

D.T3.2.1

FINANCIAL OPTIONS ANALYSIS APPLIED TO THE 5 PILOT DEMONSTRATION CASES



Content

1) INTRODUCTION.....	3
2) FINANCIAL OPTIONS ANALYSIS FOR CZECH CASE STUDY	4
2.1. SCENARIO 1: THE INVESTOR IS A MUNICIPAL ENTITY (CITY, MUNICIPALITY).....	4
2.2. SCENARIO 2: THE INVESTOR IS A PRIVATE ENTITY	6
3) FINANCIAL OPTIONS ANALYSIS FOR GERMAN CASE STUDY	12
3.1. SCENARIO 1: FINANCING WITH WASTEWATER CHARGES	12
3.2. SCENARIO 2: LOANS	12
3.3. SCENARIO 3: GRANT PROGRAMS	13
4) FINANCIAL OPTIONS ANALYSIS FOR AUSTRIAN CASE STUDY	15
4.1 EUROPEAN LEVEL	15
4.2. AUSTRIAN NATIONAL LEVEL	16
4.3. UPPER AUSTRIAN REGIONAL LEVEL.....	17
5) FINANCIAL OPTIONS ANALYSIS FOR ITALIAN CASE STUDY	18
5.1. FINANCIAL OPTIONS ANALYSIS OF PILOT IN THE EMILIA ROMAGNA REGION.....	19
5.2. ESTIMATION OF COSTS FOR THE PILOT PLANT.....	19
5.3. ESTIMATION OF REVENUES/SAVINGS.....	20
5.4. FUNDING OPPORTUNITIES	21
6) FINANCIAL OPTIONS ANALYSIS FOR CROATIAN CASE STUDY	22
6.1. SCENARIO 1: LOCAL/NATIONAL BUDGET FINANCING	23
6.2. SCENARIO 2: BANK LOANS	23
6.3. SCENARIO 3: EU GRANT PROGRAMS.....	24



1) INTRODUCTION

In response to increased demand for renewable energy, the project focuses on the untapped potential of energy saving and production in the municipal wastewater treatment sector. Wastewater treatment plants are major energy consumers and often have a key share of the carbon footprint of municipalities and cities. Their energy consumption usually accounts for most of the operating costs of wastewater treatment plants, sometimes up to 60 percent. Wastewater has large potential as a source of electricity and heat, which is not, used enough. In fact, the amount of energy it contains can be ten times greater than the amount needed for cleaning. Recently, more and more wastewater operators have introduced energy efficiency improvement measures and new technologies to make better use of wastewater energy. The evaluation of the first projects shows that public services are not only becoming energy self-sufficient but also energy suppliers, thus diversifying the local energy mix.

The Reef 2 Water (REEF2W) project fully respects that wastewater is an integral part of the water-energy connection. The project is funded by the European Development Bank's Interreg Central Europe program and is implemented through 11 research institutes and wastewater treatment facilities from Italy, the Czech Republic, Germany, Croatia and Austria. The main objective of the projects is to increase energy efficiency and renewable energy production in wastewater treatment plants.

It provides an innovative approach to the integration of organic waste and wastewater streams and infrastructures. If beneficial, bio-waste is used to enrich sludge from sewage treatment plants, thereby increasing heat and electricity outputs in the co-fermentation process. Another key task of REEF2W is to explore the legal and political framework conditions and advocate policy alternatives that encourage the widespread use of wastewater solutions for energy.

One of the important parts of the REEF2W project is the economic assessment of potential projects. The aim of this part is to summarize the possibilities of financing the REEF2W projects in the Czech Republic and transfer this knowledge to other partner countries.

As regards an implementation of REEF2W technologies, the following scenarios can be considered as model situations:

- a) Production of energy from RES
 - Cogeneration units
 - Heat pumps
 - Solar panels for water heating



- Solar power stations
 - Production of biomethane from biogas
 - Power To Gas devices
- b) Adjustment of wastewater treatment plant (WWTP) technologies
- Implementation of biogas production technology at WWTP (anaerobic digestion)
 - Intensification of biogas production (sludge hydrolysis)
 - Implementation of a facility for bio-waste receiving

2) Financial options analysis for Czech case study

2.1. Scenario 1: The investor is a municipal entity (city, municipality)

The vast majority of wastewater treatment infrastructures in the Czech Republic are owned by cities and municipalities. These entities then realize their own implementation of the WWTP infrastructure, including R2W technology.

Option 1: Budget financing

The simplest option is simple financing by providing funds from the municipal budget. However, this is not very common, as investments in WWTP infrastructure are relatively high and there are not many municipalities that have the financial resources directly available.

The problem can be practically only ensuring the support of the project at the municipal level.

Option 2: Budget and loan financing

This option assumes financing partly from the municipal budget and co-financing by a commercial loan from a banking or non-banking institution (we assume similar conditions). Here you can find some pitfalls for the investor. In general, cities and municipalities have very good conditions with banks and chances of getting loans to secure their investments. Some banking institutions may refuse project financing (guarantee by their own project) and require loan collateral, for example, by municipal property, which brings certain risks to the project. The project is further assessed by the bank itself, which can be both formal and very detailed.

Bank Loan Terms: 4.0-4.8%.

However, the problem of many municipalities is over-indebtedness.



Option 3: Financing municipal investment using grant programs

In this variant, it is not possible to specify unambiguously precise financing conditions for a relatively wide range of R2W projects, as it depends primarily on the specific announced subsidy program and its conditions, which projects are eligible for support and sustainable and effective in terms of providing support (this provides for a specific evaluation of the projects under the application for support).

In the Czech Republic it is possible to apply for support from EU funds and national funds. Given the volume of resources and priorities, in the case of R2W projects it is possible to consider almost exclusively support from EU funds.

One example is the support from the Operational Program Environment (OPE) for projects aimed at reducing waste.

Priority Axis 3: Waste and material flows, environmental burdens and risks

Specific objective: 3.2 - Increase the share of material and energy recovery of waste

The call applies to individual integrated projects under Integrated Territorial Investments (ITI).

The main objectives are to promote waste management methods that use waste as a source of secondary raw materials, to support waste recycling and waste management that increase the economic value of waste, to promote separate collection of waste, separate waste collection systems and 'waste collection'. Door-to-door system.

Types of supported projects and activities

construction and modernization of facilities for collection, sorting and treatment of waste (systems for collection, collection and separation of waste and bio-waste, collection yards and storage facilities, systems for waste separation, overhead and underground containers including related infrastructure),

- *construction and modernization of material recovery facilities,*
- *construction and modernization of energy recovery facilities and related infrastructure,*
- *construction and modernization of hazardous waste facilities, including medical waste (excluding landfilling)*

Examples of supported projects

- *construction and modernization of waste collection, sorting and treatment facilities,*
- *addition of separate collection, storage and waste management systems,*
- *building new and upgrading existing collection yards,*



- *sorting and sorting lines providing quality output raw material and lines with related technologies for waste treatment,*
- *installations for the treatment or recovery of 'other' waste,*
- *facilities for heat treatment of waste,*
- *construction of biogas plants for the treatment of bio-waste,*
- *facilities for the thermal treatment or modernization of medical and hazardous waste,*
- *facilities for the management or modernization of hazardous waste,*
- *construction / modernization of facilities for the thermal treatment of sewage sludge from sewage treatment plants,*
- *construction / modernization (with increased capacity) of sewage sludge dewatering technology,*
- *production of fuels from other wastes,*
- *separation / separate collection systems with increased municipal waste capacity, and more*

The public sector subsidy may amount to up to 85% of eligible costs.

2.2. Scenario 2: The investor is a private entity

Option 1: Self-financing

In the case of a commercial entity, it is possible to envisage financing partly by own resources and for the most part by using loans or other financial instruments. In general, the price of own money in this case is significantly higher than in the case of towns and municipalities. Similarly, in the case of loans, higher interest rates and the cost of own financing can be expected.

Internal interest rate (required return) for equity investment: 10 - 13%

Interest rate on credit financing: 7%

Option 2: Financing using subsidy support

Business entities can also apply for investment support from EU funds. These are divided into 'small, medium and large' enterprise for the purposes of determining the amount of aid.

Table 2.1.

Micro enterprise	Employs less than 10 people.	
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	The annual turnover or annual balance sheet does not exceed 2 mil. €.	In the evaluation of a company in difficulty, it is considered as one category
Small enterprise	Employs less than 50 people.	
	The annual turnover or annual balance sheet does not exceed 10 mil. €.	
Medium enterprise	Employs less than 250 people.	
	The annual turnover does not exceed 50 mil € or annual balance sheet does not exceed 43 mil. €.	
Large enterprise	It does not meet the criteria for SMEs - for example, it is more than 25% owned by a public body or is a connected enterprise.	In the evaluation of a company in difficulty, it is considered as an extension category
	or	
	Employs more than 250 people.	
	The annual turnover exceed 50 mil € or annual balance sheet exceed 43 mil. €.	

De minimis support. The support is up to a maximum of 200,000 € (the enterprise may not receive additional funds within 3 years).

Other support is determined by the region and its own intention according to the rules of the OPE program:

The support can be granted only for the first investment, the applicant specifies in the supporting documentation what type of first investment is from the following list:

- construction of a new establishment,
- increasing the capacity of an existing establishment,
- the extension of the establishment by new additional products - the eligible expenditure must be at least 200% higher than the book value of the reused property recorded in the accounting period preceding the start of the works,
- fundamental change in production process - if the applicant is a large company, the eligible expenditure must be higher than the depreciation made over the last three fiscal years from the accounting assets used for the activity to be modernized

The support intensity is determined in accordance with the regional support map for the period 2014-2020 (the regional map is available at www.opzp.cz).

Table 2.2.

Enterprise / support (%)	Prague	Other regions
Large enterprise	0	25



Medium enterprise	0	35
Small enterprise	0	45

Table 2.3.

Intended investment	Eligible expenditure for the calculation of LP
Increasing the capacity of the facility for waste management by acquiring / supplementing the technology.	Investment costs of plant capacity increase.

Table 2.4. Support for small and medium-sized enterprises to establish a new establishment

Enterprise / support (%)	Prague	Other regions
Large enterprise	0	0
Medium enterprise	10	10
Small enterprise	20	20

Intended investment	Eligible expenditure for the calculation of LP
Construction of a new waste management facility.	Investment costs for the establishment of a facility

Support may be granted for a cogeneration unit that meets or, after installation, meets the energy efficiency requirements laid down in European legislation. Support may be granted for measures to enable an existing cogeneration unit to operate in an even higher efficiency mode or for the installation of a high-efficiency cogeneration unit.

Enterprise / support (%)	Prague	Other regions
Large enterprise	45	60
Medium enterprise	55	70
Small enterprise	65	80

Intended investment (a)	Identified relevant standard	Identified alternative investment (b)	Eligible expenditure
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reconstruction of high-efficiency CHP for even greater efficiency	EED ¹	it is not	a
installation of high-efficiency CHP	EED ¹	for example a heating boiler with the same installed capacity	difference a - b
installation of high-efficiency CHP in place of existing heat production	EED ¹	repair of existing equipment, if applicable	difference a - b

¹ EED = Directive 2012/27 / EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125 / EC and 2010/30 / EU.

Investment support for REEF2W technologies:

Eligible expenditure: investment costs of the measure, reduced by the cost of an investment of the same capacity but with a lower degree of environmental protection, which would probably be implemented without support, or expenditure on a separately identifiable ancillary equipment

Alternative investment: Support may be granted, on the one hand, to equipment which is an additional equipment (installation of RES). In this case, the scenario that there is no alternative investment can be argued. Expenditure on the installation of RES as eligible for ancillary equipment is eligible.

Enterprise / support (%)	Prague	Other regions
Large enterprise	45	60
Medium enterprise	55	70
Small enterprise	65	80

Intended investment (a)	Identified relevant standard	Identified alternative investment (b)	Eligible expenditure
installation of the RES boiler	it is not	coal boiler with the same installed capacity	difference a - b
reconstruction of the boiler, change of fuel on RES	it is not	general repair of the boiler without changing the fuel, if relevant	difference a - b



Alternatively for the installation of RES - small equipment:

Enterprise / support (%)	Prague	Other regions
Large enterprise	30	45
Medium enterprise	40	55
Small enterprise	50	65

Intended investment (a)	Identified relevant standard	Identified alternative investment (b)	Eligible expenditure
installation of RES - small equipment	it is not	it is not	a

For energy-efficient district heating and cooling:

The support is granted for the construction or reconstruction of a district heating system in order to achieve high efficiency (as defined in the EED¹). "Effective district heating and cooling" means a district heating or cooling system that uses at least 50% of renewable energy, 50% of waste heat, 75% of heat from cogeneration or 50% of the combined heat and power.

Enterprise / support (%)	Prague	Other regions
Large enterprise	45	60
Medium enterprise	55	70
Small enterprise	65	80

For distributions:

Enterprise / support (%)	Prague	Other regions
Large enterprise	max. 85	max. 85
Medium enterprise	max. 85	max. 85
Small enterprise	max. 85	max. 85

Intended investment (a)	Identified relevant standard	Identified alternative investment (b)	Eligible expenditure
reconstruction of the CHP source, after reconstruction, the	EED ¹	general repair without impact on EED ¹ efficiency requirements	difference a - b



conditions for the efficiency of the system are met			
construction of the CHP source, the system efficiency requirements are met	EED ¹	construction of the source, the system efficiency requirements of the EED ¹ are not met (see above)	difference a - b
extension of distribution system	it is not	it is not	implementation expenditure net of the operating benefits over the useful life
reconstruction of distribution systems	it is not	it is not	implementation expenditure net of the operating benefits over the useful life

¹ EED = Directive 2012/27 / EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125 / EC and 2010/30 / EU.

For recycling and re-use of waste:

- support may only be granted for the management of waste by other entities
- support must not merely increase the demand for recycling material without increasing its collection
- recycled or reused materials would otherwise be disposed or used less environmentally
- principle “polluter pays” must be respected
- investments must be directed to processes that are superior to the state of the art

Enterprise / support (%)	Prague	Other regions
Large enterprise	35	50
Medium enterprise	45	60
Small enterprise	55	70

Intended investment (a)	Identified relevant standard	Identified alternative investment (b)	Eligible expenditure
innovative waste recycling line	state of the art for industry branch	standard waste recycling line of the same capacity	difference a - b



additional equipment	state of the art for industry branch	it is not	a
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3) Financial options analysis for German case study

More than 90% of the water and wastewater infrastructure in Germany is owned by municipalities and cities. Since 2013, the water and wastewater infrastructure in Berlin has belonged entirely to the municipality. For this reason, the financial possibilities for the case study in Berlin take this option into account.

In order to implement REEF 2W technologies, the wastewater operators must either generate funds themselves or increase the wastewater charges or take out loans.

3.1. Scenario 1: financing with wastewater charges

In the case of financing via wastewater charges, the costs of the REEF 2W technologies are passed on to the fee payers. There is thus an additional burden for the fee payers in addition to the existing wastewater charges. The advantages of this financing option are its simple implementation and transparency.

3.2. Scenario 2: loans

Loans to municipal enterprises, just like loans to all other enterprises, must be backed by equity capital. Credit institution thus examines the financial circumstances of the company for the ability to repay the loan today and also in the future. This option will be similar for the private entities. The following table shows a list of loan programs for case study in Berlin.

Table 3.1: Examples for credit programs

Funding programs	Funding Region	Funding priority
BMU-Umweltinnovationsprogramm	Loans up to 70% of eligible expenditure/costs. The term of the loans is up to 30 years.	–Wastewater treatment / hydraulic engineering, –Waste avoidance, recycling and disposal as well as the remediation of old deposits, –Energy saving, energy efficiency and use of renewable energies, –Resource efficiency and material savings.



Kreditanstalt für Wiederaufbau KfW	Loan	–Energy and Environment
L-Bank	Loan	–Wastewater treatment plants in Baden-Württemberg
Berlin Infra	Loan	–All investments in municipal infrastructure in Berlin
Brandenburg-Kredit für Kommunen	Loan	–All investments in municipal infrastructure in Brandenburg
Kommunaler Aufbaufonds	Loan	–All investments in municipal infrastructure in Mecklenburg-Vorpommern

3.3. Scenario 3: grant programs

It is also possible to finance the REEF 2W approaches through grant programs. However, these programs are specific to each technology. The following table shows a list of these programs in Germany. The private entities can also make use of this option.

Table 3.2: Examples for grant programs

Funding programs	Funding agency	Funding priority
BENE (Berliner Programm für Nachhaltige Entwicklung)	EFRE (EU Fonds For Regional Development)	BENE-Klima funding priorities: - Investments to increase energy efficiency and the use of renewable energy in public infrastructure, including public buildings, - Environmental and energy management systems, - Encourage application-oriented research, innovation and uptake of low carbon technologies.
7. Energieforschungsprogramm	BMWi (Federal Ministry for Economic Affairs and Energy)	-Power generation: photovoltaics, wind energy, bioenergy, geothermal energy, hydropower, thermal power plants -Cross-System research topics of the energy turnaround: CO ₂ technologies for energy system transformation;
FONA³ (Research for Sustainable Development)	BMBF (Federal Ministry for	-Maintaining and enhancing quality of life and competitiveness,



	Education and Research)	-Using resources intelligently and efficiently
DBU (DEUTSCHE BUNDESSTIFTUNG UMWELT)	DBU	<ul style="list-style-type: none"> -Energy and resource conserving district development -Renewable energy, energy saving and efficiency -Resource efficiency through innovative production processes, materials and surface technologies -Reduction of emissions of reactive nitrogen compounds into the environmental compartments , -Integrated concepts and measures for the protection and management of groundwater and surface waters
Anreizprogramm Energieeffizienz (APEE)	Bundesamt für Wirtschaft und Ausfuhrkontrolle (BAFA)	<ul style="list-style-type: none"> -Solar collector systems, -Efficient heat pumps -Optimization of the entire heating system. -local heating networks and -large efficient heat pumps.
Projekte von Verbänden im Umweltschutz und im Naturschutz	Umweltbundesamt (UBA); Bundesamt für Naturschutz (BfN)	<ul style="list-style-type: none"> -Projects that promote environmentally friendly and nature-friendly behaviour, -Environmental advice and training measures.
Europäischer Energieeffizienzfonds (EEEF)	European Energy Efficiency Fund S.A.	-Municipal and regional projects: Renewable energy, energy saving and efficiency
InnovFin - EU-Mittel für Innovationen	European investment bank (EIB)	-Research & innovation; Infrastructure

Besides, there are some programs that are specified for each region of Germany. The following table gives some examples of these regional programs.

Table 3.3: Examples for regional grant programs



Funding programs	Funding Region	Funding priority
Förderung wasserwirtschaftlicher Vorhaben	Baden-Württemberg	-projects to ensure public water supply and sewage disposal -hydraulic engineering and water ecology projects
Klimaschutz mit System	Baden-Württemberg	-integrated climate protection concept
Bayerisches Umweltkreditprogramm	Bavaria	-wastewater treatment, -environmental services, -resource efficiency

4) Financial options analysis for Austrian case study

This Deliverable provides an overview on public funding possibilities and related information points concerning the energetic use of wastewater and the REEF 2W approach, respectively, in Austria. Private funding (private investors as for instance energy suppliers etc., compare Deliverable 2.5.1) is rather site specific and cannot be generalized. Consequently, related options are not subject of the here presented overview.

Basically, in Austria three levels of public funding can be distinguished: (1) European level, (2) Austrian national level and (3) provincial/regional level (for the Austrian REEF 2W case study site the federal province of Upper Austria). In the following chapters, key aspects concerning the different funding levels will be presented. However, the primary focus lays on the Austrian national and regional levels.

4.1 European level

The European Union provides a multitude of funding possibilities for various sectors. An overview in German language can be found under the following link:

https://ec.europa.eu/info/funding-tenders/funding-opportunities/funding-programmes/overview-funding-programmes_de

For the energetic use of wastewater and the REEF 2W, among others, the following can be of interest (in German language):

- Umwelt- und Klimapolitik (LIFE)



- Europäischer Landwirtschaftsfonds für die Entwicklung des ländlichen Raums (ELER)
- Europäischer Fonds für regionale Entwicklung (EFRE)

Austrian national and regional funding associations/contact points usually are aware of current European funding initiatives and considered them for national/regional funding requests. Therefore, the European level of funding will not be further discussed here.

4.2. Austrian national level

In Austria, the national “Umweltförderungen” (environmental support schemes“) shall support and promote ideas, concepts and projects which have a positive impact to the environment and are resource friendly. In behalf of the Federal Ministry for sustainably and Tourism the Kommunalkredit Public Consulting handles the practical aspects of the funding. The legal framework is being provided by the following national laws:

- Umweltförderungsgesetz (UFG)
- Förderungsrichtlinien für die Umweltförderung im Inland i.d.g.F.

An overview on the different support schemes in German language can be found under the following link:

<https://www.umweltfoerderung.at/>

Basically, the funding schemes adress industries, municipalites as well as private persons. Concerning the energetic use of wastewater and the REEF 2W approach the following thematic areas for funding appear relevant:

- Energiesparen (energy saving) concerns (among others) heat recovery and efficient use of energy
- Gebäude (buildings) concerns (among others) solar thermal applications
- Strom (electricity) concerns (among others) photovoltaics and combined heat and power
- Wärme (heat) concerns (among others) district heating connections, solar thermal applications and heat pumps

The water sector, which integrates wastewater managements, is explicitly addressed under the following link:

<https://www.umweltfoerderung.at/rechtliche-grundlagen-wasserwirtschaft.html>

In this context an additional regulation is available:

- Förderungsrichtlinien für die Siedlungswasserwirtschaft i.d.g.F.



This guideline specifically aims at supporting an orderly wastewater disposal, an adequate drinking water supply and the amelioration of the ecologic state of watercourses. Concerning the energetic use of wastewater and the REEF 2W approach the following thematic areas for funding appear relevant:

- Installation of or reinvestment in anaerobic sludge treatment (digestion)
- Installation of facilities for digester gas utilization (for internal purposes)

However, the guideline also explicitly mentions the following measure not eligible for funding (in the sense of this guideline):

- Additional installations for the use of renewable energy (e. g. (drinking water) hydropower, photovoltaics, wastewater heat recovery, co-digestion)

In the context of these aspects one has to refer to the funding schemes mentioned before.

4.3. Upper Austrian regional level

In the province of Upper Austria the primary contact point for provincial/regional funding is the OÖ Energiesparverband (Upper Austrian Energy Saving Agency), accessible via the following links:

<https://www.land-oberoesterreich.gv.at/49661.htm>

<http://www.energiesparverband.at/startseite.html>

This association is a body of the provincial government and supports energy efficiency, eco-energy and innovative energy technologies and provides information for households, municipalities and enterprises/industries.

An overview on energy related funding opportunities in the province of Upper Austria are available under the following link (this summary also refers to the related national funding schemes):

<http://www.energiesparverband.at/foerderungen/liste-aller-energiefoerderungen.html>

Concerning the energetic use of wastewater and the REEF 2W approach the following funding opportunities appear of major importance:

- Energiegewinnungsanlagen (Funding of installations for energy generation): solar thermal (more residential focus) and photovoltaics (also utilities and municipalities), heat pumps (more residential focus), connection to district heating (more residential focus), small hydropower (also utilities)
- Förderung für Betriebe, Gemeinden und Institutionen (funding for utilities, municipalities and institutions):



- Reference to national funding scheme (Umweltförderung) - but „Energiesparen“ here explicitly addresses wastewater heat recovery from wastewater
- Additional funding beyond Umweltförderung: Connection to district heating, solar thermal, heat pumps, energy efficiency

As on national level, also on provincial/regional level Upper Austria provides special funding in the field of sanitary engineering:

<https://www.land-oberoesterreich.gv.at/Landesfoerederungsrichtlinien.htm>

However, this provincial/regional funding scheme strongly orientates on the before mentioned national law (Umweltförderungsgesetz (UFG)) and guideline (Förderungsrichtlinien für die Siedlungswasserwirtschaft). Its current version has a specific focus on drinking water supply which is not relevant in the context of REEF 2W.

5) Financial options analysis for Italian case study

The present deliverable aims at assessing the economic and financial framework of the 5 pilot demonstration cases, taking into account the specific situation of each pilot.

In each case, the approximate costs of the implementations in the different considered scenarios are analysed, with a degree of approximation depending on the knowledge of the relevant parameters. The economic advantages of the proposed solutions are then highlighted, in terms of additional revenue deriving from the sale of excess renewable energy and/or savings deriving from the use of the energy produced or from the greater efficiency of the new plants.

The analysis includes the identification of possible funding sources, the setting up of the relative financial plans and the estimation of the payback period.

This will provide the decision makers with the knowledge some of a key point to decide the implementation of the new installations. Moreover, the results of the present deliverable will be used in the Integrated Sustainability Assessment (ISA) for the evaluation of the economic sustainability in addition to the environmental and social ones.



5.1. Financial Options Analysis of pilot in the Emilia Romagna Region

The pilot case in the Emilia Romagna region was conceived by Montefeltro Servizi in the framework of a general renovation plan of both the waste collection service and the internal organization. The objectives of the renovation plan are as follows:

- Improvement of the waste collection service taking into account the peculiarities of the territory, with a door-to-door collection, thereby overcoming the percentage of separate waste collection envisaged by the regional plan: from the present 43,7% to 74,0%.
- Development and valorization of the society, equipping it with facilities for the management of integrated waste cycle;
- Optimization of the collection rates undertaking in the same time the whole waste cycle management.

The plan includes investments for new vehicles and facilities for about Euro 2.300.000, covered by bank loans at an annual rate of 3%, repayable in 7 years.

The pilot case proposed by Montefeltro Servizi fits very well in this context. From one hand the renovation plan improves both the quantity and the quality of the organic waste, from the other hand the REEF 2W installation, as can be seen in the next paragraphs, has the potential for producing an amount of renewable energy to generate savings that can contribute to lower the collection rates. This way, the Emilia Romagna pilot can represent a sustainable model for small multi-utilities serving dispersed communities.

5.2. Estimation of costs for the pilot plant

With reference with D.T2.3.1 where three different scenarios are assessed for the gasification of biomass and production of electricity and thermal energy, in the present analysis we consider scenario III only. In fact, scenario III optimizes the quantity of biomass available for the gasification process integrating all the biomass available: the organic fraction of municipal waste (OFMSW), prunings deriving from the maintenance of public green and from mowing of brushwood along the banks of rivers, exhaust mushroom litter coming from an enterprise of the territory, the excess sludge of three small WWTPs. Moreover, this is the only scenario with the potential of generating a substantial economic return.

In addition, the proposed pilot is completed by about 100 m² of photovoltaic panels to be installed on the roof of the Montefeltro Servizi headquarters, as required by law in Italy. In recent years, in Italy photovoltaic plants have had a rapid drop in costs due to booming



market growth and have now stabilized. Features and costs of a plant like that under consideration are as follows:

Surface	100 m ²
Power peak	20 KW
Energy produced yearly	19,52 MWh
Cost of plant	Euro 32.000
Cost of the accumulation system	Euro 13.000
Other costs	Euro 5.000
Total cost	Euro 50.000

The cost of a system for the production of syngas starting from biomass, aimed at producing both electricity and thermal energy, greatly depends on the specific features of the system. We have made a careful market analysis concerning the major producers in Italy, the results of which are shown below for a system matching the requirements of the Emilia Romagna pilot:

Nominal electric power	150 KW
Annual operating hours	7000
Biomass drying system	yes
Flue gas filtering system	yes
Electricity yearly production	1050 MWhe
Thermal energy yearly production	1200 MWht
Cost of plant	Euro 600.000
Installation cost	Euro 200.000
Total cost	Euro 800.000

The estimation of the total cost of the plants for the pilot in Emilia Romagna is of Euro 850.000.

5.3. Estimation of revenues/savings

The economic return of a plant producing renewable energy strongly depends on the level of incentives and from the legislative framework.



Considering the electricity production, economic advantage can be generated by selling the electric energy at the grid or directly use it. For the Emilia Romagna pilot the most favourable option is to directly use it thanks to a specific measure provided by the Italian legislation called “scambio sul posto altrove” (exchange on the site elsewhere). Based on this regulation, public bodies can produce electricity in any place of the Italian territory and use it in any other place where the same public bodies have a utilization point. In our case of the place where the electricity will be produced, that is the Montefeltro Servizi treatment platform is directly owned by the seven municipalities and the excess of electricity produced can be used by the same municipalities for all their electricity needs (public lighting, provide energy at schools, and social centres, etc.).

The present yearly average electricity consumption of Montefeltro Servizi to run the offices and the treatment facilities is of about 17,25 MWh and even the future needs can be mainly covered by the electricity produced by photovoltaic plant.

Therefore, the excess production of 1050 MWh from the gasification plant will be used by the 7 municipalities. Presently, they collectively use about 6722 MWh per year, with a cost of Euro 1.210.000 and an average cost of Euro 0,18 per KWh. The pilot plant can thus generate savings for about Euro 189.000 per year.

Concerning the thermal energy produced by the gasification plant, the configuration of the territory and the distribution of possible utilization points make it not convenient to distribute the heat towards public buildings/facilities or private users. Therefore, it will be used only partly in the Montefeltro Servizi facilities.

5.4. Funding opportunities

The Energy Efficiency Directive encourages Public Administrations to use Energy Performance Contracts (EPC) when planning energy efficiency initiatives. This kind of Public Private Partnerships between local public administrations and energy service companies (ESCO) is also supported by the Emilia Romagna regional administration (see <http://energia.regione.emilia-romagna.it/low-carboneconomy/temi/imprese-energetiche-esco/esco>).

However, after contacting some regional ESCOs, and after considering the services offered by those companies, Montefeltro Servizi, in agreement with the 7 municipalities decided not to use EPC for the possible implementation of the pilot.

Indeed, the most convenient option seems to be to negotiate with the same bank that granted the mortgage necessary for the renovation plan a further mortgage for additional Euro 850.000. In this case, with a five-year mortgage at the same conditions, the annual repayment installment should be of Euro 185.000, easily covered by the annual saving for the electricity costs, with a payback period of 5 years.



6) Financial options analysis for Croatian case study

In Croatia the majority of water and waste water services are provided under the direct public management model, where the responsible public entity is entirely in charge of services provision and management. In the city of Zagreb the waste water treatment plant is managed through delegated private management (concession). Wastewater Treatment Systems & Sewage Systems used in Croatia are mechanical, biological, membrane, or plant Lagoon, while the sewage systems are mixed or separate. Only a few smaller cities and residential districts of bigger towns have separate or split sewage systems.

The primary legislation for water management consists of two acts: the Water Act, (OG No. 107/95, 150/05) and the Water Management Financing Act, (OG Nos. 107/95, 19/96, 88/98 and 150/05). The Water Act regulates and defines the legal status of water and water estate, the preconditions for their use and protection, and the activities and organization of water management. The Water Management Financing Act defines water management revenues, the most significant of which are water charges.

The regulation of water services in terms of ecological standards and water resources protection is the jurisdiction of the Ministry of the Environment and Energy. The scope of the ministry's work includes tasks related to the protection and conservation of the environment and nature in line with the sustainable development policy of the Republic of Croatia.

The Ministry of the Environment and Energy performs tasks related to water management; monitoring and adaptation of water management development to the needs of the overall economic development of the Republic of Croatia; protection against harmful effects of water and ice; erosion and torrential protection; management of water resources and their use; irrigation and drainage; implementation of water protection and water environment protection against pollution; implementation of sea protection against pollution from land; use of water for various purposes; activities of public water supply and public sewage and waste water treatment; planning and harmonisation of the development of water structures; conducting administrative oversight of water management; international cooperation; the tasks of the Intermediate Body Level 1 for the use of structural instruments of the European Union in the Republic of Croatia, as well as other international sources of funding in the part related to water management projects and other activities from its scope of activity. In this sense, financing framework for waste water treatment sector in Croatia has to be within the defined specifics.



The wastewater treatment infrastructures in Croatia, same as in the Czech Republic, is mostly owned by the local government. In general, there are three options regarding the financing of the project:

- i) Local/national budget financing
- ii) Bank loans
- iii) EU grant programs

6.1. Scenario 1: Local/national budget financing

The overall objective for the Environmental Operational Programme in Croatia is to invest in projects that will contribute the greatest impact with the limited resources available in the waste and water sub-sectors. This will help Croatia to meet its obligations for implementing the EU environmental acquis governing the treatment and disposal of waste, the supply of drinking water, collection, treatment and discharge of waste water. It will also develop the administrative and management capacity of the institutions implementing the mentioned programme. This will improve access to environmental services and facilities in the waste and water sub-sectors. It will also produce other indirect development benefits, such as raising the quality of life of residents, attracting new investment and creating new jobs. Eventhough this programme is financed by EU, there is always smaller portio that needs to be financed from local or national budget (usually about 15%). For this matter, good planning of internal resources is required in order to implement waste water treatment project in municipalities in Croatia.

6.2. Scenario 2: Bank loans

This is efficient and fast way to build a WTP, and usually is not very common. In some cases banks or other financing institutions are becoming concessionaire of a local wastewater treatment plant, their upgrade to tertiary treatment in order to meet EU/national environmental standards. The concrete loan amount is depending on the project size and usually is between 20-60% of total value. Usually the requirement to get loan is to have a green project which will, besides direct waste water treatment, result with significant reduction in nutrients (nitrogen and phosphorus), and its return to the natural environment to meet the EU environmental standards. Improved wastewater treatment is expected to result in significant environmental benefits in and around the waste water producer's area. Furthermore, it is expected that the WTP will also improve energy efficiency via biological technology for wastewater treatment and sludge fermentation for the purpose of biogas generation, as well as a combined heat and power station for the generation of electricity in order to minimize energy costs and residual materials.



Banks are also aware of certain risks during the project implementation, which is usually mitigated by the EU/national legislation which requires compliance with the directive on urban wastewater treatment. Besides the technical review, project are often assessed through Environmental and Social Due Diligence. Reason for this is the confirmation that potential environmental and social impacts will be specific and mainly related to the construction works. The impacts of the proposed projects are also assessed through the national Environmental Impact Assessment. Each project has to improve environmental and health benefits for the local communities and further improve the water quality through the reduction of pollutant discharges. Banks are also usually monitoring the implementation of the project and reviewing the performance of the construction.

6.3. Scenario 3: EU grant programs

European Union membership for Croatia is requiring many commitments in this sector, such as a fulfilment of the Urban Waste Water Directive (91/271 EEC) and the Water Framework Directive (2000/60/EC). One of the most important part of these requirements is construction of wastewater infrastructure, such as collectors/sewers and wastewater treatment plants.

The preparation of water sector infrastructure projects through EU funding is covered within the Environmental Operational Programme, which is within the Ministry of the Environment and Energy portfolio. In general, these projects are very time-consuming where many project development stages must be completed before actual start of work, such as feasibility study and environmental impact assessment, different permits, tendering documentation, etc. Therefore, these projects can have a lifetime of more than 6 years. Also, the project approval requires detailed analysis to be performed. The analysis is the first and often crucial step in project development. Its goal is to accurately quantify all important technical parameters of the project. It very often requires population analysis, demographic forecasts and water consumption analysis. Financial analysis requires financial capacity of the end-beneficiary, mainly current consumer tariffs.

The main reason for municipalities to apply for this financial scenario is the possibility to get EU grants which can be even up to 70% of the total project, and the rest of the funding comes from the first two scenarios.