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

LIFEVISIONS
InnoVative photocatalytIc paintS
for healthy envirOnment and eNergy Saving

On line Course 24/01/2024

Module 1: LIFE VISIONS project: Scope and objectives **NCSRD**

Module 2: Indoor air quality (IAQ) – **NCSRD**

Module 3: Photocatalytic materials and their role in IAQ – **FORTH**

Module 4: Energy efficiency in a building environment **AUTH**

Module 5: Modeling tools for the assessment of photocatalytic materials efficiency- **AUTH**

Module 6: The VISIONS photocatalytic paint **VITEX**

Module 7: Case studies: Real scale applications of VISIONS paint_IAQ **NCSRD**

Module 8: Case studies: Real scale applications of VISIONS paint_Energy **AUTH**

Module 9: The DSS: a holistic tool for stakeholders and end-users **EVOLUTION**

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

LIFEVISIONS
InnoVative photocatalytIc paintS for healthy envirOnment and eNergy Saving

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, Research Director
Head of Atmospheric Chemistry & Innovative Technologies Lab/NCSR "Demokritos"

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

LIFEVISIONS
InnoVative photocatalytic paintS for healthy envirOnment and eNergy Saving

PROJECT'S IMPLEMENTORS:

Coordinating Beneficiary:

NATIONAL CENTRE FOR SCIENTIFIC RESEARCH "DEMOKRITOS"
P.O. BOX 60037 | 15310 AGIA PARASKEVI • GREECE | TEL: 0030 210 650 3000 | www.demokritos.gr

National Center for Scientific Research "Demokritos"

Associated Beneficiaries:

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

ARISTOTLE UNIVERSITY OF THESSALONIKI

FORTH
Foundation for Research & Technology - Hellas

EVOLUTION PROJECTS

vitex

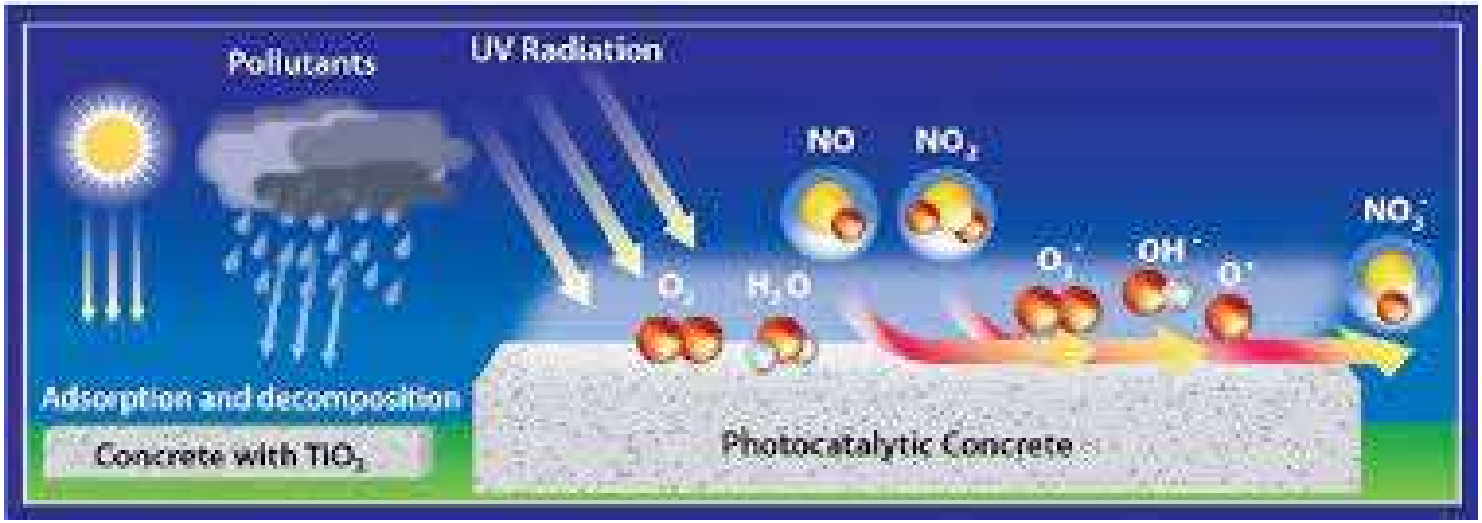
The project has received funding from the LIFE Programme of
the European Union under GA number LIFE19 ENV/GR/000100

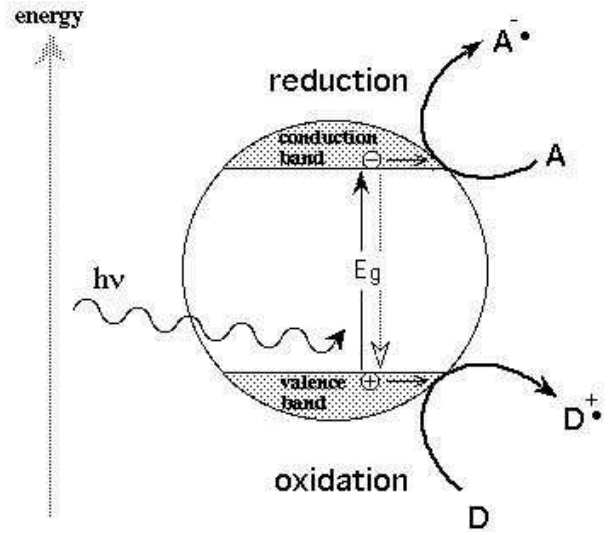
LIFEVISIONS
InnoVative photocatalytIc paintS
for healthy envirOnment and eNergy Saving

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





- Με την επίδραση ακτινοβολίας σχηματισμός στην επιφάνεια του καταλύτη ζεύγους θετικών οπών και ελεύθερων e^-
- Συμμετοχή αυτών σε αντιδράσεις με μόρια δότες και δέκτες e^- αντίστοιχα
- Σχηματισμός ισχυρών οξειδωτικών όπως ανιονικών ριζών οξυγόνου ($\cdot O_2^-$) και ριζών υδροξυλίων ($OH\cdot$) τα οποία έχουν την δυνατότητα οξείδωσης οργανικών και ανόργανων ενώσεων.

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

LIFEVISIONS
InnoVative photocatalytic paintS for healthy envirOnment and eNergy Saving

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 a 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)**.
- Establishment of a **commercial company** which aims to deliver the project outcomes into the masket

Key "After Life" action

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

Optimization and Upscaling of synthesis root of the novel photocatalytic powder (FORTH)

The optimization process concerned 3 main parameters:

Optimization of Synthetic Pathways

In order to find the best synthetic procedure which will be easy, cost effective and lead to photoactive titanium dioxide, TiO_2 powders with different synthetic procedures were synthesized.

Optimization of Concentration of Dopants

Metal doped TiO_2 powders with 0.04 dopant concentration

Optimization and control of the particle size

Optimization and control of the particle size with ball milling system.

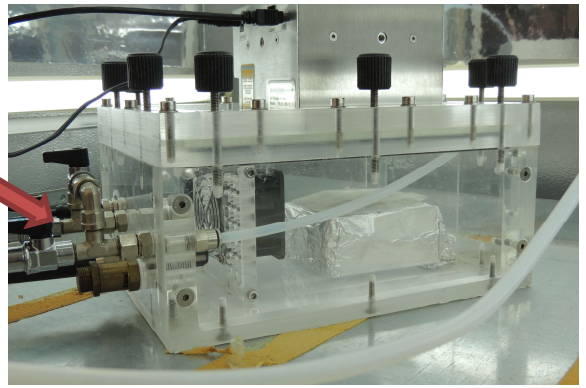
FORTH prepared 30 optimized powders. Among them the 4 most promising powders in terms of air pollutants degradation were further evaluated for their physicochemical properties and photocatalytic efficiency and 1 (V3) was selected for the VISIONS photopaint production

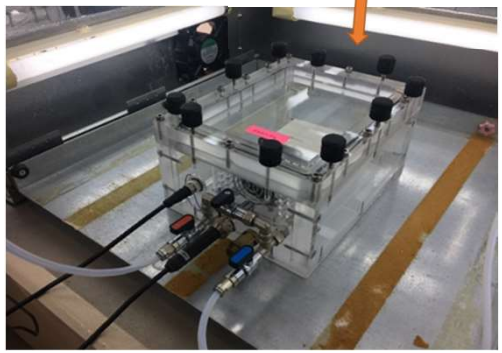
The project has received funding from the LIFE Programme of the European Union under GA number LIFE19 ENV/GR/000100

LIFEVISIONS
InnoVative photocatalytic paintS for healthy envirOnment and eNergy Saving

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





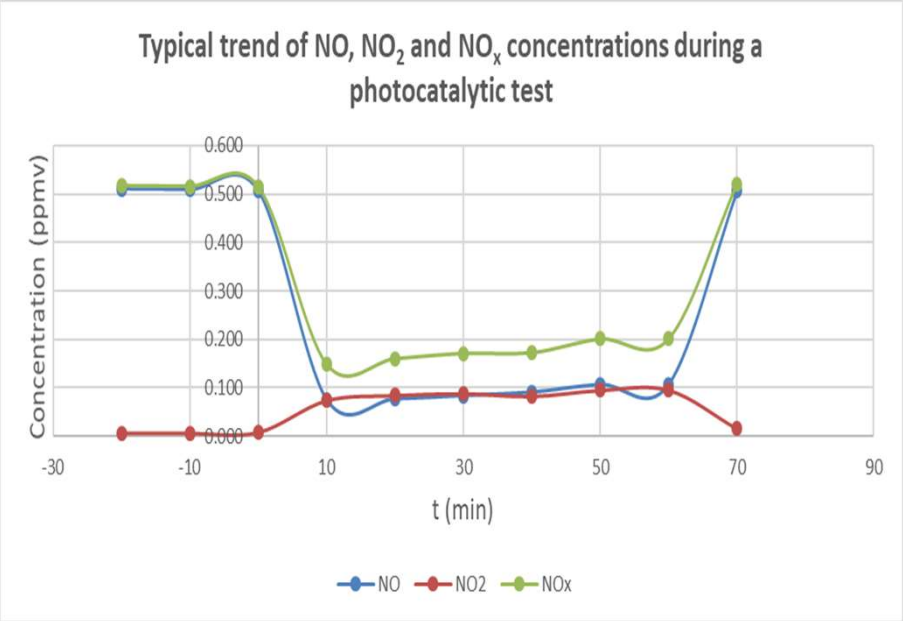
The project has received funding from the LIFE Programme of the European Union under GA number LIFE19 ENV/GR/000100

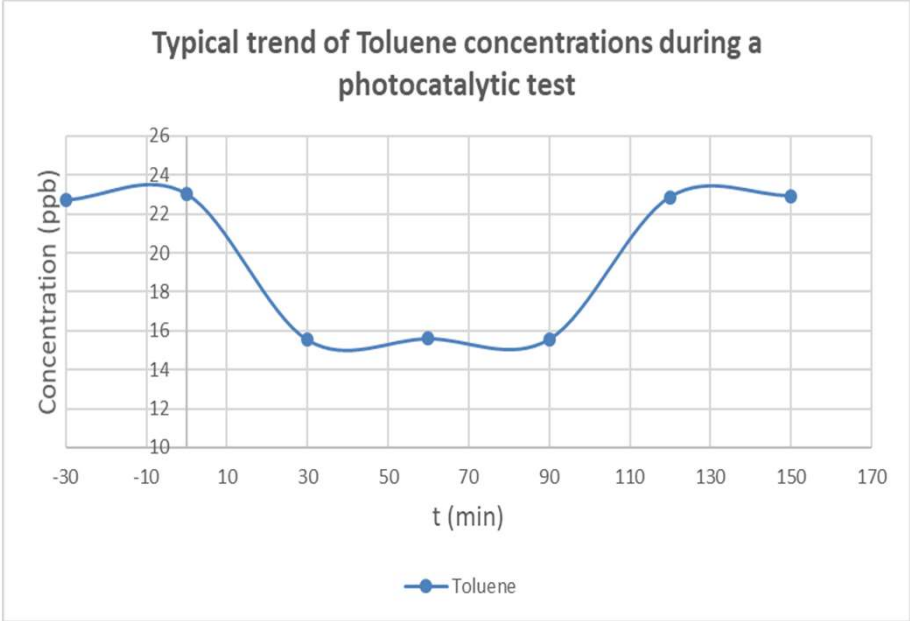
LIFEVISIONS
InnoVative photocatalytIc paintS for healthy envirOnment and eNergy Saving

Sample V -3-

Results

η_{NOi}^{total}	**85.4%**
$\eta_{Toluene}^{total}$	**31.9%**





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

LIFEVISIONS
InnoVative photocatalytIc paintS
for healthy envirOnment and eNergy Saving

Semi-Industrial production of Photo-Paints (VITEX)

1. **Organic (with organic binder)**
2. **Inorganic silicate paint (with potassium silicate binder)**

- high surface porosity to increase photo-paints action and the appropriate all-around performance (appearance, gloss, easy of application, water scrub resistance etc)

- formulations are above the CPVC (Critical Pigment volume Concentration).

- The stability of the formulated paints in storage overtime was checked in the lab using also accelerated methods (oven ~50o C, centrifuge, etc).

- The concentration of the VISIONS powder in these matrices ranged between 5% to 20%.

- increase the porosity of the film (reducing resins while increasing fillers - elevate P.V.C.) and the quantity of powder up to 20% (> will be economically unviable)


Solids % (W/W)


Stormer Viscosity (Krebs Units)


SG Density cup

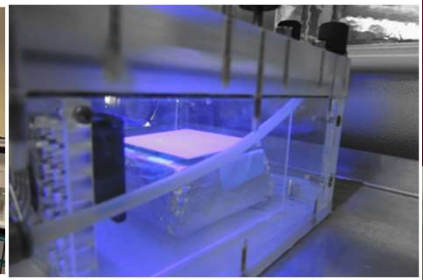

Paint application

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

LIFEVISIONS
InnoVative photocatalytIc paintS for healthy envirOnment and eNergy Saving

Semi-Industrial production of Photo-Paints (VITEX) (Lab tests)

More than 20 paint formulation were tested in NCSRD labs



and finally VITEX produced:

- **Organic Paint (tested in DEMO houses)**
- **Inorganic Paint (tested in DEMO houses)**
- **Hybrid Paint – Production failed due to stability issues**

Action B.3 Real Scale Applications (NCSRD)

Subaction B3.1 *Application of Photo-Paints in Demo-Houses prototype demonstrator (FORTH)*

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

LIFEVISIONS
InnoVative photocatalytIc paintS
for healthy envirOnment and eNergy Saving

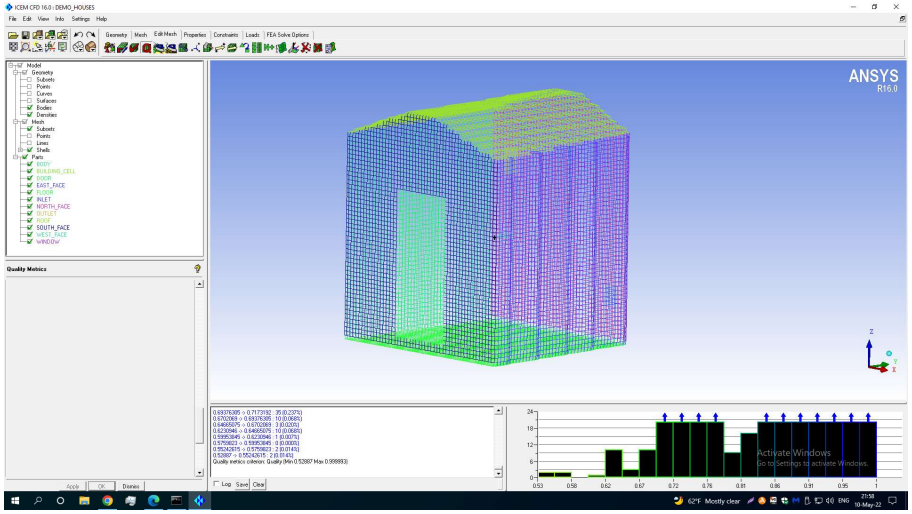
Subaction B3.2 Application of the most promising Photo-Paint in real life conditions. The case of Hellenic Naval Academy (HNA) Buildings

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

LIFEVISIONS
InnoVative photocatalytic paint5 for healthy envir0nment and eNergy Saving

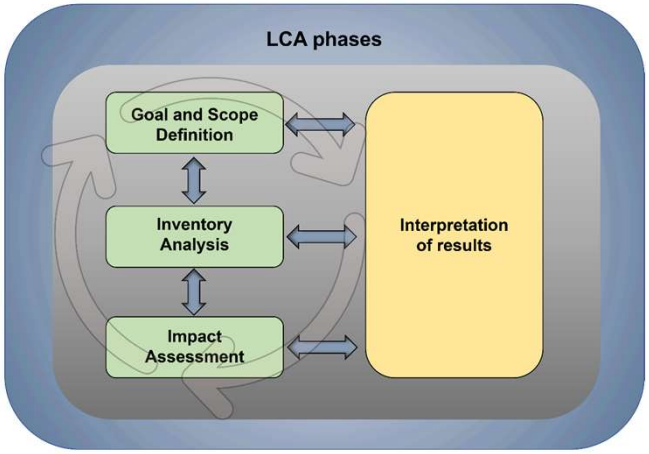
Depollution modelling (CFD)

In the frame of the Life Visions project the methodology for CFD modelling in indoor environments will be followed in order to estimate through simulations the effectiveness of paints to improve IAQ .



LCA, CBA, CEA Methodology

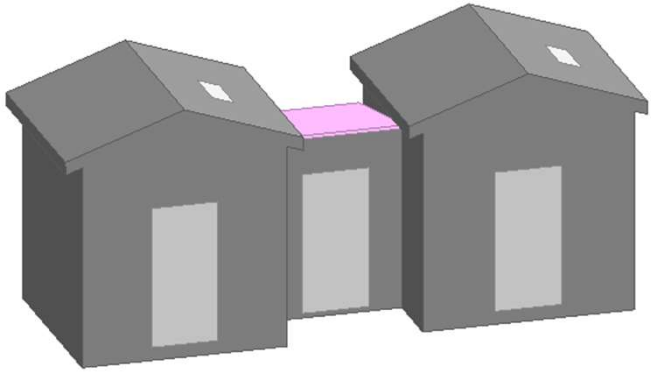
- Environmental impacts comparison:
  - Conventional paint vs Innovative photocatalytic paint
- Cradle-to-Gate & Cradle-to-Grave approach

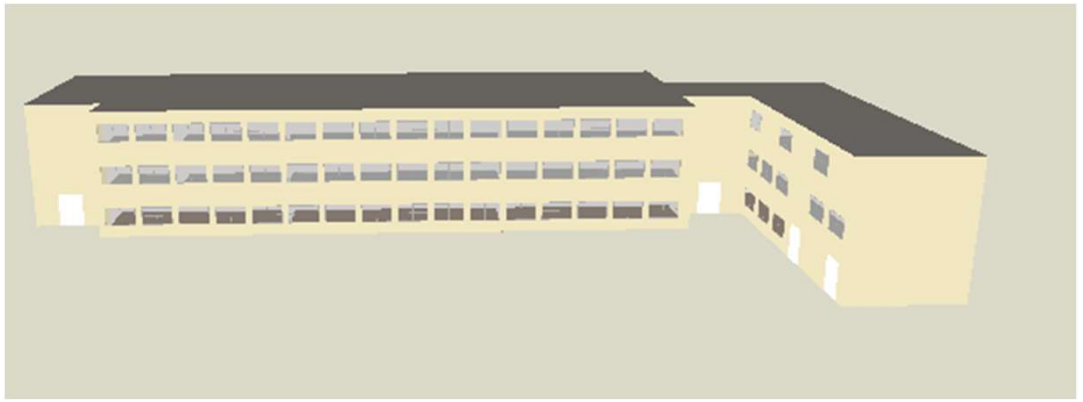


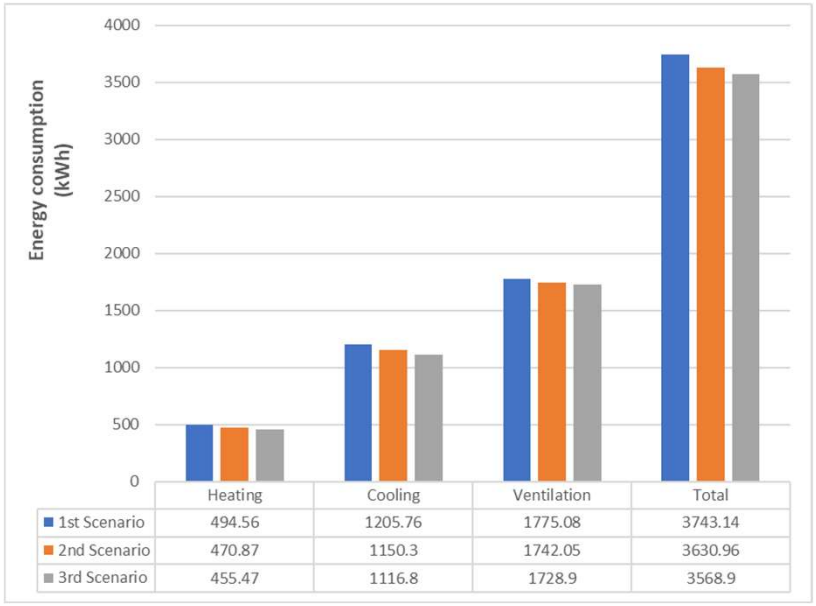
The project has received funding from the LIFE Programme of the European Union under GA number LIFE19 ENV/GR/000100

LIFEVISIONS
InnoVative photocatalytic paintS for healthy envirOnment and eNergy Saving

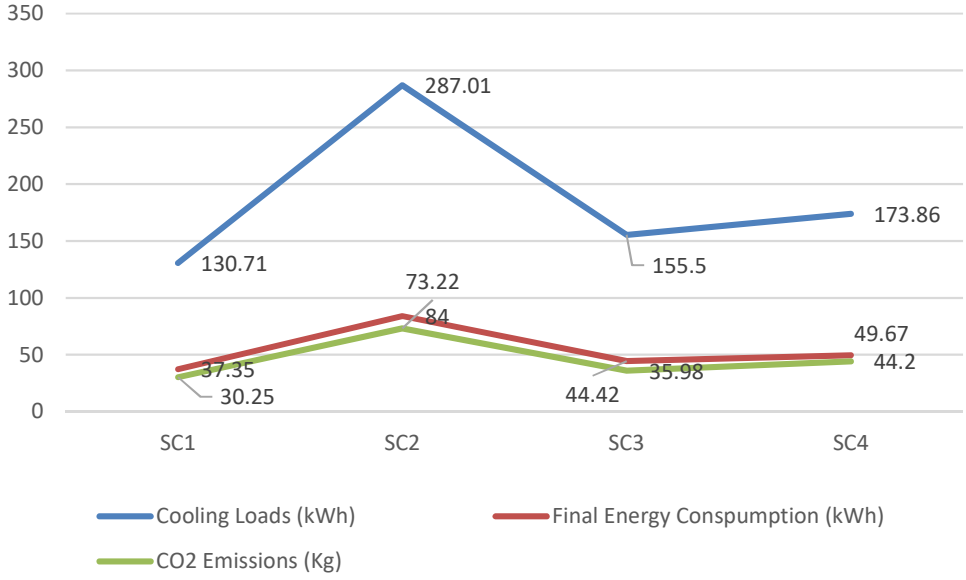
Energy efficiency of Demo Houses and Naval Academy







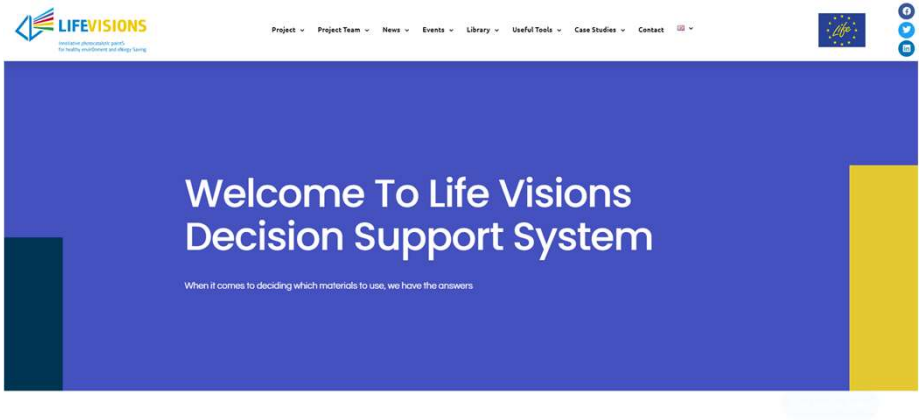
	Heating	Cooling	Ventilation	Total
1st Scenario	494.56	1205.76	1775.08	3743.14
2nd Scenario	470.87	1150.3	1742.05	3630.96
3rd Scenario	455.47	1116.8	1728.9	3568.9

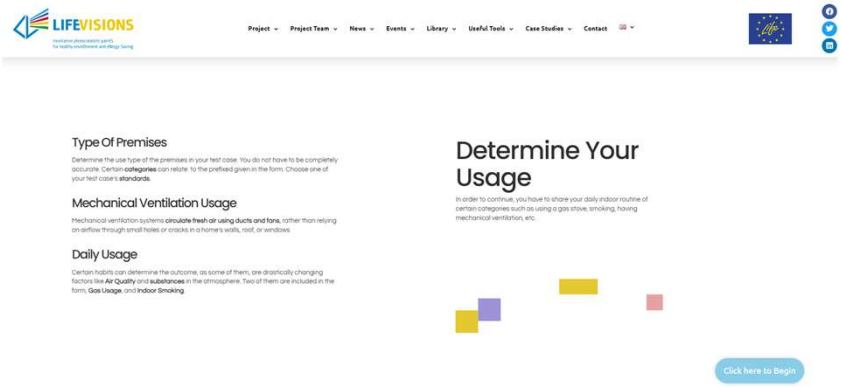


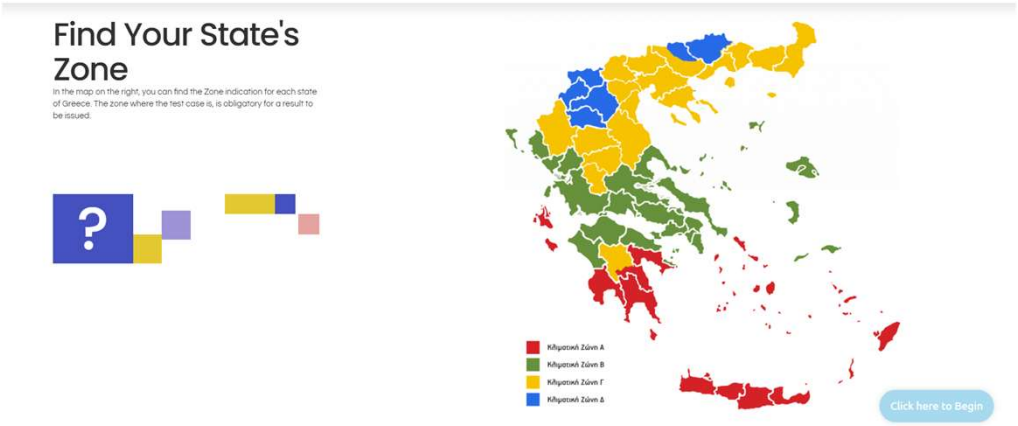
The project has received funding from the LIFE Programme of the European Union under GA number LIFE19 ENV/GR/000100

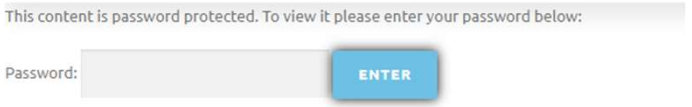
LIFEVISIONS
InnoVative photocatalytIc paintS for healthy envirOnment and eNergy Saving

Instruction and Password Page









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

LIFEVISIONS
InnoVative photocatalytic paintS for healthy envirOnment and eNergy Saving

Form Page and Results

Complete The Form

Mechanical Ventilation usage: Yes

State's Zone: A

Type of Premises: Offices

Smoking indoors: Yes

Gas Usage: No

City's Zone: Suburban

Construction Year: 2005

Square Meters: 350

SUBMIT

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

LIFEVISIONS
InnoVative photocatalytIc paintS
for healthy envirOnment and eNergy Saving

Establishment of LIFEVISIONS company:

ProVisionAir+

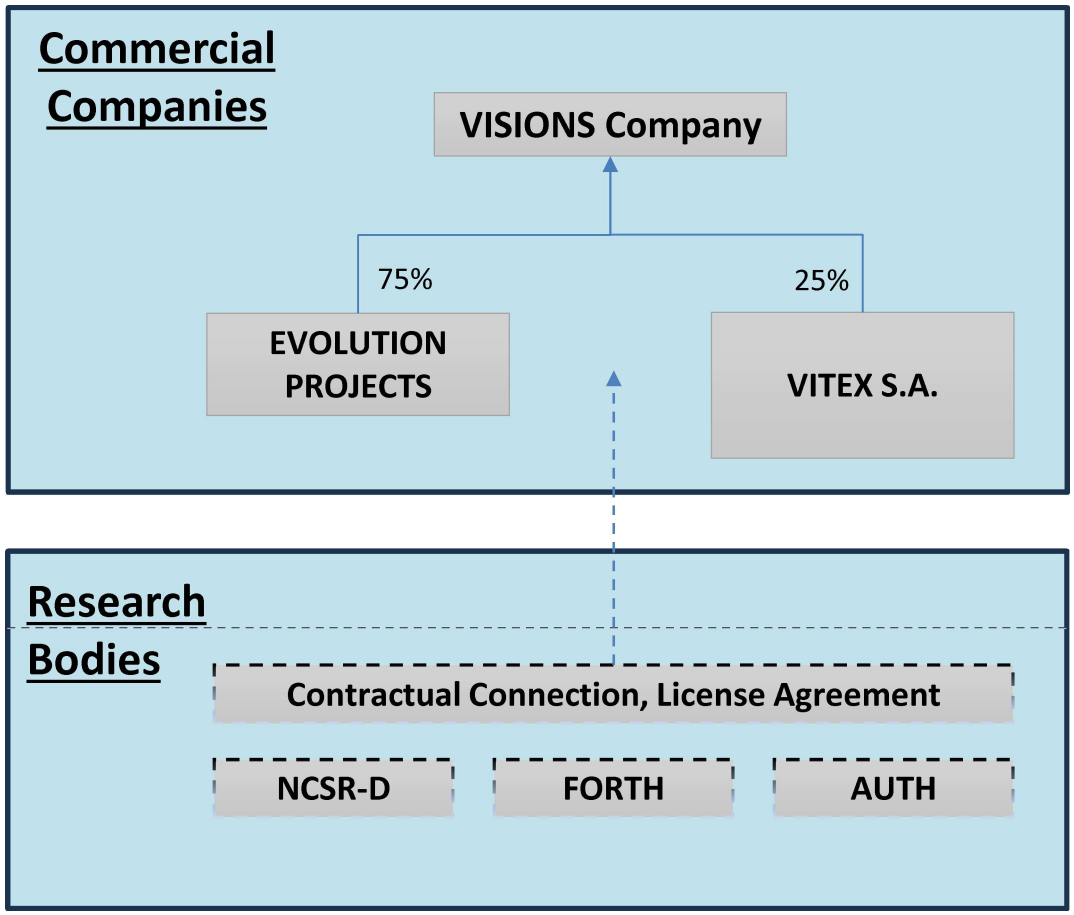
Promote the photocatalytic technology in terms of both photocatalytic building materials as well as the IT tools that accompanies them

All partners will be involved

Key "After Life" action

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

ProVisions+



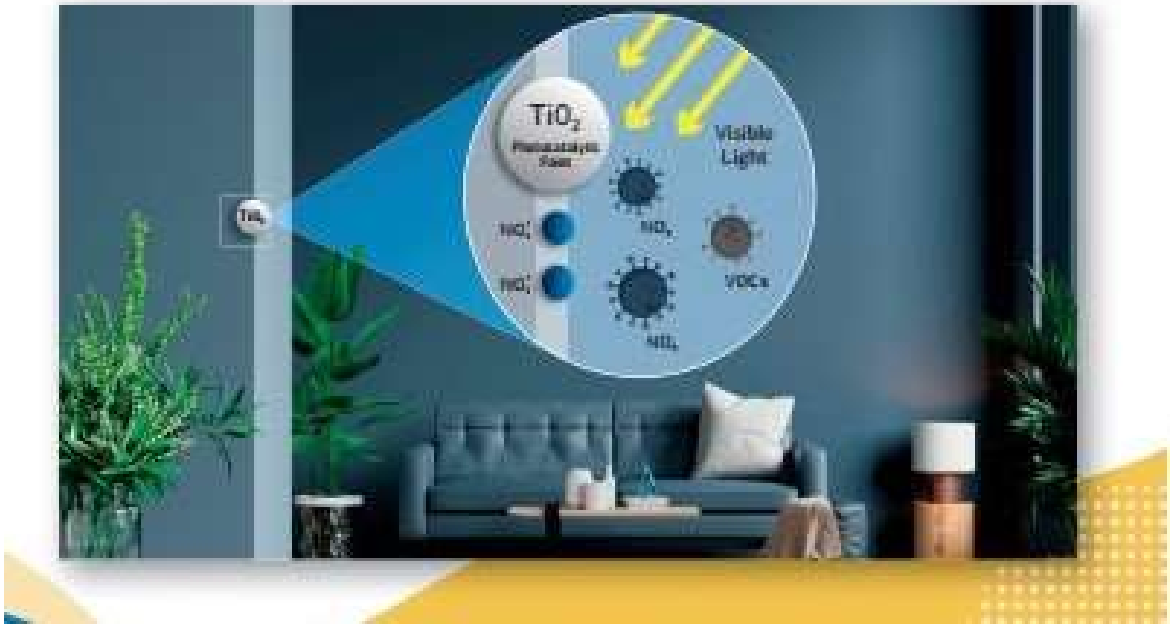
ΕΜΠΟΡΙΚΗ ΕΤΑΙΡΕΙΑ – ΕΤΑΙΡΟΙ ΕΡΓΟΥ: Η αξιοποίηση των αποτελεσμάτων του έργου θα γίνει από μία **νέα Εμπορική Εταιρεία, ιδρυόμενη από τους εταίρους που έχουν σήμερα εμπορική νομική φύση δηλ. τις εμπορικές εταιρείες.**

Η νέα Εταιρεία **θα συμπράξει με τους άλλους εταίρους (ερευνητικοί φορείς)** με σχετικές Συμβάσεις βάσει των οποίων οι ερευνητικοί φορείς **θα παραχωρούν δικαίωμα χρήσης της τεχνογνωσίας** τους και θα υποστηρίζουν την δραστηριότητα της εταιρείας.

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

LIFEVISIONS
InnoVative photocatalytic paintS for healthy envirOnment and eNergy Saving

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.

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

LIFEVISIONS
InnoVative photocatalytic paintS for healthy envirOnment and eNergy Saving

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)

Email: tmaggos@ipta.demokritos.gr (LIFEVISIONS Coordinator)