



The project has received funding from the LIFE Programme of the European Union under GA number LIFE19 ENV/GR/000100



InnoVative photocatalytIc paintS for healthy enviroNment and eNergy Saving «VISIONS»

PROJECT LOCATION: Greece

BUDGET INFO

Total amount: 1,403,752

% EC Co-funding: 757,763

DURATION: Start: 07/09/20 - End: 06/09/23



Project Coordinator:

**Dr. Thomas Maggos, Senior Researcher
Head of Atmospheric Chemistry & Innovative Technologies Lab/NCSR “Demokritos”**



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PROJECT'S IMPLEMENTORS:

Coordinating Beneficiary:



National Center for Scientific Research "Demokritos"

Associated Beneficiaries:

- *Aristotelio Panepistimio Thessalonikis*
- *Foundation for Research and Technology - Hellas*
- *MICHOPOULOS I. & CH. G.P.*
- *VITEX*





OBJECTIVES & SCOPE

The main scope of the project is the production of an innovative photocatalytic paint, which aims at improving the quality of the indoor environment while it will enable significant energy savings in buildings

The project main objectives are:

- **Optimization and Upscaling of the novel photocatalytic powder**
- **Semi-industrial production of innovative photocatalytic paints** (VISIONS Photo-Paints)
- **Real scale application** of the VISIONS Photo-Paints in a set of existing **Demo-Houses** and in **public building (HNA)**.

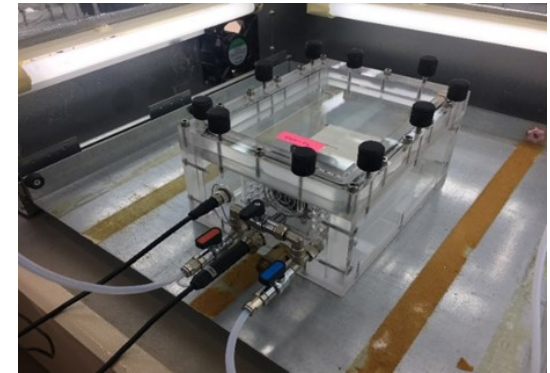
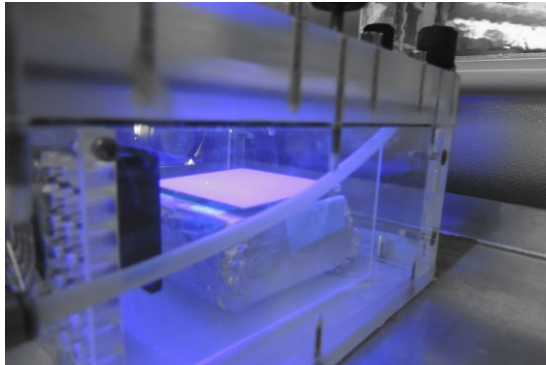


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Lab - scale tests:

Detailed information on the efficiency of the optimized powders and paints to photocatalytically degrade air pollutants such as Nitrogen Oxide (NO) & Volatile Organic Compounds e.g toluene (VOCs) in the gaseous phase are provided



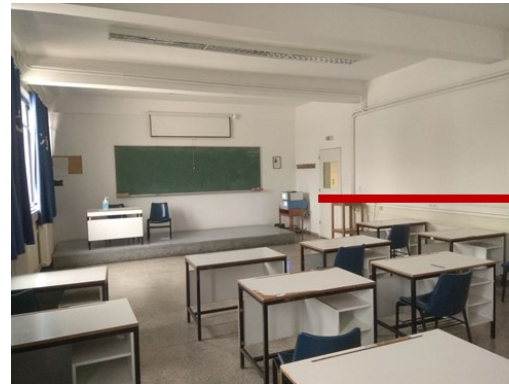


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Real Scale Applications:

Detailed information on the efficiency of the VISIONS paints to photocatalytically degrade air pollutants such as Nitrogen Oxide (NO) & Volatile Organic Compounds in Real World environments





OBJECTIVES & SCOPE

- **Assessment of the effectiveness** of the VISIONS Photo-Paint for large scale applications through the application of a state of the art **numerical modelling (CFD)**.
- **Development of a sophisticated Decision Support System (DSS)**
- Development of **performance indicators** for evaluation of the photocatalytic efficiency in terms of:
 - i) the expected **reductions in the concentration of specific pollutants**
 - ii) the **expected improvement of the energy efficiency** of the building sector
- **Establishment of a start-up (or spin-off) company** that will undertake the exploitation of the products (VISIONS Photo-Paints)

Key actions to achieve VISIONS objectives

Action 1-FORTH (Sep.20-Feb.21)

Optimization and upscaling of synthesis root of the novel photocatalytic powder



Action 2-VITEX (Feb.21-Aug.21)

Semi-Industrial production of Photo-Paints by mixing the optimized powder with 3 different kinds of paints



Action 3-NCSR (Sep.20-Dec.22)

Application of the 3 types of Photo-Paints in:

1. Demo-Houses
2. Hellenic Naval Academies buildings

LAB Investigation of the Photocatalytic materials efficiency



Action 6-NCSR (Sep.22-Aug.23)

Establishment of a spin-off company



Action 5- ENOLUTION (Aug.21-Dec.22)

Development of a Decision Support System (DSS)



Action 4-AUTH (Sep.20-Dec.22)

- Computational Fluid Dynamics (CFD)
- Life Cycle Assessment (LCA)
- Cost Efficiency Analysis (CEA) & Cost Benefit Analysis (CBA)



Expected Impacts

The expected impacts are divided in 5 main sectors:

1. **Environment**: Significant **improvement of IAQ** could be achieved by the degradation of air pollutants (NO_x, VOCs). A **degradation of up to 40% for NO_x and 15% of VOCs** from the application of the **VISIONS Photo-Paint** under **real world conditions** is expected.
2. **Energy**: Ventilation and HVAC systems are the major energy consumers in buildings. As a result of the expected improvement of the indoor air quality and the thermal comfort of the users, **both the needed amount of time for operating artificial ventilation and the required ventilation rate** will be reduced. It is foreseen that for a 1000 m² building area a reduction of 10% in energy demand could be feasible.

In this way, VISIONS forms a cost-efficient technological solution to further enforce the environmental and socio-economic impacts of the energy consumption of the building sector

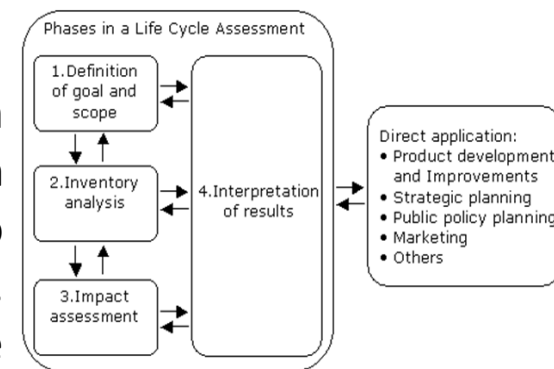
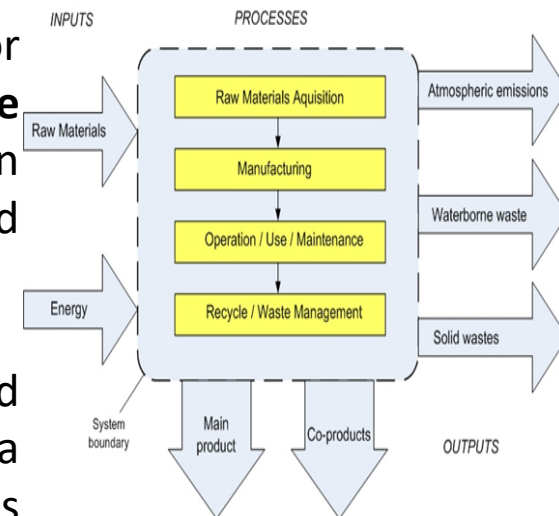


Expected Impacts

3. Innovation: Optimization & application of TCM-1 catalysts for industrial building coatings capable for air de-pollution **by visible light without producing any harmful by-products**, comprises an innovation and originality at a European level. Both optimized TCM-1 and Photo-Paint **could be patented**.

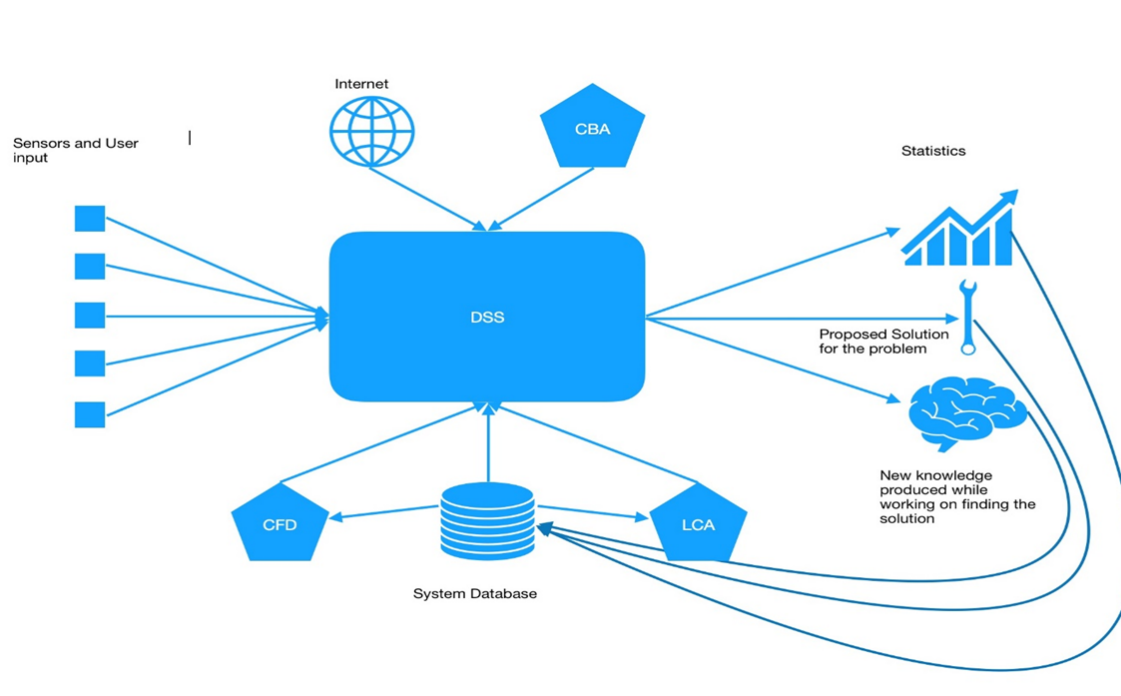
4. Economy: **Demonstration of the effectiveness** of the said application will set the platform for a wider application to a number of indoor environments (homes, schools, hospitals) thus contributing on a decisive manner on IAQ with both environmental and health benefits.

The replication of the present results to other producers in European countries is expected to **create an added value chain of environmental and commercial benefits** as it is expected to penetrate 40% into the ecological interior paint market. Quantification of the economic impact of VISIONS will be achieved through the CEA, CBA and LCA.



Expected Impacts

5. Dissemination: Stakeholders and end users (Building Construction Companies, Chemical and Paints companies, Local and Regional authorities and the public at large) will take advantage of the outcome of the project as it will be translated into a **Decision Support System (DSS)**. To that end characterization of the sustainability of each particular photocatalytic application could be achieved.





Policy Implications

- Due to its nature, the proposed methodology can easily be reproduced and transferred not only in the other indoor microenvironments but outdoors as well. As a result, VISIONS is strongly associated with the **Article 114 of the TFEU** (Consolidated version of The treaty on functioning of the European Union)
- VISIONS is in line with the **Energy Performance Buildings Directive (2010/31/EU)** which requires Member States to consider how high-energy performance affects general indoor climate conditions, in order to avoid possible negative effects such as inadequate ventilation, poor indoor air quality etc.



Policy Implications

- VISIONS could contribute to the recommendations on how to establish healthy and energy-efficient buildings in the European Union as described in the “**Promoting healthy and energy efficient buildings in the European Union**” report issued from JRC in 2017.
- The specific demonstration project will help the assessment whether or not photocatalytically active construction material may be a technology for achieving better indoor air quality throughout Europe. **VISIONS will prove that it could provide the basis for a European Directive on the usage of photocatalytically active construction materials in Europe.**
- Dealing with a holistic approach for demonstrating the effectiveness of the application of a novel Photo-Paint material as a viable mean for the improvement of the air quality in indoor environments, **it contributes to the European Union policy on environmentally sustainable development**



Continuation

The main action to safeguard the project continuity after its completion and it is foreseen to **support the "next-day" of the project outcomes** is the establishment of an academic **spin-off company**.

- It will transfer the project findings and tools to the market rapidly.
- Pricing, marketing plan and exact resources for the commercialization will be defined and quantified.
- A business plan will be put in place as early as possible during the project.
- Identification of the main key resources, market channels and revenue streams.
- Based on information coming from the market analysis detailed sales forecasts will be estimated.
- It is foreseen to **cover up to 2% of the paint market** during the first 3 years of operation



Global Photocatalyst Market by Application, 2014-2025 (in Million USD)

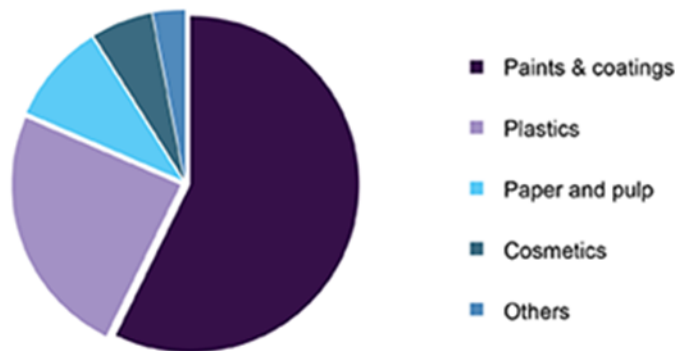


<https://www.ameriresearch.com/product/photocatalyst-market/>

Photocatalytic building materials are **already commercialized** in some European countries and the market seems to increase with a good slope.

Globally, **six sectors** in which photocatalysis may have a significant impact have been identified: **construction, transport/automotive, consumer products, energy, environmental and medical products**. Among these, the Construction and Transport sectors are dominant and mainly cover applications to mitigate pollution and self-cleaning activities of exterior buildings and traffic infrastructures.

Global titanium dioxide market revenue, by application, 2015 (%)



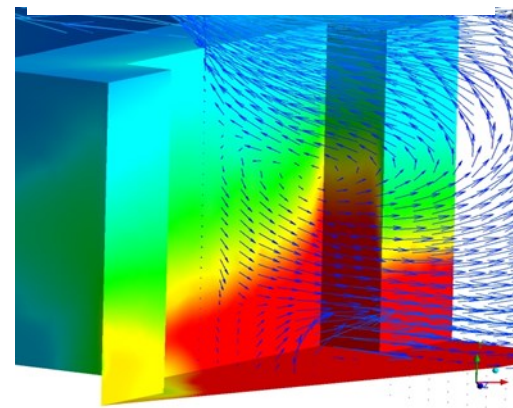


The comparative advantage of VISIONS outcome is not only the innovative product (VISIONS photo-paint) but also the full set of IT tools that accompanies it.

To that end the proposed actions give a clear and **integrated answer** to the real needs of the market in terms of:

- **the innovative photo-paint**
- **recommendations** (how to use these materials and techniques),
- **design tools**
- **simulations** of possible **air pollution and energy consumption** abatement under real conditions.

Estimated concentrations field close to the treated wall





<http://lifevisions.gr/>

LIFE VISIONS Facebook page

The project Facebook page is available as [LifeVisions](#). (@LifeVisionsGR)

LIFE VISIONS Twitter account

The project Twitter account is available as [LifeVisionsGR](#), (@gr_visions)

VISIONS - LIFE19 ENV/GR/000100

Καινοτόμα Φωτοκαταλυτικά Χρώματα για Υγιές Περιβάλλον και Εξοικονόμηση Ενέργειας / Innovative photocatalytic paints for healthy environment and energy saving

Εξοικονόμηση ενέργειας
Απολύμανση αέρα
Απολύμανση επιφανειών

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Προϋπολογισμός: 1.403.752€ (Ποσοστό συγχρηματοδότησης 54%)

Διάρκεια υλοποίησης: 07/09/2020 - 06/09/2023

Εταίροι του έργου:
Συντονιστής: Εθνικό Κέντρο Έρευνας Φυσικών Επιστημών «ΔΗΜΟΚΡΙΤΟΣ» Έργα Τεχνολογίας και Έρευνας (ITE)
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