Photovoltaic Solar-Powered Modular Regeneration Waste Water System for obtaining Multipurpose Reused Water Quality Ranges and its Reinjection in the Productive Cycle.

CircSolarRegen

1. Excellence

1.1 Objectives

- To build a photovoltaic large scale demonstrative engine in an existing waste water treatment plant of the Valencian region (about 65.000 to 100.000 habitants, 3,5Hm^3/year capacity) for regenerating waste waters including the removal of CEC's. Aim: a) reuse at least 75% of regenerated water, b)obtain at least 50 to 65% energy requirements by photovoltaic solar power for regeneration process, and at least 50% for former WWTP.
- To obtain a ***variable*** water output with different levels of quality (quality reference, *see page 6*) which will meet the criteria to be used in the following applications: from *urban bucket water*; *Irrigation in urban gardens,* a*griculture irrigation, environmental applications* (such a refill of aquifers), to *animal industry* and even for *food industry* and *human consumption*. Offering at least 50% reinjection in productive cycles.
- Offer a real water effluents essay facilities centre with a monitoring centre that allows an applicability test bench for new emergent pollutants and micro-pollutants abatement technologies.
- Get knowledge and field experience that could be used to offer technical and ***viability studies*** for UE regulations for water reuse.
- Increase significantly the participation of the economic and social sectors in the water governance (network platform).
- Inclusion, ressourcement or participation in European frameworks, platforms and clusters

1.2 Relation to the work programme

This project framed in the topic "*CIRC-02-2016-2017: Water in the context of the circular economy"*, fits requirements of the cross-cutting Call -*Industry 2020 in the circular economy* of the *WP 2016-2017*

In first instance, this proposal is born directly from the collaboration between the Regional Government (Generalitat Valenciana -water management board-), the Polytechnic University of Valencia, UJI, Alicante University, their international partners and other stakeholders from the private sector (agriculture and industry). This multi-actor perspective, has the aim to give a step forward in economically, technically and environmentally integrated solution approach to unlock some technical and regulatory barriers that difficult innovative solutions which would allow the real water resource ***re-circulation***, achieving the political and legislative objectives related with water reuse.

As a requirement of the systemic approach that is the global concept of this project, the proposal include the experience and lessons learned along the years by all the members of the development team, from a special regard of a Regional Government of a very hydric depressed area. They all participate in a holistic view of each steps of the ***water value chain*** . This project will also offer the use of regenerated water's quantitative viability costs as a *self*-added value in the value chains of consumption and production patterns. Also, the Regional Government of Valencian Region that has a firm commitment with Green Public Procurement **(GPP)**, is drafting and fostering a range of measures for compliance with the criteria of *Green Procurement* -Buy green-, *Public procurement for a better environment" (COM (2008) 400*) under the *Sustainable Consumption and Production and Sustainable Industrial Policy (SCP/SIP) Action Plan.*

Moreover, after its implication in almost all of the **7th EAP priorities (2,3,6,7,8,9)** the Regional government encourage and *help* partners (through the local responsible of RIS3), concretely SMEs involved, to transfer and replicate knowledge and technology acquired in the Project. In the same way it contributes to the capacity for placing not only the final results, but every modular and adaptable parts, into market (IVACE for PPP's), creating not only wealth but also contributing in sustainability of jobs as new creation of ones. Indeed, this system shall be able to be implemented wherever in the EU have to treat a wide range of flow and a great variety of pollutants, amplifying its self-replicability.

Additionally, reducing the price of the treatment for a high quality water, by the use of the solar energy, it´s expected, as the abatement of economic final prices of water is concerned, to be able to make better economic proposition comparing the economically justified, cost-effective and financially feasible conditions. The economic appraisal (EA) based on ***integrated*** (transmission, ***treatment***, and distribution of fresh water, *The wealth of waste, the economics of wastewater use in agriculture, FAO water report 2010, Roma*) cost-benefit framework shall be developed and further studies related to the return of the investment will be integrated in a viability plan.

The proposal, involves the implementation of a modular system concept for water regeneration, which could be a final step after a regular WWTP that shall increase the quality of the water to make it valuable for different uses. It is well known that others more environmentally friendly water remediation systems does exist, but their applicability are not, in the actual state of art, useful for such flows, volumes or near direct reuse of regenerated waters (phytoremediation, green filters, etc..). The proposed system will also take in account the partial recovery of valuable compounds, N-P loads, and materials, such as metals concentration. Like so, it will help to complete the strengthening of circular economy for several resources.

Facing the future natural enforcement of EU legislation, a part of the implementation's site of this project, will allow some facilities for research and innovation tasks linked to the experimentation with real waste water regeneration projects or water reuse systems improvement. Strengthening particularly the position of EU as a front runner in I*nnovative Circular Economy* of water, this project will boost economic growth and industrial capacities in a world of which water is a finite resource. Furthermore, through the DMP, the complete information and integrated knowledge produced will be offered in open source data through the pilot *Open Data Research Programme,* including the economical, social technical and scientific data, its handling and respective methodologies.

From the regard of the ***roadmap for circular economy strategy*** (04/2015) to the report ***On the implementation of the Circular Economy Action Plan***, Brussels, 26.1.2017 COM(2017) 33 final), this project, due to its morphology, returns to water a substantial part of its initial value, as well it provides to scarcity affected populations, safe, available and affordable, while ensuring sufficient water for the environment.

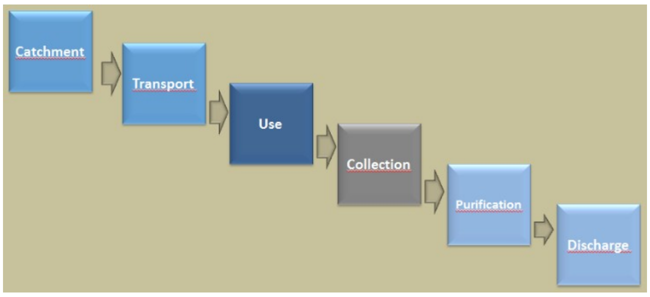
It is well known that many water reuse projects of former or current calls exists (technology, health, quality, agriculture, industry, pilots concerned, about 800 current and formers). With clarifying purpose, some H2020 calls are followed with great interest to propose possible synergies development (*Greening the economy, Sustainable food security, Rural renaissance, and of course,* the coordination and support action*: Policy support for Industry2020 in the circular economy* and its projects). From the point of view of non-overlapping bottom-up expected applicability *criteria*, the use of the respective innovation centres and networks of the partnership is fundamental in the definition of the best open adaptive solutions. Moreover, the coordinator, the Regional Government, has very close contact with the multidisciplinary teams of the Research Centres envolved in this project, and has the firm intention to give continuity to this project (*Ie*: innovation deal agreements) creating a guiding thread as concequence of the applicated produced knowledge, giving reproducibility and continuity trasnference force beyond the project lifetime. For this purpose, the project coordinator has iniciated contacts to participate in European Technology Platforms (WssTP, water is concerned, ETP-Alice as supply chain management is concerned, PhotoVoltaic), and offered sinergies to frameworks as FRAME *A novel Framework to Assess and Manage contaminants of Emerging concern in indirect potable reuse*, and ICT4water (cluster). During the developpement of the projec,t it is expected to explore and enable interactions through some KIC's (Climate-KIC, KIC InnoEnergy). The close firm of the JDI of the *Sustainable wastewater treatment using innovative anaerobic membrane bioreactors technology (AnMBR),* is an example of these proposed activities.

Finaly, as funding complements or follow up ressources to the main project, the applying for several other funds from the EC are planned: a)*Interreg Sudoe*, to make a comparison and effectiveness with others regions between different water reuse solutions of WWT, b)*Urban Innovative Actions*, for closing the gap of the water *mouvements* and the re-introduction infraestructures, including monitoing systems for environmental quality of reused water, c)*Interreg Europe*, to work in policy learning tasks for the improvement of the related regulations to this approach (contribution to *Regulation on minimum quality requirements for reused water in agricultural irrigation and aquifer recharge*, *EU-level instrument of Water reuse, etc..,* or suporting with real data the implementation of some not yet answered questions (*Optimizing Water reuse in UE - final repport*, *DG ENV-*, *Guidelines on Integrating Water Reuse into Water Planning and Management in the context of the WFD*, *10th June 2016*), d) Particularely, due to the envolvement of Regional Governememt, an *Integrated Project type of LIFE program* will embrace some more specific environmental problems. As other public funds, which could be of interest for the continuation of the project, are the Commitment of Regional Governement Budgets headings planned for water management issues and R&D that include about 60M € lines in four years. A direct acces to State budget and FEDER acces funds lines are also dirctely manadged by transferred conpetency to Regional Governement. The viability demostration of this system will allow the acces to infraestrucural remodeling funds.

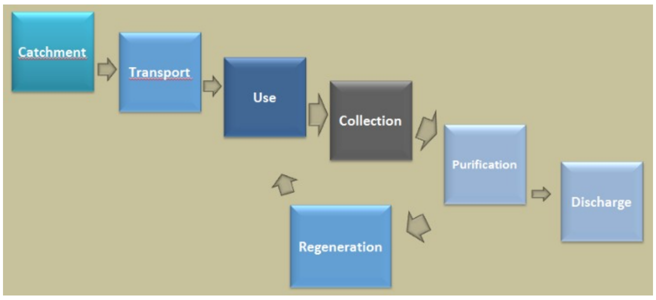
1.3 Concept and Methodology

1.3.1 Concept

The partial or complete closing of water cycles is an essential part of sustainable water resources management and a crutial fight against the increasing scarcity of human quality water consumption (It is expected that by 2030, water stress and scarcity will affect half of the European water basins, *European Commission, 2012, Blueprint, European Commission, SWD(2012)380, Report on the review of the European Water Scarcity and Droughts Policy*). One of the options consist in the increase of the reuse of water for multi-purposes, especially for industrial and agro/food production activities, and, of course, for human consumption. While the costs of end of pipe solutions may be reduced by stronger controls on primary effluents waters, currently, the waste water treatment systems are receiving not only wellknowed contaminants, but also the called emergents contaminats. The other limitant factor is the in-out detection level of those contaminats and the “on the fly modularity” of treatment's pertinents costs fitting for the removal of those components. These techical barriers, characterisation, efficient depurations techniques, transport, are often merely focused on clasical costs models. Obviously, reuse is already a key part of water management in Europe but several technical and regulatory issues remain to be addressed to make sure it has no undesirable impact on the environment or on public health. In addition, safe reuse practices require good practice, water quality guidelines and appropriate training. This project will contribute to offer real scale technical and economical feasability studies and practices to overcome bottlenecks in water reuse.



Old Approach



New Approach

The purpose of this demostrative project is to build a ***solar empowered***, robust large scale, well-fitted, end-effluent facility modular system for waste water treatment, that lead to an effective and selective reuse of water in a hydric depleted zone. This station shall be conceived with the real factible purpose of the ***reuse and reinyection*** in urban or industrial productive system in compliance with the actual more restrictive national and EU legislation **(*Quality is understood as set in Water Framework Directive (2000/60/CE); Directive 98/83/CE modified by Directive 2015/1787; Directive 75/440/CE; and further regulations such as the initiative “Minimum quality requirements for reused water in the EU” (new EU legislation)***; ***Royal Decree 1620/2007 from the Spanish government)***. It would be take in some consideration the operative and Best Available Techniques Reference Documents (BREFs) prospected cascade tecnnologies for CEC´s too ***(****PS and CEC's list at* ***JRC Technical repport, Development of the***

first* Watch List *under the Environmental Quality Standards, Directive Directive 2008/105/EC, as amended by Directive 2013/39/EU, in the field of water policy, DIRECTIVE 2008/105/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 16 December 2008 on environmental quality standards in the field of water policy, amending and subsequently repealing Council Directives 82/176/EEC, 83/513/EEC, 84/156/EEC, 84/491/EEC, 86/280/EEC and amending Directive 2000/60/EC of the European Parliament and of the Council). The continuous or semi continuous data samplers will provide reliable data for the automatized, or at least a help to a rapid decision making, well-fitted operation's costs. ***The core realization*** is an actual state of art WWT modular system for reuse of WW for urban and produtive sectors, empowered by optimized ***photovoltaic solar energy***, which could provide an energy complement to the clasical WWTP. The ***TRL's 4*** to *7* component's part soft of this project have to be integrated in a unique, scalable, robust and transferible system that will be use as referent for reuse of WW. Due to the quick advances of the technologies, this project has also the ambition to offer a "on the field" essays site pilots testing bench for continuous improvements of new WWT for water reuse, detection, characterisation and monitoring methods.

The proposed regeneration system is presented with the capability to "choose" the treatment that water will receive *"for what use?"*. A near-continuous characterisation and monitoring station at the end of the traditional WWTP, shall improve the water treatment ways. The system will be able "to choose" the best treatment ways in the relation of found pollutants. A decision-making assistance software (DmaS) or decision support system (DSS) will adapt the best treatment to remove the detected pollutants, with a special regard to CEC's. In a second stage, more sensors will link the system to the monitoring station by the use of the "internet of the things", providing a constant flow of data for the optimization. In the same way, at the end of the system, the second part of the monitoring system will analyze the effectiveness of the treatment and will be used as a warning system to aware of possible environmental and health risks.

The inclusion of social, governance and economic stakeholders, that have participated since the conceptual idea in the process of development of the Project, noticeably increase the expectance and probability to establish at regional level, an interactive network or platform of the different stakeholders interested on the use of regenerated waters. An aimed aspect, as direct consequence of the project, is the use of this platform to allow the productive sectors (industrial, agricultural, etc..) to express the good quality water supply needing and requirements. That tool should be able to offer a good instrument for decision making at regional level, as an equitable use of water is concerned. Besides the feedback or integration of the stakeholders needs, the treatment conditions of the system should be adapted to satisfy the end-user. This feedbacked exploitation modular conditions will also fit the operative cost and lengthen the lifetime of the system.

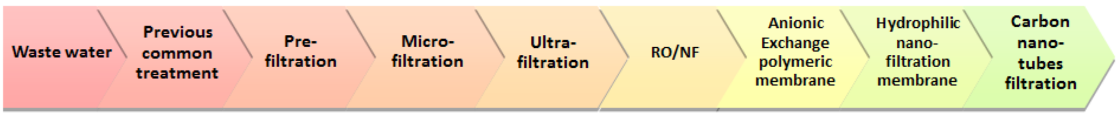
Throughout the course of this project, an exhaustive financial viability study will be achieved. When new facilities are planned, it is necessary to predict the operation and maintenance costs of water reclamation plants. Not only total costs are important but also the relationship between costs and the quality of the water for each water regeneration process. It is fundamental that pricing for reused water also takes the cost recovery principle into account. Otherwise, regenerated water never will be competitive. The inclusion of externality charges in regenerated water is very difficult because these externalities are often unperceived by society. Therefore, it will be essential to develop public awareness campaigns about the true cost and benefits of both sources of water, and the quantified costs of "***do nothing***". In spite of, financial instruments and mapping feasible business models, financial and non-financial values to water reuse will be integrated as another essential ***core realization*** through all the project.

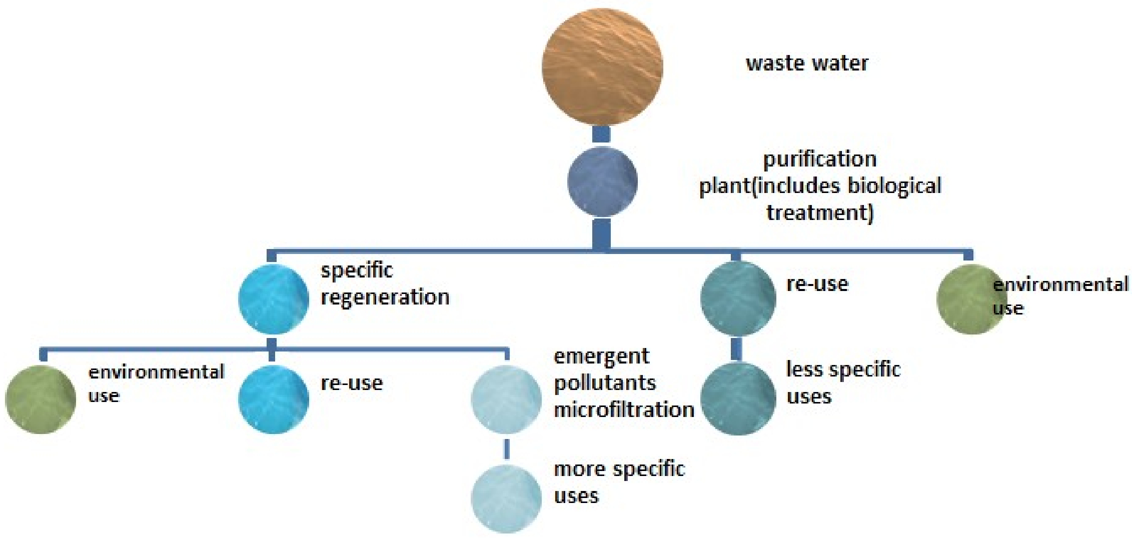
The international expert boards, as well as the national ones, -*Spain has a large experience on water reuse*-, as by example the Eusko Jaurlaritz (EHU), Universidad Rey Juan Carlos (URJC), Universidad de Barcelona (UB), Aalborg Universitet, and of course UPV and UV for some concern, Universidad Nova de Lisboa (UNL), and others universities (University of Zagreb, Istambul Technical University, Jahangirnagar University, Hokkaido University) and Research Intitutes (health, membranes, biotechnology, chemical engineering, environmental sciences), is extremely large. This modular project, through an open scheme, is opened to contributions of all of them.

1.3.2 Methodology

One of the most difficult aspects of planning and designing a reuse scheme is the identification as the need of the level of treatment as the choice of treatment technology. A design and implementation of an under-performing treatment system could lead to unacceptable or unreliable reuse of water. The movement (distribution or storage) of *cleaned* waters is also a problem. So it is necessary to find a location for those reuse treatment plants, by itself expensive yet, that don't overrun the costs of the treatment. Thus, the economic viability of water reuse schemes not only depends on technological capabilities o costs. However, according to the EEA DPSIR *(Driving force, Pressure, State, Impact and Water Response)* assessment framework, this project is aimed to build and calculate viability assumptions from some real concatenated technological responses at the anthropogenic driving forces as beginning and end of the water cycle.

In first instance, the proposed system will be integrated in a WWTP as follow. Increasing abatement ratios of CEC's will be offer at end-pipe outflow.





Reuse pathway overview proposed scheme

Focussing on the best possible quality of regenerated water (CEC's removal), according to the properties (porosity, electrical charge) of the used membrane, there are four pressure-driven membrane processes: Microfiltration (MF) Ultrafiltration (UF) Reverse Osmosis (RO) and Nanofiltration (NF).

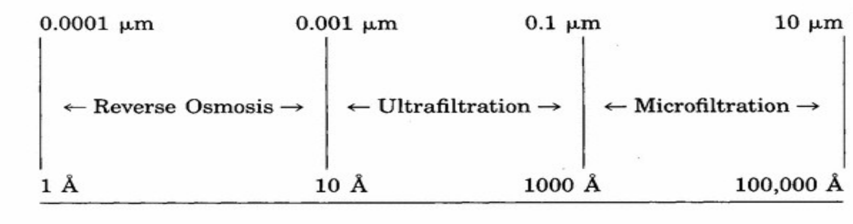
Moreover, this project will include the Activated Carbons (ACs) filters.

Moreover, some filtration process can be addressed to retain some specific elements. The use of these technics in cascade enables the decision maker to choose the water quality. The different steps of this procedure are explained below.

The following technologies have been used alone for a CEC'S large spectrum removal, but their use is sometimes restricted due to high cost. This new approach includes the use of solar energy as an environmentally and economically sustainable source of power that will supply electricity not only to the regeneration process but also to the normal WWT processes of the WWT plant where this system will be installed.

5 Most usual membrane configurations

- Hollow Fibre, Spiral-wound, Plate and Frame, Plated Filter Cartridge, Tubular



Regeneration modules

Prefiltration: membranes with porous larger than 20 µm

Microfiltration: this stage retains particles from 0.1 to 20 µm and a molecular weight until 500.000 which includes some large organic molecules, bacteria and suspended solids. The membrane is made of a polymeric material such as polysulfone, cellulose acetates, polyamides, PVDF, PTFE, polycarbonates or olefins.

Ultrafiltration: In this stage molecules with a molecular weight of 1000 to 500 000 are removed in a filtration process performed with pressure f from 1 to 6 bar. The membrane for ultrafiltration is made of cross-linked regenerated cellulose acetate. The membrane I Asymetrix with a thin skin layer and a larger layer with the function to give physical resistance.

Reverse Osmosis/Nano-filtration: The basic difference between an NF and a RO membrane is in their rejection of ions. It is typical or NF membranes to reject almost completely di- and multivalent ions, with the retention of univalent ions being less than 70%. The rejection of different ions by a RO membrane varies less, and is mostly governed by the ions' hydrated size. In the case of organic molecules, there is no clear boundary between the rejections of nanofiltration and reverse osmosis membranes. For this project, nano-filtration process (approximately 0.5–2 nm of pore size) will be contemplate, in spite of reverse osmosis (approximately 0.2–1.0 nm of pore size), because its proprieties are better adequate to the requirements.

Anionic exchange polymeric membranes: Adsorbent membrane with amino groups that presents bifunctional proprieties adsorbing cationic and anionic compounds. Are especially useful for removing heavy metal pollutants that can´t be retained by previous treatments.

Hydrophilic nano-filtration membranes: These membranes are made of asymmetric poly-heterosulfone. Its special configurations enables these membranes to remove pharmaceuticals compounds. It avoids the discharge of water with significant concentrations of products which can carry out several hazards for humans and to the environment. Specially, the removal of antibiotics as amoxicillin will prevent the creation of antimicrobial resistances, one of the most important threats for the current health planning.

Carbon nano-tubes filtration : As a final stage, for waters requiring the best quality possible, will be used the carbon nano-tubes filtration. CNTs have an exceptional sorption capability and interesting sorption efficiency due to their high surface active site to volume ratio and controlled pore size distribution, compared to conventional granular and powder activated carbon]. CNTs show adsorption capability and high adsorption efficiency for removal of organic pollutants like 1, 2-dichlorobenzene, trihalomethanes, n-nonane, and carbon tetrachloride (CCl_4), heavy metals (e.g., Cu^{2+}, Pb^{2+}, Cd^{2+}, and

Zn2+) such as oxidized CNTs with H2O2, KMnO4, and HNO3 from water, fluoride adsorbed from water by amorphous Al2O3 supported on carbon nanotubes (Al2O3/CNTs). Nano-tubes present a form of pure carbon with diameter in nanometres, length in microns and are perfectly straight tubules. The walls of these tubes are made of a hexagonal lattice of carbon atoms and capped by fullerene like structures. The unique structure of CNTs can be divided mainly into multi-walled carbon nanotubes.

<u>Detection and DSS</u>

Automated mass-spectrometry, automated chromatographic methods, automated waste water samplers as their integrated calibration, detection and frequency software are "commonly" used. The information outputs in a DSS integrated system are comtemplated as part of typical wwt and regeneration plant. A fitting to the CEC's detection is are contemplated as a basic requirement. *Contamination Sensor Based on an Array of Microfibers with Nanoscale-Structured Film* shall be one of the first key enabling technology tested.

<u>Energy position.</u>

The first estimation of energy requirements of the photovoltaic power system are estimated in 100Kw/h, for covering both the energetical needs of the diurnal wwtp and regenerations cascade systems for the expected 50% of water regeneration ratio of 3,5 Hm^3/year. Taking wellfitted photovoltaics panels surface requirements are about 500 m2. This will avoid as first approximation the emission between 400 and 600TCO2/year emissions (total emissions model or total footprint models).

In the next figures TRL, and a preview of workpackages are showed.

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TRL and Work Packages

<u>*1.4 Ambitions.*</u>

Born as a one more step of a chain of investment in the water sector located in this area, one of the most important aims is the integration of all the technologies referred above in ***one*** operative site. With a special regard to adequate, in every regeneration step process, as well the water required parameters to extend the lifetime of the global process, as the sufficient quality requirements to stop or increment the online treatments. The innovation potential of a multidisiplinary dedicated site is enormous. With regard to *Regulation on minimum quality requirements for reused water in agricultural irrigation and aquifer recharge* Roadmap (Inception Impact Assessment), this project has the unique purpose to develop ***a desition-making instrument for the EU by offering measurable, reliable and replicable technical data, as well as integrated socio-economic, global viability and replicability models to the reuse of water in context of circular economy.***

2. Impact: Expected Impacts

This project is expected to have a significant impact in the area of the water economy and the re-use of this resource in the context of the circular economy.

Impact 1: "*significant reduction of the current water and energy consumption"*

One of the main issue of water reuse is the difficulty to reach a good enough water quality to a wide range of applications. This project allows to adequate the water treatment to the use that is required, achieving then a significant reduction in consumption of pristine waters for not really suitable uses.

Project aims: a) reuse of 50 % of 3,5 Hm^3/y of treated waste water discharge reintroducing it in the economical productive cycles, b) produce 50% of regeneration and former WWTP (grid and generators) energy requirements. It will increase around 1% of total reused water at regional level and avoid 613T/y of CO_2 emissions.

Impact 2*: "interconnectivity between the water system and other economic and social sectors and "increased public involvement in water management"*

The former mentioned network platform will allow members from productive sectors to express their ***needs*** to adequate quality water requirements permitting feedback adequacy for disposable treatments. Under the coordination of the Regional Government, from unique citizen to social or sector groups, will be aware of the reuse waters use, shall be able to propose new uses and applications for reuse water, or partially participate in its management.

Impact 3*: "increased citizen satisfaction with water services"*

This system will be able to be adapted to of the socio-economic context requirements, and obtain a public transparent feedback for price's fitting of the reuse water. Not only the awareness campaigns about the importance of the reused water, although included in this project, will contribute to the awareness of the public. The responsible availability increase of water in hydric depleted areas (touristic season aggravated) is the perfect target to introduce win-win strategies for the success of water reuse projects.

Impact 4*: "replication of new business models in other areas and replication of models for synergies between appropriate funding instruments at regional, national or European level"*

Unfortunately, if the current over exploitation or in some case *irresponsible* use of water and the consequences of climate change parameters don't change, the replicability of this project is guaranteed by the "near to come" outcomes. Moreover, an increasing number of authorities of different consideration, show at least an active concern in this issue. After the demonstration of feasibility and viability of this project boosted by the access and success of this proposal, in addition to funding instruments mentioned in the *relations to work programme*, ERDF, ECF, ESIF, and in some case ACP and some EIB funds are contemplated. After a transparent strategic independent feasibility and viability study, the Regional Government will acquire the capability to transfer and replicate the model through specific budget headings. Based on the extension of viability model developed for the reintegration of this resource as added value in circular economy, other projects, products or services will be able to use the same approach, using it as a competitiveness advantage by the inclusion of not usually contemplated but more new EU legislation compliant. The integration of infrastructure demand for reinjection of reused water adequacy will be a good example of proposed investment.

Impact 5**:** *"creation of new markets in the short and medium term"*

The system will study the viability of extracting valuable materials from waste water increasing the potential for a new business by transforming and commercializing these materials. As well, this system that will act as an experimental tool to implement innovations in water treatment such as new developments in membranes, will noticeably increase the potential of high added value business in water treatment process at European level.

Impact 6: *"providing evidence-based knowledge that facilitate a broader transition to a circular economy in the EU"*

As regard of The *REPORT FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS, on the implementation of the Circular Economy Action Plan* (*Brussels, 26.1.2017 COM(2017) 33 final*) the development of this project consider some critical keys as *launching of the innovation deal*s *BREF's integration* or *Research and Innovation, industry 2020*. Due to the reinforcement of these purposes by a regional Government, it's expected that the extracted knowledge could help to concretise regional regulations related to circular economy and more concretely in the water sector. As principal actor and responsible of the project, offering a large scale and extended approach with real data, from an integrated point of view, this experience fully supported by the Valencian Regional Government will humbly give a little help to develop better policies in Europe.

Impact 7: *"implementing the Sustainable Development Goals (SDGs), in particular SDG 12 'Ensure sustainable consumption and production patterns' and SDG 6 'Ensure availability and sustainable management of water and sanitation for all', as well as the conclusions of the COP21 Paris Agreement"*

As regard of the contributions to the SDG's, this project will contribute to the implementation of the 6.3, 6.4, 6.6, 6.B. (*Ensure availability and sustainable management of water* and sanitation for all), 12.2, 12.5, 12.7 (*Ensure sustainable consumption* and production pattern). Even more this project will contribute to the implementation of some aspects of respectively the 9th, 11th, 13th, 14th goals. As the COP21 is concerned, sourced in a Regional Government, this project by its solar empowering, will contribute to reducing greenhouse effects emissions and low carbon economy development.

In a further stages of the project, by the reduction of the price of the construction, engineering an implementation costs, this technology will be accessible to some emerging economies.

ABSTRACT

The Photovoltaic Solar-Powered Modular Regeneration Waste Water System for obtaining Multipurpose ***Reused Water Quality Ranges***, is an innovative integrated system that uses the newest filtration membranes techniques "in cascade" at an eisting end-pipe WWTP. It enables the posibility to obtain an output up to 6 different water quality's streams (from cleaning tasks to food insdustry and even direct human consumption) that could fit concretly the requested parametres for the pourposes of the ***end-users***. Success goals will be, as well the continous or near-continuous detection and characterisation of ***CEC's***, as their abattement or complete removal. This project also offer a real water effluents ***essay facilities*** centre with a ***monitoring*** centre that allows an applicability test bench for new ***emergent pollutants*** wtch list detection and micro-pollutants abattement technologies. New TIC technologies for sensoring leads to the integration of DSS software to ensure the effectivity and efficiency of the control center. This multi-actor perspective, due to the international partnership, has the aim to give a step forward in economically, technically and environmentally integrated solution approach to unlock some technical and regulatory barriers that difficult innovative solutions which would allow the real water resource ***re-circulation.*** In a holistic point of view for each steps of the ***water value chain***, this project has the aim to offer measurables, reliables and replicables technicals data, as well as integrated socio-economic, global viability, replicability models to the reuse of water in context of ***circular economy***. The integration of non common ***quantitative*** parameters ***as health and environmental costs-benefits*** in viability studies, will be also contempled.

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