(Projects funded under the Call 2014 onwards must use this format)

LIFE Project Number

<LIFE16 ENV/ES/000419>

Final Report

Covering the project activities from 01/10/2017[1] to 30/09/2021

Reporting Date[2]

<21/02/2022>

<LIFE LIBERNITRATE>

Data Project	
Project location:	Spain, Italy, Netherlands
Project start date:	<01/10/2017>
Project end date:	<30/09/2020> **Extension date:** <30/09/2021 >
Total budget:	2.354.292 €
EU contribution:	1.412.573 €
(%) of eligible costs:	60%

Data Beneficiary	
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1 Project start date

[2] Include the reporting date as foreseen in part C2 of Annex II of the Grant Agreement

0. Index of deliverables

- Deliverable related to Action A1.
  - 05-A1 Informe del estado del arte y técnica y protocolo del ciclo de vigilancia de innovación tecnológica LIFE LIBERNITRATE
- Deliverable related to Action A2.
  - 04-A2 Informe de indicadores y prodedimientos para la medición del impacto medioambiental, socio-ecpnómico y de las acciones de difusión
- Deliverable related to Action A3.
  - 02-A3 Convenios necesarios para el desarrollo del proyecto
- Deliverable related to Action B1
  - 17-B1 Material formativo y guia explicativa de prácticas de fertilización responsable en castellano, inglés, italiano y holandés
- Deliverable related to Action B2.
  - 03-B2.1 Diseño del valorizador (updated 2021)
  - 14-B2.2 Protocolo de puesta en marcha, guias operacionales, guías de mantenimiento, protocolos de emergencia y riesgos del valorizador y la obtención de sílice activa
- Deliverable related to Action B3.
  - 08-B3.1 Diseño de prototipos de lechos de sílice activa (updated 2021)
  - 15-B3.2 Informe de validación de Fase I. Rechazo planta de osmosis
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- Deliverable related to Action B5 (All of them in the same file)
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  - 21-B5.2 Plan de escalabilidad de resultados LIFE LIBERNITRATE
  - 25-B5.3 Listado de identificación de líneas de apoyo y financiación
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- Deliverable related to Action C1
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    - 35-D1.3 Notice Boards
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2. List of key-words and abbreviations

CRIB	Consorci de la Ribera
AVSA	Aguas de Valencia, S. A.
DIVAL	Diputació de València
LWI	Stichting Incubator
UNIGE	Università Degli Studi di Genova
UNIO	La Unió de Llauradors i Ramaders del País Valencià
UPV	Universitat Politècnica de València
UVEG	Universitat de València - Estudi General
RO	Reverse Osmosis
CBA	Cost-Benefit-Analysis
LCA	Life Cycle Analysis
GVA	Generalitat Valenciana
FVMP	Federación Valenciana de Municipios y provincias
DOCV	Diari Oficial de la Comunitat Valenciana

3. Executive Summary (maximum 2 pages)

LIFE LIBERNITRATE is a demonstration project funded by the EC under the LIFE Programme. Its objective is to reduce the concentration of nitrates in the comprehensive water cycle ant the reduction of the environmental impact of this activity by using an adsorption bed made of silica obtained from the ashes produced by a controlled burning of rice straw in a pilot specifically designed, constructed and set up by the project consortium.

The objectives achieved demonstrate the environmental benefits of the LIFE LIBERNITRATE project as an alternative in the water cycle by acting on the reject water flow of an industrial osmosis plant and on well water (for human consumption) in small municipalities without using RO plants. Also, efforts made to teach and educate farmers in the use of slow-release nitrogen fertilizers will reduce the infiltration of nitrates in aquifers.

Summarising,

Preparatory actions have contributed to creating a technological surveillance protocol as well as analyzing the state of the art and methodologies for the recovery of agro-industrial waste, the obtaining and activation of silica and the validation of the quality of the soil and water through the control of nitrates and nitrogen mitigation in crop fields. In these actions, the indicators related to environmental aspects have also been identified, analyzing water samples and determining the parameters of eutrophication and the presence of priority and specific pollutants. Finally, an agreement was signed between all the partners to include CPV and CSR criteria in their purchases of products and services and hiring of personnel. It was also possible to sign the contracts for the transfer of facilities and the supply of rice straw.

Regarding the task of educating farmers to use other nitrogen fertilization alternatives that have already demonstrated their viability to reduce the amount of nitrogen in the soil, without reducing the profitability of crops and, in this way, reduce the cause of excess nitrates in drinking water, tests were carried out with different types of crops where it was shown that the use of slow-release fertilizers is at least as productive as conventional fertilizers.
The awareness/information and training campaign for farmers was completed with the creation of a MOOC course, a much broader achievement than the educational guides provided for in the initial proposal.

Regarding the task of obtaining suitable active silica for the reduction of nitrates and the demonstration that it is possible to reduce them in the reject stream of a reverse osmosis plant and in the supply stream to a population, by means of a prototype of active silica beds :
It has been possible to design and build a valorizer (boiler) where the collected rice straw has been incinerated, from which 261 kg of silica-rich ash has been obtained. However, the design of this valorizer must be improved, since the equipment has suffered many breakdowns and continuous operation without human presence has not been achieved.
To obtain active silica, the system for obtaining and functionalizing it has been patented, developed in the Alginet laboratories, where it has been possible to functionalize the 72 kg of active silica that have been used in the different adsorbent bed prototypes.
It was possible to design and build prototype I, which worked with flow rates of 130 liters/day in well water and reject water from the osmosis plant, with average retention of 29.6% and 14.5%, respectively.
It was possible to design and build the prototype II, which worked with flow rates of up to 26,000 liters/day in well water, achieving an average retention of 23.63%.

Regarding the development of political action and dissemination of the project, although there have been many difficulties in accessing politicians and delays in the organization of events and conferences, due to the different electoral processes, the pandemic and that the interests were focused on palliating the effects of COVID, the task has been carried out and the following achievements should be highlighted:

• The high degree of participation of the different political and social actors in the development of the project's actions, which has made it possible to achieve high visibility of both the problem of water nitrification and the solutions proposed by the project to all Valencian public administrations. at all levels of competition.

• The signing of the manifesto of interest, the participation in different working groups and initiatives (Covenant of Mayors, working group of the Agriculture DG, Water Observatory) and the different commitments reached (creation of a social working group) that will allow that the project, in addition to its execution period, continue working together with the public administration and social entities.

In short, we have generated a wide territorial scope from the local to the state, passing through the provincial and regional levels.

The development of these tasks has been complicated, due to all the problems described in the deliverables of action B4 (electoral processes, pandemic, politicians focused on problems associated with COVID, etc). Even so, an acceptable level of participation of the political representatives in the meetings has been achieved and the commitment of the main Valencian administrations to finance and support future actions has been achieved.

Regarding the monitoring actions, it has been possible to produce all the expected deliverables, such as the life cycle analysis report, the cost cycle analysis report, the communication impact monitoring report and this same report with the monitoring of the KPI indicators of the project.

Finally, with regard to guaranteeing environmental, economic and social sustainability, ensuring the continuity of technological innovations and validated good practices, regardless of the existence of public financing, given that sufficient maturity in treatment technology has not been achieved. of waters, it has had to design a business plan and an After-LIFE plan, where potential clients have been identified to whom the product can be sold once it has been improved and can be manufactured and used in industrial environments. Even so, given the potential of the product, which contributes to the circular and proximity economy, commitments have been reached with the Valencian public administrations, so that when the product is fully evolved in the future, financing is not a problem.

4. Introduction

- Description of background, problems and objectives

1) Environmental problem/issue addressed.

The Nitrates Directive stipulates that nitrate concentration in water must not be higher than 50 milligrams per litter. High levels of nitrate in water can be dangerous to human health as well as to freshwater- and marine ecosystems.
Excessive nitrate levels cause eutrophication due to the large input of nutrients to a water body and the main effect is the imbalance in the food web that results in high levels of phytoplankton biomass in stratified water bodies. The direct consequence is an excess of oxygen consumption near the bottom of the water body. This can lead algae blooms, which pose a threat to fish, wildlife and biodiversity. The effects of eutrophication on the environment may, have deleterious consequences for the health of exposed animal and human populations, through various pathways.
Specific health risks appear when fresh water, extracted from eutrophic areas, is used for the production of drinking water. In some specific cases, local authorities must rely on eutrophic waters for producing drinking water. There are two major risks for health in using such waters:

1. Risks linked to the presence of organic matter: Treating raw water with high levels of organic matter is always technically difficult. It can lead to the creation of carcinogenic by-products (Trihalomethanes – THMs -, other chlorinated components) as a result of their reaction with disinfectants.
2. Risks linked to the presence of specific cyanobacteria in fresh waters: When eutrophication leads to the development of cyanobacteria that are potentially toxic, the elimination of these toxins is complex.

On the other hand, according to the European Environment Agency, “the main source of nitrogen pollutants is run-off from agricultural land. From the year 1950 until 2000 the use of mineral nitrogen in fertilizers for agriculture in the EU member states has been increased tenfold, from around 1 to 9 - 10 million tons. At the same time the amount of nitrogen released by animal husbandry rose to nine million tons. The nitrogen pressure on the environment currently reaches 18 million tons solely from agriculture. Agricultural practices have led to a reduction of permanent grassland, and other “buffer” areas such as ditches, hedges and wetlands a situation which favours erosion, run-off and quick drainage of nutrient to the water bodies.

2) Outline the hypothesis to be demonstrated / verified by the project

The project has designed, constructed and set up an innovative and efficient technology for the removal of nitrates in ground water intended for drinking water and / or water treatment for the rejection of the reverse osmosis plants, with a high concentration of nitrates, which are currently dumped directly, without taking any action on them. Therefore, it helps to ensure the safe and efficient use of water resources.

3) Description of the technical / methodological solution

The objectives anticipated in the proposal will be achieved by means an *integrated innovative system* based on the use of an adsorption bed made of active silica obtained from the ashes got from the controlled incineration of rice straw in a spouted bed reactor adapted for this purpose.

4) Expected results and environmental benefits

a. Reduction of at least 30% of the concentration of nitrates of an effluent of 130 l/day in: (a) water form header, at 65-75 ppm, to below 50 ppm in drinking water plant (b) from the rejection effluent of a reverse osmosis plant.
b. Reduction of energy consumption in osmosis plants 0.97 kWh per m3 of water that does not go through the osmosis plant due to the decrease of energy consumption by reducing partially or totally the flow of water to be treated in a reverse osmosis plant.
c. For small municipalities of 200 inhabitants, direct purification of at least 26m3/day of well water reducing the nitrate concentration below 50 ppm and close to 25ppm.
d. Both aspects will permit capturing a considerable part of $NO3^-$ in the beds of active silica, which has reached groundwater by leaching, not reaching the rivers and humeral where denitrification occurs.
e. Nitrogen fertilizers provide more than 40% of nitrogen (N_2) and it has been calculated that only 17% of nitrogen fertilizers are assimilated by crops, scattering the rest by ecosystems. These farming practices are responsible of anthropogenic nitrogen and have triggered harmful processes to the environment. LIFE LIBERNITRATE proposes to tackle this problem in the origin and to implement corrective measures providing advice to farmers to reduce the amount of nitrogen fertilizer that will reduce the presence of $NO3^-$ in the ground.
f. Promoting Political Action Plan to get funds of other EU programs as ESEF, FEDER, etc. in order to act against bitrate pollution.
g. To issue a Business Plan to extend the results of the project by replicability and transferability activities at European level.

- Expected longer term results (as anticipated at the start of the project):

The LIBERNITRATE project is in line with the 2nd key action area of the *7th Environmental Action Programme (EAP)* which refers the "resource-efficient economy", given that the results of the project should contribute to improve the efficient use of water by "turning waste (water with high content in NO_3^-) into a resource" by means specific bed of active silica obtained from the ashes of rice straw to be developed at the project.

The LIBERNITRATE project will help to ensure the reduction of nitrates (Article I of Water Framework Directive 200/60 / EC of the European Parliament and the Council), the Nitrates Directive (91/676/EEC) development and together to that, it will help to minimize eutrophication processes and to protect the humeral and marine waters (Directive 2008/56 / EC of the European Parliament and Council, Article 3, Item 5 and 8, Article 9 paragraphs 1 and 3, Annex I).

Other European policies related to the LIBERNITRATE project are the Groundwater Directive (2006/118/EC) and the Drinking Water Directive (98/83/EC).

5. Administrative part

The LIBERNITRATE project developed without major problems and, in general terms; all actions have been carried out as foreseen. During all the project's development, the project has benefited from close collaboration between all the participants and has maintained close contact through different media (e-mail, telephone, meetings, etc.)

The project's management process needed daily work to maintain a permanent flow of action with the aim of achieving the objectives foreseen in the proposal. The specific management activities carried out were:

- Preparation of the Partnership Agreement
- Organisation of Coordination meetings
- Organisation of Monitoring meetings
- Organisation of different phone and web meetings between some beneficiaries in order to plan and monitor the project technical activities
- Continuous contact between all project beneficiaries for monitoring project activities
- Preparation of material for meetings and dissemination events.
- General actions and activities for the coordination of the project.
- Management of the financial and administrative aspects of the project.
- Preparation of all of reports (Mid Term, 1st and 2nd progress report and Final Report to be submitted to the EC)

The management of the project was carried out in compliance with what was established in the proposal approved by the European Commission, with all partners acting in compliance with the Grant and Partnership Agreements.

The project management structure is some complex due to the participation of eight beneficiaries of three different European countries, plus EC and LIFE external team.

The LIBERNITRATE project beneficiaries established a "Management Board" in which all the participants are represented. A series of scheduled general meeting of the partners has been considered all throughout the project lifetime. During the kick-off meeting carried out in Valencia on 21 November 2017. the leadership for the development of each task was distributed along with the roles of each partner in each action of the project. Furthermore, each action has been divided, when necessary, into different relevant issues and the development of such parts assigned to the most adequate partner. The leader of action is responsible to coordinate the other partners in the progress of the action and produce a draft internal reported to be submitted to the project coordinator. Technical meeting between some partners are performed "ad-hoc" to make progress in technical documents. Despite the number of partners involved in the project, the management structure allows for a fluent interchange of information mainly via electronic mail. Thus, the leader of action reports directly to the coordinator and sends internal reports for evaluation. Finally, with all the information exchanged the coordinator prepares the final document corresponding to a deliverable scheduled at the Proposal.

The LIFE LIBERNITRATE project consortium added value is:

- CRIB, beneficiary coordinator, is regional agency expert in implementing projects that promote sustainable energy development, public awareness and environmental education.

- AVSA associated beneficiary, is a private structure, participating throughout its department of I+D+I and department of Desalination, is expert in water treatment specifically in this LIFE in reverse osmosis.
- DIVAL associated beneficiary, is a public body, participating throughout its department of Office of European Projects, is expert in advanced tools for the dissemination and communication of its actions and policies.
- LWI associated beneficiary, is a private structure. The organization does not have departments and is flat. Associates and the workforce of LWI are expert in the analysis of business plans and feasibility study of start-up companies.
- UNIGE, associated beneficiary, is a public university, participating throughout its department DICCA and through the PERT group. PERT is expert in innovative and traditional topics in chemical and process engineering with specific interest in the interactions between technology and environment to promote a sustainable development.
- UNIO, associated beneficiary, is a private structure, participating in all its technical department, is an expert in agronomic and agro-environmental management of crops.
- UPV, associated beneficiary, is a public university, participating throughout its department of, Degradation and Recycling of Polymer-based Materials. DREMAP is a research group that belongs to the Materials Technological Institute. The expertise of this group are multidisciplinary and transversal, including research lines such as the (i) Material and energetic valorization of biomass; (ii) Design, preparation and characterization of new polyelectrolytes for energetic applications in direct alcohol fuel cells; (iii) Study of the durability of polymer-based materials through accelerated simulated service life conditions; (iv) Evaluation of the long-term properties and end-of-life of polymer-based materials; and (v) Development, functionalization and validation of smart nanoscaled scaffolds for biomedical applications.
- UV, associated beneficiary, is a public university, participating in its MINTOTA and ECON departments, experts in analytical chemistry, nanomaterials, chromatography, in situ analysis, waste valorisation, environmental science and health (MINTOTA) and cost analysis and efficiency in the management of water resources (ECON).

In summary, there have been four visits to the project by NEEMO (Mr. Borja Dominguez), external assistance of CINEA, and one visit by officer by CINEA (Mr. Federico de Filippi) telematically, to whom we must thank for his good disposition and comments througout the project. In addition, CRIB and Mr Borja Dominguez have had many phone and e-mail contacts. There have been no difficulties on this side.
In July 2020, an amendment to the grand agreement was requested to extend the project period, which was accepted in September 2020 and thus all the actions reviewed in the proposal could be completed.

6. Technical part (maximum 25 pages)

6.1. Technical progress, per Action

Action A1: Definition of the state of the art and the technical basis of the technological innovation.

Foreseen start date: October 2017	Actual start date: October 2017
Foreseen end date: January 2018	Actual end date: January 2018

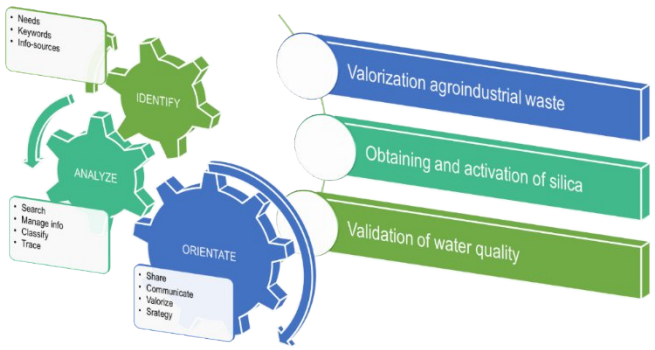
DL: Informe del estado del arte y técnica y protocolo del ciclo de vigilancia de innovación tecnológica LIFE LIBERNITRATE

Foreseen date: 01/01/2018	Actual date: 01/2018

No ML anticipated in the proposal

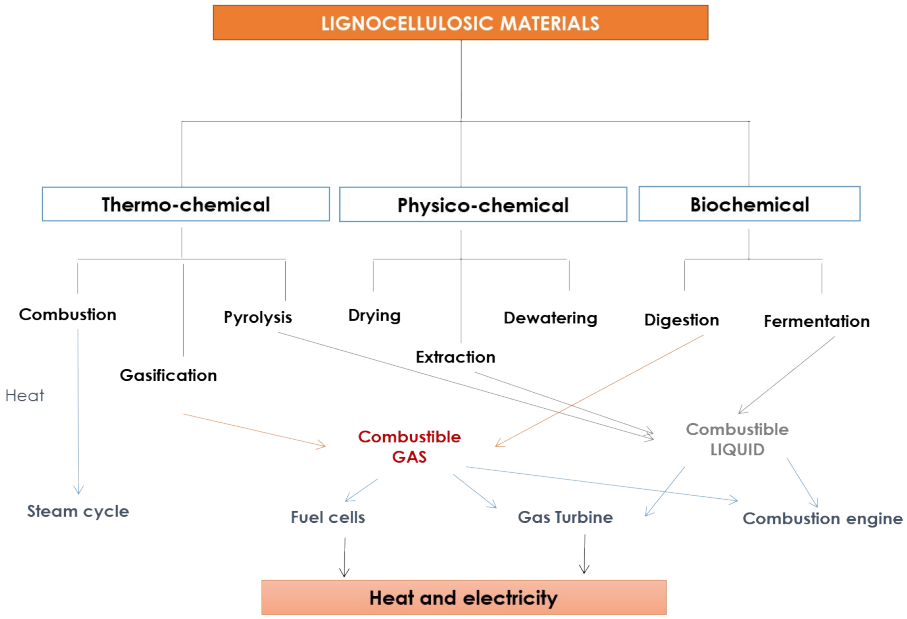
- The A1 action has been carried out as outlined in the LIBERNITRATE project. Within this Action, the scientific and technological studies on which the LIFE LIBERNITRATE project starts are defined. The types of biochemical, thermochemical and physical-chemical conversion of agroindustry waste are indicated, with special emphasis on rice straw. Likewise, the different procedures for obtaining silica and its surface functionalization are indicated to increase the activation potential of nitrate adsorption. Finally, an exhaustive study of the different water quality analysis methodologies is carried out.
- The Action A1 has been coordinated by UPVLC, and participated by UVEG, UNIGE and UNIO. To achieve the preparation of adsorbent beds from the treatment of the silica obtained from the ashes of the thermal-energy recovery of rice straw residues two aspects were considered: technological watching procedure and update of the state of the art. For one thing, the partners developed deskwork using advanced meta search engines, which has permitted access to scientific papers and technological patents. After a process of reading, analysing, selecting and synthesizing the information. For another, the latest innovations have updated in the fields of:
  - (i) valorisation of agroindustry waste,
  - (ii) methodologies for the obtaining and activation of silica,
  - (iii) adsorption and validation of quality of soils and water.

The methodology carried out can see in the following scheme:



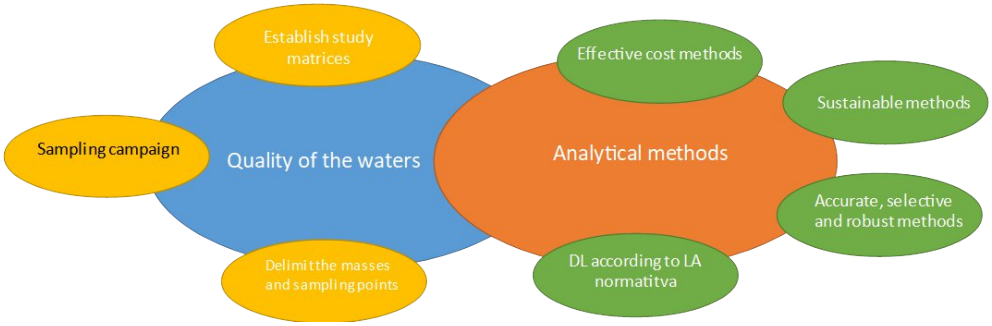
In addition, nitrogenised fertilisation in crop fields has been analysed and a study of the different fertilizers of slow absorption has been carried out because they are the most adequate to contribute to reduce nitrates to the water cycle

- The foundations of the technological watching system of the project are established in terms of planning, resources and evaluation of the results of the system. In the central core of the Action A1, the scientific and technological studies on which the LIFE LIBERNITRATE project starts are defined. The types of biochemical, thermochemical and physical-chemical conversion of agroindustry waste are indicated, with special emphasis on rice straw. In this sense, the possibility of using it as an energy vector and, further on, as a source of material for obtaining adsorbent materials, are shown.



Likewise, the different procedures for obtaining silica and its surface functionalization are indicated to increase the activation potential of nitrate adsorption.

Finally, an exhaustive study of the different water quality analysis methodologies is carried out, as a key tool for the technical assurance of the monitoring capacity of the key indicator of the LIFE LIBERNITRATE project: the nitrate concentration of an effluent. All these results have important implications for the project, since it permits to discuss and establish the technological cornerstones for the development of the project.



- Action A1 started in October 2017 and at the end of implementation in January 2018. The activities undertaken and outputs achieved which can be highlighted are

~ 1 Technological watching system for the project LIFE LIBERNITRATE, prepared by UPVLC, and revised by the rest of the partners of Action A1.

- 1 Revision of the state of the art on valorisation of agroindustry waste, prepared by UPVLC and UNIGE, and revised by the rest of the partners of Action A1.
- 1 Revision of the state of the art on methodologies for the obtaining and activation of silica, prepared by UPVLC and UNIGE, and revised by the rest of the partners of Action A1.
- 1 Revision of the state of the art on adsorption and validation of quality of soils and water, prepared by UVEG, and revised by the rest of the partners of Action A1.
- 1 Revision of the state of the art on nitrogenised fertilisation in crop fields, prepared by UNIO, and revised by the rest of the partners of Action A1.
- 1 Deliverable A1, which accounts for the explanation of the technological watching system and the revisions of the state of the art, considering 75 selected references.

- The Action A1 has been executed according to the technical requirements and planned schedule, and the Deliverable A1 fully delivered (January 2018).
- Neither activities were modified, nor major problems / drawbacks were encountered along to the Action development.
- No complementary action outside LIFE was carried out.
- The perspective for continuing the Action A1 after the project are clearly concerned by the technical development of the innovation sought by LIFE LIBERNITRATE and is, therefore, inherent to the demonstration activities taken into account in the Actions B of the project.

Action A2: Establishment of technical indicators and monitoring procedures for the project

Foreseen start date:	1/10/2017	Actual start date:	1/10/2017
Foreseen end date:	31/12/2017	Actual end date:	31/12/2017

DL: Informe de indicadores y procedimientos para la medición del impacto medioambiental, socioeconómico y de las acciones de difusión

Foreseen date: 01/01/2018	Actual date: 01/2018

No ML anticipated in the proposal

- The A2 action has been carried out as outlined in the LIBERNITRATE project. UVEG coordinated this action and AVSA participated. Within this Action, the tasks carried out have been the following:
  - *Task A 2.1. ESTABLISHMENT OF INDICATORS AND PROCEDURES FOR MEASURING THE ENVIRONMENTAL IMPACT*. The selection of the methods for measuring parameters (ammonium, phosphate and nitrate) in water matrices was carried out. Analysis of the several water matrices bearing in mind the proposed scheme 1 of the project, ecological and chemistry state evaluation and priority and specific contaminants selection and determination have been realized.
  - *Task A 2.2. ESTABLISHMENT OF INDICATORS AND PROCEDURES FOR MEASURING THE SOCIO-ECONOMIC IMPACT*. The following socio-economic impact indicators have been chosen: Replicates; Transfers to other sectors; Reduction of costs per unit of production and operation; Profit and repayment time (pay-back); Workers, direct and indirect and Beneficiaries
- Overall, regarding both sub-actions,
  - the absorbance measurement at 220 nm was selected for nitrate determination.
  - Validation of the nitrate on-line measurements has been performed by using an optical probe and an analyser.

- The levels of nitrate concentration found exceed the allowed value of 50 ppm, both for the incoming and reject water of the osmosis plant.
    - The incoming water would have a very good / good state in relation to ammonium, deficient / bad for nitrate and good / very good in relation to phosphate.
    - The situation worsens markedly for the reject water, the last two parameters reflecting a poor / bad state.
- The supply water after osmosis treatment considering the nitrate presents a good / moderate state (RD 817/2015).
- The results for priority and specific contaminants are in accordance with the water quality established by the WFD for this type of compounds.
- Geographical areas that may favour the implementation of the proposed technology have been considered and social-economic impacts selected.

- All the methodologies, tools and resources necessary for the subsequent analysis and monitoring, which will be developed in actions C1, C2 and C3, have been prepared and put into practice in this action.

  The indicators and procedures for measuring the environmental impact and for stablishing the ecological and chemistry state for the several water matrices have been selected. The socio-economic impact indicators are corresponded to the labour penetration of the project results, through the replicability and transferability potential (Action B5) and the project sustainability plan (Action B6). The objective of this action is: To assess the impact of the project on environmental, social and economic terms.

  The expected impacts are focussed on improving water quality 9,584 m3/year (project end); 9,154,200 m3/year (beyond project end); nitrate concentration <45 ppm (project end and beyond project end) and nitrate reduction -30% (project end and beyond project end)

- Action A2 started in October 2017 and at the end of implementation in December 2017. The activities undertaken and outputs achieved which can be highlighted are

  - The selection of the methods for parameters (ammonium, phosphate, nitrate) in water matrices was carried out. Sensors developed by MINTOTA were used for ammonium and phosphate determinations. Absorbance measurement at 220 nm was selected for nitrate determination.
  - Validation of the nitrate on-line measurements have been performed by using an optical probe and an analyser. Similar and suitable figures of merit were achieved for both of them.
  - Analysis of the several water matrices bearing in mind the proposed scheme 1 of the project, ecological and chemistry state evaluation and priority and specific contaminants selection and determination have been realized.
  - The concentrations of NO3- indicate that the levels of concentration found exceed the allowed value of 50 ppm, both for the incoming and reject water of the osmosis plant. The plant is efficient and allows reducing the concentration of nitrates up to 25 ppm (good / moderate state).
  - The following socio-economic impact indicators have been chosen: Replicates; Transfers to other sectors; Reduction of costs per unit of production and operation; Profit and repayment time (pay-back); Workers, direct and indirect and Beneficiaries.
  - The number of geographical areas that, due to their characteristics and water needs, may favour the implementation of the proposed technology has been used as an

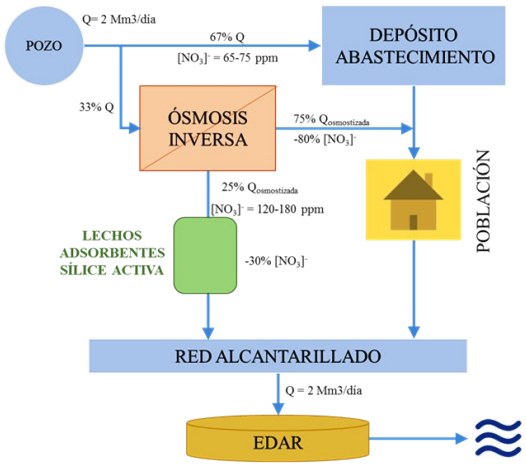
indicator. A classification has been established in which the priority of the different zones has been identified.

- The territorial variable has been considered in order to quantify the existence of possible agglomeration economies. The existence of associations of municipalities to which the implementation of the project could be offered with a unit cost lower than that of an isolated user has been considered.
- Changes in the tariff structure (tranches) has been studied more than a linear increase in the water tariff. In the areas where there is a risk of regulatory noncompliance, an indicator relating to the cost of not acting through a contractual scenario has also been included.
- The number of direct positions has been counted, and the number of indirect positions related to the execution of the project has been estimated.
- Indicators related to the effects on health derived from the consumption of water with excess nitrates has been used and other ones related to the consequences of non-actuation.
- The impact of the website and social networks has been measured through the registration of visits and interaction with citizens through the threads of information on the networks.

- The comparison with planned output and time schedule is included in the chart below

Activity	Expected date	Actual date	Justification
Stablishing INDICATORS AND PROCEDURES FOR MEASURING THE ENVIRONMENTAL IMPACT	1/10/2017	1/10/2017	According to the scheduled dates
Stablishing INDICATORS AND PROCEDURES FOR MEASURING THE SOCIO-ECONOMIC IMPACT	1/10/2017	1/10/2017	According to the scheduled dates

- Neither activities were modified, nor major problems / drawbacks were encountered along to the Action development.
- No complementary action outside LIFE was carried out.
- In a future perspective, the proposed methodologies for measuring the environmental and social-economic impacts are expected to continue working once the project is finished provided that rice straw is always available.



Scheme of the proposed design 1 in LIBERNITRATE

Action A3: Development of procedures for corporative social responsibility, green public purchase and permits for the territorial implementation

Foreseen start date:	10/2017	Actual start date:	01/2018
Foreseen end date:	01/2018	Actual (or anticipated) end date:	03/2019

DL: Convenios necesarios para el desarrollo del proyecto

Foreseen date: 01/01/2018	Actual date: 03/2019. Delayed but neither affecting the project advances, nor its objectives.

No ML anticipated in the proposal

- The A3 action has been carried out as outlined in the LIBERNITRATE project. Within this Action, the tasks carried out have been the following:

    - Task A3.1. Development of procedure of Corporate Social Responsibility and Green Public Purchase. A GPP and CSR agreement was always drafted to ensure compliance with the requirements detailed in the proposal, and also comply with all the provisions of the European Parliament and Council directives 2014/23 / EU and 2014/24 / EU.
    - Task A3.2. Development of the agreement for the transfer of facilities for the implementation of the demonstration pilot. CRIB met on several occasions with the town hall of Alginet to define the necessary spaces to be transferred. It was agreed that Alginet City Council would provide a room in the sports centre for the installation of the rice straw waste valorisation equipment, a room in the Adult School for the location of the laboratories, a municipal warehouse for the location of the treatment equipment of the rice straw (pelletizer) and the water treatment plant for human consumption for the installation of the prototypes of the active silica filters.
    - Task A3.3: Development of collaboration agreements with farmers. UNIO raised the problem of nitrates in its county headquarters and many farmers showed their interest in participating and providing plots for experimentation. To ensure the supply of raw material, selected among the interested farmers was chosen the most suitable for the project.

- Overall, regarding these sub-actions, the work done was

    - Task A3.1. The application guidelines and criteria used by the Barcelona City Council, the Basque administration and the GPP manual published on the EU website were studied. With all these data, a first version of the agreement was drawn up among the members of the consortium, which was analysed and after some tweaking, the final version was approved to be signed.
    - Task A3.2. For the selection of spaces to be assigned by the Alginet City Council, CRIB, together with UPVLC, UVEG, UNIO and AVSA, visited all the facilities offered by Alginet City Council for the project. These locations were evaluated and the most appropriate for the implementation of the project were selected. Since then, the facilities were ready to be used by the Consortium to carry out the activities planned in the project.
    - Task A3.3. UNIO applied various selection criteria to its partners database, from which various candidates emerged, to which it was interviewed and one of them was the most appropriate for the needs of the project.

- At the end of the project, the main findings and results are

- Task A3.1. The objective of this action was to develop and apply CSR and GPP procedures in purchases and contracts. As a result of the signing of this agreement, criteria of CSR and GPP have been applied in purchases and contracts. In some cases, the application of these criteria has slowed the administrative procedure and caused delays in the execution of the actions.

- Task A3.2. The objective of this action was to obtain the permits and agreements for the correct development of the project. The cession by Alginet City Council of the adequate facilities for the correct development of actions B2 and B3 has been achieved.

- Task A3.3. The objective of this action was to obtain agreements with the farmers for the cession of the plots necessary for the experimentation and agreements for the supply of raw material. It has managed to sensitize many farmers who will be convinced with the results provided by action B1. The supply of raw material has also been ensured.

- Action A3 began in January 2018, and although all beneficiaries immediately began to implement everything specified in the agreement, the signature of some partners has been delayed until March 2019, the date on which the action was completed:
  - The RSC and GPP agreement were signed between all the members of the consortium (three agreements were signed by CRIB: CRIB + UVEG, CRIB + UPVLC and CRIB with the rest of AB of the project).
  - All partners have applied CSR and GPP criteria in their contracts.
  - Alginet City Council has given the locations for the implementation of the project. The room for the laboratories has been adapted to the needs of the project.
  - The rice straw necessary for the execution of the project has been obtained, which has been stored and protected from moisture in Alginet facilities.
- There are no modifications regarding to anticipate in the proposal; the comparison with planned output and time schedule can be seen in the chart below,

Activity	Expected date	Actual date	Justification
Development of procedure of Corporate Social Responsibility and Green Public Purchase	31/12/2017	11/03/2019	Agreement signed after the deadline due to internal administrative procedures of public bodies but without causing delay in other actions.
Development of the agreement for the transfer of facilities for the implementation of the demonstration pilot	31/12/2017	12/06/2018	Agreement signed after the deadline but without causing delay in other actions
Development of collaboration agreements with farmers	31/12/2017	7/12/2017	According to the scheduled dates

- The main problem encountered has been the signing of the CPV and RSC agreement by the partners being public bodies. Its internal administrative procedures have been responsible for the delay. However, as these criteria are already being applied currently according to their internal rules so imply the criteria related to CPV and RSC will be applied, for sure, after the end of the project.
- No complementary action outside LIFE was carried out.

Action B1: Awareness programme for farmers to reduce the excessive use of nitrogen fertilizers.

Foreseen start date:	01/01/2018	Actual start date:	01/01/2018
Foreseen end date:	30/06/2020	Actual end date:	31/09/2021

DL: Material formativo y guía explicativa de prácticas de fertilización responsable en castellano, inglés italiano y holandés

The Action B1 has been coordinated and implemented by UNIO. This action is subdivided in:

- Action B.1.1 *Advice to farmers in fertilization of low environmental impact*.
- Action B.1.2 *Awareness raising and training.*

In order to develop these sub-actions different activities have been performed:

- ACTION B.1.1 ADVICE TO FARMERS IN FERTILIZATION OF LOW ENVIRONMENTAL IMPACT.

Phase 1 Selection of test plots.

The plots selected are the following:

Crop	Municipality	Plot size	Location
Rice	Sueca	1,165 Ha	39° 15′ 0.22′′ N, 0° 18′ 37.16′′W
Persimmon	Alberic	0,4 Ha	39º 5′ 35.58′′ N. 0º 31′ 53.87′′ W
Citrus	Alberic	0,4 Ha	39º 5′ 30.92′′ N. 0º 31′ 56.71′′ W

The selection of the plots involved the selection of the farmer-owners. These farmers are opinion leaders of the agrarian community and respected. One of them had both persimmon and citrus plots with flood irrigation (which allows an easy control of the test). Both plots are contiguous which would facilitate control and cost savings per visit.

Phase 2 Fertilizer selection.

Slow release fertilizers are characterized by the use of inhibitors that lengthening the time nitrogen remains in the soil, either as urea-N or ammonium-N, improving nitrogen use efficiency by the plant and therefore reducing emissions to the environment but giving nutrients to the plant during all the natural cycle.

Rice slow release fertilizer. NP 40-10 fertilizer with urease inhibitor (*Triamide N-(n-butyl) thiophosphoric (NBPT)*) has been chosen for rice crop.

Slow release nitrification inhibitors have been chosen for persimmon and citrus crops.

- NPK complex fertilizer (Mg-S) 20-7-7 (2,7-10) with nitrification inhibitor (*3,4-dimethyl- 1H-pyrazol phosphate (DMPP)*).
- Ammonium sulphate 21 (60) with nitrification inhibitor (*3,4-dimethyl- 1h- pyrazole phosphate (DMPP)*).21% ammonia.
- Ammonium nitrosulphate 26 (37) with nitrification inhibitor (*DMPP*).

Phase 3 Implementation in the crops. Methodology and Experimental design.

Rice.

Methodology: The objective of our experimental design is to verify that with this NP 40-10

fertilizer with urease inhibitor, the additional fertilization is unnecessary, which means cost and time savings and a reduction in the consumption of nitrogen fertilizers that, in excess, would end up as nitrates in drinking water. During the last 4 years, the farmer has needed to make additional fertilization to support the growth of the plant, including foliar to maintain an average total production of 11.176 Kg by season for the whole surface.

First year results. 2018.

Dividing the plot in two parts: Control and test. Objective: Comparing growing and production using classical fertilizer versus slow fertilizer. For basal fertilization, May 7th , 39-11-0 (400Kg) traditional fertilizer was used against 400 Kg/ha of slow release 40-10-0 fertilizer. The evolution of the crop was monitored and controlled on a monthly basis.
The additional contributions of fertilizers it will be based on the nutritional state of the plant that can be determined by calibrating the green colour of the plant in a template.
At the end of June, the greenness of the plant was checked in both sub-plots. The results were very promising for the demonstration plot, a sustained colour 4, however the control subplot maintained a 3 and only in some cases approached the 4. The control subplot had to be fertilized with an additional 70 kg of urea.

Quantitative results:

1. The harvest results were as follows: Plot Control: 5,500 kg, Plot Test: 5,700 kg, 3.6% more. So without additional fertilization the slow release fertilizer proves to be more effective and efficient.
2. Soil analyses show a post-harvest nitrate concentration of 1.24 mg/kg for control and 1 mg/kg for test. Sufficient difference and aligned with the starting point, that is, the use of nitrogen is more effective in slow release fertilizers. The amount of nitrogen not used by the plant and susceptible to being leached is lower in this case.

2nd year Results. 2019

During the 2nd year the experiment goes beyond, all the plot was fertilized with slow-release fertilizer.

Quantitative results**:**

- 2.6% less production.
- Less fertilizer used.
    - Only 720 Kg basal dressing (40-10).
    - Saving 150 Kg of Urea 2nd dressing.
    - Average reduction 2019: 17,24%
- Nitrate in the soil.
    - Analysis: Intermediate < 5 mg/Kg . Post harvest < 2mg/Kg

The 2nd year data consolidate the results of the first year with a not significant reduction of the production.

Citrus fruits and persimmon.

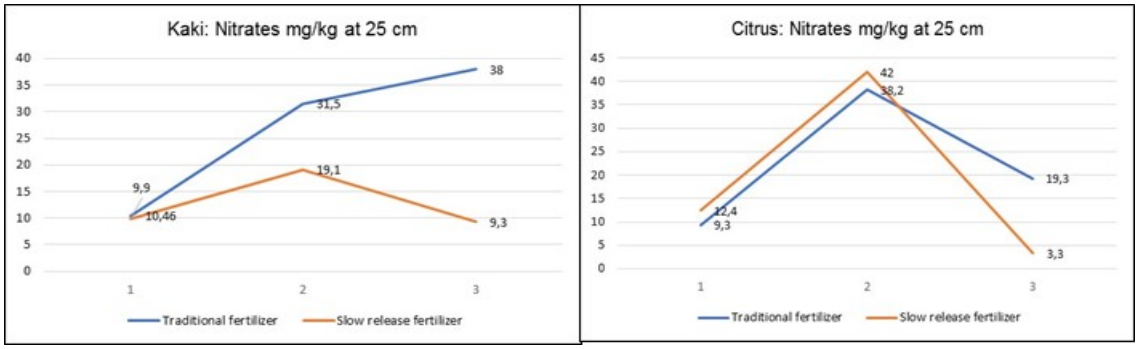
First year (2018)

Methodology: The same amount of fertilizer was used in plots, traditional fertilizer in the control plot and slow-release fertilizer in the test plot.
Both citrus and persimmon are fertilized three times during a year. The table shows the data

of these fertilizations.

Citrus/Kaki (Persimmon)			
Date	**Fertilization**	**Plot control**	**Plot test**
21/03/2018	Bassal	Fertilizer 20-10-5-3(Mg) 400Kg/ha	Fertilizer NPK (Mg-S) 20-7-7 (400kg/ha)
22/06/2018	1st Additional	Ammonium sulphate 300Kg/ha	Ammonium sulphate 21 DMPP(300kg/ha)
10/08/2018	2nd Additional	Nitromagnesium 400kg/ha	Nitrosulphate of ammonia 26 DMPP.338kg/ha

Quantitative Results: A soil analysis was carried out after each one of the fertilization dates looking for determinate the nitrate level in both sub-plots: control versus test. Sampling at a depth of 25 cm



As can be seen, the final residue of nitrates shows a significant difference in line with what would be foreseeable: The nitrate residue that remains in the soil in the case of traditional fertilizer was higher than in the case of slow-release fertilizer.

Agronomic results**:** Persimmon has not been harvested this season due to the hail that fell in July 2018 that devastated the crop. 100% lost. The citrus harvest was also affected by hail. The harvest was lost by 50%. No significant differences between citrus plots.

2nd year Results. 2019

Methodology: The plots were divided in test and control sub-plots.

Both citrus and persimmon are fertilized three times during a year. The 2nd year was very stable in terms of weather, no frost or hail and fertiliser uptake has been in line with expectations. The table shows the data of these fertilizations.

In the case of Persimon a 33% less of fertilizer was used in the test sub-plot, in citrus a -25%.

Persimon		
Fertilization	**Plot control**	**Plot test**
Bassal	Fertilizer 20-10-5-3(Mg) 480Kg/ha	Fertilizer NPK (Mg-S) 20-7-7 (480kg/ha)
1st Additional	Ammonium sulphate 300Kg/ha	Ammonium sulphate 21 DMPP(100kg/ha)
2nd Additional	Nitromagnesium 360kg/ha	Nitrosulphate of ammonia 26 DMPP.180kg/ha

Citrus		
Fertilization	**Plot control**	**Plot test**
Bassal	Fertilizer 20-10-5-3(Mg) 480Kg/ha	Fertilizer NPK (Mg-S) 20-7-7 (480kg/ha)
1st Additional	Ammonium sulphate 300Kg/ha	Ammonium sulphate 21 DMPP(200kg/ha)
2nd Additional	Nitromagnesium 360kg/ha	Nitrosulphate of ammonia 26 DMPP.180kg/ha

Agronomic results 2nd year.

- In persimmon: 4% less production in the test sub-plot. Not significant
- In citrus**:** 1% less production in the test sub-plot. Not significant

In synthesis: We demonstrate to the farmers that is possible with commercial slow release fertilizers to reduce the environmental impact reducing cost (less fertilized used) at the same time.

SUBACTION B1.2 AWARENESS RAISING AND TRAINING OF FARMERS

The continuous monitoring of the crops and checking the nitrates situation with different agrarian communities but also with the municipal agrarian councils we detect the almost absolute unknowledge about what means Nitrate vulnerable zones and what type of environmental problems generate an excessive nitrogen fertilization in the soil and water. At the same time the Covid 19 pandemic changes everything. A face-to-face training action as foreseen seems impossible to carry out. Faced with this situation, we decided to transform a face-to-face training action, which was to be developed using the pedagogical guide foreseen, into a MOOC course, i.e. to develop a complete, self-training course in video format for all farmers. Developing the new MOOC course, a new and key element emerged, the new Common Agrarian Policy.
The new CAP, especially the Pillar I, determinates, in few words, a new and green approach: The respect to the Water a Nitrates directive will means to the farmers a 20% of the total payments they can receive by crop following different eco-schemes. This is a revolution and an opportunity for the new course: to incorporate these new contents, the new PAC and eco-schemes in the course and by this way to complete the concept circle: "You, farmer, need to know what a Nitrate vulnerable area is, you have to know how to fertilize with low environmental impact because by this way you will reduce cost, but also you will be prepared for the eco-schemes of the new PAC".
All this has generated a new **ecosystem of products** available in detail in the deliverable B1**.**

1. The course.

General and structure.
The course has a single target group: the agricultural community.
The course consists of 5 modules plus 1 additional module (module 6) that, describes the experience of fertilisation with slow-release fertilisers in persimmon, citrus and rice crops.
These 6 modules are as follows:

1. Fertilisation: General
2. The Nitrates Directive and Nitrate Vulnerable Zones.
3. Determination of nitrates in soil.
4. Good Agricultural Practices and the New CAP.
5. How to make a fertilisation plan.

6. Libernitrate: An example of responsible fertilisation.

The course together with the interviews is available at:

- The youtube channel of the Libernitrate project: https://bit.ly/3aRUJpb
- The youtube channel of La Unió de Llauradors i Ramaders: https://bit.ly/3pfBHS6

2. The teaching/pedagogical guides.

The teaching guides are the heart of the course content. They define, slide by slide, what is offered as content to the learner. This content has been the fundamental workhorse of the course: what to explain and how to explain to a farmer the exceptional amount of possible content around an axis, such as responsible fertilisation, in a convulsive framework such as the one defined by the new CAP.

Since we are talking about a MOOC course, we have considered it necessary to focus on strong arguments on the one hand and on exposing and "discovering" for the farmer the legislation and regulations that go with those arguments on the other hand. Furthermore, we have avoided as much as possible to use technical language, but on the contrary, as easy as possible.

These guides have been published and are freely available in English, Spanish, Dutch and Italian.

- Spanish version: See this link.
- English version. See this link.
- Italian version. See this link.
- Dutch version. See this link

1. **Power point presentations.**

This is an intermediate product that visually supports the MOOC course or in other words the way in which the teaching guides are shown to the learners. It can be used by teachers (in the future) as model and template for new contents. direct link

2. **The podcasts.**

The podcasts were foreseen in the approved project as an element of dissemination of the experience of low environmental impact nitrogen fertilisation. Sub-Action 1.1.

Obviously, after the development of the course, the dissemination effort should focus on the MOOC course itself, so podcasts will play a much less relevant role. Even so, they will continue to be useful in those circumstances in which the farmer cannot, be attentive to a video.

These podcasts are available in each language provided (English, Dutch, Italian and Spanish):

- English: https://bit.ly/3lSi1Sc
- Dutch: https://bit.ly/3pfJDT5
- Italian: https://bit.ly/3aPGC3y
- Spanish: https://bit.ly/3vpLZQz

Comparative Results and Conclusions.

- All the planned products have been developed, implemented, and are fully available free of charge. In the case of podcast, we have made 20 in total, with an average length of 5 minutes each. If we sum the interviews to the farmers co-protagonist of the field test, we have 10 minutes more for each language.
- In addition to the planned 5-minute subtitled video explaining the nitrogen fertilisation experience of sub-Action 1.1, a separate 16-minute video training module, Module 6, has been produced. If we sum the interviews to the farmers co-protagonist of the field test, we have 10 minutes more for each language. Almost half an hour of explanation.

- To validate the contents of the course, 3 independent and face to-face training actions were foreseen, but a complete self-training and online course has been developed, composed of 6 independent modules that together add up to more than 1,5 hours of training, and almost 2,5 hours if we consider the 10 interviews carried out with different stakeholders. The current course is not only based on this experience, but is also defined and aimed at raising awareness among the farming community of the nitrate problem, including the effect of the new CAP. It is not only a much broader course, but also much more urgent and necessary, innovative, and unique in its content, as it combines environmental, economic, and technical aspects in a single pedagogical package.
- The MOOC course and its guides are a living instrument as opposed to a planned pedagogical guide. The guides allow that the MOOC course to be continually updated with new information and content, adapting indefinitely to the new realities that will result from the new CAP and the continuous need to reduce the environmental impacts of fertilisation. They will not be limited to just 3 crops and will be equally useful, adapted to any crop, becoming an instrument not only for replicability but also for transfer between crops and new agricultural collectives.

The B1 Action has overcome the expectations and their results and products go beyond, they are absolutely adapted to the new needs coming from the green deal and new CAP. The products are easily re-adaptable and transferable to other crops and new contents attending the real needs of the farmers can be inserted in the future. Regarding the impact data of the MOOC course, the detail is included in the summary of the dissemination action carried out in action D.2, however it can be advanced that 318 complete views of the course have been achieved through the youtube channel and at least 754 people have seen a training module. The execution of the Action B1 has not required from complementary action outside LIFE.

Action B2: Technological demonstration: material recovery of agricultural waste for the obtaining of active silica.

Foreseen start date:	01/2018	Actual start date:	02/2018
Foreseen end date:	12/2020	Actual (or anticipated) end date:	09/2021

DL: Diseño del valorizador.

Foreseen date: 01/01/2018	Actual date: 05/2018 – Finished with delay (see comments below)

DL: Protocolo de puesta en marcha, guías operacionales, guías de mantenimiento, protocolos de emergencia y riesgos del valorizador y la obtención de sílice activa.

Foreseen date: 30/09/2020	Actual date: 01/2019. Last modifications: 09/2021

ML: Puesta en marcha del valorizador.

Foreseen date: 01/10/2018	Actual date: 05/2019 - Delayed (see comments below)

ML: Puesta en marcha del laboratorio de sílice activa.

Foreseen date: 01/04/2019	Actual date: 03/2019

- The B2 action has been carried out as outlined in the LIBERNITRATE project but delayed. Within this Action, the tasks carried out have been the following:
  - Sub-action B2.1: A total of 2.5 tons of rice straw were collected and stored in a dry warehouse in Vall d'Uixò (Valencia) by UNIO (October 2017 and October 2020). The straw was transported to Alginet, stored under adequate conditions and used for all the described tests.
  - Sub-action B2.2: The design of the valorisator was delivered (date 20/04/2018) according to the technological requirements described in the public tender process

following UNIGE's normative. The corresponding Deliverable (Deliverable 2.1) was submitted on 23/05/2018.

- Sub-action B2.2: The public procurement procedure for the construction of the prototype (including Green Procurement criteria) was awarded to "Bio Fire Soluciones S.L.U" by CRIB on 29/10/2018. Its construction started straightforward, and the start-up was done in May 2019.
- Sub-action B2.2: Set-up and optimisation activities were done in the period September 2019-June 2020. Modifications on the initial design to achieve improved results were performed throughout the optimisation process. The last modifications were done in January 2021 and, after them, the valorisator worked in continuous and automated mode, with human supervision.
  Sub-action B2.2: The optimisation activities consisted in finding the optimal operational conditions (percentage of wood/straw pellets, air inflow, temperature). Simulation activities using Aspen Plus helped assessing the technical limits/range of improvement of the valorisator.
- Sub-action B2.2: A total of 2332 kg of pellets (60wt%rice straw/40wt%wood) were burnt in the valoriser (total of **1624 kg rice straw** in the whole project) to obtain **261 kg of ashes** (ash efficiency=16%wt)
  Sub-action B2.3: A reactor with capacity 30L and the associated laboratory were designed and set up in Alginet to carry out the functionalization of silica. A total of **71.84 kg of silica** has been extracted and funcionalised (efficiency=25%wt).

- In quantifiable terms, the outputs achieved were:
  - 2.5 tons of rice straw were collected and stored by UNIO
  - 1 design of the valorisator was produced by UNIGE (technical details on its design in Deliverable B2.1)
  - 1 prototype for the valorisator was constructed by Bio Fire Soluciones S.L.U (technical details on its running in Deliverable B2.2)
  - 1 design for the laboratory for the functionalization of silica was carried out by UPVLC
  - 1.6 tons of rice straw were converted into 261 kg of ashes that were successively converted into 72 kg of active silica.
  - 2 deliverables were produced: Diseño del valorizador and Protocolo de puesta en marcha, guías operacionales, de mantenimiento, protocolos de emergencia y riesgos del valorizador y obtención de sílice activa.

- The comparison with planned output and time schedule can be seen in the chart below.

Activity – Expected Output	**Expected date**	**Actual date**	**Motivation**
Design of the valorisator - Public tender procedure	-	25/2/2018	The call was open with delay as the internal procedures of UNIGE did not permit to launch the awarding procedure to contract the design until the consortium agreement was signed and the first pre-financing was received form CRIB in February 2018

Submission of *Design of the valorisator*	31/1/2018	20/4/2018	The activity was carried out in 2 months (March-April) instead of the foreseen 4 months (October-January) so it has been possible to partially make up for lost time. The design was delivered in April 2018, the deliverable was sent in May 2018.
Submission of *Deliverable*	31/1/2018	23/5/2018	The design was delivered in April 2018, the deliverable was sent in May 2018.
Construction of valorisator - Public tender procedure	-	29/10/2018	The call was opened as soon as the administrative process was defined since the award process started in May 2018, three months delayed (see comments above).
Construction and start-up of the prototype	30/09/2018	23/05/2019	The delay incurred was due to difficulties on the side of CRIB to finish the award process for contract the pilot plant construction; it was solved in November 2018 and the contract was signed in December 2018
Optimization and start-up of the prototype for the obtaining and functionalization of silica	31/03/2019	31/03/2019	The design has been started and no delays are foreseen. To solve the delay in the pilot plant construction (see comments above) ashes obtained at industrial furnaces are being used by the partner UPVLV.

Major drawbacks have been legal and technical-related issues. Delay in the signature of the partnership agreement between CRIB and UNIGE which lead to delay the start of the design of the valorisator. The modification of the contractual Spanish normative delayed the public tender procedure for the prototype on the side of CRIB. The need of further details from one of the technical proposals delayed the award process. As a contingency measure rice straw was burnt in industrial furnaces to get enough quantity of ash available to carry out the reaction and optimization of silica production. Once the prototype was constructed, technical difficulties were encountered when running the valorisator, with multiple modifications on the initial design required, until achieving a continuous run of the valorisator.

Action B3: Demonstration. Nitrate removal through beds of active silica.

Foreseen start date: 10-2018	Actual start date: 10-2018
Foreseen end date: 12-2019	Actual end date: 30-9-2021

The Demonstrative Action B3 started in T5 and ended on the last day of the project because it has finally been demonstrated that the silica beds have retention properties superior to those foreseen in the initial proposal. Although the total amount of water foreseen in phase III has not been treated, the ability of the prototypes to achieve the objectives of the proposal has been validated, so it can be considered that the percentage of execution is 100%. Action B3 has been coordinated by UPVLC and participated by UVEG, AVSA. The B3 action is constituted by three sub-actions:

B3.1. Design and construction of active silica bed prototypes

B3.2. Conditioning and tuning of the prototype

B3.3. Nitrate reduction operation and validation. In turn, this sub-action is comprised by made up of (i) Phase I validation. Rejection of the osmosis plant; (ii) Phase II validation. Average inhabitant consumption;(iii) Phase III validation. Average consumption 200 inhabitants.

B3.1. Design and construction of active silica bed prototypes. As has been indicated in deliverable 3.1, this action was carried out:

(1) Based on the patented silica functionalization process ES-2727673_B2, (described in B2 action), the tests to obtain the conditions and parameters to produce the active silica in quantity and quality required, were carried out. The functionalization reactors have been scaled up to 30L to increase silica production. It has verified that both, the functionalization of the silica and the activation process, are the determining factors to control the capacity of absorbance of nitrates. The possibility to activate the silica more than 32 times makes this silica very competitive in the market.

(2) The studies, calculations, and previous simulations at the laboratory scale to design the prototypes allow concluding that the active carbon beds, which were chosen in the original proposal, are not optimal. It is worth highlighting the factors that have influenced the final design of the prototypes, which are: (i) the contact of the silica with the treated water active, which was solved add a layer of Teflon© (consume water) or recycled glass (reject water of osmosis plant), to reduce inflow and formation of preferential flow channels. (ii) The particle size distribution should be around 100 microns to have maximum retention. The fact of obtaining thinner and smaller silica particles allows increasing the area-to-volume ratio, the capability of absorbance of nitrates, and the effective functionalization. (iii) a continuous activation process in the plant. (iv) it is a very important remark that the silica adsorbs all the anions present in the water. The nitrate adsorption in the presence of other anions decreased from 15 ppm of a standard solution to 1.8 mg/g of active silica for HCO_3^-, to 1.2 mg/g of active silica for Cl^- and 0.5 mg/g of active silica for sulphate (SO_4^-), because the silica can adsorb each one of them before of nitrate.

After testing 8 versions of Prototypes I, the select consists of a 75 mm diameter and 1.5 m long tube and a piece at the top to extend its diameter to 160 mm for a greater retention surface with a 50 μm layer of stainless steel. The amount of silica per Prototype I is 200g but it has been found that 300g or 350g are also valid. 26 beds have been prepared of which 4 have been to carry out the transferability tests (Action B5)

After testing 3 versions of Prototype II, the final is a tube with dimensions of 10 × 54 inches and two external beds of 5 and 0.1 μm. The amount of silica per Prototype II is 2kg or 3kg. 3 beds have been prepared.

B3.2. Conditioning and tuning of the prototype. To adapt the facilities of the Alginet osmosis plant, it has been necessary to install water intakes, an in-line nitrate measurement equipment, support for the adsorbent beds, a system for collecting the analyzed water, and a system activation in situ.

The working pressure may be selected to ensure the necessary flow, provided it is less than 5 bar, for operational safety reasons.

The linear speed of the current will be 10 m /h.

In the proposal, the flow of Phase I and II beds will be 130 L/day, equivalent to 5.5 L /h. However, the operating capacity of prototype I is 0.5 L/min, so it would have the ability to treat 360L/day, considering the activation time.

The prototype II flow rate is 7.2 L/min, considering the activation time; it would be treated 5184L/day. With 5 prototypes is possible to achieve the 26000L/ day of the proposal.

Installation and conditioning of the plant with continuous nitrate measurement equipment on 04-15-2019. The equipment operation check was carried out from this day until 06-3-2019. The operation was checked, both for the reject water (Phase I) and the well water (Phase II and Phase III).

The prototype I / version	Start of assembly and function tests	Ending of function tests
v-1 was rejected was rejected due to silica clogging	17- 06-2019,	15-07-2019
v-2 was rejected because the water formed preferential channels	25-07-2019	25-07-2019
v-3 is the basis for the following versions	12-10-2019	19-10-2019
v-4 is an improved version of v-3 to increase the retention of silica	08-1-2020	08-1-2020
v-5 is an improved version of v-3 to increase the retention of silica	17-2-2020	17-2-2020
v-6 is an improved version of v-3 to ease assembly and extraction of the silica from the bed.	25-2-2020	25-2-2021
v-7 is the v-6 version but the gravel has been replaced by crushed glass	25-2-2021	30-09-2021
v-8 is the v-6 version but the gravel has been replaced by Teflon	25-2-2021	30-09-2021
The prototype II	Start of assembly and function tests 29-1-2021	Ending of function tests 30-09-2021

B3.3. Nitrate reduction operation and validation.

(i) Phase I validation. Rejection of the osmosis plant

The nitrate adsorption tests on the rejection water started 25-2-2020. In a first step, it was carried out through the installation of an independent prototype I, (v-6, v-7, and v-8) and the nitrate reduction was 8.5%, 7%, and 8% respectively. In addition, following the proposal, two beds were set up in parallel (2-10-2020), which did not work properly. In this case, the nitrate concentration was reduced to 100L by 24.5%. In addition, 2 and 8 prototypes were tested in series (1-10-2020 and 10-12-2020 respectively**),** which did not work properly, the last allows reducing by 27% the concentration of 759L. Overall, 1604 L of reject water has been processed with 3,4 kg of silica, which represents average retention of 9%.

From June 2021, the silica was summited to successive acidification processes and the capacity of the silica retention increases significantly. Different tests have been carried out:

(i) 2 prototypes I v-8 with 200g each one submitted to 2 and 3 acidifications respectively, treated 43,5L with average nitrate retention of 29,6%. TEST DATES 28 to 30 June 2021

(ii) 2 prototypes I v-8 with 350g each one submitted to 9 and 8 acidifications respectively, treated 102L with average nitrate retention of 31,9% . TEST DATES 14-16; 20-23 September 2021

(iii) 2 prototypes II v-2 with 3kg each one submitted to 12 acidifications, treated 5184L with average nitrate retention of 36,03% of retention and maybe summited at more acidification process. TEST DATES 17, 21 and 24 September 2021.

According to the proposal, 11,700L of reject water must be treated with 12 kg silica. Finally, **6933,5 L** of **reject water** have been processed with **10,5 kg** of **silica, whit average nitrate retention of 29,68%,** but the last proves have verified that the retention capacity of the silica is higher than that foreseen in the proposal.

(ii) Phase II validation. Average inhabitant consumption

The nitrate adsorption tests on the well water with the prototype I v-6 started 25-2-2020. Many tests have been carried out with different arrangements of the beds operating in series, in parallel, each of the beds independent. Furthermore, the morphological stability of the silica has been tested by subjecting the prototype I v-6 to 7 days of continuous operation (37800 L of the silica has been treated). Overall, 42050 L (37800L + 4250L) of well water has been processed with 4.6kg, which represents average nitrate retention of 12.9% if the morphological stability test is not considered.

However, from September 2021, the silica was summited to successive acidification processes and the capacity of the silica retention increases significantly. 2 prototypes I v-8 were tested.

(i) Bed A with 300 g of sílica was acidified 32 times, allowed to treat 291L of well water with retention of nitrate of 32%. It should be remarked the experiment is stopped because the project ended but the silica could continue to be activated. Furthermore, it has been found that when the hydrochloric acid solution is renovated, the retention increases significantly.

(ii) Bed B with 300 g of sílica was acidified 12 times allowed to try 102,5L of well water with retention of nitrate of 35%. The experiment is stopped because the acidification time is too long and it was decided to use the nitrate analyzer to perform Phase III.

According to **the proposal, 11,700L of reject water must be treated with 6 kg silica.** Overall (37800L + **4643,5 L)** of **well water** have been processed with **5,2 kg** of **silica, with an average nitrate retention of 14,58%,** because most tests are performed with a single activation process**.** Neverless, the last proves have also verified that the retention capacity of the silica is higher than that foreseen in the proposal.

(iii) Phase III validation. Average consumption 200 inhabitants

The nitrate adsorption tests on the well water with the prototype II v-3 started 29-1-2021. The first tests have been carried out with only one activation process. Thus, 13200 L were treated with 12,2 kg and average nitrate retention of 11.15%.

However, from July 2021, the silica was summited to successive acidification processes and the capacity of the silica retention increases significantly. The tests are:

(i) One prototype II v-3 with 3k g of sílica was acidified 3 times allowed to treat 2325 L of well water with retention of nitrate of 36%. TEST DATES 5 to 90of July 2021

(ii) Three prototype II v-3 with 3 kg of sílica each one, in a serial configuration, acidified 3 times allowed to try 1650L of well water with retention of nitrate of 37,47%. The same prototypes with an unconnected configuration but running at the same time were acidified 11 times and allowed to try 5167 L of well water with retention of nitrate of 31,33%. Overall have been treated 6817L with retention of nitrate of 32,82%. TEST DATES 13 to 16 of July 2021.

(iii) Three prototype II v-3 with 3 kg of **reused sílica** each one, was acidified 8 times during 90 minutes allowed to try 5184L of well water with retention of nitrate of 19,75%. The same 2 prototypes II v3 labeled B and C were continued to acidify 7 times more during 90 minutes allowed to try 903,4 L with retention of nitrate of 29,29% and 1402 L with retention of nitrate

of 25% respectively. Overall have been treated 7489.4L with retention of nitrate of 21,88%. TEST DATES 2 to 6 August 2021.

(iv) One prototype II v-3 with 3k g of sílica was acidified 25 times allowed to try 4684,6 L retention of nitrate of 42,1%. TEST DATES 13 to 30 September.

According to **the proposal, 26000L/day of well water for 30 days. This water must be treated with 40,62kg sílica.** Overall **34516 L** of **well water** have been processed with **27,12 kg** of **silica with average nitrate retention of 23,63%**, because a part of tests is performed with a songle activation process**.** However, the last proves have also verified that the retention capacity of the silica is higher than that foreseen in the proposal**.**

The most relevant results are:

- *Prototype (I) (300g of silica) could work continuously for 24 hours. Activate every 30 minutes and retain nitrates for 30 minutes. To specifically treat Alginet's well water, that contains Sulfates, Phosphates, and Carbonates; it would be running for 15 minutes, to prevent nitrates from being released. Thus, Prototype (I) would allow the elimination of more than 32% of nitrates from 360L.*
- *Prototype (II) (3kg of silica), because it contains more silica, has been verified that it could operate continuously for 24 hours. Activate every 30 minutes and retain nitrates for 30 minutes. This makes it possible to eliminate 40-42% of nitrates from 5184L. Therefore, 5 Prototype (II) would be necessary to treat the 26000L per day that a population of 200 inhabitants needs.* ***It has been shown that the system designed by the LIBERNITRATE project is capable of offering this innovative treatment to any municipality with less than 200 inhabitants in all of Spain at a reasonable price and indefinitely, responding to their water consumption needs.***
- *It has been proven that both 2 Prototypes (I) and 2 Prototype (II) are capable of treating the rejected water of the osmosis plant by adsorbing more than 30% of nitrates*
- *It is very important to remark that functionalized and activated silica retains not only nitrates but also Sulfates, Phosphates, Carbonates, and all the anions present in well water.*

Action B4: Development of a Political Action Plan

Foreseen start date: 01/01/2018	Actual start date: 13/06/2018
Foreseen end date::30/06/2020	Actual end date: 31/09/2021

***** The main objective of Action B4 was to include the proposals and results of the project in the different supraterritorial policies through processes of social and political dynamization at all levels, from the local to the European sphere, which would allow to promote the generation of legislative regulations that promote Specific lines of support to provide resources to those actions capable of reducing the causes of nitrification of soils, reducing its impact and improving water quality.

This action of intervention and political and social mobilization has been developed mainly in the regions and municipalities of the competence of the Provincial Council of Valencia with the aim of advancing and improving public action in its political, administrative and social spheres, to act in a more effective and efficient in the fight against nitrate pollution.

The activities planned in the execution of this action have been carried out as initially planned in the project, but with certain accumulated delays throughout the project, also taking into account the extension of the project. Thus, the delays produced in the development of the activities have been, fundamentally, motivated by the following causes: (some determinant in the motivation for the request and granting of the extension)
1) The different electoral processes started in March 2019 with the municipal elections from which the political composition of the municipalities of the province of Valencia and later of the Provincial Council itself derives. Without a configured political structure, that is, without decision-makers, actions cannot be planned.
2) The crisis caused by COVID since the start of the state of alarm in March 2020. The pandemic has diverted both interest and priorities at all political and technical levels of the different public administrations for months.
3) Delays in obtaining project results. For a correct dynamization of the tables of social or political debate, it is convenient to provide results that can contribute to the generation of debate and contribution of feasible and acceptable ideas.

The degree of execution of the tasks assigned to the action of both the deliverables (DL) and the milestones (ML), regardless of the delays in their preparation and delivery that have been reported, as of the closing date of this report, are detailed below:

Name of the Deliverable	Action	Deadline	Status
Adhesions to the water pact (1)	B4	01/04/2021	Done on 09/21
CSR/Green Purchaising Agreement (2)	B4	01/04/2021	Done on 09/21
Creation of the Smart Social and Political list (3)	B4	01/04/2021	Done on 09/21
Agreement signed with the GV, managing authority of the PO, FEDER and FSE, (4)	B4	01/04/2021	Done on 09/21

Name of the Milestone	Action	Deadline	status
Political dynamization meetings	B4	01/12/2020	2018 - Initial meeting (13/06/18) 2020 - 3 meetings (26/02,07/10,18/12) 2021 - 2 meetings (21/05, 29/09)
Social dynamization meetings	B4	01/12/2020	2021 - 2 meetings (21/05, 29/09)

* In relation to this action, the activities carried out in each subaction are:

Action B4.1 Social and political mobilization:

a) Make visible and promote the operating criteria of the consortium in terms of Corporate Social Responsibility (CSR) and Green Public Procurement (CPV). For this, a framework document was prepared that is sent to the group of project partners for their respective signature. Valencia Provincial Council approved the signature under the format of "Protocol of intentions for the promotion of green public purchasing (CPV) and Corporate Social Responsibility (CSR) within the framework of the LIFE Libernitrate project" on February 1, 2019. (DL2).

The purpose of the approved document and that is part of the corresponding DL is to promote the implementation of CPS and CSR actions in the purchasing / public services

and contracting procedures and that all the signatories are actively involved in the following objectives:

- Reduce the environmental and social impact of the project association.
- Work for a more efficient public administration, implementing actions based on the efficient use of resources.
- Promote Green Public Procurement and a productive system model, where the Public Administration is the main responsible consumer.

On the other hand, although Action B4 provided as a DL the formalization of a CPV / CSR agreement with all all public entities in the different territories, the fact that it is an obligation legally imposed by European regulations and, consequently, the national regulations of each of the States represented by the partnership of this project make it unnecessary to promote the formalization of these agreements with local entities and other entities of the public sector. Explanation developed in the respective DL

b) The following activities have been organized days of social and political action:

.- Political action conference held on June 13, 2018 at the Valencia Provincial Council under the title "Present and future political proposals and actions" (slogan that has remained more or less unchanged for the rest of the conference). This conference presentation of the project objectives for the reduction of nitrates in the integral water cycle is aimed both at the media and at the political representatives of the Provincial Council, associations and mayors of Valencian municipalities. In addition, it serves as a public presentation of the project website and the different RSS channels created to disseminate the results and activities that are being implemented.

After the new Deputy of the area of European Projects of the Provincial Council takes office, a meeting is held between the coordinators of the project (CRIB) and the Provincial Council in November 2019 and a calendar of actions is agreed in which 2 days were established of social action work and of the 17 work days at the political level planned for the 17 regions of the province, grouping them by groups of regions to attend to the total result a total of 6 days.

After the health crisis caused by COVID-19 and the approval of the extension of the project, the initially planned execution of the conference was modified, establishing a new calendar, a new format from face-to-face to blended learning, reorganising the territories and looking for places that would adapt to compliance with the relevant health regulations. Finally, they are grouped into 5 sessions grouping the territories and the final implementation timetable being as follows:

Expected date 2020	Date of realisation	Planned/executed location	Initial / final communities
Week of 17 february	26 february (1)	Algemesi / Algemesí	Ribera Baixa / Ribera Alta
Week of 23 march	7 october (2)	Anna / Anna	Canal / Costera/ Vall d'Albaida / Safor
Week of 27 april	18 december (3)	Utiel / Diputación	Plana utiel / Hoya Bunyol / Cofrentes
Week of 25 may	21 may 2021 (4)	L'Eliana / Diputación	Initially = Rincón Ademuz/Serranos/Camp Turia/ Finally = Valencia / Horta Nord / Horta Sud
Week of 8 june	29 september 2021 (5)	Burjassot /Diputación	Initially = Camp Morvedre / Horta Nord Finally = Rincón Ademuz/Serranos/Camp Turia/
Week of 29 june	29 september 2021 (5)	Valencia / Diputación	Initially = Valencia / Horta Sud Finally = Rincón Ademuz/Serranos/Camp Turia/

.- 1st meeting of political action held on February 26, 2020 in Algemesí and aimed at the regions of Ribera Baixa and Ribera Alta. It should be noted that the conference includes a space for conclusions and collection of contributions made by both the members of the discussion table and the attendees. Space that is initially designed to create the Smart List of subaction B4.2. Number of assistants 22.

After the arrival of the covid, the extension granted and in compliance with the different regulations and sanitary restrictions, a new calendar is designed and the territories and places of celebration are reordered.

.- 2nd meeting held on October 7, 2020 at the Palace of the Counts of Cervellón in Anna and aimed at the regions of La Costera, La Canal, La Vall d'Albaida and La Safor. This conference is carried out in a blended format, broadcasting it live on the project's social networks and streaming. The conference includes a space to explain the objectives and progress of the project, a technical table with experts from different public administrations and the political debate table of the territory. Number of assitants: 10 presential and 42 online.

.- 3rd meeting held on December 18, 2020. Aimed at the Plana Utiel, Requena, Hoya de Buñol, y Cofrentes regions, it takes place in the Plenary Hall of the Valencia Provincial Council. The structure of the previous day is maintained, but it is proposed for the first time in a blended format broadcast by the project's social media channels, such as the counties and municipalities to which the project is directed. The General State Administration joins the political debate for the first time through the Government Delegation in the Valencian Community. Number of assitants: 14 presential and 32 online.

.- 4th meeting is held on May 21, 2021. Aimed at the regions of Valencia, Horta Nord and Horta Sud, changing and grouping the planned order and reducing the number of days from 6 to 5 and is held in the Plenary Hall of the Provincial Council From Valencia. The same semi-face-to-face format and online broadcast are used, maintaining the structure of the previous conferences, but incorporating for the first time a social debate table (incorporation of consumer entities and private companies supplying water in the municipalities) "LIFE Project + Discussion table of social action ". Number of assitants: 23 presential and 45 online.

Highlight the commitment acquired at the social debate table, the public commitment to establish a working group of social entities with the support of the Diputación de Valencia and different partners of the project to advance in the collection of proposals and their transfer to the rest of the public administrations with competence in water management.

This fourth meeting is aimed at the regions of Valencia, Horta Nord and Horta Sud, thus changing and grouping the established territorial order and reducing the number of sissions from 6 to 5.

.- 5th meeting held on September 29, 2021 at the Valencia Provincial Council's Beneficencia Cultural Center, coinciding with the final event and grouping the rest of the regions together under the title "PROYECTO LIFE + Debate Table Social Action and Politics Water and nitrates, present and future political and social proposals and actions ". Political representatives from different public administrations such as the government of Spain are present through the Government Delegation, the Generalitat Valenciana, the Provincial Council and the Federation of municipalities. It was carried out in face-to-face format and the presentation part of the project and results and the political debate table and the 2nd social debate table was maintained. Number of assitants: 33 presential.

A total of 225 people participated in the conferences described above and organised within the scope of Action B.4, according to the different registration and attendance records.
Meeting day 13 June 2018 (40 registrations)
Meeting day 26 February 2020 (22 registrations) Face-to-face format
Meeting day 7 October 2020 (52 registrations) Semi-attendance format
Meeting day 18 December 2020 (46 registrations) Blended learning format
Meeting day 21 May 2021 (68 registrations) Blended learning format
Meeting day 29 September 2021 (33 registrations) Blended learning format

In addition to the sessions described, the project has had political representatives in other activities carried out in the political and social sphere:

April 09, 2019. Life Libernitrate was the technical conference under the title "Valencian Municipalities towards the energy transition.
May 07 and 08, 2019. Conference on drinking water and wastewater in La Ribera.
June 12, 2019 to June 28, 2019. XI National and II International Congress of Thermodynamic Engineering.
04 July 2019. Life Libernitrate in the Carrizales de la Vega Baja (Elche).
October 11, 2019. La Unió presents the Libernitrate Project at the Fireta del Camp d'Elx.
October 15th and 16th. Conference on Drinking and Waste Waters in La Safor (Gandia)

In summary, the project has had the direct participation of a high number of political leaders from the municipalities of the province of Valencia (17 mayors / mayors), Mancomunidades (4 presidents), Valencia Provincial Council (4 provincial deputies), FVMP (2 representatives), Generalitat Valenciana (6 senior positions) and Government Delegation (2 representatives), in addition to 225 attendees (political and social) to the conference. At the social level, a total of 8 representatives of private entities. In addition to a high number of technical personnel from all the entities described. This participation and public-private combination has enriched the debate and allowed the resolution of different questions raised at the conference.

In addition, as a result of the debate and public and private participation in the meetings, a smart list has been prepared, as reflected in the action deliverable (3), in which present and future actions and proposals for action are proposed, with challenges to face and collaboration commitments of all the actors involved in solving the problem.

Action B.4.2 Political action.

Different political intervention actions have been carried out to achieve the planned objective described and mainly that of making the problem of nitrate contamination visible in supra-territorial decision-making spheres in order to promote concrete intervention measures in the programs and financing lines for its reduction. or elimination:

- Signature of the "Manifesto of Interest for the implementation of future actions of the LIFE Libernitrate project" by the Government Delegation, GVA, FVMP and the Valencia Provincial Council on September 29, 2021.
- Meetings (Dec18, Jan19, Jan20,) with staff from the GVA (Planning Service for water resources and water quality) responsible for setting up the "Citizen Water Observatory of the Valencian Community" which is located in its final phase of creation and publication. Will collect project proposals.

- The participation of a project partner (Unió) is accepted in the "nitrogen fertilization" work table set up by the General Directorate of Agriculture of the GVA to collect proposals and improve the GVA Decree in terms of improving the use of fertilizers in agriculture and livestock.
- Acceptance of the Inclusion of project proposals in the Valencian Code of Good Practices of the Department of Agriculture (approved on March 29, 2020 published DOCV April 10).
- Different meetings were organized with the technical staff coordinating the Covenant of Mayors for Climate and Energy, as well as their participation in the days described given that at the provincial level this agreement is coordinated by technical staff from the Environment area of the Provincial Council From Valencia. This situation has allowed us direct contact with the participating municipalities and give visibility and include good practices of the project in their database. Currently, a total of 243 municipalities of the 266 that are part of the province of Valencia are adhered to the pact (91.35% of all municipalities)
- At the European level, all the documentation generated by the project has been sent to the European Network of Intermediary Organizations (Partenalia) to organize an institutional visit to the Committee of the Regions when the final document is available. This institutional visit will take place in the first semester of 2022 (outside the project execution period). Likewise, different conversations have been held with a Spanish MEP and with the representative of the City Gruop of the PSE (European Socialist Party) in the Valencian Community.

Although, as such, an Operational Report has not been prepared on the different measures to be adopted to combat nitrate pollution to avoid and mitigate its negative effects, mainly due to the delay in setting up the discussion tables and therefore the delay in the preparation of the Smart List that should serve as the basis for the report, it is important to highlight that a high commitment has been achieved from the Public Administrations, as described, both in terms of the results of the project and its business plan as well as the proposals included in the Smart List. However, as a result of this commitment, once the project has been completed and the final report has been validated, an operational document with strategic lines on the matter will be delivered to said administrations in order to maintain the commitment made and continue advancing in resolving the problem.

Action B 4.3. Information to local entities

On the occasion of the planning and call for each of the actions described in this document, the Valencia Provincial Council has systematically sent information and documentation related to the specific activity as general information about the project to all the municipalities of the province of València. In addition, in September 2020, CRIB began a round of visits to the 49 municipalities of the Ribera Alta and Ribera Baixa regions, with the aim of informing their political leaders of the problem of nitrates in the waters and the actions that was developing the LIBERNITRATE project.
A specific information service has not been created, but information and calls for the sessions described have been systematically sent through the following permanent communication channels:

- At an institutional level, from the office of the Vice-president of the Valencia Provincial Council directly to the mayoral offices of the 266 municipalities in the

province and from the database of the Covenant of Mayors for Climate, from the Ministry of the Environment area of the Council.

- At a technical level from the Unit for Territorial Cohesion and European Projects to municipal technicians, linked to the environmental area and territorial development and mainly to Local and Territorial Development Agents and through the "Newsletter Red ADL Diputación de València".
- In addition, project partners such as the Consorci de la Ribera, have increased the visibility of the project by visiting the municipalities of the region in which they have their headquarters with a total of 49 municipalities visited.

The comparison with the production and the forecast schedule can be seen in the following graph,,

Actividad	Fecha Prevista	Fecha Realizada	Justificación
Adhesions to the Water Pact	01/04/2021	Sept'21	Done late due to the reasons described (1,2). It is considered that the Covenant of Mayors for Climate and Energy and the coordination in Valencia by the Diputación and the increase in accessions allow transferring the results of the project and the involvement of the municipalities in the improvement of water quality and the reduction of nitrates without the need to specifically create a "new deal"..
CSR/Green Purchasing Agreement	01/04/2021	Sept'21	In February 2019, the adhesion of the project partners to the ad hoc Agreement designed and prepared for the rest of the municipalities. The signature of the rest of the municipalities, as justified in the Deliverable, already complies with current legislative regulations as established in the text of the agreement.
Creation of the Smart social and political list	01/04/2021	Sept'21	Made late due to the reasons described (1,2,3). The elaboration of the Smart List is delayed due to the delay of the social and political revitalization meetings
Agreement signed with the GV, managing authority of the PO, FEDER y FSE	30/06/2021	Sept'21	Made late due to the reasons described (1,2,3). The signing of the agreement with the GV to adhere to the rest of the Public Administrations, including the Government of Spain through the Government Delegation, is delayed.
Political dynamization meetings	01/12/2020	Sept'21	Made late due to the reasons described (1,2,3) and made on the following dates: 0º Starting day (06/13/18) (it was not considered as such) 1st Day of Political Action (02/26/20) 2nd Day of Political Action (07/10/20) 3rd Day of Political Action (12/18/20) 4th Day of Political Action (05/21/21) 5th Day of Political Action (09/29/21)
Social dynamization meetings	01/12/2020	Sept'21	Made late due to the reasons described (1,2,3) and made on the following dates: 1st Social Action Day (05/21/21) 2nd Day of Social Action (09/29/21)

Action B4 has been carried out with a general delay in relation to the initial forecast as a consequence of the causes described. However, highlight:

- The high degree of participation of the different political and social actors in the development of the actions of the project that has allowed to achieve a high visibility both of the problem of water nitrification and of the solutions proposed by the project to all public administrations Valencian at all levels of competence..
- The signing of the manifesto of interest, participation in different work groups and initiatives (Covenant of Mayors, DG Agriculture work table, Water Observatory) and the different commitments reached (creation of a social work table) that will allow the

project, further of its execution period, continue working together with the public administration and social entities

- Territorial scope to all the municipalities of the province of Valencia and to the set of Valencian public entities of supraterritorial scope such as the Generalitat Valenciana, the Federation of Municipalities of the Valencian Community and the Government Delegation. In short, we have generated a wide territorial scope from the local, to the state, through the provincial and regional levels.

Indicate that the effort made in the development of the action will not provide the immediate results expected in the short term, however, the social and political involvement achieved during the development of the actions, not only by the signed manifesto but also by what is transmitted in the different events, it will be maintained and strengthened thanks to the commitment acquired at the political level by the Diputación de Valencia, once the project is finished.

Pending actions committed: April-May 2022 multilevel meeting with social and political actors to shape the working group of the social table and to give content to the Manifesto and to disseminate the Business plan of the project and the search for funding for its implementation together to the Covenant of Mayors. June 2022. Visit to the Committee of the Regions delivers final document and event in Brussels.

Action B5: Demonstration of the replicability and transferability of the results of the project.

Foreseen start date: 10-2019	Actual start date: 01-2018
Foreseen end date: 9-2021	Actual end date: 09-2021

DL:

- Informe de replicabilidad y transferibilidad de los resultados de LIFE LIBERNITRATE
- Plan de escalabilidad de resultados de LIFE LIBERNITRATE
- Listado de identificación de líneas de apoyo y financiación

(All of them in the same document 21-24-25 B5 Deliverables)

The objective of this action was to reinforce the continuity of the project by testing the results obtained by previous actions in terms of replicability in other geographical realities and transferability in other industrial sectors. All aspects acquire a national and transnational character, in order to maximize the market penetration capacity of the project's innovations. There is a strong relationship with B6 (business plan) where the results of B5 and its subactions have been integrated.

The Libernitrate filter has been tested in various conditions and in various sectors. Technically, the Libernitrate filter fits the product market perfectly when it comes to filtering nitrates from clean water. Tested with limited quantities yet, but promises to be expanded and thus the market potential in the first target market of small Spanish towns with less than 200 inhabitants.

The transfer to other sectors has been investigated and that is a difficult aspect. The first hypothesis that it could help farmers prevent nitrate leakage from slurry was tested on cattle farms, and was found to be infeasible. As research reveals that animal manure producing companies follow a similar manure structure (chicken, pig, cow), we have chosen to test the best option for the region. All animal manure producing farms face a similar.

Literature shows that the same applies to pigs as to cows. In general it can be seen that pigs excrete substantially less nitrogen per animal than cows. The observation of no nitrate in manure is therefore common to all animals. Nitrogen is released in the form of organic nitrogen and ammonium. In which ammonium is converted in the soil to nitrate.

The textile sector in Italy has also been investigated and since heavy metals have positively charged ions and our produced silica retains all kinds of negatively charged ions, the results with cchromium and other heavy metals or metal ions have not been favourable.

Financial replicability can be found in various EU programs and with various grants. The Valencian government has signed a document in which it declares that it will finance the collection of waste from the Valencian rice fields. In addition to that, various EU programs can be used for further expansion of the product to the following TRL levels. The current TRL level of Libernitrate is 5 according to research. To use Libernitrate on TRL 6-8/9, some funds can be attracted that can be used specifically for that level. Depending on the interests of the partner using it for the next steps, the Enterprise Europe guide can be used to find that next financial instrument.

There are replicability possibilities for the Libernitrate filter and depending on the business plan, the next steps for the consortium or future partners may bring the product to market.

Action B6: Design and implementation of the sustainability project plan.

Foreseen start date: 4/2020	Actual start date: 03/2021
Foreseen end date: 09/2021	Actual end date: 09/2021

The objective is to guarantee environmental, economic and social sustainability, to ensure the continuity of technological innovations and validated good practices, regardless of the existence of public financing.

Subaction B6.1: Ensuring environmental sustainability
Subaction B6.2: Ensuring economic sustainability
Subaction B6.3: Ensuring social sustainability

Subaction B6.1: Ensuring environmental sustainability

Silica filtration water treatment seems to have a higher environmental impact than the reverse osmosis technology. The main impact is due to the high quantity of silica needed to treat 26 m3 of water (required water flow for 200 inhabitants) and the number of reactants needed to produce silica. It should be noted that the comparison has been made between a laboratory-scale process (silica filtration system) and industrial processes (reverse osmosis and bottled water production).

During the process scale-up, the innovative system could be optimised and made more efficient allowing a decrease in the number of filter change and becoming competitive respect to the use of bottled water. The innovative process could be applied to treat water in small town where the reverse osmosis technology may not be installed.

Subaction B6.2: Ensuring economic sustainability

PRODUCT DESCRIPTION

Characteristics
Patented filter bed produced out of rice straw ashes combined with active silica beds. The filter cleans water contaminated with nitrates into potable water in limited volumes.
Potential competition
Bottled water with strong marketing budgets could be a competitor for our water system. There are also many other adsorbents in the market, which have been compared. The adsorbents which stand out in terms of capacity are SBA-15, RSi-bPEI, Amberlite PWA5 as they have high nitrate removal capacities and low contact time (below 200 minutes). The contact time, however, appears to be on the shorter side of the spectrum for Libernitrate, which is positive; it gives an average adsorption in a relatively short contact time.
In this sense, competition can be found mainly from bottled water and the fact that people hardly change old habits (buying bottled water in the supermarket for consumption).

PRODUCT MARKET FIT
Villages with less than 200 inhabitants
Our product fits villages with an independent water board servicing the inhabitants. The developed product can clean the potable water demand of villages with a filtering cost less than 10 ct/liter. This cost shows a decreasing trend as the process is optimized. A significant decline is also expected due to economies of scale.
Reverse Osmosis Plants
The filter can be used for wastewater pre-treatment in reverse osmosis plants. The scalability of the current process is required. Change in legislation per country will open a window of opportunity. The moment the reverse osmosis plants are not allowed to dump their residues to the sewering system, the Libernitrate filter (after scale-up of water volume capacity) is a good alternative from other adsorbents in the market.

Greenhouses dumping water in sewerage

Research shows that Dutch greenhouses now are regulated and prohibited to dump their (contaminated) water in the sewerage before cleaning it. Nitrates are not yet on the list of prohibition. But expected to be soon. Greenhouse owners are a potential customer for our product soon when regulation kicks in. This is also a window op opportunity in the future, comparing to the business case of reverse osmosis plants. However, since the volume of water in greenhouses is not as large as with osmosis plants and the legislation on greenhouses is much further developed than other sectors, the expectation of this business case to become valid is much higher.

Filtering agricultural waste from manure pits
Research has shown that manure pits do not produce nitrates. Nitrates start to exist later in the process. No product/market fit in this area.

MARKETING PLAN
70 villages in the Valencian region with 200 inhabitants and less are under research to obtain market information about acceptance of a specific water distribution in town as compared to buying bottled water in the supermarket. Reactions so far show an acceptable potential market penetration in the village. The inhabitants have to pick-up bottled water (purified for drinking purposes) and they have to change their behaviour. The latter is the most challenging, since the change of behaviour will take marketing capacity and time. People do not change their behaviour easily. However, as more and more people become aware of the environment and stopping unnecessary waste, this is the time to start promoting the Libernitrate water, which is free of waste. The business plan mentions various sales price options which need between

4,5% and 31% of the population per village to change to the Libernitrate system. This seems feasible based on the research we did.

Our communication is planned on actual cases making use of this potable water in the village and demonstrate that it makes life better and contributing to a cleaner and more sustainable society.

POTENTIAL FINANCIAL FUTURE RESOURCES

It has been considered Europeans Funding Programs and Local Funding of the Valencian Government.
A list of potential subsidies and grants has been elaborated. Besides, several partners of the LIBERNITRATE consortium have confirmed their interest to invest time in the further development of the product and markets to achieve an ultimate product-market fit with high feasibility and participation in a following start-up activity.

Funding will become available from Valencian region funds to clean the rice crop residues from fields and prevent water contamination. Further funding can be expected from local resources, depending on the choice of residence seat of the start-up. European funding can be considered in the field of Horizon Europe. Since the product is in TRL-stage 5 at this time, we think local/regional funding is the best resource to further grow the company. Upon reaching TRL-8 structural funding can be considered.

Subaction B6.3: Ensuring social sustainability

To ensure the social sustainability of the project, we have managed to get representatives of the FVMP, Government Delegation, GVA, Provincial Council, and some municipalities with less than 200 inhabitants to sign a letter of interest to collaborate in the financing and the promotion of project results.

With these documents of interest, we ensure sustainability in the short term, as with the support of these administrations we can develop more pilot tests in other municipalities and improve our product to ensure that costs are competitive at the market level.

Action C1: Analysis and monitoring of the environmental impact of the project.

Foreseen start date: 10/2019	Actual start date: 10/2019
Foreseen end date: 09/2021	Actual end date: 09/2021

DL: Protocol for monitoring selected environmental indicators.

Foreseen date: 01/2020	Actual date: 01/2020

DL: Life Cycle Assessment (LCA) drawing up.

Foreseen date: 09/2021	Actual date: 09/2021

The C1 action has been carried out as outlined in the LIBERNITRATE project. Within this Action, the tasks carried out have been the following:

Sub-action C1.1: The selection of the relevant environmental indicators and the Protocol drafting have been performed. For define the indicators, the following aspects have been taking into account:

- The parameters mainly evaluated were resource consumption (raw materials, water, and energy), pollutant emissions and waste production.
- The indicators are similar for the different activities, elaborating elaborate different lists for each project activity has been considered more useful.
- A data collection related to the standard process (the situation before the LIFE LIBERNITRATE project implementation) has been considered necessary to further make the comparison between the new process and the initial situation.

Sub-action C1.2: A document contained the indicator lists has been sent to all project partners on 26th of November 2019 with the aim of collecting data concerned the identified environmental indicators. The collection and evaluation of the relevant environmental indicators have been carried out throughout the whole duration of the project. A final report which includes all collected data has been drawn up and it is used for the following sub-action.

Sub-action C1.3:

The main objective of the Life Cycle Assessment is to assess the environmental impact related to a technology, process or product during all life cycle and this tool is not used to validate the technical aspect of a technology or a process.

The replicability activities carried out at University of Genoa laboratory showed that the innovative technology to remove nitrate by active silica filter is effective.

A column and material for the adsorbent bed were delivered to the UNIGE laboratories from Polytechnic University of Valencia specifically to perform the replicability test of nitrate removal: well water containing 70 mg/l of nitrate has been tested.

Two tests with different water flow (130 l/d and 78 l/d) have been carried out: for the one with greater flow, the exhaustion time is about 4 hours, while for the slowest test the same condition is achieved in about 6.5 hours. The comparison of the same results as a function of the volume passed through the adsorbent bed shows the excellent reproducibility of the process.

On the contrary, transferability activities carried out at University of Genoa laboratory showed that silica adsorbent bed did not provide any removal of chrome from the waste water.

The results obtained by LCA study (carried out in sub-action C1.4) regarding the environmental impact of the innovative tehcnology for water treatment by active silica are effective for different European countries such as Spain, Italy, Holland, ect. since data of chemical material production, transport, electricity production, ect. collected from database and scientific literature are referred to average European data. Therefore, the replicability and trasferability of this technology is proved.

Regarding the validation of use fertilisers contained urease inhibitor (slow nitrogen release), the LCA (sub-action C1.4) showed that the environmental impact of the innovative fertiliser is lower in all categories, including eutrofication. The latter is the build-up of a concentration of chemical nutrients in an ecosystem which leads to abnormal productivity. This causes excessive plant growth like algae in rivers which causes severe reductions in water quality and animal populations. Emissions of ammonia, nitrates, nitrogen oxides and phosphorous to air or water all have an impact on eutrophication. The environmental impact in the eutrofication category is reduced by 40% using fertilisers contained urease inhibitor rather than traditional fertilizers.

Sub-action C1.4:

Life Cycle Assessment has been drawn up based on and conforms to the ISO 14040, standard on LCA. According to it, there are four main stages in an LCA: goal and scope definition; inventory analysis; impacts assessment and interpretation of the results.

The objective of the LCA was to compare the environmental impacts caused by the innovative process carried out within the Life LIBERNITRATE project and the ones caused by the current process. Three systems have been analysed and compared: the current and innovative fertiliser application, the water treatment by filtration with active silica and reverse osmosis technology, again the water treatment by filtration and the use of bottled water.

The inventory analysis has been carried out taking into account interviews of project partners, experimental data from other actions of the project, literature data and information from Ecoinvent database (www.ecoinvent.org). The latter is a Life Cycle Inventory database that supports various types of sustainability assessments, it contains around 18'000 reliable life cycle inventory datasets, covering different sectors.

The impact assessment was evaluated using the OpenLCA software (an open source software) and the CML 2 baseline method. This analytical tool is in accordance with ISO 14040 standards and it was developed in 2001 by a group of scientists under the lead of the Center of Environmental Science of Leiden University.

The following impact categories were evaluated: abiotic depletion, abiotic depletion (fossil fuel), acidification, eurtrophication, fresh water aquatic ecotoxicity, global warming, human toxicity, marine aquatic ecotoxicity, ozone layer depletion, photochemical oxidation, terrestrial ecotoxicity.

The Life Cycle Assessment proved that the innovative process studied within the Life LIBERNITRATE project can contribute to reduce the environmental impact respect to the current system.Innovative fertilizer, contained urease inhibitor, allows an important decrease of environmental impact: the impact reduction is always higher than 10% and it arrives to 40% for global warming potential and eutrophication and to 60% for acidification as shown in Figure C1.4.1. This chart shows the relative indicator results of the different fertiliser application. For each indicator, the maximum result is set to 100% and the results related to the other fertilser application are displayed in relation to this result.

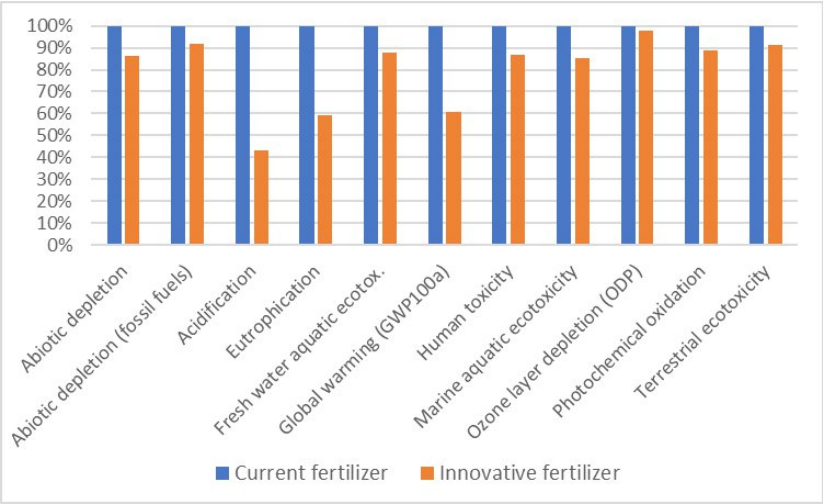


Figure C1.4.1. Fertiliser comparison: different impact categories

Therefore, the application of this kind of fertilisers can reduce the nitrate problems into the soil and water. Considering a rice production of 11 t/y according the Unió de Llauradors, it is possible to save 5,7 t/y of CO_2.

The innovative process, that consists of reducing the water nitrate concentration by using active silica filter obtained by ashes produced during rice straw thermal treatment, is more eco-friendly than use bottled water showing a lower impact for almost all analysed categories, while its impacts are higher respect to the reverse osmosis technology (Figure C1.4.2)

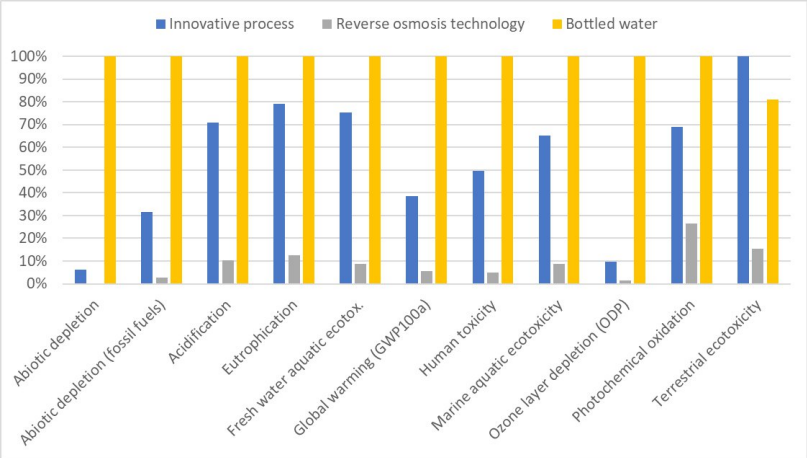


Figure C1.4.2. Water treatment comparison: different impact categories

However, it is important to take into consideration that this comparison has been made between a laboratory- scale process (silica filtration system) and industrial processes (reverse osmosis and bottled water production), thus during the process scale-up, the innovative system could be optimised and made more efficient allowing a decrease of active silica amount used to treat 26 m3/d of water.

In addition, the increasing time of use of active silica and the reduction of active silica changeover times could also make easier the maintenance operation of water filtration system and reduce costs.

Therefore an assessment of environmental impact related to the innovative process considering the use of the same active silica for a week has been made: in this way the amount of active silica can be reduced by roughly 90%.

The result comparison between this last analysis, reverse osmosis technology and the bottled water use highlighted that the environmental impact of the innovative process is slightly lower than that of reverse osmosis technology and significantly lower than the bottled water use in almost all analysed impact categories (Figure C1.4.3).

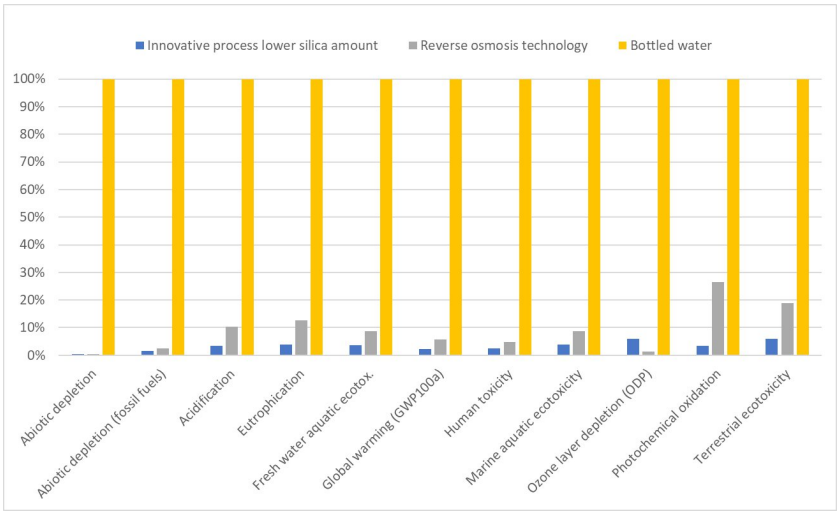


Figure C1.4.3. Water treatment comparison (lower silica amont): different impact categories

In this direction, it is important to take into account that other tests carried out near the end of the project, which due to timing they could not be included in the LCA studies, showed that silica could actually be used further times effectively.

Considering that the reverse osmosis process involves several equipment, it can require an important economic investment and, likely, a significant environmental impact in phase of plant construction.

Therefore, the innovative process could be applied to treat water in small town (i.e. 200 inhabitants) where the reverse osmosis technology may not be installed, avoiding the use of bottled water and saving 2000 t/y of CO_2 to treat 26 m^3/d of water.

Action C2: Analysis and monitoring of the socio-economic impact of the project.

Foreseen start date: 01/2019	Actual start date: 01/2019
Foreseen end date: 09/20221	Actual end date: 09/2021

The objective of this action is to monitor the socio-economic data and results achieved during the project by comparing them with the initial reference situation.

Subaction C2.1: Identification of the socio-economic associated with the project
Subaction C2.2: Monitoring and evaluation of socio-economic indicators
Subaction C2.3: Validation of socio-economic results at regional level and replication at European level
Subaction C2.4: Elaboration of the cost cycle analysis (CCA)

Subaction C2.1: Identification of the socio-economic associated with the project

The indicators selected for the quantification of the socioeconomic impact associated with the project were the following:
- Replicas.
- Transfers to other sectors.
- Cost reduction per unit of production and operation
- Benefit and amortization time (pay-back)

- Workers, direct and indirect.
- Inhabitants benefited

Although all of them have a relevant role for the socioeconomic analysis, it has been necessary to establish a prioritization protocol to assess the implementation of the project in those areas with the greatest potential for generating social, economic and health benefits. These potential benefits are greater in those areas with more serious nitrate problems and greater barriers to a solution.

The highest intervention priority should focus on those situations with the highest cost of not acting. This cost of inaction represents a key indicator when prioritizing actions. When the cost of implementing the project is much lower than the cost of not acting, then we have the guarantee of obtaining a very positive socioeconomic impact. Certainly, the presence of nitrates in water bodies reinforces the importance of implementing new elimination technologies to avoid the negative social and economic repercussions that this situation entails. The cost of not acting has been analyzed in a study area of the Valencian Community with a population of around 2 million inhabitants exposed to nitrate contamination. It is estimated that the cost of not acting, only in health terms, is around 250 million euros per year.

Subaction C2.2: Monitoring and evaluation of socio-economic indicators
Given the wide range of geographical areas directly or indirectly affected by excess nitrates in water bodies, it is necessary to identify and assess the intensity of the problem, as well as the greater or lesser possibilities of implementing a viable and sustainable solution. This makes rural areas with small municipalities priority areas for proposing effective and low-cost actions given the difficulties (or impossibility) of implementing conventional-type technologies. For this reason, a classification of geographical areas has been established based on the priority to act.

A market segmentation criterion has been applied considering firstly, whether they are municipalities that have not yet taken measures to act against nitrate pollution and, furthermore, there is a clear risk of regulatory non-compliance in this matter. In this case, an assessment of the seriousness of the situation has been carried out considering the effects on health, the volume of the affected population and the existence or not of alternative water sources.

In those areas in which corrective measures have not been adopted despite the high health risks, an indicator has been built relative to the cost of not acting, which will allow local authorities to show the magnitude of the expected consequences if they do not act against nitrate contamination. It is intended to demonstrate that the value of the damage caused by non-action is much higher than the costs of the action itself.

The presence of economic or organizational barriers that could prevent the implementation of corrective measures due to lack of financial sustainability is also analyzed. Municipalities are grouped according to the type of management of water services. On the one hand, those municipalities that are directly in charge of water supply and, on the other, those that provide the service indirectly through concessions or agreements with private companies.

Another reference variable is the territorial distribution of the affected population, specifically, their concentration or dispersion in a certain geographical area. This allows knowing the possibilities of replicating the technology for each space area and, therefore, taking advantage of the so-called economies of scale and agglomeration. Municipalities are grouped according

to the level of severity associated with nitrate contamination based on the variables mentioned. The municipalities are also classified according to whether they have a serious, moderate, or low problem for the water supply, guaranteeing the quality thresholds.

Subaction C2.3: Validation of socio-economic results at regional level and replication at European level

The existence of organizational structures based on associations of municipalities is a very relevant factor to facilitate the implementation of the project with a lower cost and generating greater benefits. A greater number of replicas in small municipalities with a certain degree of agglomeration facilitates the creation of a management infrastructure for the provision of technical support and commercial services. This implies the creation of both direct and indirect jobs.

The situation of those areas with an excess of nitrates but that had already adopted some correction measure based on conventional technologies has also been analysed. It is the case of larger municipalities with water supply infrastructures that include reverse osmosis treatment to reduce the nitrate content. In the first place, the possibility of adopting silica filters as an improvement option on the technology already implemented has been analyzed. For this, the application of the proposed technological solution at the head of the treatment is proposed to quantify the energy savings that could be achieved. Given the importance of energy consumption in reverse osmosis installations, a significant reducing impact is expected due to the implementation of filters. In addition, the use of filters on the rejection flow has also been studied with the aim of reducing the high concentration of nitrates in this flow, thus allowing its adaptation to the discharge limits established by current regulations.

It is possible to demonstrate the economic viability of implementing filters as a technological improvement solution, considering factors such as the size of the installation itself, the percentage of energy savings and its economic and environmental consequences, as well as the unitary cost of the required filters. The presence of economies of scale and agglomeration also plays a relevant role. The location of these facilities affects the greater or lesser presence of economies of scale and agglomeration. This also implies the creation of direct and indirect jobs and facilitates the transfer of technology to other sectors.

A high concentration of potential customers in a geographical area is decisive when it comes to providing a quality service at a reduced cost. The implementation of these service networks involves the creation of new jobs, both direct and indirect. Given that the technology proposed is not yet ready for commercialization on the market, it has not been possible to carry out a marketing plan to facilitate its replicability on a European scale. It has also not been possible to quantify the socioeconomic impact associated with this replicability.

Subaction C2.4: Elaboration of the cost cycle analysis (CCA)

In this Action, the investment and operating costs of the different existing technologies for the elimination of nitrates in water have been evaluated. The investment costs vary depending on the design of the plant and the volume required to be treated, while the operating costs mainly include the costs of personnel, energy, reagents and costs related to the maintenance of the installation. The use of cost functions makes it possible to compare different technologies to facilitate the selection of the optimal option, integrating economic, social and environmental criteria.

It is highly important to know the specific process to be compared, since the relationships between energy consumption, reagents, personnel and materials can significantly vary both investment and operating costs. Given that the elimination of nitrates requires the use of different treatment technologies that guarantee their retention, some of them, such as reverse osmosis and ion exchange, have been compared with the technology proposed within the LIBERNITRATE project. A comparative study of the detailed costs of the processes mentioned has been carried out.
The evaluation of the viability of an investment project implies, in the first place, comparing the operational (OPEX) and capital (CAPEX) costs of the different proposed alternatives. In this sense, the costs for reverse osmosis and ion exchange are addressed. The different results have been calculated from a reference scenario including the capital amortization of each of the technologies. Finally, an analysis and cost projection of the technology based on Active Silica has been carried out.
If the volume of water treated per kg of silica remains fixed at 1,562 m3 for the different levels of production, a cost of 0.64 € per cubic meter treated could be obtained for a production of 15,000 kg of silica. Although we need to act with the utmost caution since it is a projection, it is worth remembering, firstly, that it is certainly a competitive figure when compared to the rest of the alternative technologies and, secondly, that notable progress has been made in terms of silica reactivation and, therefore, an increase in the volume of treated water per kg of active silica.
Despite the limitations and the caution required when making projections about the operation of a laboratory prototype and its behavior on an industrial scale, based on the information available at the end of the project, we consider that there are sufficient reasons to bet on the viability of the technological proposal raised both by the decreasing trend in production costs and by its already proven efficacy in the elimination of nitrates on a laboratory scale.

Action C3: analysis and monitoring of the impact of the dissemination actions of the project

Foreseen start date: 01/04/2018	**Actual start date:** 06/2018
Foreseen end date: 30/09/2021	**Actual end date**: 09/2021

* Action C3 has as its main objective the follow-up, evaluation and action in relation to the planning of the planned communication, both the operational analysis and the impact analysis and the evaluation of the effectiveness and efficiency of the communication plan. The execution of the action is based on the following sub-actions, which are described below:

C3.1. Monitoring of process indicators. Related to the deliverable products of each activity and the planned milestones. The process indicators, both DL and ML, will be related to the production of deliverables in each activity, either in absolute value or in relative value with respect to economic, technical or temporal resources.

C3.2. Monitoring impact indicators quantifying and describing the impact of the activities. The impact indicators must quantify or qualify the impact of the activity, in terms of reach on the website or social networks, attendance at events, number of contacts, intensity and periodicity of interest in the results, etc.

The planned activity in the execution of this action has been carried out concert delays throughout the project. It should be noted that the granting of an extension of the project, which forced the development of new schedules to adapt the new delivery dates for both the DL and the ML, is not considered a delay.

The main reasons for the delays in the fulfillment of the project's monitoring and impact analysis tasks have been mainly due to difficulties encountered in decision-making by policy makers for hiring external personnel, mainly due to regulations and administrative procedures. of the Diputación de Valencia in personnel matters. The hiring of external personnel linked to the project to collaborate in the development of tasks has only been possible for the period from December 1, 2020 to April 5, 2021. The general administration technician hired, although he was not a specialist in the management and monitoring of project monitoring indicators and analysis, it has contributed to improving the development of activities. Add, to the absence of additional specialized personnel, administrative difficulties for hiring external companies for, among other tasks, domain management and web design, social media management. These difficulties, described in report D1, have generated delays in the management of authcodes and DNS's and generated irregularities in the analysis of the impact of communication.

This situation has caused an overload of work to be produced among the permanent staff for the execution of the global actions assigned to the Provincial Council.

The degree of execution of the tasks assigned to the action of both the deliverables (DL), regardless of the delays in their preparation and delivery that have been reported, as of the closing date of this report, are detailed below:

Name of the Deliverable	Number of the associated action	Deadline (initial)	Deadline f (extension)	Done on time	Done after the deadline	DATE
Informe de seguimiento impacto comunicación	C3	30/09/2020	30/06/2021		REALIZADO	30/09/2021

* In relation to this action, the activities carried out in each section and regardless of the delays in their preparation and delivery that have been reported, as of the closing date of this report, are:

On the other hand, it should be noted that the degree of execution of the tasks assigned to subaction C3.1 is closely linked to the development and fulfillment of both the deliverables (DL) and the milestones (ML) of the project as a whole.

C 3.1. Monitoring of process indicators:

The process indicators are linked to the deliverables of each activity, that is, in terms of the absolute and relative figures of economic, technical and temporal resources. To do this, the Valencia Provincial Council has prepared a follow-up document for deliverables and milestones. Document approved in December 2018 at the III coordination and follow-up meeting that took place at the UV Campus in Burjassot. The document prepared in an Excel sheet is sent to each partner of the project..

Since it is established that the control will be carried out continuously in terms of the process indicators, in the coordination and follow-up meetings held throughout the project, described in the D1 report, the degree of compliance has been analyzed and deviations considered. , validations and possible corrections to the planned planning, as well as

proposals for improvements to the follow-up document as reflected in the respective minutes of the meetings

As a result of the analysis of the degree of compliance with the DL and ML from the coordination of the project, different bilateral meetings have been held "coordination vs partner" such as those that have taken place in the Diputación de Valencia (November 12, 2019 and August 27 2020) to analyze and find alternatives to delays in the execution of tasks.

The data obtained at the closing date of the project, as can be seen in annex C.3.1, are as follows:

DELIVERABLES LIBERNITRATE 2018-2020	Number of deliverables planned	Number of deliverables on time	Number of late deliverables	% Activities completed
2017	1	0	1	100,00
2018	6	3	3	100,00
2019	4	3	1	100,00
2020	11	7	4	100,00
2021	16	13	3	100,00

MILESTONE LIBERNITRATE 2018-2020	Number of milestone planned	Number of milestone on time	Number of late milestone	% Milestone completed
2017	3	3	0	100,00
2018	8	5	3	100,00
2019	9	5	3(*)	88,89
2020	8	2	6	100,00
2021	8	0	8	100,00

(*) Intermediate event not carried out (Report B4 describes all events and conferences)

C 3.2. Monitoring of impact indicators.

The objective of the impact indicators is to quantify and evaluate the impact of the activities carried out in terms of degree of penetration of the website and social networks, participation in activities / events, number of contacts made, intensity and periodicity of the results.

To carry out this task, we have referred to the Communication Plan and the forecast of actions for each of the activities that are listed, or we have prepared ad hoc documents.

a) Communication plan (deliverable) in which the impact measures planned in the framework of the project are described. In this sense, a table with the (expected) impact figures based on

the project's dissemination activities has been included in the Communication Plan (see Communication Plan). Thus, the communication plan described a series of actions to be implemented during the development of the project, such as the elaboration of: A1. Website, A2. Social Networks, A3. RSS, A4. Alert systems, A5. Newsletters, A6. Press releases, A7. Wedges and Ads, A8. Interviews, A9. Radio and TV., A10 Presentation brochure, A11. Diptychs, A12. Rollers and posters, A13. Presentations, A14. Signage, A16. Layman Report, A17. Plan after Life, A18. Videos, A19 Merchandising, C1. Banner exchange, C2. Public relations, C3. Press kit. The following indicators are established for each of them: priority group, Responsible party, Number of expected items, Number of items completed, Performance indicator, Planned impact, Real impact, Impact indicator, Expected dates.

b) Google Analytics and social media reports. The degree of impact and visibility of the project both on the web and on social networks, due to the incident described, especially regarding the delay in access to data, was results and operational at the end of 2019. This has allowed us to obtain mainly Monitoring results and impact from the beginning of 2020 to Google Analytics and obtain the respective reports from both the web and social networks through monthly or bimonthly reports. This period of access to data allowed to measure the increase and impact on communication. Thus, and as an example, the number of visits to the project's Facebook page increased progressively, going from 5 monthly visits in April 2020 to 228 in October 2020 and stabilizing at 94 monthly visits in January 2021, which represents a 87% increase.

At the end of the report, there were a total of 301 followers on Facebook, 287 on Twitter and 27 subscribers on the YouTube channel, which has a total of 88 uploaded videos.

b) "Actions follow up sheet Life". Once all the tools and actions necessary for the management of the communication actions and the results of the Project are operational and in order to increase the collection of information and transfer it therefore to social networks and the web, and comply with For the objectives set in the Communication Plan methodology, a follow-up sheet "Actions follow up sheet Life" is designed, which is sent monthly to all project partners as of January 2019.

d) Preparation of registration documents for project activities and signing of assistance. Each day or activity has had its own personalized registration form made in google forms and the attendance signature document in pdf format (in the case of face-to-face activities) of both the activities and the respective coordination or bilateral meetings held

e) Merchandising. The merchandising products have been distributed among the project partners according to the communicated needs to deliver in the realization of their respective actions within the project and the rest have been distributed to the attendees and speakers of the different political debate tables and social, as well as on the final day of the project. In total, 200 bottles with esparto wrap have been distributed, 300 16Gb wooden usb memory, 600 pens with reservoir and disinfectant gel spray, 300 silk-screened cardboard folders, 220 silk-screened executive backpacks, 800 masks, 200 folders padded document holder and 200 2021 agendas in A5 size with soft covers.

f) Preparation of communication bulletins, informative material, press releases, etc.

Each newsletter has been sent to the 266 municipalities of the province of Valencia 266, 17 Mancomunidades, as well as to other public and private entities in the province with which contact has been maintained and uploaded in pdf format on the web.

The informative material, brochures, posters, poster, roller up has been distributed in each of the activities carried out by the project. More than 250 face-to-face attendees (despite covid restrictions) have received some type of project material.

Press releases and articles in specials published in local and regional newspapers. As an example, the newspaper most used to communicate project results with a total of 12 publications has been the Levante newspaper with a total of 271,200 readers at the regional level.

Articles in scientific journals such as EDMA have an international circulation of more than 220,000 copies.

The result of the impact generated by the actions of the project and that as a summary have been described in this report, are included in the tables of the communication plan, as well as the rest of the documentation and reports that can be consulted in deliverable D .1 "Dissemination Report of the LIFE Libernitrate project".

* The comparison with the projected production and schedule can be seen in the following graph:

Activity	Expected date	End date	Justification
Communication impact monitoring report	30/06/2021	30/09/2021	Done late due to difficulties in decision-making by political leaders for the hiring of additiona personnel (regulations and administrative procedures regarding personnel) + delays in the procedures for contracting external companies for the management of services such as registration domain, web design, social network management (authcodes and DNS's...)

* In short, and despite the difficulties mentioned, a high number of monitoring actions have been carried out both on processes and on the impact of communication in close collaboration with the project coordinators to meet the planned objectives, obtaining results of positioning and visibility of a medium-high impact level at the communication level and a very high degree of compliance with the DL and ML provided with the corresponding corrections and modifications.

Effort that will be maintained once the project is finished, as detailed in the after LIFE plan (action E2), since it is planned to mantain and update the website to publish and analyze the results and final impacts of the project, as well as any news or progress related to actions B.4.

Action C4: Analysis and monitoring of the LIFE Project Performance indicators

Foreseen start date: 04/2018	Actual start date: 07/2018
Foreseen end date: 09/2021	Actual end date: 01/2022

DL: Informe monitorización indicadores (Mid Term)

Foreseen date: 03/2019	Actual date: 06/2019

DL: Informe monitorización indicadores (Final Report)

Foreseen date: 12/2020	Actual date: 12/2021

Action C4 has been carried out as indicated in the initial proposal of the LIBERNITRATE project.

The analysis and evaluation of the project indicators has resulted in the preparation of the Mid-Term report, 1st Progress Report, 2nd Progress Report and tfe present Final Report.

Action D1: Design and implementation of the project communication plan

Fecha de inicio prevista: 01/09/2017	Fecha real de inicio: 1/04/2018
Fecha prevista de finalización:09/2021	Fecha real de finalización: 09/2021

* The objective of this action was to maximize the visibility of the objectives and results of the LIFE LIBERNITRATE project, through the planning and implementation of a Communication Plan to publicize all aspects related to the project, presentation of partners, problems to deal, solution adopted, project planning and progress, results and conclusions. For its execution, the action relied on the following sub-actions; D1.1. Design of the Dissemination Plan of LIFE LIBERNITRATE, D1.2. Networking with other projects and D.l.3. Development of the Dissemination Plan

Action D1 has been carried out in general lines as foreseen in the LIBERNITRATE project, but with a certain delay, fundamentally motivated by the following reasons:
a) The excessive length of the administrative deadlines of the Provincial Council related to the management and procedures for contracting of external companies for the purpose of providing communication services.
b) A certain period of inactivity and uncertainty generated by the pandemic that, despite the granting of an extension of the project, has hindered the development of actions that mainly require the face-to-face participation of the actors such as networking actions, conferences, meetings, social action and politics. Without activity and execution of actions, no relevant information is generated to be visible.
c) The difficulty of hiring additional staff with knowledge in information management and social networks except for the period from December 1, 2020 to April 5, 2021, which incorporates a general administration technician, who is not a specialist in the management and dynamization of social networks contributes to the development of project activities with respect to action D1.

The degree of execution of the tasks assigned to the action of both the deliverables (DL) and the milestones (ML), regardless of the delays in their preparation and delivery that have been reported, as of the closing date of this report, are detailed below:

Name of the Deliverable	Action	Deadline	Status
LIFE LIBERNITRATE dissemination plan	D1 (1)	01/01/2018	DONE 05/18
Website and social media profiles	D1 (2)	01/01/2018	DONE 05/18
Layman report	D1 (3)	30/06/2021	DONE 09/21
Project dissemination report	D1 (4)	30/06/2021	DONE 09/21
Notice boards	D1 (5)	30/06/2021	DONE 09/21

Name of the Milestone	Action	Deadline	status
Initial event	D1	01/11/2017	11-Nov-2017. CRIB Algemesí
Coordination meetings: every six months	D1	01/11/2017	11-Nov-2017. CRIB Algemesí
2017			
Opening web and RSS	D1	01/01/2018	13-Jun-2018. Diputación de Valencia
Editing publications-I	D1	01/01/2018	Leaflets June-2018 MDPI 8/18
Newsletter edition-I	D1	01/04/2018	Published in May-2018
Coordination meetings: every six months and the initial-II	D1	01/04/2018	from 11 to 13 June-2018. Diputación de Valencia
Newsletter edition-II	D1	01/10/2018	Published in Nov-2018
Coordination meetings: every six months and the initial-III	D1	01/10/2018	from 18 to 19 December-2018. Campus Universitario Burjassot UV
2018			
Editing publications-II	D1	01/04/2019	March, July and October 2019
Newsletter edition III	D1	01/04/2019	Published in June 2019
Intermediate event	D1	01/04/2019	No done
Coordination meetings: every six months and the initial-IV	D1	01/04/2019	10-July-2019 Universidad Politécnica de Valencia
Newsletter edition IV	D1	01/10/2019	Published in November-2019
Coordination meetings: every six months and the initial- V	D1	01/10/2019	4-November-2019. Universidad de Genoa
2019			
Coordination meetings: every six months and the initial- VI	D1	01/07/2020	10-July-2020. Online
Editing publications-III	D1	01/07/2020	26-November-2020. Material enlargement
Newsletter edition V	D1	01/07/2020	Published in June-2020
Coordination meetings: every six months and the initial- VII	D1	01/12/2020	21-April-2020. Online
Newsletter edition VI	D1	30/12/2020	Published in November-2020
2020			
Newsletter edition VII	D1	30/06/2021	Published in September-2021
Coordination meetings: every six months and the initial- VIII	D1	30/06/2021	28-September-2021. Oceanográfic Valencia.
Final event	D1	30/06/2021	29-September-2021. Centro Cultural Beneficiencia. Diputación de Valencia.
Newsletter edition VIII	D1	30/09/2021	No done. This publication is planned once the final report has been validated. All the final information generated by the project, delivered and validated,will be collected in the last newsletter.
2021			

* In relation to this action, the activities carried out in each subaction are:

D 1.1. Design of a "LIFE LIBERNITRATE" dissemination plan.

Corporate image. Prior to the design and delivery of the communication plan, the corporate image manual of the LIFE Libernitrate project was drawn up, agreed and participated by voting all the project partners on January 26 of 2018.

Communication plan. Drafted in May 2018 (DL) addresses the following general objectives 'to communicate to the recipients the objectives, actions and results of the project during

and after its execution.' and its specific objectives, such as: to emphasize the problem of contamination of drinking water by nitrates in the water, manage internal communication addressing this problem, promote our proposal in the national and European market, its reproducibility and transferability, among others.

An initial forecast schedule for the different communication actions and start-up or execution periods is established in the plan, as can be seen in the deliverable described, the result of which is analysed in action C3.

D 1.2. Networking with other projects.

During the execution of the project, the following networking actions have been developed with other European projects, prioritizing those days in which LIFE projects are shown, with the aim of sharing good environmental practices and nurturing LIBERNITRATE with innovations related to its scope of application.

- Collaborative network with researchers and experts on topics from similar projects, such as Life Alchemia, Life Algaecan, Life Ecogranularwater, Life Low Carbon Feed Project and IRRILIFE..
- Participation in the Euromembrane Conference held at the Polytechnic University of Valencia (July 2018).
- Presentation of the project at the XIV Conference of La Unió de Llauradors I Ramaders. Attendees: 300 representatives from all the regions of the Valencian Community. Objective: promotion of the project among the Valencian agricultural sector (November 11, 2018).
- Participation in the ECOFIRA and EFIAQUA Valencia fair. (November 8, 2018)
- Presentation of the project to the farmers of La Ribera who will attend the final meeting of the Life Irrilife project in La Alcudia. Develop networks for the exchange of experiences with other Life projects (November 19, 2018).
- UVEG dissemination activities. Visibility of the project as a subject for the preparation of Master and Degree Theses. 1st Thesis of the Master on a topic related to LIFE LIBERNITRATE in collaboration with UNIGE-UVEG (January 2109)
- Participation in the technical conference "Valencian Municipalities towards the energy transition within the framework of the European Cheap-GSHPs project" organized by the ICT area against Climate Change of the ITACA Institute of the UPV. MUVIM Provincial Council of Valencia (April 9, 2019).
- Networking Day at the Go Hub in Valencia in which the UV participated, exposing the project. (April 12, 2019).
- Participation in the EU Information and Networking Day (REDIT), a day dedicated to the environment and climate action program, an instrument of the European Union. The UV presented the results of Libernitrate among other Life projects. (May 7, 2019)
- Conference on drinking water and wastewater in La Ribera. Aguas de Valencia (AVSA) participated in the conference on drinking and waste water held in Alzira (May 7 and 8, 2019)
- The Life Libernitrate project was present at the XI National and II International Congress of Thermodynamic Engineering (11-CNIT) held in Albacete. (June 18, 2019)
- La Unió promotes low environmental impact fertilization in the Carrizales de la Vega Baja irrigation community. (July 4, 2019).

- Participation and Stand at the ECOFIRA and EFIAQUA Valencia fair. (from October 01 to 03, 2019).
- Participation in the technical conferences of the Life Ecogranularwater Project. Granada (October 10, 2019)
- La Unió presents the Libernitrate Project at the Fireta del Camp d'Elx in which a stand of the Libernitrate project was available. (October 11, 2019)
- Conference on Drinking and Waste Water in La Safor. (October 16, 2019).
- Festival della Scienza de Genova in which a stand is installed for the project and networking is carried out with Italian public and social entities and representatives. A presentation of the project was held in the festival's auditorium (November 3, 2019)

The project website includes a specific section on linking and reciprocal visibility of the LIFE projects approved by the European Commission for the 2018 call, in addition to including a link to the entire LIFE project (https://www.lifelibernitrate.com / derivative-projects /)

With the arrival of the pandemic and the restrictions derived from health regulations, networking actions with the rest of LIFE projects are drastically reduced.

Action D 1.3. Development of the dissemination plan.

Through collaborative processes of the project partners, the dissemination of the objectives and results is promoted as established in the Dissemination Plan, using their own communication systems and processes and their interrelation with the different communication offices of public institutions. For this, a web space is created and managed, social media profiles, specific information bulletins, press releases, articles in specialized magazines (national and international), informative and training videos, signage and merchandising materials, among other events.

- Different presentation templates are designed and generated in compliance with the aforementioned corporate identity manual. Thus, different templates are designed both for presentations and for writing reports, sending emails, newsletters, etc.
- Web creation of the project (Presented on 06/13/18) www.lifelibernitrate.eu
- Change of domain of the web space to www.lifelibernitrate.com update, design improvement and translation into the 4 languages of the project (November 2019)
- Creation of social networks (October 2018.) Impact on C3 report
    - https://www.facebook.com/LifeLibernitrate/
    - https://twitter.com/libernitrate
    - https://www.youtube.com/channel/UCEYr1EBtHUnerpDVDyM1PhQ)
- The following topics are designed to increase the presence in networks: 1) Our project. Periodically, a message is transmitted with the objectives of the project and its link to current and interesting information. 2) Libernitrate partners. Interviews are carried out with different representatives of the project entities and in which the objectives of the entity to be developed in the project are made known, as well as the current status in the development of the related actions. 3) Did you know ... This section deals with different aspects related to water quality, as well as any news related to the project's objectives, being carried out through a question and answer format
- Newsletter. In total, 7 of the 8 newsletters planned have been produced and can be downloaded from the web in pdf format. The preparation and distribution of newsletter number 8 is pending with all the final validated information of the project that will serve as a final memory document. (In operation since November 2018)

- Press releases and published news. The total news of the LIFE Libernitrate project published throughout the project exceeds twenty among local, county, provincial and regional press. In addition to those published in the popular magazines of some project partners. In summary, there have been: 3 Press releases sent to the media and published, 2 Levante EMV Report (Special European Funds Supplement), 5 Levante EMV News (Monthly Special Notebooks from Europe), 8 News in different local newspapers or comarcal, 5 News Conference on Political Action in the newspaper Levante EMV
- Presence on regional TV "A punt Televisió" in the program Terra Viva, a program specialized in environmental issues and sustainability that is broadcast weekly on Valencian public television. (Aired on TV in October 2019).
- There have been 3 presentation videos (3 languages), 7 Videos "Capsules interviews parnerts", MOOC Course available on the project's YouTube channel (video version and Podcast), welcome video and 4 modules presented in the different languages of the project. In total, 44 information and dissemination videos of the project have been made
- Specialized press (scientific journals): 1) "Energies" of the Multidisciplinary Digital Publishing Institute (MDPI), where an article explaining our proposal is published in August 2018 and which can be consulted at: https://www.mdpi.com / 2071-1050 / 10/9/3007. 2) EDMA (European Dissemination Media Agency) article on the objectives and results of the project in volume 11 dated October 2021. It is distributed among the scientific community, political representatives of the European Commission, government agencies and departments, companies, universities, research tips, etc. both at the European level with a circulation of 150,000 copies, and in the US, China and Japan with a circulation of 70,000 copies.
- Production of merchandising for the project serigraphed with the logos of the project and the LIFE program. 200 bottles have been made with esparto wrap, 300 16Gb wooden usb memory, 600 pens with reservoir and disinfectant gel spray, 300 silk-screened cardboard folders, 220 silk-screened executive backpacks, 800 masks, 200 padded document folders, 200 diaries 2021 in A5 size with soft covers.
- Publications of information brochures, posters, roller up and other project signage and support documents, as well as informative and documentary support documents such as registration forms, holiday greetings, etc., which have made it possible to disseminate the objectives and results of the project among the beneficiaries of the different actions of the project

The follow-up document "Actions follow up sheet Life" is designed. (Available from January 2019). It is sent monthly to all partners as a report of the activities carried out according to the distribution: 1) Attendance to events (fairs, workshops, meetings, project events, 2) Network actions, 3) Actions in social networks, 4) Communications press, 5) Publications and merchandising

Throughout the project, informational and documentary support documents such as registration forms, holiday greetings, etc. have been produced, which have made it possible to disseminate the objectives and results of the project among the beneficiaries of the different actions of the project.

The activities carried out at the time of writing this report have been:

ML: Initial event. November 21, 2017. The Kick off meeting of the Life Libernitrate project on November 21, 2017 at the headquarters of the Consorci d'energia de la Ribera -Algemesí-
ML: Intermediate Event. It is not organized on the scheduled date (April 2019) in a "specific" way. However, throughout the project different days and meetings have been organized that

have been made to coincide, either with the project follow-up meetings or with the political and social action days (action B.4) reserve space to present the objectives and results of the project.
ML: Final event of the project. "LIFE LIBERNITRATE Project: Water and nitrates, proposals and political and social actions of the present and future" Friday, September 29, 2021 at the Cultural Center la Beneficencia de Diputación de Valencia.

ML: Coordination meetings:

- 1st Coordination Meeting is held coinciding with the initial kick-off event that took place in Algemesí on November 21, 2017.
- 2nd Meeting and Follow-up and Coordination Meeting is held in the Valencia Provincial Council on June 11 and 12, 2018.
- 3rd Meeting and Follow-up and Coordination Meeting took place at the Burjassot campus of the University of Valencia on December 19, 20 and 21, 2018.
- 4th Meeting and Follow-up and Coordination Meeting took place on the campus of the Polytechnic University of Valencia on July 10, 2019.
- 5th Meeting and Follow-up and Coordination Meeting took place in Genoa on November 4, 2019. The coordination meeting coincided with the Festival della Scienza de Genova in which the project was presented and a stand was installed.
- 6th Meeting and Project Coordination and Follow-up Meeting was held on July 10, 2020.
- 7th Encounter and Follow-up and Coordination Meeting was held online on April 19, 2021.
- 8th Encounter and Project Monitoring and Coordination Meeting was held in person in Valencia on September 28, 2021.

ML: Web opening and RSS. February 2018. In June 2018, it was publicly presented on the first day of the project aimed at political and social representatives carried out in the Valencia Provincial Council held in June 2018. July 2019 an extension of the website was carried out to include new sections and adapting it to the needs and proposals of the project partners. December 2020 the last update of the website is carried out to include a better relationship with the project's social networks and improve its connection with social networks. April 2021. An external company specialized in the management of social networks is hired given the increase in information foreseen for the last months of the project, as well as covering and increasing the visibility in the RSS of the political and social debate tables and the final event.

ML: Publication edition:

- June 2018. 1st edition of publications. Design the project information brochure with the general objectives and proposed solutions.
- March 2019. 2nd edition of project publications in which posters are designed and printed for installation in the spaces intended to implement the project (Alginet treatment plant, work fields and information offices implemented by the Unió).
- July 2019. 3rd New project brochures are produced with a new design, as well as informative and training quadribs aimed at the Unió de Llauradors
- October 2019. 4th Specific informative and informative material is produced for the Ecofira stand.
- November 2020. 5th Update informative material (brochures) in Valencian for distribution to project partners for the development of planned actions
- In summary, the following informative, informative and training materials for the project have been produced: 100 initial brochures and 3 initial Roller-ups, 1000 new design diptychs (four languages), 1000 informative and training quadrilaterals for the Unió de Llauradors, 14 A2 posters and 3 A3 Foam Cardboard Poster, 10 new Roller up (4 languages), 2 exterior

signage supports (Unió fields), 5 interior PVC panels, 1 canvas with eyelets for Nave Algemesí.

ML: Newsletter edition

- 1st published in May 2018. Information period from project start-up to May 2018.
- 2nd published in November 2018. Information period from May to November 2018.
- 3rd published in June 2019. Information period from November 2018 to June 2019.
- 4th published in November 2019. Information period from June to November 2019.
- 5th published in July 2020. Information period from November 2019 to July 2020.
- 6th published in November 2020. Information period from July to November 2020.
- 7th published in Sept. 2021. Information period from November 2020 to September 2021.

Activity	Expected date	End date	Justification
Initial event	01/11/2017	Nov'17	Done according to planned schedule
Coordination meetings: every six months	01/11/2017	Nov'17	Done according to planned schedule
2017			**2 activities planned and carried out in 2017**
LIFE LIBERNITRATE Dissemination Plan	01/01/2018	May'18	Made with delay due to the file for awarding an external company for its design and realization.
Website and social media profiles	01/01/2018	May'18	Made with delay due to the file for awarding an external company for its design and realization.
Web opening and RSS	01/01/2018	Jun'18	Made late. It was considered opportune to carry out a public presentation and dissemination of the web and RSS channels in June 2018. Previously available to members.
Edition publications-I	01/01/2018	Jun'18	Made late. First documents of the project and articles published in June MDPI coinciding with the 1st conference organized by the Diputación
Newsletter edition I	01/04/2018	May'18	Done on schedule with slight delay
Coordination meetings: every six months and the initial-II	01/04/2018	Jun'18	Done late to make the meeting coincide with the day in June according to the planned schedule
Newsletter edition II	01/10/2018	Nov'18	Done on schedule with slight delay
Coordination meetings: every six months and the initial-III	01/10/2018	Dic'18	Done on schedule with slight delay
2018			**8 activities planned and carried out in 2018**
Edition publications-II	01/04/2019	Mar'19	Made according to planned schedule with slight advance. Support documentation and information in facilities where project activities are carried out. An improvement is made to the initial informative publications in June
Newsletter edition III	01/04/2019	Jun'19	Done late due to the fact that project activities are concentrated in the months of April and May.
Evento intermedio	01/04/2019	No realizado	It is not done according to schedule. (*) It is replaced by including information about the project in all the conferences organized by the project.
Coordination meetings: every six months and the initial-IV	01/04/2019	Jul'19	Made late. Activities are concentrated in the months of April and May. Mainly prototype tests.
Newsletter edition IV	01/10/2019	Nov'19	Done on schedule with slight delay
Coordination meetings: every six months and the initial-V	01/10/2019	Nov'19	Done on schedule with slight delay
2019			**6 planned activities and 5(*) carried out in 2019**
Coordination meetings: every six months and the initial-VI	01/06/2020	Jul'20	Done on schedule with slight delay. Online format
Edition publications-III	01/06/2020	Oct'20	Made late. Publication of materials in Valencia to distribute among the partners
Newsletter edition V	01/06/2020	Jul'20	Done according to planned schedule with slight delay. The significant reduction in news about activities and networking due to the COVID situation stands out

Coordination meetings: every six months and the initial-VII	01/12/2020	Abr'21	Made with delay to analyze data and results obtained from the tests carried out. online format
Newsletter edition VI	30/12/2020	Nov'20	Done in advance of the VI Newsletter given the accumulated information.
2020			**4 planned activities and 4 carried out in 2020**
Newsletter edition VII	30/06/2021	Sept'21	Done late due to the fact that project activities are concentrated in the months of July ang August
Coordination meetings: every six months and the initial-VIII	30/06/2021	Sept'21	Made according to schedule with delay in order to match the end of the project with the analysis of the final results obtained.
Newsletter edition VIII	30/09/2021	Feb'22	No done. This publication is planned once the final report has been validated. All the final information generated by the project, delivered and validated,will be collected in the last newsletter.
Final event	30/09/2021	Sept'21	Made according to schedule with delay in order to match the end of the project with the analysis of the final results obtained.
2021			**4 planned activities and 3 carried out in 2021**

In short, despite the difficulties mentioned and, as can be seen in this document, a significant effort and number of activities have been made to disseminate the actions of the project by the Provincial Council and all the partners to comply with the planned objectives, obtaining positioning and visibility results of a medium-high impact level of the project

Effort that will be maintained once the project is finished given that it is planned to maintain and update the website to publish and analyze the final results and impacts of the project, as well as any news or progress related to actions B.4.

Action D2: Implementation of the special program of diffusion for the agricultural corporate.

Foreseen start date: 4/2019	Actual start date: 07/2019
Foreseen end date: 09/2021	Actual end date: 09/2021

Objective: To communicate and raise awareness among farmers about low nitrate fertilization. In practical terms this means to disseminate the products of B1.

Subactions foreseen:

1. D.2.1 Information points for farmers. Advice "face to face"
2. D.2.2 Podcasts
3. D.2.3. To disseminate pedagogical guide and videos.

D.2.1 Information points for farmers.

The information points were created for:

- To give information about B1 development to the farmers. Face to face, by telephone or by email.
- To attend the media in each province.
- Supporting D1 with news and contents.
- To support the training action foreseen.

According with this framework the following activities and results has been achieved:

- ✓ 3 Information points created: Elche, Villareal and Carlet. See pictures

- ✓ Staff of the information points were trained by the technicians responsible for pilot plots.
- ✓ A Manual/brochure was realized (see here) as support document to information points (see here). This manual was used as source of information in the face-to-face meetings but also in different events we detail below. 800 copies in Spanish and Valencian language were made and disseminated.
- ✓ Face to face advice and information. 523 Farmers advised and informed.

Attendance to events:

- (2019/09/20) Training Course in Aspe: https://bit.ly/3El1mgA. 15 attendees
- (2019/10/11) Fair of Elx: https://bit.ly/3o3f4iB . 40 farmers informed.
- (2019/09/12) La Unió Plana Baja council. https://bit.ly/3G42gP0. 17 attendees
- (2020/02/13) Seminar with farmers in Les Alqueries. https://bit.ly/3d28v9B. 50 attendees
- (2019/11/07) Agrarian Management Course. https://bit.ly/3pe7MYH. 15 attendees
- (2019/10/02) La Unió Alto Palancia council. https://bit.ly/3p7C6UI. 7 attendees
- (2019/10/29) Training Course in Hondo de las Nieves. https://bit.ly/3lm63j7. 8 attendees
- (2019/09/19-20) Fair of Nules. https://bit.ly/3rn3rFt. 30 farmers informed.
- (2019/07/04) Carrizales. Networking. Event with the participation of the regional Ministry of Agriculture and Environment. https://bit.ly/3o7TY2M. 25 attendees
- (2020/01/23) Training course in Banyeres. https://bit.ly/3I6H7Wi. 8 attendees
- (2020/03/05) Project presentation to the Ribera farmers. https://bit.ly/317QrJa. 25 attendees
- (2019/10/25) Training course in Beneixama. https://bit.ly/31jHRXw. 10 attendees
- (2019/09/26) Project presentation in La Vall d´Uixó. https://bit.ly/3D9N8Oc. 50 attendees
- (2020/01/28) Project presentation to Ribera´s farmers. https://bit.ly/3pewtUT 15 attendees

Other activities.

- (May-June/2021) Article in the magazine El Camp Valencià. https://bit.ly/3xCaI56. At least 4000 readers.

Impacts.

- In the farmer community: At least 838 Farmers directly informed by the information points. 4000 farmers informed by news. Nearly 5000 impacts.
- In the general people: At least 30.000 people watched in A punt TV (regional tv) the news about Carrizales.

D.2.2 and D.2.3 Dissemination of the MOOC Course. Deliverable D.2.2.

As we have detailed in the action B1, the presential training action together the publication of the guides has been replaced by an online MOOC course in Internet together several related training tools and products as the pedagogical guides and podcast.

All this meant the development of a special plan of dissemination whose aim was to spread the MOOC Course in the farmer community. For this, 2 youtube channels were created one in the youtube channel of the project and another one in the youtube of La Unió We chose the most

widely used and widespread tool, WhatsApp, which La Unió uses massively in an official group of this social network. See details in the deliverable D.2.2.

In addition to the use of this tool, the awareness-raising work of the information points would be maximised by publicising the existence of the course, its nature and availability.

Results of the campaign.

The WhatsApp campaign was launched in the second half of September with these results:

- 4464 impacts via WhatsApp.
- 67 impacts through the information points.

Views of the course on Nitrogen Fertilisation in nitrates vulnerable areas.

Based on the results of the dissemination campaign, the following visualisations of the course have been achieved:

- On the youtube channel of the project: 318 persons.
- In addition, a total of 297 people has watched the interviews on this channel.
- On the youtube channel of La Unió a total of 436 people has seen the course. The interviews have been viewed by 519 people (November 2021).

So, in summary:
- Total views of at least one training module: 754 people.
- Viewings of interviews (in addition to the module viewers): 816 people.

Pedagogical guides dissemination.

The didactic guides are aimed at a different public to that to which we have addressed the MOOC course, in this case we are targeting entities dedicated totally or partially to agricultural training.

Therefore, the communication channel chosen, in this case, mainly via email, is much more selective. Furthermore, this dissemination seeks to directly transfer this result to the common agri-food training, as part of a necessary change in curricula of the young farmers.

These guides have been sent to the following entities

- Federación de Cooperativas Agroalimentarias de la Comunidad Valenciana. Spain
- AreaEuropa SCRL, Italy.
- Liceu Thenologic “Jacques M.Elias”. Romania.
- Istituto Istruzione Secondaria Vergani Navarra Ferrara. Italy.
- Federación EFAS CV La Malvesia. Spain
- FRMFR Bretagne. France
- MFR FOUGERES. France

Comparative Results and Conclusions

- The information points have been a success. This decentralized system has achieved, despite the pandemic have had a significant impact on the farming community, but also on the media and especially on the regional authorities, including the regional minister of agriculture.
- The planned deliverable "dissemination of teaching guides" included the publication and dissemination of 200 guides. Obviously, this product, as described in deliverable

B1, has been largely surpassed by the emergence of the video-course on nitrogen fertilisation in vulnerable areas to nitrates.

- A first approximation, very crude, could equate the number of impressions of the guides to the number of visualisations, which would almost quadruple the reach. However, we would like to emphasise that distributing 200 guides on paper does not imply that they are read, so this comparator would be even more favourable to the incontrovertible fact of viewing the didactic material on video.
- On the other hand, we voluntarily set ourselves the target of 600 views of the MOOC Course by 30.09.2021 and we have exceeded it.
- About the guides, we would like to highlight their new role as a transfer element. They are no longer a final product that is disseminated among farmers, they have become a spearhead for transfer focused on European agricultural vocational training schools, where the new European agricultural entrepreneurs are being generated and where it is necessary to change their vision on fertilisation towards a fertilisation that must be responsible with the environment, soil, and water.

Action E1: Technical and economic-administrative project management by CRIB

Foreseen start date: 10/2017	Actual start date: 10/2017
Foreseen end date: 09/2021	Actual end date: 09/2021

DL: Firma del "Partnership Agreement"

Foreseen date: 11/2017	Actual date: 07/2018

DL: Actas y hojas de firma de las reuniones "Grupo de Gestión" (MB) - I

Foreseen date: 03/19	Actual date: 03/2019

DL: Actas y hojas de firma de las reuniones "Grupo de Gestión" (MB) - II

Foreseen date: 12/21	Actual date: 12/2021

ML: Kick - off meeting. Primera reunion del MB

Foreseen date: 11/2017	Actual date: 11/2017

ML: MB 3.

Foreseen date: 10/2018	Actual date: 12/2018

ML: Reunión Final MB 8 (6).

Foreseen date: 09/2020	Actual date: 09/2021

- The E1 action has been carried out as outlined in the LIBERNITRATE project. Within this Action, the tasks carried out have been the following:
  - Task E1.1. Relations with the European Commission. CRIB has been the formal contact with the CE and NEEMO monitor. The communication has been carried out through telephone calls, emails and some visits.
  - Task E1.2. Implementation of the Governance of the Project. The structure and procedure of project management was defined as described in this sub-action. The functions have been described and assigned to the operational, management and superior levels.
  - Task E1.3. Project justification. To complete the periodic justification reports, CRIB established an internal system to collect technical and financial reports every 6 months.
  - Task E1.4. Review of progress though milestones and deliverables. As previously mentioned, CRIB has compiled technical reports every 6 months. In addition, a calendar of deliverables and milestones has been prepared to track them and avoid delays.

- Action E1 started in October 2017 and finised in September 2021. The activities undertaken and outputs achieved which can be highlighted:

  - On May 25, 2017, the CRIB representative signed the Grant Agreement and sent it to EASME.
  - CRIB has been in contact with the Technical Monitor to resolve any question related to the rules of the Program that may affect the beneficiaries.
  - The produced deliverables have been sent to the monitor for review.
  - The Mid-term report and 2 progress reports have been delivered.
  - CRIB has periodically informed Technical Monitor of the development of the actions as well as of the periodical meetings of the management group.
  - CRIB coordinated and facilitated the creation of the Management Group (MB).
  - It organized and coordinated 8 meetings of the management group, as well as a multitude of work meetings between the leaders of the different tasks.
  - The minutes of the MB meetings were prepared by CRIB and sent to all the beneficiaries.
  - A Google Drive account was created for the project, to which the beneficiaries have access. In this platform you will find all the relevant documents of the project, including the deliverables produced.
  - CRIB prepared the Association Agreement between all the beneficiaries that was signed between November 2017 and January 2018.
  - CRIB prepared a template for the technical reports of the actions initiated or in progress. These was prepared by the beneficiary responsible for each action, with the contribution of all the beneficiaries participating in the action.
  - For the financial report, all the beneficiaries were asked for the Excel sheet of the program, the financial statement, for the period considered together with the supporting documents of the expenses incurred within this period.
  - In addition, CRIB has hired external assistance to support the financial information of the project.

- The comparison with planned output and time schedule is included in the chat below:

Activity	Expected date	Actual date	Justification
Kick-off meeting. First MB meeting	11/2017	11/2017	According to the scheduled dates
signature of the "Partnership Agreement"	11/2017	07/2018	Done but with delay
MB 3	10/2018	12/2018	According to the scheduled dates
MB 6 (8)	09/2020	09/2021	According to the scheduled dates in the amendment

- It was necessary to request an amendment to extend the project duration for 12 months
- It was necessary to organize and coordinate 2 more meetings than those foreseen in the initial proposal of the management group, as well as a multitude of work meetings between the leaders of the different tasks.
- Due to the restrictions due to COVID-19, it was more difficult to organize meetings in person, so most of them had to be organized electronically.

Action E2: Sustainability and communication after-LIFE activities

Foreseen start date: 07/2021	Actual start date: 09/2021
Foreseen end date: 09/2021	Actual end date: 09/2021

DL: After-LIFE sustainibility and communication plan

Foreseen date: 09/2021	Actual date: 09/2021

The planning of after-LIFE sustainability and communication activities has been designed to ensure the continuity of the project's results and enhance its impact at the end of the project's financing. The purpose of this planning is to effectively, efficiently and economically define the communication tools to be used to increase the awareness of citizens and political actors regarding the problem of nitrates in water, as well as to stimulate acceptance and promote the use of the solution designed by LIBERNITRATE in small towns with nitrate problems where current technologies are not economically viable.

The plan of future communication actions during the 5 years after the end of the project, will be a natural continuation of the dissemination activities that have been carried out during the implementation of the project.
All project partners will promote the activities proposed in this after-LIFE plan, to ensure greater dissemination of the project's objectives and results, as well as the key messages and lessons learned.
Main aspects of the plan are:
— The website of the project, social network profiles and the YouTube channel will be operational for at least 5 years after the closure of the project.
— Maintenance of information about the project on the website of each of the partners, where the link to the website will be maintained (www.lifelibernitrate.com.)
— Stakeholder meetings and continuation of the networking areas with the aim of disseminating the results and improving the knowledge acquired.
— Maintenance and dissemination of the MOOC course on fertilization in Nitrate Vulnerable Areas.

The plan of future sustainability actions during the 5 years after the end of the project, will have two lines of action:
— On the one hand, and given that in the aspect of the elimination of nitrates in the water, during the implementation period of the project the technological maturity necessary to launch the product on the market has not been reached, all the partners of the project will continue working, testing and improving the prototypes built by LIBERNITRATE for at least two years, with the aim that in that time municipalities with less than 200 inhabitants and water management companies can be offered the installation of nitrate adsortion beds using active silica, supported by a business structure that is capable of producing and supplying the quantities of silica necessary for their operation, at a competitive cost.
— On the other hand, and given that in neighboring regions of the Valencian Community, such as the Murcia Region, there is also the problem of aquifer contamination by nitrates, and the type of crops and climate is similar to that of the Valencian Community, it will spread to this province the information points for farmers. There will also be specific dissemination campaigns for the MOOC course on fertilization and its educational guides, with the aim that the crops in the area adapt to the new realities of the CAP and reduce the environmental impacts of fertilization.

6.2. Main deviations, problems and corrective actions implemented

The LIFE LIBERNITRATE project started on time and although there were many delays and an extension had to be requested, all the planned tasks could be executed.

However, as indicated in the progress reports previously submitted (delays and problems due to COVID-19), it was necessary to request an extension of the project in order to meet all the objectives set forth in the initial proposal.

In general, the apparition of COVID in March 2020 forced the Consortium to cooperate online. Due the not presential communication issues this has not made life easy, nor has it contributed to the quality of the outcomes. Also, the fact that the consortium was made up of so many entities, almost all of them public entities, has made it difficult to coordinate activities and complicate decision-making, especially in terms of launching the product on the market. However, the consortium meetings and bilateral meetings which were held frequently, have lead to sound and constructive discussions to improve parts of the plans.

With regard to the different tasks, these are some of the main problems found:

- There was hail and frost in the plots of the test fields.

During the first year of the test on the fields (citrus and persimmon) a hail and frost devasting the field don´t giving us the opportunity of establishing the real reduction of nitrates (in normal conditions) in the soil. This circumstance, a very intense frost and hail in the same year is absolutely exceptional in the area of La Ribera.
To prevent this problem from recurring, some preventive actions were taken, such as: Against the frost. To request a quote for paraffin torches that could mitigate the intensity of future frosts. They would have been purchased and placed in the fields immediately if necessary, according to weather forecasts. Fortunately, this was not necessary.
Against the hail, it´s expensive to protect the fields. One of the passive defences would have been to purchase and cover the plots with anti-hail netting. However, the probability of hail occurring again with similar intensity on the same plots two years in succession was and is practically nil.

- Many probles with the technology demo

Many technical problems arose both for the production of ash and for the use of the beds. All these problems are detailed in the deliverables of Actions B2 and B3.
These technical problems in actions B2 and B3 caused the prototypes to be re-studied, redesigned and reconditioned to solve the problems and also allocate more personnel resources for their control and use.

- Political action and dissemination of the project

As has been indicated in the different technical reports on the execution and degree of fulfillment of the activities foreseen in each of the actions, the development of the action has been accumulating significant delays mainly due to:

- The different electoral processes initiated in March 2019 with the municipal elections from which the composition of the Valencia Provincial Council Policy derives. Thus, the Diputación was formally constituted in July 2019 and Decree of the President of the Diputación No. 9090/2019, of July 23, of delegations of the Presidency in the Provincial Deputies was published.

After the appointment of the deputies, the assignment of delegations and areas of competence and the end of the vacation period, work begins to make contact with the new political leaders to transfer the projects and commitments acquired in the previous period, as well as those tasks started and that demand a certain continuity.
This situation has caused a delay in the resolution of those actions initiated or the non-implementation of those that the electoral period and the configuration of the current government have delayed, for which it was necessary to propose corrective actions to achieve the commitment acquired in the execution of the draft.

- Crisis caused by COVID since the start of the state of alarm in March 2020. The local government teams were set up in mid-2019 and the start-up and reorganization and scheduling of activities for their execution began. Throughout 2020, the pandemic diverts both interest and priorities at all levels of public administrations. We therefore found ourselves with enormous difficulties in developing actions for social and political debate, not so much because of the "obligation" of moving from a usual face-to-face format to an online one, but because political representatives did not consider interesting to be part of these spaces of debate in the face of the unprecedented social and economic crisis they are facing.

- Delays in obtaining tangible results of the project proposal. Another aspect to take into account was the speed of progress and advances in obtaining the specific results of the project within the initially planned deadlines. It was necessary, for a better dynamization of the social and political action tables, not only to transfer to the debate the problem of nitrates in the integral water cycle and what was the proposal for its reduction proposed by the project, but also to provide concrete results that can contribute to the generation of debate and the contribution of feasible and acceptable ideas.

The main reasons for the delays in the fulfilment of the monitoring and impact analysis tasks of the project have been mainly due to the difficulties encountered in the decision making of the political decision makers for the recruitment of external staff, mainly due to the regulations and administrative procedures of the Provincial Council of Valencia in the field of personnel. The contracting of external personnel linked to the project to collaborate in the development of the tasks has only been possible for the period from 1 December 2020 to 5 April 2021. A general administration technician was recruited, although not specialised in the management and monitoring of indicators and project monitoring analysis. This person contributed to improve the development of the activities. In addition to the absence of additional specialised staff, we also had administrative difficulties in contracting external companies for, among other tasks, the management of the domain and design of the website and the management of social networks.

a) Period of inactivity and uncertainty generated by the pandemic which, despite the extension of the project, has hindered the development of actions that mainly require the participation of the actors in person, such as networking actions, conferences, meetings, social and political action. Without activity and execution of actions, no relevant information is generated to be disseminated through the different communication channels foreseen for the project.

a) The excessive length of the administrative deadlines of the Provincial Council related to the management and procedures for the hiring of external companies for the provision of communication services and the difficulty of hiring additional staff with knowledge in the management of information and social networks except for the period from 1 December 2020 to 5 April 2021 in which a general administration technician is incorporated, who although not

a specialist in the management and dynamisation of communication and social networks contributes to some extent to the development of the activities of the project with respect to action D1. This situation has led to an overload of work among the permanent staff for the implementation of the global actions assigned to the Provincial Council.

- Business plan and after LIFE plan

Before the business plan was written, few partners were convinced to participate in a new start-up after the end of the project. However, once the potential of the product was demonstrated, at a final meeting of the project, all the partners showed interest in joining the start-up after the project. All partners promised a time commitment for the next stage of product development. However, everyone agreed that at least two or three more years were needed to finish maturing the product before launching it on the market.

6.3. Evaluation of Project Implementation

We consider the methodology for the implementation of the project was chosen correctly. However, the pandemic situation declared in March 2020 caused significant delays in the execution of the implementation tasks, which is why in August 2020 it was necessary to request an extension of the deadline to be able to execute all the project tasks.

The preparatory actions (Actions A1, A2 and A3) were planned in a way to ensure smooth implementation of technical actions (Actions B1 to B6). Despite the delay of Actions B2 and B3, the corresponding contingency plans have been applied in the rest of the actions that were related to this action, so that majority of other actions have not been affected by this delay and are implemented in due time.

Monitoring methods are satisfactory (Actions C1 to C4).
Public awareness and informative activities for farmers (Actions D1 and D2) have helped to distribute the knowledge gained to a wider audience and increased awareness of the objectives of LIBERNITRATE.

The project partners has been chosen correctly. Therefore, it is not much difficult to coordinate project actions and solve the problems. Coordinator Beneficiary (CB) has specific knowledge and experts, experienced in European funds management, however, as the number of benificiaries is high, an external assistance, very experienced in the LIFE Programs has been contracted up to support the CB. Overall, the CB and the knowledge external assistance contracted is used to monitor and evaluate the project and the management actions.

The evaluation of the project implementation Action by Action can be seen in the chart below:

Action	
A1	**Foreseen in the revised proposal**
	The objective of this action was to highlight the review of the state of the art of the different technological innovations to be developed by LIFE LIBERNITRATE.
	Achievements
	A technological surveillance protocol has been created. In addition, with respect to the state of the art, methodologies have been analyzed for the valorization of agro-industrial residues, the obtaining and activation of silica and the validation of the quality of the soil and water through the control of nitrates and the mitigation of nitrogen in the fields of cultivation.
	Evaluation
	Action performed without delays. The achievements made in this action have been positive and have helped in the development of implementation actions. The deliverable issued in line with the schedule of the proposal
A2	**Foreseen in the revised proposal**
	To establish indicators and procedures to evaluate the impact of the project on environmental and socioeconomic aspects.
	Achievements
	The indicators related to environmental aspects were selected: analysis of nitrates in water samples; water eutrophication parameters and presence of priority and specific pollutants. Socioeconomic indicators were also selected mainly in relation to the transferability and replicability of the project to the market and the population affected by NO3- in the water supplies.
	Evaluation

	Action performed without delays. The achievements made in this action have been positive and have helped in the development of monitoring actions. The deliverable issued in line with the schedule of the proposal.
A3	**Foreseen in the revised proposal**
	To develop corporate social responsibility procedures, green public procurement and permits, licenses and agreements that enable the development of the project and meet all the necessary legal and administrative requirements.
	Achievements
	An agreement was signed between all the partners to include CPV and CSR criteria in their purchases of products and services and hiring of staff. It was also possible to sign the contracts for the transfer of facilities and the supply of rice straw.
	Evaluation
	Action performed with some delay but not affecting implementations actions. The achievements made in this action have been necessaries to development of implementation actions. The deliverable issued in line with the schedule of the proposal.
B1	**Foreseen in therevised proposal**
	To educate farmers to use other nitrogen fertilization alternatives that have already demonstrated their viability to reduce the amount of nitrogen in the soil, without reducing the profitability of crops and, in this way, reduce the cause of excess nitrates in the soil. drinking water.
	Achievements
	Tests were carried out with different types of crops where it was shown that using slow release fertilizers is at least as productive as conventional fertilizers. The awareness/information and training campaign for farmers was completed by creating a MOOC course, achivement much broader than the educational guides provided for in the initial proposal.
	Evaluation
	Action performed with some delay but without affecting other actions. The tasks carried out in this action have made many farmers change their fertilization habits to the system proposed by LIBERNITRATE. The deliverable produced has been much more complete and of much more value than anticipated in the initial proposal.
B2	**Foreseen in the revised proposal**
	To obtain suitable active silica for the reduction of nitrates through the adsorption beds developed in action B3.
	Achievements
	It has been possible to collect 2.6 tons of rice straw, design and build a valorizer (boiler) to incinerate the rice straw in a controlled manner and obtain ashes rich in silica. It has been possible to design and build a laboratory to extract the silica contained in the ashes and functionalize it so that it is capable of adsorbing the nitrates contained in the water flows. This procedure has been patented. In total, it has been possible to functionalize around 72 kg of silica.
	Evaluation
	The execution of this action had certain delays until it was possible to obtain an optimal ash. However, it was not possible for the valorizator to function without human presence, so more personnel resources had to be allocated than those foreseen for its control and supervision. Although the planned objectives have been achieved, the design of the valorizer (boiler) must be improved so that continuous human supervision is not necessary and thus reduce operating costs. Deliverables are available and they detail the problems encountered.
B3	**Foreseen in the revised proposal**
	To demonstrate that it is possible to reduce nitrates in the reject stream of a reverse osmosis plant and in the supply stream to a population, by means of a prototype of active

	silica beds.
	Achievements
	It was possible to design and build prototype I, which worked with flows of 130 liters/day in well water and in reject water from the osmosis plant, with average retention of 29.6% and 14.5%, respectively. It was possible to design and build the prototype II, which worked with flow rates of up to 26,000 liters/day in well water, achieving average retention of 23.63%.
	Evaluation
	Action performed with some delay due to the number of problems encountered. The reductions in nitrate concentration foreseen in the initial proposal have been achieved, although the production costs of the beds have been higher than expected. Deliverables are available and they detail all the problems encountered.
B4	**Foreseen in therevised proposal**
	To integrate the project's results and advances in the European policies. To get a plan to search/promote specific funding in FEDER, FEADER and FSE schemes to reduce the impact of nitrogen in soils and water in line to the LIBERNITRATE project.
	Achievements
	Although the B4 action has been carried out with a general delay, the following achievements are worth noting: • The high degree of participation of the different political and social actors in the development of the actions of the project that has allowed to achieve a high visibility both of the problem of water nitrification and of the solutions proposed by the project to all public administrations Valencian at all levels of competence. • The signing of the manifesto of interest, participation in different work groups and initiatives (Covenant of Mayors, DG Agriculture work table, Water Observatory) and the different commitments reached (creation of a social work table) that will allow the project, further of its execution period, continue working together with the public administration and social entities. • Territorial scope to all the municipalities of the province of Valencia and to the set of Valencian public entities of supraterritorial scope such as the Generalitat Valenciana, the Federation of Municipalities of the Valencian Community and the Government Delegation. In short, we have generated a wide territorial scope from the local, to the state, through the provincial and regional levels. Deliverables related to B4 are available.
	Evaluation
	The development of this action has been complicated, due to all problems described in the deliverables of action B4 (electoral processes, pandemic, politicians focused on problems associated with COVID, etc). Even so, an acceptable level of participation of the political representatives in the meetings has been achieved and the commitment of the main Valencian administrations has been achieved to finance and support future actions. Deliverables are available and they detail all the problems encountered.
B5	**Foreseen in the revised proposal**
	To reinforce the continuity of the project by testing the results obtained in terms of replicability in other geographical realities and transferability in other industrial sectors.
	Achievements
	The MOOC course has been adapted to the reality of Italy and the Netherlands, and in 3 years it is expected to generate at least 50 plot plans in these countries. Active silica beds have been shown to be just as efficient in Italian waters. It has been found that although not much silica can be obtained from other lignocellulosic agri-food residues, they can be mixed with rice straw to achieve a more stable combustion process.
	Evaluation
	The results of the LIFE LIBERNITRATE project are replicable in other locations. However, with the current development of technology, the silica beds are only applicable

	to clean water sources. With a little more research, this technology can be transferred to other areas such as farms or the textile sector. Deliverables are available and they detail all the tests realised.
B6	**Foreseen in the revised proposal**
	To guarantee environmental, economic and social sustainability, to ensure the continuity of technological innovations and validated good practices, regardless of the existence of public funding.
	Achievements
	Although the technological maturity to launch the product on the market has not been reached, it has been possible to identify the potential clients to whom the product can be sold once it is more competitive. In addition, the commitment of the public administrations to support and finance the future actions of the project has been achieved.
	Evaluation
	While it is not possible to launch the LIBERNITRATE product on the market, it has been possible to identify the market niche to target when the product is available. In addition, commitments have been reached with public administrations, so that financing is not a problem in the future. Deliverables are available.
C1	**Foreseen in therevised proposal**
	Monitor the data and environmental results achieved during the project by comparing the initial situation with that analyzed after a period of project implementation.
	Achievements
	The selected environmental indicators have been identified and a follow-up has been carried out during the execution of the project. As a result of this monitoring, it has been possible to analyze the LCA and compare it with other systems for obtaining water for human consumption.
	Evaluation
	Action performed without delays. The achievements made in this action have been positive and have helped in the development of other actions. Deliverables issued in line with the schedule of the proposal.
C2	**Foreseen in therevised proposal**
	Monitor the socioeconomic data and results achieved during the project by comparing the initial situation with that analyzed after project implementation.
	Achievements
	The selected socioeconomic indicators have been identified and a follow-up has been carried out during the execution of the project. As a result of this monitoring, it has been possible to analyze the CCA and compare it with other systems for obtaining water for human consumption.
	Evaluation
	Action performed without delays. The achievements made in this action have been positive and have helped in the development of other actions. Deliverables issued in line with the schedule of the proposal.
C3	**Foreseen in therevised proposal**
	Monitoring, evaluation and action regarding the planned communication planning, both operational and impact.
	Achievements
	Although the pandemic prevented the communication actions from being carried out as planned, the conferences and meetings were adapted to online formats and thanks to this, up to 35 political representatives were involved in the communication actions. The level of visibility on networks was high, reaching 2.084 visits to the website, 3.958 views on the YouTube channel, 225 in-person attendees at the different meetngs and events organised, and up to 25 publications in magazines and newspapers was made, with a high number of readers.
	Evaluation

	Action performed with a lot of problmes, but with good results. The achievements in this action have been positive and have helped give visibility to the actions carried out in the project. Deliverables issued in accordance with the proposal schedule.
C4	**Foreseen in therevised proposal**
	Monitoring and evaluation of the LIFE project performance and KPI indicators
	Achievements
	As a result of monitoring the KPI indicators, it has been possible to carry out the indicator monitoring report (Final Report)
	Evaluation
	Action performed without some delays. This final report is available.
D1	**Foreseen in the revised proposal**
	To maximize the visibility of the results of LIFE LIBERNITRATE, through the planning and implementation of a Communication Plan.
	Achievements
	LIBERNITRATE has participated in more than 17 conferences or events. The website has been visited by 2.084 people, of which 304 have subscribed. The social network profiles have obtained a total of 615 followers and the YouTube channel 3.958 views. More than 225 people have attended the different conferences and events organized. Up to 25 publications in magazines and newspapers was made. LIBERNITRATE has been interviewed in a specialized program on regional TV in Valencia.
	Evaluation
	Although the principal partner in charge of dissemination and communication had problems hiring staff and carrying out these tasks, the rest of the partners collaborated with them, and thanks to this, good results have been obtained in terms of visibility and dissemination. Deliverables issued in accordance with the proposal schedule.
D2	**Foreseen in the revised proposal**
	The objective of this action is to implement a special communication action to the agricultural productive sector, as the originating agent of nitrate contamination.
	Achievements
	Three information points were created for farmers (Elche, Carlet and Villareal), which served more than 832 interested parties. The MOOC course was launched to more than 4.500 farmers, achieving that 754 people at least one training module seen.
	Evaluation
	Tasks carried out in this action have made many farmers change their fertilization habits to the system proposed by LIBERNITRATE.
E1	**Foreseen in the revised proposal**
	To manage the project implementation from a technical, administrative and financial points of view - Communication with the EC. - Project's management development and justification. - Management and Advisory boards creation. - Monitoring of the project progress.
	Achievements
	Even with the difficulty of managing a consortium made up of so many partners, it has been possible to implement the governance of the project and obtain the necessary information to feed the justification reports delivered to CINEA.
	Evaluation
	Action performed with some delays. Deliverables are available.
E2	**Foreseen in the revised proposal**
	Activities related to the project sustainability and the After-LIFE communication: After-LIFE dissemination and sustainability Plans

	Achievements
	Although during the development of the project, sufficient technological maturity was not reached to launch LIBERNITRATE on the market, the commitment of all partners to continue developing the product and maintaining communication efforts over the next few years has been achieved.
	Evaluation
	Action performed with some delays. After-LIFE plan is available.

6.4. Analysis of benefits

1. Environmental benefits
    a. *Direct / quantitative environmental benefits for LIFE Environment & Resource Efficiency*

The report of the European Environment Agency states that the watersheds that have intensive agriculture and/or high densities population are those that report higher concentrations of nitrates in the European Union, as is the case of Spain. EEA Reports (2021) reveal that the level of nitrates in groundwater in the European Union has remained high (and even climbed) to levels of 1044 mg/l for the period 2000-2017. This trend demonstrates the grand scope of the problem and its social and environmental relevance because much of the groundwater in the European Union is contaminated by nitrates. The project LIFE LIBERNITRATE has shown during this development that it is possible to implement the innovative process proposed, which involves:

1. Application of fertilisers with urease inhibitor for rice cultivation
2. Collection of rice straw
3. Controlled incineration of rice straw to obtain silica-rich ashes
4. Production of active silica from ashes
5. Water treatment by means of active silica beds to reduce nitrate concentration.

Thus, each of these lines of action has produced environmental benefits

Application of fertilisers with urease inhibitor for rice cultivation

LIFE LIBERNITRATE carried out actions to advise the farmers to reduce the presence of NO3- in the ground. It was demonstrated that the use of commercial slow-release fertilizers reduces the environmental impact and, at the same time, reduces cost (less fertilizer used). Nitrogen fertilizers provide more than 40% of nitrogen (N_2), and it has been calculated that only 17% of nitrogen fertilizers are assimilated by crops, scattering the rest by ecosystems. These farming practices are responsible for anthropogenic nitrogen and have triggered destructive environmental processes. Given that nitrogen oxides contribute 6% of the gases that produce the greenhouse effect, the LIFE LIBERNITRATE project contributes to reaching the binding objective for the EU in 2030 of at least 55% less greenhouse gas emissions greenhouse compared to 1990.

Slow-releasefertilizersuse inhibitors such as urea-N or ammonium-N and reduce emissions to theenvironment. In the rice fields, the average reduction in the use of fertilisers is 17,24%, and the analysis intermediate of nitrate in the soil was < 5 mg/Kg and post-harvest < 2mg/Kg. In the citrus fruits and persimmon, a -25% and 33% less fertilizer, respectively, without significant losses in the harvest.Considering a rice production of 11 t/year, saving 5,7 t/y of CO2 is possible

In general, the LIBERNITRATE project has reduced environmental and human health problems such as Abiotic depletion; acidification; eutrophication; Freshwater aquatic ecotox; global warming; Human toxicity; Marine aquatic ecotoxicity; Ozone layer depletion (ODP); Photochemical oxidation; Terrestrial ecotoxicity, in percentages that range between 40 and 11%, as shown in table 3 of the deliverable action B6. The aim is to protect water quality throughout the EU by preventing nitrate pollution from agricultural sources and promoting sound farming practices. Under Article 10 of this Directive, the Member States must report periodicals and present data on water monitoring results in areas vulnerable to nitrates.

In addition the development of the new MOOC course available in each language provided (with 318 complete views of the course and at least 754 people have seen a training module) is a formidable new tool in terms of dissemination and training on good practices in line with the new in the Common Agrarian Policy that is supporting eco-schemes based on the respect of Directives Water and Nitrates .

Collection of rice straw and Controlled incineration of rice straw to obtain silica-rich ashes

The abandonment of rice straw in the fields is very harmful, producing high mortality of all aquatic species precisely in a protected and high-value area such as the Albufera de Valencia. As shown in deliverable B6.2 page 14, the Valencian area's total cleaning costs would be around 1.3 million euros.It´s necessary collect the rice and offer an sustainable alternative to their use.

The valorisation of the rice straw to obtain active silica, concerning specific data, LIFE LIBERNITRATE has already fulfilled the following environmental benefits: 2,3 tons of rice straw was burned in the valorisator. It was produced about 260 kg of ashes of rice straw. With these ashes, 72 kg of silica has been extracted and functionalised to clean more than 50m^3water. This means that for every cubic meter of treated water, 46 kilograms of straw is consumed. In l'Albufera de València some 75.000 – 90.000 tons of straw per year are originating, which would allow the elimination of nitrates at least 1.630.435 m^3/ year of water per year. The project has been considered that the annual need of a town of 200 inhabitants is 9360 m^3/year. Therefore, with this straw and the corresponding production of silica, **174 small villages with 200 or fewer inhabitants can have drinking water with a nitrate reduction more significant than 30%.**

Production of active silica from ashes and water treatment by means of active silica beds to reduce nitrate concentration

Throughout the development of the LIFE LIBERNITRATE project, the process of obtention, functionalizing and silica activation has been optimized until a competitive product is achieved. We can compare this product to bottled water consumption and drinking water obtention by means of osmosis plants.

In the first case, we have demonstrated that our process is eco-friendlier than using bottled water. Suppose an inhabitant consumes 2 litres of water per day in a polyethene terephthalate container. In that case, it means that a town of 200 inhabitants would produce a waste of 200 bottles per day: 6,000 a month and 73,000 bottles in a year. All us, know the extreme environmental impact of micro-plastics in the biodiversity, our process avoid this impact.

In the second case, the reverse osmosis process involves a costly investment in equipment, costly in economic terms (but also in envormental terms due to carbon fingerprint of the construction) that small towns cannot afford in fact, the osmosis plants for municipalities are planned to treat large volumes of water. The smallest plant found treats 500 m3/day for a population of 1,400 inhabitants, and its cost (ad hoc design included) was more than €500.000. The small municipalites have not chance: they cannot provide a drinking water supply service at a reasonable cost/price and this is another nail in the coffin of rural depopulation.The active bed system is straightforward and does not require a large installation; it is enough to connect the bed to the water current to be treated.

In conclusion, the innovative process could be applied to treat water in a small town where the reverse osmosis technology may not be installed, avoiding bottled water and saving 2000 t/y of CO2 to treat 26 m3/d of water.

It is a crucial remark a significant result proves in the LIFE LIBERNITRATE because this innovative process allows clean the rejection water from the osmosis plants. **The silica beds adsorb at least 30% of nitrates and it can reduced not only nitrates but also other anions present in the water as carbonates, sulphate, phosphates** with more proportion since these anions have more affinity to the active silica than the nitrates. Therefore, they can be **complementary to the osmosis plantsobtention procees to obtain drinking water** since they reduce the waste (ultra-saline water) the osmosis plants discharge into the sewers. Incorporating active silica adsorbent beds in the rejection effluent of the reverse osmosis plant would reduce the treatment of nitrates/nitrogen in the waste-water treatment plant (WWTP), require less residence time, less time aeration, less associated energy, and lower associated financial requirements in line with the Water Framework Directive (Directive 2000/60/EC) which was passed to establish clear criteria to assess the good chemical status of the waters and identify and reverse trends in the deterioration of its quality, imposing measures to prevent or limit the immediate entry of hazardous substances into groundwater.

At the same time, it also contributes to an environmental improvement by reducing the energy consumption of the osmosis plant because the active silica beds do not require the use of high-pressure pumping, which is the equipment that carries most of the energy expenditure in the osmosis plants. Our osmosis plants' average consumption estimated energy for brackish water (extracted from aquifers) is 1,192 kW/m3. Since small energy is used to produce the silica, low-pressure pumping lighting control, etc., that has been overestimated on 0.219 kW/m3, **the savings energy is estimated at 0.970 kW/m3.**

The silica beds prove in LIFE LIBERNITRATE project permit capturing a considerable part of $NO3^-$, which has reached groundwater by leaching, not reaching the rivers and humeral where denitrification occurs. In addition, the promoting Political Action Plan and the proposed Business Plan allow extending the project's results by replicability and transferability activities at the European level. The European Commission (COM (2013) 683 final) concluded that, despite the pressure on agriculture, 14.4% of analyzed water exceeds 50 ppm in nitrates, and 5.9% had between 40-50 ppm. Directive 91/676/CEE, of December 12, refers to protecting waters against nitrate contamination from agricultural sources.

b. *Qualitative environmental benefits for LIFE Environment & Resource Efficiency:*

long term sustainable technology, from product to functional focus, from end-of-pipe to prevention;

Since the early 1990s, industrial ecology was introduced as an approach that aimed at improving the environmental efficiency of technological systems (Graedel and Allenby 1995). Recycling and re-use technologies that feed waste (product) back into production processes can be termed end-of-pipe if the waste in question is from a different process loop, as in the case of waste being used as a fuel, for example. If waste is re-used in the same production loop without requiring much additional energy or generating much pollution, however, recycling may be sustainable (as in the case of reprocessed metals).

It can be said that sustainable technological development and innovations do not automatically lead to total reduction of environmental burden of industrial production. However, technological innovation is an important factor, and, from a wide point of view, it seems to play a central role in the long-term initiation of sustainable and cleaner industrial activities as it is expected that the installation of valorisator will be a feasible alternative to reduce the uncontrolled management of rice straw waste, which are currently either burnt or let flood provoking eutrophication.

From this point of view, LIFE LIBERNITRATE achieves the main objective of the project an optimize active silica beds obtained from the ashes produced by a controlled burning of rice straw to reduce the concentration of nitrates in the comprehensive water cycle, implementing an integrated innovative, simple, economical, sustainable and transferable system

The University of Valencia, the Polytechnic University of Valencia, and the University of Genova have developed and tested a method to filter nitrate from water using a EUROPEAN PATENT APPLICATION published in accordance with Art. 153(4) EPCEP3929161A1 to obtain the silica compound extracted from rice straw, a waste product unfit for livestock feed or biomass due to the high silica contents. In the business plan is to assess the economic impact and viability of the developed innovation.

It was demonstrating an affordable nitrate filter system for small villages in Spain up to 200 inhabitants that could not afford a large-scale water filtration plant by using a waste product that was plentiful in Spain, rice straw. Spain and Italy produce 80% of the rice grown in Europe.

During the market research four other potential applications were looked at for replicability:

1. Filtering out nitrate from the waste slush after reverse osmosis in water treatment plants so this was not end up in natural bodies of water
2. Filtering out nitrates from agricultural manure slush to filter out the nitrates at the source
3. Filtering out nitrates from the waste water from greenhouses
4. Using the silica as concrete filler.

The market research found that for market viability to be reached the production cost will need to drop by at least a factor ten and the technological readiness level will need to be raised.
Currently a licencing model of the patented activated silica holds the most promise. It is possible to create an added value product (filtering nitrates out of water) out of the residual waste rice straw produces and leaves out on the fields in Valencia. The various tests have demonstrated the working flow capacity a filter would need for a village with less than 200 inhabitants. Market validation should be done to a market price of 21 cents per liter, which will demonstrate feasibility with 4,5% market share in villages at current cost levels.

c. *high visibility for environmental problems and/or solutions;*

The intention of LIFE LIBERNITRATE is to become a specialized interlocutor among different stakeholders with different interests to offer a multi-perspective and consensual approach to the problem of the pollution of nitrates. Under this framework, the project consortium contacted stakeholders from the origin of the problem, (i.e., the overuse of nitrogenised fertilizers), to the responsible to offer solutions, (i.e., administrations and water management entities). In this sense, all activities were performed considering the high visibility of both the problems and the solutions, with special focus on the political sector. For this matter, several meetings with the regional responsible for environment, as well as to the county and municipal have helped visualize the problem and set an interest to the development of the project. As a result of these meetings, public entities and the main political representatives of the Valencian Community signed a letter of interest to finance future projects related to the reduction of nitrates in wastewater, using innovative solutions such as the one developed by LIBERNITRATE. In addition, LIFE LIBERNITRATE was presented the project to professionals of the water management sector, politicians and users as explained in detail in the section Action D 1.3. Development of the dissemination plan

d. *spin-off effect in other environmental areas etc.*

The spin-off effect of the application of LIFE LIBERNITRATE in other environmental areas is highly connected to the verification of the replicability and transferability actions foreseen during the second term of the project. In this sense, the MOOC training course and advice given to farmers, the waste-to-silica process of the active silica beds, have been carried out without losing the perspective of replication in other areas of cultivation of rice or land with polluted aquifers, which are very widespread around the Mediterranean basin. A specific analysis of replicability has been performed for each potential result at item 4 of this chapter.

2. *Economic benefits; number of full time equivalent (FTE) jobs created.*

The improvements performed during the implementation of LIFE LIBERNITRATE have permitted to reduce the cost foreseen in the proposal, and therefore, have open new opportunities for the future implementation and replication of the technology. In particular, the modifications that induce a cost saving are:

(i) Changes related to the cost-effective operation of the valorisation and the ash-to-silica process previously mentioned.
(ii) Modifications in the design of the ash-to-silica process, by means of the creative combination of lab-glass and electronic supplies, that permit scale-up different prototypes to test different optimisation procedures and multiply the production sets.
(iii) Adjustments in the design of the active silica beds, going from discontinuous big steeled expensive reactors to small piston-flow plastic affordable reactors, which allows for the combination of different arrangements and increase the chances of replicability.

The implementation of the LIFE LIBERNITRATE technologies is tightly related to the focus of the environmental problems tackled in the project: accumulation of nitrates and reduction of rice straw wastes. The expected cost reductions will be mainly obtained in the management of water, which is usually based on technologies such as reverse osmosis, which needs a high energy demand to reduce nitrates form highly polluted aquifers.

The geographical dispersion of the technologies can be focused on areas both close to the valorisation facilities (upstream) or close to the facilities for the preparation of active silica beds (downstream), with a high potential impact for replication in same and other sectors

at the local and EU levels at different stages by following a multi-scale approach: locality, county, region, country, and continent. This will offer new opportunities to develop economic activities based on innovative technologies. The companies will not only be able to build up the technologies, but also offer turn-key installations and deal maintenance, technical support or capacitation agreements.

During the execution of the project and related to the project development itself, the following Full-Time Equivalent jobs of qualified staff have been created

- UVEG has hired 1 graduate in chemistry (25/04/2018 until 15/09/2018, 20 h/week) and 1 doctor in chemistry (01/09/2018 until 31/01/2019, 37.5 h/week) for working in the action B2 and 1 graduate in economics (01/06/2018 until 11/11/2018, 20h/week and 12/11/2018 until 31/01/2019, 35.5 h/week) for working in the actions B5, C2 and C4 and 1 graduate in economics (01/01/2019 until 31/01/2019, 20h/week) for working in the action C2
- CRIB has hired 1 Industrial Engineer for the development and implementation of the project's actions.
- UNIGE has hired 1 doctor in Chemical Engineering for the design and running of the valorisator
- UNIO has hired 1 Technical Director for the development and implementation of the project's actions.
- UPV has hired 1 automatic and electronics engineer as senior technician with doctor degree in charge sf the project Life Libernitrate. He is responsible for the correct execution of all the tasks related to this project, specially the actions B2 and B3.

Since the LIBERNITRATE product still needs improvement, no new jobs are expected to be created in the next 3 years.
However, in the long term jobs creation, once our solution by in the market, the industry will create direct and indirect qualified and non-qualified employment:
1. Direct qualified employment is foreseen among the workers of the companies that are in the streamline of the waste-to-active silica bed process.
2. Indirect non-qualified employment is expected for the collection and transportation of waste, and even for the operation of the waste-to-ash valorisation.

3. *Social benefits (e.g. positive effects on employment, health, ethnic integration, equality and other socio-economic impact etc.).*

The benefits of the implementation of LIFE LIBERNITRATE in terms of social impacts are particularly focused on two aspects: health and regional development.
The health of the inhabitants of the regions affected by both the accumulation of nitrates in their aquifers and by the uncontrolled management of rice straw waste will be positively affected by the results of LIFE LIBERNITRATE We have been able to demonstrate that activated silica beds are capable of adsorbing sufficient nitrates to ensure a supply of drinking water in municipalities of less than 200 inhabitants where it is not economically viable to install reverse osmosis plants. In social and human health terms, this is a considerable step forward: from a social point of view, it enables economic development and equal opportunities for the most disadvantaged populations, who, without drinking water, are simply doomed to disappear. From the citizens' point of view, it removes a pollutant, nitrates, from their daily diet and this means not only avoiding the shadow of serious health damage but also the health costs themselves in the treatment of diseases caused by an excess of nitrates in the diet.

4. *Replicability, transferability, cooperation:*

a. *Potential for technical and commertial application*

The potential for technical and commercial application is discussed as follows for the different current results of LIFE LIBERNITRATE:

1. Awareness and training for farmers;
2. Valorisator of rice straw to obtain ashes;
3. Obtaining process of functionalised silica and
4. Silica adsorption beds to treat nitrates.

AWERENESS AND TRAINING FOR FARMERS

MOOC Course and other training materials.

We would like to emphasise on this point what the implementation of the deliverables of action B1 has represented.

1. All the planned products have been developed, implemented, and are fully available free of charge. We are referring to the pedagogical/teaching guides, the complementary materials (bibliographical references and regulations to expand on the course content) and the podcasts. In the case of podcast, we have made 20 in total, with an average length of 5 minutes each. If we sum the interviews to the farmers co-protagonist of the field test, we have 10 minutes more for each language.
2. In addition to the planned 5-minute subtitled video explaining the nitrogen fertilisation experience of sub-Action B1, a separate 16-minute video training module, Module 6, has been produced. If we sum the interviews to the farmers co-protagonist of the field test, we have 10 minutes more for each language. Almost half an hour of explanation.
3. To validate the contents of the course, 3 independent and face to-face training actions were foreseen, but a complete self-training and online course has been developed, composed of 6 independent modules that together add up to more than 1,5 hours of training, and almost 2,5 hours if we consider the 10 interviews carried out with different stakeholders. The current course is not only based on this experience, but is also defined and aimed at raising awareness among the farming community of the nitrate problem, including the effect of the new CAP. It is not only a much broader course, but also much more urgent and necessary, innovative, and unique in its content, as it combines environmental, economic, and technical aspects in a single pedagogical package.
4. The MOOC course and its guides are a living instrument as opposed to a planned pedagogical guide that was intended to guide the teacher on how to teach our experience of nitrogen fertilisation as a subject in aclassroom course. The guides allow that the MOOC course to be continually updated with new information and content, adapting indefinitely to the new realities that will result from the new CAP and the continuous need to reduce the environmental impacts of fertilisation. They will not be limited to just 3 crops and will be equally useful, adapted to any crop, becoming an instrument not only for replicability but also for transfer between crops and new agricultural collectives.

We consider this course (and all the intermediate products) only the beginning of a long road towards raising awareness in the agricultural sector about the problem of nitrate pollution.
In contrast to what has happened up to now, in which there has been practically no institutional strategy for awareness-raising-training-advice for farmers and the nitrate problem, we are

laying the foundations for such a strategy to really exist, with the direct participation of the farmers themselves through their grassroots organisations. This should have been done from the beginning and now this problem would not exist or would be residual.
It is also true that, on its own, a professional agricultural organisation such as La Unio will find it difficult to achieve the success that would mean a considerable reduction in the nitrate problem, not only in the Valencian Community but also in Spain and beyond. Public collaboration is essential, not only by legislating, but also by understanding that they cannot achieve this on their own.
Something is changing, not only because the CAP imposes more ambitious environmental protection requirements, but also because the efforts made are also "raising awareness" the Valencian Government to this new form of collaboration. As the Director General of Agriculture himself, Antonio Quintana, acknowledged in the interview we did with him, we are already discussing together a new regulation for the use of manure as organic fertiliser, one of the factors of nitrate pollution, and when this regulation is agreed and in force, we will demonstrate that, together, yes, this time, yes, things can be done well.
The course we have created will be the cornerstone of this path we areembarking on. We intend to incorporate it into the general background of the training provided by the Unio de LLauradors and transfer it to the agricultural vocational training schools (at national and EU level: Federación de Cooperativas Agroalimentarias de la Comunidad Valenciana (Spain), AreaEuropa SCRL, (Italy), Liceu Thenologic “Jacques M.Elias” (Romania) Istituto Istruzione Secondaria Vergani Navarra Ferrara (Italy), Federación EFAS CV La Malvesia (Spain) FRMFR Bretagne, (France) and MFR FOUGERES. France) so that they can use it in classroom or blended learning, adapting it to their needs but maintaining its essence, which is none other than to raise awareness of the problem of excessive nitrogen fertilization among future young farmers.In this case, the message is clear: tackling the problem of nitrate pollution is also a training/educational problem that must be dealt with in agricultural schools to avoid continuing to reproduce obsolete and counterproductive fertilization schemes.

VALORISATOR OF RICE STRAW TO OBTAIN ASHES

The valorisation of rice straw to obtain ashes is one of the bases of the LIFE LIBERNITRATE project. The main technological advances, in comparison with the proposal, have been the modifications of the design to reduce the erosion of the reactor chamber by ashes, and the incorporation of a pelletizer to increase the density of the feed and, subsequently, increase the efficiency and production of ashes of the valorisator.

The**cost-effectiveness** of the valorisator to reduce rice straw wastes is based on the comparison with the current management options. Since burning at open air causes odours and irritation of eyes and nose; and flooding causes euthropization, the use of the valorisator is effective to reduce waste without further contamination. In addition, the possibility to transform the heat into energy contributes to a recovery of costs related to a future implementation of the valorisators in different facilities.

The **benefits for direct and indirect stakeholders** related to the installation of valorisators is direct. On the one hand, the farmers would reduce individual and/or agglomerated amounts of waste without necessity of relying on moratoria to the European policies. In addition, if the valorisators are connected to a water stream, it offers the possibility of heating water through heat exchangers, reducing the cost of energy. Finally, the possibility of obtaining ash, which has a value for the further obtaining of silica might report economic benefices. On the other

hand, the administration, as environmental responsible of the fields, found less contamination by burnt or flooded rice straw.

However, two main obstacles are foreseen; on the one hand, the cost of installation and, on the other hand, the difficulties related to the management of rice straw wastes in smallholdings. This fact might seduce the industry to create the adequate **market conditions** to be ready for the construction and assurance of supplies and maintenance of these technologies, in order to positively respond to the **pressure of the public**, highly concerned about the problems related with the management of rice straw wastes.

There is a potential **degree of geographical dispersion** of the application of valorisators for the elimination of rice straw waste. In fact, there are rice crop fields in the Valencian region of Spain and the Piamonte in Italy. In addition, it is expected to open the possibility to test the transferability of the valorisation to other lignocellulosic wastes, coming from crops such as persimmon or citrus fruits. Therefore, it has a potential impact **for replication in same and other sectors at the local and EU levels**at different stages by following a multi-scale apporach: locality, county, region, country, and continent.

In order to arrive to the **specific target group by promoting information to ensure high LIFE LIBERNITRATE visibility** in the field of valorisation of rice straw wastes, it is expected to focus the actions of communication specifically to farmers, handled by the association of farmers (UNIO), and administrations competent in Agricultural and Environmental development, which might act as influencers and policy-drivers to ensure the implementation of environmentally-friendly alternatives to the current pernicious elimination of wastes.

OBTAINING PROCESS OF FUNCTIONALISED SILICA

The obtaining process of functionalised silica valorisation has fulfilled the expectations met in the proposal, in terms of efficiency of silica production (80%), capability of functionalisation and quality of the active silica. In addition, the process has been optimised in order to obtain thinner and smaller silica particles. As a consequence, the area-to-volume ratio increased, which enabled further functionalisation, which was relevant in terms of increase of capability of absorbance of nitrates. Another important aspect is that it has been shown that the same active silica can be reactivated up to 32 times, achieving with this process lower silica production costs and increasing the number of liters of water treated.

The **cost-effectiveness** of the prototypes to obtain active silica has a great potential, since it has been possible to build up different lab-sets to scale up the production, by means of the acquisition of consumables of lab, mainly form lab-glass providers. It has permitted to considerably reduce the cost of the prototypes to consider more experimental sets within the budget of LIFE LIBERNITRATE.
This will positively influence the production of active silica, which will be increased at lower cost.
The technology is currently at TRL 6, the improvements that are being incurred in the method, focusing on two aspects:

1. Reduce the time of reaction
2. Increase the ash-to-functionalisation agent ratio in order to obtain more active silica per unit of ash, will help strengthen the possibilities of implementation in the market. In this case, the benefits **for direct stakeholders** are concerned on the optimisation of the

method to be developed at industrial scale, and therefore depends on the modifications that are being currently performed, which will permit
    1. the obtaining of more active silica at lower time;
    2. the replication of prototypes at lower cost; and
    3. the consumption of less reagents per mass of ashes.
3. Reduce the time to activation at half hour
4. Reactivate the same active silica to 32 times, achieving with this process lower silica production costs and increasing the number of liters of water treated.

Concerning the **market conditions** for the replication, the consumables necessary to build up the prototypes of functionalisation are easily available in the market, as well as the structures necessary to scale up the production at industry level. Therefore, the strategies of the market depend on the final value of the process downstream, in terms of effectiveness of the active silica to reduce nitrates and potential of reduction of related costs, as discussed later. The **pressure of the public**, highly worried about the number of nitrates in their aquifers, must be an effective support to involve the administration in the enablement of policies to promote these technologies along the whole market chain.

There is a potential **degree of geographical dispersion** of the application of prototypes for the functionalisation of silica. It can be both focused on areas close to the valorisation facilities (upstream) or close to the facilities for the preparation of active silica beds (downstream), since the mass that has to be transported is the ash, which does not occupy volume. The places where rice is cropped are Valencia in Spain and Piamonte in Italy, while the regions where nitrates are eminent and therefore the facilities for the preparation of active silica beds are along the Mediterranean Sea: Valencia, Catalonia, Aragon, Castilla La Mancha in Spain, Italy, Greece, Macedonia or Malta. Therefore, it has a potential impact **for replication in same and other sectors at the local and EU levels**at different stages by following a multi-scale approach: locality, county, region, country, and continent.

In order to arrive to the **specific target group by promoting information to ensure high LIFE LIBERNITRATE visibility** in the field of activation of silica, it is expected to focus the actions of communication specifically to the industry agents nearby the areas of valorisation of wastes, or contaminated aquifers, as well as administrations competent in Water and Environmental development, which might act as influencers and policy-drivers to ensure the implementation of environmentally-friendly alternatives to the current costly technologies for the reduction of nitrates, such as reverse osmosis.

ACTIVE SILICA BEDS TO REDUCE NITRATES

The different activities and tests performed at lab scale have improve the technological premises considered in the proposal is achieved and is closer to be an implemented technology. According to lab tests, the design of the active beds has been simplified, and the costs related highly minimized. Different configurations in terms of diameter and length to adapt to engineering requirements, and therefore foresee a positive **cost-effectiveness** of LIFE LIBERNITRATE. After different testing versions were selected

- Prototypes (I) is a bed of a 75 mm diameter and 1.5 m long tube with a piece at the top to extend its diameter to 160 mm for a greater retention surface with a 50 μm layer of stainless steel. The amount of silica is between 200 and 350g
- Prototype (I) is a tube with dimensions of 10 × 54 inches and two external beds of 5 and 0.1 μm. The amount of silica is between 2kg or 3kg.

The improvements that are being considered was increased the benefits **for direct stakeholders.**
Themost relevant results are:

1. Prototype (I) (300g of silica) could work continuously for 24 hours. Activate every 30 minutes and retain nitrates for 30 minutes. To specifically treat Alginet's well water, that contains Sulfates, Phosphates, and Carbonates; it would be running for 15 minutes, to prevent nitrates from being released. Thus, Prototype (I) would allow the elimination of more than 32% of nitrates from 360L.
2. Prototype (II) (3kg of silica), because it contains more silica, has been verified that it could operate continuously for 24 hours. Activate every 30 minutes and retain nitrates for 30 minutes. This makes it possible to eliminate 40-42% of nitrates from 5184L. Therefore, 5 Prototype (II) would be necessary to treat the 26000L per day that a population of 200 inhabitants needs. It has been shown that the system designed by the LIBERNITRATE project is capable of offering this innovative treatment to any municipality with less than 200 inhabitants in all of Spain at a reasonable price and indefinitely, responding to their water consumption needs.
3. It has been proven that both 2 Prototypes (I) and 2 Prototype (II) are capable of treating the rejected water of the osmosis plant by adsorbing more than 30% of nitrates
4. It is very important to remark that functionalized and activated silica retains not only nitrates but also Sulfates, Phosphates, Carbonates, and all the anions present in well water.

There is a potential **degree of geographical dispersion** of the application of active silica beds. The potential market is made up of municipalities of 200 or those to which an osmosis plant cannot be implemented. As an example, only in the Valencian Community the nitrates problem affects more than 200 municipalities that gather more than two million inhabitants. The regions where nitrates are eminent and therefore the facilities for the preparation of active silica beds are around the Mediterranean Sea: Valencia, Catalonia, Aragon, Castilla La Mancha in Spain, Italy, Greece, Macedonia or Malta. Therefore, it has a potential impact **for replication in same and other sectors at the local and EU levels**at different stages by following a multi-scale approach: locality, county, region, country, and continent.

In order to arrive to the **specific target group by promoting information to ensure high LIFE LIBERNITRATE visibility** has been carried out actions described in the Action D 1.3. Development of the dissemination plan. Likewise, AFTER LIFE actions are also considered to spread the nitrate retention capacities of active silica beds. During the tasks will do of the After-LIFE plan, it is expected to focus the actions of communication precisely to the industry agents nearby contaminated aquifers, as well as administrations competent in Water and Environmental development, which act as influencers and policy-drivers to ensure the implementation of environmentally-friendly alternatives to the current costly technologies for the reduction of nitrates, such as reverse osmosis.

b. *State the project's likelihood of replication (high/low/zero), and if its replication is market-driven or policy-dependant.*

The likelihood of replication of the MOOC courses on awareness and advice to farmers is potentially high, despite the fact that the results were consolidated during the final stage of the validity of LIFE LIBERNITRATE, this course could become a course of general use in all farmers associations. To enhance its dissemination, it could help to carry out publicity campaigns at the beginning of the crop campaigns.

The likelihood of replication of the installation of valorisators for the elimination of rice straw wastes will depend on three different scenarios, detailed as follows in increasing order of difficulty:

- (i) necessity for farmers of compliance with EU directive concerning hazardous management of wastes, which will promote the installation of valorisators by obligation.
- (ii) interest of farmers on the possibility of obtaining energy from the heat exchange of the valorisator to reduce their fares of electricity or gas;
- (iii) awareness on the benefices related by the capitalisation of the obtained ashes for the future preparation of silica beds. It is therefore highly capital that the market downstream is ensured.

The likelihood of replication for the functionalisation of silica and the active silica beds basically depend on adapting prototypes to market needs. In this sense, financing has already been requested from the Generalitat Valenciana through Grisolia projects, or Strategic Cooperation Projects whose objective is to support the development of large R&D&i projects in cooperation between various agents of the Valencian Innovation System, such as the way to develop joint solutions to problems of common interest.

c. *Specification of potential market/replication vehicles.*

The LIFE LIBERNITRATE project is also focused on the industrial agents nearby the areas of valorisation of ashes and/or contaminated aquifers, in order to show both the ash-to-active silica process and the preparation of active silica beds, highlighting three main aspects to make them attractive:
(i) the processes are economical and easy-to-perform, so the investments are affordable, and the capacitation is assumable;
(ii) the process helps improve the environment and health of citizens, which incises in the corporative social responsibility of the companies;
(iii) the obtained silica and the active silica filters can be capitalised to guarantee benefices that ensure the sustainability of the company.

The industries interested in working with these products will be mainly those dedicated to manufacturing filtration systems, e.g. CABOT NORIT NEDERLAND B.V, RAVAGO CHEMICALS SPAIN. S.A., JACOBI CARBONS SPAIN, S.L, CALPLAS SL, etc. The application and use of the systems manufactured by these industries will be carried out by utilities such as Aguas de Valencia, S.A.

The capitalisation strategy does consider not only the construction of the equipment but also the turn-key installation and related maintenance, capacitation and technical support, which mobilises economic activity around the results of LIFE LIBERNITRATE.

By the other hand, a potential market for LIBERNITRATE in the first years of development are the 70 towns or supply areas with less than 200 inhabitants and that currently have nitrate problems in the water of the aquifers.

d. *Possibilities for complementarity with existing market players and/or other solutions/projects (bundling).*

Given that the commercial strategy to be developed involves the sale of the product and/or the provision of technical maintenance services and tariff and financial advice to the municipalities, the market players compatible with LIBERNITRATE are water management companies and companies dedicated to the manufacture of filtration systems, as indicated in the previous section.

5. *Best Practice lessons: briefly describe the best practice measures used and if any changes in the strategy employed could lead to possible adjustment of the best practices.*

Best practices in the field of using slow-release fertilizers are mainly based on
(i) the benefits of the slow-release fertilizers themselves, which ensure the lower release of nitrogen leached through the soils to the aquifers and higher efficiency and efficacy in the harvests;
(ii) the selection of plots of different crops, i.e rice, persimmon and citrus fruits, to help ensure wider replicability;
(iii) involvement of key farmers as opinion leaders among the agriculture society to impulse the future geographical dispersion of the use of slow-release fertilizers and get an economy of scale that reduce the prizes of the market and make them competitive.

Best practices in the case of the design of the valorisator of rice straw waste are currently focused on
(i) the specific design to prevent the reactor body from the erosion of ashes;
(ii) the importance of pelletizing the straw before increasing the density of the feed, and therefore the efficiency of the valorisator and the future production of ashes.

Best practices in the case of the design of the process of obtaining active silica from ashes have been the improvement of
(i) the ash-to-functionalisation agent ratio, which reduces the consumption of reagents and increases the production of active silica;
(ii) the economisation of the prototypes by means of the combination of consumables from lab-glass providers and electronic suppliers;
(iii) the obtaining of smaller and thinner silica, which increments the area-to-volume ration, and therefore increase the potential of future adsorption of nitrates
(iv) the design of a new activation system so that the silica can be activated at least 32 times, which increases the amount of water treated with the same silica and reduces production costs.

Best practices in the case of the design of the active silica beds were focused on the reconsideration of
(i) type of reactor, from a discontinuous reactor based on active-carbon (broad, short, expensive), to a piston-flow type reactor (long, thin, affordable), which permits to reduce cost and adapt to expected water flows;
(ii) combination of beds, in series/parallel, to account for different engineering necessities, offering versatility and easing further replicability.

6. *Innovation and demonstration value.*

Slow-release fertilisers' innovation level might be classified as TRL8-9, since the products are already available in the market. Still, their establishment needs demonstration activities to ensure widespread acceptance and therefore reduce their price by the economy of scale. The current actions concerning the stakeholder involvement at the local level and the foreseen

activities of demonstration and diffusion of benefits among the agricultural society through a pedagogical guide at a multi-geographical level might pave the way for an effective establishment of this result LIFE LIBERNITRATE.

The level of innovation of the valorisator is expected to be classified as TRL7, since its demonstration scale at controlled conditions are currently under evaluation. The actions focused on the replicability and transferability to be used for the waste from other crops, and the business plans developed at the end of LIFE LIBERNITRATE have been the key tools to help increase the TRL level, as a result of a wider implementation enabled by policy makers and the interest of farmers and/or associations of farmers.

The level of innovation of the obtaining process of active silica from ashes can be currently classified as TRL6-7. All steps were focused on reducing the cost related to the installation and operation of the prototypes and increasing the efficiency and effectiveness of the process.

The level of innovation of active silica beds reached is a TRL6-7. The feasibility of the technology to achieve the expected nitrate reduction, through sustainable technology, understood in terms of the correct balance between the needs of the planet, the requirements of the people and the requests for profit, has been demonstrated. However, it still needs improvements, to be able to commercialize the product at an industrial level.

All innovations present a high potential of replicability and transferability at national and European level, as has been considered in the planning of the technical actions of the proposal. LIFE LIBERNITRATE presents at this stage a correct balance between technical developments of the technologies and stakeholders' involvement, from farmers to responsible of management of water, as well as policy-makers that will help enable the contextual conditions for the sustainable implementation of the results of the project.

7. *Policy implications*:

The existence of associations of municipalities to which the implementation of the project could be offered with a unit cost lower than that of an isolated user will be considered. A market segmentation criterion will be established considering whether measures have already been taken to act against nitrate contamination (whether there is a reverse osmosis facility), as well as the greater or lesser risk of regulatory non-compliance in nitrate matter in addition to the possibility of finding alternative sources of water or not.

In addition, it can advise municipalities on various proposed tariffs including investment costs and operation of the project with a payback period according their needs and without a remarkable impact on the end user. For this, changes in the tariff structure (blocks) will be studied before a linear increase in the water tariff.

In the areas where there is a risk of regulatory noncompliance, an indicator relating to the cost of not acting through a counterfactual scenario will also be included. That is, show to the municipalities what would be the expected consequences in the case of not taking any action against nitrate contamination.

It is this aspect, the main public entities of the province of Valencia, aware of the problem of contamination by nitrates in the aquifers of the Valencian Community and of the environmental problem that generates the uncontrolled burning of rice straw in the production areas intensive.

Knowing that the main objective of the LIFE LIBERNITRATE project is the reduction of nitrates in the integral water cycle through the revaluation of a residue such as rice straw, they signed a manifesto of support and interest to collaborate with the consortium entities to explore different Necessary ways of attracting financing and investment.

The public entities that signed the manifesto were:
- Government Delegation in the Valencian Community
- Department of Climate Emergency and Ecological Transition of the Generalitat Valenciana
- Section of Territorial Cohesion and European Projects of the Diputación de Valencia
- Valencian Federation of Municipalities and Provinces.

As a summary, these are the main results and commitments acquired thanks to the development and implementation of the actions described:

- Signing of the "Manifesto of Interest for the implementation of future actions of the LIFE Libernitrate project" by the Government Delegation, GVA, FVMP and Valencia Provincial Council on September 29, 2021.
- Meetings (Dec18, Jan19, Jan20) with personnel from the GVA (Hydraulic resources and water quality planning service) responsible for setting up the "Citizen Water Observatory of the Valencian Community" located in its final phase of creation and publication. Collect project proposals.
- The participation of a project partner (Unió) is accepted in the “nitrogen fertilization” work table constituted by the General Directorate of Agriculture of the GVA to collect proposals and improve the GVA Decree in terms of improving the use of fertilizers in agriculture and livestock.
- Acceptance of the inclusion of project proposals in the Valencian Code of Good Practices of the Department of Agriculture (approved on March 29, 2020, published DOCV on April 10).
- Different meetings were organized with the coordinating technical staff of the Covenant of Mayors for Climate and Energy, as well as their participation in the conferences described, given that at the provincial level this pact is coordinated by technical personnel from the Environment area of the Diputación From Valencia. This situation has allowed us direct contact with the member municipalities and give visibility and include good practices of the project in its database. Currently, a total of 243 municipalities of the 266 that are part of the province of Valencia are adhered to the pact (91.35% of the total number of municipalities)
- At European level, all the documentation generated by the project has been sent to the European Network of Intermediary Organizations (Partenalia) to organize an institutional visit to the Committee of the Regions when the final document is available. This institutional visit will take place in the first half of 2022 (outside the project execution period). Different conversations have also been held with a Spanish MEP and with the representative of the City Group of the PSE (European Socialist Party) in the Valencian Community.

7. Comments on the financial report

The budget has been spent within the foreseen limits and, overall, there is no significant discrepancy about initial estimations.

7.1. Summary of Costs Incurred

Complete the following table to show the project costs incurred compared to the approved budget and comment on each of the cost categories focussing particularly on discrepancies compared to the allowed flexibility of the 20% limit (cf. Article II.22 of the General Conditions).

PROJECT COSTS INCURRED				
	Cost category	Budget according to the grant agreement in €	Costs incurred within the reporting period in €	%
1.	Personnel	1.613.967	1.628.930,99	100,93
2.	Travel and subsistence	127.910	56.609,52	44,26
3.	External assistance	67.100	101.038,17	150,58
4.	Durables goods: total non-depreciated cost			
	- *Infrastructure sub-tot.*	0	0	0
	- *Equipment sub-tot.*	0	0	0
	- *Prototype sub-tot.*	179.500	151.521,92	84,41
5.	Consumables	98.000	108.683,36	110,90
6.	Other costs	113.800	59.773,69	52,53
7.	Overheads	154.015	147.454,49	95,74
	TOTAL	**2.354.292**	**2.254.012,15**	95,74

- The costs charged to the project are in line with the concepts established in the approved proposal, the actual state of the project's execution and, at the closing date of the financial declaration of this report (31/09/2021), exceed the minimum threshold established in the GC to request payment of the balance.
- There are not discrepancies compared to the flexibility of the 20% limit (Article II.22 of the General Conditions).