain investment funds at the beginning of the project, during the project implementation but also after the project implementation, which are defined as expenditures and expenses.

The methodology for preparing this financial analysis is in line with the guidelines of the European Commission's Guide to Cost-Benefit Analysis of Investment Projects; Economic Appraisal Tool for Cohesion Policy 2014-2020; European Commission, Directorate General for Regional and Urban Policy, 2014). The project is intended to be financed by grants from EU funds.

Financial analysis is necessary to identify, estimate and calculate the costs incurred in the investment phase of the project. In the case of the project in question, investment costs form an important part of the financial analysis due to the amount of investment and the specifics of the project.

In addition to investment costs, it is necessary to determine the duration of the project, revenues and receipts, and expenses and expenditures that will be incurred during the observed period. Based on the estimated cash flows in the observed period, all relevant indicators of return on investment in the project or its justification will be calculated.

Since this is a project of social interest, the focus of financial analysis is not on proving financial viability but on the financial viability of the project. Namely, a better quality, cheaper and more environmentally friendly heating / cooling system in terms of operating costs are in the function of positive socio-economic effects, especially from the aspect of a positive contribution to tackling climate change.

Based on the above, in order to make a decision on the profitability of the investment in question, only the financial criteria for making decisions on project acceptance cannot be taken into account, but the beneficiaries' benefits and positive externalities arising from the project in question must be taken into account. For this analysis, the methodology of valuing social costs and benefits (**Cost Benefit Analysis**) is used.

6.1. Assumptions of financial analysis

Financial analysis is necessary to identify, estimate and calculate the costs incurred in the investment phase of the project.

In addition to investment costs, it is necessary to determine the duration of the project, revenues and receipts, and expenses and expenditures that will be incurred during the observed period.

The stated financial amounts can be used to calculate the annual cash flows and all other financial characteristics of the project. Based on the estimated cash flows for the observed period, all possible indicators of financial sustainability and profitability of investment in the project will be calculated (from the aspect of financial analysis).

Given the specifics of the project, which does not generate direct revenues, but results in financial savings, revenues are constant throughout the reference period, as well as all operating expenses, except for heating / cooling costs. The project will be implemented by the end of 2023,

so the first year of performance measurement is defined as 2024. At the same time, the reference year of the assessment of operations, i.e., operating income and expenses is based on available data, possibilities of their reconstruction and projection in the following period.

6.1.1. Currency - prices used in the analysis

The monetary price of production factors and project output is stated with value added tax (VAT) included, as the project holder does not have the possibility of VAT refund.

6.1.2. Financial analysis period

The reference period in which this project will be observed is the number of years in which cash flows are realized. The reference period must be in line with the current European Commission's Guide to Cost-Benefit Analysis of Investment Projects; Economic Appraisal Tool for Cohesion Policy 2014-2020; European Commission, Directorate General for Regional and Urban Policy, 2014). Table 17 shows the recommended reference periods of projects by sectors, in accordance with the recommendations of the European Commission.

Table 17: European Commission reference periods by sector

Sector	Reference period (in years)
Railways	30
Roads	25-30
Ports and airports	25
city transport	25-30
Water supply / remediation	30
Waste management	25-30

Energy	15-25
Broadband network	15-20
Research and innovation	**15-25**
Business infrastructure	10-15
Other sectors	**10-15**

Source: Annex I to Delegated Regulation (EU) no. 480/2014.

Taking into account the specifics of the project, which partially classify it into the Research and Innovation Sector (15-25 years) and Other Sectors (10-15 years), and in accordance with the instructions of Annex I to Delegated Regulation (EU) no. 480/2014, the reference period of the project in question is 20 years.

6.1.3. Estimation of income and expenses

The financial analysis of the project in question is done in accordance with a conservative estimate of revenue and a realistic estimate of expenditure. The estimation of revenues and expenditures is based on previous financial results, experiences and assessments of investors, and good practice of the authors of the study in the development of similar projects. For the estimation of income, constant prices by key sources of income were used, while for the estimation of expenses, constant prices of current expenses were used.

6.1.4. Discount rate

For the purposes of this study, the financial discount rate is 4.0%, and according to the recommendations of the current Guide to Cost-Benefit Analysis of Investment Projects;

Economic appraisal tool for Cohesion Policy 2014-2020; European Commission, Directorate General for Regional and Urban policy, 2014).

6.2. Investment costs

Investment costs refer to the costs of construction and craft works and mechanical installations, in accordance with the needs of the expected users of the facility.

Table 18 shows the investment costs of the project.

Table 18: Investment costs of the project by variant solutions

Position	Amount (HRK)	VAT (HRK)	Amount + VAT (HRK)
V1 - Direct capture of sea water from a nearby port			
1. SEA INTAKE	879.541,00	219.885,25	1.099.426,25
2. SEA INTAKE – POWER PLANT	462.749,00	115.687,25	578.436,25
TOTAL	1.342.290,00	335.572,50	1.677.862,50
V2 - Coastal seawater abstraction by wells			
1. MAKING WELLS (1 x production + 2 x impression)	248.950,00	62.237,50	311.187,50
2. COLLECTION CIRCLE OF WELLS	618.066,00	154.516,50	772.582,50
3. POWER PLANT	462.749,00	115.687,25	578.436,25
TOTAL	1.329.765,00	332.441,25	1.662.206,25
V3 - Indirect use of seawater via well exchangers (closed system)			
1. DRILLING WORKS - well field	406.200,00	101.550,00	507.750,00
2. COLLECTION SYSTEM - well field	307.886,00	76.971,50	384.857,50
3. POWER PLANT	449.783,00	112.445,75	562.228,75
TOTAL	1.163.869,00	290.967,25	1.454.836,25

According to Table 18, investment costs V1 amount to HRK 1,677,862.50, V2 amounts to HRK 1,662,206.25, and V3 amounts to HRK 1,454,836.25.

6.2.1. Changes in working capital in the observed period

Working capital is the difference between current assets and current liabilities of a business entity. Working capital is a condition of liquidity and financial stability of the business entity and an indicator of liquidity, and ultimately the sustainability of the project.

Since this is an investment project in public infrastructure, there is no imperative to achieve high business profits that would arise from business functions after the implementation of the project. In this particular case, working capital is the implementation of a new heating / cooling system, which will primarily enable the reduction of operating costs.

6.2.2. Remaining project value

Depreciation is the gradual depletion of long-term tangible and intangible assets, and the transfer of part of the value of these assets to new products and services. Depreciation also represents the systematic allocation of the depreciable amount of an asset over its useful life. Depreciation includes buildings, plant and equipment, plantations and other long-term tangible and intangible assets. The project life is aligned with the economic life of the project, which is estimated at 20 years. Therefore, a depreciation rate of 5.0% is applied for construction and craft works. According to the Ordinance on depreciation, equipment and devices are subject to a depreciation rate of 10.00% (rate defined for equipment and other fixed assets) but according to analysis and consultation with suppliers and designers, the service life of equipment and devices is estimated at 20 years. equipment after the tenth year of project implementation. The cost of replacing equipment and devices in all variant solutions is estimated at HRK 100,000.00.

Table 19 shows depreciation rates by type of fixed assets.

Table 19: Depreciation rates by type of fixed assets

Position	Economic life	Depreciation rate
Buildings and structures	20	5,00%
Equipment and devices	20	5,00%

Extending the service life is possible through regular investment in investment / capital maintenance and replacement of equipment. In the subject study, in addition to the costs of regular investment maintenance with the aim of extending the life of the project, the approach of a one-time increase in investment costs / replacement of equipment and devices was applied.

Table 20 shows the calculation of the residual values of the project.

Table 20: Calculation of the residual value of the project by variant solutions (V1)

Year	Fixed assets (Buildings and structures)	Fixed assets (Equipment + Devices)	Replacement of assets (Equipment)	Depreciation amount	The rest of the project value
2021	0,00	0,00		0,00	
2022	0,00	0,00		0,00	
2023	1.099.426,25	578.436,25		0,00	1.677.862,50
2024				83.893,13	1.593.969,38
2025				83.893,13	1.510.076,25
2026				83.893,13	1.426.183,13
2027				83.893,13	1.342.290,00
2028				83.893,13	1.258.396,88
2029				83.893,13	1.174.503,75
2030				83.893,13	1.090.610,63
2031				83.893,13	1.006.717,50
2032				83.893,13	922.824,38
2033				83.893,13	838.931,25
2034			100.000,00	83.893,13	855.038,13
2035				88.893,13	766.145,00
2036				88.893,13	677.251,88

2037				88.893,13	588.358,75
2038				88.893,13	499.465,63
2039				88.893,13	410.572,50
2040				88.893,13	321.679,38

The remaining value of the project at V1 is HRK 321,679.38.

Table 21: Calculation of the residual value of the project by variant solutions (V2)

Year	Fixed assets (Buildings and structures)	Fixed assets (Equipment + Devices)	Replacement of assets (Equipment)	Depreciation amount	The rest of the project value
2021	0,00	0,00		0,00	
2022	0,00	0,00		0,00	
2023	1.083.770,00	578.436,25		0,00	1.662.206,25
2024				83.893,13	1.578.313,13
2025				83.893,13	1.494.420,00
2026				83.893,13	1.410.526,88
2027				83.893,13	1.326.633,75
2028				83.893,13	1.242.740,63
2029				83.893,13	1.158.847,50
2030				83.893,13	1.074.954,38
2031				83.893,13	991.061,25
2032				83.893,13	907.168,13
2033				83.893,13	823.275,00
2034			100.000,00	83.893,13	839.381,88
2035				88.893,13	750.488,75
2036				88.893,13	661.595,63
2037				88.893,13	572.702,50
2038				88.893,13	483.809,38
2039				88.893,13	394.916,25
2040				88.893,13	306.023,13

The remaining value of the project at V2 is HRK 306,023.13.

Table 22: Residual project value (V3)

Year	Fixed assets (Buildings and structures)	Fixed assets (Equipment + Devices)	Replacement of assets (Equipment)	Depreciation amount	The rest of the project value
2021	0,00	0,00		0,00	
2022	0,00	0,00		0,00	
2023	892.607,50	562.228,75		0,00	1.454.836,25
2024				83.893,13	1.370.943,13
2025				83.893,13	1.287.050,00
2026				83.893,13	1.203.156,88
2027				83.893,13	1.119.263,75
2028				83.893,13	1.035.370,63
2029				83.893,13	951.477,50
2030				83.893,13	867.584,38
2031				83.893,13	783.691,25
2032				83.893,13	699.798,13
2033				83.893,13	615.905,00
2034			100.000,00	83.893,13	632.011,88
2035				88.893,13	543.118,75
2036				88.893,13	454.225,63
2037				88.893,13	365.332,50
2038				88.893,13	276.439,38
2039				88.893,13	187.546,25
2040				88.893,13	98.653,13

The remaining value of the project at V3 is HRK 98,653.13.

6.3. Operating revenues and expenditures of the project

6.3.1. Financial impact of variant project solutions

In order to make a projection of revenues and expenditures, it is necessary to estimate the differences in the financial costs of the current heating / cooling system and the system of considered alternative solutions.

Available data on the physics of the building and the technical characteristics of the devices and equipment are used to assess the direct financial effects according to the variant solutions of the City Palace of the City of Poreč-Parenzo.

Table 23 shows the conversion values of energy products by position.

Table 23: Conversion values of energy products by positions

Conversion	Oil	Electric energy
CO_2 conversion rate (kg/MWh)	0,29957	0,23481
Price (HRK/kWh)	0,52703	1,12935

According to the above, the price of heating oil per kWh averages HRK 0.52703, and electricity HRK 1.22935.

Due to the transparency of the calculation, the conversion values of CO2 emissions per MWh of energy are also shown, although these changes are subject to quantification and monetization in socio-economic analysis.

The stated values are fixed and apply to all variant solutions.

Table 24 shows the calculation of energy and financial savings for V1 - Direct capture of seawater from a nearby port.

Table 24: Calculation of energy and financial savings at V1 - Direct seawater abstraction from a nearby port

CURRENT SYSTEM		Building needs (kWh/a)	Electric energy consumption (kWh/a)	CO_2 (t)	Renewable energy (air)
EER (air cooled chiller)	2,28				
Avg annual oil consumption	l	10.868,00			
Calculated annual required thermal energy for cooling QC,nd	kWh/a	10.302,0	4.518,42	1,06	5.783,58
Annual thermal energy demand for heating for actual climate data QH,nd	kWh/a	234.253,0		70,18	
Annual thermal energy demand for heating for reference climate data QH,nd	kWh/a	172.766,0		51,76	
Annual thermal energy input for heating for the reference year (on the basis of oil consumption)	kWh/a	104.343,00		31,26	
Annual thermal energa input for heating delivered to space in the reference year (on the basis of oil consumption)	kWh/a	70.875,00		21,23	
NEW SYSTEM (inverter heat pump 25-100 kW)		Building needs (kWh/a)	Electric energy consumption (kWh/a)	CO_2 (t)	Renewable energy (sea water)
EER	5,18				
SCOP	5,45				
Calculated annual required thermal energy for cooling QC,nd	kWh/a	10.302,00	1.988,80	0,47	8.313,20
Annual thermal energy demand for heating for actual climate data QH,nd	kWh/a	234.253,0	42.982,20	10,09	191.270,80
Annual thermal energy demand for heating for reference climate data QH,nd	kWh/a	172.766,0	31.700,18	7,44	141.065,82
Annual thermal energy input for heating for the reference year (on the basis of oil consumption)	kWh/a	104.343,00	19.145,50	4,50	85.197,50
Annual thermal energa input for heating delivered to space in the reference year (on the basis of oil consumption)*	kWh/a	70.875,00	13.004,59	3,05	57.870,41

***Heating manifold losses assumed to be the same**					
ENERGY SAVINGS\CO_2 EMMISION REDUCTION		Conventional energy consumption change (MWh/a)	Renewable energy production change (MWh/a)	CO_2 (t) change	Financial result (HRK)
Calculated annual required thermal energy for cooling QC,nd	MWh/a	-2,53	2,53	-0,59	-2,86
Annual thermal energy demand for heating for actual climate data QH,nd	MWh/a	-191,27	191,27	-60,08	-74.916,41
Annual thermal energy demand for heating for reference climate data QH,nd	MWh/a	-141,07	141,07	-44,31	-55.252,26
Annual thermal energy input for heating for the reference year (on the basis of oil consumption)	MWh/a	-85,20	85,20	-26,76	-33.369,92
Annual thermal energa input for heating delivered to space in the reference year (on the basis of oil consumption)*	MWh/a	-57,87	57,87	-18,18	-22.666,52

According to the analysis and calculation shown in Table 24, the implementation of V1 results in average annual savings in the amount of HRK 33,372.77 based on energy consumption.

Table 25 shows the calculation of energy and financial savings in V2 - Coastal seawater abstraction through wells

Table 25: Calculation of energy and financial savings in V2 - Coastal seawater abstraction through wells

CURRENT SYSTEM		**Building needs (kWh/a)**	**Electric energy consumption (kWh/a)**	**CO_2 (t)**	**Renewable energy (air)**
EER (air cooled chiller)	2,28				
Avg annual oil consumption	L	10.868,00			
Calculated annual required thermal energy for cooling QC,nd	kWh/a	10.302,0	4.518,42	1,06	5.783,58

Annual thermal energy demand for heating for actual climate data QH,nd	kWh/a	234.253,0		70,18	
Annual thermal energy demand for heating for reference climate data QH,nd	kWh/a	172.766,0		51,76	
Annual thermal energy input for heating for the reference year (on the basis of oil consumption)	kWh/a	104.343,00		31,26	
Annual thermal energa input for heating delivered to space in the reference year (on the basis of oil consumption)	kWh/a	70.875,00		21,23	
NEW SYSTEM (inverter heat pump 25-100 kW)		Building needs (kWh/a)	Electric energy consumption (kWh/a)	CO_2 (t)	Renewable energy (sea water)
EER	5,18				
SCOP	5,45				
Calculated annual required thermal energy for cooling QC,nd	kWh/a	10.302,00	1.988,80	0,47	8.313,20
Annual thermal energy demand for heating for actual climate data QH,nd	kWh/a	234.253,0	42.982,20	10,09	191.270,80
Annual thermal energy demand for heating for reference climate data QH,nd	kWh/a	172.766,0	31.700,18	7,44	141.065,82
Annual thermal energy input for heating for the reference year (on the basis of oil consumption)	kWh/a	104.343,00	19.145,50	4,50	85.197,50
Annual thermal energa input for heating delivered to space in the reference year (on the basis of oil consumption)*	kWh/a	70.875,00	13.004,59	3,05	57.870,41
***Heating manifold losses assumed to be the same**					

ENERGY SAVINGS\CO₂ EMMISION REDUCTION		Conventional energy consumption change (MWh/a)	Renewable energy production change (MWh/a)	CO_2 (t) change	Financial result (HRK)
Calculated annual required thermal energy for cooling QC,nd	MWh/a	-2,53	2,53	-0,59	-2,86
Annual thermal energy demand for heating for actual climate data QH,nd	MWh/a	-191,27	191,27	-60,08	-74.916,41
Annual thermal energy demand for heating for reference climate data QH,nd	MWh/a	-141,07	141,07	-44,31	-55.252,26
Annual thermal energy input for heating for the reference year (on the basis of oil consumption)	MWh/a	-85,20	85,20	-26,76	-33.369,92
Annual thermal energy input for heating delivered to space in the reference year (on the basis of oil consumption)*	MWh/a	-57,87	57,87	-18,18	-22.666,52

According to the analysis and calculation shown in Table 25, the implementation of V2 results in average annual savings in the amount of HRK 33,372.77 based on energy consumption.

Table 26 shows the calculation of energy and financial savings in V3 - Indirect use of seawater through well exchangers (closed system).

Table 26: Calculation of energy and financial savings in V3 - Indirect use of seawater via well exchangers (closed system)

CURRENT SYSTEM		Building needs	Electric energy consumption	CO_2 (t)	Renewable energy (air)
EER (air cooled chiller)	2,28				
Avg annual oil consumption	l	10.868,00			
Calculated annual required thermal energy for cooling QC,nd	kWh/a	10.302,0	4.518,42	1,06	5.783,58
Annual thermal energy demand for heating for actual climate data QH,nd	kWh/a	234.253,0		70,18	

Annual thermal energy demand for heating for reference climate data QH,nd	kWh/a	172.766,0		51,76	
Annual thermal energy input for heating for the reference year (on the basis of oil consumption)	kWh/a	104.343,00		31,26	
Annual thermal energa input for heating delivered to space in the reference year (on the basis of oil consumption)	kWh/a	70.875,00		21,23	
NEW SYSTEM (inverter heat pump 25-100 kW)		Building needs	Electric energy consumption	CO_2 (t)	Renewable energy (sea water)
EER	4,6				
SCOP	4,84				
Calculated annual required thermal energy for cooling QC,nd	kWh/a	10.302,00	2.239,57	0,53	8.062,43
Annual thermal energy demand for heating for actual climate data QH,nd	kWh/a	234.253,0	48.399,38	11,36	185.853,62
Annual thermal energy demand for heating for reference climate data QH,nd	kWh/a	172.766,0	35.695,45	8,38	137.070,55
Annual thermal energy input for heating for the reference year (on the basis of oil consumption)	kWh/a	104.343,00	21.558,47	5,06	82.784,53
Annual thermal energa input for heating delivered to space in the reference year (on the basis of oil consumption)*	kWh/a	70.875,00	14.643,60	3,44	56.231,40
***Heating manifold losses assumed to be the same**					
ENERGY SAVINGS\CO_2 EMMISION REDUCTION		Conventional energy consumption change (MWh/a)	Renewable energy production change (MWh/a)	CO_2 (t) change	Financial result (HRK)
Calculated annual required thermal energy for cooling QC,nd	MWh/a	-2,28	2,28	-0,54	-2,57
Annual thermal energy demand for heating for actual climate data QH,nd	MWh/a	-185,85	185,85	-58,81	-68.798,52

Annual thermal energy demand for heating for reference climate data QH,nd	MWh/a	-137,07	137,07	-43,37	-50.740,20
Annual thermal energy input for heating for the reference year (on the basis of oil consumption)	MWh/a	-82,78	82,78	-26,20	-30.644,83
Annual thermal energa input for heating delivered to space in the reference year (on the basis of oil consumption)*	MWh/a	-56,23	56,23	-17,79	-20.815,51

According to the analysis and calculation shown in Table 26, the implementation of V3 results in average annual savings of HRK 30,647.41 based on energy consumption.

6.3.2. Operating income

The operating revenues of the City of Poreč-Parenzo are included in the budget revenues from operations.

To calculate the amount and projection of operating revenues, the method of averaging budget revenues in the period from 2016 to 2020 is used, up to the level of financial sustainability in the option without a project. Converted realized financial savings based on the implementation of each of the variant solutions are added to the revenues.

Table 27 shows revenues during the reference period based on average revenues generated in the period from 2016 to 2020, increased by the converted amount of financial savings (V1)

Table 27: Operating income during the reference period (V1)

Year	Operating income	Savings-Project Performance	Total
2021	16.956.496,00	0,00	16.956.496,00
2022	16.956.496,00	0,00	16.956.496,00
2023	16.956.496,00	0,00	16.956.496,00
2024	16.956.496,00	33.372,77	16.989.868,77

2025	16.956.496,00	33.372,77	16.989.868,77
2026	16.956.496,00	33.372,77	16.989.868,77
2027	16.956.496,00	33.372,77	16.989.868,77
2028	16.956.496,00	33.372,77	16.989.868,77
2029	16.956.496,00	33.372,77	16.989.868,77
2030	16.956.496,00	33.372,77	16.989.868,77
2031	16.956.496,00	33.372,77	16.989.868,77
2032	16.956.496,00	33.372,77	16.989.868,77
2033	16.956.496,00	33.372,77	16.989.868,77
2034	16.956.496,00	33.372,77	16.989.868,77
2035	16.956.496,00	33.372,77	16.989.868,77
2036	16.956.496,00	33.372,77	16.989.868,77
2037	16.956.496,00	33.372,77	16.989.868,77
2038	16.956.496,00	33.372,77	16.989.868,77
2039	16.956.496,00	33.372,77	16.989.868,77
2040	16.956.496,00	33.372,77	16.989.868,77

Operating revenues of the variant solution V1 during the effecting period amount to an average of HRK 16,989,868.77 per year.

Table 28 shows revenues during the reference period based on average revenues generated in the period from 2016 to 2020, increased by the converted amount of financial savings (V2)

Table 28: Operating income during the reference period (V2)

Year	Operating income	Savings-Project Performance	Total
2021	16.956.496,00	0,00	16.956.496,00
2022	16.956.496,00	0,00	16.956.496,00
2023	16.956.496,00	0,00	16.956.496,00
2024	16.956.496,00	33.372,77	16.989.868,77
2025	16.956.496,00	33.372,77	16.989.868,77
2026	16.956.496,00	33.372,77	16.989.868,77

2027	16.956.496,00	33.372,77	16.989.868,77
2028	16.956.496,00	33.372,77	16.989.868,77
2029	16.956.496,00	33.372,77	16.989.868,77
2030	16.956.496,00	33.372,77	16.989.868,77
2031	16.956.496,00	33.372,77	16.989.868,77
2032	16.956.496,00	33.372,77	16.989.868,77
2033	16.956.496,00	33.372,77	16.989.868,77
2034	16.956.496,00	33.372,77	16.989.868,77
2035	16.956.496,00	33.372,77	16.989.868,77
2036	16.956.496,00	33.372,77	16.989.868,77
2037	16.956.496,00	33.372,77	16.989.868,77
2038	16.956.496,00	33.372,77	16.989.868,77
2039	16.956.496,00	33.372,77	16.989.868,77
2040	16.956.496,00	33.372,77	16.989.868,77

Operating revenues of the variant solution V2 during the period of effecting amount to an average of HRK 16,989,868.77 per year.

Table 29 shows revenues during the reference period based on average revenues generated in the period from 2016 to 2020, increased by the converted amount of financial savings (V3)

Table 29: Operating income during the reference period (V3)

Year	Operating income	Savings-Project Performance	Total
2021	16.956.496,00	0,00	16.956.496,00
2022	16.956.496,00	0,00	16.956.496,00
2023	16.956.496,00	0,00	16.956.496,00
2024	16.956.496,00	30.647,41	16.987.143,41
2025	16.956.496,00	30.647,41	16.987.143,41
2026	16.956.496,00	30.647,41	16.987.143,41

2027	16.956.496,00	30.647,41	16.987.143,41
2028	16.956.496,00	30.647,41	16.987.143,41
2029	16.956.496,00	30.647,41	16.987.143,41
2030	16.956.496,00	30.647,41	16.987.143,41
2031	16.956.496,00	30.647,41	16.987.143,41
2032	16.956.496,00	30.647,41	16.987.143,41
2033	16.956.496,00	30.647,41	16.987.143,41
2034	16.956.496,00	30.647,41	16.987.143,41
2035	16.956.496,00	30.647,41	16.987.143,41
2036	16.956.496,00	30.647,41	16.987.143,41
2037	16.956.496,00	30.647,41	16.987.143,41
2038	16.956.496,00	30.647,41	16.987.143,41
2039	16.956.496,00	30.647,41	16.987.143,41
2040	16.956.496,00	30.647,41	16.987.143,41

Operating revenues of the variant V3 solution during the effect period amount to an average of HRK 16,989,868.77 per year.

6.3.3. Operating expenses

When it comes to the operating costs of the City Administration, the biggest cost is the salaries of employees. The project in question does not envisage an increase in staff, so there is no increase in labor costs on this basis during the reference period. Other operating expenses are included in expenses:

- ✓ Compensation of employees,
- ✓ Office supplies and other material expenses,
- ✓ Material and raw materials,
- ✓ Energy,
- ✓ Material and parts for current and investment maintenance,
- ✓ Small inventory and car tires,
- ✓ Formal, work and protective clothing and footwear.

The reference year for estimating operating expenses is the average value of these costs in the period from 2016 to 2020. We emphasize that the values of operating expenditures by cost items are taken from the official reports on the execution of the budget of the City of Poreč-Parenzo[9].

Table 30: Operating expenditures of the City of Poreč-Parenzo and calculation of the value of the reference year (without project)

Position	2016	2017	2018	2019	2020	Reference value
Employee costs	11.644.153,00	11.920.925,00	13.369.818,00	12.913.487,00	12.148.705,00	12.399.417,60
Compensation of employees	820.332,00	779.339,00	563.450,00	513.463,00	431.785,00	621.673,80
Office supplies and other material expenses	251.075,00	262.312,00	256.194,00	251.931,00	330.058,00	270.314,00
Material and raw materials	5.528,00	8.336,00	4.455,00	4.698,00	4.914,00	5.586,20
Energy	3.515.261,00	3.476.869,00	3.919.377,00	3.622.252,00	3.566.471,00	3.620.046,00
Material and parts for current and investment maintenance	1.537,00	1.554,00	8.014,00	11.212,00	7.418,00	5.947,00
Small inventory and car tires	9.709,00	7.573,00	31.653,00	2.216,00	4.327,00	11.095,60
Formal, work and protective clothing and footwear	19.836,00	18.636,00	30.396,00	27.181,00	16.030,00	22.415,80
TOTAL	16.267.431,00	16.475.544,00	18.183.357,00	17.346.440,00	16.509.708,00	16.956.496,00

[9] The source of data is the statistical data of the Ministry of Finance of the Republic of Croatia. Available at: https://mfin.gov.hr/istaknute-teme/lokalna-samouprava/financijski-izvjestaji-jlp-r-s/203

The average annual operating expenses of the City of Poreč-Parenzo amount to HRK 16,956,496.00.

Each of the observed variant solutions affects the change in costs to at least two cost positions; on energy costs and costs of materials and parts for current and investment maintenance.

The change in energy costs is presented in Chapter 6.3.1, and in accordance with the applied methodology, energy cost savings are treated as an increase in revenue.

Costs of materials and parts for current and investment maintenance during the reference period recorded changes due to the replacement of the existing heating system with heating oil and the elimination of the boiler room. These costs are expected to decrease by HRK 1,500.00 per year.

The installation of any of the variant solutions generates additional operating costs for them, and they are included in the costs of regular maintenance and cleaning. Regular maintenance is very important for the functionality and smooth operation of the entire system. In accordance with the application of a conservative approach to the estimation of operating income and expenses, the maintenance costs of technical systems are estimated at an average of 1% of investment costs per year during the reference period.

In the case of variant solution V2 - Coastal capture of sea water through wells, there is an additional cost in the form of compensation for the affected water. Preliminary calculations show that an average of 5,400 m^3 of seawater will be abstracted from the wells annually.

Compensation for affected water in a system with geothermal heat pumps is paid according to the expression:

$$N = N_4 \times V_4$$

where:

N – is the total amount of compensation

N4 – is the amount of the fee for the use of water according to Article 5 of the Decree on the amount of the fee for the use of water (OG 82/10, 83/12) is HRK 0.10 per 1 m^3 of affected water.

V4 – is the amount of water in m3 for the accounting period.

Given the above, the cost of compensation for affected water at V2 – Coastal seawater abstraction through wells averages HRK 540.00 per year.

Table 31 shows the changes in operating expenses by variant solutions.

Table 31: Changes in operating expenses by variant solutions (V1, V2, V3)

Variant solutions	New costs		Costs of the current system	Total maintenance costs
	Maintenance and cleaning	Seawater collection fee	Reduction of maintenance costs	
V1 - Direct capture of sea water from a nearby port	16.778,63		1.500,00	15.278,63
V2 - Coastal seawater abstraction by wells	16.622,06	540,00	1.500,00	15.662,06
V3 - Indirect use of seawater via well exchangers (closed system)	14.548,36		1.500,00	13.048,36

The net new operating costs of annual system maintenance for V1 average 15,278.63, for V2 average HRK 15,662.06, and for V3 average HRK 13,048.36.

Table 32 shows the movement of operating expenditures during the reference period (V1)

Table 32: Trends in operating expenditures during the reference period (V1)

Year	Employee costs	Compensation of employees	Office supplies and other material expenses	Material and raw materials	Energy	Energy Material and parts for current and investment maintenance	Small inventory and car tires	Formal, work and protective clothing and footwear	New maintenance costs
2021	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	0,00
2022	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	0,00
2023	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	0,00

2024	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.278,63
2025	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.278,63
2026	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.278,63
2027	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.278,63
2028	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.278,63
2029	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.278,63
2030	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.278,63
2031	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.278,63
2032	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.278,63
2033	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.278,63
2034	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.278,63
2035	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.278,63
2036	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.278,63
2037	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.278,63
2038	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.278,63
2039	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.278,63
2040	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.278,63

Table 33 shows the movement of operating expenditures during the reference period (V2)

Table 33: Movement of operating expenditures during the reference period (V2)

Year	Employee costs	Compensation of employees	Office supplies and other material expenses	Material and raw materials	Energy	Energy Material and parts for current and investment maintenance	Small inventory and car tires	Formal, work and protective clothing and footwear	New maintenance costs
2021	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	0,00
2022	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	0,00

2023	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	0,00
2024	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.662,06
2025	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.662,06
2026	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.662,06
2027	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.662,06
2028	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.662,06
2029	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.662,06
2030	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.662,06
2031	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.662,06
2032	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.662,06
2033	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.662,06
2034	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.662,06
2035	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.662,06
2036	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.662,06
2037	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.662,06
2038	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.662,06
2039	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.662,06
2040	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	15.662,06

Table 34 shows the movement of operating expenditures during the reference period (V3)

Table 34: Trends in operating expenditures during the reference period (V3)

Year	Employee costs	Compensation of employees	Office supplies and other material expenses	Material and raw materials	Energy	Energy Material and parts for current and investment maintenance	Small inventory and car tires	Formal, work and protective clothing and footwear	New maintenance costs
2021	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	0,00
2022	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	0,00
2023	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	0,00
2024	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	13.048,36
2025	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	13.048,36
2026	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	13.048,36
2027	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	13.048,36
2028	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	13.048,36
2029	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	13.048,36
2030	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	13.048,36
2031	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	13.048,36
2032	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	13.048,36
2033	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	13.048,36
2034	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	13.048,36
2035	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	13.048,36
2036	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	13.048,36
2037	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	13.048,36
2038	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	13.048,36
2039	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	13.048,36
2040	12.399.417,60	621.673,80	270.314,00	5.586,20	3.620.046,00	5.947,00	11.095,60	22.415,80	13.048,36

6.4. Calculation of co-financing share

The assumed maximum co-financing intensity of the project in question is 85.00%. Since the project does not generate revenue, the amount of co-financing is based on the calculation of the financial gap, i.e., the calculation of the amount to which the maximum intensity of project co-financing is applied. The co-financing intensity applies only to the eligible costs of the project.

Table 35 shows the calculation of the financial gap and the amount of grants by variant solutions.

Table 35: Calculation of the financial gap and the amount of the grant (V1, V2, V3)

	V1	V2	V3
Position	Amount (HRK)	Amount (HRK)	Amount (HRK)
Total project costs (undiscounted)	1.677.862,50	1.662.206,25	1.454.836,25
Eligible project costs (undiscounted)	1.677.862,50	1.662.206,25	1.454.836,25
Ineligible project costs (undiscounted)	0,00	0,00	0,00
Eligible project costs (discounted)	1.551.278,20	1.536.803,12	1.345.077,89
Discounted net income	296.145,43	284.401,47	215.373,36
Financial gap	82,35%	82,89%	85,20%
Co-financing intensity	85,00%	85,00%	85,00%
Community grant (85,00%)	1.174.459,51	1.171.134,07	1.053.543,46
Applicant's own resources	503.402,99	491.072,18	401.292,79

The largest financial gap is recorded in the variant solution V3 (85.20%). In the variant solution V2 the financial gap is 82.89%, and in the variant solution V1 the financial gap is 82.35%.

6.5. Sources and dynamics of project financing

The previous chapter presents the calculation of the financial gap and the amount of grants of variant solutions.

Table 36 shows the sources and dynamics of project financing by variant solutions

Table 36: Sources and dynamics of project financing by variant solutions (V1, V2, V3)

V1			
Year	Community grant (HRK)	Applicant's own funds (HRK)	Total (HRK)
2021			
2022			
2023	1.174.459,51	503.402,99	1.677.862,50
2024			
V2			
Year	Community grant (HRK)	Applicant's own funds (HRK)	Total (HRK)
2021			
2022			
2023	1.171.134,07	491.072,18	1.662.206,25
2024			
V3			
Year	Community grant (HRK)	Applicant's own funds (HRK)	Total (HRK)
2021			
2022			
2023	1.053.543,46	401.292,79	1.454.836,25
2024			

The City of Poreč-Parenzo must provide HRK 503,402.99 for the implementation of the V1 variant solution, HRK 491,072.18 for the implementation of the V2 variant solution, and HRK 401,292.79 for the implementation of the V3 variant solution.

6.6. Financial return on investment (FNPV (C) and FRR (C))

Financial analysis is performed by estimating net cash flows and calculating net return indicators. The key indicators are financial net present value (FNPV) and financial internal rate of return (FRR), which are considered according to the total investment cost.

The internal rate of return (FRR) method is a rate that equates the present value of expected expenditures with the present value of expected receipts. It is a modification of the FNPV formula, provided that a discount rate is required at which the FNPV will be equal to zero. The discount rate at which the present value of the expected future cash inflow is equal to the present value of the expenditure; it is the rate at which the present value of the inflow is equal to the present value of the invested capital, i.e., the rate at which the net present value is zero. For manufacturing investments, such as industrial plants, the FRR is higher than 10%. For FRR infrastructure projects, they are generally lower than 10%.

A discount rate of 4% was used to discount cash flows, in accordance with the current Guide for cost-benefit analysis of the European Commission.

Table 37 shows the values of the financial net present value of the project and the financial internal rates of return by variant solutions.

Table 37: Financial indicators of the project in question (V1, V2, V3)

V1	
FINANCIAL ANALYSIS INDICATORS	AMOUNT (HRK)/ PERCENTAGE
EXQUISITE. NET PRESENT VALUE (FNPV (C))	**-1.255.132,77**

EXQUISITE. INTERNAL RETURN RATE (FRR (C))	**-7,63%**
V2	
FINANCIAL ANALYSIS INDICATORS	AMOUNT (HRK)/ PERCENTAGE
EXQUISITE. NET PRESENT VALUE (FNPV (C))	**-1.252.401,65**
EXQUISITE. INTERNAL RETURN RATE (FRR (C))	**-7,85%**
V3	
FINANCIAL ANALYSIS INDICATORS	AMOUNT (HRK)/ PERCENTAGE
EXQUISITE. NET PRESENT VALUE (FNPV (C))	**-1.129.704,54**
EXQUISITE. INTERNAL RETURN RATE (FRR (C))	**-10,77%**

A high negative FRR (C) value is common for occurrences characterized by high investment values and low cash inflows, and minimal residual project values at the end of the reference period. The stated values of the indicators are unacceptable in every aspect, which proves that the alternative solutions without Community funds are not financially viable.

6.7. Financial return on capital (FNPV (K) and FRR (K))

Financial analysis is performed by estimating net cash flows and calculating net return indicators. The key indicators are financial net present value (FNPV) and financial internal rate of return (FRR), which are considered according to the total investment cost, while FNPV (K) and FRR (K) are considered according to the national capital invested in the project.

A discount rate of 4% was used to discount cash flows, in accordance with the current Guide for cost-benefit analysis of the European Commission.

Table 38 shows the values of national capital indicators by variant solutions.

Table 38: Values of national capital indicators (V1, V2, V3)

V1	
FINANCIAL ANALYSIS INDICATORS	AMOUNT (HRK)/ PERCENTAGE
EXQUISITE. NET PRESENT VALUE (FNPV (C))	**-169.278,93**
EXQUISITE. INTERNAL RETURN RATE (FRR (C))	**0,37%**
V2	
FINANCIAL ANALYSIS INDICATORS	AMOUNT (HRK)/ PERCENTAGE
EXQUISITE. NET PRESENT VALUE (FNPV (C))	**-169.622,37**
EXQUISITE. INTERNAL RETURN RATE (FRR (C))	**0,24%**
V3	
FINANCIAL ANALYSIS INDICATORS	AMOUNT (HRK)/ PERCENTAGE
EXQUISITE. NET PRESENT VALUE (FNPV (C))	**-155.644,39**
EXQUISITE. INTERNAL RETURN RATE (FRR (C))	**-1,39%**

Indicators of the national investment component prove that variant solutions do not generate financial profitability of investments. The stated negative values of FNPV (K) and the value of FRR (K), which is lower than the used financial discount rate, are common for occurrences characterized by investments in infrastructure whose primary mission is not net income but development of society and economy. Therefore, the need to create a CBA that will prove the social justification of investing in the project in question is emphasized. It is presented in Chapter 7. Socio-economic analysis.

6.8. Financial sustainability

The financial viability analysis is performed to determine whether the total financial resources are sufficient to meet all financial obligations, observing in order all the years of the reference period. Financial sustainability is acceptable if the cumulative cash flow does not take on negative values in any of the reference years.

The financial viability of the variant solutions is shown in the following tables.

Table 39: Financial sustainability of variant solution V1

YEARS	PROJECT COST	SOURCES OF FINANCING		INCOME	COST	REPLACEMENT	R.V.	CASH FLOW	CUMULATIVE C.F..
		GRANT (EU+RH)	OWN RESOURCES						
2021	0,00	0,00	0,00	16.956.496,00	16.956.496,00			0,00	0,00
2022	0,00	0,00	0,00	16.956.496,00	16.956.496,00			0,00	0,00
2023	1.677.862,50	1.174.459,51	503.402,99	16.956.496,00	16.956.496,00			0,00	0,00
2024				16.989.868,77	16.971.774,63			18.094,15	18.094,15
2025				16.989.868,77	16.971.774,63			18.094,15	36.188,30
2026				16.989.868,77	16.971.774,63			18.094,15	54.282,44
2027				16.989.868,77	16.971.774,63			18.094,15	72.376,59
2028				16.989.868,77	16.971.774,63			18.094,15	90.470,74
2029				16.989.868,77	16.971.774,63			18.094,15	108.564,89
2030				16.989.868,77	16.971.774,63			18.094,15	126.659,03
2031				16.989.868,77	16.971.774,63			18.094,15	144.753,18
2032				16.989.868,77	16.971.774,63			18.094,15	162.847,33
2033				16.989.868,77	16.971.774,63			18.094,15	180.941,48
2034				16.989.868,77	16.971.774,63	100.000,00		-81.905,85	99.035,62

2035				16.989.868,77	16.971.774,63			18.094,15	117.129,77
2036				16.989.868,77	16.971.774,63			18.094,15	135.223,92
2037				16.989.868,77	16.971.774,63			18.094,15	153.318,07
2038				16.989.868,77	16.971.774,63			18.094,15	171.412,21
2039				16.989.868,77	16.971.774,63			18.094,15	189.506,36
2040				16.989.868,77	16.971.774,63		321.679,38	339.773,52	529.279,88

According to Table 39, during all the years of the reference period, the variant solution recorded a positive cumulative cash flow, thus meeting the criterion of financial self-sustainability of the project.

Table 40: Financial sustainability of variant solution V2

YEARS	PROJECT COST	SOURCES OF FINANCING		INCOME	COST	REPLACEMENT	R.V.	CASH FLOW	CUMULATIVE C.F..
		GRANT (EU+RH)	OWN RESOURCES						
2021	0,00	0,00	0,00	16.956.496,00	16.956.496,00			0,00	0,00
2022	0,00	0,00	0,00	16.956.496,00	16.956.496,00			0,00	0,00
2023	1.662.206,25	1.171.134,07	491.072,18	16.956.496,00	16.956.496,00			0,00	0,00
2024				16.989.868,77	16.972.158,06			17.710,71	17.710,71
2025				16.989.868,77	16.972.158,06			17.710,71	35.421,42
2026				16.989.868,77	16.972.158,06			17.710,71	53.132,13
2027				16.989.868,77	16.972.158,06			17.710,71	70.842,84
2028				16.989.868,77	16.972.158,06			17.710,71	88.553,55
2029				16.989.868,77	16.972.158,06			17.710,71	106.264,26
2030				16.989.868,77	16.972.158,06			17.710,71	123.974,97
2031				16.989.868,77	16.972.158,06			17.710,71	141.685,68

2032				16.989.868,77	16.972.158,06			17.710,71	159.396,39
2033				16.989.868,77	16.972.158,06			17.710,71	177.107,10
2034				16.989.868,77	16.972.158,06	100.000,00		-82.289,29	94.817,81
2035				16.989.868,77	16.972.158,06			17.710,71	112.528,52
2036				16.989.868,77	16.972.158,06			17.710,71	130.239,23
2037				16.989.868,77	16.972.158,06			17.710,71	147.949,94
2038				16.989.868,77	16.972.158,06			17.710,71	165.660,65
2039				16.989.868,77	16.972.158,06			17.710,71	183.371,36
2040				16.989.868,77	16.972.158,06		306.023,13	323.733,84	507.105,20

According to Table 40, during all the years of the reference period, the variant solution recorded a positive cumulative cash flow, thus meeting the criterion of financial self-sustainability of the project.

Table 41: Financial viability of variant solution V3

YEARS	PROJECT COST	SOURCES OF FINANCING		INCOME	COST	REPLACEMENT	R.V.	CASH FLOW	CUMULATIVE C.F..
		GRANT (EU+RH)	OWN RESOURCES						
2021	0,00	0,00	0,00	16.956.496,00	16.956.496,00			0,00	0,00
2022	0,00	0,00	0,00	16.956.496,00	16.956.496,00			0,00	0,00
2023	1.454.836,25	1.053.543,46	401.292,79	16.956.496,00	16.956.496,00			0,00	0,00
2024				16.989.868,77	16.969.544,36			20.324,41	20.324,41
2025				16.989.868,77	16.969.544,36			20.324,41	40.648,82
2026				16.989.868,77	16.969.544,36			20.324,41	60.973,23
2027				16.989.868,77	16.969.544,36			20.324,41	81.297,64
2028				16.989.868,77	16.969.544,36			20.324,41	101.622,05

2029				16.989.868,77	16.969.544,36			20.324,41	121.946,46
2030				16.989.868,77	16.969.544,36			20.324,41	142.270,87
2031				16.989.868,77	16.969.544,36			20.324,41	162.595,28
2032				16.989.868,77	16.969.544,36			20.324,41	182.919,69
2033				16.989.868,77	16.969.544,36			20.324,41	203.244,10
2034				16.989.868,77	16.969.544,36	100.000,00		-79.675,59	123.568,51
2035				16.989.868,77	16.969.544,36			20.324,41	143.892,92
2036				16.989.868,77	16.969.544,36			20.324,41	164.217,33
2037				16.989.868,77	16.969.544,36			20.324,41	184.541,74
2038				16.989.868,77	16.969.544,36			20.324,41	204.866,15
2039				16.989.868,77	16.969.544,36			20.324,41	225.190,56
2040				16.989.868,77	16.969.544,36		98.653,13	118.977,54	344.168,10

According to Table 41, during all the years of the reference period, the variant solution recorded a positive cumulative cash flow, thus meeting the criterion of financial self-sustainability of the project.

7. SOCIO-ECONOMIC ANALYSIS

Cost benefit analysis is an economic tool intended for the public sector whose goal is to quantify the social benefits and costs of projects whose effects are reflected on society. This tool is used to analyze policies that affect infrastructure, urban renewal, agriculture, public health, justice, defense, education, environment, etc. The goal of the CBA is to quantify social benefits to compare different categories of social benefits, or to link them with the other, as well as with the categories of social costs.

The first and basic task of the CBA is to identify the possible costs and benefits of a particular project, as well as to determine the parties / individuals who will cause those costs, or use the benefits of the project. The CBA should determine the monetary value of different cost-benefit categories and summarize them into different cost-benefit categories.

A project will be considered eligible if its benefits outweigh the costs and the selection is made by optimizing the net benefit (s), i.e.: Net B = B-C. In this sense, the CBA provides information to decision makers on the direction and strengths of social preferences, as well as on the general social acceptability of the project.

7.1. Conversion of market to economic prices

7.1.1. Applied conversion factors

Specific and standard conversion factors were applied to convert market prices into prices that reflect market distortions. Conversion factors were applied in accordance with the guidelines of the European Commission's CBA Guide (Guide to Cost-Benefit Analysis of Investment Projects; Economic Appraisal Tool for Cohesion Policy 2014-2020; European Commission, Directorate General for Regional and Urban Policy, 2014). The starting point for economic analysis is financial analysis.

The project in question is based on energy savings, the use of renewable energy sources and a positive contribution to tackling the challenge of climate change.

The project does not build a new facility or plan additional absorption of available space / land. The building has the status of immovable cultural property, so neither the building nor the land can be used for market commercialization. In view of the above, the project in question does not generate a possible social loss on this basis. Moreover, the installation of a new and more environmentally friendly heating / cooling system will result in an increase in the value and attractiveness of the space in which it is located, so that all local stakeholders will enjoy multiple benefits. Therefore, a conversion factor of 1 is applied to the value of the land.

Since the construction works do not require the engagement of a larger number of construction workers, the implementation of the project does not lead to distortions in the labor market, so it is not necessary to apply corrective conversion factors for work.

When it comes to hiring new employees, the project does not result in new hiring due to which conversion factors are applied for work.

The holder of the project, the City of Poreč-Parenzo, is not liable for VAT, so corrective conversion factors are applied to investment costs.

Investment costs that require the application of conversion factors, with the full amount of VAT, in order to correct the expected possible price distortions affected by customs duties on equipment and materials to be used in construction, it is necessary to make fiscal adjustments. An estimate of the customs variable was used to calculate the conversion factor that will be used to make the fiscal correction of the project in question. The largest share of investment inputs refers to construction materials, equipment and devices whose declarative origin is from the EU. Due to the specifics of construction materials, equipment and devices, there is a high level of probability that inputs originating from third countries were used in their production, which means that they were subject to the corresponding rates of customs taxation. The estimate was made according to the average customs rate of the EU common market on imported goods, which is 7.1%.

The conversion factor calculation is shown below.

CF = (1-B)*(1-A)

CF = (1-0,071)*(1-0,25)

CF= 0,70

The conversion factor of the fiscal correction for the material investment costs of the mentioned project components is 0.70.

7.1.2. Shadow wages

Shadow wages represent the highest possible compensation that could be earned elsewhere for the engagement in question. Often, due to legal and other legally valid provisions, there are minimum fees or salaries. That is why the wages paid are sometimes not the real value of the opportunity labor cost. These are usually large infrastructure projects that involve a significant workforce or larger projects that take place in specific sectors where there is a shortage of staff or significantly more staff, so the project directly affects significant changes in the labor market. When it comes to this project and the analysis of the labor market, which includes labor prices, it is not necessary to make additional adjustments because there are no significant deviations. The impact of this project is primarily reflected in the sustainable and socio-economic benefits of using renewable energy sources, eliminating fossil fuels (fuel oil) and reducing CO2 emissions.

7.1.3. Fiscal adjustments

Market prices include taxes, subsidies and transfer payments. This affects real prices. Therefore, it is necessary to correct such deviations in the cost benefit analysis as much as possible. In Chapter 7.1.1. The applied conversion factors show the calculation and value of the conversion factor for indirect tax (VAT) that was included in the financial analysis and various customs duties that burdened the production / procurement of construction materials, equipment and devices to be procured under the project.

Table 42 shows the fiscal correction by variant solutions.

Table 42: Fiscal correction by variant solutions

Position	CF (conversion factor)	Uncorrected value (HRK)	Adjusted value (HRK)
V1 - Direct capture of sea water from a nearby port			
Material costs	0,70	1.677.862,50	1.174.503,75
TOTAL		1.677.862,50	1.174.503,75
V2 - Coastal seawater abstraction by wells			
Material costs	0,70	1.662.206,25	1.163.544,38
TOTAL		1.662.206,25	1.163.544,38
V3 - Indirect use of seawater via well exchangers (closed system)			
Material costs	0,70	1.454.836,25	1.018.385,38
TOTAL		1.454.836,25	1.018.385,38

After applying the conversion factor, the economic value of the initial investment in V1 is HRK 1,174,503.75, in V2 it is HRK 1,163,544.38, and in V3 it is HRK 1,018,385.38.

7.2. Quantification of social benefits

The social benefits of the project that can be quantified are reflected in:

- ✓ reduction of CO_2 emissions.

7.2.1. Reduction of CO_2 emissions

The benefits of reducing CO_2 emissions can be demonstrated through the cost of internalizing environmental costs. Thus, the price of internalization represents a monetized corrective factor of the negative impact on the environment during the conduct of business activities. In the Republic of Croatia, fees are paid to the Environmental Protection and Energy Efficiency Fund (EPEEF) according to the "polluter pays" principle, in accordance with the Environmental Protection and Energy Efficiency Fund Act, the Air Protection Act, the Environmental Protection Act, the Sustainable Waste Management Act and other regulations on fees in the field of environmental and nature protection and energy efficiency and renewable energy sources (regulations, ordinances, technical regulations, programs and plans).

Methods of calculating fees according to the "polluter pays" principle are defined by decrees of the Government of the Republic of Croatia, and based on the EPEEF Act, depending on environmental impacts.

The Decree on Unit Fees, Corrective Coefficients and Detailed Criteria and Criteria for Determining Carbon Emissions in the Environment defines the method of calculating the amount of CO_2 emissions.

It is calculated according to the following model:

$$N = N1 * E * Kk$$

N represents the amount of CO_2 emission fee in HRK, variable N1 the fee for one ton of CO_2 emission, variable E the amount of CO_2 emissions in tons per calendar year, and variable Kk the corrective incentive coefficient depending on the amount and origin of CO_2 emissions.

According to the Decree amending the Decree on unit emissions, correction coefficients and more detailed criteria for determining the emission fee for carbon dioxide emissions (OG 46/2021), the unit fee for one ton of CO_2 emissions from 29 April 2021 is HRK 11,20.

The correction incentive coefficient Kk is calculated according to the defined model:

$$Kk = k1*k2*k3*k4$$

Kk represents the total value of the correction factor, variable k1 correction coefficient depending on the annual amount of emissions, k2 correction coefficient depending on the origin of emissions, k3 is the correction incentive coefficient depending on investment in energy efficiency and renewable energy projects and programs, and k4 is the corrective coefficient. dependent on the development and implementation of the CO_2 emission reduction program using the best available techniques, i.e., technical documentation for the implementation of the $C0_2$ emission reduction project[10].

The main energy sources used in the building for heating, cooling and other ongoing activities are electricity and heat (extra light fuel oil). Electricity is supplied by Elektroistra - HEP ODS, and fuel oil is the most favorable distributor of petroleum products.

Table 43 shows the average annual CO_2 emissions per ton and the expected reduction after the implementation of the project according to the variant solutions.

Table 43: Average annual CO2 emissions per ton and expected reduction after project implementation (V1, V2, V3)

Variant solutions	No project (CO_2 (t))	With the project (CO_2 (t))	Project impact (CO_2 (t))
V1 - Direct capture of sea water from a nearby port	31,25803	4,495556	26,76248
V2 - Coastal seawater abstraction by wells	31,25803	4,495556	26,76248
V3 - Indirect use of seawater via well exchangers (closed system)	31,25803	5,062145	26,19589

Table 44 shows the factors of primary energy and CO_2 emissions that have been applied since 01.10.2014. whose values affect the calculation of CO_2 emission reduction after the implementation of the project.

[10] Pursuant to Article 17, paragraph 1 of the Law on the Fund for Environmental Protection and Energy Efficiency (Official Gazette 107/2003), at its session held on 10 July 2007, the Government of the Republic of Croatia adopted the Decree on Unit Fees, Corrective Coefficients and Detailed Criteria for Determining the Carbon Emission Compensation.

Table 44: Primary energy factors and CO_2 emissions

Energy		Primary energy factor				Emission tCO_2/TJ ($kgCO_2/GJ$)	Emission $kgCO_2/MWh$
		Total	Renewable comp.	Non-renewable comp.	Import computer		
Stone coal		**1,038**	0,00003	1,0381	0,00003	95,49	343,78
Brown coal		**1,054**	0,00004	1,0540	0,00004	98,09	353,14
Lignite		**1,082**	0,0001	1,0814	0,0001	105,13	378,48
Firewood		**1,111**	1,0001	0,1108	0,0001	8,08	29,09
Wood briquettes		**1,180**	1,033	0,117	0,030	9,10	32,76
Wood pellets		**1,191**	1,036	0,123	0,032	9,56	34,40
Wood chips		**1,211**	1,030	0,154	0,027	11,76	42,35
Charcoal		**1,286**	1,187	0,100	0,000	7,27	26,17
Solar energy		**1,048**	1,013	0,024	0,011	1,96	7,04
Geothermal energy		**1,211**	1,093	0,080	0,038	6,52	23,48
Natural gas		**1,097**	0,001	1,095	0,001	61,17	220,20
LPG		**1,162**	0,001	1,160	0,001	72,47	260,88
Petroleum		**1,033**	0,000	1,033	0,000	73,54	264,73
Extra light fuel oil		**1,140**	0,001	1,138	0,001	83,21	299,57
Fuel oil		**1,132**	0,001	1,130	0,001	86,20	310,31
Electricity		**1,614**	0,433	0,798	0,383	65,22	234,81
District heat	Croatia – average	**1,523**	0,022	1,494	0,008	100,69	362,49
	CTS ZG+OS (cogeneration)	**1,486**	0,010	1,466	0,009	97,59	351,33
	KO – average for CRO	**1,605**	0,004	1,597	0,004	109,57	394,46
	CTS ZG (cogeneration)	**1,481**	0,010	1,462	0,009	96,05	345,78
	CTS OS (cogeneration)	**1,498**	0,010	1,478	0,009	110,15	396,53
	KO – average for ZG	**1,567**	0,004	1,559	0,004	107,86	388,31
	KO – average for OS	**1,537**	0,004	1,529	0,004	93,66	337,18
	KO – average for RI	**1,577**	0,004	1,569	0,004	106,84	384,62
	KO – average for Sl. Brod	**1,393**	0,004	1,385	0,004	100,12	360,42
	KO – average for Split	**1,548**	0,004	1,540	0,004	132,48	476,94
	KO – average for KA	**1,442**	0,004	1,434	0,004	115,77	416,77
	KO – average for VŽ	**1,498**	0,004	1,489	0,004	91,27	328,56
	KO – average for Vinkovce	**1,451**	0,004	1,442	0,004	103,52	372,66

	KO – average for Vukovar	**1,371**	0,004	1,363	0,004	86,00	309,61
	KO – average for Sisak	**2,427**	0,004	2,419	0,004	148,13	533,25
	KO – natural gas	**1,358**	0,004	1,350	0,004	82,74	297,88
	KO – fuel oil	**1,452**	0,004	1,444	0,004	124,41	447,88
	KO – extra light fuel oil	**1,437**	0,004	1,429	0,004	118,87	427,94

Considering the current consumption of electricity and heat, and their sources, the total CO_2 emissions are 31.26 t. The implementation of project activities reduces the consumption of electricity and heat, and consequently reduces CO_2 emissions.

Based on available data, Kk is estimated at 0,912.

The price of CO_2 emissions per ton is HRK 11,20.

According to the model for calculating the CO_2 emission fee, N = N1 * E * Kk, Table 45 shows the calculation of the total annual monetized social benefit from the reduction of CO_2 emissions according to variant solutions.

Table 45: Monetized social benefits from reducing CO_2 emissions by variant solutions

Variant solutions	Net reduction of CO_2 emissions (t)	Annual CO_2 emission fee (HRK/t)	Correction coefficient	TOTAL (HRK)
V1 - Direct capture of sea water from a nearby port	26,76	11,20	0,912	273,36
V2 - Coastal seawater abstraction by wells	26,76	11,20	0,912	273,36
V3 - Indirect use of seawater via well exchangers (closed system)	26,20	11,20	0,912	267,58

The annual social benefit for the variant solution V1 is HRK 273.36, for the variant solution V2 it is HRK 273,36, and for the variant solution it is HRK 267,58.

7.3. Discounting of estimated costs and benefits

To calculate the elementary indicators of economic sustainability assessment, it is necessary to discount all estimated social costs and benefits. According to the European Commission's CBA Guide (Cost-Benefit Analysis of Investment Projects; Economic Appraisal Tool for Cohesion Policy 2014-2020; European Commission, Directorate General for Regional and Urban Policy, 2014), the discount rate is 5%.

The following tables show total social costs, operating social revenues and expenditures, by variant solutions.

Table 46: Total social costs of the variant solution, operational and economic social revenues and expenditures (V1)

YEARS	PROJECT COST	INCOME	COST	REPLACEMENT COSTS	SOCIAL BENEFITS	R.V.	NET C.F.
2021	0,00	16.956.496,00	16.956.496,00	0,00	0,00	0,00	0,00
2022	0,00	16.956.496,00	16.956.496,00	0,00	0,00	0,00	0,00
2023	1.174.503,75	16.956.496,00	16.956.496,00	0,00	0,00	0,00	-1.174.503,75
2024	0,00	16.989.868,77	16.969.544,36	0,00	273,36		20.597,77
2025		16.989.868,77	16.969.544,36	0,00	273,36		20.597,77
2026		16.989.868,77	16.969.544,36	0,00	273,36		20.597,77
2027		16.989.868,77	16.969.544,36	0,00	273,36		20.597,77
2028		16.989.868,77	16.969.544,36	0,00	273,36		20.597,77
2029		16.989.868,77	16.969.544,36	0,00	273,36		20.597,77
2030		16.989.868,77	16.969.544,36	0,00	273,36		20.597,77
2031		16.989.868,77	16.969.544,36	0,00	273,36		20.597,77
2032		16.989.868,77	16.969.544,36	0,00	273,36		20.597,77
2033		16.989.868,77	16.969.544,36	0,00	273,36		20.597,77
2034		16.989.868,77	16.969.544,36	70.000,00	273,36		-49.402,23
2035		16.989.868,77	16.969.544,36	0,00	273,36		20.597,77

2036		16.989.868,77	16.969.544,36	0,00	273,36		20.597,77
2037		16.989.868,77	16.969.544,36	0,00	273,36		20.597,77
2038		16.989.868,77	16.969.544,36	0,00	273,36		20.597,77
2039		16.989.868,77	16.969.544,36	0,00	273,36		20.597,77
2040		16.989.868,77	16.969.544,36	0,00	273,36	225.175,56	245.773,34
UKUPNO	1.174.503,75	339.697.257,13	339.351.742,16	70.000,00	4.647,16	225.175,56	-669.166,05

Table 47: Total social costs of the variant solution, operational and economic social revenues and expenditures (V2)

YEARS	PROJECT COST	INCOME	COST	REPLACEMENT COSTS	SOCIAL BENEFITS	R.V.	NET C.F.
2021	0,00	16.956.496,00	16.956.496,00	0,00	0,00	0,00	0,00
2022	0,00	16.956.496,00	16.956.496,00	0,00	0,00	0,00	0,00
2023	1.163.544,38	16.956.496,00	16.956.496,00	0,00	0,00	0,00	-1.163.544,38
2024	0,00	16.989.868,77	16.972.158,06	0,00	273,36		17.984,07
2025		16.989.868,77	16.972.158,06	0,00	273,36		17.984,07
2026		16.989.868,77	16.972.158,06	0,00	273,36		17.984,07
2027		16.989.868,77	16.972.158,06	0,00	273,36		17.984,07
2028		16.989.868,77	16.972.158,06	0,00	273,36		17.984,07
2029		16.989.868,77	16.972.158,06	0,00	273,36		17.984,07
2030		16.989.868,77	16.972.158,06	0,00	273,36		17.984,07
2031		16.989.868,77	16.972.158,06	0,00	273,36		17.984,07
2032		16.989.868,77	16.972.158,06	0,00	273,36		17.984,07
2033		16.989.868,77	16.972.158,06	0,00	273,36		17.984,07
2034		16.989.868,77	16.972.158,06	70.000,00	273,36		-52.015,93
2035		16.989.868,77	16.972.158,06	0,00	273,36		17.984,07

2036		16.989.868,77	16.972.158,06	0,00	273,36		17.984,07
2037		16.989.868,77	16.972.158,06	0,00	273,36		17.984,07
2038		16.989.868,77	16.972.158,06	0,00	273,36		17.984,07
2039		16.989.868,77	16.972.158,06	0,00	273,36		17.984,07
2040		16.989.868,77	16.972.158,06	0,00	273,36	214.216,19	232.200,26
UKUPNO	1.163.544,38	339.697.257,13	339.396.175,06	70.000,00	4.647,16	214.216,19	-713.598,95

Table 48: Total social costs of the variant solution, operational and economic social revenues and expenditures (V3)

YEARS	PROJECT COST	INCOME	COST	REPLACEMENT COSTS	SOCIAL BENEFITS	R.V.	NET C.F.
2021	0,00	16.956.496,00	16.956.496,00	0,00	0,00	0,00	0,00
2022	0,00	16.956.496,00	16.956.496,00	0,00	0,00	0,00	0,00
2023	1.018.385,38	16.956.496,00	16.956.496,00	0,00	0,00	0,00	-1.018.385,38
2024	0,00	16.989.868,77	16.969.544,36	0,00	267,58		20.591,99
2025		16.989.868,77	16.969.544,36	0,00	267,58		20.591,99
2026		16.989.868,77	16.969.544,36	0,00	267,58		20.591,99
2027		16.989.868,77	16.969.544,36	0,00	267,58		20.591,99
2028		16.989.868,77	16.969.544,36	0,00	267,58		20.591,99
2029		16.989.868,77	16.969.544,36	0,00	267,58		20.591,99
2030		16.989.868,77	16.969.544,36	0,00	267,58		20.591,99
2031		16.989.868,77	16.969.544,36	0,00	267,58		20.591,99
2032		16.989.868,77	16.969.544,36	0,00	267,58		20.591,99
2033		16.989.868,77	16.969.544,36	0,00	267,58		20.591,99
2034		16.989.868,77	16.969.544,36	70.000,00	267,58		-49.408,01
2035		16.989.868,77	16.969.544,36	0,00	267,58		20.591,99
2036		16.989.868,77	16.969.544,36	0,00	267,58		20.591,99
2037		16.989.868,77	16.969.544,36	0,00	267,58		20.591,99

2038		16.989.868,77	16.969.544,36	0,00	267,58		20.591,99
2039		16.989.868,77	16.969.544,36	0,00	267,58		20.591,99
2040		16.989.868,77	16.969.544,36	0,00	267,58	69.057,19	89.649,17
UKUPNO	1.018.385,38	339.697.257,13	339.351.742,16	70.000,00	4.548,78	69.057,19	-669.264,44

7.4. Economic performance indicators (economic rate of return or net present value of the project in monetary terms)

Indicators of economic effects of feasibility of variant solutions are shown in Table 49.

Table 49: Indicators of economic effects of variant solutions (V1, V2, V3)

Economic Performance Indicators	Values
V1 - Direct capture of sea water from a nearby port	
Discount rate	5,00%
Economic net present value (ENPV)	**-802.691,42**
Economic Internal Rate of Return (ERR)	**-6,16%**
B/C	**0,998**
V2 - Coastal seawater abstraction by wells	
Discount rate	5,00%
Economic net present value (ENPV)	**-823.815,41**
Economic Internal Rate of Return (ERR)	**-6,77%**
B/C	**0,998**
V3 - Indirect use of seawater via well exchangers (closed system)	
Discount rate	5,00%
Economic net present value (ENPV)	**-722.927,98**
Economic Internal Rate of Return (ERR)	**-8,76%**
B/C	**0,998**

The results of the economic analysis shown in Table 49 show a positive negative Economic Net Present Value of the Project (ENPV) for all variant solutions (using a discount rate of 5.0%). Negative values for all variant solutions are also recorded for the economic rate of return (ERR). The ratio of social costs and benefits (B/C ratio) whose value in all variant solutions is less than 1.

The ENPV of variant solutions whose nominal investment value is between HRK 1.45 million and HRK 1.67 million cannot achieve a positive value even by applying the quantification of social benefits.

The biggest reason for the negative values of the key indicators of acceptability of alternative solutions is not in their socio-economic harmfulness, but primarily limited opportunities to quantify and monetize social benefits (due to lack of relevant and verified data and information).

This analysis also shows that in the case of standard projects, the application of the recommended methodology for the evaluation of socially useful projects calls into question the possibility of their provability as socially useful. Consequently, eligible for Community grants. The subject variant solutions are not financially demanding, so future tenders will most likely not require provability in terms of preparing a cost-benefit analysis, but the results of this analysis are certainly an indicator that more financially demanding projects would use the sea as a renewable energy source. of EUR 1 million) could lead to the problem of the inability to prove the eligibility of projects for Community grants.

In view of the above, the risk analysis will recommend the development of a special guide for the preparation of feasibility studies with an analysis of social costs and benefits for projects using the sea as a renewable energy source. This specific guide should contain detailed guidance on the design methodology, in particular in terms of the possibility of quantitative evaluation of societal benefits.

8. EVALUATION OF VARIANT SOLUTIONS

8.1. Evaluation criteria for variant solutions

Criteria for evaluating variant solutions were selected based on their distinctive elements. These are the following criteria:

1. Technical-technological,
2. Financial,
3. Socio-economic.

The criteria are defined in accordance with the following objectives of the study:

1. Selection of the optimal variant solution from the technical-technological, financial and socio-economic perspective,
2. Assessment of the impact of variant solutions on the financial performance of the City of Poreč-Parenzo (primarily on the reduction of energy costs),
3. Potential and risks of variant solutions and standard projects in general when applying for tenders for grants from EU funds.

It is important that the selected criteria are clear and measurable, i.e., that what is measured or evaluated can be unambiguously stated and determined, and methodologically consistent.

8.1.1. Technical and technological criteria

The technical-technological criterion refers to the technology of using sea water for the heating / cooling system, i.e., its advantages and disadvantages.

The biggest advantage of using these technical and technological solutions is the use of sea water as a renewable energy source and encouraging the development of new technologies in energy.

To assess the shortcomings in the technical-technological sense, the variant solutions differ according to the model of sea water use. Seawater abstraction is one of the most important parts of a seawater heat pump system as a heat source as the continuous and stable operation of the heat pump depends on a continuous, stable and sufficient inflow of seawater. The characteristic seawater intake system consists of a suction pipeline and its associated suction opening and a protective grille around it, a pump and a return pipeline. As a rule, the operation of the sea for the needs of the heat pump is performed:

- ✓ direct capture of sea water,
- ✓ batch water from wells by the sea.

Biological contamination of direct seawater abstraction is a major problem with seawater-water heat pump systems, especially in areas with higher temperature seawater.

Due to biological contaminants, the system needs to be cleaned and maintained regularly, and often by hand. The annual number of cleanings depends on each installed system separately.

In addition to biological contaminants, direct input of seawater should also pay attention to the entry of larger organisms such as fish and mollusks and the withdrawal of sand from the seabed in a pipe[11].

Subsurface treatment of brackish or seawater means that this water contains less impurities, oils and debris and biological micro - and macro-organisms, resulting in less biological pollution of pipelines and interchangers, and thus more stable system operation. Also, such water is less saline, which reduces the possibility of corrosion. The application of pump, pipeline and intermediate exchanger materials is the same as for direct seawater abstraction[12]. The results of the pilot plant with subsurface seawater abstraction show that such seawater abstraction enables more efficient operation of the seawater-water heat pump system, since the

[11] Mitchell, M. S., Spitler, J. D. Open-loop direct surface water cooling and surface water heat pump systems, HVAC&R Research, SAD, 2013.
[12] Watereuse, White paper, Overview of Desalination Plant Intake Alternatives, 2011.

temperature changes of such water are less than in direct intervention, which has a major impact on system efficiency[13].

In the indirect use of seawater through well exchangers (closed system), wells are drilled in the ground next to the sea so that a good part of the wells is immersed in seawater, which facilitates the transfer of heat. Works on the well field are performed with a suitable dedicated drilling set for geothermal systems. The set uses drilling with a protective column and drill pipes, and the drilled material is brought to the surface by compressing and injecting air (the process of blowing with a compressor). As a rule, a mud injection system (a mixture of water and bentonite clay) is not used to remove debris, as is the case with deeper drilling for oil, gas or deep groundwater exploration. In this way, by using only compressed air to remove debris, no chemicals are introduced into the underground, and there is no negative impact on the environment. As a result, regular maintenance of the system is simpler, which further positively results in a reduction in direct and indirect costs.

For the technical-technological criterion, it is also important to point out the availability and experience of authorized repairers of devices and equipment of variant solutions in Istria. The use of seawater as an energy source for heating / cooling systems in Croatia is still in its infancy, which to some extent puts users in a subordinate position in relation to suppliers and service providers.

To assess the value of this criterion, the availability of technology and experience of its application, environmental performance (positive, neutral or negative) and the complexity of system maintenance are considered. This criterion will be evaluated in the range of 0 to a maximum of 40 points.

[13] Xin, J., Lin, D., Haiwen, S.: Effect of seawater intake methods on the performance of seawater source heat pump system in cold climate areas, Energy Buildings, 2017.

8.1.2. Financial criterion

For the evaluation of variant solutions according to the financial criterion, the result of the financial analysis is used, expressed through two indicators:

1. Financial net present value,
2. Financial rate of return.

These indicators sublimate all relevant aspects of alternative solutions in financial terms, and these are the following positions:

1. Amount of investment costs,
2. Equipment replacement costs,
3. Changes in maintenance and cleaning costs,
4. Residual value.

According to the financial results, all variant solutions are characterized by high negative net present values and negative rates of return. The highest negative NPV was recorded in V1 - Direct seawater abstraction from a nearby port (HRK -1,255,132.77), followed by V2 - Coastal seawater abstraction through wells (HRK -1,252,401.65), and the lowest value was recorded in V3 - Indirect use of sea water through well exchangers (HRK -1,129,704.54). All other aspects of financial performance of variant solutions are analyzed in detail and presented in Chapter 6. Financial analysis.

This indicator will be evaluated in the range from 0 to 40 points, depending on the height of NPV variant solutions.

8.1.3. Socio-economic criterion

For the evaluation of variant solutions according to the socio-economic criteria, the result of economic analysis is used, expressed through 3 indicators:

1. Economic net present value,
2. Economic rate of return,
3. B/C ratio.

These indicators sublimate all relevant aspects of alternative solutions in economic terms, and these are the following positions:

1. Amount of economic investment costs,
2. Economic costs of equipment replacement,
3. Changes in maintenance and cleaning costs,
4. Economic residual value,
5. The amount of monetized social benefits.

According to the results of the economic analysis, all variant solutions are characterized by high negative net present values, negative yield rates and B / C ratio lower than 1. The largest negative ENPV is recorded in V2 - Coastal seawater abstraction through wells (HRK -823,815.41), followed by V1 - Direct capture of sea water from a nearby port (HRK -802,691.42), and the lowest value is recorded V3 - Indirect use of sea water through well exchangers (HRK -722,927.98). The ratio of social costs and benefits records the same value (0.998) for all variant solutions.

All other aspects of socio-economic performance of variant solutions are analyzed in detail and presented in Chapter 7. Socio-economic analysis.

This indicator will be evaluated in the range of 0 to 40 points, depending on the height of the ENPV variant solutions and the value of the B/C ratio.

8.1.4. Choosing a variant solution

The criteria for evaluating variant solutions have been previously explained, and the evaluation calculations are presented below.

Table 50 shows the values of variant solutions according to the defined criteria.

Table 50: Values of variant solutions according to defined criteria (V1, V2, V3)

Variant solutions	Technical-technological criterion	Financial criterion	Socio-economic criterion
V1 - Direct capture of sea water from a nearby port	30	30	35
V2 - Coastal seawater abstraction by wells	35	35	30
V3 - Indirect use of seawater via well exchangers (closed system)	**40**	**40**	**40**

According to the presented evaluation, for the City of Poreč-Parenzo the best solution for the use of sea water for the heating / cooling system is the variant solution V3 - Indirect use of sea water through well exchangers (closed system).

9. RISK ANALYSIS

9.1. Defining critical variables using sensitivity analysis and sensitivity analysis

Sensitivity analysis enables the identification of critical variables of the selected variant solution. Critical variables are those variables whose variations, whether positive or negative, have the greatest impact on the financial performance of a project. Sensitivity analysis is performed by testing one variable at a time and determining the effect of observed changes on the dependent variable (in this case on the net present value of the project). The critical variable is characterized by the effect of a variable whose variation ± 1% of the value adopted in the baseline scenario gives an increase in variation greater than 1% in the net present value of the project. The variables tested should be deterministically independent and disaggregated to the extent possible. Correlated variables often lead to distortions in the results of the analysis, and double addition. Therefore, it is recommended to qualitatively analyze the selected model in order to select relevant independent variables and eliminate possible deterministic interdependencies. In accordance with the guidelines of the European Commission's CBA Guide (Cost-Benefit Analysis of Investment Projects; Economic Appraisal Tool for Cohesion Policy 2014-2020; European Commission, Directorate General for Regional and Urban Policy, 2014) for sensitivity analysis as possible critical variables the following variables were selected:

operating costs - V3 - Indirect use of seawater via well exchangers (closed system)

operating income - V3 - Indirect use of seawater via well exchangers (closed system)

investment costs - V3 - Indirect use of sea water through well exchangers (closed system)

These variables were selected for the purpose of relevant testing. Thus, when testing revenues, the adjusted operating revenues of the City of Poreč-Parenzo were taken into account (through the prism of the specifics of the project in question). For the same reasons, only adjusted operating expenses of the City of Poreč-Parenzo are tested. The amount of the investment is tested in accordance with its inherent nature of the variant solution in question

Table 51 shows the results of testing the selected variables for financial net present value (V3).

Table 51: Testing of selected variables on the financial net present value of the project (V3)

Variable tested	Change (+/- 1,0%)	Basic scenario (FNPV)	Test scenario (FNPV)	Change FNPV (%)
Operating income	-1,00%	-1.129.704,54	-1.129.704,54	-1,01
Operational costs	+1,00%	-1.129.704,54	-1.129.704,54	-1,00
Investment costs	+1,00%	-1.129.704,54	-1.129.704,54	-1,00

Table 52 shows the estimates of the tested variables on financial net present value (V3)

Table 52: Estimates of tested variables on financial net present value (V3)

Variable tested	Change (+/- 1,0%)	Variation in ENPV (%)	Criticality assessment
Social benefits	-1	-1,01	**Not Critical**
Social costs	+1	-1,00	**Not Critical**
Investment costs	+1	-1,00	**Not Critical**

According to the presented values of variations in the financial net present value of the project (FNPV) which are determined by changes in the values of the selected variables, none of the tested variables is critical. Namely, although the percentage changes of the variable were recorded to the second decimal place, they cannot be defined as critical. It is important to point out that the high negative net present value of the project (more than HRK 1.1 million) cannot achieve a positive value even with a multiple increase in operating revenues.

The results of the sensitivity analysis of the financial analysis do not indicate the need for testing according to the selected variables.

The following variables were selected as possible critical variables for the sensitivity analysis of the socio-economic analysis of the subject project:

- ✓ social costs,
- ✓ social benefits,
- ✓ investment costs.

These variables were selected for the purpose of relevant testing. Thus, income testing took into account the overall social benefits during the reference period. For the same reasons, total social costs are tested. The amount of socio-economic value of the investment is tested in accordance with its inherent nature of the project.

Table 53 shows the test results of selected variables on economic net present value (V3)

Table 53: Testing of selected variables for economic net present value (V3)

Variable tested	Change (+/- 1,0%)	Basic scenario (FNPV)	Test scenario (FNPV)	Change FNPV (%)
Operating income	-1,00%	-722.927,98	-722.927,98	-1,86%
Operational costs	+1,00%	-722.927,98	-722.927,98	-0,11%
Investment costs	+1,00%	-722.927,98	-722.927,98	-0,77%

Table 54 shows the estimates of the tested variables on economic net present value (V3).

Table 54: Estimates of tested variables on economic net present value (V3)

Variable tested	Change of variables (+/- 1,0%)	Variation in ENPV (%)	Criticality assessment
Social benefits	-1,00%	**-1,86%**	**Critical**
Social costs	+1,00%	-0,11%	Not critical
Investment costs	+1,00%	-0,77%	Not critical

The results of the sensitivity analysis of the socio-economic analysis indicate that with a decrease in social benefits of 1.0%, the ENPV will decrease by 1.86%. An increase in the value of investment costs and social costs of the project in question of 1.00% results in a decrease in ENPV by -0.77% and -0.11%, respectively.

The results of the sensitivity analysis indicate the need to analyze the pessimistic and optimistic scenario towards the change of the variable Social Benefit, so in accordance with the recommendations of the European Commission's CBA Guide (Guide to Cost-Benefit Analysis of Investment Projects; Directorate General for Regional and Urban Policy, 2014) the scenario simulation is presented below.

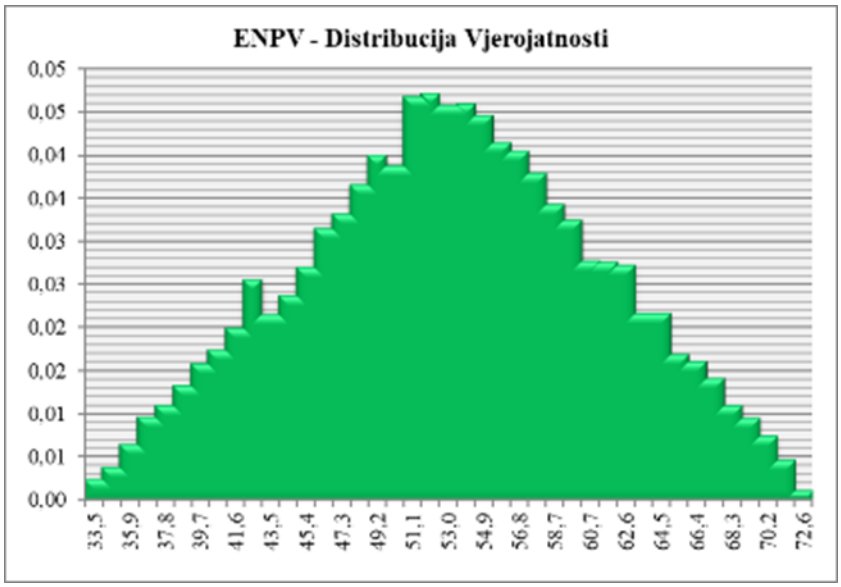
9.2. Simulation of the best- and worst-case scenario

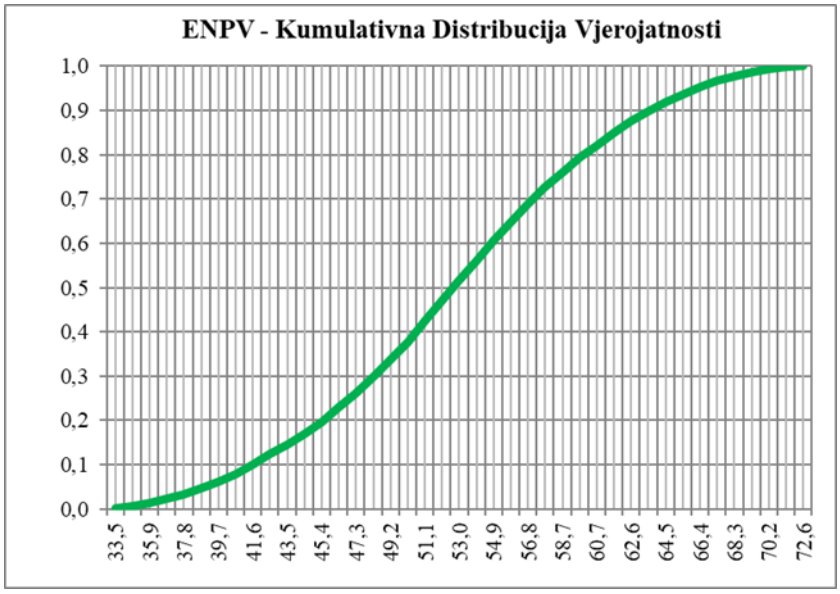
The probability distribution was performed based on the minimum and maximum base value of the Social Benefit variable in the range of +/- 20% of the baseline scenario. Monte Carlo simulation (at 10,000 iterations) is used to simulate the pessimistic and optimistic scenarios using the tested sensitivity analysis variables.

Table 55: Results of the Monte Carlo simulation for ENPV

Indicators	Values (HRK in thousands, number, percentage)
Mean	-53,14
Median	-53,13
Standard Deviation	8,11
Minimun	-33,48
Maximum	-72,57
Probability of ENPV>0	0,00%

Graph 4: Graphic representation of the probability distribution and cumulative probability distribution for the ENPV of the project in question





According to Graph 2, and taking into account optimistic and pessimistic scenarios, the ENPV of the project in question with the highest level of probabilistic amounts to HRK -0.53 million. **The probability that the ENPV of the project in question is greater than 0 is 0.00%.**

9.3. Risk assessment

To assess the risk of the project, the project as a whole should be considered and key risk factors (organizational, operational, market, other internal and external factors) should be identified. The analysis of this project identified key risk factors that may negatively affect the realization, implementation and life of the project. Risk factors, their probability and impact and the necessary measures to mitigate them are presented in the next chapter.

The methodology for classifying the probability of occurrence of risk, the severity of the impact of risk and the level of risk was developed using the method required in the EC Guide[14].

[14] Guide to Cost-Benefit Analysis of Investment Projects; Economic appraisal tool for Cohesion Policy 2014-2020; European Commission, Directorate General for Regional and Urban policy, 2014.

Probability or probability of risk is attributed to each adverse event. According to this methodology, probabilities are classified according to the following classification:

- A - Very unlikely (0–10% probability)
- B - Unlikely (10–33% probability)
- C - Approximately as probable as unbelievable (33–66% probability)
- D - Probably (66–90% probability)
- E - Very likely (90–100% probability)

For each impact strength effect is given, from e.g. I (no impact) to V (catastrophic), based on the cost and / or loss of the project or the expected results. These numbers allow the classification of risks, related to the probability of their occurrence (Table 56).

Table 56: Risk strength classification

Rating	Meaning and clarification
I - negligible impact	There is no relevant impact on project efficiency even without corrective action.
II - small impact	Small damages and costs that have minimal impact on the long-term efficiency and sustainability of the project. Corrective action is needed.
III - medium impact	Moderate damages and costs, mostly problems of a financial nature, in the medium or long term. Improvement measures can correct the problem.
IV - high impact	Significant damages and costs; the occurrence of risk causes damage to the main purpose of the project and its sustainability. Even serious improvement measures may be insufficient to avoid damage.
V - catastrophic impact	Failure of the project that may seriously or completely damage the main purpose of the project. The main effects of the project are not being shown in the medium or long term. The viability of the project is seriously threatened and a catastrophic (pessimistic) scenario threatens.

In order to optimally perform the assessment of the level of risk, and taking into account the probability of the risk and the strength of the risk impact, it is necessary to matrix them. This alignment also provides a transparent overview to the study reader.

Table 57 shows a matrix of risk impact strength, risk probability and risk level.

Table 57: Impact, probability and risk level matrix

Impact / probability of risk	I negligible impact	II small impact	III medium impact	IV high impact	V catastrophic impact
A very unlikely (0-10%)	Low	Low	Low	Low	Moderate
B unlikely (10-33%)	Low	Low	Moderate	Moderate	High
C about as likely as not (33-66%)	Low	Moderate	Moderate	High	High
D probably (66-90%)	Low	Moderate	High	Very high	Very high
E very likely (90-100%)	Moderate	High	Very high	Very high	Very high

Table 58 shows a qualitative risk analysis through identified risks.

Table 58: Qualitative risk analysis through identified risks

Methodology	Based on the subject feasibility study	Author's assessment	Based on the subject feasibility study	Author's assessment	The probability classification was made using the method required in point 2.9.2 of the EC Guide	The severity classification was made using the method required in point 2.9.2 of the EC Guide	Classification of the level of risk prepared by the author using the method required in point 2.9.2 of the EC Guide	Author's assessment
Design risk								
Insufficient optimization of valorisation of a variant solution	1. The designer did not make optimal use of the available capacity of the variant solution	Engagement of a designer with a lack of experience in designing demanding mechanical and electrical installations	-	Failure to achieve optimal valorisation of available energy resources and capacity of the variant solution	B - unlikely (10-33%)	IV - high impact	High	The project team will select an experienced designer (s) and participate proactively during the design process
Defining cost estimates	1. The designer made an incorrect estimate of the costs of equipment, devices, construction works, etc.	Engagement of a designer with a lack of experience in designing demanding mechanical and electrical installations	-	Incorrect assessment of the costs of project activities may jeopardize the implementation of the project in question; but it certainly leads to suboptimal investment capacity planning,	B - unlikely (10-33%)	IV - high impact	High	The project team will select an experienced designer (s) and participate proactively during the design process

				implementation dynamics, to oversizing of investment values, which results in a significant increase in investment costs and a consequent reduction in the expected efficiency of the project in question.				
Public procurement and administrative implementation of the project								
Extension of public procurement procedures	1. Delay in the implementation of project activities	Problems with the implementation of public procurement procedures	-	Delay in the implementation of a variant solution	C = approximately as likely as not (33-66%)	III - medium impact	Moderate	The user has competent employees who have gained the necessary knowledge, experience and competencies for the implementation of public

								procurement procedures through many years of work experience. If the user deems it necessary, he will additionally hire external associates who will perform quality control of the prepared documentation.
Risks of construction and equipping								
Costs of construction, craft, mechanical and electrical works	1. Increasing the cost of project activities	Incorrect cost estimation of costs of implementation of project activities and increase of costs of equipment, devices, construction, craft and other works on the market	-	Increasing the costs of the selected variant solution or project activities requires the provision of additional investment funds and negatively affects the dynamics of project implementation, and reducing the	B - unlikely (10-33%)	IV - high impact	Moderate	The supervising engineer will regularly monitor and report to the project team on whether the performed works in terms of quantity and quality fully correspond to the project-technical

				expected efficiency of the project				documentation and cost estimate.
Delay in the implementation of construction, mechanical and electrical works	1. Extending the time needed to implement the investment	Delay in the execution of works due to the contractor's failure to meet the deadlines	-	Delays in the implementation of the variant solution and the consequent increase in project costs, as well as the lack of planned revenues, savings and social benefits	B - unlikely (10-33%)	III - medium impact	Moderate	In order to prevent the occurrence of this risk, the project team, in cooperation with the supervising engineer, will carefully monitor all phases of field work and compliance with the agreed implementation schedule. It should be emphasized that when defining the time plan for the implementation of project activities, sufficient time is provided for the execution of works. In addition, the Applicant will

								conduct the public procurement procedure on time, all with the aim of selecting the contractor and its timely introduction to the construction site.
Poor quality of work performed and installed equipment and devices	1. The quality of performed works and specifications of materials, equipment and devices do not correspond to the set norms and standards	Non-compliance of contractors and suppliers of devices and equipment with contractual conditions and defined norms and standards	-	Poorly performed works and inadequate equipment and devices in the future will generate higher costs of current and investment maintenance. It will also reduce the positive effects in terms of expected energy and financial savings.	B - unlikely (10-33%)	III - high impact	Moderate	The supervising engineer will regularly monitor and report to the project team on whether the performed works in terms of quantity and quality fully correspond to the project-technical documentation and cost estimate. The project team will monitor and proactively participate in the procurement,

								delivery and installation of equipment and devices.
Operational risks								
The costs of regular and current investment maintenance are higher than projected	1. Materials, equipment and devices that will be procured through the project in question require certain maintenance costs	Purchased equipment and devices, as well as materials for construction and decoration result in high maintenance and servicing costs	-	The increase in these operating cost items only to a lesser extent negatively affects the expected efficiency of the project in question	A - very unlikely (0-10%)	II - low impact	Low	Proactive participation of supervision and control by the supervising engineer and the project team is envisaged. The City of Poreč-Parenzo will train employees in the position of caretaker / boilermaker in order to reduce this risk and / or its intensity.
Financial risks								
Implementation of the project in the given scope and content	2. Reduction or absence of	Funds from EU funds do not participate in the implementation of the	-	The lack of implementation of the project in	B - unlikely (10-33%)	V - catastrophic impact	High	The beneficiary will prove to the Public Body that will

	expected investment funds from EU funds	project in accordance with expectations		question in the given scope and content calls into question the entire project, and consequently the expected efficiency of the project				conduct the procedure of awarding grants from EU funds that only the implementation of the selected variant solution in the given scope and content contributes to sustainable business of the City and the realization of direct and indirect social benefits. It will also provide in its own budget the necessary funds to co-finance the project in question.
Demand risk								
Reducing the demand for services of the City of Poreč-Parenzo	1. Possible reduction of the use of services of the City Administration of	Available services do not meet the demand determinants of target groups, which are accompanied by negative demographic	-	The reduction in the use of the City Administration's services is positively correlated with the	B - unlikely (10-33%)	IV - high impact	Moderate	The City of Poreč-Parenzo provides public services to the local community and entrepreneurs in accordance with

	the City of Poreč-Parenzo	trends or population decline. Also, insufficiently competent employees negatively affect the reputation of the City Administration, resulting in a decrease in demand		reduction in the expected efficiency of the project in question				the Law. The city is implementing incentive demographic measures, and in the coming period is expected to merge neighbouring local governments, which will amortize the effects of negative demographic trends and keep demand at current levels, with the potential to increase the number of services and users. In its operational work, the City Administration of the City of Poreč-Parenzo is already implementing systems for monitoring and managing the quality of services.

Other risks								
Lack of an adapted guide, methodology and instructions for the development of CBA studies for projects using seawater as an energy source	1. EU and national rules for financing seawater projects	Without an adapted methodology and clear instructions in the form of a Guide for standard projects and adapted Public Calls, it will not be possible to prove the socio-economic justification of financing standard project grants from EU funds.	.	Lack of Community grants	B - unlikely (10-33%)	V - catastrophic impact	Moderate	The City of Poreč-Parenzo will regularly monitor public hearings on standard project preparation procedures and propose a set of measures to avoid the risk of not being able to prove the socio-economic justification of standard projects and consequently the possibility of using Community grants.
Change of legal regulations	2. EU and national laws and regulations related to energy and environmental policy	Changes in laws and regulations that may affect the operations of the City of Poreč-Parenzo and the possibility of using Community grants	-	Lack of Community revenue and/or grants	A - very unlikely (0-10%)	V - catastrophic impact	Moderate	The City of Poreč-Parenzo will regularly monitor all legal amendments, and proactively participate in public debates to avoid possible risks. Given the recent legal, multilateral and

								other models of improving environmental protection and decarbonization in the coming period, even more opportunities are expected to finance projects such as the project in question.

9.4. Risk management and risk reduction

In addition to the risk of fluctuations in investment costs, operating income and operating expenses, for effective project management it is necessary to identify other risks that accompany the project.

Anticipating objective risks that cannot be influenced at the time of project preparation contributes to reducing the probability of risk occurrence and / or their prevention.

Therefore, the study applied a conservative method of estimating demand and revenue, showed higher operating costs than real, included significant annual reserves for maintenance costs, labour costs, etc. Also envisaged and recommended a number of measures and activities that will directly and indirectly contribute efficient implementation of the project in question in the given scope and content, and the desired long-term sustainability and achievement of expected social benefits. The recommendations primarily relate to the optimization of the selected variant solution, procurement of standardized and quality equipment and devices, training of employees in charge of system maintenance and energy education of employees.

A significant number of planned and recommended measures and activities that are in the function of mitigating / preventing identified risks are also presented through the matrix of qualitative risk analysis.

In order to optimally prevent and / or reduce the impact of risk occurrences, it is recommended to develop a Risk Management Strategy, and the following table shows the recommended measures for prevention and / or mitigation of risks.

Table 59 shows the recommended measures in accordance with the identified risks, their impacts, probability and level of risk.

Table 59: Recommended measures for risk prevention and mitigation

Impact / probability of risk	I negligible impact	II small impact	III medium impact	IV high impact	V catastrophic impact
A very unlikely (0-10%)	no activity required	mitigation	mitigation	mitigation	prevention and mitigation
B unlikely (10-33%)	prevention	prevention or mitigation	prevention or mitigation	prevention and mitigation	prevention and mitigation
C about as likely as not (33-66%)	prevention	prevention or mitigation	prevention or mitigation	prevention and mitigation	prevention and mitigation
D probably (66-90%)	prevention	prevention and mitigation	prevention and mitigation	prevention and mitigation	prevention and mitigation
E very likely (90-100%)	prevention and mitigation	prevention and mitigation	prevention and mitigation	prevention and mitigation	prevention and mitigation

10. LIST OF FIGURES, TABLES AND CHARTS