VINCI and ParisTech: partners for environmental performance.
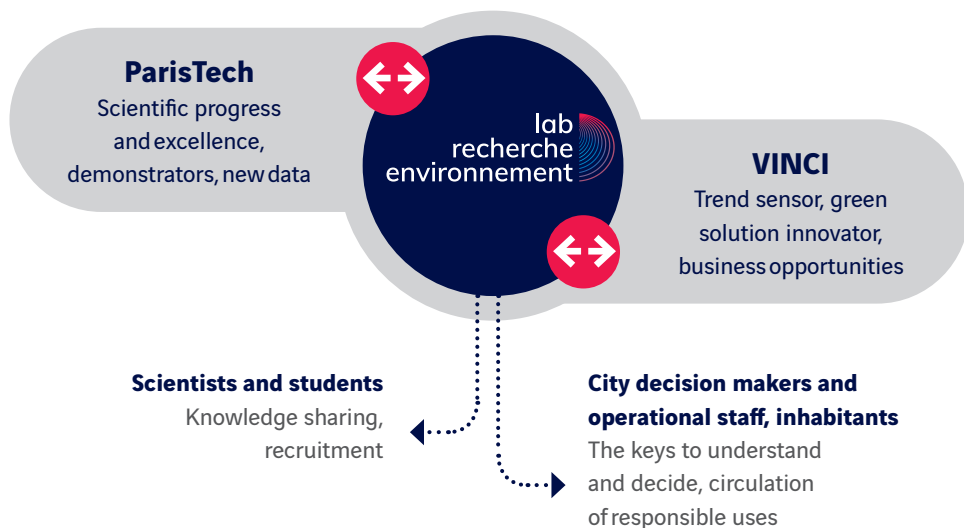
|Contents

| Understanding to anticipate and reduce environmental impacts

The lab recherche environnement is the result of the scientific partnership between VINCI and ParisTech. Its goal is to improve the environmental performance of buildings, neighbourhoods and infrastructure.

The lab recherche environnement arose from the partnership between VINCI and three ParisTech engineering schools, under the aegis of the **ParisTech Foundation**. Since 2008, the research centres design tools to reduce the environmental impact of buildings, neighbourhoods and infrastructure.

The VINCI projects serve as a testing ground for researchers working on three essential themes on ecodesign:

- the energy efficiency of buildings and life cycle assessment of neighbourhoods (**Mines ParisTech**);
- biodiversity (**AgroParisTech**);
- and sustainable mobility (**École des Ponts ParisTech**).

ParisTech
Scientific progress and excellence, demonstrators, new data

lab recherche environnement

VINCI
Trend sensor, green solution innovator, business opportunities

Scientists and students
Knowledge sharing, recruitment

City decision makers and operational staff, inhabitants
The keys to understand and decide, circulation of responsible uses

Scientific excellence

The lab recherche environnement follows a scientific sponsorship approach. It favours the development and circulation of knowledge of environmental issues, in conjunction with VINCI's business areas, in a general-interest approach that respects researchers' independence. Research results are made public and shared not only with the scientific community but also with all city and regional stakeholders, to facilitate decision-making and improve uses.

The lab recherche environnement University – The annual conference of the lab recherche environnement network of researchers and operational staff took place in November 2019 in Marseille.

Relationship with operational staff

Environmental themes are more and more technical, and must take multiple criteria into account. ParisTech researchers fuel the ecological transition of buildings and infrastructure with solid knowledge and a multidisciplinary approach. This ecoperformance goal is pursued in conjunction with VINCI employees, who contribute by reflecting on the economic viability of sustainable solutions designed by researchers, within an action-oriented research approach.

From science to businesses

A distinctive feature of the lab recherche environnement is the strong collaboration that exists between the company and researchers: we call this **action-oriented research**. VINCI's projects serve as experimenting labs. At the same time, the lab recherche environnement provides VINCI subsidiaries with the knowledge necessary to develop business opportunities that will meet both clients' and employees' expectations in terms of environmental sustainability. The operational application of the lab recherche environnement's work has three main outlets:

Understand new innovation trends in eco-design.

Fuel VINCI's green solutions.

Help to create new activities.

Partners for over 10 years

Ever since its creation in 2008, the lab recherche environnement has been supported:

- by the VINCI Group, for as much as 7 million euros;
- for a total of 30 projects conducted especially as PhDs.

VINCI's commitment has been renewed until 2023, with an additional financing of 5 million euros.

Some 50 group employees are involved in the lab recherche environnement's life, especially through mirror groups, made up of VINCI managers associated to steering research projects.

Circulation is a key point, with over 150 academic publications and almost 500 people (VINCI employees and external participants), who attend each year the lab recherche environnement's conferences. The acceleration of the operational application of research work has so far resulted in:

- the creation of the **Kocliko start-up** (www.kocliko.co);
- the **Pleiades** software (www.izuba.fr/logiciels/) which arose from the work of Mines ParisTech with support from the lab recherche environnement, and which is used by over 2,500 design offices and architecture firms.

Current research

The 2018–2023 road map points to three goals:

Limit the environmental impact of buildings, neighbourhoods and transportation.

Erica Dorr
urban agriculture

Mija Frossard
life-cycle assessment

Aurore Wurtz
energy optimisation

Increase business digitisation in the area of ecological transition.

Cyrille François
sustainable mobility

Liu Liu
air quality

Lucas Striegel
positive-energy road

Offer solutions that improve users' daily lives.

Samih Akkari
smart sensors

Sonia Le Mentec
heat island

Sharing day at Leonard:Paris, January 2020.

Environmental impacts

Eco-districts

- Guide the design of neighbourhoods to reduce various environmental impacts, such as carbon footprints and the consumption of power, water and other natural resources.
- Consider the constraints relating to costs, comfort, variability in uses, and the climate in the eco-design of buildings and neighbourhoods.
- Optimise transport planning from an economic, social and environmental point of view.
- Improve the evaluation of energy efficiency in terms of reliability, usability and costs.
- Include the local production of energy in optimal power management strategies for buildings.
- Evaluate the social impacts of transport projects and infrastructure development projects.
- Study the impact of new forms of mobility on user expectations and investments.

Ecological compensation

- Develop a "serious game" for ecological compensation projects.
- Evaluate the socio-economic and ecological consequences of compensation.
- Develop a decision support tool for compensation.

Circular economy

- Measure the impact of the use of secondary raw materials in transportation infrastructures.
- Evaluate the sustainability of urban agriculture as a food source.

Digitisation of business lines

BIM – Building Information Modelling
- Adapt building life-cycle assessment (LCA) tools to BIM.
- Combine socio-economic assessment and building LCA.

Resilience
- Forecast the influence of microclimates on the energy efficiency of buildings.

Big data
- Know users' behaviour thanks to data from mobile phones, electronic toll collection and ticketing systems.
- Simulate and evaluate the mobility of inhabitants living in a specific neighbourhood, and its social, economic and environmental impacts.

Users' health and comfort

Comfort
- Use smart sensors to know the impact of behaviours and the climate on the energy efficiency of buildings and on comfort.
- Evaluate comfort on public transportation and on road transport.

Health
- Locate the emissions of pollutants and anticipate their transfer to the human body.

Effects of nature
- Forecast the impact of urban revegetation on air quality and on heat islands.
- Study the effects of rooftop vegetable patches.

This new cycle also aims at multiplying operational applications.
The partnership has already made it possible to develop many environmental solutions supported by VINCI's business lines, such as Urbalia (urban biodiversity), Equo Vivo (environmental engineering), Resallience (adaptation of cities and infrastructure to climate change) and Power Road (energy-producing roads). The tools developed are also intended to be implemented on demonstrator projects, as in the project in the Les Lumières neighbourhood of Saint-Denis (Paris area), within the framework of Rêve de scènes urbaines (Dream of Urban Scenes).

|The lab recherche environnement's tools

The lab recherche environnement has created and improved decision support tools that can be mobilised at any step of a construction or development plan.

1 Relevance and specifications

2 Simulation and design

3 Production

4 Sustainable operation

Pleiades DTS (COMFIE)

This model of dynamic thermal simulation for buildings, which is compatible with BIM, anticipates power consumption and the risk of discomfort in all seasons, since the design phase. Thanks to the Amapola module, this software can identify the least costly solution, anticipate use and optimise the reliability of forecasts. It is therefore possible to evaluate power consumption as part of an energy efficiency guarantee with a risk of overruns lower than 5%. Based on data gathered by smart sensors, the software considers the impact of occupants and their behaviour.

ENVI-met

This microclimate model, developed by the University of Mainz (Germany), evaluates the consequences of an urban project on comfort in exterior spaces. In particular, the software evaluates the impact of revegetation on urban heat islands.

Bio(V)district®

This tool assesses the state of biodiversity in a specific neighbourhood. It allows to compare the impact of various construction or rehabilitation projects on biodiversity in cities.

ParkCap

This model of parking simulation in an area evaluates the spatial extension of saturation, delays for users and over-emissions of environmental impacts.

Pleiades ACV (EQUER)

This life-cycle assessment software evaluates the environmental impacts of a neighbourhood project, from the manufacturing of materials until their end of life.
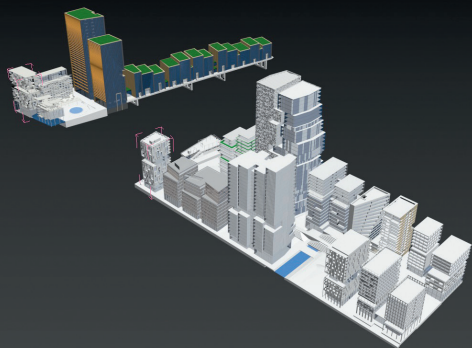
STEM

This model, which simulates mobility scenarios on a metropolitan scale, evaluates the economic, social and environmental impact of various transport policies. This includes pricing measures and changes in mobility services.

FOCUS

One of our demonstrators: the Les Lumières neighbourhood in Saint-Denis (Paris area)

A development project in the Les Lumières neighbourhood of Saint-Denis is the subject of research by Mines ParisTech. The aim is to improve the decision support tools for developers: **life-cycle assessment** (multi-criteria, multi-stage environmental balance of the buildings' entire life-cycle) and the **dynamic thermal simulation** (modelling of the evolution of the buildings' thermal state over time). These tools help to inform a development team on the strategic choices that must be implemented to improve the environmental performance of a building or neighbourhood: the major causes of the project's environmental impacts; the level of environmental performance that can be achieved; potential recommendations for architects (choice of biosourced, low-carbon materials, glazing ratio on façades); or optimised management of excavated soil.

| Governance

Direction and Evaluation Committee (DEC)

Missions: to supervise and verify the lab recherche environnement's activities, approve the annual budget presented by the steering committee, examine the allocation of funds as part of the annual budget, as well as the activity report presented annually by the steering committee.

Members: Valérie Archambault (Mines ParisTech), Marc Barra (Regional Agency on Biodiversity in Île-de-France), André Broto (VINCI Autoroutes), Élisabeth Dupont Kerlan (French Ministry for the Ecological Transition), Christophe Gobin (Scientific counsellor at ESTP), Vincent Laflèche (Chair of the Committee, Mines ParisTech), Corinne Laniece (VINCI Energies), Chantal Monvois (AgroParisTech), Françoise Preteux (École des Ponts ParisTech), Isabelle Spiegel (VINCI), Jacques Teller (University of Liège).

Steering Committee (Copil)

Missions: to define and follow up on research subjects, promote the research undertaken by the lab recherche environnement, define communication policies, draw up a budget that will be submitted to the Evaluation Committee, create annual activity reports.

Patrick Lerat, member of the Copil, and Isabelle Spiegel, member of the DEC.

Members: Elise Bon (VINCI Construction), Nicolas Coulombel (École des Ponts ParisTech), Frédéric Depaepe (VINCI Autoroutes), Ivan Drouadaine (Eurovia), Patrick Lerat (VINCI Concessions), Nathalie Mehu (VINCI Construction France), Bruno Peuportier (Mines ParisTech), Jean Roger-Estrade (AgroParisTech), Aymeric Tissandier (VINCI Energies), Maxime Trocmé (VINCI).

| Visited the site
lab-recherche-environnement.org

Keep up with the latest news.

Participate in events.

Take part in projects.

VINCI ◆   lab recherche environnement   ParisTech

Contacts

lab recherche environnement VINCI ParisTech – Leonard:Paris
6, place du Colonel Bourgoin – 75012 PARIS
contact.lab@lab-recherche-environnement.org