

## INTERDISCIPLINARY MODEL

The CRETUS institute is an interdisciplinary research center devoted to the *conception, development and evaluation of sustainable environmental technologies* under a circular economy approach. The multidisciplinary skills available include Biology, Chemical Engineering, Chemistry, Economics, Environmental Law, Physics and Social Psychology applied to environmental issues. The aim is to *integrate* these capacities to *comprehensively* address the environmental challenges of society, offering technological solutions that minimize environmental impacts and risks and maximize the potential for resource recovery. The economic, social and legal implications of proposed new solutions will be analyzed as well. The environmental challenges will be conceived under different perspectives: a) **DIAGNOSIS** – Evaluating, measuring and understanding their dimension; b) **TECHNOLOGIES AND METHODOLOGIES** – Conceiving proper scientific-technological solutions for preventing or treating environmental pollution, proposing new processes, tools and methodologies and; c) **IMPACTS** – Assessing the proposed solutions under an environmental, economic and social impact. The coordinated integration of the diverse capacities facilitates a mutual enrichment of all the scientific approaches and allows addressing the new environmental challenges, of increasingly complex characteristics, from a holistic perspective.

It is evident that the development of this new way of organizing research implies a cultural change that requires the promotion of collaborative and multidisciplinary research. As a result, CRETUS groups should become familiar with a methodology that can address scientific challenges from a global and more ambitious perspective, by combining completely different disciplines as science, engineering, economy, law or social psychology.

The partnership promotes the evolution from a traditional mono-disciplinary approach towards a more ambitious collaborative research model that makes possible putting into practice the comprehensive and multidisciplinary vision in the CRETUS research activities. This implies that we will change from a mainly *Bottom-up* strategy in the projects to a *Top-down* strategy, meaning that the research areas are selected and proposed within the Steering Committee in line with the major environmental challenges identified from national and international research agendas.

## RESEARCH AGENDA

The research agenda consists of 4+1 areas representing the main societal environmental challenges: 1) **Water cycle management**; 2) **Remediation and sustainable uses of soils**; 3) **Waste management and valorisation** and 4) **Air pollution monitoring and control**. One additional area aims to ensure that the technologies conceived and developed by CRETUS comply with environmental, economic, social and legal requirements, advancing towards **sustainable cities and industries**. The Diagnosis-Technology development-Sustainability principle will be applied to the different projects developed by CRETUS, independently from the environmental challenge approached.

As an example, but not limited to, some of the research topics that are currently included in the research agenda are presented below.

### 1) *Water cycle management*

CRETUS has a strong background in the development of advanced technologies for the treatment and posttreatment of wastewater. More concretely in this field, the detection and treatment of organic micropollutants in wastewater, the conception of advanced technologies

for nutrient removal and resource recovery processes (including water for reuse) can be highlighted. Concepts related to the use of nanoparticles or biocarbons for the removal of recalcitrant compounds are investigated. Modelling, optimization and control of wastewater treatment processes are used for approaching sustainability. The development of tools for the direct (analysis of water) or indirect (following animal colonies influenced by water) monitoring of the chemical and ecological status of water matrixes is considered essential to ensure the quality standards required by the new legal frameworks. Water scarcity is managed by the modelling of groundwater and water reservoirs for the prediction of available resources for the future.

### *2) Remediation and sustainable uses of soils*

There has been a consolidated research on the analysis and treatment of polluted soils, with an in-depth study of the biogeochemical processes. Technologies based on the use of enzymes, phytoremediation or technosols have been developed. The properties of soils to act as terrestrial carbon sink, to prevent fire and to better suit its functions (urban, agricultural, etc.), are studied and used for sustainable land planning.

### *3) Waste management and valorisation*

Several research lines promote the transition from a lineal towards a circular economy model. The biorefinery concept is applied to wastewater and waste treatment in a wide range of processes: the recovery of biopolymers (PHB), the selective VFA production, yielding sugar from lignocellulosics. A second research activity focuses on the extraction of added-value products from natural compounds by chemical and enzymatic transformations.

### *4) Air pollution monitoring and control*

The use of mosses for air quality biomonitoring has been applied to different production processes. Atmospheric modelling of pollutants is used for analysing the geographic impact of certain industrial and urban activities. Damage related to climate change is predicted through modelling of climatic conditions, floods and pollution by greenhouse gases.

### *+1) Sustainable cities and industries*

The research agenda of CRETUS has an environmental technological orientation aligned with the objectives of circular economy and sustainable development. To do so, one option is to avoid pollution through the design of clean productive processes. This is for example targeted by the design of ionic liquids as green solvents, as well as by promoting the ecodesign in consumer products. If pollution has to be treated, sustainability of the developed solutions is analyzed by means of Life Cycle and Risk Assessment methodologies. New business models and policies are being framed in order to foster the implementation of innovation actions.

CRETUS goes further in promoting the implementation of innovative processes, by studying the economic, social and legal barriers and based on that proposing activities for social engagement and generating new business models and policies for cities and industry.

**If you perform research in line with the CRETUS agenda and are convinced that performing collaborative activities in a multidisciplinary team can enhance your professional development, please fill in the expression of interest enclosed below for joining the CRETUS institute.**