LIFE Project Number

<LIFE14 ENV/ES/000427>

Final Report

Covering the project activities from 01/09/2015 to 31/03/2019

Reporting Date

<30/06/2019>

LIFE PROJECT NAME or Acronym

<LIFE In-Brief>

Data Project

Project location:	SPAIN
Project start date:	01/09/2015
Project end date:	31/03/2019
Total budget:	€ 1.184.381
EU contribution:	€ 710.627
(%) of eligible costs:	60%

Data Beneficiary

Name Beneficiary:	Instituto tecnológico Metalmecánico, Mueble, Madera, Embalaje y Afines (AIDIMME)
Contact person:	Mr. Francisco Bosch
Postal address:	Parque Tecnológico. Avenida Leonardo Da Vinci, 38 CP 46980 Paterna. Valencia, Spain
Telephone:	(0034) 96 131 85 59
E-mail:	fbosch@aidimme.es
Project Website:	www.lifeinbrief.eu/

Table of contents

Table of contents 2
Table of figures 3
1. List of key-words and abbreviations 4
2. Executive Summary 5
3. Introduction 7
4. Administrative part 9
5. Technical part 10
   5.1. Technical progress per action 10
   5.2. Evaluation of Project Implementation 39
   5.3. Analysis of benefits 49
6. Annexes 55
   4.1. Deliverable list 55
   4.2. Process and products at demo plant 58

Table of figures

Figure 1. Customized calendar of inputs to the digester for AEMA 12
Figure 2. Substrate input composition to the digesters: Tm vs number of weeks 12
Figure 3. Biogas/Energy generated at La Vall d'Uixó from 2015 to 2018 12
Figure 4. Hydraulic diagram of demo plant 12
Figure 5. Pictures of outside part of the plant – before full construction 14
Figure 6. Indoor part of the plant at Inderen and Aema facilities – before full construction. 14
Figure 7. Pictures of the final disposition at demo plant 14
Figure 8. Control panel of the demo plant 14
Figure 9. Concentration section of liquid fertilizer products 14
Figure 10. The 4 Different products, respectively: 17
Figure 11. Samples of the different stages for the DOE (left) and Kjeldahl analysis (right). 17
Figure 12. Point of generation of each product 17
Figure 13. Installation of equipment and FL1 validation (Forners) 19
Figure 14. Validation of FS2 in lettuce (Compo) 20
Figure 15. FS2 inPepper,sunflower and maize trials (Compo) 20
Figure 16. Rondabout trial of FS1 urban fertilizer in turf (Compo) 20
Figure 17. Urban gardens and athletic- field for FL2. City Hall of Vall d'Uixó (Forners) 20
Figure 18. Example of surveys for the assessment of stakeholders' feedback 24
Figure 19. Dissemination material (demo and validation sites, rollup at Forners hall) 28
Figure 20. Dissemination material (leaflet, technical separatas, poster) 28
Figure 21. Project Website 29
Figure 22. Forum images and invitation 31
Figure 23. Graphic Content of Networking Actions 33
Figure 24. Layman report cover 34
Figure 25. Block diagram of the process at LiB plant 58

1. List of key-words and abbreviations

Key words

Biogas, Anaerobic digestion, Business model, Renewable energy, Bio-waste, Sewage sludge, Nutrient recovery, fertilizers, environment and circular economy.

Abbreviations

AD	Anaerobic Digestion
AF	Agricultural fertilizer
CF	Concentration Factor
DOE	Design Of Experiments
EASME	Executive Agency for SMEs
EU	European Union
FA/HA	Fulvic and Humic Acids
FS1	Fertilizer from the first separator sieve, urban use
FS2	Fertilizer from the concentrated streams, agricultural use
FL1	Liquid fertilizer obtained in the evaporator, agricultural use
FL2	Liquid fertilizer from the Reverse Osmosis, urban use
GHG	Green House Gases
LiB	Life in Brief
LVDU	La Vall d'Uixó
NPK	Nitrogen-Phosphorous-Potassium
OM	Organic matter
RO	Reverse Osmosis
PPT	Power Point
SMEs	Small and Medium-sized Enterprises
UF	Urban fertilizer
WWTP	Waste Water Treatment Plants

2. Executive Summary

Life In Brief (LiB) project **aims** to develop a new business model based on the efficient management of waste by means of its use for bio-energy and further transformation of digestate into high added value fertilizers in a biogas plant.

Turning waste into a resource is part of circular economy systems and is one of the main pillars of the Roadmap for a Resource-Efficient Europe. In particular, the project is using biodegradable wastes and converting them into energy and potential resource of minerals and organic nutrients.

Mainly, the specific **objectives** of the project deal with the sustainable and efficient production and validation of high quality fertilizers, avoiding improper application of biogas digestate.

For this purpose, the **consortium** was composed by a biogas plant to implement the actions (AEMA), a biogas engineering company (LUDAN), fertiliser experts (COMPO and FORNERS) and a technological centre with experience in environmental processes as a coordinator of the project (AIDIMME). Besides, the project counts on the support of local city Hall of La Vall d'Uixó to validate some of the fertilizers and also to promote the project.

The most significant **outputs** and environmental benefits of the project are involved with the recovery of energy and nutrients from wastes so it tackles waste generation issues in Europe; Avoid improper management by procuring renewable energy and by the recovery of its nutrients plus eliminating its transportation and disposal costs. The energy surplus can be used to run the plant of digestate transformation into fertilizers. The plant recovers the organic and inorganic content present in the digestate and prevents digestate from being poured directly to the soil, in line with nitrate and landfill directive. Besides, the plant recovers the water content via osmosis. This can be translated into an improvement of local environmental conditions in surrounding areas and potentially in all countries where a biogas plant is set.

These results merge into the definition of a new business model for biogas plants, following the next interrelated phases:

- Definition of a waste management model to increase energy production and obtain a suitable digestate to be used as raw material for the production of fertilizers:
    - Definition of set-point composition in digester
    - Protocol of accepted wastes
    - Balance substrates: Schedule the entrance
- Digestate control;
    - Definition of suitability; range of technical parameters
    - Checking composition compliance
- Treatment process for the transformation of digestate into fertilizers for them to be used formulated or not, in urban and agricultural context.

As it was stated in the previous progress report, from the beginning LiB has gone through different unexpected situations, which led to **two amendments (first and third)** proposed by the beneficiaries[1] to the initial proposal, being the last one accepted in October 2017.

1 The project has had the following amendments to date:
1st corresponded to a Partnership modification.
2nd one refers to several modifications introduced by EASME to all LIFE14 Grant Agreements
3rd one was the most complex one and included:
- Extension of the project duration
- Technical modifications

There were **deviations** chiefly in the deadlines initially proposed; since the plant was being installed by the end of 2017 most of the tasks related to the demo activities could not be started until that date. In 2018 the pilot plant was fully operative, starting up was done in January-18 with water and finally at the middle of February-18 with digestate. The starting up of the pilot plant implied a generation of products at the plant so the agronomic validation could start.

Different people were trained to operate the plant to help and speed up this stage. While the first products were being elaborated, the fields and pots were being prepared to validate the products. The agricultural fertilizers were poured on the testing soil based on each test designs; different seeds and other probes such as other synthetic fertilizers and no fertilizers to compare the effect of LiB products to all of them. Along with the validation actions, the contact with the city hall was boosted and so the possibilities to test the urban fertilizers; in green parks, urban gardens, grass field in athletics tracks so the validation and dissemination of the project had been also encouraged.

Technical actions are framed into the business model, considering different technical and economic requirements for its implementation in other businesses which can be observed both in the economic study and guide of transference tasks.

All in all, LiB project, has been launched with the effort of all partners so the demo plant could be operative to produce the different fertilizers to be validated in urban and agricultural environment. This lead to an important advance in dissemination actions, supported both by stakeholders and administration. This notable improvement has been raised by the significant potential of the project, both economic and environmental, for the different sectors that it covers.

- Budget shifts
- Coordinating beneficiary's administrative modification
- Changes in banking references of coordinator

4th one corresponds to an EASME modification of conditions for natural persons, submission of VAT certificate and threshold for submission of the certificate on the financial statements31/08/2018

3. Introduction

- For LIFE Environment & Resource Efficiency

– Description of background, problems and objectives (as foreseen in the proposal)

- Environmental problem addressed

At present, biogas plants receive bio-wastes to generate electricity and a waste so-called digestate. This digestate is currently being discharged in agricultural fields, with the environmental consequences that it implies and with increasingly restrictive regulations that complicate this use.

Nowadays there is still a non sustainable use of these resources and wastes are not yet properly managed. Because of this situation, bio wastes suppose a serious environmental concern due to the digestate effluent coming from biogas plants, implying a loss of nutrients, and a further impact in soil and atmosphere as a consequence of an inadequate management of digestate in some circumstances.

- Outline the hypothesis to be demonstrated by the project

If the nutrients contained in digestate are seized, they can be turned into fertilizers, "closing the loop" in circular economy systems. Additionally, the substrates constituting the bio wastes are introduced in the digesters in a determined order, biogas yield can be increased and more bio energy would be produced for the same volume of digesters. This energy surplus can be retrieved and used to run a plant able to recover the nutrients from digestate so all streams become useful and profitable for biogas sector, demonstrating a new efficient and sustainable business model.

- Description of the technical solution

The technical solution is a combination of a modification in biogas plants methodology of waste management as well as a process recovery applied to digestate by means of a chemical extraction and physical separation. Bio Wastes are no longer introduced in the digester in an arbitrary way but the idea is to introduce the different substrates depending on their composition in a specific sequence so the final content of the digester is balanced in two ways; to maximize biogas production and to obtain a suitable digestate so as to produce fertilizers.

The digestate resulting from digestion is introduced in the pilot plant to a series of unique sequence of unit operations that produce a chemical extraction and physical separation so the soluble organic matter is extracted from digestate and different formats of fertilizers can be obtained. The process is finalized with a concentration stage at low temperature to avoid harming the product and controls the proportion of nutrients in the final product.

This methodology allows to have different fertilizers that might be sold as ecologic and also be additive with substances that confers other properties and allow it to be categorized at will. The proposed solution can be self-sufficient since the plant uses surplus energy obtained from the biogas waste, boosted by the new combination of substrates at the plant.

- Expected results and environmental benefits

The most significant results and environmental benefits of proper waste management through LiB project are related with the waste management and further treatment of digestate as raw material to enhance resource efficiency; defining a business model that enables self-financing valorisation of wastes into fertilizers.

The digestate obtained will be used in the demo plant to produce both agricultural and urban fertilizers that will be validated in different fields. The composition of fertilizers is analyzed and in case it is necessary reformulated to meet local requirements and ecologic specifications in terms of nutrients and other secondary elements.

The amount of digestate that is transformed in the demo plant is not being sent to landfill or incineration so it implies an environmental benefit in terms of the avoidance of improper application which could lead to a soil, water and atmosphere pollution coming from the decomposition of the materials which has an equivalent emission of 15kg of CO_2 in the form of N_xO per ton of waste in land.

Besides, the water content in the digestate is recovered with a high quality, maintaining a generation of sub-products or waste streams to a zero level. Indicators of these parameters can be seen both in attached deliverables C.1 and D.3.

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

There are important consequences resulting from the activities and outcomes of the project from different points of view; regarding the global applicability and reproducibility of demonstrated technology it is worth mentioning that a part of the project is focused in the fact that other companies across Europe can benefit from the results obtained in the project and to ensure that it is feasible to proceed with the business model independently from the country where it is applied.

Life in Brief project also aims to contribute to the updating and development of European Union Environmental legislation, since as it is shown in all legal deliverables, there is a lack of homogeneity in fertilizing and digestate uses' regulations. This is a global concern which is being already tackled for many countries and LiB business model target is to promote the integration of bio wastes and digestate as a raw material of fertilizers, and to encourage the waste management through energy and fertilizer production by closing the loop in circular economy aligning with EU roadmap to a Resource Efficient Europe.

Special attention is also taken in terms of future market strategy, since the main objective of the project is related to the feasibility of the business model in terms of waste management, energy production and specially fertilizer generation, being all of them important incomes for the business. In line with the applicability and reproducibility, there is a special care taken in the future market of the obtained fertilizers, being some of them high added value products that can be introduced into different countries of the European Union and categorized into different types of fertilizers obtained through a sustainable process and coming from an and renewable source such as bio waste. This approach to an ecologic strategy is a recognized promising bet since it is well-known that it eco-fertilizers suppose a growing market.

4. Administrative part

– The project management process, working method, problems encountered, partnerships and their added value, including comments on any significant deviations

The management procedures were formalised in Deliverable E1 already sent to EASME. The management bodies foreseen were constituted: The assembly, the technical committee, the demonstration Committee, the monitoring Committee and the technical unit.

Reporting templates and rules were transmitted to the partners in the KOM and in every coordination meeting these are revised. Coordination meetings have been held every six months, to discuss with the partners the content of reports in relation to the work done and the documents submitted.

Coordinator contacting person changed from Manuel Sánchez to Francisco Bosch, both from AIDIMME. Due to unforeseen circumstances (the initial investment plan for the prototype could not be assumed by one of the partners, so there were technical and budgetary reviews in order to solve this), the initial plan for the project changed leading to an amendment request in January 2017 (third amendment); Schedule, cost distribution and to a much lower extent technical programme, changed.

In November 2018 LUDAN ceased its activity. This affected mainly tasks C, which were partly assumed by AIDIMME and partly subcontracted.

– Communication with the EASME and Monitoring team.

At the beginning of the project we had Mr. Jose Álvarez as External Monitor and by the end of 2016 he was changed by Mr. Cristobal Ginés both from Neemo. The communication with both External Monitors has been fluent by e-mail and phone. We have contacted them to solve minor and big problems and they have been helpful all the time.

The communication with EASME has been done by the external monitor mainly. Before submitting the third amendment, the coordinator had a meeting with the EASME to explain one of the partners (AEMA) and find the best solution for the project. This meeting was held in EASME on 28/09/2016. Besides the coordination meetings, partners have been visited several times by the coordinator to discuss about technical and financial particular issues. There is a direct and fluent communication between coordinator and partners both, by phone and email.

– The changes due to amendments to the Grant Agreement.

The project has had the following amendments to date:

1. 1st corresponded to a Partnership modification.
2. 2nd one refers to several modifications introduced by EASME to all LIFE14 Grant Agreements
3. 3rd one was the most complex one and included; Extension of the project duration, Technical modifications and budget shifts, coordinating beneficiary's administrative modification and changes in banking references of coordinator
4. 4th one corresponds to an EASME modification entering into force at 31/08/2018

5. Technical part

5.1. Technical progress per action

A. PREPARATORY ACTIONS

Foreseen start date:	09-2015	**Foreseen end date:**	09-2016
Actual start date:	09-2015	**Actual end date:**	02-2018

A.1. Preparation of new demonstration model of bio-waste management in Biogas plant

- *Progress Achieved*: All activities planned for this action have been finished. The activities of this action can be divided into three different duties hereinafter explained.

These preparatory actions were coordinated by AIDIMME, performed with the help of AEMA who revised the incomes and dealt with the suppliers of wastes whereas LUDAN helped with the review of the prototype as well as with the review of the calendar of input products based on their wide experience with other biogas companies. Due to AEMA financial problems, AIDIMME had to reformulate the project. Several detailed designs were necessary to accommodate to the current budgetary situation, as well as satisfying the requirements from the EASME. These designs were developed by LUDAN and AIDIMME, this explains the over person-days spent here. The action is divided in 3 different tasks:

A) Preparation of documentation and permissions request

Based on legislation 6/2014, July 25th - prevention, quality and environmental control of activities at the Valencian Community [2014/7304] – in line with other environmental normative and the characteristics of LiB plant, the local administration of LVDU has been informed about the technical details of the project and the demo plant itself, so it can be included as not-substantial modification to Aema's Environmental Autorization 000080/2009-ACT. These documents regarding the city-planning compatibility and communication for the environmental permit according to law can be found at the attached folder of Project Evidences.

B) Bio-Waste and Sewage Sludge input control and digestate output analysis

According to the new methodology proposed for the European waste management issues (waste-to-energy-and-fertilizers), two steps had to be considered: on one hand the transformation of *waste into renewable energy* (biogas) via anaerobic digestion and on the other hand the *transformation* of the output sludge (digestate) *into fertilizers*.

The purpose is to increase biogas production and improve digestate quality for its suitability as raw material for fertilizers. Then, based on the assessment of the desired nutrients inside the digesters and the composition of wastes entering the plant, a schedule of inputs was defined. This involved an arrangement of entrances with waste managers, so the "menu" of the digesters could be assorted.

Concerning digestate composition to produce fertilizers, a definition of the technical parameters to comply was done. Besides, several analyses were taken and compared to the established requirements for its acceptance in the demo treatment plant. Based on the available nutrients, the recovery conditions and prototype units were defined.

C) Prototype design units

Digestate composition was used to detail the equipment of the demo plant so the different stages could be used to transform it into fertilizers according Royal Decree 999/2017, 24th November, about fertilizing products (see Deliverable A.1.2.). Besides, it has to be mentioned that this design took important efforts due to AEMA conditions stated in third Amendment, where part of the equipment had to be substituted and other re designs were made to satisfy EASME requirements. Finally, based on the procedure of Extraction-Separation-Concentration, the design including material selection, sizing, safety concerns and layout was finally set up and operational at LVDU by the beginning of 2018.

- *Results*:

  a) *AEMA permits*: final documents can be found in annexes.
  b) *Calendar of feeding products*: procurement of a substrate schedule with a retention time of 5 weeks so the digesters improve their production and the obtained digestate fits into the limits set. The content of water, lipids, proteins and carbohydrates was compensated in time among the different wastes available so the global composition can be balanced. A protocol of inputs has also been defined, so there is a restriction of the materials that may enter the digesters that can be harmful for the process.
     Digestate output analysis: according to fertilizer legislation, the range of heavy metals, pathogens, salts and nutrients such as NPK was defined so the suitability of the digestate could be verified and different options to amend the deviations could be proposed (in terms of input control and demo-equipment selection).
  c) *Pilot plant design*: pilot plant was defined according to previous actions and necessities definition; the removal of particles, sanitization, solubilisation of organic mattes, control of the humidity in solids, separation of phase, ease the distribution of the products and concentrate nutrients. The manual of the plant was also developed, which helped to the further operation of the equipments by different people at the demo plant with a description of the equipment and modes of operation

- *Difficulties*: Issues were identified in the three tasks; the development of the calendar of inputs in the digesters for two main reasons: Firstly, obtaining a higher rate of biogas and a good composition for fertilizers are contradictory objectives since what is good for fertilizers may inhibit the microorganisms and vice versa. There was a compromise/balance between both purposes so both were optimized either in the entrance or at the further treatments. Another issue was getting the desired compositions at the established times; since there are not storages for all types of wastes entering the plant, agreements have to be done with the waste suppliers to bring their substrates on time and with a composition between defined ranges. Finally, finding materials and equipment with the conditions suitable for a fluid such as digestate (high viscosity and fouling) was not also easy. Neither of these issues became an obstacle for the correct development of the project.

- *Outside LIFE*: There is an interest in keeping a control on the inputs at the biogas plant since there has been a effect on its yield during the project. More biogas plants can also benefit from results obtained at this stage, so the environmental objective widely met.

- *Deliverables*:

  - *A.1.1. Detailed timetable of feed products in digesters*.
  - *A.1.2. Digestate sampling plan and results.*
  - *A.1.3. Manual of the demo plant*.

- *Graphic content*: Below it can be found some pictures and graphs with the main results of this action, whose details can be found at the corresponding deliverables;

  Figure 1 refers to the detailed and customized timetable prepared for AEMA in order to maximize the output of biogas and obtain a good digestate to be a proper raw material for fertilizers. At Figure 2, it can be seen the graph where it is shown the Tm of inputs (y-axis) and the week that they were introduced (x-axis) so it can seen that the feeding program has been followed based on the customized calendar for the project. At Figure 3, it is shown the output of MWh produced at AEMA biogas plant after and before LiB.

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1 Sum up week 1: Total Tm: 180 Water (%): 86.42 FOG (%): 6.83 Proteins (%): 3.58 Carbohydrates (%): 3.08	2 - Oils & fats 10 Tm. - Agroalimentary sludges 30 Tm.	3 - Agroalimentary sludges 100 Tm	4 - Agroalimentary sludges 10 Tm	5 - Cleaning waters 15 Tm	6 - Soft drinks & dairy products 15 Tm	7
8 Sum up week 2: Total Tm: 175 Water (%): 82.14 FOG (%): 11.14 Proteins (%): 3.66 Carbohydrates (%): 3.06	9 - Oils & fats 40 Tm.	10 - Agroalimentary sludges 85 Tm	11 - Agroalimentary sludges 40 Tm	12	13 - Soft drinks & dairy products 10 Tm	14
15 Sum up week 3: Total Tm: 295 Water (%): 80.47 FOG (%): 13.47 Proteins (%): 3.29 Carbohydrates (%): 2.69	16 - Oils & fats 50 Tm.	17 - Agroalimentary sludges 140 Tm	18 - Oils & fats 20 Tm.	19 - Agroalimentary sludges 50 Tm	20 - Soft drinks & dairy products 15 Tm	21 - Cleaning waters 20 Tm
22 Sum up week 4: Total Tm: 215 Water (%): 78.14 FOG (%): 14.51 Proteins (%): 3.12 Carbohydrates (%): 3.23	23 - Oils & fats 40 Tm	24 - Agroalimentary sludges 80 Tm	25 - Oils & fats 30 Tm.	26 - Agroalimentary sludges 30 Tm	27 - Soft drinks & dairy products 15 Tm	28 - Soft drinks & dairy products 20 Tm
29 Sum up week 5: Total Tm: 260 Water (%): 78.5 FOG (%): 15.92 Proteins (%): 2.81 Carbohydrates (%): 2.65	30 - Oils & fats 40 Tm	31 - Agroalimentary sludges 100 Tm	1 - Oils & fats 30 Tm.	2 - Agroalimentary sludges 30 Tm	3 - Soft drinks & dairy products 10 Tm - Cleaning waters 30 Tm	4 - Soft drinks & dairy products 10 Tm

Figure 1. Customized calendar of inputs to the digester for AEMA

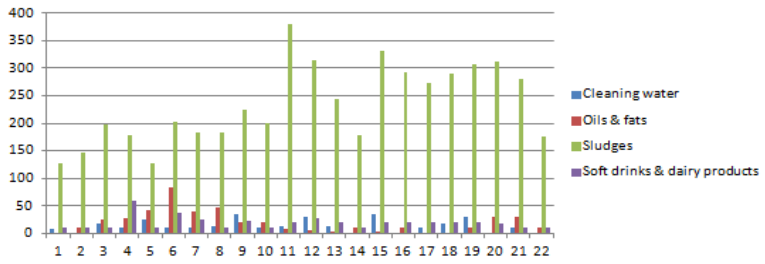

Figure 2. Substrate input composition to the digesters: Tm vs number of weeks

MWh	Enero	Febrero	Marzo	Abril	Mayo	Junio	Julio	Agosto	Septiembre	Octubre	Noviembre	Diciembre
2015	271,028	232,068	188,286	175,003	161,662	163,088	151,325	174,984	185,851	253,019	197,556	163,434
2016	150,886	154,482	189,191	121,7	186,037	177,263	175,174	194,679	207,912	153,007	238,621	275,792
2017	293,799	258,263	215,287	194,988	222,006	230,138	269,7	179,401	137,813	193,862	151,076	242,875
2018	294,476	176,749	249,727	190,185	250,172	252,041	215,134	240,645	300,392	201,435	247,212	208,153

Figure 3. Biogas/Energy generated at La Vall d'Uixó from 2015 to 2018

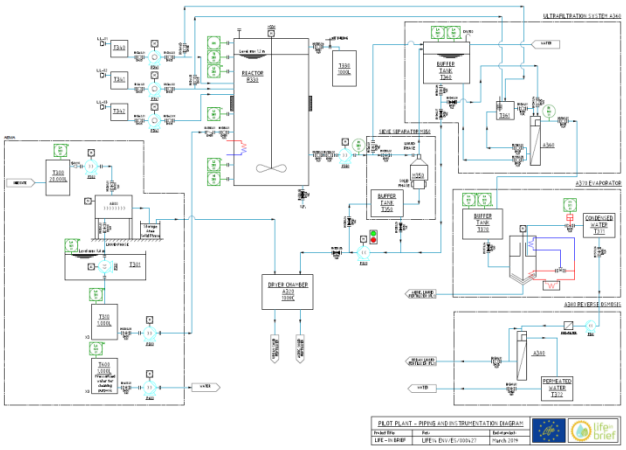

Figure 4. Hydraulic diagram of demo plant

B. IMPLEMENTATION ACTIONS

Foreseen start date:	10-2016	Foreseen end date:	12-2018
Actual start date:	10-2016	Actual end date:	03-2019

B.1. Pilot plant construction

Foreseen start date:	10-2016	Foreseen end date:	03/2017
Actual start date:	10-2016	Actual end date:	02/2018

- *Progress Achieved*: During this task, the demo pilot plant has been built and started at the biogas plant in La Vall d'Uixó. All equipments were assembled and tested before running it with digestate. The assembly and installation was done by an engineering company (Ingeniería y Desarrollos Renovables S.L.) who tried it fully in advanced so as to minimize the launching time and possible future problems. The building up was finished in January 2018 and by the end of that month and the beginning of the following, the initial hydraulic and electric trials were carried out and all the issues solved. Main partners involved in this action were LUDAN, AEMA and AIDIMME.

- *Results*: The plant is fully installed and connected, auxiliary pumps and devices are also operative and the plant can run according to the defined specifications. There are photos and videos of the plant as well as a definition of the protocols involved with the operation of the plant.

  At the deliverable of *protocols*, there is a definition of the modifiable operational indicators necessary to run the plant in a steady mode and define the protocols to control these parameters in each of the units of the plants.

  In the deliverable of *photos of the prototype*, the progress in the construction of the plant has been showed, from the very beginning of the construction and conditioning of the site to the actual disposition.

- *Problems/difficulties*: The main difficulty during this phase was to perform the activity confined by a tight deadline and budget after the 3rd amendment; besides the low time available, the plant should synchronise the generation of products with the agronomic cycles, so the full phase could be done within the stipulated margins. After the start of the demo plant, the evaporation stage had to be complemented with an extra evaporator so as to even the mass balance.

- *Outside Life*: Apart from the technological actions, during the building up of the plant there were people interested in the plant and the technology of the project itself, giving rise to questions and ideas for this field of research, as the use of a selective membrane that allows to extract ammonium directly from digestate.

- *Deliverables*:

  - *B.1.1. Protocols comprising operational indicators.*
  - *B.1.2. Photos and videos showing built prototype.*

- *Graphic content*: Hereinafter there are pictures of the different main elements of the plant (primary separator, reactor, small sieve, membrane, dryer chamber, evaporator, osmosis, reagents and the control panel). Extra explanation and pictures can be found in deliverable "*Photos and videos showing built prototype*" as well as in the attached complementary folder of "Project Evidences".

Figure 5. Pictures of outside part of the plant – before full construction

Figure 6. Indoor part of the plant at Inderen and Aema facilities – before full construction

Figure 7. Pictures of the final disposition at demo plant

Figure 8. Control panel of the demo plant

Figure 9. Concentration section of liquid fertilizer products

B.2. Technical demonstration of bio-waste and sewage sludge integrated business model

Foreseen start date:	04-2017	Foreseen end date:	12-2018
Actual start date:	07-2017	Actual end date:	02-2019

- *Progress Achieved:* AIDIMME has been the main responsible of this action with the help of LUDAN. This action covers two main tasks, both of them successfully finished:

a) Start-up of the prototype:

For the first task, there was a definition of the operation and emergency protocols to launch the prototype as well as the elaboration of operation and maintenance guidelines based on the specifications of the different equipment. The same way, a start-up protocol of the demo plant was defined prior to the production of fertilizers.

b) Operation of the prototype and DOE (Design Of Experiments)

The plant has been operated in different configurations (see deliverable B.2.3) both in manual and automatic mode, with the purpose to optimize overall performance in terms of output parameters such as especially organic extraction.

With this objective, a DOE has been performed, in which key factors are set to at least 2 different levels. Tests were held in a randomized order to avoid bias. Fertilizers were produced with the best operational conditions.

The chosen factors were: Temperature, pH of reaction and dilution of digestate in the reactor. The effect on output variables was studied and they were analyzed in the laboratory for all the samples taken at the tests. They were selected according to fertilizing assets;

· pH	· TOC	· Ammoniacal N
· Dry mass	· Conductivity	· N, P, K,
· COD	· Cl, Na	· S, Ca, Mg

Additionally, the membrane pore size was also studied by testing different sizes; 0.1, 0.45, 0.8, 1.4 µm.

Sampling points were set at the inputs and outputs of each key stage (extraction-separation-concentration) for the following equipment; Reactor, Membrane Filtration and Evaporation.

The most important information sought was the following;

- Reactor: percentage of extraction
- Membrane filtration: separation of soluble organic matter
- Evaporation: concentration factor over liquid fertilizer 1.

- *Results*: regarding the objective of demonstration and validation of the demo-process to turn bio-waste into valuable resource, it can be stated that the plant works successfully.

a) Start-up of the prototype

Technical information about the equipment and the different processes was gathered to constitute the first deliverable of the action, which covers operational directions that are complementary to the manual of demo plant covering operation and maintenance tips in addition to safety, emergency and risk protocols in case contingencies occur.

The start up was done firstly with water and once all parts were verified, with digestate. Main operational variables were checked and the results were the following:

Reactor:

Temperature: 55-70ºC

pH: 9.5 – 11.5

Reverse Osmosis

Permeate flow: 50-100 L/h

Conversion factor: 75%

Evaporation

Concentration Factor: 10

Membrane filtration:

Permeate flow: 40-50 L/h

Concentration Factor: 4-5

Dryer

Temperature: 90-110ºC

Time: 20 – 24h

b) Operation of the prototype and DOE:

Mass and energy balances have also been done, as can be seen in the deliverable B.2.2. Also, the events that took place during the start up were recorded and listed to take into consideration the limitations of the plant, such as the unexpected constant necessity of cleaning some parts of the plant and the continuous clogging of the upstream pump.

With respect to the products, four total fertilizers were obtained from the plant, plus the quality water recovered. As it is explained in this section, different incidences took place so the production was initially hindered. Initial batches were set to study the parameters according to the aforementioned DOE. With the results, a study of the evolution of the parameters along the stages of the process to assess its evolution through the process, then, the study of the significant parameters by the Least Square Adjustment and prediction profiler which allow to select the optimum values.

Fertilizers were produced with the chosen configuration: 0.8 µm, T-70ºC, pH-9.5 and Dilution of Digestate:Water-5:1 (details at deliverable B.2.4.).

Production and characteristics;

- FS1: Amount: ~2.1% of input. Organic matter 36% and NP 6.1%. Urban
- FS2: Amount: ~3.2% of input. Organic matter 35% and NPK 28%. Agricultural
- FL1: Amount: ~7.6% of input. Organic Carbon 3% and NPK 7.2%. Agricultural
- FL2: Amount: ~13.3% of input. Content in Nitrogen 0.5%. Type: Urban

Full composition and analyses of the products can be found at deliverables B.3.3 and B.3.4 corresponding to the agronomic validation of the fertilizers.

- *Problems/difficulties*: At first, difficulties were based on the tight deadlines and the issues occurring at the plant; during the starting up of the plant there were technical problems that were tackled in order to increase productivity. Detail of the occurrences and key learning of incidents during the starting up is included in deliverable B.2.2. It is also included the issues faced during the operation; automation problems, addition of insulation to the oven, addition of a forced ventilation in the plant, fouling of membrane, foam formation at evaporator etc. These events were complicating the concentration process thus hindering the global production of the plant.
- *Deliverables*:
  - *B.2.1. Guideline of operational, maintenance, emergency and risks of demo plant.*
  - *B.2.2. Start-up protocol of the prototype demo plant.*
  - *B.2.3. Design Of Experiments for the demonstration test.*

- *B.2.4. Report of results of the different demo test*.

- Graphic content:

Figure 10. The 4 Different products, respectively: FS1, FS2, FL1, FL2

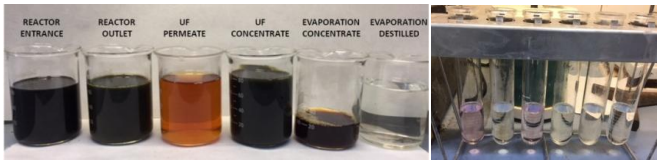

Figure 11. Samples of the different stages for the DOE (left) and Kjeldahl analysis (right)

Figure 12. Point of generation of each product

B.3. Fertiliser agronomic validation in urban and agricultural environment

Foreseen start date:	03-2017	Foreseen end date:	12-2018
Actual start date:	03-2018	Actual end date:	03-2019

- *Progress Achieved*: This task has been developed by COMPO and FORNERS with the assistance of AIDIMME in contact with the city Hall of La Vall d'Uixó. As it was stated in the proposal, the city Hall has provided municipal plots for this validation task. Meetings were held to propose the best options for the different products, resulting in an assignation of the athletic field, urban garden plot and city roundabouts.
  - FL1: Forners has tested the liquid format in Betera farms (variety orogrande and Lane Late – surface application by srprinklers, 7.5 hectares) and Vall d'Uixó (citrus, variety of oronules and Tango – fertigation, 22.7 hectares). There have been analyses of the leaves and soil and besides lysimeters have been installed to evaluate the filtration of the product in soil. Total surface area for validation tests 30.200 m^2.
  - FS2: Compo has tested the product on lettuce, maize, sunflower and pepper both in LVDU, Novelda (Alicante) and Ulea (Murcia) with the collaboration of IDEAGRO.
  - FS1 & FL2: For the urban liquid fertilizer FL2, Forners has been in charge of the Rugby field and the urban gardens (256 m^2+ 80 m^2). For the urban solid fertilizer (FS1) tests, Compo has been in charge of the roundabouts at La Vall d'Uixó. This makes a total validation surface for these tests of 1500 m^2.
- *Results*: Two of the products (FS2 and FL1) have been registered in the Ministry of Agriculture platform to assess their catalog as a fertilizer. For the different products and tests performed in this period, results are:
  - FL1 – Agricultural Liquid fertilizer (Forners): There was a statistically significant progress in ripening and improvements in size and percentage of juice by the application of HA. Also the structure, absorption of ions and stability of the soil was improved in all cases. There were no incompatibilities or clogs in the irrigation systems both in sprinklers and irrigation parts. No significant improvements were observed in leaves. Although it presented some deficiencies in nutrient content, it has a great potential as an organic fertilizer to improve the rhizosphere of fruit crops. It is recommended to apply an enrichment process to guarantee the composition and boost its positioning in the market if that was the final use.
  - FS2 – Agricultural Solid fertiliser (Compo): the organic matter and NPK nutrients are high, which can cause increase in the interest in the fertilizing market. There were no problems of phytotoxicity and both the mineral and digestate treatments had a good behaviour compared with control plots. This makes it an interesting and viable alternative to the conventional fertilization
  - FS1&FL2 – Urban solid and liquid fertilizers tested at LVDU green zones (By Compo and Forners): tests involved the visual comparison among the turf on a delimited zone and a part where the fertilizer was spread. Behaviour of grass was considered as normal in all cases, considered useful as a soil conditioner for the soil in urban fields. This performance would allow a win-win situation for the biogas plants and the municipal areas.

  It is worth mentioning that urban gardens involved a local social plan; by this initiative, unemployed and disabled people can have a piece of field and sow plants learning and enjoying the benefits of harvesting. Therefore LiB has become part of an integration project by providing and spreading these organic fertilizers to prepare the soil. It was also useful to show that the future fertilizing needs may also be covered from digestate sources.

All in all, the content in potassium, organic matter and their origin as a product obtained from bio-waste reuse is undoubtedly an added value in this regard.

- *Problems/difficulties*: the solid fertilizer format in which it is obtained is larger than expected, so it was necessary a preliminary crush prior to its scattering on the land. One of the test fields foreseen at the proposal had to be changed; a traditional irrigation system which involves the use of a large amount of water and that is not considered as a sustainable testing method, besides it is gradually disregarded in Spain mostly where water is scarce. This test was conveniently substituted by the validation in urban gardens not to alter the results of the validation tests. Lastly, Forners would need extra time to close the agricultural cycle, extract all possible conclusions and follow up the results to fully complete their validation.
- *Deliverables*:
  - *B.3.3. Report of FINAL results of agronomic validation of agricultural fertilizers.*
  - *B.3.4. Report of FINAL results of agronomic validation of urban fertilizers.*
- *Outside LIFE*: The fact of being related with the city hall has benefitted the project in different aspects; The Urban Garden from the City Hall is a project involving people in need so there has been a greater effect than expected in terms of the impact of the project, both in dissemination and validation of the products (See point D.3.1 for further information). Besides, the city hall is working in another LIFE project "Low Carbon Feed" which will allow performing additional networking actions and collaborations in after LIFE stage.
- *Graphic content*: Charts with the analyses can be found at the deliverables. Some photos of the agronomic validation done by COMPO and FORNERS as well as the fields assigned by Vall d'Uixó city hall are shown below.

Figure 13. Installation of equipment and FL1 validation (Forners)

Figure 14. Validation of FS2 in lettuce (Compo)

Figure 15. FS2 inPepper,sunflower and maize trials (Compo)

Figure 16. Rondabout trial of FS1 urban fertilizer in turf (Compo)

Figure 17. Urban gardens and athletic- field for FL2. City Hall of Vall d'Uixó (Forners)

C. Monitoring of the impact of project actions

Foreseen start date:	10-2017	Foreseen end date:	12-2018
Actual start date:	10-2017	Actual end date:	03-2019

C.1. Effectiveness of the project's impact on the environmental problem targeted.

Foreseen start date:	10-2017	Foreseen end date:	12-2018
Actual start date:	10-2017	Actual end date:	03-2019

- *Progress Achieved*: Data from of the demonstration activity has been registered to measure and evaluate the environmental impact. To measure effectiveness on the aims, specific indicators have been set in line with the main objectives of the project:

- *Results*: These indicators have been compared to the initial values/objectives and measured in the mid-term and after the implementation of the solution in the project, including both the new waste management model and the demo plant:

- Energy efficiency in waste treatment:
  - 100% Energy surplus recovered
  - 24% Increase
	- Greenhouse emissions, soil and water:
	  - ↓ 13.500 Kg CO_2 eq/ton waste
	  - 100% Reduction in soil pollution
	  - 0,35 Tons of water / Ton waste

- Use of waste for energy:
  - 690 KWth / ton bio-waste
  - 460 KWth / ton sewage sludge
  - Quality biogas (↑15% CH_4, ↓15% CO_2, ↓30 % H_2S) resp.2015 data
	- Waste for fertilizers:
	  - 100 Kg agri / ton of waste processed
	  - 140 Kg Urban / Ton of waste processed
	  - Quality increase (see DL A.1.2)
	  - 238 kg fertilizers / Ton waste

- *Energy Efficiency in waste treatment*: The amount of surplus energy in the biogas plant rise up to the 7000 kWth per month calculated by the declared energy for the years 2017 and 2018 compared to the energy produced during the years 2015 and 2016 (which implies a 24% rise). According to the consumption of the equipment and working hours, the consumption of the treatment plant can be as much as 7000 KWh per month; therefore, the 100% of the surplus energy is uses by the plant.
  Deliverable C.1.2 includes a compilation of the production of energy and the introduction of waste per month at the biogas plant for the previous 4 years on which calculations are based.
- *Use of waste for energy*: The assessment of the energy produced by the different types of inputs is detailed in deliverable C.1.2; these values have been updated based on the production values given by Aema and the entrance of wastes at the plant since they refer to the KWth obtained by the biogas produced per bio-wastes and sludge at the digesters, which is 690 and 460 respectively, in comparison to the 600 and 400 KWth initially proposed.
  The quality of biogas was registered by a sensor which indicates on screen which are the values measured for the CO2, CH4, and H2S as it is indicated in Deliverable C.1.2.
- *Waste for fertilizers:* Resource efficiency in terms of production of fertilizers per ton of bio waste has been affected; the total amount has been maintained but the proportion of agricultural and urban has been altered. This is caused by the necessity of increasing product concentration of the products. This has implied a reduced amount of agricultural fertilizer; a greater amount of water had to be removed in the evaporation stage, resulting in a larger quantity of distillate to be processed through reverse osmosis

giving more urban fertilizer and less fertilizer coming from the concentration at the evaporation or agricultural (see mass balance at deliverable B.2.2).

- *Greenhouse emission, soil and water*: 0.35 tons of water/ton of waste value implies a small reduction regarding the original proposal, which was set at 0.5. This is due to the necessity of increasing the temperature at the reaction stage (up to 70º) to ensure sanitization, thus this water is evaporated and not recovered. Besides, an important amount of water had to be removed to reach dryness specifications of solid fertilizers this water that is removed from the feed and is evaporated could not be recovered. Nevertheless, this could be easily solved in an industrial facility by the installation of recovery equipment.

- *Problems/difficulties*: Water recovery is less than foreseen since the temperature at reactor was increased; a greater amount was evaporated. Production of fertilizers has changed for the sake of product composition; the agricultural stream has been reduced to increase its concentration, resulting in a greater amount of the urban liquid stream as a balance of the system. Global amount of fertilizer is approx. the initially foreseen

- *Deliverables*:
  - C.1.2. Report 2 on environmental impact of proposal and comparison with initial status.

C.2. Assessment of socio-economic impact of the project on local economy and population.

Foreseen start date:	10-2017	Foreseen end date:	12-2018
Actual start date:	07-2018	Actual end date:	03-2019

- *Progress Achieved*: All partners have participated in this action by the review of the developed surveys by Aidimme and their distribution on the different stakeholders depending on the sectors that each one belongs to, i.e.: Biogas and energy plants (Aema); Waste managers (Aema); Fertilizer users and associations (Forners); Fertilizer producers (Compo); Engineering companies (Ludan); Waste water plants (Aidimme); Local government (Aidimme).

  A first specific survey was sent, in which there were different questions according to their working field. After this step, a second and more generic survey was sent, so as to obtain extended information about the project view from outside. This is done to gather indicators on the socio economic impact in terms benefits, effect and future view of the project in these different sectors.

- *Results*: Total number of surveys completed; 54 (43 paper + 11 online). The sector with a greater response rate has been the agricultural one, followed by the waste managers.

  Data collected has been both of quantitative and qualitative type. Quantitative information is provided in the deliverable, while the overall conclusions are hereinafter summed up.

  For biogas plants, it was asked if they comply with the minimum requirements to get on with LiB business model such as the excess of heat/energy and will to modify inputs. Even if the conditions are not met, the owners state that they would be able to modify their conditions and include a treatment process so as to obtain an income for their digestate. However, they expect that this successful situation is present in another biogas plant prior to run the risk themselves.

  With regard to waste managers, there has to be a differentiation among those who are producer and manager of wastes and those who are only waste management companies; formers have more margin for the modification of their conditions to adjust LiB model and the latter cannot; e.g., producers have the facilities to adapt their waste to the substrate requirements of biogas plants and even keep them for longer in their facilities than the managers can do, and that could lead to an advantage for them in the model.

  For WWTP, in spite of not completing the surveys, those contacted show an interest in having their sludge sent to a biogas plant so their nutrients can be profitable instead of conventional dumping, but it is thought necessary further investigation to get a better harnessing of its potential.

  Especially useful were the contacts done for the agricultural sector; for fertilizer users, it has been inquired their priorities to select a fertilizer and the price that they would be willing to pay. On the other hand, the responses of fertilizer producers have been valuable as well, in order to know whether those companies would be prepared to sell this product as raw material for formulation or as a final product and the reply has been positive; as long as it complies with legislation or if it is sold to less demanding clients

  Lastly, regarding the local government and population, it has to be remarked their eagerness to help both with the agronomic validation and the dissemination actions (social and technical areas).

Regarding figures on the impact, it has been assessed that at least 5 employees would be necessary for the implementation in a large biogas plant (apart from the jobs dedicated to the temporary construction tasks), moreover the investment required for this size of plant would go up to 2M€ (See Deliverable 3.4 and 3.5 on economic and transferability studies). This fact shows positive predilection on LiB approach, considering it feasible to give an important impact in job creation, social awareness and acceptance of the benefits of using safe fertilizers that are obtained from wastes.

- *Problems/difficulties*: There were no problems during the development of the task, only special care with the way to approach the different stakeholders with relevant questions but being careful not to ask for delicate information. Besides, regardless of the interest that the stakeholders have, the response is occasional and sometimes it is necessary to maintain contact to ask for the replies. Once some responses are obtained, two concerns arise; on the one hand it is hard to study the biogas plant sector since each plant is a different case and on the other hand the fact of obtaining relevant quantitative data to assess the indirect impact of the project.
- *Deliverables*:
    - C.2.1. Report on socio economic impact
- *Graphic content*: Surveys sent to stakeholders to assess feedback. Paper and online:

Figure 18. Example of surveys for the assessment of stakeholders' feedback

C.3. Replicability and transferability of the novel business model.

Foreseen start date:	12-2017	Foreseen end date:	12-2018
Actual start date:	04-2018	Actual end date:	03-2019

- *Progress Achieved*: The action is divided into different tasks to gather enough information to replicate and transfer the model:

a) Legislative study: a report has been included with the aim to examine the legal framework of digestate use as a fertilizer in Europe, uses and limitations.
b) Cataloguing rule for fertilizers: A study has been done on the regulation concerning the cataloguing of LiB products in the fertilizer sector.
c) Biogas plant requirements: It frames the different characteristics of biogas plants in Europe, main trends in the sector, current digestate uses and future perspectives challenges and related statistics.
d) Economic study: present the financial viability of the project, assess the associated risks and consider the improvements to be done so the business model can be feasible.
e) Guide of transference: Ludan has gathered relevant information about biogas framework and along with the results obtained in this project, has defined the requirements for the model to be applied in other plants. Ludan maintained meetings with 3 European biogas companies to propose case studies to assess the viability of the application of LiB model to them: Agro Hensbroek plant, Groen Gas Goor and Kernel Exports. Since digestate management is a matter of concern to them, owners were highly interested in knowing the details on LiB model.

- *Results*:

a) Legislative study: there is a need to review and unify regulation that controls and supports the use of digestate in soil since it depends on the country. Entry 12 of REACH regulation, which exempts compost, should also apply to digestate or else European legislation would be negatively contributing to a bio-based economy.
b) Cataloguing rule for fertilizers: According to the national rules, there is a proposal of classification for the products of the plant; in Spain, there are 7 different categories of fertilizer, each one with several sub-groups. According to RD 999/2017, based on their composition with no formulation requirements, FL1 could be categorized as an organo-mineral fertilizer Sub-group nº3.7 and FS2 as organo-mineral NPK sub-group nº3.2. Urban fertilizers performance fits as amenders or fertilizer basis for formulation.
c) Biogas plant requirements: main barriers found for the sector were the operational and management costs, the need of developing technologies for digestate treatment, the lack of standards for digestate use as well as lack of general awareness in its use. The trends of this sector, related to digestate treatment, are focused in the search of enhanced treatments or pre-treatments for substrates, raise of awareness and risk management, and last but not least economical concerns regarding its management.
d) Economic study: it is possible to develop a successful and profitable fertilizer plant associated to biogas plant especially for larger plants (40.000 t/yr input) and the requirement of at least 500 KWth to optimize the model. Prices of agricultural fertilizers should be 120€/t for FS2 and 50€/ton for FL2. Best performance indicators are obtained for larger plants, with a NPV of 1.700.000 and IRR of 25%.
e) Guide of transference: The 3 biogas plants have given details on their inputs, methodology of acceptance of substrates to the biogas plant, actual treatment of digestate, local regulations about use of digestate, use/amount of biogas and availability of space in their plants. They have strict laws regarding the content of ammonia in digestate; For them it would be very interesting to have a treatment that

removes the ammonia content for different reasons: it inhibits their biogas production so they have to re-circulate digestate usually; there is a limiting level of ammonia to be spread in the field and this would ease the distribution of the product. This way, the possibility of recovering the ammonia and giving added value to the fertilizer could be an interesting source of revenues in the plant. Some of the requirements set for the transfer were:

Technical	Economical
- Energy availability - Input modification - Spare room available - Fertilizer potential production - Quality of digestate	- Digestate treatment expenses (management and/or transportation costs) - Proximity to customers - Revenues from fertilizers - NPV, IRR and Payback time - Legislation margins

There were different conclusions on the transferability of the model depending on the plant studied; based on the size of the Dutch plants, the implementation of LiB model would be advisable, however, Kernel which is a small plant, and since it spends over 500k€ in the production of fertilizers, the self-consumption of these product would imply a higher revenue which makes the implementation feasible in the same amount of time that for the greater plants.

- *Problems/difficulties*:

During the development of the action, the main problem was the cease of activity of LUDAN, which forced the consortium to subcontract part of the work to an external engineering company expert in the biogas field.

As per the results, the fact of not having surplus energy to run the transformation plant is a difficulty to transfer the model, unless the model is economically feasible for the plants.

Outside LIFE: No actions outside life have been envisaged. This study has shown that the model could be transferred to other plants so more business can benefit from this model.

- *Deliverables*:
  - C.3.1. Legislative study.
  - C.3.2. Biogas plant requirements.
  - C.3.3. Cataloguing rule for fertilizers.
  - C.3.5. Public/private transference Guide
  - C.3.4. Economical feasibility study

D. Public awareness and dissemination of results

Foreseen start date:	09-2015	Foreseen end date:	03-2019
Actual start date:	09-2015	Actual end date:	03-2019

D.1. Notice Boards. Dissemination plan and media work

Foreseen start date:	09-2015	Foreseen end date:	03-2019
Actual start date:	09-2015	Actual end date:	03-2019

- *Progress Achieved*:

  D1.1. Dissemination plan and media work: Concerning the first activity, since all the dissemination plan was based on results, the work in E1.1 has been focused on the preparation of the "dissemination pack" (two versions) and the maintenance of a minimum awareness through the publication of generic news and references.

  The "Dissemination pack" is a set of promotion instruments to be used in the dissemination activities of Life in Brief currently available (apart from the website):

  1) Generic and specific Presentation
  2) Leaflets. Notice Boards. Totems/Rollup.
  3) Boards (Atriles) at the fields for agronomic validation (7).
  4) Video of the project.
  5) Technical separatas: 4 different sheets summarizing results of the project.

  The quantification of the impact of this action is at the deliverable E.3. Life project specific indicators, where it is described the number of persons attending to the events, readers of the news, visitors to the web etc. The overall development is positive, although the late availability of data prevented from a complete dissemination phase.

  Most of the dissemination scopes were covered (biogas associations, waste managers, engineering) but one of the forums foreseen was not celebrated (Madrid), nor was the technical day at Brussels.

  D1.2. Notice Boards: Two types of notice boards have been designed and printed: totems and notices. Totems were displayed during the project in strategic visible places on all the beneficiaries' premises and notices were also placed in visible locations at the Demo Site and validation fields.

- *Problems*: the main problem for this task was the delay due to the absence of technical results when this action was expected to start. A project extension was requested but some of the foreseen dissemination activities could not be completed.

- *Results*: Deliverables for this action can be found in annexes as well as in the attached folder.

- *Deliverables:*

  - D.1.1. Dissemination pack v1
  - D.1.2. Dissemination pack v2.
  - D.1.3. Final report on dissemination activities

- *Graphic content*: Below there are some pictures of the dissemination material that has been used in the project. For further content, refer to the deliverables Dissemination Pack v1 and Dissemination Pack v2

Figure 19. Dissemination material (demo and validation sites, rollup at Forners hall)

Figure 20. Dissemination material (leaflet, technical separatas, poster)

D.2. Life in Brief project website and multimedia material

Foreseen start date:	09-2015	Foreseen end date:	12-2018
Actual start date:	09-2015	Actual end date:	03-2019

- *Progress Achieved*: AIDIMME started the development of the project website during 2016 and has been updating the news along with the technical advances. The rest of the partners contributed on the design phase. The website is bilingual and follows the graphic rules stated by the LIFE Programme.

  Social networks activity has been developed by COMPO and AIDIMME by replicating LiB news in their corporative social networks. Indicators in DL D3.1

- *Problems:* No issues with the web launch.

- *Results*: Website active and available both in Spanish and English. It is also being used to upload public dissemination material and to be used as a private common storage for official documents of the project so they are available for all the partners. The number of visitors is being recorded and it is included in deliverable E.3. of indicators (Excel file) www.lifeinbrief.eu

- *Deliverables*:
  - D.2.1. Project website http://www.lifeinbrief.eu/

- *Graphic content*

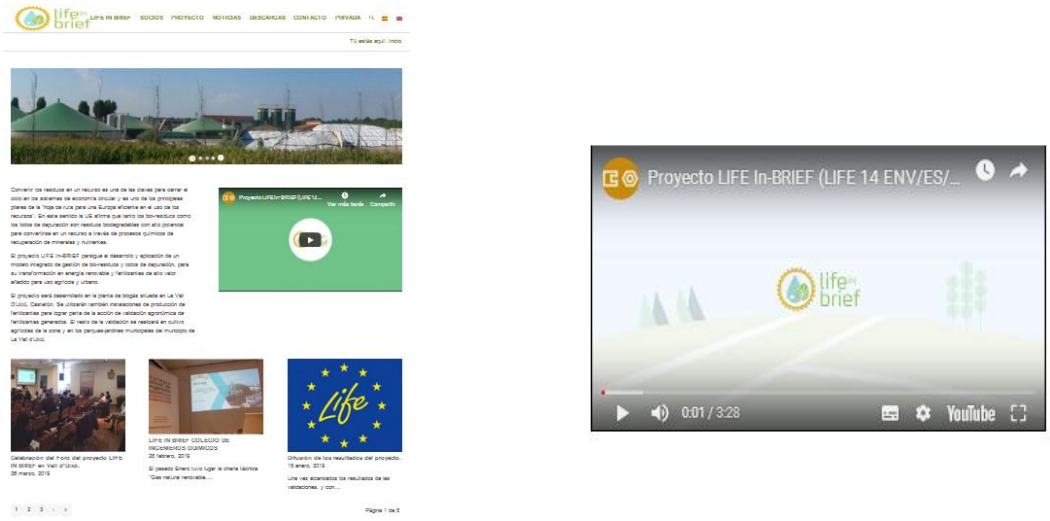

Figure 21. Project Website

D.3. Stakeholder oriented dissemination and project forum

Foreseen start date:	07-2016	Foreseen end date:	12-2018
Actual start date:	07-2016	Actual end date:	03-2019

The lead and coordination was carried out by LUDAN until Nov. 18, where AIDIMME took over the lead of the action. The rest of the partners arranged specific actions with the relevant stakeholders in their fields of competence.

- *Progress Achieved*:

Task D3.1: Stakeholder oriented dissemination.

A simple matrix of stakeholder categories and interests has been defined where specific interests and roles in the business model have been identified, according to the methodology stated in DL3.1,

An initial list of stakeholders was defined, and once, refined, a final list used in the project accounts for 89 contacts of the identified categories:

- Biogas Plants managers and related.
- Fertilizer producers and applicators.
- Engineering companies in the chemical industry.
- Waste management and treatment companies.
- Agro-farming cooperatives and societies.
- Municipalities.
- Other

54 entities were directly contacted (some 70 contacts of this list) and information exchanged.

Although the results were not completely customized to the stakeholder categories, the exchange of information translated into contributions of the main deliverables from the early stages of the project. Contributions can be traced to DL .A.1.1, DL C.3.4, DL C.3.5 and DL E.6.1 (See DL D.3.2).

After the meetings with the city Hall of LVDU, and its approach on circular economy, coordinators contacted the “Taller de empleo” to maintain several meetings, ending up in a concession of the urban gardens implying a collaboration in the validation action.

This “employment workshop”, as mentioned in task B3.3, consists in training unemployed people in agricultural matters to help them in their careers. The convergence of LiB and them has been seized to collaborate in a reciprocal way; on the one hand, this is a future potential application of biogas fertilizers in a local circumstance, on the other hand, all members were involved and there was a presentation for them, where it was explained the LIFE framework, the objectives of the project as well as their engagement and as a courtesy of FORNERS, a greater explanation on agricultural topics and personal advices about hiring and the type of development tasks usually asked in this sector.

Task D3.2. Open forum.

The celebration of the Forum took place in March 15 2019, Palau de Vivel, Vall D’Uixó.

The forum was also prepared with a high didactic content (both the attendants reception and the session break were really informal presentations of the results, and a “presentation pack” was handed out to each attendant, including technical sheets, project summary and a set of samples of each of the products obtained.

There was an attendance of 36, of all stakeholder categories considered, and the objective of the forum (productive exchange of ideas) was fulfilled with the clear dominance of the following concepts:

- Without digestate treatment, biogas projects are economically incomplete.
- Valorisation of the digestate can also eliminate often "invisible" environmental costs
- The application of this model will be specific to each plant (size, type of digestate, distance to partners, integration into urban or rural environment, etc.).

- *Problems:* Unavailability of final technical results has delayed launching the open forum and address specific stakeholders. Two forum meetings were foreseen (Madrid and LVDU) and only the Vall D'Uixó one was celebrated. However, all stakeholder categories were addressed.

- *Results:*
  - Set up a database of 90 stakeholders, most of them already directly contacted and interviewed.
  - Information valuable for deliverables linked to the implementation of the LiB model.
  - Celebration of a Forum in LVDU.

- *Deliverables:*
  - D.3.1. Participating methodology
  - D.3.2. Global view of the stakeholder. Summary of key contributions to the Deliverables. Minutes of the open forums

- *Graphic content*

Figure 22. Forum images and invitation

D.4 Networking with other LIFE and/or non-LIFE projects

Foreseen start date:	09-2015	Foreseen end date:	03-2019
Actual start date:	09-2015	Actual end date:	03-2019

- *Progress Achieved*: As well as generic networking activities, focused networking was successfully carried out. Good practices and different approaches for the project were exchanged. The participation in the different events allowed the different partners of the project to have further contact of different project managers so as to arrange meetings and exchange of opinions and ideas over the digestate treatment and the fertilizer sector opportunities.

  A set of projects has been identified as contact targets and meetings have been held to share the main objectives, difficulties and synergies of the different projects since the topics were significantly related to LiB focus.

  - Attendance to networking events: 6 networking events (Detail at Dissemination annex)
  - Contact with LIFE and non-LIFE projects: Total of 13 contacts (detail at Dissemination Annex)

- *Results:* agendas and minutes from the meetings can be found attached at the folder "Meetings". There was an exchange of good practices related to LIFE projects such as: the use of a new type of specific membranes that are resistant to fouling and harsh environments such as digestate media, however prices are still not competitive for this kind of applications.

  The common points for the different meetings were the objectives and methodology of the project, as well as common difficulties and proposed solutions.

  There have been interesting findings in terms of the difficulties of handling bacteria; how the different parameters of the projects affected their specific bacteria; for some of them, a small change in temperature could imply a weakening of the population thus having to stop the process and have to introduce new ones (Anadry) whereas for other project, bacteria was being cultivated so they can stand strong variations of conditions (Bactiwater), making it also interesting from the Biogas point of view. These stronger strains would be able to cope with severe environments so biogas plants could accept a wider range of inputs.

  For the projects which have been considered as similar to LiB for dealing with sludge, interesting information was exchanged; there is an undeniable difficulty in finding the proper technology to treat and separate sludge, special effort for those with high grease content. It was worth noticing that neither of the projects embraced both a demo plant and also the validation of the product.

  On the other hand, there were also comments on the difficulties of coordinating these projects, both from the technical and administrative points of view.

  All in all, there has been an exchange of contacts and ideas for future improvement in the different projects and future contacts for new projects.

- *Problems*: Since there was a patent risk of suspension of the project caused by issues on one partner financial capacity, the consortium self-limited the outreach tasks. Specifically in those tasks which could eventual involve common work or exchange of practices, such as the specific networking. However, collective networking was addressed.

- *Progress:* Progress in this task, has followed schedule despite the initial delays, being a rather steady task from the beginning.
- *Deliverables*:
  - D.4.1. Networking Report
- *Graphic content*: Below some screenshots are shown in line with the dissemination actions

Figure 23. Graphic Content of Networking Actions

D.5 Production of Layman's Report

Foreseen start date:	09-2018	Foreseen end date:	12-2018
Actual start date:	09-2018	Actual end date:	03-2019

- *Progress Achieved:*

Strongly based on the project results, a bi-lingual layman document has been developed. Only digital version is available. Since results were available late and both development and edition did not allow the product to reach the Forum at LVDU (the main stakeholder event), it was decided to produce a limited print the technical separatas for that event and keep the Layman only at digital downloadable version.

The main delivery of this product will be at the After LIFE period, both through the LiB website and the partners Websites. An specific dissemination strategy has been devised in the AFTER LIFE DL.

- *Problems*:

No remarkable problems.

- *Deliverables*:
    - Layman Report DL D.5.1

- *Graphical Content.*

Figure 24. Layman report cover

E. Project management and monitoring of the project progress

Foreseen start date:	09-2015	Foreseen end date:	03-2019
Actual start date:	09-2015	Actual end date:	03-2019

E.1. Project Management

Foreseen start date:	04-2018	Foreseen end date:	03-2019
Actual start date:	04-2017	Actual end date:	03-2019

- *Progress Achieved*: The objective of the action is to plan, organize and control activities so that the project reaches its results as successfully as possible in spite of all the risks. AIDIMME: as coordinator has developed the following activities:

  A) Partnership agreements have been signed between each partner and the Coordinator.

  B) Management system

  The management procedures have been formalized (Deliverable E1, already issued). The management bodies foreseen have been constituted: the Assembly, the technical committee, the demonstration Committee, the monitoring Committee and the technical unit.

  Report templates and reporting rules transmitted to partners.

  C) Development of the management part of the project's web site (internal repository).

  D) Arrangement of Coordination Meetings involving all partners (Minutes available at the attached folder "Project Evidence – Meetings"):

20/05/2016	22/12/2016	19/12/2017	09/12/2016
22/06/2017	17/07/2018	30/10/2018	30/01/2019

  E) Monitoring and development of each action.

  F) Issue of 1st and 3rd amendments due respectively to the change of partner LUDAN, and a re-structuring of the project due to financial issues on AEMA with the pilot plant.

  G) Incorporations of all modifications in the amendments:

     a. New conceptual process based on the kernel of the initial proposal.

     b. Rearrangement of responsibilities among the consortium.

     c. Budget modification

     d. New task description C3.

  H) Risk management and changes in the project (See "Problems").

- *Problems*: The main issue faced by the management of the project has been the amendment required by the AEMA issue (third one), which had the consequence of a technical change on the structure the pilot plant as well as modifications of budget, schedule and responsibilities, including the definition of new tasks. AIDIMME managed the definition and of these changes and most of the modifications themselves.

  After the presentation in Brussels of the new approach (Sep 2016), the coordinator informed on the end of Nov. 2016 to the rest of the partners that, since the main investment –pilot plant- modification needed to be accepted, the project halted till that acceptance.

The first pack of the request for amendment was submitted to the monitoring team before the end of 2016. The formal submission took place on the first week of February 2017, and some additional information sent on March. An informal notice from Brussels arrived to AIDIMME on October 2nd and the signed documentation on 15/10/2017. This made possible the start of the demo phase in the end of 2017 and the pilot plant operative in Feb 2018. The tight schedule influenced the long-term demo phase, the agronomic validation cycles and the time availability for dissemination.

In Nov. 2018 LUDAN ceased its activity, and their pending work needed to be distributed and rearranged.

- *Results:* A lot of effort has been put on management due to multiple departures from the initial situation in the proposal. Most of the objectives of the proposal have been accomplished and a fair justification level, coherent to the implementation level, reached.
- *Deliverables*:
  - Progress Report (December 2017).
  - Management procedures.
  - Mid-term report (October 2018).

E.2 After LIFE Dissemination and Communication Plan

Foreseen start date:	07-2018	Foreseen end date:	12-2018
Actual start date:	10-2018	Actual end date:	03-2019

- *Progress Achieved*: Since the operative start of the project, a view was put on the future activity of the business model. Each of the main achievements were thought to be expanded at the end of the project, namely:
    - Intelligent waste admission.
    - Optimized anaerobic digestion
    - Batch digestate buffering.
    - Digestate processing and generation of fertilizers.
    - Fertilizer conditioning
    - Fertilizer application.
    - Agronomic validation.
    - Dissemination.

The constraints, circumstances of implementation and outcomes of these areas were analyzed with a view on eventual benefits of keeping development, as well as taking advantage of the existing results for cost-effective expansion of the results, both internal (new projects and optimisation of the current model) and external (dissemination and promotion).,

- *Results:* After LIFE Plan.

An After Life Plan has been put in place focused on 4 main areas:

- Demonstration.
- Follow-up.
- Production
- Dissemination and promotion of project practices and results.

The plan is initially scheduled for 16 months, although some of the actions (web) will last for a minimum of 3 years.

	Responsible	abr.-19	may.-19	jun.-19	jul.-19	ago.-19	sep.-19	oct.-19	nov.-19	dic.-19	ene.-20	feb.-20	mar.-20	abr.-20	may.-20	jun.-20	jul.-20
Visits to Plant	AEMA																
Follow-up	AIDIMME																
Agronomic Follow-up	COMPO/FORNERS																
Processing of external digestates	AIDIMME																
POWERDIGEST (improvement of digestate processing)	AEMA																
Project Image	AIDIMME																
Life in Brief Web	AIDIMME																
Dissemination/Networking Events	AIDIMME																
Generic dissemination	AIDIMME																
Stakeholder oriented dissemination	AIDIMME																

- *Problems*: None.
- *Deliverables*:
    - E.2.1 AFTER LIFE Plan.

E.3. Compilation of indicators on project progress

Foreseen start date:	09-2015	Foreseen end date:	03-2019
Actual start date:	09-2015	Actual end date:	03-2019

- *Progress Achieved*: AIDIMME gathered and structured most of the data in a chart whose format was given. It contains data at the initial stages of the project, at the final report and 5 years after project end/ at replication or transfer level.

  All data gathered in the chart can be summarized and divided into these parts; 1) Demo plant inputs: Digestate treated, energy consumed 2) Demo plant outputs: Fertilizers, water, emissions 3) Dissemination scope 4) Economic assessment 5) Replication.

- *Results*: Table of indicators can be found in the deliverable, a summary of which:
  - Digestate treated: total biowaste and sewage sludge treated has been 900 m3. It has been lower than the initial definition because of all the trials done within the first months and the production issues that were described in previous sections.
  - Water recovery: resource recovery by the utilization of reverse osmosis stream, which is a 40% of the entrances, although in absolute terms this amount has decreased as the input has also been lesser. This water is used for the dilution in the reactor and for cleaning purposes in the plant.
  - Energy consumed: the electricity production in the plant has increased 24% in kW over standard in 2018 from biogas in average bio-waste and sludge.
  - Fertilizer production: per ton of bio-waste processed, a ratio of 100 kg and 140 kg of agricultural and urban fertilizers respectively; they have been decreased since agricultural fertilizers undergo a stricter concentration process both in the membrane and the evaporator (thus less amount of agricultural is obtained in the end, and this amount is transferred to the urban fertilizers as a system balance).
  - Greenhouse gases: a total of 13.500 kg CO2 eq in terms of NOx reduction has been assessed to be saved to be thrown to the environment for a ratio of 15kg CO2 per ton of waste processed.
  - Dissemination scope: total visits to the web of LiB and the related news posted at the partners' webs: over 20.000 visits, with more than 8.000 additional visits in social media. Printout media scope is 1.000 units, and over 40 visits to the plant have been assessed. Impact at conferences, demonstrations and related people can be counted as approximately 650 individuals.
  - Economic assessment; number of jobs, data on running costs, operating expenses, capital costs and expenditures, revenues and savings in case of replication of the project. These values have been extracted from economical study at action C3.
  - Replication: The expected replications in the post LIFE 3 to 5 year period is 4 (at Spain, France, UK and Netherlands)

- *Problems:* None.

- *Deliverables:*
  - E.3.2 Final Indicators Table.

5.2.Evaluation of Project Implementation

<table>
<tr><td>Action A</td><td colspan="2">PREPARATORY ACTIONS</td></tr>
<tr><td colspan="3">Foreseen in the revised proposal</td></tr>
<tr><td colspan="2">Objectives expected</td><td>Expected results</td></tr>
<tr><td colspan="2">Prepare AEMA facilities to hold LiB plant
Study the characteristics of the digestate to provide a good raw material for the plant
Define a design of the pilot plant that would transform the ready digestate into fertilizers</td><td>Preparation of permits and licenses for the plant
Bio Waste input control to feed the digester and and digestate output analysis
Design of the prototype units</td></tr>
<tr><td colspan="3">Achieved</td></tr>
<tr><td colspan="2">Objectives Achieved</td><td>Results Achieved</td></tr>
<tr><td colspan="2">All objectives were successfully achieved for this action.</td><td>Procurement of necessary permits and licences.
Analyses were done on the digestate to know its compositions and define main characteristics for the demo plant and calendar of waste entrances.
Lab tests and analysis to determine the digestate as an input of the pilot plant and to make decisions on the type of units that the plant would contain
A detailed PID diagram was developed for the plant.</td></tr>
<tr><td colspan="3">Evaluation</td></tr>
<tr><td colspan="3">• Successes:
All tasks were successfully finished for this action; Even though the amendment was done in this phase, the actions were re-defined and by taking a longer time than scheduled, all tasks could be successfully performed. There were a lot of designs prepared for the demo plant since the amendment forced a change in the initial system, with a low amount of time and budget available.
• Failures
The time spent in asking for the permits and licenses. All the re-designs of the plants were held in this period and spent some project time too.
• Lesson learned/cost-efficiency of actions:
Disregarding that this action took too long because of the amendment request, the design of the plant took longer than expected because it had to be completely re-defined due to a budget cut and each time a technical proposal was made, an offer had to be asked so as to guarantee the economical and technical viability of the solution leading to delays each time that a step was taken.
• Overall
This action has been necessary to prepare the rest of the actions in the project, so it is important that this base was well settled before continuing with the rest of tasks.</td></tr>
</table>

<table>
<tr><td>Action B</td><td colspan="2">IMPLEMENTATION ACTIONS</td></tr>
<tr><td colspan="3">Foreseen in the revised proposal</td></tr>
<tr><td colspan="2">Objectives expected</td><td>Expected results</td></tr>
<tr><td colspan="2">a) Construction of the prototype – selection of equipment and control elements, automation defined.
b) Start up of the prototype and operation of the pilot plant and definition of guidelines and risk</td><td>a) Prototype built and assembled with all automation and control elements, hydraulic systems installed and equipment ready for the introduction of digestate
b) Start up of the pilot plant – optimize the stages</td></tr>
</table>

<table>
<tr><td>protocols
c) Operation of the prototype to start producing fertilizers, design of experiments to obtain the best conditions to run the plant
d) Agronomic validation of agricultural and urban fertilizers in different fields and test conditions</td><td>and re-engineering of the necessary elements
c) Operation of prototype and run the different tests included in the design of experiments so the conditions of the plant are optimized
d) Plant seeds with digestate/without/with inorganic fertilizer to compare results. Sampling of different parameters to know if there are significant differences and digestate is suitable for this application</td></tr>
<tr><td colspan="2">Achieved</td></tr>
<tr><td>Objectives Achieved</td><td>Results Achieved</td></tr>
<tr><td>All objectives are finished and achieved.
Fertiliser validation has finished although more time would be needed to fully assess the effect of the fertilizer on citrus varieties.</td><td>a) All the elements of the prototype have been selected and assembled. The automation is defined and installed
b) The plant has been started and it is fully operative to process digestate to produce 4 fertilizers as planned without rejections
c) Several tests in different conditions have been held to define best operating conditions for the production of fertilizers (assess the effect of Temperature, Dilution and pH)
d) The validation has been done with the 4 fertilizers in different fields.</td></tr>
<tr><td colspan="2">Evaluation</td></tr>
<tr><td colspan="2">• Successes:
The plant was built in a shorter period than expected; it was done in good conditions with all equipment operative and ready to cope with the viscous and fouling digestate.
The products were obtained on time to be used with the corresponding crops, one risk was not to have the fertilizers available during the sowing period but a lot of effort from different people was made in obtaining these products and quickly pour them in the fields to seize the spring effects on plants.
• Failures
There were unexpected situations in the plant; clogging of an upstream pump, membrane fouling, foam formation in the evaporator and issues with automation decreased the expected production.
• Lesson learned:
There are always unforeseen events during a starting up of a pilot plant and there should be enough time expected to do these kinds of tasks. The fact of outsourcing the construction of the plant has relieved a lot of efforts for the partners of the project and avoided possible communication issues.
Regarding the operation of the plant, there were some problems related with the complexity of the waste to be treated in the plant by higher scale membranes and evaporation technologies, which do not arise on a smaller scale.
Cost-efficiency of actions: Apart from the design of the process, the rest of the actions were done in a very short period of time and the output was fortunate, thus the efficiency was very high.
• Overall
This action has been crucial for the development of the project since if the plant was not built, any of the other actions would have not been able to start.</td></tr>
</table>

<table>
<tr><td>Action C</td><td colspan="2">MONITORING THE IMPACT OF THE PROJECT ACTIONS</td></tr>
<tr><td colspan="3">Foreseen in the revised proposal</td></tr>
<tr><td colspan="2">Objectives expected</td><td>Expected results</td></tr>
<tr><td colspan="2">Measuring the project impact on Environmental problems; both in initial state and the final environmental state after the project has been performed.
Collection of data regarding the indicators defined to measure the selected parameters of environmental efficiency.</td><td>The expected results of this actions are the values measured for the indicators enabling to know:

a) Quantity of the obtained fertilizers
b) Quality of the fertilizers obtained;
c) Indicators to know the energy gained in the biogas plant after implementing the proposal:
d) Know the rejections and by-products are reduced after implementing the proposal
e) How improves the quality of the digestate and biogas</td></tr>
<tr><td colspan="3">Achieved</td></tr>
<tr><td colspan="2">Objectives Achieved</td><td>Results Achieved</td></tr>
<tr><td colspan="2">During the project, the different indicators were assessed and some of them were modified depending on the ease of them to be quantified and defined among the conditions of this project.</td><td>a) Quantity of the obtained fertilizers: This can be found in deliverables C.1 and D.3.
b) Quality of the fertilizers obtained; this is assessed by Compo and Forners. Detailed results can be found in B3 deliverables.
c) Indicators to know the energy gained in the biogas plant after implementing the proposal with respect to the production before carrying the project. See Deliverable C1.2 and E3.2.
d) Zero Secondary streams produced in the plant.
e) How it improves the quality of the digestate and biogas: the quality of the biogas is improved by the addition of fishing wastes as the scales and iron content prevents the sulphur from appearing in the gas phase and damages the engines of the motor. The quality of the digestate is improved by a reduction in percentage of wastes that does not imply a benefit to the product such as nitrogen, metals, hydrocarbons and high conductivities.</td></tr>
<tr><td colspan="3">Evaluation</td></tr>
<tr><td colspan="3">• Successes:
Biogas production has been increased at La Vall d’Uixó and the digestate obtained as an output is a suitable raw material for the production of fertilizers.
The 4 fertilizers are obtained and their validation gave good results both in agricultural and urban uses.
• Failures:
The necessity of a greater register of data to monitor the environmental impact at the biogas plant.
• Lesson learned:
For a more desirable compilation of results, it would be advisable to set at first some protocol defining data register to ease its follow up itself.
• Overall
This was necessary to quantify the progress and impact of the tasks, assessed direct and indirectly.</td></tr>
</table>

<table>
<tr><td>Action D</td><td colspan="2">PUBLIC AWARENESS AND DISSEMINATION OF RESULTS</td></tr>
<tr><td colspan="3">Foreseen in the revised proposal</td></tr>
<tr><td colspan="2">Objectives expected</td><td>Expected results</td></tr>
<tr><td colspan="2">Dissemination of the state of the project to different areas of interest;
Production of dissemination packs to provide interested people graphic content of the project.
AIDIMME communication area spreading the progress on different actions of the project.
Definition of a plan of actions to carry out in the future.
Define a Participation Methodology for the sake of dissemination actions..</td><td>a) Promotional brochures, leaflets, notice boards and project presentations.
b) Generic dissemination; social network and articles in different websites.
c) Visits from different people to the plant
d) Website of the project with different sections and in several languages.
e) Technical conferences, congresses and infodays.
f) Identification of stakeholders and open forum
g) Networking with other life projects
h) Networking with non life projects
i) Production of Layman Report</td></tr>
<tr><td colspan="3">Achieved</td></tr>
<tr><td colspan="2">Objectives Achieved</td><td>Results Achieved</td></tr>
<tr><td colspan="2">The progress of the project has been registered and updated in different media during the previous months with technical and graphic information
Besides, brochures and other printed material were also used in the different meetings.
All material holds LIFE logo as well as the partners’ and that of the project itself; the type of funding that it has received and the environmental problem targeted in a visual way.
Participation methodology is defined and a list of 80 stakeholders interested in project outcomes is outlined to stay in touch when more results are obtained.
All partners have contributed in the dissemination of the project progress both in social media, in their webs and personally through meetings and conferences.</td><td>Results so far per each expected item are:
a) Printed promotional brochures, roll-ups, leaflets, notice boards, project presentations and canvas for outdoor activities such as agronomic validation.
b) Twitter, Facebook and all partners websites have been used for the generic dissemination (links can be found in the previous section)
c) There have been visits of people from different backgrounds to the plant so they can know more about the whole project and the process of transformation.
d) A Website of the project with different sections and in several languages has been made, with an update with the progress of the project in the different months
e) Members of the team have assisted to technical conferences and info-days sharing the project objectives and the results obtained until the moment of the speech
f) A list of stakeholders has been done distinguishing between the different sectors of interest so the Open forum and other news can be transferred to them.
g) Networking with other life projects; similar projects were identified at the beginning of the project and contact has been maintained with them. Some meetings have also been carried out with very useful outcomes. The detail can be seen in deliverables attached.
h) Networking with non life projects such as TRIS, useful to spread the content of the</td></tr>
</table>

	project and get different opinions from people outside Life. i) Layman report finished.
Evaluation	

- Successes

All promotional activities have been positive for the project, they covered the project different stages and relied on the feedback of ideas that other people gave. A dissemination pack was also delivered, focused in the clear explanation of the business model and the results obtained. In general, the project has received kind feedbacks and the exchange of different point of views and good practices from other projects. Some meetings also led to the possibility of partnering together for future projects to deal with common issues that have been shared during the encounters, widening the focus of the action and boosting the exploitation of the results so far obtained

- Failures

Due to the delay in the procurement of technical results, some dissemination activities were delayed as well to wait for these results to share. Therefore, most of the conferences held were in the latter months of the project, making it impossible to coincide with any conference in Brussels or the celebration of a Forum in Madrid as it was initially expected. Part of the dissemination plan was also impossible to carry out during the last 3 months, and therefore the dissemination Action can not be considered as fully implemented

- Overall

This has been a very important action to promote the different activities and the core of the project to a multitude of audiences allowing a two way exchange from different entities. Actions have also been useful for future contacts in line with the transference of knowledge, with a focus on regional and national scopes.

Action E	PROJECT MANAGEMENT AND MONITORING OF PROJECT PROGRESS
Foreseen in the revised proposal	
Objectives expected	Expected results
The main objective of this action is to plan, organise and control the activities to avoid risks and make sure that objectives are successfully achieved.	a) Minimum delay on schedule. No deviation from the number and quality of the expected results and economic audits b) After LIFE dissemination plan c) Compilation of indicators of the project at the beginning and in the final stages of the project
Achieved	
Objectives Achieved	Results Achieved
All members have shared tasks and responsibilities along the project so in case any of them is not able to execute a task, the outcome of the activities is not jeopardized. Main decisions were made during project meetings (in person) and daily communication is done via e-mail. Beneficiaries are obliged to periodically report costs as specified in the Grant Agreement All beneficiaries are considered to provide relevant information to the coordinating beneficiary in due time before the submission of the reports to the commission and be available with additional information (both in technical and economic parts)	a) Delay in the schedule was caused by an amendment application and administrative issues and not due to a lack of project management issues; in fact efforts were done by all partners to prevent the delays from being greater. Therefore the baseline of the project and its results are still maintained from those initially expected in the proposal. An economic audit was also proposed at the end of the project to ensure right justification for all members of the project b) After Life dissemination plan has been done and it is detailed in deliverable E.2.1. c) Indicators have been gathered in an excel file

	at the beginning, middle and end of the project with a state of play after 3 or 5 years once it is finished. Different parameters have been assessed, mitigation of pollution, production and consumption of resources, indicators on general awareness and economic matters.

Evaluation

- Successes

It is considered that the project communication has been maintained among the different partners of the project; all beneficiaries were engaged with their tasks and willing to provide solutions to the different contingencies that may have been showing up during the project.

- Failures

In some meetings it has been impossible to arrange the schedules of all beneficiaries, so the coordinator has split the meetings at some points to make sure the activities were done by the partners.

- Lesson learned

It is important to rely on partners but also to control that their tasks are being completed on time, a proper communication is important and agree periodic updates of the project even if no relevant events have occurred to anticipate to possible incidents.

- Overall

This project has been through different difficulties, so a good management was crucial to deliver proper results on time and budget.

– Indicate which project results have been immediately visible and which results will only become apparent after a certain time period.

As the most significant result of the project, which is immediately visible, is the pilot plant that has been built up for the treatment of digestate. This plant counts on different units that are intended for performing an extraction, separation and concentration of the digestate. The second result that is visible for the companies dealing with the biogas plant is the requirement of sending their wastes in different periods of time that AEMA told to his clients, according to the "menu" of substrates requirements.

Along with the first point, a visible activity directly involved with the project is the generation of new fertilizers; the products are being moved from one place to another and people is interested in knowing more about the development of these products.

The environmental benefits are not immediately visible but could be noticeable in further years; the reduction of pollution directly involved with the digestate disposal is evident but the decrease in pollution caused by the transportation of digestate, GHG emissions as well as soil/water leaking problems will be shown after years of the implementation of the project.
Once the project has showed the potential benefits of this business model, the impact on environment and society could be exponentially increased.

– If relevant, clearly indicate how a project amendment led to the results achieved and what would have been different if the amendment had not been agreed upon.

The 3rd amendment has implied significant adjustment in the project course; if the partners had not reached an agreement, then the project would have not continued.

Based on the modifications that were thought by the technical people dealing with the project's concerns, the treatment of the pilot plant could be done in a reasonable amount of expenses.

This amendment has brought a lot of work in terms of partnership and technical skills; since the initial equipment necessary for the first treatment proposed was out of budget, a new treatment process had to be designed.

This new process has to be simple and most importantly has to provide the high added value fertilizers that are the key for the new business model.The new amendment was essential to propose a new and more economic treatment process which is inside budget requirements and is also providing the promised products, or else the project would have stopped.

- Describe the results of the replication efforts.

Transferability and replication actions have been oriented to contacting with other biogas plants and sharing LiB proposal and results to see if the products and possibilities are feasible for them as well. Biogas plants across Europe have as one of their main interest to find a profitable way to manage digestate; European policies are becoming stricter on the use of wastes and high nitrate fluids on farming terrains.

This limitation on the use of digestate could develop in a restriction of digestate production and that would mean the end of their biogas plants since there is no other option where to take that digestate.

Another concern for them is the hygienization of the digestate; it is compulsory to treat it with heat and that supposes an extra cost in terms of energy; the most of them do not have energetic surplus since they inject the gas into the grid.

The use of a rigorous menu that controls the production of biogas and future composition of the digestate is an interesting attraction in which most of them will also focus.

As it is defined in deliverable C.3.5 of transference guide, in the three different case studies it is applied the key aspects of the model to assess the technical and economical viability;

- The possibility of modifying inputs and having extra energy
- The suitability of digestate composition to obtain fertilizers
- Possibility of installing a transformation plant for this process
- Economic revenues and expenses derived from the model

Even though there have been important conclusions made on the meetings for the transference guide, more efforts are still to be done in regarding the maintenance of the communication with the different business that have been contacted, which is considered in the After Life task.

- Indicate the effectiveness of the dissemination activities and comment on any major drawbacks.

Dissemination activities have been held by the end of the period once all results and implementation of the process has been considered as definitive.

Since the plant has been raised and the products have been generated, the dissemination activities started (apart from the web, social network, posters and other printed media that was done in advanced).

The participation in congresses and different environments provided a wider contact with technical people and raised interest in the project. During events organized by official entities, different project managers contacted LiB to know more about the project and ask for a personal meeting to debate such an ambitious project and exchange difficulties found in the technical and administrative parts.

- Policy impact

  - Describe project achievements which supported legislation (regional, national, EU):

Nowadays, there are regulations restricting the use of digestate depending on the municipal ordinances. For instance, some landfill directives restrict the use of digestate since it is a product of an anaerobic digestion, whose LER is 190606 thus it is restricted. On the other hand, this material contains animal sub-products so it is also categorized as SANDACH (Animal Sub-products Not Directed to Human Consumption), which is indeed allowed to be used on soil.

Consequently, depending on the regulation, the action of using this digestate is supported or not; there is a regulatory gap which should be covered and consolidated.

Therefore given the difficulty in using this material and the main aim of this project, it can be stated that LiB has contributed in the acceptance of this material by its transformation into a product suitable for the land, with no room for ambiguities. .

According to the policies tackled by LiB approach, the most relevant are the following:

Landfill directive (1991/31/CE): the directive aims to reduce the amount of bio waste sent to landfill by 2020. In this project, we avoided pouring that waste by treating it into the pilot plant.

Nitrate directive (91/676/EEC): aims to reduce and strictly limits the amount of nitrates sent to farms. Thanks to LiB, this can be approached both by the reduction of the amount of nitrogen into the digesters, the recovery of this compound in the form of ammonia during the project and by a promotion of the application of this treated compost instead of the use of raw digestate which has been untreated.

Sludge and soil strategy (86/278/EEC): There is a limitation on the maximum annual quantities of heavy metals to the soil, according to that Directive. In line with this normative and those of fertilizers, LiB project aims to receive wastes that do not contains heavy metals so any point in the process is damaged.

Waste framework directive (2008/98/EC): it encourages the recycling of wastes and promotes the use of environmentally safe materials produced from bio-waste, which is the core of Lib project.

Climate Change Programme (ECCP): LiB project aims to reduce greenhouse gas emissions by the promotion of the use of biogas plants to manage waste safely from the industries.

  - Indicate the main barriers identified and the action(s) undertaken to overcome them:

There were no barriers identified to the accomplishment of legislation in terms of renewable energy and re use of materials since all the project is based on the sustainability of the business model and “closing the loop” in circular economy. However, there are legal restraints in the direct use of the wastes coming from biogas plants specially those including animal sub-products in their inputs and restraints in the market of electricity in Spain.

Indeed, the fact of turning the focus of biogas plants over the production of fertilizers was driven by these policy constraints. The introduction of the product into a regularized market where also a ministry is involved could provide the legal support that is at first debated.

Nevertheless, to mention complications in the sector, it is worth mentioning the lack of awareness of digestate and wastes in general to the farming sector; however this is being solved by a presentation of the product and showing analysis so they can be proven that the product will be safe.

- Describe any policy developments that resulted from your project activities:

Firstly, it is worth mentioning that the project itself is a policy development in terms of a proposal of procedures in order to obtain good management of waste by its use to produce renewable energy and fertilisers allowing nutrient recovery.

An official policy could be suggested in order to propose sustainable and profitable ways to dispose bio-waste and sewage sludge. Also, it would be important that digestate is no longer considered as a waste to ease its utilization as a material for its use as soil amenders.
In spite of the great importance of this point in the future, official terms have not been defined by the project for this purpose at the moment.

- Describe how the project delivered the results foreseen in the Grant Agreement form B3 "EU ADDED VALUE OF THE PROJECT AND ITS ACTIONS". In addition, if in the Grant Agreement Form B1, the project has been labelled as significantly climate related, cover these elements as well.

During the months of performance, the Project has coped with the environmental issues considered and managed to achieve the core objectives of the project and deliver the expected results in line with the mentioned environmental regulations.

The biogas plant at La Vall d'Uixó has been receiving wastes from different sources and introducing it in a determined sequence by asking the providers to distribute their loads according to a calendar developed during this project based on Life in Brief specifications.

After the methanisation, digestate is sent to a container where it starts the treatment process and is then transformed into fertilizers; this way, it is sanitized and valorized during the separation, extraction and further concentration stages.

Furthermore, fertilizers were validated in Fertilizer institutions as well as in zones ceded by the city hall of La Vall d'Uixó, where it has also been disseminated thus future social effects focused in energy and safe waste recovery will be greater. It is worth mentioning that the treatment process has been developed in a way that no streams are rejected, contributing to the implementation of high efficiency processes and zero waste generation in European framework: this way, the loop is closed in the circular economy strategy as it was initially considered.

Life in Brief Project has successfully managed to cover the main activities by which it was labeled significantly climate-related; Firstly, bio waste was arranged into the biogas digesters to undergo a bio-methanisation through Anaerobic Digestion in which the organic matter is transformed into biogas in an optimized way since the substrates were adjusted to maximize biogas production from one side and produce a good digestate from the other side.

Secondly, that digestate is suitable to be recovered as a valuable fertilizer in which the valuable composition is extracted, separated and concentrated to form a marketable fertilizer;

the added value of these products is based firstly on their renewable source, and secondly its essence resides in the organic matter and potassium content, summed up to the suitability for fertigation in the case of the liquid fertilizers. No rejections are generated during their production and last but not least the transformation process runs on renewable energy (see point 6 in section 5.4 of this document).

Nowadays the options to treat these kinds of wastes comprise incineration, composting or land-filling; these imply an expense for the plants apart from being a potential environmental damage. For either reason, the solution of taking bio waste to digesters and obtaining renewable energy has been more interesting rather than the other uses.
For those reasons, it is presumed that GHG emissions are reduced; wastes are no longer in contact with the atmosphere since the methane is stored and transformed into energy. Besides, soil and water stop receiving possible leakages from the disposal of sludge not to forget that by the use of these organic fertilizers, less inorganic fertilizers coming from mineral ores (phosphate rock and leonardite whose obtaining is pollutant and considered as a non-renewable source) are used.

5.3. Analysis of benefits

1. Environmental benefits
    a. Direct / quantitative environmental benefits:
        i. LIFE Environment & Resource Efficiency: e.g. reductions of emissions, energy or resource savings.

Life In Brief Project contributes directly to the environment from different shares; hereinafter they are described following the order as it is described at the environmental impact indicators as well as the KPIs.

Regarding energy efficiency, this project is conceived to propose a waste management that allows the plants to obtain more energy than with regular random inputs and proposes to seize that surplus of energy in the further treatment of digestate output, whose composition will be also optimized by the schedule of inputs for it to be composed of suitable content for the production of fertilizers. The amount of energy recovered to run the plant is a 100%, so the plant runs fully on the renewable energy which has been obtained as a surplus of the plant, with a 24% increase over standard of the production of renewable energy. During the previous months, from 150 up to 190 kW have been obtained per ton of bio waste processed.

In relation to the use of bio-degradable waste for bio-products it is worth mentioning the resource savings, the use of waste as a source of fertilizers implies a recovery of their nutrients that otherwise would be misused. It is estimated that 238 kg urban fertilizers and an amount of 98 kg of agricultural per ton of bio waste is obtained by the use of this project.

With respect to the reduction of emissions, there is a direct effect both in the atmosphere and the soil resulting from the prevention of the disposal of nitrates contained in regular digestate. The water content in digestate is recovered as well so it can be reused, with a recovery of 0.35 tons of water per ton of processed waste.

Those nitrates are limited by the European regulation, and when emitted to the atmosphere it forms NOx which are precursors of acid rain and that can also be translated in CO2 equivalents (13.500kg of CO2 eq reduced during the whole project). Besides, in some cases soil filtration may transport these nitrogen compounds to underground water with negative and persistent effects on ecosystems. Furthermore, the treatment process of Life in brief is intended not to have any secondary products and to recover and reuse the water content in digestate.

Please see Deliverables C.1 and E.3 to see the quantitative values of these specific environmental indicators. In them, it is shown both the objectives set for the project and the actual values that have been obtained in the demo plant, which are deviated (although maintaining the order of magnitude) due to the issues defined in action B2.

b. Qualitative environmental benefits
    i. LIFE Environment & Resource Efficiency: e.g. long term sustainable technology, from product to functional focus, from end-of-pipe to prevention; high visibility for environmental problems and/or solutions; spin-off effect in other environmental areas etc.

Apart from the aforementioned environmental benefits, LiB casts an effect on other environmental areas which are also included in the project strategy.

In line with the resource saving based on the extraction of nutrients contained in waste, this way to utilize the nutrients avoid exploiting standard non-renewable sources of fertilizers. Furthermore, additional benefits could be derived from the results such as the building of biogas plants in areas where the wastes are produced, so the digesters are close to the source and less fuel is used in the transportation of these materials.

Likewise, application fields (crop fields, urban areas etc.) could be close to the biogas plants so the fertilizer obtained at the plant can be used in adjacent plots with the least consumption of fuels. Based on results of the business model there will be more investors interested in participating in this sustainable activity.

2. Economic benefits (e.g. cost savings and/or business opportunities with new technology etc., regional development, cost reductions or revenues in other sectors); state the number of full time equivalent (FTE) jobs created, showing a breakdown in qualified/non-qualified staff.

Economic benefits of this Project are the key for this project to succeed, according to the economic balance (See deliverable C.3.4):

- Costs savings in digestate management (from 10€/ton upwards)
- Cost savings in transportation expenses of fertilizers
- Revenues by the sales of the four types of fertilizers (up to 180€/ton)
- Exploiting spare energy (in the case of some plants)
- Revenues/savings for fertilizer companies or city halls for the use of a territorial products as they would benefit from a reasonable price compared to general providers
- Number of jobs in a plant can rise up to 6 trained people to operate a large plant; at least 4 non-qualified and at least 2 qualified to manage the plant. Not considering the qualified technicians necessary to do the engineering and non-qualified for the construction actions.

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

Through results it can be found in the final socio-economic deliverable (see deliverable C.2.1.) the results from stakeholder's feedback used to quantitatively assess these benefits. It is expected a positive impact in job creation and social awareness by the understanding of the benefits of using fertilizers from renewable sources, considering the different sectors involved.

Besides, this model looks for an enhancement in environmental issues from two points of view; the management of input wastes and the transformation of digestion waste (digestate), which translates into health improvement and by the synergies of the project with the urban garden, and people using these fertilizers could be more aware of recycling and the impact of wastes and circular economy in everyone's life. Apart from the mentioned in the previous segment, there is an initiative set by La Vall d'Uixó city hall which consists in letting people

in needs to have their piece of field so they can use it to grow their plants in an urban garden environment which is helpful for them to integrate and promote their wellbeing.

4. Replicability, transferability, cooperation: Potential for technical and commercial application (transferability, economic feasibility - bankability, limiting factors, suitability for additional funding from other streams e.g. structural funds, EIB financial instruments, venture capitals, pension funds, responsible investors) including cost-effectiveness compared to other solutions, benefits for stakeholders, drivers and obstacles for transfer, market conditions, pressure from the public, potential degree of geographical dispersion, specific target group information, high project visibility (eye-catchers), potential for replication in same and other sectors at the local and EU levels, etc. State the project's likelihood of replication (high/low/zero), and if its replication is market-driven or policy-dependant. Specification of potential market/replication vehicles. Possibilities for complementarity with existing market players and/or other solutions/projects (bundling).

Along with this subject, a preparation of a guide was foreseen so as to transfer the new business model, as well as other data collected at deliverables of action C.3.Application of the project both in commercial and technical view is clear; the engineering solution can be employed in different plants, making it possible to widespread its reach. Regarding commercial application, it can be stated than both for the biogas plants and fertilizer companies, revenues can be incremented both from the sale of fertilizer and for the saving in digestate management/ raw material cost.

Economic feasibility is detailed in the economic study, deliverable C.3.4, and a part in the second point of this section. Considering the different mass/energy balances and the different inputs and outputs an assessment for small, medium and large companies is done. Related to this economic feasibility, drivers and obstacles can be mentioned; as promoters, it has to be mentioned the necessity of proposing alternatives to digestate treatment since legislation is increasing constraints in this regard.

Also, limited resources for the production of fertilizers and the increasing demand of organic ones act as a supporter of this model. Besides, based on contact made with the different companies and the forecast of biogas associations, the use of raw digestate as manure is becoming more and more limited by some countries so it is crucial to have alternatives for its disposal in the mid-short term. LiB technical proposal offers a compact process design for the treatment of this digestate into a safe product that can be even sold, so it is highly desirable for the rest of the biogas plants.

Among the obstacles, it should be considered those legislatives (in some countries it is harder to use digestate as raw material), technical (space available, energy availability, possibility of modifying inputs etc.) and economic (such as the cost of digestate management, the prices of fertilizers or the future acceptance of customers).The size of the plants can also be an issue, since the model is much more profitable for those larger plants than for the small ones, due to the economy scale and energy consumption of the equipment related to the production.

Lastly, it can be stated that the likelihood of replicability is very high since the whole model can be adapted to any biogas plant, as long as the economic balance is positive, its replication is great part policy dependent since there are stricter regulations and also market driven, since this project is proposed as a profitable business model.

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 practice measures for LiB involve different topics which can be divided in different categories or actions; First technological action to be taken into account is the new method proposed to treat the digestate, which uses clean technologies with zero leftovers and is run with renewable energy. Second action would be the waste management which is focused on the arrangement of inputs in the digesters so the composition is optimized both to produce more biogas and to obtain an appropriate raw material for its transformation into fertilizers.

On the other hand, there are also measures focused on the biogas plant staff (and also in not-involved people) awareness and training on the process to enhance the foundations of the project. Staff would be encouraged to contribute with their ideas on process optimization and would be coached to collaborate on green practices.

Besides, it is also important to consider a constant stakeholder dialogue; this is achieved by being open to the public through websites, forums, providing information to media etc. and an upload of the news and technical progress on the topic that is being acquired. This is closely related to the dissemination and networking actions done at action D.

It is important to continue working in those actions in After Life to consolidate the best practices and keep recommending environmental measures to facilitate an effective sharing of experiences. This would provide a basis to proceed on the improvement of environmental performance when it comes to bio-waste management, eco-energy production and resource saving.

All in all, the whole project looks for a promotion of environmental-friendly procedures within biogas and waste management sectors.

6. Innovation and demonstration value: Describe the level of innovation, demonstration value added by EU funding at the national and international levels (including technology, processes, methods & tools, nature management methods, models for stakeholder involvement, land stewardship models, organisational & co-operational aspects).

The key innovative aspects of LiB lie in different items;

- Implementation of a waste management model that allows the procurement of energy, recovery of nutrients and prevents improper disposal of these materials
- Development of a timetable for the input of bio-wastes entering biogas plants, that allow to increase their production and obtain a digestate suitable as raw material for fertilizer; this involves also organisational concepts: Agreements with waste provider companies and the subsequent homogenization of the overall composition, thus involving a co-operative chain.
- Transformation process that uses a combination of mature technology to obtain different types of fertilizers with no rejections and using renewable energy/resources.
- Focus on the recovery of organic nutrients (FA/HA) with the extra of having inorganic K in the final composition.
- Extra value for the fact of being suitable for fertigation, since they do not collapse irrigation heads and concentrated enough to reduce transportation costs (FL1, FL2).
- The only sub-product of the plant is high quality water, which can be used in the process itself

Demonstration value has been proved by the validation of all fertilizer products in different environments, even involving public local figures for the task; Products are safe and suitable to be used in different crops. Besides, by changing concentration factors and by the formulation/addition of extras, composition can be modified in the process. Products have shown a positive performance; comparable to conventional fertilizers

The model involves different sectors, an economic study and a transference guide to promote its spreading and allow its economic feasibility. Different stakeholders, as enumerated in action D, have shown interest in the project development, to help and make sure that legal and technical requirements fit their expectations.

7. Policy implications: Indicate any important achieved targets contributing to the future implementation, design or take-up of regional, national or European legislation.
   Please highlight any potential unintended impacts, bottlenecks or barriers to the implementation of your project due to regional, national or European legislation including recommended actions further to actions already taken to overcome these barriers.

By the development of an innovative waste management system and recovery process LiB is considered to promote the sustainable development and to provide solutions to actual environmental problems.

The use of the resulting sludge from AD is controlled by EU legislation in most of European countries with limits on its composition. Several organizations have been striving for the acceptance and spreading of this material in the agronomic sector with some progress made in the past two years. However, official procedures are not quick enough and there is room for improvement in terms of the development of reliable and cost-efficient methodologies to transform the digestate according to the legal requirements.

Regulations are necessary to control the requirements and environmentally compatible use of fertilizers; Treaty of Lisbon entered in 2009 and allowed the free movement of fertilizer among borders. However, to commercialize fertilizers the local regulations ought to be followed, which difficulties the marketing across EU. In this sense, amendments should be done; currently EU fertilizer regulations are under revision to harmonize these rules, but no target dates are exposed.

To mention a barrier for the project development, in line with fertilizer regulation on composition, it has to be mentioned that the fact of framing products like treated digestate in strict boundaries makes it harder to categorise it as such. Minimum requirements should be modified to ease the inclusion of renewable sources as raw materials for fertilizers.

There are limited arable land zones, this implies that digestate has to compete with animal manure to be spread. This forces biogas plants to further treat digestate to be able to export it so as to prevent further nitrogen concentration in soils and aquifers; this project is favoured by this legislation implementations, as LiB provide solutions for it.

LiB is closely associated to the Waste Framework Directive: this Directive foresees in its article 22 specific provisions to encourage the treatment of bio-waste following the waste treatment hierarchy by promoting separate collection with a view to the composting and digestion, stimulating the use of environmentally safe materials (e.g. composts or fertilizers) produced from bio-waste.

Apart from legal barriers, difficulties have also been envisaged respecting to the lack of information among traditional agricultural sectors, which still consider digestate an unsafe

fertilizer to apply in their fields so they are reluctant to its use. Therefore, recommended further actions with this purpose is to provide this sector the proper information regarding digestate by means of publications in specialized journals, speeches, personal talks etc.

As an unexpected and potential impact of the agronomic validation of this project, is that the use of these fertilizers by official entities (such as city hall) in urban/agricultural areas aids the announcement of these products and provide a sense of reliability that will be highly appreciated in future market tasks.

Summing-up, this LIFE project is willing to cooperate in the development and implementation of EU environmental policy in terms of clean technologies, waste management, renewable fertilizer production and energy efficiency.

6. Annexes

4.1. Deliverable list

Task	Name of the deliverable	Beneficiary
A1.1	Detailed timetable of feed products in digesters	AIDIMME
	Description of LVDU Biogas plant, input quality requirements and schedule for the digester.	
A1.2	Digestate sampling plan and results	AIDIMME
	Review on digestate state of the art, description of the new methodology of bio-waste and sludge management, initial sampling and results on LVDU plant. Range of digestate accepted technical parameters and plant design based on the data collected.	
A1.3	Manual of the demo plant including: - Technical specifications of the units and hydraulic diagrams	AIDIMME
	Definition of the process units, technical specifications of the equipment and HMI control as well as protocols to proceed. Includes a P&ID diagram of the plant and specific manuals.	
B1.1	Protocols comprising operational indicators	LUDAN
	Procedures for the correct performance of the different equipment in the plant.	
B1.2	Photos and videos showing built prototype	LUDAN
	Pictures of the construction, installation and operation of the pilot plant.	
B2.1	Guideline of the operational, maintenance, emergency and risks of the prototype demo plant	LUDAN
	Operation, maintenance and risk considerations for a safe operation of the plant.	
B2.2	Start-up protocol of the prototype demo plant	AIDIMME
	Steps taken and key learnings during the first stages in the digestate treatment. Mass and energy balances included.	
B2.3	Design of experiments for the demonstration tests	AIDIMME
	Statistical review, selection of software, factors and parameters and definition of the tests to run so as to study the best performance of the system.	
B2.4	Report of results and discussion of the different demo tests	AIDIMME
	Step by step selection of the best operation mode given by the software-based on the results of the run tests.	
B3.3	Report of FINAL results of agronomic validation of agricultural fertilizers	COMPO/FORNERS
	Report on the validation of fertilizers FL1 (Forners) and FS2	

	(Compo) and analysis	
B3.4	Report of FINAL results of agronomic validation of urban fertilizers	COMPO/FORNERS
	Report on the validation of FL2 (Forners) and FS1 (Compo) at City Hall concessions and analysis	
C1.2	Report 2 on environmental impact of the proposal and comparison with the initial status	AIDIMME
	Collection of data assessment on the initial and final state of the project dealing with the main environmental problems targeted	
C2.1	Report on socio-economic impact	AIDIMME/ALL
	Assessment of the positive and negative impacts of the different sectors affected by the project based on stakeholders feedback.	
C3.1	Legislative study (about uses allowed and limitation of bio-wastes)	AIDIMME
	Overview of national and European legislation; regulatory framework for digestate and approach of the use of digestate as a fertilizer	
C3.2	Biogas plants requirements	AIDIMME
	Review on the trends and segmentation in biogas sector, digestate use and its challenges, statistics, treatments, barriers and future perspectives	
C3.3	Cataloguing rule for fertilizers	COMPO/FORNERS
	National classification options for LiB fertilizers as well as European legislation for its registration.	
C3.4	Economical study	LUDAN/AIDIMME
	Study of the effect on size for the business model, revenues, cost and benefit analysis, risk and strategies for the model and a balance sheet with all considerations.	
C3.5	Public/Private Transference Guide	LUDAN/AIDIMME
	Preparation of premises and minimum requirements to transfer the business model to other companies. It includes three case studies on real biogas plants and conclusions over their possibilities based on technical and economical considerations.	
D1.1	Dissemination pack v1. brochure, presentations, promotional website	AIDIMME
D1.2	Dissemination pack v2: updated presentation. Video, technical separatas	AIDIMME
D1.3	Final report on dissemination activities	ALL
D2.1	Project Website	AIDIMME
D3.1	Participation methodology	AIDIMME
	Set of the mechanisms to get a balanced effective	

	implementation of LiB solution on the demo phase with the regional and national scopes as references	
D3.2	Global view of the stakeholders on the LIFE IN BRIEF approach. Summary of key contributions to the Deliverables. Minutes of the open forums	AIDIMME
D4.1	Networking report	AIDIMME
	Description of the contact with other agents from projects with compatible situations, detail on the good practices exchanges and conclusions.	
D5	Layman report (hardcopy and digital)	AIDIMME
E	Progress Report	ALL
E1	Management procedures	AIDIMME
	Description of management system and operative procedures to deliver the actions on time, budget and scope	
E	Mid-Term Report	ALL
E2.1	Definition of the LIFE in BRIEF AFTER LIFE communication plan.	AIDIMME
E3.2	Final Indicators Table	ALL
	Collection on indicator and parameters to assess the impact in initial, mid-term, final and in future situation. Parameters are related to the environmental and economical impact.	
E	Final Report	AIDIMME

4.2. Process and products at demo plant

Below it is shown a diagram of the final process which has been set at the pilot plant for the production of fertilizers during the project demo phase.

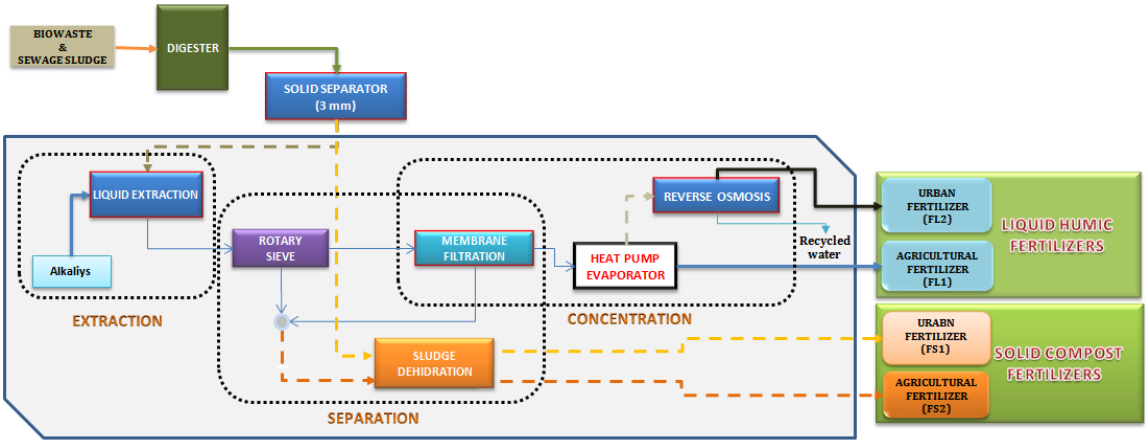

Figure 25. Block diagram of the process at LiB plant

The products obtained in the plant, their characteristics and their nomenclature, are the following:

FS1: Urban Solid Fertilizer. It is the 1st solid fertilizer obtained in the plant. It is the dehydrated part of the solid phase resulting from the first solid separator; it has not undergone the extraction process. It is categorized as an urban fertilizer since its content in nutrients is not high enough to be considered an agricultural product.
FS2: Agricultural Solid Fertilizer. It is the 2nd solid fertilizer obtained in the plant. It is the dehydrated part of the solid phase resulting from the mixture of solid particles of the rotary sieve and the concentrated part which has not been permeated at the membrane phase.
FL1: Agricultural liquid Fertilizer. It is the 1st liquid fertilizer in the process, containing FA/HA, it is obtained from the concentrated part of the evaporator whose feed is the permeate of the membrane. The concentration factor resulting in the percentage of nutrients of this product can be modified by the retention time inside this equipment.
FL2: Urban Liquid fertilizer. It is the 2nd liquid fertilizer obtained, and it is obtained from the distilled stream of the evaporation stage, since the concentration in nutrients was initially not too high, this part is concentrated in the reverse osmosis equipment.

Percentages of production, for a membrane CF=5 and an evaporator CF=8 are:

FS1	FS2	FL1	FL2		
2.1	3.1	7.6	13.3		
SOLID FERTIL.		LIQUID FERTIL.		RO WATER	EVAP WATER
5 %		21 %		40 %	34 %