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# Clear-up is about all of us about a healthy indoor life

As Europeans, we spend 90% of our lives indoors and providing the right environment takes a lot of energy, mostly from fossil sources.

Living in today's homes may make us sick. Living well indoors depends on resources provided by nature, such as daylight and fresh air.

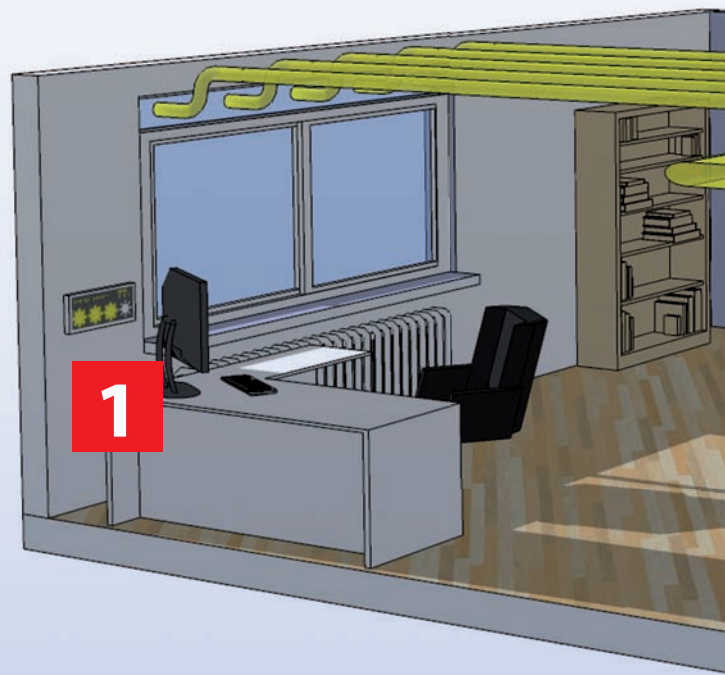
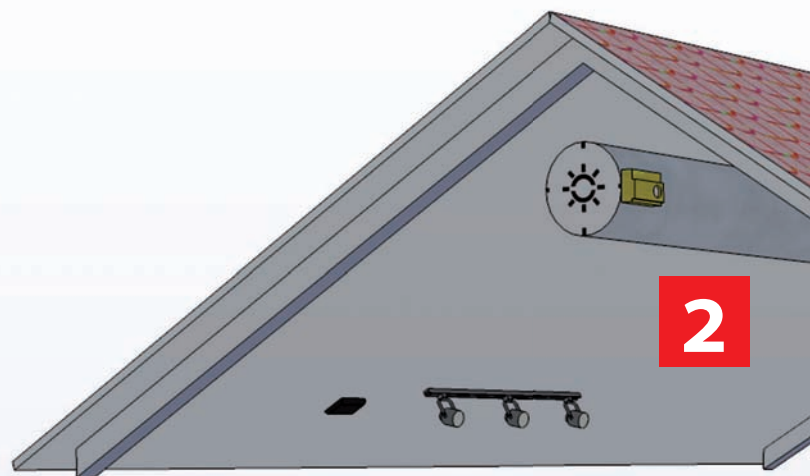
Clear-up aims to reduce energy use in existing buildings using environmentally-sound components, creating sustainable solutions. Clear-up strives to deliver comfortable homes and workplaces to an affordable price.

Clear-up wants to deliver safe, optimised solutions using new technologies such as high performance materials, smart design and sensing and control.

Clear-up wants to achieve that without increasing the overall energy and resource burden of buildings and in balance with nature.

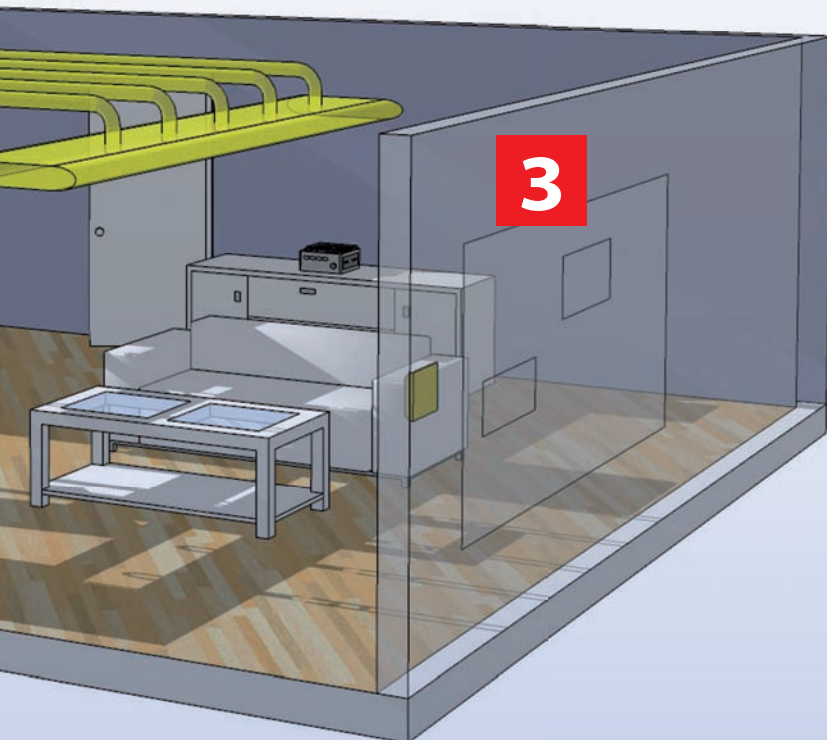
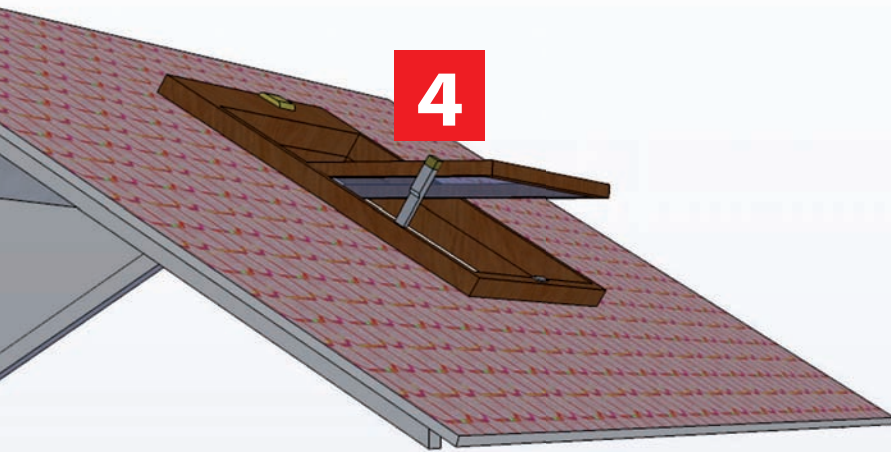
Our primary needs in a building are for daylight, fresh air and the right temperature. Clear-up is responding to these demands using both natural and technological solutions. Clear-up is important because it will work to improve the existing buildings which make up most of our cities and towns.

Clear-up is a European project bringing together technologists and the construction industry. It will drive change in construction with new tools and methods and will improve buildings for their occupants.



# >> Overview

## Clear-up will work on four key components of buildings:



- 1** Sensors and control provide an underpinning technology for Clear-up's approach. New sensors will be developed for smart windows, demand controlled ventilation, and air purification.
- 2** Air conditioning. Clear-up will improve demand controlled ventilation and the intelligent combination of natural and artificial ventilation.
- 3** Walls. Clear-up uses photocatalytic materials for air purification and nano-porous vacuum insulation combined with phase change materials to passively control temperature.
- 4** Windows. Clear-up uses shutters and electrochromic window foils which reduce the building cooling load and along with light-guide technology, reduce the need for artificial lighting. It incorporates controlled natural ventilation with integrated heat recovery potential reducing the need for heating in winter and cooling in summer.

# What is healthy indoor environment?

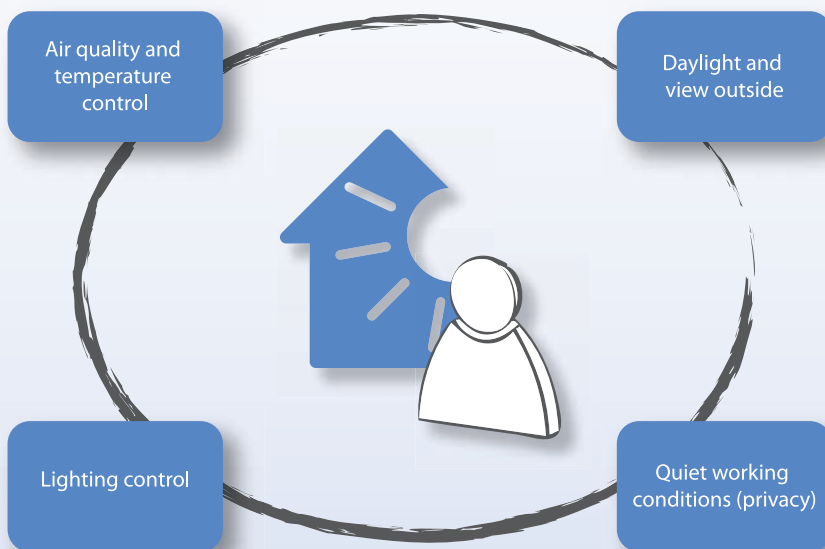
Clearing up the relationship between people and buildings

*Jakub Kolarik, Danish Technical University*

## » Buildings are for people

Clear-up's objective is to integrate several innovative technologies to provide a healthy, comfortable and productive indoor environment. That is why the occupants and their perception of the indoor environment stand right in the middle of the Clear-up's focus.

Design and operation of the building has a strong influence on the Indoor Environmental Quality (IEQ) and human responses. This is obviously important to us in our home lives, but also has important implications for employers. The way that occupants feel in the building - their satisfaction with the environment - affects their productivity at work. In Europe, employees' salaries exceed building energy costs by a factor of 100, so it is clear that reduced energy consumption should not be achieved at the expense of occupants' health, comfort and performance.



*A good indoor environment relies on the occupants' perceptions of a range of factors. Clear-up is investigating ways of optimising energy consumption and the quality of the environment taking all of these into consideration.*

image: Thomas Heine, University of Tübingen, Germany

Dr Jakub Kolarik is a post doc researcher at the International Centre for Indoor Environment and Energy, Department of Civil Engineering, Technical University of Denmark. He is involved in research regarding the effects of indoor environment on human comfort, performance and well-being.

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## »» People who do not feel very well do not work very well

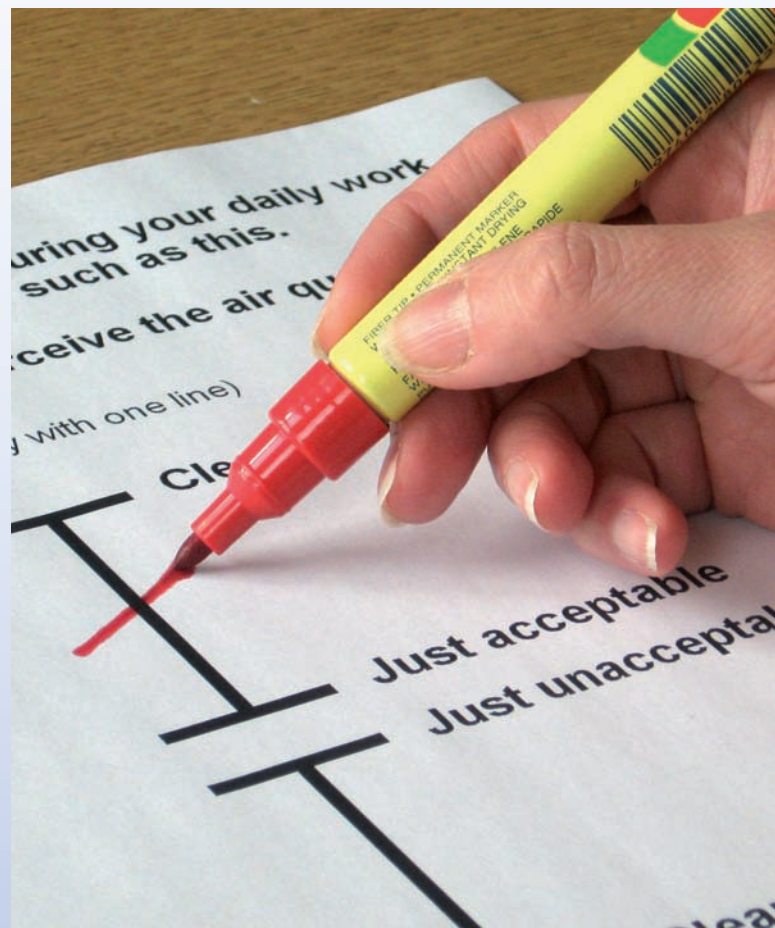
Exposure to a poor indoor environment adversely affects well-being and leads to decreased satisfaction. This results in low work productivity and absenteeism. People who do not feel very well do not work very well. Poor indoor air quality leads to a higher prevalence of headaches and concentration difficulties. Increased concentrations of indoor pollutants result in the irritation of mucous membranes (nose, eyes), odour distraction, allergic reactions or toxicological effects. Thermal discomfort can distract attention, lower arousal and intensify health related symptoms.

## »» Accounting for perceptions

Clear-up aims to design sustainable climate conditioning concepts, testing them both in the laboratory and in real buildings. The tests include extensive measurements of physical parameters characterizing IEQ (temperature, humidity, concentrations of different pollutants indoors, etc.) as well as the subjective evaluation of the indoor environment by human sensory panels.

Research has shown that physical measurements of single parameters do not tell the whole story – often it is their combination that is important. For example relatively high levels of two pollutants might be tolerable individually, but just a small amount of them in combination causes huge irritation. Humidity also has a very strong impact on perceptions of air quality. Using real people to make up sensory panels enables us to explore these complex relationships.

The members of the sensory panels indicate their perception of the environment using different scales. Comparison of the results obtained during the subjective evaluation campaign and objectively measured data give deep insights into the relationships between a building, its systems and its occupants.



# Clearing up with photocatalysis



Gian Luca Guerrini, develops photocatalytic materials at CTG

CTG is the R&D arm of Italcementi Group, the world's fifth largest cement producer. The Group supports research and innovation leveraging on its industrial experience and scientific and technological know-how. Its annual innovation rate (ratio of revenues generated by innovation projects to the total Group sales) is 3.4%, with a target of 5% in the next years. The Group's annual budget for research and innovation is around € 13 million. Currently, 170 researchers are in CTG.

*So Gian Luca, why is Italcementi Group involved in this European research project?*

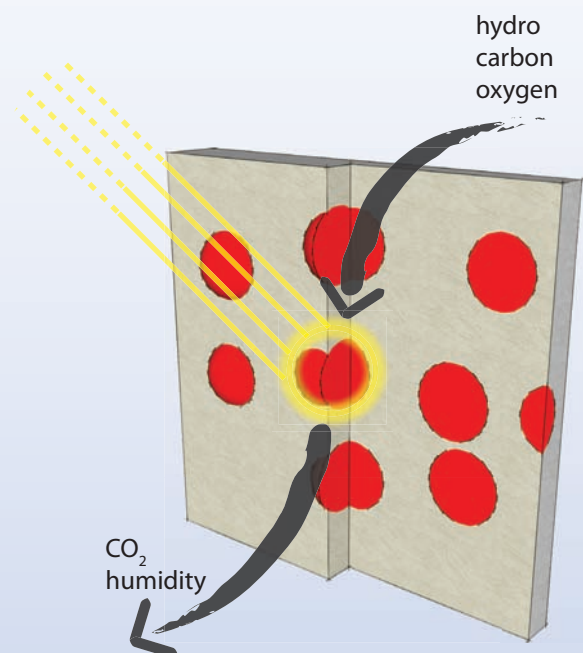
Italcementi Group has always participated in important European R&D projects on building applications. Our interest is applying innovative cement-based materials and demonstrating their effectiveness. In particular in this project, our products will be applied on the walls and the main goal is to optimize performance and durability under indoor light. Currently our products work best with ultra-violet light which is fine for outdoors where they are exposed to sun, but less effective inside with artificial lighting.

The Clear-up project is a great opportunity to introduce photocatalytic cement-based coatings in indoor environments to produce better air quality.

*And what are your ambitions for this collaboration?*

This project should create strong interactions between the partners to develop innovative solutions in the building sector, especially in combining

different technologies – photocatalysis with demand controlled ventilation, sensors and monitoring devices, lighting systems, etc. >>



*The principle of photocatalysis. Using the lights energy to transform noxious substances into harmless compounds.*

image: Thomas Heine, University of Tübingen, Germany

» *Can you explain in a few words what this photocatalytic technology is about? And how is it applied in your products?*

Photocatalysis is a natural phenomenon similar to photosynthesis. A substance called a photocatalyst uses natural or artificial light to stimulate a chemical reaction transforming noxious organic and inorganic substances into absolutely harmless compounds.

Photocatalysis simply accelerates the processes which occur in nature. It promotes faster decomposition of pollutants, preventing them from accumulating in the air around us.

The photoactive cements and binders, designed and patented by Italcementi, are used for manufacturing a wide range of building products. This includes paints, mortars and precast elements - with which pavements, plasters and any type of horizontal or vertical structure and coating can be made. In our products, the TX Active® photocatalyst is held

within the cement matrix, so it is very durable. The photocatalyst is not consumed by the reactions which it stimulates so it also has a long working life.

*This looks very promising! We are looking forward to working together on the applications of photocatalysis in the research lab and in Clear-up's real scale demonstrators.*

Gian Luca Guerrini is a chemical engineer developing special cementitious products and innovative technologies in the building sector. He is the global coordinator for Italcementi Group R&D projects on photocatalysis of cement-based materials.

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# European Initiative on Energy-efficient Buildings

In the context of the European Economic Recovery Plan, Research Commissioner Janez Potocnik announced at the end of March, the rapid implementation of Public Private Partnerships (PPP) for research and development in three major sectors. The three European initiatives are for "Green Cars", "Factories of the Future", and "Energy-efficient Buildings". The latter emerged from the work of the European Construction Technology Platform. The announcement means that the EU will provide €500 million in funding for R&D over 4 years to be matched with equivalent funding from the private sector over the same period. A legal entity, known as Energy Efficient Buildings Association (E2BA) has been set up to enable the private sector to enter into the proposed PPP or European initiative.

The first implementation of the PPP in Energy-efficient Buildings (EeB), will involve cross-thematic calls for research proposals within the FP7 thematic areas NMP, Environment, Energy and ICT. A first series of calls is launched on 30 July 2009 with deadlines ranging from 15 October 2009 to March 2010.

More information is available on the following websites:

[www.e2b-jti.eu](http://www.e2b-jti.eu)

[www.ectp.org](http://www.ectp.org)



# The right team for the job

Clear-up is a consortium of over twenty organisations with different skills and perspectives. Participants include architects and building engineers as well as research scientists. The team first met in December 2008, and will work together for the next four years.

## Meet the Clear-up team at upcoming events

**European Construction Technology Platform Conference  
Innovation in Construction:  
Taking the lead in greening the future**

Tuesday 24 and Wednesday 25 November 2009

**Hotel Le Plaza in Brussels.**

Achievements and perspectives on research in Construction will be presented in various sessions and through poster presentations. There will be focus on the Energy Efficient Buildings Initiative, one of the three Public Private Partnerships arising from the European Economic Recovery Plan.

A Technology Brokerage event for SMEs is also planned to provide opportunities to launch business activities. Clear-up will discuss its goals and achievements with the European stakeholders at the ECTP conference.

Programme and practical details on: [www.ectp.org/conference2009.asp](http://www.ectp.org/conference2009.asp)



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