



LIFE Project Number
< **LIFE16ENV/ES/000156**>

Final Report
Covering the project activities from 01/09/2017 to 31/08/2021

Reporting Date¹
< **30/11/2021**>

LIFEPROJECT NAME or Acronym
< **LIFE NEWEST**>

Data Project

Project location:	Comunidad Valenciana (SPAIN)
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Data Beneficiary

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¹ Include the reporting date as foreseen in part C2 of Annex II of the Grant Agreement

This table comprises an essential part of the report and should be filled in before submission

Please note that the evaluation of your report may only commence if the package complies with all the elements in this receivability check. The evaluation will be stopped if any obligatory elements are missing.

Package completeness and correctness check	
Obligatory elements	✓ or N/A
Technical report	
The correct latest template for the type of project (e.g. traditional) has been followed and all sections have been filled in, in English <i>In electronic version only</i>	✓
Index of deliverables with short description annexed, in English <i>In electronic version only</i>	✓
<u>Mid-term report</u> : Deliverables due in the reporting period (from project start) annexed <u>Final report</u> : Deliverables not already submitted with the MTR annexed including the Layman's report and after-LIFE plan Deliverables in language(s) other than English include a summary in English <i>In electronic version only</i>	✓
Financial report	
The reporting period in the financial report (consolidated financial statement and financial statement of each Individual Beneficiary) is the same as in the technical report with the exception of any terminated beneficiary for which the end period should be the date of the termination.	✓
Consolidated Financial Statement with all 5 forms duly filled in and signed and dated <i>Electronically Q-signed or if paper submission signed and dated originals* and in electronic version (pdfs of signed sheets + full Excel file)</i>	✓
Financial Statement(s) of the Coordinating Beneficiary, of each Associated Beneficiary and of each affiliate (if involved), with all forms duly filled in (signed and dated). The Financial Statement(s) of Beneficiaries with affiliate(s) include the total cost of each affiliate in 1 line per cost category. <i>In electronic version (pdfs of signed sheets + full Excel files) + in the case of the Final report the overall summary forms of each beneficiary electronically Q-signed or if paper submission, signed and dated originals*</i>	✓
Amounts, names and other data (e.g. bank account) are correct and consistent with the Grant Agreement / across the different forms (e.g. figures from the individual statements are the same as those reported in the consolidated statement)	Bank account has changed. See Annex A6 .
Mid-term report (for all projects except IPs): the threshold for the second pre-financing payment has been reached	✓
Beneficiary's certificate for Durable Goods included (if required, i.e. beneficiaries claiming 100% cost for durable goods) <i>Electronically Q-signed or if paper submission signed and dated originals* and in electronic version (pdfs of signed sheets)</i>	✓
Certificate on financial statements (if required, i.e. for beneficiaries with EU contribution ≥750,000 € in the budget) <i>Electronically Q-signed or if paper submission signed original and in electronic version (pdf)</i>	✓
Other checks	
Additional information / clarifications and supporting documents requested in previous letters from the Agency (unless already submitted or not yet due) <i>In electronic version only</i>	✓
This table, page 2 of the Mid-term / Final report, is completed - each tick box is filled in <i>In electronic version only</i>	✓

**signature by a legal or statutory representative of the beneficiary / affiliate concerned*

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2. List of key-words and abbreviations

SERVYECO	SERVIECOLOGIA Y TRATAMIENTO DE AGUAS S.L.
GOMSA	GLOBAL OMNIUM MEDIOAMBIENTE S.A.
EGEVASA	EMPRESA GENERAL VALENCIANA DEL AGUA S.A.
SEASA	SOCIEDAD ESPAÑOLA DE ABASTECIMIENTOS, S.A.
REACH.....	HEALTH AND SAFETY AUTHORITY
UE.....	EUROPEAN UNION
EASME.....	EXECUTIVE AGENCY FOR SMALL AND MEDIUM-SIZED ENTERPRISES
WWTP.....	WASTEWATER TREATMENT PLANT
AV.....	DISCHARGE AUTHORISATION
RD.....	ROYAL DECREE
COD.....	CHEMICAL OXYGEN DEMAND
SS.....	SUSPENDED SOLIDS
TOM.....	TOTAL ORGANIC MATTER
GI.....	GERMINATION INDEX
RQ.....	RISK QUOTIENT
DP.....	ROOTSTOCK TRUNK DIAMETER
DT.....	TRUNK DIAMETER
AP.....	TREE HEIGHT
ROI.....	RETURN ON INVESTMENT
SROI.....	SOCIAL RETURN ON INVESTMENT
ESIF.....	EUROPEAN STRUCTURAL AND INVESTMENT FUNDS
LCA.....	LIFE CYCLE ASSESSMENT
ADR.....	EUROPEAN AGREEMENT CONCERNING THE INTERNATIONAL CARRIAGE OF DANGEROUS GOODS BY ROAD
IBC.....	INTERMEDIATE BULK CONTAINER
SDDR.....	DEPOSIT AND RETURN SYSTEM
KPI.....	KEY PERFORMANCE INDICATOR

3. Executive summary

General progress of the project has been good and the work on all the project actions has finished according to the time plan. Please, refer to chapter 6.1 for the detailed description of the general progress by the action. All the actions have been conveniently initiated and finished during the reported period. The main **project objectives** are listed below:

- Remove the use of inorganic coagulants, with corrosive and dangerous character, in the wastewater treatment being replaced by natural based products that are developed and manufactured during the project.
- Ensure the replicability and transference of the proposed technology and the dissemination of UE results.
- Provide an efficient solution, economically cost-effective and environmental sustainable for the phosphorous removal in treated wastewaters, enforcing the Directive 2000/60/CE and following the LIFE Program priorities.

All **Deliverables and Milestones** planned to complete during the project have been conveniently accomplished. As expected, only new and updated deliverables are attached with this final report.

The project evolved with no deviation neither on schedule nor global budget. The goals defined in the project proposal were almost completely achieved. The main **outputs** are listed below:

- Coagulants efficiency improvement in the wastewater treatment, reducing the phosphorous content, suspended solids and turbidity in the treated water against currently used products (iron salts).
- Total removal (100%) of toxic and corrosive coagulants such as aluminum sulfate or ferric chloride, and pH neutralizer such as hydrochloric acid or sodium hydroxide in urban and industrial wastewater treatments.
- By replacing corrosive and dangerous coagulants by natural based products, waste production is reduced considerably, decreasing the management costs (packaging and sludge management, not ADR transport, etc).
- Lifetime of the treatment facilities is increased due to the metallic parts protection thanks to the use of non toxic and non corrosive products.
- Workers security is improved in comparison with the products currently used, avoiding risks and people damages.
- Sludge production with low metals (iron and aluminum) and chlorides content to use it on farming while is agronomical efficient and secure to the ground ecosystem, reducing management costs.
- Sludge production has been biomethanized in anaerobic digesters enhancing the efficiency obtained with traditional coagulants.
- Reduction of energy consumption compared to new technologies.

The project has been executed as scheduled and finished on August 2021 according to calendar. No major **problems or deviations** have been encountered. There has not been any significant modification neither in the financial nor in technical aspects of the project. However, slight variations in some tasks duration occurred.

During the *Action B.1*, regarding the quality control and standard values verification process it was decided to launch the REACH registration process, needed to finally sell

the new product along Europe. Chemical characterization of the natural based product was the first step in the registration process. Additionally, it was truly important to define the degree of dangerousness of the product. Reviewing the reactants used during the activation chemical reaction, residual formaldehyde value was established as a critical value. Accordingly, INESCOP research centre was selected to perform a specific chemical analysis procedure to determine free formaldehyde values in the new product. This way, reaction times and reactants ratio were conveniently modified in order to minimize residual values of free formaldehyde in the new synthesized product. Several samples, synthesized at semi-industrial scale level using the brand new premix reactor, were accordingly characterized. In order to classify the new product as not dangerous, all the dangerous components and residual reactants content should be below 0,1%.

At this point, two different issues appeared:

- a) Analytical values of residual formaldehyde were still slightly over 0,1%, so the product should be classified as dangerous.
- b) REACH registration process would delay the start of the industrial scale production, probably delaying the following actions B.2, B.3, B.4 and B.5.

For those reasons, it was decided to continue these tasks but additionally aboard a different approach consisting in developing an alternative new natural product, based on blending, that can:

- Reach the values of phosphorus removal efficiency established in the proposal (< 1 ppm).
- Contain only raw materials i) lacking formaldehyde, in order to treat the final product as non dangerous, and ii) already registered in REACH.

This alternative development was successfully performed on time. Even this technical modification has slightly delayed the supply of raw materials for the manufacture process of the new product (*Action A.1.1*), previous experiences carried out in this task to date regarding the original synthetic process, were crucial in order to minimize the delay. This way, following actions B.2, B.3, B.4 and B.5 started as originally planned.

As previously mentioned, during Action A1.1 (production plant design and built up) minor additional technical adjustments were performed, compared to the planning defined in the proposal. Previous semi-industrial scale tests have been done to facilitate the startup process from laboratory to industrial scale and to confirm the results of coagulant efficiency previously reached. Accordingly, technical modification has slightly delayed the supply of raw materials for the manufacture process of the new product. Previous experiences carried out in this task, regarding the original synthetic process, have been crucial in order to minimize the delay. Please, refer to chapter 6.1 for the detailed description of the progress by the action.

No other problems or difficulties were found, not affecting the project's implementation or the timely completion of the project. However, final dosages in urban wastewater treatment implementation have been higher than expected, compared to ferric chloride. On the other hand, the environmental objectives have been more than met.

4. Introduction

Regarding the **environmental problem assessed**, phosphorus causes eutrophication in rivers, generating excessive growth of vegetation, phytoplankton or sessile algae and, consequently, a lack of oxygen in inland waters. The incorporation of phosphorus in water bodies has increased notably in recent times as a result of its use in agricultural fertilizers, in industrial activities, in detergents and in products for domestic uses. The phosphorus present in urban wastewater comes mainly from human fecal matter (50 - 65%), food waste discharges and inorganic phosphate compounds contained in detergents and cleaning products (30 - 50%). The tertiary treatment of wastewater provides a final stage to increase the quality of the effluent to the required standard before it is discharged to the receiving environment. Wastewater usually contains high levels of phosphorus at this point, which can be toxic to fish and invertebrates, since high amounts of these produce eutrophication. The main negative effects derived from eutrophication, generated by the incorrect elimination of phosphorus in the water, are:

- Modification of the characteristics of the body of water, which entails a loss of quality, as it cannot be used for its normal use.
- Deoxygenation of the water, normally causing fish mortality.
- Increase in operating expenses of public water supply systems due to taste and odor problems.
- Clogging and obstruction of irrigation channels by aquatic weeds.
- Reduction of the possibility of using water for recreational purposes due to the odors produced by the decomposition of algae.
- Impediments to navigation due to the growth of dense masses of algae.
- Economic losses due to the modification of fish species.
- Increased production and biomass of primary producers (phytoplankton and macrophytes).
- Production of toxins by certain algae (dinoflagellates-red tides).

Currently, the removal of phosphorus from wastewater is mainly carried out using the chemical precipitation. This is a process of destabilization of charges on colloidal particles that occurs by neutralizing the forces that keep them apart, through the addition of chemicals and the application of mixing energy. The chemicals used to remove phosphorus are metal salts (ferric chloride) and, sometimes, lime. This technology has the following disadvantages:

- This method contributes metals to the dehydrated sludge, such as aluminum or iron, making its subsequent management difficult and more expensive.
- Part of the active sludge returns to the biological system. The residual values of metals present in this activated sludge can limit the efficiency of removal of organic load during the aerobic treatment.
- Both inorganic coagulants and pH regulators increase the conductivity of treated water, being able to breach the discharge limits and drastically reducing the life time of the facilities.
- Inorganic coagulants and pH regulators are toxic and corrosive products, being dangerous for the operators during their handling.
- The dosage of inorganic coagulants provides salts, dangerously increasing the values of chlorides and sulphates in the purified water.
- Certain residual iron values contribute color to the water.
- The chemical precipitation process generates a high volume of sludge, limiting the efficiency and working flow of the installation used.

- The dependence on large industrial processes worldwide leads to constant increases in the price of inorganic precipitants, such as ferric chloride or aluminum polychloride, generating an increase in treatment costs.

This is a demonstration project as it evaluates and disseminates a **new chemical technology focused on the use of natural based coagulants**, to eliminate specific pollutants such as phosphorus, in urban and industrial wastewater. These organic polymers have never been used before in urban treatment plants, during the secondary treatment of waste water assimilable to urban or where the content of industrial waste was higher. This technology is easily applicable at a European and global level, since the characteristics of urban wastewater do not differ too much depending on its geographical location. For all the aforementioned, it is considered that the project will contribute to compliance with EU environmental policy and legislation, in particular compliance with the Water Framework Directive, in addition to creating synergies with other EU policy areas, such as agriculture, soils or waste. According to data from the European Environment Agency (<http://www.eea.europa.eu/data-and-maps/data/waterbase-uwwtd-urban-waste-water-treatment-directive-4#tab-european-data>), the number of urban wastewater treatment facilities in the European Union is approximately 30,000. After the implementation of the technology, the use of corrosive and environmentally disrespectful products such as ferric chloride or polychloride of aluminum would no longer be used, estimating a elimination of 1.27 million tons of dangerous products each year, only at the European level (Anales de Geografía 2012, vol. 32, no. 1 69-89).

The **technical solution** focuses on the synthesis of the natural based coagulant. A new synthesis procedure based on patents US4558080 and US6955826 has been developed, in order to produce a new natural based coagulant focused on elimination of phosphorus in secondary wastewater treatment. The eco-innovative technology assessed focuses on the use of organic natural based polymers, which are extracted from the bark of the black acacia and, after undergoing certain chemical modifications are able to improve coagulant efficiency compared to other inorganic materials like ferric chloride. The production process of the new coagulant at industrial scale has been optimized and the possible methods of quality control and safety for the workers have been determined. Additionally, the assessment of the coagulation efficiency of the products has been carried out. This efficiency has been compared with that of the products currently used in order to confirm the expected technical and economic advantages. Similar levels of total phosphorus removal are achieved using a natural based product, avoiding the use of a corrosive product such as ferric chloride. Additionally, it has recently been shown that the use of ferric chloride hinders the recovery of phosphorus in the form of struvite.

Regarding the **expected results and environmental benefits**, a large number of technical, economic and environmental advantages are listed below:

- Due to its strong cationic character, it has an improved coagulant action during the treatment of colloidal systems, neutralizing charges and attracting suspended particles.
- It does not modify the pH of the aqueous medium and, in addition, it presents an optimal efficiency in a very wide range of pH, between 4.5 and 9.0.
- It does not consume alkalinity of the medium. In this way, its coagulant efficiency is always maximum since it does not undergo hydrolysis in an aqueous medium.
- Provides rapid flocculation and decantation. Eliminates or considerably reduces flocculant consumption.

- Protects against corrosion of metal parts, since it does not increase the conductivity of the medium.
- It is an organic-based polymer, respectful with the environment. It is not corrosive or toxic, which favors subsequent biological processes. In addition, removing the ferric chloride from the process facilitates the recovery of phosphorus in the form of struvite.
- By not providing toxic elements or metals, the dehydration of sludge and its subsequent reuse or recovery are promoted.

5. Administrative part

The overall project coordination and administration started with the nomination of the project staff and organization of the kick off meeting for the project partnership. Partnership agreements have been signed by the associated beneficiaries, GOMSA, EGEVASA and SERVYECO, Project coordinator (DL_E1.1 - Partnership agreement). Under the project's beneficiary control, the project team members have been working together and/or independently on their actions according to what was planned in the proposal. The partnership responsibilities were well defined, and the work carried out has been very satisfactory.

Regarding the project's structure and working method, SERVYECO as the beneficiary-coordinator (CB) of the project is the main responsible for its correct development. Obviously, SERVYECO assumes the maximum responsibility in the management and coordination of the project with the support of the associated beneficiaries and, for the whole project, the support of the project's external assistance. The overall management process on the side of the CB is being carried out by:

- Asking the consortium members for periodic information about their activities and supporting documents regarding technical, administrative and financial issues.
- Conducting periodic evaluations of progress and results achieved.
- Controlling the calendar of the actions, according to the proposal approved, and its level of implementation.
- Controlling the administrative control and financial justification of the expenses charged to the project with reference to the provisional and real schedule and the real state of the project's implementation.
- Reporting to the European Commission on the progress of the Project, as established in the approved proposal.
- Keeping in contact, when necessary, with NEEMO representative assigned to the project.

For the correct management of the project, the members of the consortium convene meetings on a regular basis. Continuous contact is also maintained by phone conferences and email. It is considered that in this aspect the project has run smoothly, controlling the project, both at the technical level and in the supervision of its execution. The project's participants also got the support of an external company expert in the LIFE programme to support the project's management which performs the supervision of project's advances and the financial and administrative justification (periodical reports are issued and sent to the CB). The project activities carried out and the project on the whole, were successful without significant problems.

Communication with NEEMO technicians, **Ms. María Rodríguez** and **Mr. Borja Domínguez** has been comfortable and fluid at all times. Both have always been available and have offered their help when required. In summary, their technical support has been crucial for the correct implementation of the project, greatly facilitating the presentation of technical reports and financial justification. **Mr. Federico de Filippi**, as Project Officer of CINEA, has closely followed the project progress, giving us very valuable advice on how to approach after-LIFE activities while receiving the latest technical results in September 2021.

6. Technical part

6.1 Technical progress, per action.

The activities conducted and resulting outputs are described below, divided into different actions and sub-actions.

A1. Preparatory actions for industrial production and demonstration phase. Stakeholders identification.

Current action encompasses a series of preparatory actions: demonstration phase plan design, design and build up of the production plant and stakeholders identification. This action is completely done, finalized in May 2018, 3 months later than expected (detailed explanations are included below).

Foreseen start date: September 2017 Actual start date: September 2017
Foreseen end date: February 2018 Actual end date: June 2018

Name of the deliverable	Foreseen deadline	Actual deadline
DL_A.1.1 - Technical report on the design and construction of the industrial reactor, including plans and diagrams.	28/02/2018	30/06/2018
DL_A.1.2 - Report on the selection of stakeholders and key actors.	28/02/2018	28/02/2018
Name of the milestone	Foreseen deadline	Actual deadline
Mn 01 - Formalization of supplier orders.	31/10/2017	31/10/2017
Mn 02 - Development of diagrams and plans of the industrial production reactor.	31/12/2018	31/12/2018
Mn 03 - Summary list of stakeholders and key actors.	31/01/2018	31/01/2018

Table 1. Deliverables and Milestones of Action A1.

A1.1 Production plant design and built up.

The design and built up process of the production plant is based on previous laboratory scale tests. Plans, schemes, components and suppliers are well defined, based on these tests. Current sub-action is already finished and Deliverable DL_A.1.1 is also ended, available and attached.

The content of the Deliverable **DL_A.1.1**, called “**Technical report on the design and construction of the industrial reactor, including plans and diagrams**”, refers the design and construction of the industrial scale production plant, including the drawing of plans and selection of suppliers. On summary, the information included in this document states: i) Components of the industrial production plant, ii) Operating instructions, iii) Setting-up, iv) Security specifications and v) Flow chart.

As previously indicated, components of the industrial production plant were conveniently described, including description, technical specifications and maintenance instructions.

The main components are following listed i) Pre-mix reactor, ii) Reagents dosing system, iii) Vapor scrubbing system, iv) Heating system, v) Process control panel and vi) Industrial reactor.

Regarding the safety specifications of the production plant, several elements have been equipped in the installed systems in order to perform a safety management by the operators. Additionally, working conditions have been conveniently described. All the safety components detailed are following listed i) Retention cubes, ii) Thermometers and temperature probes, iii) Manometers and pressure transducers, iv) Frequency variators, v) Level probes, vi) Load cells and vii) Safety switches.

Minor technical adjustments have been performed during the production plant design and built up process, included in Deliverable DL_A.1.1, compared to the planning defined in the proposal. The most important technical modification comprises a small premix reactor, with the following purposes:

- a) Preliminary dilution of hydrochloric acid, before dosage for final pH adjustment. This step was necessary at industrial scale production in order to avoid spikes or possible decomposition of any of the components, while acid start to blend with the other components of the chemical reaction.
- b) Additional organic additives have been tested in the enhanced version of the product. These additives, even added in low amounts are currently increasing the coagulant efficiency. Premix reactor is already used for in situ preparation of additional organic additives.

On the other hand, the inclusion of the small reactor allows SERVYECO to perform previous semi-industrial scale tests, initially not included in the proposal, but necessary to facilitate the start up process from laboratory to industrial scale and to confirm the results of coagulant efficiency previously reached.

A1.2 Planning. End user facilities adaptation.

Current sub-action encompasses two main tasks i) Specific protocol definition for sending and receiving samples procedure during the implementation phase and ii) Set of dosing points of the new natural based product in the end user facilities. Planning task also includes the selection of technicians from SERVYECO, EGEVASA and GOMSA who will access the plant and the number of samples that will be analyzed during the validation phase, among others.

This sub-action is already finished. Built up process for dosing systems in Beniganim and Lloc nou d'en Fenollet was finished in May 2018. Dosing points for the new natural based coagulant let the product enough reaction time to perform an enhanced coagulation and facilitate the sampling procedure before and after the treatment. No significant difficulties were suffered for the development of this activity.

A1.3 Identification of stakeholders and key actors.

Key actors have been detailed and selected in order to further transfer specific results and conclusions of the project. For the information transference, several types of initiatives have been planned. Key actors selected are divided in the next groups i) Target Public, ii) Indirect Target Audience and iii) General Public.

Current task has been completed. In a first stage, Deliverable **DL_A.1.2**, called “**Report on the selection of stakeholders and key actors**”, was finished and attached already in the Mid-Term Report (initial version). In this deliverable, there is a list of entities/organizations, people of contact, availability, location, etc. Additionally, it has been updated every 6 months, attaching the last and final version with this Final Report. No difficulties were detected in the development of this activity.

B1. Industrial scale production of natural based coagulants and procedure validation.

Action B1 comprises the start-up and validation process for the industrial scale production of the new organic natural based coagulant. The start-up process includes the controlled production of the product and fine tuning/optimization of the process from the industrial point of view. Additionally, the validation of the productive process fits the standards of quality and control methodology, including the verification of the coagulant efficiency through Jar Tests with real wastewater samples.

All sub-actions B.1.1, B.1.2, B.1.3 and B.1.4 were conveniently ended, enforcing expected deadlines with no remarkable delays.

Foreseen start date:	January 2018	Actual start date:	January 2018
Foreseen end date:	November 2020	Actual end date:	November 2020

Name of the deliverable	Foreseen deadline	Actual deadline
DL_B.1.1 - Technical report on the start-up procedure of the production reactor, including the user manual.	30/06/2018	30/06/2018
DL_B.1.2 - Technical report on the optimization and quality control procedure of the production process at an industrial level.	30/09/2018	30/09/2018
DL_B.1.3 - Technical report on incidents that occurred during the industrial production phase, including recovery procedures.	30/11/2020	30/11/2020
Name of the milestone	Foreseen deadline	Actual deadline
Mn 04 - Start-up of the industrial production reactor.	30/06/2018	30/06/2018
Mn 05 - Standardization of the production process, including its optimization and quality control.	30/09/2018	30/09/2018
Mn 06 - Review of incidents that occurred during the industrial production phase.	30/11/2020	30/11/2020

Table 2. Deliverables and Milestones of Action B1.

B1.1 Production plant start-up.

This sub-action focuses on the start-up and continuous production of the natural based organic polymer that has been implemented later, during the demonstration phase, in the end user facilities. Current sub-action was finished on time, as expected, and DL_B.1.1 was also ended (June 2018), available and attached.

The content of the Deliverable **DL_B.1.1**, called “**Technical report on the start-up procedure of the production reactor, including the user manual**”, refers the start-up

process to produce the new organic natural based coagulant, once the reactor is built as it was proposed in action A1. This developed product is the base of the technology presented in the project, which will be implanted after demonstration steps. The start-up process includes the controlled production of the product and the initial refining, minimizing the costs and waste generated. On summary, the information included in this document states previous actions before start up, start up procedure, user manual and possible constraints during the start up.

B1.2 Fine tuning and optimization of the production process.

Reactor start-up procedure comprises a fine adjustment of the process, in order to optimize the production phase. Current sub-action was finished on time, as expected.

B1.3 Quality control and standard values verification.

Standards of quality and control methodology, including the verification of the coagulant efficiency through Jar Tests with real wastewater samples, needed to be performed during the first stages of start-up procedure. Current sub-action was finished on time, as expected.

Results obtained during sub-actions B1.2 and B1.3 were conveniently summarized within the deliverable DL_B.1.2, that was also ended (September 2018), available and attached. The content of the Deliverable **DL_B.1.2**, called “**Technical report on the optimization and quality control procedure of the production process at an industrial level**”, refers the process of technical optimization that was taken place during the industrial production of the new organic natural based coagulant. Additionally, this report details the quality controls carried out to confirm the correct industrial production process, minimizing technical problems that could arise during the life cycle of the product or in the subsequent implementation phase at the end user facilities. On summary, the information included in this document states the optimization process of the production phase and defines the quality control procedure.

B1.4 Technical validation of coagulant efficiency.

Additionally, it is necessary to verify the coagulant efficiency of the organic polymer produced at industrial scale by Jar Tests with real wastewater samples. To do this, inlet wastewater samples were taken from the end users facilities of the end customers and treated by Jar Test using the product manufactured from various batches.

Current sub-action was finished on time, as expected. Total phosphorus content of treated water is determined, related to coagulant dosage, for several promising samples. Coagulant efficiency is been demonstrated through Jar Tests, always trying to maintain phosphorus content below required parameters and decrease product dosages in order to demonstrate the economic viability of the proposed treatment.

Finally, even the whole action B1 was technically succeeded, during the production phase along the project several incidents occurred, both due to human and mechanical errors, which lead to invalid products that could become waste for later management.

Results connected to this incidents and subsequent recovery of unsuitable products were conveniently summarized within the deliverable DL_B.1.3, that was also ended on time (November 2020), available and attached. The content of the Deliverable **DL_B.1.3**, called “**Technical report on incidents that occurred during the industrial production**

phase, including recovery procedures”, refers the technical incidents that occurred in each of the manufacturing processes. In every case, within the deliverable the errors occurred and the technical consequences detected in the finished product are defined. Some cases are described below:

- When poor quality of the softened water is used there is a significant increase in the viscosity of the final product, greatly reducing the lifetime.
- When the calibration of hydrochloric acid pump is not correct, the pH values of the finished product do not reach the originally established values and can give the finished product an unexpected dangerous character.
- Abnormally high levels of formaldehyde present in the finished product for human error during the manufacture process would affect the level of free formaldehyde slightly exceeding the limit established.

Additionally, this report details technical protocols that have been established for the recovery of this waste generated after technical incidents at an industrial level. Accordingly, several procedures for the recovery of unsuitable products, carefully detailed in the deliverable, are divided according to the technical limitation detected in the finished product. Some of them are i) recovery process related to abnormally low final pH values and the hazardous nature of the finished product and ii) recovery process related to abnormally high residual formaldehyde values and the hazardous nature of the finished product.

B2. Industrial validation of natural based coagulant efficiency in urban wastewater treatment plants.

This activity includes the methodology and results obtained during phase B.2 Industrial validation of the efficiency of coagulants of natural origin in URBAN wastewater treatment plants at the Lloc nou d'en Fenollet and Benigànim WWTPs. The objective is describe the activities and, based on the results obtained, assess the feasibility of using BEWAT NW3 (previously called ECOTAN) in Lloc nou d'en Fenollet and Benigànim WWTPs. Additionally, the product BEWAT MA has been studied at the Benigànim WWTP. Both WWTPs have an urban inflow, with the difference that the Benigànim WWTP receives occasional discharges that will allow us to observe the behavior of BEWAT NW3 in this type of scenario in regard to the chemical precipitation of phosphorus and the rest of the study variables.

The main characteristics of the Lloc nou d'en Fenollet WWTP are as follows:

- Influent 100% assimilable to urban load.
- Operator: EGEVASA.
- Flow: 125 m³/day.
- Pt limit according to AV (NR1973VS0128) of 4 mgP/l.

The main characteristics of the Benigànim WWTP are as follows:

- Influent 100% assimilable to urban load.
- Occasional discharges from the canning industry.
- Operator: EGEVASA.
- Flow: 1,900 m³/day.
- Pt limit according to AV(NR1973VS0063) of 2 mgP/l.

All sub-actions B.2.1 and B.2.2 were conveniently ended, enforcing expected deadlines with no remarkable delays.

Foreseen start date: July 2018 Actual start date: July 2018
 Foreseen end date: November 2020 Actual end date: August 2021

Name of the deliverable	Foreseen deadline	Actual deadline
DL_B.2.1 - Technical-economic report on the feasibility of the study coagulant for chemical precipitation in urban wastewater.	30/11/2020	31/08/2021
Name of the milestone	Foreseen deadline	Actual deadline
Mn 07 - Reach the discharge limits for total phosphorus in the Lloc Nou d'en Fenollet.	31/10/2019	31/10/2019
Mn 08 - Reach the discharge limits for total phosphorus in the Beniganim WWTP, reducing the consumption of ferric chloride for its precipitation.	30/11/2020	30/11/2020

Table 3. Deliverables and Milestones of Action B2.

B2.1 Industrial demonstration in urban wastewater facility 1 (Lloc Nou d'en Fenollet).

The action started on schedule (August 2018), starting the phase with the installation of the dosing system with PLC control for dose adjustment and monitoring. The working dose of the BEWAT NW3 used during the implementation of the technology was 44 mg/l. This dosage was observed to permit compliance with the Pt limit value.

The tests at the Lloc Nou d'en Fenollet WWTP began in October 2018 and finished in October 2019. In quantitative terms, before BEWAT NW3 dosing, the average total phosphorus value in the effluent during the period analyzed was 3.76 mg P/l. After the implementation of the new technology the average value in the effluent was 2.3 mg P/l. This indicates an average improvement in phosphorus precipitation reduction of 39% after BEWAT NW3 dosing.

B2.2 Industrial demonstration in urban wastewater facility 2 (Beniganim).

The tests at the Beniganim WWTP began in October 2019 and finished in December 2020, following the completion of the tests at the Lloc nou d'en Fenollet WWTP. To carry these out, the dosing system was relocated and the storage system was adapted for the higher consumption of BEWAT NW3, increasing from one IBC to four IBCs.

During the BEWAT NW3 (October 2019 – September 2020) and BEWAT MA (September 2020 – December 2020) dosing periods, the established total phosphorus limit of 2 mg P/l is complied with, except for a few specific moments caused by the intake of discharges into the WWTP. It can be concluded that the products BEWAT NW3 and BEWAT MA allow correct chemical precipitation of phosphorus in the Beniganim WWTP, with compliance with the Authorization to Discharge at an operating concentration of 40 mg/l.

The content of the Deliverable **DL_B.2.1**, called “**Technical-economic report on the feasibility of the study coagulant for chemical precipitation in urban wastewater**”,

refers the assessment of BEWAT NW3 and BEWAT MA for chemical phosphorus precipitation in urban WWTPs in terms of effluent quality and cost. The conclusions are i) BEWAT products are suitable for chemical phosphorus precipitation in urban WWTPs in terms of COD, SS and conductivity, ii) the optimal consumption of the BEWAT products for chemical phosphorus precipitation in this type of WWTP is 40 mg/l to achieve an effluent discharge limit of less than 2 mg/l, iii) BEWAT products significantly improve effluent quality in terms of conductivity reduction (in the case of BEWAT NW3) and COD removal, iv) BEWAT products reduce the concentration of chlorides and iron in the effluent compared to the use of ferric chloride, v) BEWAT products improve sludge sedimentability in secondary clarification units and vi) BEWAT products generate a significant savings in the consumption of reagents (polyelectrolyte) due to the improved dryness of the feed sludge (sludge from the flotation units) to the dewatering unit.

Although the new BEWAT products have not been competitive against ferric chloride in urban wastewater, these products have been competitive in industrial wastewater, having generated real sales before the end of the project (See deliverables DL_E.1.4.4 and DL_B.6.3).

B3. Industrial validation of natural based coagulant efficiency in industrial wastewater treatment plants

This action analyzed the technical-economic feasibility of using the coagulant BEWAT NW3 in urban WWTPs with an industrial component. In addition to the chemical precipitation of phosphorus, the technical analysis evaluated all of the variables potentially related to the use of BEWAT NW3, for both the water line (reduction of SS, COD, etc.) and in the sludge line (variation of dryness in floated sludge, reduction in the consumption of polyelectrolyte, etc.).

Firstly, the WWTP studied was the Ontinyent-Agullent WWTP, which has an urban influent with an industrial component in terms of load in the influent. The industrial load that this WWTP receives is average, which makes it a suitable installation for an initial technical-economic assessment. This report is divided into two distinct parts; its suitability from a technical point of view and its suitability from an economic point of view.

In addition, this activity includes the methodology in Canals-L'Alcudia INDUSTRIAL wastewater treatment plant. The report describes the activities and the results obtained in order to study the viability of using BEWAT NW3 and BEWAT MA in the Ontinyent and Canals-L'Alcudia WWTPs for removing phosphorus. In addition, this report shows how BEWAT NW3 and BEWAT MA could remove chromium in Canals-L'Alcudia WWTP.

All sub-actions B.3.1, B.3.2 and B.3.3 were conveniently ended, enforcing expected deadlines with no remarkable delays.

Foreseen start date:	October 2018	Actual start date:	October 2018
Foreseen end date:	November 2020	Actual end date:	November 2020

Name of the deliverable	Foreseen deadline	Actual deadline
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DL_B.3.1 - Technical-economic report on the viability of the study coagulant for chemical precipitation in urban waters with an industrial component in a WWTP with two-stage treatment.	31/10/2019	31/10/2019
DL_B.3.2 - Technical-economic report on the viability of the study coagulant for chemical precipitation in urban waters with an industrial component in a WWTP with physical-chemical treatment.	30/11/2020	31/08/2021
DL_B.3.3 - Technical-economic report on the feasibility of the study coagulant for chemical precipitation of Chromium in physical-chemical primary treatments.	30/11/2020	30/11/2020
Name of the milestone	Foreseen deadline	Actual deadline
Mn 09 - Reach the discharge limits for total phosphorus in the Ontinyent-Agullent and Canals-L'Alcudia WWTP, reducing the consumption of ferric chloride for its precipitation.	30/11/2020	30/11/2020
Mn 10 - Substitution of ferric chloride in the physical-chemical primary treatment of the WWTP of Canals-L'Alcudia.	30/11/2020	30/11/2020*

Table 4. Deliverables and Milestones of Action B3.

* BEWAT products cannot completely replace the use of ferric chloride in the physico-chemical precipitation of chromium. The maximum ferric chloride reduction achieved by using BEWAT products is close to 50%.

B3.1 Industrial demonstration in urban wastewater facility 3 (Ontinyent).

The action began at the established time (October 2018), with the phase beginning with the installation of the dosing system with PLC control for dose adjustment and monitoring. A storage system with 4 IBCs was added to the installed dosing system to ensure the autonomy of the dosing system. Lastly, an online orthophosphate analyzer was installed to ensure the quality of the discharge and to adjust the coagulant dose as much as possible.

The Ontinyent-Agullent WWTP treats urban wastewater with an industrial component in a very widespread two-stage treatment for the treatment of industrial effluents. It adds a new scenario to evaluate the performance of BEWAT NW3 in phosphorus removal.

The Ontinyent-Agullent WWTP has the following main characteristics:

- Effluent with high industrial load.
- Operator: GOMSA.
- Design flow: 10,500 m³/day.
- Pt limit according to AV (NR1992VS0028) of 1 mgP/l.

The successful dosing of BEWAT NW3 at the Ontinyent-Agullent WWTP began on April 2019 and ended on November 2019. It can be concluded that the product BEWAT NW3 allows the correct chemical precipitation of phosphorus in the Ontinyent-Agullent WWTP with the compliance with the Discharge Authorization at an operating concentration of 60 mg/l.

The content of the Deliverable **DL_B.3.1**, called “**Technical-economic report on the viability of the study coagulant for chemical precipitation in urban waters with an industrial component in a WWTP with two-stage treatment**”, refers the assessment of BEWAT NW3 product for chemical precipitation in WWTPs with a low industrial component in terms of the quality of the effluent obtained and cost. The conclusions are i) BEWAT NW3 product is suitable for chemical precipitation of phosphorus in WWTPs with an average industrial contribution in terms of COD, SS and conductivity, ii) the optimal consumption of BEWAT NW3 for the chemical precipitation of phosphorus in this type of WWTP is 60 mg/l, to achieve a discharge limit in the effluent below 1 mg/l, iii) BEWAT NW3 significantly improves effluent quality in terms of reduced conductivity and SS and COD removal performance, iv) BEWAT NW3 reduces the concentration of chlorides and iron in the effluent in comparison with the use of ferric chloride, v) BEWAT NW3 improves sludge sedimentability in the secondary clarification units, vi) BEWAT NW3 significantly improves the WWTP sludge line by increasing the dry matter percentage in the sludge flotation and dewatering units and vii) BEWAT NW3 enables a significant savings in the consumption of reagents (polyelectrolyte) due to the improvement in the dryness of the feed sludge (sludge from the flotation units) to the dewatering unit.

B3.2 Industrial demonstration in urban wastewater facility 4 (Canals). Phosphorous removal.

The Canals-L'Alcudia WWTP receives discharges from the tanning industry (with high values of conductivity, COD and chromium) that add a new scenario to evaluate the performance of BEWAT NW3 and BEWAT MA in phosphorus removal. A storage system with 4 IBCs was added to the installed dosing system to guarantee the autonomy of the dosing system.

The Canals-L'Alcudia WWTP has the following main characteristics:

- Effluent with high industrial load from tanning industry: conductivity, COD and Cr.
- Operator: GOMSA.
- Design flow: 10,500 m³/day.
- Pt limit according to AV (NR1992VS0028) of 1 mgP/l.

This sub-action started with a slight delay (January 2019) because the same dosing system used in sub-action B.3.1 Industrial demonstration at installation 3 (Ontinyent-Agullent WWTP) was used. As a result, there was a series of slight delays in this sub-action which were supported and justified in the report DL_B.3.1 - Technical-economic report on the feasibility of the study coagulant for chemical precipitation in urban water with industrial component in WWTP with two-stage treatment.

The dosing of BEWAT at the Canals-L'Alcudia WWTP began in January 2020 and ended in November 2020. During the BEWAT NW3 (January 2020 – September 2020) and BEWAT MA (September 2020 – November 2020) dosing periods, the established total phosphorus limit of 1 mg P/l is complied with, except for a few specific moments caused by the intake of discharges into the WWTP during which Pt values in the effluent increased. It can be concluded that the product BEWAT NW3 and BEWAT MA allows the correct chemical precipitation of phosphorus in the Canals-L'Alcudia WWTP with the compliance of the Discharge Authorization at a working concentration of 120 mg/l.

The content of the Deliverable **DL_B.3.2**, called “**Technical-economic report on the viability of the study coagulant for chemical precipitation in urban waters with an industrial component in a WWTP with physical-chemical treatment**”, refers the assessment of BEWAT products for chemical precipitation in WWTPs with a high industrial component in terms of the quality of the effluent obtained and cost. The conclusions are i) The BEWAT products are suitable for chemical precipitation of phosphorus in WWTPs with a high industrial contribution in terms of COD, Cr, SS and conductivity, ii) The optimal BEWAT NW3 and BEWAT MA consumption for chemical phosphorus precipitation in this type of WWTP is 120 mg/l to achieve an effluent discharge limit of less than 1 mg/l, iii) BEWAT NW3 significantly improves effluent quality in terms of conductivity reduction and SS and COD removal effectiveness, iv) BEWAT products reduce the concentration of chlorides and iron in the effluent compared to the use of ferric chloride, v) BEWAT products improve sludge sedimentability in the secondary clarification units, vi) BEWAT products improve the clarification of mechanical sludge dewatering units by reducing the load at the plant intake and vii) BEWAT products generate a significant savings in the consumption of reagents (polyelectrolyte for the sludge dewatering system).

B3.3 Industrial demonstration in urban wastewater facility 4 (Canals). Chromium removal.

The water resulting from the treatment (water from primary clarification) must have adequate values to avoid possible inhibition of the subsequent biological treatment due to the presence of heavy metals. The concentration of total chromium (Cr T) and chromium (VI), also called Cr (VI), which are present in water from the tanning industry, is especially important.

It is agreed that the maximum concentration of Cr (VI) that can be accepted by the biological treatment is 0.05 mg Cr (VI)/ml and that higher concentrations could lead to inhibition of the subsequent biological process. For this reason, during this part of the dosing of the BEWAT products, the target value will be the Cr (VI) concentration.

The action started at the time of the project, assembling and installing the necessary components for the dosing of BEWAT products. However, the dosing of these products was slightly delayed and started on 16/03/2020. This was due to the fact that there was a significant intake of industrial discharges, which meant that the physical-chemical treatment was not sufficiently stable to be able to dose new products. A storage system with 4 IBCs was added to the installed dosing system to guarantee the autonomy of the dosing system.

The initial dosage of ferric chloride in the physical-chemical treatment of the Canals-L'Alcudia WWTP was 110 mg/l. There was a gradual reduction of ferric chloride and the increase in the dose of BEWAT NW3 made it possible to maintain the Cr (VI) concentration below the established limit of 0.05 mg Cr (VI)/l. These values were maintained until a working concentration of 60 mg/l of ferric chloride and 70 mg/l of BEWAT NW3 was reached, at which point, the Cr (VI) concentrations reached the defined threshold. For this reason, the maximum reduction of ferric chloride that can be achieved is 50 mg/l. These results were reproduced with the use of BEWAT MA, where once again the maximum reduction that can be achieved without compromising the subsequent biological treatment is 50 mg/l ferric chloride.

The content of the Deliverable **DL_B.3.3**, called “**Technical-economic report on the feasibility of the study coagulant for chemical precipitation of Chromium in physical-chemical primary treatments**”, refers the assessment of BEWAT products during the chemical precipitation of total chromium and chromium (VI) in a WWTP with a high industrial component. The conclusions are i) BEWAT products cannot completely replace the use of ferric chloride in physical-chemical treatment, ii) the maximum reduction of ferric chloride achieved by the use of BEWAT products is close to 50% of the standard working dose, iii) BEWAT products significantly improve quality of the effluent from physical-chemical treatment in terms of reduced conductivity and SS and COD removal performance and iv) there were no significant differences between the use of ferric chloride and the BEWAT products with regard to industrial sludge thickening or mechanical dewatering of industrial sludge.

Although the new BEWAT products have not been competitive against ferric chloride in urban wastewater, these products have been competitive in industrial wastewater, having generated real sales before the end of the project (See deliverables DL_E.1.4.4 and DL_B.6.3).

B4. Sludge evaluation procedure for its biomethanation and reutilization in agriculture.

This activity includes the results obtained during sub-actions B.4.1, B.4.2, B.4.3, B.4.4 and B.4.5 in relation to the produced sewage sludges with and without BEWAT NW3, its composting process and its final phytotoxic, ecotoxicological and agronomic evaluation. The objective of these sub-actions is to describe the activities carried out and assess, based on the results obtained, the effect of BEWAT NW3 on the composting process, on the produced compost and on its application to fruit crops.

All sub-actions B.4.1, B.4.2, B.4.3, B.4.4 and B.4.5 were conveniently ended, enforcing expected deadlines with no remarkable delays.

Foreseen start date:	September 2019	Actual start date:	April 2019
Foreseen end date:	July 2020	Actual end date:	October 2021

Name of the deliverable	Foreseen deadline	Actual deadline
DL_B.4.1 - Technical environmental report about agronomical advantages using the new coagulant.	31/07/2021	31/10/2021
DL_B.4.2 - Technical environmental report about advantages in the biogas production using the new coagulant.	31/08/2020	31/08/2020
Name of the milestone	Foreseen deadline	Actual deadline
Mn 11 - Improvement in the agronomic quality of the compost derived from the sludge where the study coagulant has been used.	31/07/2021	31/07/2021*
Mn 12 - Improvement in the production of biogas in the sludge where the study coagulant has been used.	31/08/2020	31/08/2020

Table 5. Deliverables and Milestones of Action B4.

* No significant agronomic quality improvement has been found in the compost.

B4.1 Characterization of sludge samples with conventional treatment.

Regardless of the iron content, the sludge produced with and without BEWAT NW3 have very similar characteristics, only observing certain differences in the content of total organic matter (TOM). Thus, in the sludge from the use of BEWAT NW3 a higher average content of TOM is observed than in those that do not use any coagulant (WWTP Lloc Nou) or those that use ferric chloride (WWTP Benigànim and WWTP Ontinyent), which seems logical, since the BEWAT NW3 coagulant is natural based and, therefore, will contribute organic matter to the whole.

B4.2 Composting of sludges.

Once the characteristics of the waste were known, the most favorable mixtures were established for each of the piles according to their nutrient content so that the composting process would develop adequately according to their carbon/nitrogen ratio. Thus, together and at different times, six composting piles of about 8.000 kg each were established, in which the layers of both materials were alternated, mixing them and forming a pyramidal pile. The composting process was different depending on the pile considered, lasting between 160 and 240 days. During the entire process, the temperature evolved adequately, clearly appreciating the thermophilic phase, which began between 16 and 56 days after assembly depending on the pile, and remained above 50 °C for between six and 120 days depending on the pile which guaranteed its sanitation, since for this the temperature must remain around 50-55 °C for 5-7 days or around 55 °C for 3 days.

After the completion of the composting process, samples were taken for the complete analysis of the compost. All compost clearly comply with the heavy metal levels required by RD 1310/1990 (Spanish regulation) in order to be applied to the soil and could also be considered class B 'organic amendment compost' fertilizer products according to RD 999/2017 that regulates it.

B4.3 Determination the ecotoxicological effect of compost on the ground.

After experimentally determine the average data of the germination index (GI) for each of the compost at different times of the process, it is appreciated that the compost with BEWAT from the sludge of the WWTP of Lloc Nou d'en Fenollet and Ontinyent-Agullent get a higher GI than the rest.

Ecotoxicological effects determined by bioassays provide information on the effects of pollutants on parameters of ecological importance such as reproduction or survival of soil organisms. The risk quotient (RQ) allows determining the ecological risk of the pollutant, which will be important when the quotient is greater than one. The ecotoxicity tests carried out show how all the compost analyzed are suitable for agriculture from an ecotoxicological point of view.

B4.4 Assessment of agronomic potential.

Once all the compost was obtained, the agronomic evaluation was carried out, in which it was wanted to know the effect of the application of the compost on the crops compared to a control without fertilization and another with the usual mineral fertilization for the type of crop studied. The crops chosen were sweet orange (*Citrus sinensis* L., var Navelina IVIA7 on Citrange carrizo) and almond (*Prunus dulcis*, var Marcona on S.F.677). The

morphological parameters of each one of them were measured. Thus, rootstock trunk diameter (DP), trunk diameter (DT) and tree height (AP) were measured.

In orange trees, no statistically significant differences were observed between treatments for the increases of the different morphological variables throughout the trial. In the DP it was seen that the greatest increase occurred with the compost from the sludge of the Lloc Nou d'en Fenollet WWTP without BEWAT NW3, while for the DT the increases were very similar for most of the treatments. At the end of the period, the increase in the height of the seedlings (AP) was greater with the mineral fertilization treatment, but without reaching statistical significance.

On the other hand, in the almond trees statistically significant differences were observed in the increases of the morphological variables after the application of the different treatments in the second and third measurements of DT, finding at the end of the trial that the compost from the WWTP sludge de Lloc Nou d'en Fenollet with BEWAT NW3, together with the treatment with FM, were the ones that gave the greatest increase of the same. Although no significant differences were observed between treatments for PA, it was observed that the application of compost from the sludge from the Lloc Nou d'en Fenollet WWTP with BEWAT also resulted in the highest growth in almond trees after the last measure. Finally, both in almond and orange trees, the content of heavy metals was much lower than that established by RD 1310/199020.

The content of the Deliverable **DL_B.4.1**, called “**Technical environmental report about agronomical advantages using the new coagulant**”, refers the assessment of BEWAT products regarding the improvements at an agronomic, phytotoxic or ecotoxicological level on the compost obtained from the sludge generated with these products versus the sludge that has been in contact with ferric chloride.

B4.5 Determination of biomethanation potential.

The objective pursued by this sub-action is to describe the activities carried out and assess, based on the results obtained, the effect of BEWAT NW3 on the anaerobic digestion process in the Ontinyent-Agullent WWTP in terms of biogas production and its composition. The increase in biogas production (Nm^3/day), the contribution of volatile matter and decomposition in the digestion process, as well as the composition of the biogas produced (CH_4 , CO_2 and SH_2) has been evaluated.

The final conclusions were i) during dosage of BEWAT NW3, the average biogas production was $625 \text{ Nm}^3/\text{day}$ and ii) during dosage of ferric chloride, the average biogas production was $374 \text{ Nm}^3/\text{day}$. This way, the use of ECOTAN NW3 was found to increase biogas production by $251 \text{ Nm}^3/\text{day}$. The increase in energy due to the use of BEWAT NW3 would therefore be $368.35 \text{ kWh}/\text{day}$. While the cost of energy used as a reference is $0.1 \text{ euros}/\text{kWh}$, so the use of BEWAT NW3 results in an annual savings due to biogas production of $13,444 \text{ euros}$ in a WWTP with anaerobic digestion similar to the Ontinyent-Agullent WWTP.

All these conclusions are detailed in the Deliverable **DL_B.4.2**, called “**Technical environmental report about advantages in the biogas production using the new coagulant**”, referring the assessment of BEWAT product regarding its impact on the anaerobic digestion process.

B5. General evaluation of the proposed technologies after implementation phase.

Action B5 covers the general evaluation of innovative technology applied to the highly efficient removal of total phosphorus in wastewater from urban and industrial treatment plants. To do this, all the results obtained during the previous actions have been compiled in order to obtain technical, economic and environmental conclusions. These results focus both on the treatment of wastewater and on the recovery process of generated sludge. In this way, the conclusions obtained in this Action assessed the effectiveness of the results achieved from a point of view that allows promoting the circular economy and the intelligent reuse of resources. Additionally, a Life Cycle Assessment (LCA) of the implemented product has been carried out. This analysis includes an environmental balance and life cycle assessment through a tool that evaluates the environmental impacts of the product during the production and delivery stages. This Action was conveniently ended, enforcing expected deadlines with no remarkable delays.

Foreseen start date: January 2021 Actual start date: January 2021
Foreseen end date: August 2021 Actual end date: October 2021

Name of the deliverable	Foreseen deadline	Actual deadline
DL_B.5.1 - Feasibility study for full implementation on an industrial scale.	31/08/2021	31/10/2021
DL_B.5.2 - Technical report of results after the implementation of the technology.	31/08/2021	31/10/2021
DL_B.5.3 - Life Cycle Assessment (LCA).	31/08/2021	31/08/2021
Name of the milestone	Foreseen deadline	Actual deadline
Mn 13 - Compilation and analysis of the results obtained.	31/08/2021	31/08/2021
Mn 14 - Technical, economic and environmental evaluation of the technologies implemented.	31/08/2021	31/10/2021

Table 6. Deliverables and Milestones of Action B5.

The content of the Deliverable **DL_B.5.1**, called “**Feasibility study for full implementation on an industrial scale**”, refers the analysis and the results obtained during the project in order to demonstrate the viability of the new technology. Therefore, this document intends to carry out a feasibility study for the implementation on an industrial scale, obtaining the following conclusions:

- The largest investments have been for the reactor and labor.
- The estimate for national BEWAT sales for 2022 has been € 979,200.
- The gross margin forecast for 2022 has been € 389,615.
- The return on investment (ROI) is estimated to be for early 2024.
- Due to the treasury, it is estimated that in 2023 we will find a balance between profits and losses since in 2022 the treasury is negative but already in 2023 it will be positive, therefore, it is estimated to find the balance in 2023.
- The average price of BEWAT will be 543 €/Tm for 2022.

- The national sales forecast is 1980 €/Tm in 2022.

The content of the Deliverable **DL_B.5.2**, called “**Technical report of results after the implementation of the technology**”, refers the general evaluation of the technology applied for the elimination of total phosphorus in urban WWTPs (Benigànim WWTP and Lloc nou d'en Fenollet WWTP) and urban WWTP with an industrial component (Ontinyent-Agullent WWTP and Canals- L'Alcudia WWTP). During the development of the preceding activities, it has been determined that the use of the BEWAT product has a positive impact on many other points of the treatment line, increasing the efficiency of the WWTP operation, such as sludge dewatering or biogas production. In this report, all the technical and environmental results have been analyzed to give a specific approach to further implementation processes of the new technology.

Finally, the content of the Deliverable **DL_B.5.3**, called “**Life Cycle Assessment (LCA)**”, refers the evaluation of the environmental aspects and impacts of the natural based coagulant, BEWAT NW3, using the Life Cycle Assessment methodology, whose scope ranges from the raw material acquisition as established by formulation until the end of the production process of the product. The main conclusions obtained are summarized below:

- The main category of impact to be considered is "climate change", secondly "resource use, energy carriers". Considering the phases of the life cycle, the contribution to the category of "climate change" impact of the energy consumed in the production process is a hotspot of the system and in particular the use of fuel.
- Regarding the knowledge and interpretation of environmental impact, the component with the greatest contribution in most of the impact categories analyzed, according to the methodology used, is the tannin and secondly the stabilizer. In this context, policies to intervene and improve environmental behavior would be based primarily on trying to reduce CO₂ emissions associated with the life cycle, through actions on energy consumption, as well as on the management of raw material supply and process associated with its extraction.
- Concerning the actions of others, the level of environmental commitment of SERVYECO has been currently transferred to its suppliers in the sense of being able to establish environmental improvement alliances, acting as a leader in the development of new processes with a better environmental result and especially with everything related to the tannin extraction phase. In this sense, a consolidated objective of comparing the environmental behavior of the current product with subsequent developments and improvements of the current product is also established as recommended in different documents and proposals of the Commission and the European Parliament.

B6. Replicability and transferability of the project's results.

The activities included in this action are aimed at replicating and transferring the results of the project to ensure its continuity over time after the end of the project. These tasks are also aimed at making the environmental benefits of the results and conclusions of the project known to the public authorities. The final objective is to demonstrate the technical and economic viability of the existing potential market for natural based coagulants for wastewater treatment in the European area at EU28 level.

All sub-actions B.6.1, B.6.2 and B.6.3 were conveniently ended, enforcing expected deadlines with no remarkable delays.

Foreseen start date: January 2019 Actual start date: January 2019
 Foreseen end date: August 2021 Actual end date: October 2021

Name of the deliverable	Foreseen deadline	Actual deadline
DL_B.6.1 - Report on the strategy defined for the results transfer to target groups and key actors.	31/03/2021	31/03/2021
DL_B.6.2 - Business Plan.	31/08/2021	31/08/2021
DL_B.6.3 - Replication and transferability plan.	31/08/2021	31/10/2021
Name of the milestone	Foreseen deadline	Actual deadline
Mn 15 - Definition of the strategy for the results transfer to target groups and key actors.	31/03/2021	31/03/2021
Mn 16 - Preparation of the necessary documents for the results transfer to target groups and key actors.	30/06/2021	30/06/2021
Mn 17 - Availability of the <i>Business Plan</i> draft.	31/12/2020	31/12/2020
Mn 18 - Availability of the <i>Business Plan</i> final version.	31/08/2021	31/08/2021

Table 7. Deliverables and Milestones of Action B6.

B6.1 Development of specific information and documents for its transferability.

The activities included in this action include the development and preparation of specific documents for the transfer of results, which have managed to promote their replication and/or adoption in other areas and in different European policies.

The regulations for sludge management have been of great importance for the transferability and replicability of the technology in other EU countries, since the product developed allows the sludge obtained to be reused for agricultural use, representing this relevant information for the project. The regulations of France, Germany, Italy and the United Kingdom have been analyzed and evaluated, in comparison with the Spanish one. The standards that have been compared are:

- Regulations that regulate the use of substances for the drinking water and quality of water.
- Regulations for the application of sewage sludge in agriculture.

Regarding the search for key players for their transferability, KOMPASS has been used as a payment database, which has offered outstanding market information on all types of companies. The information obtained has been filtered by country, sector of activity, type

of products and number of workers, among others. Through the information obtained a classification by countries of all the companies that are part of the European Union and that are related to the activities of greatest interest such as water treatment.

All the activities and information have been summarized in the Deliverable **DL B.6.1**, called “**Report on the strategy defined for the results transfer to target groups and key actors**”.

B6.2 Specific strategy on results transferability.

In this action, a replication and transferability plan has been drawn up. Thanks to this, a greater impact of the project has been achieved, offering the new technology developed to various agents and distributors related to the sector. With this, it has been achieved that the technology is replicated or distributed in other countries, both at national and European level.

To carry out the **commercial strategy**, different specific actions have been carried out. The strategy for the transfer of results has focused on holding specific meetings to establish distribution contracts differentiating between distributor and operator. Transfer conferences have also been held in different public and private entities such as the University Jaume I (UJI) or the *Club de Calidad Ceramica*. It has participated in several European fairs such as IFAT and AQUATECH, facilitating the process of disseminating the project and getting new contacts. Finally, additional contacts have been made at the national level, mostly with private companies.

Another point addressed in the replication and transferability plan has been **technical feasibility**. This task has made it possible to affirm and verify the validity and efficiency of the product at a technical and functional level. Various tests have been carried out on an industrial scale in different companies. One of the most notable was carried out in the wastewater treatment facility of an Oil Refinery. In these trials, the BEWAT product was shown to perform better than the current treatment, with a reduction in coagulant of 26% and flocculant of 27%. Another notable test took place in the treatment plant of a Dairy company, using a settling-flotation treatment system. In this case, the ferric chloride was replaced by the new proposed technology, achieving a reduction of the coagulant dose of 49% and of the flocculant of 10%. Finally, another industrial test was carried out in the treatment plant of a slaughterhouse using a flotation treatment system. Here, ferric chloride was replaced by the BEWAT products, achieving a 42% reduction in the coagulant dose. In all these tests, environmental improvements were obtained, achieving the elimination of a toxic and corrosive product, the improvement in the safety of the workers and the reduction of packaging, transport and, consequently, the reduction of the carbon footprint. The breakdown of the amount of project product used for the trials conducted in each of the companies is provided below:

Oil Refinery	Jul 2018
	2.200 kg
Ceramic company	Apr 2021
	3.300 kg
Oil Cleaning company	Apr 2021
	4.400 kg
Glazes and Frits company	May 2021

	4.400 kg
Slaughterhouse company	Jun 2021
	1.100 kg
Dairy company	Jul 2021
	14.000 kg

Table 8. Breakdown of the amount of project product used for the trials.

All the activities and information have been summarized in the Deliverable **DL_B.6.3**, called **“Replication and transferability plan”**.

However, additional 204 Tm of BEWAT products developed in the project for industrial wastewater plants (not included in the project budget) have been manufactured and supplied to different customers. In these cases, coagulant efficiency and economic viability is confirmed because the end users are still ordering these products.

B6.3 Development and planning of a business plan.

The business plan has been structured in different stages, which have been carried out in the different periods established throughout the project. These stages are briefly detailed below.

- The first stage of the business plan was structured in several points i) description of the business, ii) target market and its study, iii) study of the competition, iv) location of the business, v) analysis of the future of the company and vi) future risks to face.
- In the second stage, the vision, mission, objectives, strategies, tactics, SWOT, CAME and commercial, technological, social and legal risks have been developed, in a period of 3 to 5 years. A study has also been made of the legislation applied by each member country of the EU28 regarding urban and industrial wastewater treatment, discharges, sludge management and its possible reuse. Finally, the variables of use, distribution of chemical products, recovery and technologies for the reuse of phosphorus have been taken into account.
- In the third stage, the entire part corresponding to marketing, product description, market analysis, competition analysis (always comparing with the variables established in our description), marketing mix (4ps), digital marketing, calendar has been carried out of shares, pricing and financial viability.
- In the fourth stage, the production and sales plan has been defined, the manufacture of the product range, necessary human resources, investments, quality management and growth strategy have been determined.
- In the fifth stage, the organization and human resources that have been required to carry out the entire business plan, promoter team, organization chart contemplating production, administration, technical, commercial and marketing assistance have been established. The involvement of the project partners and the subcontracting of an external consultant have also been defined.
- In the sixth stage, the actions to be carried out in the legal-fiscal area, the legal aspects, contracts, technology transfer and patents have been described. Likewise, the subcontracting of an external consultancy specialized in international law has been valued. Additionally, the tax forms and obligations, labor obligations, permits and licenses have been defined.
- In the seventh stage, the economic and financial aspects to be taken into account, investment plan, financing plan, system of customer collections and payment to

suppliers, treasury budget, forecast of the income statement, balance sheet, point balance and profitability ratios.

All the activities and information have been summarized in the Deliverable **DL_B.6.2**, called “**Business Plan**”.

C1 Monitoring and evaluation of the impact of Project actions.

The monitoring and evaluation of the communication strategy and technical objectives allows assessing its effectiveness, correcting it if necessary in order to achieve the aims defined in the Project proposal. In this way, Action C1 periodically analyzed the results achieved. This Action was conveniently ended, enforcing expected deadlines with no remarkable delays.

Foreseen start date: September 2017 Actual start date: September 2017
 Foreseen end date: August 2021 Actual end date: October 2021

Name of the deliverable	Foreseen deadline	Actual deadline
DL_C.1.1 - Periodic follow-up document.	30/09/2018	30/09/2018
DL_C.1.2 - Periodic follow-up document.	30/09/2019	30/09/2019
DL_C.1.3 - Periodic follow-up document.	30/09/2020	30/09/2020
Name of the milestone	Foreseen deadline	Actual deadline
Mn 19 - Periodic information provided by the participants.	31/10/2018	31/10/2018
Mn 20 - Periodic information provided by the participants.	31/10/2019	31/10/2019
Mn 21 - Periodic information provided by the participants.	31/10/2020	31/10/2020

Table 9. Deliverables and Milestones of Action C1.

The development of this Action was also carried out through the **monitoring indicators**. Those selected for this project will be taken into account in the "LIFE Project Specific Indicators - Call 2016" table, being of three types: i) Environmental, ii) Technical and iii) Dissemination. The specific communication indicators have been updated through the "on line" tool set defined by the European Commission. The last update and validation of the tool information was carried out just before the Final Report. Please, find further specific information about Key Project-level Indicators in Section 7 of the Final Report.

As **references**, the periodic documents about the development of the project sent by each one of the partners has been used, as well as the contacts with them and the periodic visits to the points in which the actions of the Project have been carried out.

Regarding the **reports**, three follow-up documents were issued and sent with the first report, the intermediate report and the final conclusions report. These reports are defined in the following deliverables, conveniently completed and attached:

DL_C.1.1 - Periodic follow-up document. Deadline Sep18
 DL_C.1.2 - Periodic follow-up document. Deadline Sep19
 DL_C.1.3 - Periodic follow-up document. Deadline Sep20

C2 Evaluation of the social and economic impact of the Project.

In this action, a study was carried out on the socioeconomic impact of the project, evaluating the achievement of its objectives and results in terms of its social perception and its impact on the local economy where the project is developed. This objectively analyzes the impact of the project in terms of the initial situation and the achievements made in these aspects in its development. This Action was conveniently ended, enforcing expected deadlines with no remarkable delays.

Foreseen start date: March 2021 Actual start date: March 2021
 Foreseen end date: August 2021 Actual end date: October 2021

Name of the deliverable	Foreseen deadline	Actual deadline
DL_C.2.1 - SROI Report.	31/08/2021	31/08/2021
DL_C.2.2 - Economic evaluation of the proposed technology.	31/08/2021	31/10/2021
Name of the milestone	Foreseen deadline	Actual deadline
Mn 22 - Subcontracting of the report and activities start.	30/04/2019	30/04/2019

Table 10. Deliverables and Milestones of Action C2.

To this end, the method known as the “social return on investment” (SROI) is used. This concept is based on the effects obtained to understand the creation of social, environmental and economic value of an organization, which is a method for planning, measuring and evaluating the social objectives of an organization. This report is reflected in the deliverable **DL_C.2.1** named “**SROI Report**”, duly completed and attached.

On the other hand, this action has carried out a comparison of the socioeconomic impact generated by the proposed solution compared to other technologies currently used. For this, data related to the cost of the treatment of other technologies compared to that of the proposed solution, the waste generated after the treatment and its management cost or the investment and maintenance costs of the compared technologies, among others, have been collected. All this information has been summarized in the Deliverable **DL_C.2.2** named “**Economic evaluation of the proposed technology**”, duly completed and attached.

D1 Public awareness and results dissemination.

The tasks included in this action aim to provide information about the Project, in the LIFE Program context, including participation/financing of the EU in its development and results.

Additionally, added value at European level, from the point of view of transferability, creation of synergies and integration, is truly described in this action. This way,

extension/replication of the results/conclusions is also conveniently publicized and promoted at European level to target audiences and interested parties.

This action is currently finished with no delay.

Foreseen start date: September 2017 Actual start date: September 2017
 Foreseen end date: August 2021 Actual end date: August 2021

Name of the deliverable	Foreseen deadline	Actual deadline
DL_D1.1 - Document <i>Communication Plan</i> .	28/02/2018	28/02/2018
DL_D1.2 - Project website.	28/02/2018	28/02/2018
DL_D1.3 - Edition of diffusion material (posters, brochures and leaflets).	31/12/2018	31/12/2018
DL_D1.4 - Layman Report.	31/08/2021	31/10/2021
Name of the milestone	Foreseen deadline	Actual deadline
Mn 23 - Preparation of the <i>Communication Plan</i> .	30/11/2017	28/02/2018
Mn 24 - Domain, logo and project website design.	30/11/2017	28/02/2018
Mn 25 - Preparation of the <i>Layman Report</i> .	31/08/2021	31/10/2021

Table 11. Deliverables and Milestones of Action D1.

The dissemination and communication activities have been developed through several Sub-tasks:

- a. Communication plan.
It has been conveniently finalized and has been updated regularly.
- b. Diffusion pack.
 - i. Creation of corporate image and project website.
This task is complete. The project website (www.lifenewest.eu) is operational and has been updated based on available information / progress. Continuous SEO improvement actions detailed.
 - ii. Project PPT presentation.
A presentation has been created that has been used in the dissemination / presentation actions of the project.
 - iii. Information panels.
A first information panel has been designed in June 2018 with the description of the project, objectives and work plan. Each of the partners has a copy. In July 2019, the second information panel was designed with updated content on the actions of the project. In September 2020, the third information panel was designed with updated content on the progress of the project. In July 2021, the last information panel was held with all the conclusions and results of the project.
 - iv. Roller up.

Already made and available, was presented at consortium meetings and other dissemination actions. In September 2020 a second edition of roll up has been designed.

- c. Edition and publication of dissemination materials of an informative nature.
A USB with information on the project has been prepared for distribution at Fairs such as IFAT 2018 and AQUATECH 2019. Four triptychs have been designed, the first with the presentation of the project (May 2018), the second with the progress made during its development (May 2019), the third includes all the news and advances obtained during the subsequent months (September 2020). The last triptych of the project with the final conclusions was made in July 2021. A second version of the USB has been made to disseminate it at events and visits to clients. In October 2020, a promotional video of the project was made, publicizing the facilities, treatment plants and all the team that is part of it. The video was finished in November and it began to be broadcast at events and RRSS. In October, the third edition of USB was held, to carry out the dissemination with our clients.
- d. Scientific and technical publications.
Technical publications have been made in the following media: iAqua, TecnoAqua, FuturENVIRO, Biodiversity, Aguasresiduales.info and ENERGIAS RENOVABLES. In addition, there are 11 publications about the project made by GOMSA. 3 technical publications have been made in FUTUR ENVIRO.
- e. Information in online media and traditional media.
Twitter: A total of 50 tweets, 123 retweets, 150 new followers, 2,854 profile views and 117,061 impressions have been posted.
Facebook: A total of 72 posts have been made.
Instagram: 42 publications have been made with an average of 11 "likes".
News about the project has been published in: Spain News, esdiario, TheWorld News, 20minutos, Valencia Noticias, Economia3.com, LA VANGUARDIA, Valencian economic newspaper, ComarcalCV, ACTUALITAT DIARIA, the digital newspaper of Castellón and LA RAZÓN CV. In addition, there are 30 publications about the project made by GOMSA.
- f. Communication / dissemination actions including congresses, fairs, exhibitions and participation in Green Week.
It has participated in the IFAT 2018 fair, held in Munich. This fair has an international character, focused on the environment and water treatment sector, where the project has been presented. In November 2019 the project was presented at AQUATECH (Amsterdam), the world's leading fair in water treatment for processes, drinking water and wastewater. In this way, the project and all the advances made so far were made known. In October 2019, we participated in the EFIAQUA fair to publicize the project. There, a presentation was made on the replacement of inorganic coagulants in WWTP with natural organic coagulants for the precipitation of phosphorus. In January 2020, we participated in the Life Waste-water treatment platform meeting in Barcelona. There it was disseminated along with a large number of LIFE projects. In May 2020 it was planned to participate in IFAT 2020 in Munich but the fair was canceled due to COVID. In June 2020, it was planned to attend the European Sustainable Phosphorus Conference ESPC4 in Vienna, being postponed to May 2021. There, a virtual presentation called "New Urban Wastewater Treatment Based on Natural Coagulants" was given. On October 15, 2020, the LIFE Renaturwat Project Kick off took place and the LIFE NEWEST Project was presented within the GO projects. In November 2020, we participated in the Highlights Fair, this time all the stands were part of the event virtually. Each

exhibitor connected to the Fair Platform and accessed their virtual stand where they hung their dissemination material, catalogs and videos. On December 1, 2020, the final conference of the LIFE Bactiwater Project was participated in, within the projects carried out by GO, where the LIFE NEWEST project was presented. On December 2, 2020, they participated in the final Workshop of the LIFE Dreamer Project along with other LIFE projects. There the project and the latest advances made so far were presented. On February 24, 2021, a specific dissemination day was held for AQUALIA. On June 10, 2021, we participated in a Green Week workshop. On July 29, 2021, the last Networking day was organized with other LIFE projects.

In summary, this Action has been started and ended in accordance with the schedule detailed in the approved proposal. Additionally, the project website has been launched within the deadlines. The project profile in social media has been launched and followed. Aside from this matter, easily remedied, further difficulties in the development of this activity have not been detected.

D2 Networking with other projects.

This Action is focused on information exchange with others LIFE Program projects (or other European/national programs) in order to exchange experiences and improve the replication capacity of the activities carried.

This action is currently finished with no delay.

Foreseen start date:	September 2017	Actual start date:	September 2017
Foreseen end date:	August 2021	Actual end date:	October 2021

Name of the deliverable	Foreseen deadline	Actual deadline
DL_D2.1 – <i>Networking</i> results final report.	31/08/2021	31/10/2021
Name of the milestone	Foreseen deadline	Actual deadline
Mn 26 - Contacts with projects. Summary.	30/09/2018	30/09/2018

Table 12. Deliverables and Milestones of Action D2.

Regarding the selection of related projects, the following list has been summarized:

- LIFE SmartWater.
Demonstration of smart actuators to reduce water losses and energy consumption in water supply infrastructures in Europe (LIFE16ENV/DE/000550).
- LIFE B2E4sustainable.
WWTP New concept for energy self-sustainable wastewater treatment process and biosolids management (LIFE16ENV/GR/000298).
- Remedia LIFE.
REmediation of Marine Enviroment and Development of Innovative Aquaculture: exploitaiton of edible/not edible biomass (LIFE16ENV/IT/000343).
- LIFE DeNTreat.
Decentralized innovative treatment of ammonium-rich urban wastewater (LIFE16 ENV/IT/000345).

- LIFE LESSWATT.

Innovative wireless tool for reducing energy consumption and GHGs emission of water resource recovery facilities (LIFE16ENV/IT/000486).

- LIFE AGUEDA.

Conservation and management actions for migratory fish in the vouga river basin (LIFE16 ENV/PT/000411).

- LIFE CLEAN UP.

Validation of adsorbent materials and advanced oxidation techniques to remove emerging pollutants in treated wastewater (LIFE16ENV/ES/000169).

- LIFE ALGAECAN.

Adding sustainability to the fruit and vegetable processing industry through solar-powered algal wastewater treatment (LIFE16ENV/ES/000180).

- LIFE ECOGRANULARWATER.

Demonstration project for ground water treatment with an innovative system based in aerobic granular technology (LIFE16 ENV/ES/000196).

- LIFE DEMINE.

Decreasing the environmental impact caused by abandoned mines on water bodies (LIFE16 ENV/ES/000218).

- LIFE DREAMER.

Demonstration of an environmentally-friendly desalination system concept: transforming seawater into valuable resources (LIFE16 ENV/ES/000223).

- LIFE-DRY4GAS.

Waste Water sludge solar DRYing FOR energy recovery through gasification GAS (LIFE16 ENV/ES/000342).

- LIFE BACTIWATER.

An environmental cost-effective activation treatment for biological failures in WWTP (LIFE16 ENV/ES/000390).

- LIFE DIME.

Demonstration of an Innovative technology for the Minimization of the Environmental impact of metal finishing processes (LIFE16ENV/ES/000410).

- LIFE LIBERNITRATE.

Responsible reduction of nitrates in the comprehensive water cycle (LIFE16 ENV/ES/000419).

- LIFE ALCHEMIA.

Toward a smart & integral treatment of natural radioactivity in water provision services (LIFE16 ENV/ES/000437).

- LIFE WATER WAY.

Creating a new concept of natural drinking fountains and demonstrating its viability along stjames' way(LIFE16 ENV/ES/000533).

- LIFE TECMINE.

Innovative techniques for Facies Weald and Utrillas mine restoration (LIFE16 ENV/ES/000159).

- LIFE IN BRIEF.

Integrated business model for turning Bio-waste and sewage sludge into renewable energy and agri-urban Fertilizers (LIFE14 ENV/ES/000427).

- LIFE ENRICH.

Enhanced Nitrogen and phosphorus Recovery from wastewater and Integration in the value Chain (LIFE16 ENV/ES/000375).

- LIFE NANOBUBBLES.

Demonstrating Nanobubbles Technology for more Sustainable and Efficient Urban Wastewater Treatment (LIFE17 ENV/ES/000434).

- LIFE ULISES.

Upgrading wastewater treatment plants by Low cost Innovative technologies for energy SELF-Sufficiency and full recycling (LIFE18 ENV/ES/000165).

- LIFE RENATURWAT.

Integrating circular economy and biodiversity in sustainable wastewater treatments based on constructed wetlands (LIFE19 ENV/ES/000197).

- LIFE WETLANDS4CLIMATE.

Mediterranean Wetlands Management and Restoration as Carbon Sinks (LIFE19 CCM/ES/001235).

In the networking actions, communication channels have been created with all these projects. The creation of a group of projects to held regular meetings has been performed. This way, the exchange of information/conclusions/experiences has been conveniently ensured by this mandatory activity in LIFE Program. The first networking day with this group took place at the SERVYECO facilities in June 2018. On the second networking day, 3 new projects were incorporated into the group (PALUDICOLA, IN BRIEF and TECMINE). On this occasion, it was organized by Global Omnium and took place at its GO HUB facilities (Valencia) in April 2019. The third networking day begins, being the online meeting in this case to facilitate the interaction of the participants. The conference was held on November 12, 2020, together with the projects of previous conferences and two new projects that were joined in this edition. The last networking day was held on July 27, organized by SERVYECO and in online format.

In summary, this Action has been initiated and ended in accordance with the schedule presented in the approved proposal.

E1 Project management.

This Action aims to ensure the development of the project is carried out accorded with the content of the approved proposal, the signed contract with the Commission and the Common Provisions of the LIFE Program. For this purpose, a project management team under the supervision of the beneficiary-coordinator and the support of the technical assistance, subcontracted for this purpose, has been created. This team has been responsible of the development and execution of the technical, financial and administrative aspects of this task. This Action was conveniently ended, enforcing expected deadlines with no remarkable delays.

Foreseen start date:	September 2017	Actual start date:	September 2017
Foreseen end date:	August 2021	Actual end date:	October 2021

Name of the deliverable	Foreseen deadline	Actual deadline
DL_E1.1 - Consortium Agreement.	28/02/2018	28/02/2018
DL_E1.2 - Consortium meeting minutes.	30/11/2017	30/11/2017
DL_E1.2 - Consortium meeting minutes.	28/02/2018	28/02/2018

DL_E1.2 - Consortium meeting minutes.	31/08/2018	31/08/2018
DL_E1.2 - Consortium meeting minutes.	28/02/2019	28/02/2019
DL_E1.2 - Consortium meeting minutes.	31/08/2019	31/08/2019
DL_E1.2 - Consortium meeting minutes.	29/02/2020	29/02/2020
DL_E1.2 - Consortium meeting minutes.	31/08/2020	31/08/2020
DL_E1.2 - Consortium meeting minutes.	28/02/2021	30/09/2021
DL_E1.4.1 - Update of the indicators in the <i>LIFE project performance indicator table</i> .	31/05/2018	31/05/2018
DL_E1.4.2 - Update of the indicators in the <i>LIFE project performance indicator table</i> .	30/04/2019	30/04/2019
DL_E1.4.3 - Update of the indicators in the <i>LIFE project performance indicator table</i> .	30/06/2020	30/06/2020
DL_E1.4.4 - Update of the indicators in the <i>LIFE project performance indicator table</i> .	31/08/2021	31/10/2021
Name of the milestone	Foreseen deadline	Actual deadline
Mn 27 - Signature of the Consortium Agreement.	30/11/2017	30/11/2017
Mn 28 - Consortium meetings.	30/11/2017	30/11/2017
Mn 28 - Consortium meetings.	28/02/2018	28/02/2018
Mn 28 - Consortium meetings.	31/08/2018	31/08/2018
Mn 28 - Consortium meetings.	28/02/2019	28/02/2019
Mn 28 - Consortium meetings.	31/08/2019	31/08/2019
Mn 28 - Consortium meetings.	29/02/2020	29/02/2020
Mn 28 - Consortium meetings.	31/08/2020	31/08/2020
Mn 28 - Consortium meetings.	28/02/2021	30/09/2021

Table 13. Deliverables and Milestones of Action E1.

The management team has been established the appropriate procedures to ensure the progress of the different actions of the project, as well as appropriate mechanisms for the execution and supervision of all activities included in the project as planned in the schedule. The execution of this Action has been carried out through several activities:

- a) Establishment of the project management team.
- b) General management of the project by the beneficiary-coordinator and associated beneficiaries.
- c) Financial management of the project by the beneficiary-coordinator and associated beneficiaries.
- d) Administrative and documentary management of the project by the coordinating beneficiary and associated beneficiaries.
- e) Periodic monitoring of project indicators.

Technical reports have been compiled (both deliverables and internal reports) for assessment and monitoring purposes. All the partners have been conveniently monitored to periodically report the actions carried out. All the meetings that have been held include the (reviewed) minutes with the crucial points discussed, as well as suggestions, etc.

It should be noted that in this action 8 deliverables, designated as DL_E1.3, were included by mistake in the application when dumping the information of the draft. Elimination of these deliverables was approved by the EC in its EASME reference letter B3/SM/FJHO D (2018) 1661479. No difficulties or incidents that may negatively affect the development of the action are expected.

E2 Development project supervision.

This action aims to assess and document the progress and development of the Project, in order to ensure that it complies with the provisions of the contract, signed with the EC, both from an administrative-financial and technical point of view. This way, the development of the project needs to strictly correspond to the approved proposal, being executed in accordance with the guidelines that regulate the LIFE Program. This Action was conveniently ended, enforcing expected deadlines with no remarkable delays.

Foreseen start date:	September 2017	Actual start date:	September 2017
Foreseen end date:	August 2021	Actual end date:	August 2021

Name of the deliverable	Foreseen deadline	Actual deadline
DL_E2.1 - First Supervision Report.	31/05/2018	31/05/2018
DL_E2.2 - Successive Supervision Report.	31/07/2018	31/07/2018
DL_E2.2 - Successive Supervision Report.	31/01/2019	31/01/2019
DL_E2.2 - Successive Supervision Report.	31/07/2019	31/07/2019
DL_E2.2 - Successive Supervision Report.	31/01/2020	31/01/2020
DL_E2.2 - Successive Supervision Report.	31/07/2020	31/07/2020
DL_E2.2 - Successive Supervision Report.	31/01/2021	31/01/2021
Name of the milestone	Foreseen deadline	Actual deadline

Mn 29 - Meetings / Follow-up contact.	30/04/2018	30/04/2018
Mn 29 - Meetings / Follow-up contact.	31/07/2018	31/07/2018
Mn 29 - Meetings / Follow-up contact.	31/01/2019	31/01/2019
Mn 29 - Meetings / Follow-up contact.	31/07/2019	31/07/2019
Mn 29 - Meetings / Follow-up contact.	31/01/2020	31/01/2020
Mn 29 - Meetings / Follow-up contact.	31/07/2020	31/07/2020
Mn 29 - Meetings / Follow-up contact.	31/01/2021	31/01/2021

Table 14. Deliverables and Milestones of Action E2.

Each of the partners' consortium has been subcontracted IGES (experienced entity in LIFE program, LIFE+ and the new LIFE Program) to carry out independent monitoring and supervision procedures, in order to evaluate the development of the activities established in the approved proposal.

In summary, a detailed protocol to monitor the progress and development of the project has been already included in the deliverable attached. Reports and status documents redacted by the partners have been used as supporting documentation.

E3 After LIFE Plan.

This action seeks to propose a realistic strategy and action plan to ensure that the technical continuity of the project, which will be maintained in the medium/long term, with the purpose of exploiting its results in accordance with the Strategy of Marketing, Business Plan and Transferability Strategy included in Action B6. This Action was conveniently ended, enforcing expected deadlines with no remarkable delays.

Foreseen start date:	March 2021	Actual start date:	March 2021
Foreseen end date:	August 2021	Actual end date:	October 2021

Name of the deliverable	Foreseen deadline	Actual deadline
DL_E3.1 - Document <i>After LIFE Plan</i> .	31/08/2021	31/10/2021
Name of the milestone	Foreseen deadline	Actual deadline
Mn 30 - Realization of the <i>After LIFE Plan</i> .	31/08/2021	31/10/2021

Table 15. Deliverables and Milestones of Action E3.

In addition, current Action is about communicating and disseminating the results and conclusions reached and the lessons learned after its completion. The communication strategy and dissemination activities after the project execution period have been established taking into account not only the results and conclusions reached but also the

conclusions of Action D, serving as a guide for the design of the approaches and activities reflected in the "**After LIFE Plan**" (Deliverable **DL_E3.1**).

6.2 Main deviations, problems and corrective actions implemented.

The project has being executed as scheduled and finished on August 2021 according to calendar, even some reports and deliverables were ended during September and October. **No major problems or deviations have been encountered.** There has not been any significant modification neither in the financial nor in technical aspects of the project. However, slight variations in some tasks duration occurred.

During the *Action B.1*, regarding the quality control and standard values verification process it was decided to launch the REACH registration process, needed to finally sell the new product along Europe. Chemical characterization of the natural based product was the first step in the registration process. Additionally, it was truly important to define the degree of dangerousness of the product. Reviewing the reactants used during the activation chemical reaction, residual formaldehyde value was established as a critical value. Accordingly, INESCOP research centre was selected to perform a specific chemical analysis procedure to determine free formaldehyde values in the new product. This way, reaction times and reactants ratio were conveniently modified in order to minimize residual values of free formaldehyde in the new synthesized product. Several samples, synthesized at semi-industrial scale level using the brand new premix reactor, were accordingly characterized. In order to classify the new product as not dangerous, all the dangerous components and residual reactants content should be below 0,1%.

At this point, two different issues appeared:

- a) Analytical values of residual formaldehyde were still slightly over 0,1%, so the product should be classified as dangerous.
- b) REACH registration process would delay the start of the industrial scale production, probably delaying the following actions B.2, B.3, B.4 and B.5.

For those reasons, it was decided to continue these tasks but additionally aboard a different approach consisting in developing an alternative new natural product, based on blending, that can:

- Reach the values of phosphorus removal efficiency established in the proposal.
- Contain only raw materials i) lacking formaldehyde, in order to treat the final product as non dangerous, and ii) already registered in REACH.

This alternative development was successfully performed on time. Even this technical modification has slightly delayed the supply of raw materials for the manufacture process of the new product (*Action A.1.1*), previous experiences carried out in this task to date regarding the original synthetic process, were crucial in order to minimize the delay. This way, following actions B.2, B.3, B.4 and B.5 started as originally planned. In addition to that, the impact of this deviation enhanced the outcomes of the project, while two different natural based coagulants were finally implemented, obtaining positive results with both treatments as vastly described in the deliverables.

As previously mentioned, during Action A1.1 (production plant design and built up) minor additional technical adjustments were performed, compared to the planning defined in the proposal. Previous semi-industrial scale tests have been done to facilitate the startup process from laboratory to industrial scale and to confirm the results of coagulant efficiency previously reached. Accordingly, technical modification has slightly delayed the supply of raw materials for the manufacture process of the new product. Previous experiences carried out in this task, regarding the original synthetic process, have been crucial in order to minimize the current delay. Please, refer to chapter 6.1 for the detailed description of the progress by the action.

Regarding urban wastewater implementation, BEWAT dosages were higher than expected, negatively affecting the economic viability for this specific application. Further technical values can be found on KPIs deliverables attached (DL_E.1.4.4). Additionally,

BEWAT products could not completely replace the use of ferric chloride in the physico-chemical precipitation of chromium. The maximum ferric chloride reduction achieved by using BEWAT products was close to 50% (See deliverable DL_B.3.3 attached).

No other problems or difficulties were found, not affecting the project's implementation or the timely completion of the project.

6.3 Evaluation of Project Implementation.

Regarding the success of the **methodology applied, the results of the actions and its cost-efficiency**, it is crucial to remind it is a demonstration project. It evaluates and disseminates a new chemical technology, based on the use of natural based coagulants, to eliminate specific pollutants such as phosphorus, in urban and industrial wastewater. This technology is easily applicable at a European and global level, since the characteristics of urban wastewater do not differ too much depending on its geographical location. After the implementation of the technology, corrosive and environmentally disrespectful products such as ferric chloride would no longer be used. Throughout the project, the following full-scale methodology has been used:

- Synthesis of the natural coagulant on a full scale in a 5 ton reactor from a new synthesis procedure, in order to produce an innovative product focused on the elimination of phosphorus in the secondary treatment of wastewater. The production capacity has been 30 tons per month of organic polymer, for 35 months. In addition, the industrial-scale production process has been optimized and possible methods of quality control and safety for workers have been determined. This activity is critical and necessary to carry out the development of new technologies and the manufacture, sale and application of chemical products for the wastewater treatment.
- Real-scale determination of the coagulation efficiency of the products developed. This efficiency has been compared with that of the products currently used in order to confirm the technical and economic advantages previously described. Very positive experimental results have been obtained regarding the elimination of total phosphorus in wastewater, reaching the same levels of elimination using a natural based product and avoiding the use of a corrosive product such as ferric chloride. The full-scale production of the new coagulant has been able to feed the Lloc nou d'en Fenollet, Beniganim, Ontinyent and Canals treatment plants during the implementation phase. The exploitation of these plants has been managed throughout the project, conveniently monitoring the experimental results obtained. This way, the

sludge generated under these conditions during the demonstration phase has served as a substrate for the subsequent validation carried out during Action B4. This activity is critical and necessary to validate the technology on a full scale, confirming the technical and economic advantages of the product.

- Marketing of the technology at European level through SERVYECO and other potential distributors. These commercial partners have collaborated in the implementation of the technology in new European facilities, by controlling and monitoring the results obtained. The commercial working procedure has been to carry out a first industrial test at no cost to the end customer and, once implemented, to start buying the product. This action is the consequence of the other two and constitutes the final objective of the project, generating benefits from an innovative and environmentally friendly development. This way, SERVYECO has generated remarkable revenues even before the end of the project, as reflected in the Financial Statement.
- Dissemination of the results obtained throughout the project to a large number of interest groups at national and international level. These dissemination activities, described in action D1, are necessary to provide information about the project and its results, as well as the enhancement of them at the European level. Consortium partners, through their extensive network of clients and managed facilities, become potential indirect users of the validated technology.

Regarding the results achieved against the objectives and expected results foreseen in the proposal, the following table compares the actions implemented in the frame of the project, including main objectives and expected/obtained results:

Action	Foreseen in the revised proposal	Achieved	Evaluation
A1. Preparatory actions for industrial production and demonstration phase. Stakeholders identification.	<p><u>Objectives</u></p> <ul style="list-style-type: none"> - Production plant design and built up. - Planning and end user facilities adaptation. - Identification of stakeholders and key actors. <p><u>Expected Results</u></p> <ul style="list-style-type: none"> - Production plant ready to start up. - End user facilities modified. - Stakeholders/key actors listed. 	YES	SUCCESS! Expected results achieved, no additional comments to report.
B1. Industrial scale production of natural based coagulants and procedure validation.	<p><u>Objectives</u></p> <ul style="list-style-type: none"> - Production plant start-up. - Fine tuning and optimization of the production process. - Quality control and standard values verification. - Technical validation of coagulant efficiency. <p><u>Expected Results</u></p> <ul style="list-style-type: none"> - Production plant started up. - Production process optimized (239 Tm). - Quality control verified. - Coagulant efficiency assessed. 	YES	SUCCESS! Two different products manufactured, generating just a slight delay (See action B1 summary for further details).

<p>B2. Industrial validation of natural based coagulant efficiency in urban wastewater treatment plants.</p>	<p><u>Objectives</u></p> <ul style="list-style-type: none"> - Industrial demonstration in urban wastewater Lloc nou d'en Fenollet. - Industrial demonstration in urban wastewater Beniganim. <p><u>Expected Results</u></p> <ul style="list-style-type: none"> - Industrial scale validation of natural based coagulant efficiency in Lloc nou d'en Fenollet (12 months). - Industrial scale validation of natural based coagulant efficiency in Beniganim (14 months). 	<p>YES</p>	<p>SUCCESS!</p> <p>Complete substitution of Ferric Chloride. BEWAT products were complied with the phosphorus limits established in the discharge authorization (See action B2 summary for further details).</p>
<p>B3. Industrial validation of natural based coagulant efficiency in industrial wastewater treatment plants</p>	<p><u>Objectives</u></p> <ul style="list-style-type: none"> - Industrial demonstration in urban wastewater Ontinyent. - Industrial demonstration in urban wastewater Canals, phosphorous removal. - Industrial demonstration in urban wastewater Canals, chromium removal. <p><u>Expected Results</u></p> <ul style="list-style-type: none"> - Industrial scale validation of natural based coagulant efficiency in Ontinyent (8 months). - Industrial scale validation of phosphorous removal efficiency of BEWAT products in Canals (11 months). - Industrial scale validation of chromium removal efficiency of BEWAT products in Canals. 	<p>PARTLY</p>	<p>PARTIALLY SUCCESS</p> <p>Complete substitution of Ferric Chloride in Ontinyent and Canals for phosphorous removal (Partial substitution for chromium removal). BEWAT products were complied with the limits established in the discharge authorization (See action B3 summary for further details).</p>
<p>B4. Sludge evaluation procedure for its biomethanation and reutilization in agriculture.</p>	<p><u>Objectives</u></p> <ul style="list-style-type: none"> - Characterization of sludge samples with conventional treatment. - Composting of sludges. - Determination the ecotoxicological effect of compost on the ground. - Assessment of agronomic potential. - Determination of biomethanation potential. <p><u>Expected Results</u></p> <ul style="list-style-type: none"> - Sludge characterization for comparison. - Sludges composted for futher analysis. - Ecotoxicological effect of 	<p>YES</p>	<p>SUCCESS!</p> <p>Complete characterization of generated sludges and composts. Assessment of ecotoxicological effect and agronomic/biomethanation potential. (See action B4 summary for further details).</p>

	<p>compost determined.</p> <ul style="list-style-type: none"> - Agronomic potential comparison. - Biomethanation potential assessment. 		
B5 General evaluation of the proposed technologies after implementation phase.	<p><u>Objectives</u></p> <ul style="list-style-type: none"> - Technical, economic and environmental assessment of the innovative technology implemented. <p><u>Expected Results</u></p> <ul style="list-style-type: none"> - Implementation results summary and complete evaluation of the technology validated at industrial scale. 	YES	<p>SUCCESS!</p> <p>Expected results achieved, no additional comments to report.</p>
B6 Replicability and transferability of the project's results.	<p><u>Objectives</u></p> <ul style="list-style-type: none"> - Development of specific information and documents for its transferability. - Specific strategy on results transferability. - Development and planning of a Business Plan. <p><u>Expected Results</u></p> <ul style="list-style-type: none"> - Creation of specific documents and strategy for results transferability. Potential market study. - A detailed Business Plan. 	YES	<p>SUCCESS!</p> <p>Expected results achieved, even direct revenues accomplished before the end of the project.</p>
C1 Monitoring and evaluation of the impact of project actions.	<p><u>Objectives</u></p> <ul style="list-style-type: none"> - Assessment of the project actions impact. <p><u>Expected Results</u></p> <ul style="list-style-type: none"> - Periodic reports monitoring the impact of project actions. 	YES	<p>SUCCESS!</p> <p>Expected results achieved, no additional comments to report.</p>
C2 Evaluation of the social and economic impact of the project.	<p><u>Objectives</u></p> <ul style="list-style-type: none"> - Assessment of the social and economic impact of the project. <p><u>Expected Results</u></p> <ul style="list-style-type: none"> - SROI Report. - Economic assessment of the technology implemented. 	YES	<p>SUCCESS!</p> <p>Expected results achieved, no additional comments to report.</p>
D1 Public awareness and results dissemination.	<p><u>Objectives</u></p> <ul style="list-style-type: none"> - Dissemination of the project results. <p><u>Expected Results</u></p> <ul style="list-style-type: none"> - Communication plan development. - Design and update of the project website. - Design and publishing of diffusion products, including posters, brochures and leaflets. - Layman Report. 	YES	<p>SUCCESS!</p> <p>Expected results achieved, no additional comments to report.</p>
D2 Networking with	<p><u>Objectives</u></p>	YES	<p>SUCCESS!</p>

other projects.	- Networking with related projects. <u>Expected Results</u> - Report summarizing the projects networked and synergies appeared.		Expected results achieved, no additional comments to report.
E1 Project management.	<u>Objectives</u> - Ensure the correct project management. <u>Expected Results</u> - Proper project management. - Consortium agreement. - Partners meetings and discussions.	YES	SUCCESS! Expected results achieved, no additional comments to report.
E2 Development project supervision.	<u>Objectives</u> - Project development monitoring. <u>Expected Results</u> - Periodic reports monitoring the proper development of the project.	YES	SUCCESS! Expected results achieved, no additional comments to report.
E3 After LIFE Plan.	<u>Objectives</u> - Development of After LIFE Plan. <u>Expected Results</u> - “After LIFE Plan” Report.	YES	SUCCESS! Expected results achieved, no additional comments to report.

Table 16. Main objectives and results of implemented actions.

6.4 Analysis of benefits.

In this section, the project’s conclusions focusing on the results achieved have been discussed. Significant deviations from the targets initially set have been explained, specifying different targets. Several references to the final Indicators (KPIs) have been included.

1. Environmental benefits.

a. Direct/quantitative environmental benefits.

Chemicals substitution, removing dangerous coagulants

At the end of the project, implementation of natural based coagulants in 4 different urban wastewater treatment facilities has been succeeded. Impact has been conveniently estimated based on real consumption in EGEVASA/GOMSL implemented urban wastewater treatment plants. Accordingly, **239 Tm of dangerous ferric chloride** have been substituted by natural based coagulants in the implementation facilities along the project.

In addition to that, 204 tons of natural based coagulants have been manufactured for replication activities in 14 industrial wastewater treatment plants (1 year replication period). While overall dose reduction is 28,67%, **286 Tm of dangerous inorganic salts** have been substituted.

Analysis of the performance of phosphorus removal

The following table summarizes the results obtained for the chemical precipitation of phosphorus in the study WWTPs using only the BEWAT product or ferric chloride.

WWTP	Coagulant	Dosage (mg/l)	P limit (mg/l)	Inlet P (mg/l)	Outlet P (mg/l)	Removal yield (%)
Lloc nou d'en Fenollet	No coagulant	0	4	8,50	3,77	55,64
Lloc nou d'en Fenollet	BEWAT	44	4	6,02	2,34	61,12
Benigànim	FeCl ₃	40	2	8,96	0,97	89,17
Benigànim	BEWAT	40	2	5,99	1,83	69,44
Ontinyent-Agullent	FeCl ₃	63	1	2,80	0,66	77,08
Ontinyent-Agullent	BEWAT	60	1	2,10	0,74	64,76
Canals-L'Alcudia	FeCl ₃	120	1	5,53	0,34	93,85
Canals-L'Alcudia	BEWAT	120	1	6,13	0,56	90,86

Table 17. Main results for the chemical precipitation of phosphorus.

As can be seen, during the use of the BEWAT product, the limits established in the discharge authorization were met with working doses similar to those of ferric chloride. Regarding the removal yields, these are similar between the use of BEWAT and ferric chloride, and may have slight variations due to the entry of occasional spills.

Analysis of sludge line parameters related to the use of BEWAT

With regard to the sludge line, improvements have been observed at different points. The following summarizes the results for the percentage of dry matter in the mechanical dehydration process and in the consumption of associated polyelectrolyte in the study WWTPs:

WWTP	Coagulant	Dosage (mg/l)	Dry Matter	Flocculant (kg/month)	Dry Matter Increase (%)	Flocculant Reduction (%)
Benigànim	FeCl ₃	40	18,06	31,36	--	--
Benigànim	BEWAT	40	18,52	23,78	2,55	24,17
Ontinyent-Agullent	FeCl ₃	63	24,46	856,20	--	--
Ontinyent-Agullent	BEWAT	60	25,63	712,50	4,78	16,78
Canals-L'Alcudia	FeCl ₃	120	No advantage	491,00	--	--
Canals-L'Alcudia	BEWAT	120	No advantage	465,00	--	5,29

Table 18. Main results for the dry matter in the mechanical dehydration process.

The use of the BEWAT product significantly increases the percentage of dry matter in both the Benigànim WWTP and the Ontinyent-Agullent WWTP. In addition, in all the study WWTPs there is a very notable reduction in the consumption of polyelectrolyte.

On the other hand, the estimated incidence that the increase in dryness could have in the mechanical dewatering process in reference to sludge evacuation is shown:

WWTP	Coagulant	Dosage (mg/l)	Dry Matter	Sludge Production (kgMH/año)	Sludge Production Reduction (kgMH/año)
Benigànim	FeCl ₃	40	18,06	300.000	--
Benigànim	BEWAT	40	18,52	298.316	1.684
Ontinyent-Agullent	FeCl ₃	63	24,46	2.700.000	--
Ontinyent-Agullent	BEWAT	60	25,63	2.658.181	41.819

Table 19. Estimated incidence of the dryness increase.

It is observed how the increase in the percentage of dry matter using the BEWAT products would allow to substantially decreasing the evacuation of sludge with the consequent environmental and economic improvements.

Increase of biogas production in the anaerobic digestion process using BEWAT

The dosage of ECOTAN NW3 allows to increase biogas production based on two differentiating characteristics with respect to ferric chloride i) ECOTAN NW3 has a lower density than ferric chloride, therefore improvements in the mixing process are foreseen and ii) ECOTAN NW3 comes from a biodegradable polymer and, therefore, increases the organic load in the anaerobic digestion process. Thus, it has been observed that:

- During the dosing of ECOTAN NW3 the average biogas production was 625 Nm³/day.
- During the dosage of Ferric Chloride, the average biogas production was 374 Nm³/day.

Finally, it is concluded that the dosage of ECOTAN NW3 allows increasing biogas production by 251 Nm³/day.

b. Qualitative environmental benefits

Analysis of water line parameters related to the use of BEWAT

The use of BEWAT products has a direct relationship with other parameters of the water line such as conductivity, suspended solids or chemical oxygen demand. In the case of the Lloc Nou d'en Fenollet WWTP, the elimination yields are very similar in the two scenarios analyzed since the elimination yields in the case of the study WWTP were already very high. It should be noted that during the use of BEWAT there have been no increases in conductivity since this product does not add chlorides to the medium.

In the case of the Benigànim WWTP, the removal yields through the use of BEWAT are as positive as those obtained through the use of ferric chloride for the same working concentration. Again, it should be noted that there is no increase in conductivity. Regarding conductivity, a small reduction would be expected, but the working concentration of ferric chloride is so low that this reduction is not observed.

In the case of the Ontinyent-Agullent WWTP, the removal yields for the study parameters are very similar both using ferric chloride and using the study product, which indicates that BEWAT improves effluent quality in a very similar way to ferric chloride. Regarding

conductivity, BEWAT slightly reduces these values by not adding chlorides to the medium.

In the case of the Canals-L'Alcudia WWTP, the yields obtained for the study parameters are very similar both in the case of ferric chloride and in the case of BEWAT products. One of the most important aspects observed is that the conductivity undergoes a slight increase that is not observed with the use of BEWAT products. This fact can be of great importance to assess how to reach the discharge limit established for conductivity. Additionally, the use of BEWAT products causes a significant reduction in the values of chlorides and iron in the effluent. In the case of the Canals-L'Alcudia WWTP, this reduction is not so noticeable given the strong discharges that the WWTP receives and that, on many occasions, increases the values of chlorides and iron in the effluent (especially the values of chlorides by the treatment of hides in tanning companies).

Assessment of the agronomic quality of the compost produced from the use of BEWAT

The sludge from the Lloc Nou d'en Fenollet, Benigànim and Ontinyent-Agullent WWTPs, obtained after treating wastewater with BEWAT products, has been composted together with garden waste for subsequent agricultural recovery, comparing them with those generated with the use of ferric chloride.

After the completion of the composting process, samples were taken for the complete analysis of the compost. It was confirmed that all compost clearly comply with the heavy metal levels required by RD 1310/1990 in order to be applied to the soil and could also be considered class B fertilizer products according to RD 999/2017.

Evaluation of the ecotoxicological effect of the compost on the soil from the use of BEWAT

Two types of laboratory evaluation have been carried out, a phytotoxic evaluation with compost extracts and an ecotoxicological evaluation with compost at increasing doses on plants and small terrestrial organisms.

All the final composts have reached values that can be considered without risk of phytotoxicity. It is observed that there is no clear trend on which compost is the one that causes the least phytotoxic effect, but in the final stage of the processes it is seen that the compost with BEWAT NW3 from the sludge of the Lloc Nou d'en Fenollet and Ontinyent-Agullent WWTPs obtained a less phytotoxic effect than the rest.

The ecotoxicity tests carried out have led to the following conclusions:

- All composts analyzed are suitable for agriculture from an ecotoxicological point of view.
- The hazard ratios show that higher work concentrations could be used in the field, always respecting good agronomic practices.
- Ecotoxicity tests do not show significant differences for the analyzed samples.

Tests on agronomic potential

The crops chosen for the agronomic evaluation have been the fruit trees with the largest area dedicated to their cultivation in the Valencian Community, such as citrus and almond trees. Specifically, two-sap seedlings of sweet orange (*Citrus sinensis* L.) and almond (*Prunus dulcis*) have been used. The choice of young seedlings, instead of adult trees, is

done because it is easier to see the possible effects on the former, since in adult trees a longer exposure time to the treatments studied is needed.

When all the trees were transplanted, the morphological parameters of each of them were measured. Thus, the trunk diameter below the graft (DP), above the graft (DT) and the height of the seedlings (AP) were measured.

At the level of development of the seedlings, in orange trees no significant differences were seen between the different treatments and in almond trees it was observed that the greatest development occurred with the mineral fertilization treatment and with one of the compost with BEWAT. At the level of plant nutrition, no differences were seen between treatments in orange trees; only mineral fertilization caused an increase in the nitrogen content of the leaves. In the almond trees greater differences were seen, but without a clear trend, not observing that the application of compost with or without BEWAT gave rise to differences between treatments. At the level of the nutritive state of the soil, the application of compost with and without BEWAT resulted in an increase in organic matter and nitrogen in the soil, not causing an increase in the content of heavy metals.

2. Economic benefits.

While the proposed technology could be used to treat for both urban and industrial wastewaters, different parameters determining the cost reduction of using BEWAT products compared to ferric chloride are detailed below.

Economic evaluation of the technology in urban wastewater treatment plants.

Parameters	Products		
	Ferric Chloride	BEWAT	Cost reduction
Product cost	220 €/Tm	900 €/Tm	-
Global cost per cubic meter of treated water	0,0264 €/m ³	0,1080 €/m ³	- 105.643,85 €/Year
Biogas production	34.178,89 €/Year	139.822,74 €/Year	14.339,54 €/Year
	374,00 Nm ³ /day	625,00 Nm ³ /day	
Additional products consumption	19.133,24 €/Year	33.472,78 €/Year	4.916,35 €/Year
	Flocculant 856,20 kg/month	Flocculant 712,50 kg/month	
	29.292,31 €/Year	24.375,96 €/Year	
Treated water conductivity	Variable	Variable	-
Corrosion of metallic parts	-	-	1.000,00 €/Year
Raw materials delivery	7.986,00 €/Year	6.969,00 €/Year	1.017,00 €/Year
Containers management	5.400,00 €/Year	3.120,00 €/Year	2.280,00 €/Year
Sludge reuse	Variable	Variable	-
Sludge production	461.340,00	315.468,00	2.662,16 €/Year

	Kg/Year	Kg/Year	
	Management Cost 8.419,46 €/Year	Management Cost 5.757,29 €/Year	
Chemicals storage conditions	-	-	2.000,00 €/Year

Table 20. Economic evaluation of BEWAT technology in urban wastewater treatment plants.

Regarding the cost of the product included, it was updated for delivery in 1.000 L containers. The reduction in the coagulant dose has also been measured, which makes the **global cost per cubic meter of treated water** higher when using the new technology, based on a typical installation with a consumption of 20 Tm/month of chemical product and a flow of 3.547 m³/day, with a dose of 120 ppm. The cost derived from **biogas production** has been determined comparing different chemical treatments in an urban wastewater plant. The organic character of BEWAT products and its lower density compared to inorganic salts enhance the biogas generation, dramatically reducing the overall treatment cost.

On the other hand, the **reduction of additional products consumption** along the treatment process, such as flocculants, makes the overall cost lower. Therefore, in the typical facility presented, using BEWAT products the cost reduction is close to 5.000 euros per year, mainly coming from the dewatering system.

Regarding the **raw materials delivery**, while BEWAT coagulants are not considered dangerous products, the cost is lower compared to dangerous inorganic salts. Raw materials delivery has been estimated in this case based on a consumption of 20 Tm/month in a standard facility. Additionally, the cost of used **IBCs management** when have contained the product (not dangerous) is also lower compared to ferric chloride. Finally, in order to enforce **storage conditions** of dangerous products like ferric chloride, it is required to make a logistic investment close to 20.000 euros. If it is amortized along 10 years, it generates a cost of 2.000 Euros/year.

As can be seen in the table, the use of BEWAT products for urban wastewater treatment is not currently economically viable since the overall cost of water treatment is still very high.

Economic evaluation of the technology in industrial wastewater treatment plants.

Parameters	Products		
	Ferric Chloride	BEWAT	Cost reduction
Product cost	220 €/Tm	525 €/Tm	-
Global cost per cubic meter of treated water	0,3146 €/m ³ [1430 ppm]	0,2888 €/m ³ [550 ppm]	5.661,15 €/Year
	68.897,40 €/Year	63.236,25 €/Year	
Additional products consumption	Sodium Hydroxide 0,1176 €/m ³ [280 ppm]	Sodium Hydroxide 0,0210 €/m ³ [50 ppm]	
	25.754,40 €/Year	4.599,00 €/Year	21.155,40 €/Year
	Flocculant	Flocculant	

	[12 ppm] 2.628,00 kg/month 7.492,42 €/Year	[8 ppm] 1.752,00 kg/month 4.521,92 €/Year	2.970,50 €/Year
Treated water conductivity	Variable	Variable	-
Corrosion of metallic parts	-	-	1.000,00 €/Year
Raw materials delivery	10.454,40 €/Year	5.372,40 €/Year	1.161,60 €/Year
Containers management	4.320,00 €/Year	1.560,00 €/Year	1.140,00 €/Year
Sludge reuse	Variable	Variable	-
Sludge production	208.000,00 Kg/Year Management Cost 3.796,00 €/Year	160.160,00 Kg/Year Management Cost 2.922,92 €/Year	2.662,16 €/Year
Chemicals storage conditions	-	-	2.000,00 €/Year

Table 21. Economic evaluation of BEWAT technology in industrial wastewater treatment plants.

Regarding the cost of the product included, it was updated for delivery in 1.000 L containers. The reduction in the coagulant dose has also been measured, which makes the **global cost per cubic meter of treated water** lower when using the new technology, based on a typical installation with a consumption of 10 Tm/month of chemical product and a flow of 600 m³/day (1.430 ppm average dose of ferric chloride / 550 ppm average dose of BEWAT products).

On the other hand, the **reduction of additional products consumption** along the treatment process, such as flocculants and/or pH neutralizers, makes the overall cost lower. As can be seen in the table, the cost reduction in a standard facility (600 m³/day; 280 ppm average sodium hydroxide dose when using ferric chloride; 50 ppm average sodium hydroxide dose when using BEWAT products) is really remarkable.

Regarding the **raw materials delivery**, while BEWAT coagulants are not considered dangerous products, the cost is lower compared to dangerous inorganic salts. Raw materials delivery has been estimated in this case based on a consumption of 20 Tm/month in a standard facility. Additionally, as previously reported, the cost of used **IBCs management** when have contained the product (not dangerous) is also lower compared to ferric chloride. Finally, in order to enforce **storage conditions** of dangerous products like ferric chloride, it is required to make a logistic investment close to 20.000 euros. If it is amortized along 10 years, it generates a cost of 2.000 Euros/year.

It is very common to find a **biological (aerobic) reactor** after the physic – chemical treatment, where BEWAT coagulants were dosed. As the technology proposed does not provide salts or metals to the treated water, the efficiency of subsequent aerobic reactors increases, reducing the oxygen consumption and generating additional savings.

As can be seen in the table, the use of BEWAT products for industrial wastewater treatment is already economically viable since the overall cost of water treatment lower compared to ferric chloride.

Additionally, estimated total turnover at the end of 2025 is close to 5,5 million euros, providing more than 10.000 Tm of natural based coagulants. As described in the Business Plan (deliverable DL_B.6.2), requested investments also imply the activation of other sectors, such as raw materials or engineering (additional production plant requested).

3. Social benefits.

As can be seen in the Deliverable DL_E1.4.4 "Update of the indicators in the table *LIFE project performance indicator table*", at the end of the project, one FTE has been created as a community manager role. Additionally, based on the Business Plan (Deliverable DL_B.6.2), beyond 3 years, the following number of FTEs are estimated: 2 admin/export, 6 production-process operators, 3 sales agents, 1 community manager and 1 product manager.

4. Replicability, transferability and cooperation.

As can be seen in the Deliverable DL_E1.4.4 "Update of the indicators in the table *LIFE project performance indicator table*", at the end of the project the considered number of individuals influenced via dissemination activities and replication actions, exclusively face to face (for example fairs, congresses...), it has been 547. Based on previous LIFE projects and planned events, beyond 3 years it is expected to triple the individuals influenced face to face.

On the other hand, several real scale tests have been carried out in a number of industrial wastewater plants from different companies. In all these tests, environmental improvements were obtained, achieving the elimination of a corrosive product, the improvement in the safety of the workers and the reduction of packaging, transport and, consequently, the reduction of the carbon footprint. The amount of project product used for the trials (and justified in the project budget) is 29,4 Tm.

However, additional 204 Tm of BEWAT products developed in the project for industrial wastewater plants (not included in the project budget) have been manufactured and supplied to different customers. In these cases, coagulant efficiency and economic viability is confirmed because the end users are still ordering these products.

5. Best Practice lessons.

As it was explained previously, mainly at Mid Term Report stage, SERVYECO (where is the production plant located) works under strong environmental, health and quality standards, regulated by ISO 9001 (Certification of Quality Management System), ISO 14001 (Certification of Environmental Management System) and OHSAS 18001 (Certification of Occupational Health and Safety Management System). In this way, the actions developed during the project have been performed following procedures based on best practice lessons, from staff education and training to optimizing chemicals used for treating water:

- Operating manuals have been prepared in order to use the reactor in a safe way.
- The objective of the project is to improve the quality of chemicals used in urban and industrial WWTP.

- By reducing the dosage of chemicals in the WWTP we will obtain a reduction in packing containers.
- SERVYECO has a Deposit and Return System (S.D.D.R) granted by the *Conselleria de Medi Ambient, Aigua, Urbanisme i Habitatge of the Generalitat Valenciana*. Thanks to this system, SERVYECO collects the containers of the chemical products used in the WWTP for its subsequent recycling and recovery. In this way, the impact on the environment of the packaging throughout its life cycle is prevented.

Now, at the end of the project, all these practice measures demonstrated being useful to carry out not only the manufacturing process of the new product developed by SERVYECO but also when using it at the WWTP involved at the project.

6. Innovation and demonstration value.

The innovation and demonstration value of presented technology needs to be divided in two different contexts. On the one hand, the application focuses on the use of natural based coagulants for the specific phosphorus removal in urban wastewater. On the other hand, a second, broader and more non-specific context has been established, focused on the treatment of mainly industrial wastewater, with outstanding importance in the commercial strategy and technology transfer processes.

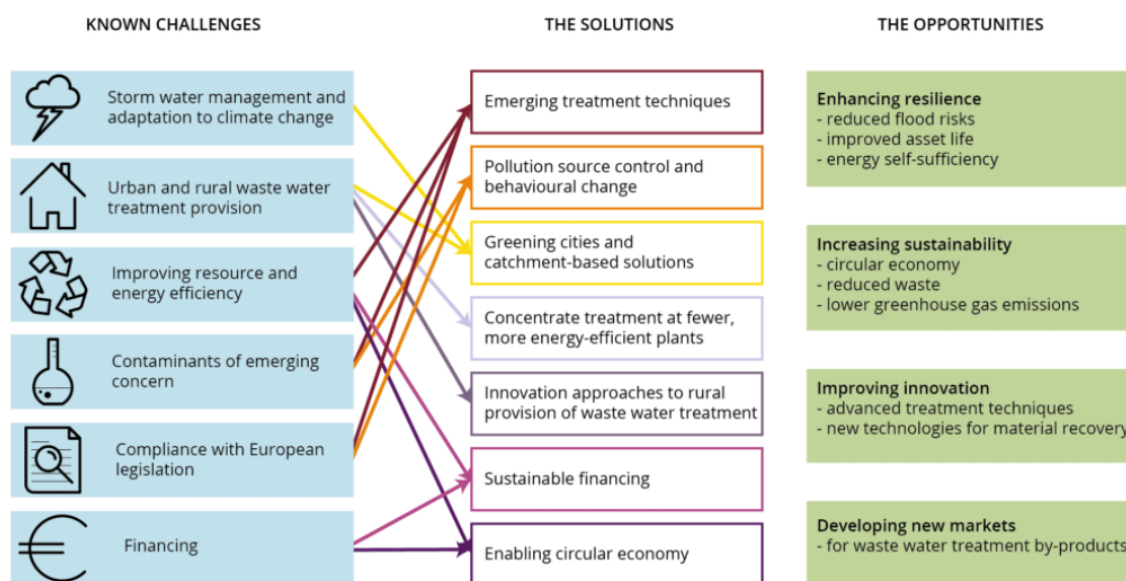
Focused on urban wastewater treatment, implementation of natural based coagulants in 4 different **urban wastewater treatment** facilities has been succeeded. As can be seen in the Deliverable DL_E1.4.4 “Update of the indicators in the table *LIFE project performance indicator table*”, at the end of the project 239 Tm of natural based coagulants have been applied in these facilities (1 year implementation period). Based on the Business Plan (Deliverable DL_B.6.2), beyond 3 years, it is expected to provide 1.051 Tm (10% of total production described, 10.511 Tm/year) of natural based coagulants, substituting Ferric Chloride (similar dosage) in urban wastewater treatment plants.

Focused on **industrial wastewater treatment**, as can be seen in the Deliverable DL_E1.4.4 “Update of the indicators in the table *LIFE project performance indicator table*”, at the end of the project 204 tons of natural based coagulants have been manufactured for replication activities in 14 industrial wastewater treatment plants (1 year replication period). While dose reduction is close to 30%, 286 Tm of inorganic salts have been substituted. Based on the Business Plan (Deliverable DL_B.6.2), beyond 3 years, it is expected to provide 9.460 Tm (90% of total production described, 10.511 Tm/year) of natural based coagulants, substituting inorganic salts in industrial wastewater treatment plants. While dose reduction is close to 30%, 13.263 Tm of inorganic salts are expected to be substituted beyond 3 years.

7. Policy implications.

According to European Environmental Agency (“*Urban waste water treatment for 21st century challenges*” (last modified 09 Mar 2021. See at: <https://www.eea.europa.eu/publications/urban-waste-water-treatment-for>), “...Supplying clean water and collecting waste water has required huge investment across Europe in recent decades. ...securing sustainable water in future, such as climate change, present new opportunities for resource efficiency and improved environmental protection”.

In this line, the EEA suggests a series of **challenges, solutions and opportunities for urban wastewater treatment plants:**



Scheme 1. Challenges, solutions and opportunities for urban wastewater treatment plants.

Fitting, at least in part, with the objectives and results achieved by the project, concretely opportunities directly referred to “advanced treatment techniques”, “reduced waste” and improving resource and energy efficiency. From this point of view, the results of the project could help to the implementation of *Urban Waste Water Treatment Directive (91/271/EEC)* as the new product permit to replace inorganic salts by an organic product at the WWTP with excellent results contributing to the protection of rivers, lakes, transitional waters (estuaries), coastal waters and ground water (*Water Framework Directive - 2000/60/EC-*) due to the improvement of the of the quality of the discharged water.

According to established at the Action B6, the vehicle to promote synergies between the results of the project and the EU policies is "Transfer Strategy" (see DL_B.6.3).

At this stage, we continue to consider that it could be possible to integrate the results of the project into other Union policies is through the initiatives promoted by the European structural and investment funds (ESIF). The EU Cohesion Policy supports sustainable growth by promoting the proper management of water and waste, clean and innovative technologies, as well as measures aimed at protecting the air, biodiversity and nature.

7. Key Project-level Indicators.

Throughout the project, successive updates have been made of the monitoring indicators, grouped into three types: Environmental, Technical and Dissemination. These were defined and selected during the preparation of the original proposal for this project through the table "LIFE Project Specific Indicators - Call 2016". In accordance with the indications established in the "Guidelines for applicants 2016", they have been periodically updated in the aforementioned table.

Regarding the most significant changes made in the table "LIFE Project Specific Indicators - Call 2016" throughout the project it is necessary to highlight two main adjustments i) the number of visits to the website and ii) the unit cost per cubic metric of treated urban wastewater. However, as detailed in the deliverable, none of these changes have had a significant impact on the replicability and transfer of the technology. Thus, real sales have been generated before the end of the project and a large number of stakeholders have been reached, without straying too far from the rest of the initially estimated KPI values.

Additionally, deliverables DL_E1.4 summarize the KPIs detailed in the online application, also updated periodically. In this application, the KPIs are detailed after the completion of the project and those present in the 3 - 5 years afterwards. These deliverables have been conveniently completed within the originally established deadlines. The most notable modifications and updates in the online application throughout the project are summarized below:

- The indicators specific context has been appropriately modified. In this way, two differentiated contexts have been established. On the one hand, the first context focuses only on the regions of Spain where the implementation phase described in detail in the original proposal has taken place. This application focuses on the use of natural based coagulants for the specific phosphorus removal in urban wastewater. On the other hand, a second, broader and more non-specific context has been established, focused on the treatment of urban and industrial wastewater located in various EU countries that are of outstanding importance in the commercial strategy and technology transfer processes.
- After the indicators specific context update, several indicators were conveniently erased because were incorrectly selected in the original proposal, while they are currently not applicable. The following indicators were deselected in the last update (August 2021):
 - Indicator 2.2 – “Aquatic extent affected by the pressure or risk addressed”.
 - Indicator 2.3.3 – “Hydrological alteration”.
 - Indicator 2.3.7 – “Diffuse source pollution”.
 - Indicator 2.4 – “Environmental status - marine, coastal or transitional waters”.
- The indicator 1.6 “Humans influenced by the project” were carefully updated in the end of the project with real numbers, accuracy estimating the values beyond 3 years, for both specific contexts.
- The indicators 2.3.6 “Point source pollution” and 5.1.2 “Chemicals substitution” were carefully updated in the end of the project with real numbers, accuracy estimating the

values beyond 3 years, for both specific contexts. The numbers defined in these indicators are based on the Business Plan (Deliverable DL_B.6.2).

- The indicator 13 “Jobs” has been correctly updated based on the Business Plan (Deliverable DL_B.6.2). Originally, this indicator was higher because several production plants manufacture was defined in the proposal. However, in the end it was decided to focus the Business Plan in just one new production plant located in Spain. Accordingly, updated indicators numbers are defined in the final Business Plan.
- Values presented in indicator 14 “Contribution to Economic growth” (including 14.1, 14.2, 14.3 and 14.4) were carefully updated in the end of the project with real numbers. These values are based on the Business Plan (Deliverable DL_B.6.2).

8. Comments on the financial report.

8.1 Summary of Costs Incurred.

		PROJECT COSTS INCURRED					
Cost category		Budget according to the Grant Agreement (€)	SERVYECO costs incurred during the reporting period (€)	EGEVASA costs incurred during the reporting period (€)	GOMSL costs incurred during the reporting period (€)	TOTAL costs incurred during the reporting period (€)	%
1.	Personnel	1.254.642	820.321,11	247.948,44	166.387,06	1.234.656,61	98%
2.	Travel and subsistence	40.892	8.912,49	1.625,89	2.189,13	12.727,51	31%
3.	External Assistance	276.332	156.606,74	37.381,90	23.320,00	217.308,64	79%
4.	Durable goods total <u>non-depreciated</u> cost					0,00	
	<i>Infraestructura sub-tot.</i>	0	0	0	0	0,00	
	<i>Equipment sub-tot.</i>	20.250	0	17.795,08	6.216,18	24.011,26	119%
	<i>Prototypes sub-tot.</i>	68.600	102.144,45	0	0	102.144,45	149%
5.	Consumables	378.510	371.189,93	44.012,83	16.475,04	431.677,80	114%
6.	Other costs	73.910	22.789,57	9.699,16	2.447,58	34.936,31	47%
7.	Overheads	146.937	103.737	24.070,00	14.927,00	142.734,00	97%
	TOTAL	2.260.073	1.585.701,29	382.533,30	231.961,98	2.200.196,57	97%

Table 22. Summary of costs incurred.

- The costs charged to the project are in line with the concepts established in the approved proposal. There are not discrepancies compared to the flexibility of the 20% limit (Article II.22 of the General Conditions).
- The cost of **travel and subsistence** has been markedly reduced for all three beneficiaries compared to the initially established values. This is because, mainly due to the general pandemic situation, many dissemination and technology transfer trips have been replaced by online meetings and other remote activities. For the same reason, in the EGEVASA and GOMSL budgets some costs present in **external assistance** and **other costs** have been eliminated or reduced, generating a small variation in the global values compared to those defined in the proposal.
- Thus, as previously detailed in the technical part of the Final Report, two natural based coagulants have been developed by SERVYECO with different manufacturing processes. This has caused to make additional modifications to the production **prototype**, substantially increasing the original SERVYECO's budget. However, this impact has been offset by the reduction of other budget items.
- Finally, the doses of the natural based coagulant during the implementation phase have been higher than expected. This has generated a slight increase in **consumables**, for all three beneficiaries compared to the initially established values, mainly due to the additional consumption of raw materials and laboratory consumables.

8.2 Accounting system.

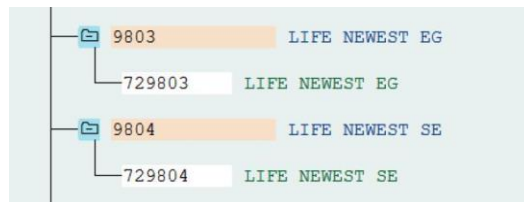
Accounting systems employed and codes that identify project costs.

- The system used in SERVYECO for the accounting of the LIFE16 ENV / ES / 000156 LIFE_NEWEST project uses exclusive subaccounts where all project expenses will be carried out.

Cuenta	Descripción
201000001	PERSONAL SALARIO BRUTO LIFE-NEWEST
201000002	PERSONAL S.SOCIAL LIFE-NEWEST
201000003	VIAJES Y ASISTENCIA LIFE-NEWEST
201000004	ASISTENCIA EXTERNA LIFE-NEWEST
201000005	PROTOTIPO LIFE-NEWEST
201000006	CONSUMIBLES LIFE-NEWEST
201000007	OTROS COSTES LIFE-NEWEST

Screenshot 1. Subaccounts for project expenses.

- EGEVASA and GOMSL: The materials and assets are allocated on several OT (from “Orden de Trabajo”, work orders) associated to the project management. On the other hand, staff costs and vehicles fuel are charged to the wastewater area. EGEVASA and GOMSL work with SAP for the assignation of costs. The work order created for this purpose is shown below.



Screenshot 2. Work order in SAP for the assignation of costs.

Cost approval procedure

- In SERVYECO the procedure which is used for the approval of the costs related to the project is carried out between the departments linked to the supervision of the person in charge of R&D department. If the amount of the subcontracted companies exceeds 6,000€, 3 estimates are requested.
- GOMSL and EGEVASA have a tool based on internal operating standards. This tool is used to keep track of travel and subsistence expenses. Regarding subcontracting expenses, GOMSL and EGEVASA are governed by their internal contracting procedure.

GOMSL: Depending on the amount of the subcontracted companies, a specific number of quotations is requested, ranging from 1 to 3, or a contract is made.

EGEVASA: Depending on the amount of the subcontracted companies, 3 quotes are requested, or a public tender is carried out. 3 quotes will be requested when they exceed 18,000€.

Both the tool and the internal contracting procedure have an internal approval flow.

Time recording system used

- The registration system used in SERVYECO is based on timesheets registered daily and manually signed by the employer and approved by the supervisor. To record time in SERVYECO, the procedure used consists in filling in the time sheets daily for each of the members, after which they are delivered duly completed and signed for approval by the person in charge.

In SERVYECO the timesheets are completed and signed by the worker, after which the company coordinator checks that they are correct and signs them, in this case Mr. Carlos de Bengoa.

- In timesheets EGAVASA y GOMSL. The time consumed in the project was recorded using manually completed timesheets. It must be mentioned that, as far as the Timesheets are concerned, since plant operators have work shifts, the hours corresponding to the no shift-days have been classified as OA (other Absence). Mrs. Tatiana Montoya signs the timesheets of the company GOMSL (before GOMSA) and Mrs. Gloria Fayos signs the timesheets from EGEVASA.

EGEVASA -GOMSL. The timesheets mentioned before are filled in and signed by the worker and after revised and signed by the coordinator of each company. The timesheets of the coordinators are revised and signed by their manager.

Procedure to guarantee the reference in the project

- In SERVYECO, before the expense related to the project is recorded, a procedure is followed to ensure its correct imputation, from the administration department it is checked in detail that the invoices linked to it contain the clear reference of the LIFE project (that is, number and title or abbreviated title). In those invoices that the project reference does not appear despite being linked to it, the department in charge of its contracting / purchase must be in charge of notifying the administration to include the stamp with the reference in the original invoice. Subcontractor invoices must be detailed enough to allow identification of unique items covered by the service provided (i.e. clear description and cost of each item).
- EGEVASA and GOMSL have associated the orders of the project with the mentioned work orders (OT), allowing the identification of all project costs. When possible, we demand to the suppliers to include the reference of the project in the invoices. In case that this is not possible, we have a stamp with the reference to mark them. The invoices are stored with their payments and compiled before each report by the Financial Manager.
For invoices including costs not related to the project, which are not declared, the partners have identified in the original invoices the items needed for the project implementation.

Coordinator beneficiary bank account

- The bank account of the coordinating beneficiary, **SERVIECOLOGIA Y TRATAMIENTOS DE AGUAS, S.L.** has changed due to the bank integration process of **BANKIA** and **CAIXABANK, S.A.**, being the new bank account **ES1521008418941300200950**. The financial identification form and bank certification is attached in **Annex A6**.

Financial reporting

The justification was carried out semi-annually, once the semester is closed all the documentation was reviewed:

It was checked that the files sent correspond to those listed in the XLS control sheet "life_financial_reporting".

It was reviewed that the documentation that justifies the expenses and payments of each item, makes reference to the project in the cases that it is required, that the traceability of the payment can be verified in the required cases, that they bear the seal of the project in the required cases, and that it is well completed in the required cases eg. TimeSheets.

Once all the supporting documentation for the semester has been reviewed, we verified that there are no significant deviations with the payment forecast schedule, if everything is correct, we proceeded to the payment of the following semester, in case of detecting deviations, an explanation of them was requested and assessed with the participant how to proceed with the payment of the semester.

Deadlines for the contribution of documentation, from the Project Coordination it is suggested that it be continuous, in this way it can be checked day by day, the documentation provided is stored in the avanbox tool.

Deadlines for documentation delivery of the preparation of the **REPORTS (Reports)**, as a general rule, the documentation requested for the preparation of the reports had to be delivered one month in advance, in any case the coordinator reviewed the deadlines to conclude with the aforementioned reports have been successful.

8.3 Partnership arrangements.

The partnership agreements were signed according to established in the GC and were attached to the Progress Report send to EASME on 25/06/2018.

Each of the partners completed their individual financial reports, after which they are transferred to **SERVYECO** as coordinating beneficiary for its review and summarize the consolidated report.

SERVYECO, as coordinating beneficiary, is responsible for all the appropriate LIFE_NEWEST payments to be made to the other beneficiaries without unjustified delay in accordance with the agreements concluded with the associated beneficiaries in the Partnership Agreement.

8.4 Certificate on the financial statement.

In Accordance with Art. II.24.2, the data of the approved auditor who are to establish the certificate for the payment of the balance, shall be included in the signed payment request are:

NAME: José Antonio Font Arquer

NIF: 18942260N

Nº Inscripción ROAC: 18.478

ADDRESS: Pza. Huerto de Sogueros, 3 - 4º 12001 Castellón de la Plana

The auditor's report (to be included with the final financial report) followed the format of the standard audit report form available on the LIFE website. After the audit report it is concluded that all the revised and imputed expenses are considered eligible.

8.5 Estimation of person-day used per action.

Action type	Budget person-days SERVYECO	Budget person-days EGEVASA	Budget person-days GOMSL	% Total PERSON DAYS SERVYECO	% Total PERSON DAYS EGEVASA	% Total PERSON DAYS GOMSL	TOTAL Estimated % person-days
Action A Preparatory actions	620	20	15	104%	93%	93%	103%
Action B Implementation actions	3216	604	432	101%	119%	130%	107%
Action C Monitoring of the impact of the project action	124	132	125	106%	39%	34%	59%
Action D Public awareness/om munication and dissemination of results	260	151	135	105%	19%	21%	61%
Action E Project	220	192	211	96%	89%	94%	93%

management							
TOTAL	4440	1099	918	102%	90%	92%	98%

Table 23. Estimation of person-day used per action.

- The percentage of personnel used by EGEVASA and GOMSL during the **Implementation Actions** has been slightly higher than that defined in the original proposal. This is mainly due to the fact that the use of a natural coagulant compared to the current ferric chloride has required a more exhaustive control in the dosage, using a number of resources higher than expected.
- On the other hand, the contribution of EGEVASA and GOMSL personnel to the **Impact Monitoring Actions** has been somewhat lower than expected. This is mainly due to the fact that the experience accumulated by SERVYECO through other LIFE projects has facilitated the communication between partners and the collection of data offered by EGEVASA and GOMSL.
- Finally, although SERVYECO has slightly exceeded the original budget for personnel focused on **Dissemination Actions**, EGEVASA and GOMSL have diverted part of these resources to Implementation Actions, where the control of the discharge of treated water had to meet certain parameters at all times. This difficulty is somewhat greater in this case since the new technology has been implemented on a full scale. However, the dissemination and networking objectives established in the original proposal have been achieved by the consortium globally.

9. Deliverables

Deliverables already presented in previous reports (and not updated) are not attached. These deliverables are DL_E1.1, DL_E1.2 (Aug18), DL_E1.2 (Feb18), DL_E1.2 (Feb19), DL_E1.2 (Nov17), DL_E2.1, DL_E2.2 (Jan19), and DL_E2.2 (Jul18). Please, find below a list of the deliverables attached (not previously presented or recently updated):

- DL_A.1.1 - Technical report on the design and construction of the industrial reactor, including plans and diagrams.
- DL_A.1.2 - Report on the selection of stakeholders and key actors.
- DL_B.1.1 - Technical report on the start-up procedure of the production reactor, including the user manual.
- DL_B.1.2 - Technical report on the optimization and quality control procedure of the production process at an industrial level.
- DL_B.1.3 - Technical report on incidents that occurred during the industrial production phase, including recovery procedures.
- DL_B.2.1 - Technical-economic report on the feasibility of the study coagulant for chemical precipitation in urban wastewater.
- DL_B.3.1 - Technical-economic report on the feasibility of the study coagulant for chemical precipitation in urban waters with industrial component in WWTP with double stage treatment.
- DL_B.3.2 - Technical-economic report on the feasibility of the study coagulant for chemical precipitation in urban waters with industrial component in WWTP with physical-chemical treatment.
- DL_B.3.3 - Technical-economic report on the feasibility of the study coagulant for chemical precipitation of chromium in physical-chemical primary treatments.
- DL_B.4.2 - Environmental report on improvements in biogas production due to the use of the new coagulant.
- DL_B.4.1 - Environmental report on the agronomic improvements achieved through the use of the new coagulant.
- DL_B.5.1 - Feasibility study for full implementation on an industrial scale.
- DL_B.5.2 - Technical report of results after the implementation of the technology.
- DL_B.5.3 - Product Life Cycle Assessment (LCA).
- DL_B.6.1 - Report on the strategy defined for the transfer of results to target groups and key actors.
- DL_B.6.2 - Business plan.
- DL_B.6.3 - Replication and transferability plan.
- DL_C.1.1 - Periodic follow-up document.
- DL_C.1.2 - Periodic follow-up document.
- DL_C.1.3 - Periodic follow-up document.
- DL_C.2.1 - SROI Report.
- DL_C.2.2 - Economic evaluation of the proposed technology.
- DL_D1.1 - Document "Communication Plan".
- DL_D1.2 - Project website.
- DL_D1.3 - Edition of diffusion products (posters, brochures and leaflets).
- DL_D1.4 - Layman Report (English version).
- DL_D1.4 - Layman Report (Spanish version).
- DL_D2.1 - Final report of “networking” results.

- DL_E1.2 - Consortium meeting minutes (Aug19).
- DL_E1.2 - Consortium meeting minutes (Feb20).
- DL_E1.2 - Consortium meeting minutes (Aug20).
- DL_E1.2 - Consortium meeting minutes (Sep21).
- DL_E1.4.1 - Update of the indicators in the table "LIFE project performance indicator table".
- DL_E1.4.2 - Update of the indicators in the table "LIFE project performance indicator table".
- DL_E1.4.3 - Update of the indicators in the table "LIFE project performance indicator table".
- DL_E1.4.4 - Update of the indicators in the table "LIFE project performance indicator table".
- DL_E2.2 - Successive supervision report (Jul19).
- DL_E2.2 - Successive supervision report (Jan20).
- DL_E2.2 - Successive supervision report (Jul20).
- DL_E2.2 - Successive supervision report (Jan21).
- DL_E3.1 - Document "After LIFE Plan" (English version).
- DL_E3.1 - Document "After LIFE Plan" (Spanish version).

10. Technical Annexes

- Annex T1. Answer to last EC letter (October 2021).

11. Administrative Annexes

- Annex A1. Consolidated Financial Statement.
- Annex A2. Individual Financial Statement SERVYECO.
- Annex A3. Individual Financial Statement EGEVASA.
- Annex A4. Individual Financial Statement GOMSL.
- Annex A5. Audit Report.
- Annex A6. Bank identification document and certification.
- Annex A7. LIFE Financial Reporting SERVYECO.
- Annex A8. LIFE Financial Reporting EGEVASA.
- Annex A9. LIFE Financial Reporting GOMSL.