

Bioclimatic trajectory for the major Parisian train stations

Strategy and action plan to 2050

Technical Deep Dive on Urban Heat
Singapore, April 25th, 2023.



AREP

the multidisciplinary architecture practice

A subsidiary of SNCF Gares & Connexions

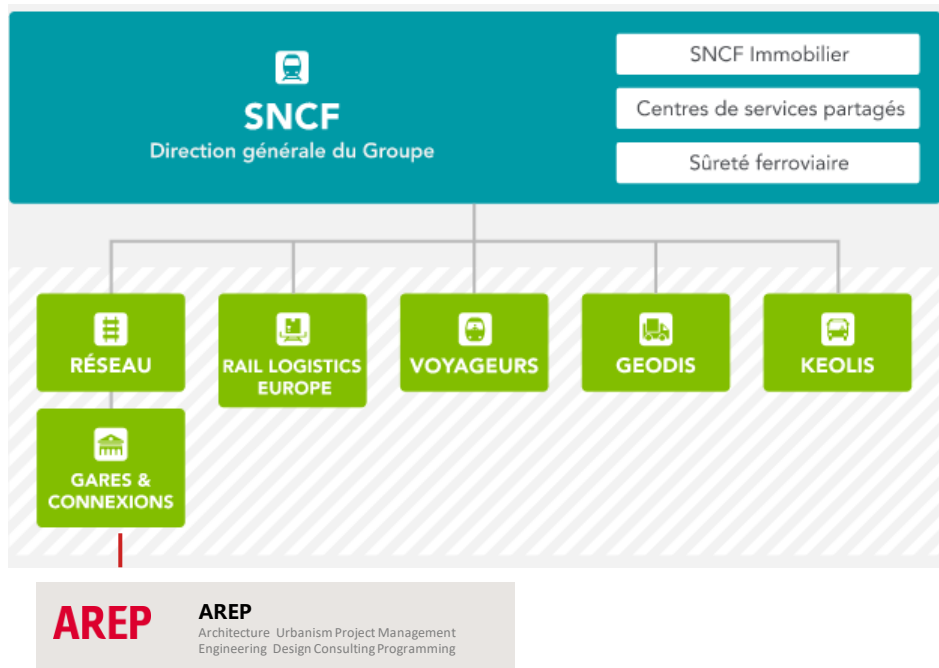
AREP is the first architecture studio in France. Our know-how and our references are at the interface between buildings and mobility. Our mission is to invent a post-carbon future.

AREP develops creative and solid solutions for **resilient urban planning, low-carbon architecture and sustainable design**, through advanced digital tools. We offer a unique approach specialising in **inclusive mobility**, where pedestrians are at the heart of the project.

We bring together a wide range of expertise from the upstream to the downstream of the project: Architecture, Urban Planning, Design, Engineering, Digital and Environmental Procedures, Assistance.

AREP Group is in France, China, Vietnam, Switzerland and develops projects all around the world.

STRUCTURE



AREP in data

Since
1997

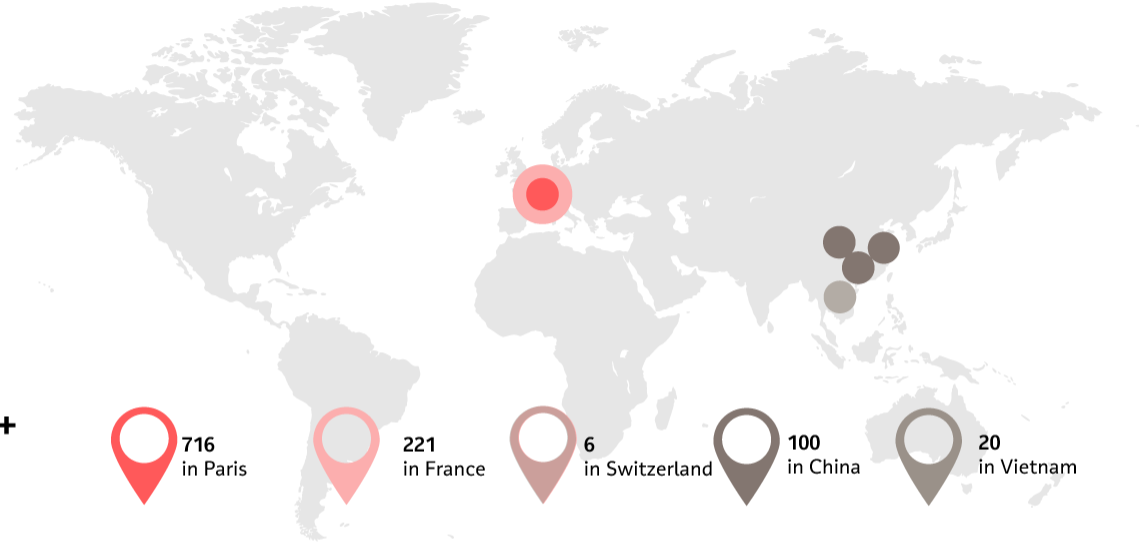


than **1 000 +**
employees



7 business
sectors

Architecture
Urban Studies and Regional Planning
Design
Engineering
Urban studies and Masterplanning
Project Management Assistance
Environment and Digital



716
in Paris



221
in France



6
in Switzerland



100
in China



20
in Vietnam

Turnover
2022
119,1M€



1st
French
architecture
practice 2022
« d'a » ranking

39

years
average age

28

nationalities

51 %

women

49 %

men

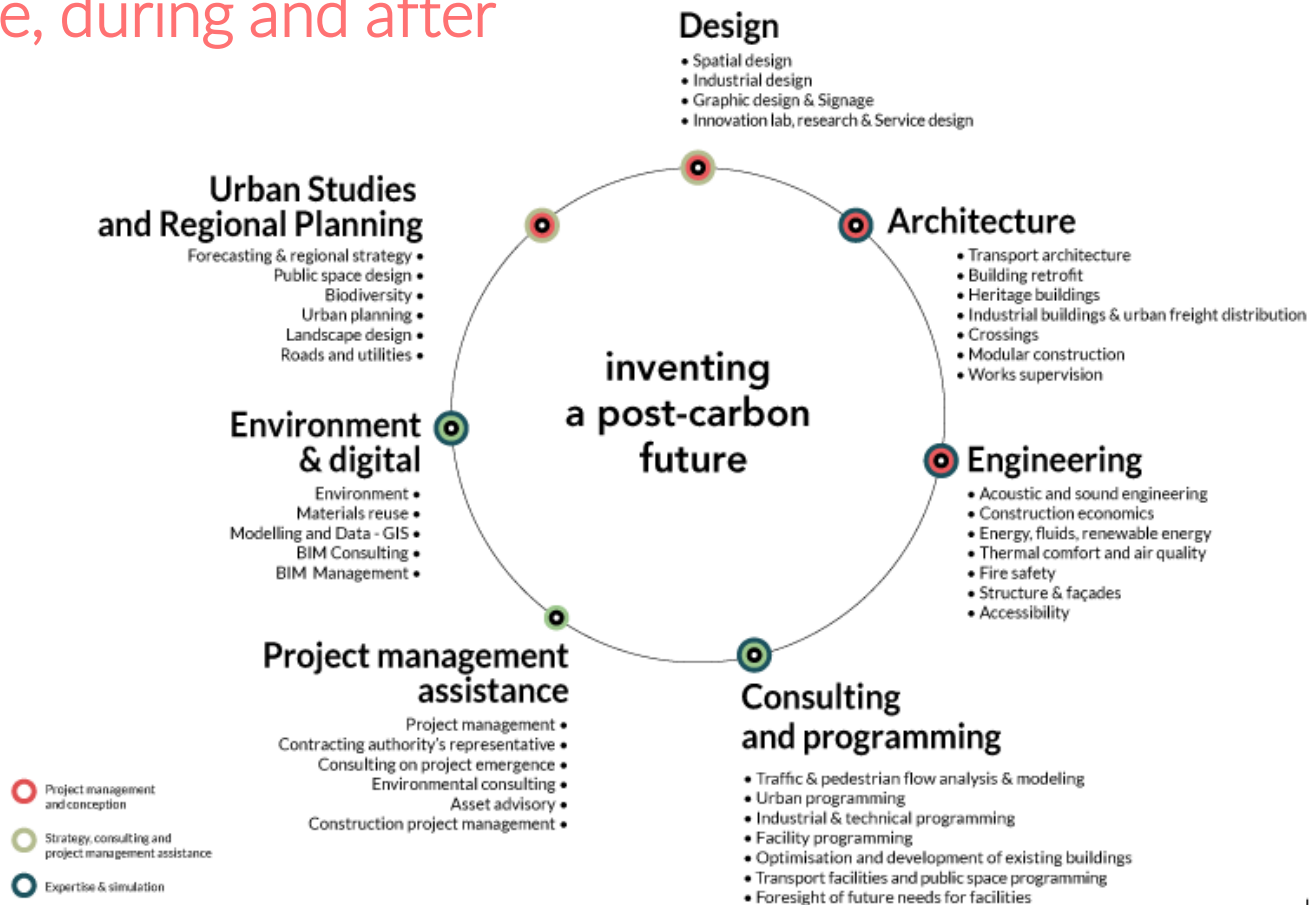
1 %

employee
recognized
as having a disability



500 +
on-going projects
each year

AREP Services and Areas of Expertise Before, during and after



AREP South Asia

Established in Vietnam since 2005

Expertise

Environment, sustainability and resilience planning and design at different scales

Consulting and providing advice to localities on the transition to a resilient and sustainable future

Urban and regional planning

Architecture and design

Technology-based design and planning, City Information Modeling (CIM)

Focus Areas



Heritage



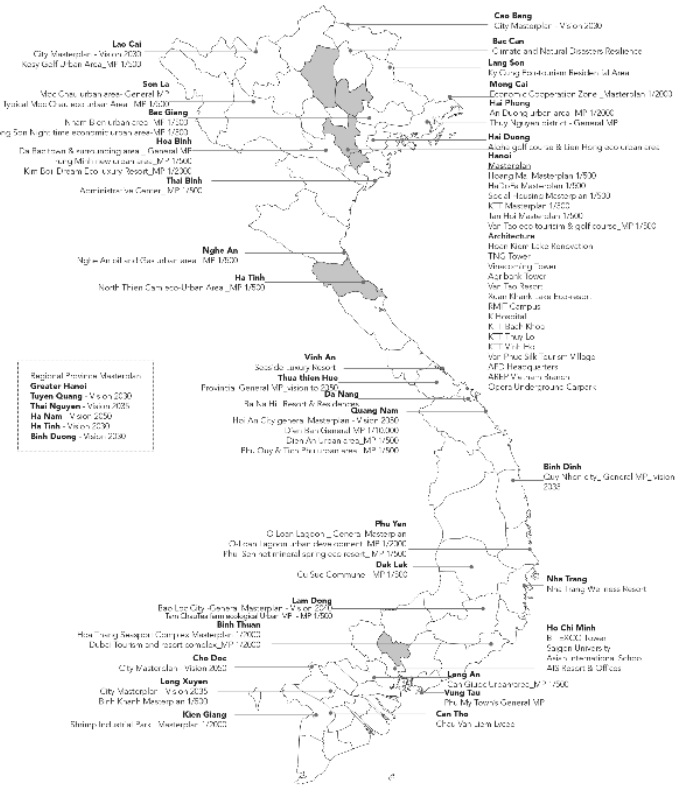
Climate Risks



Urban Industrial Synergy



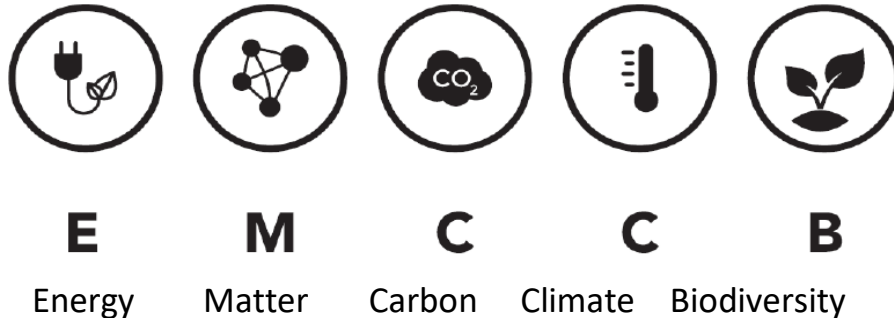
Transportation



Responding to the climate emergency

AREP is at the forefront of the design of French and international stations.

Prescriber and stakeholder in urban transformation, our mission is to **invent a post-carbon future** through an environmental approach integrated into design: EMC2B approach – energy, matter, carbon, climate and biodiversity.



Iconic gateways to the capital



Gare de l'Est



Gare du Nord



Gare Saint-Lazare



Gare de Lyon



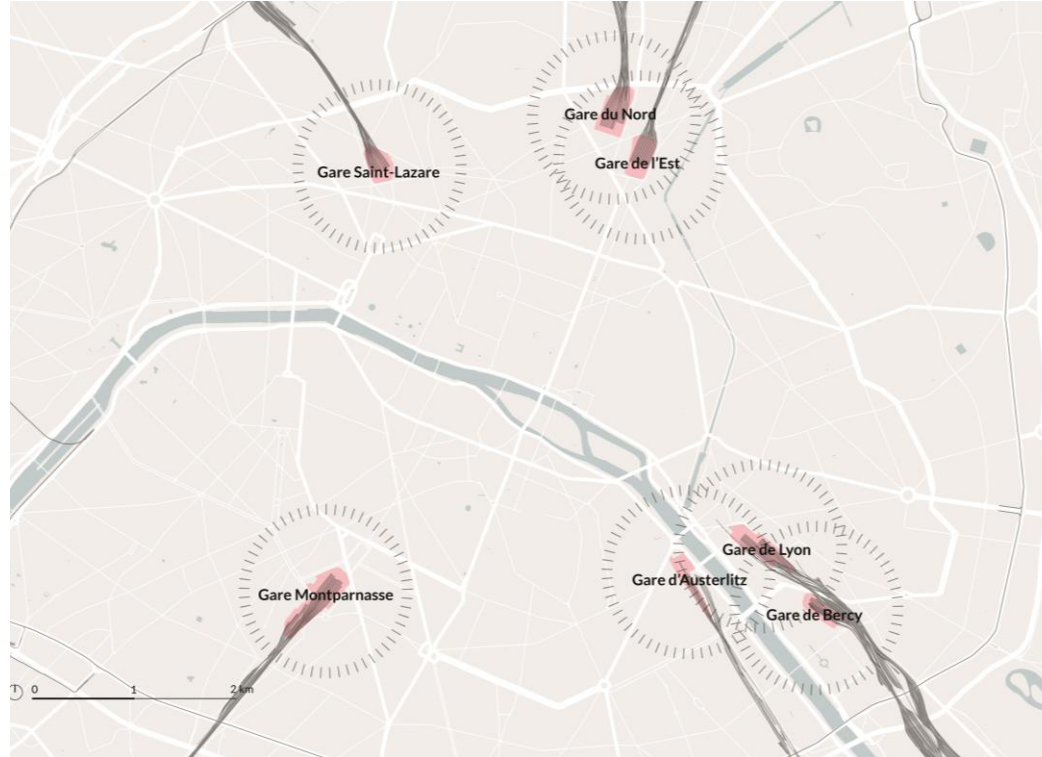
Gare d'Austerlitz



Gare Montparnasse

Demonstrators

We propose to mobilize the 7 Paris train stations as "demonstrators" of the bioclimatic design approach and to make them models of ecological transition and resilience.



71 Ha
footprint of Parisian train stations

115 GWh
consumed per year

10 500 tCO²eq
emitted in a year

0,5Ha
of planted areas

0,35
average albedo

Bioclimatic trajectory themes

As intermodal nodes, stations generate a mix of flows and users whose efficiency is a **major challenge for the decarbonization of mobility**.

As major consumers of energy, Parisian train stations must now change their model.

- revisit their way of **consuming energy**
- question their renewable **energy production** potential
- **reduce** their carbon emissions.

Energy and Carbon



Covering large urban footprints at the heart of the city, train stations have historically been designed as heavily mineralized and poorly planted areas, and therefore poorly prepared to cope with the effects of climate change.

The station transition trajectory aims to :

- **fight the heat island effect** through greening and improving the average albedo
- **strengthen the resilience** by reducing the volume of rainwater discharge to a network that is currently highly saturated and a strengthening of resilience to floods.
- Reintroducing **biodiversity**, demineralizing to **promote soil porosity**

Adaptation and resilience



Energy and Carbon

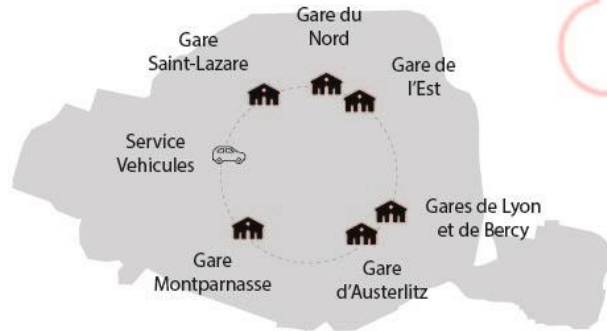
Current situation

Today | Situation of reference

115
GWh consumed

0,4% of Parisian energy consumption

26% ratio of renewable energy
0 GWh electricity produced



10,5
ktCO₂e emitted
0,2% of direct Parisian GHG

In 2019,
The Parisian train stations represent:

0,4 %
of Parisian energy consumption at 115 GWh

0,2 %
of Parisian direct greenhouse gas emissions at 10,5 ktCO₂e

Energy and Carbon

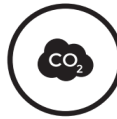
3 targets for the energetic transition of train stations



Reduce the energy consumption of buildings by identifying dedicated work action plans station by station and the strong commitment of businesses in this transition.



Promote renewable energies such as solar photovoltaic on the roofs of buildings and on the shelters of running docks.



Reduce greenhouse gas emissions using renewable and recovered energies, the end of the use of fuel oil and the end of thermal mobility for the fleet of service vehicles.

Energy and Carbon

Actions to implement

Improving the energy performance of buildings



Gare Montparnasse, the renovated façade, 2020

Environmental commitment of retail businesses through specifications at bidding stage



Shops in gare Saint-Lazare, 2015

Energy and Carbon

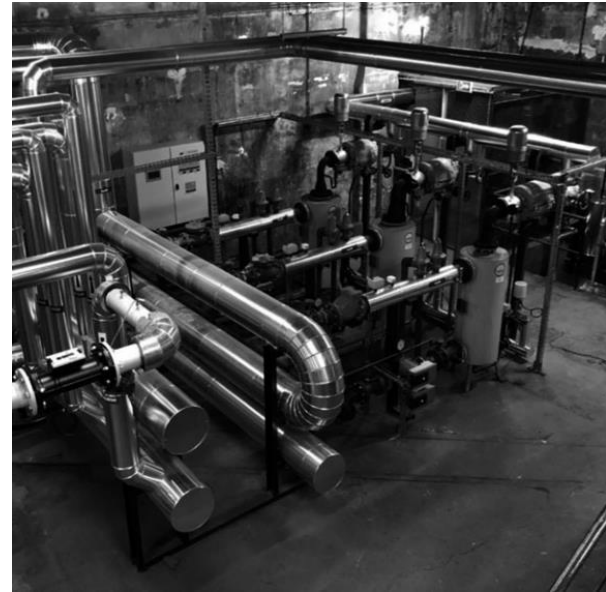
Actions to implement

Solarization of roofs or shelters



Bicycle hall at Gare du Nord – Horizon 2024

Improved energy performance
of production systems



Regeneration of the steam substation with
condensate recovery, Gare de Lyon, 2019

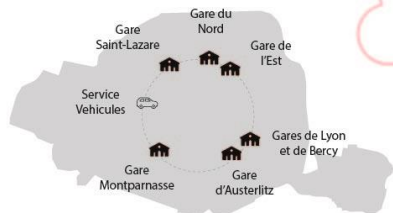
Trajectory for Energy and GHG emissions until 2050

Today | Situation of reference

115
GWh consumed

0,4 % of Parisian energy consumption

26 % ratio of renewable energy
0 GWh electricity produced



10,5
ktCO₂e emitted

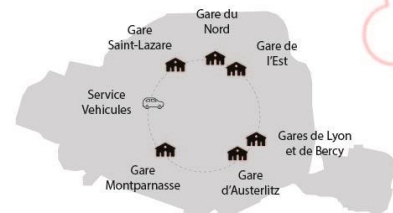
0,2 % of direct Parisian GHG

2024 | 0,4 ktCO₂e avoided

109
GWh consumed

0,4 % of Parisian energy consumption

33 % ratio of renewable energy
0,2 GWh electricity produced



7,8
ktCO₂e emitted

-26 % compared to 2019

2030 | 1,5 ktCO₂e avoided

92
GWh consumed

-20 % compared to 2019

43 % ratio of renewable energy
2,1 GWh energy produced



5,8
ktCO₂e emitted

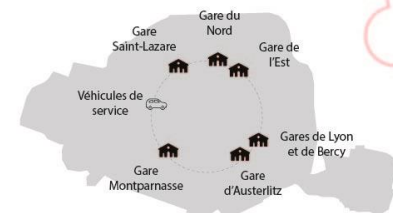
-45 % compared to 2019

2050 | 1,4 ktCO₂e avoided

69
GWh consumed

-40 % compared to 2019

64 % ratio of renewable energy
3,6 GWh energy produced



2,1
ktCO₂e emitted

-80 % compared to 2019

Climate adaptation and Resilience

Effect of green areas on Heat Island Effect



Temperature curve of the urban heat island.

Extract from « Heat wave adaptation in Paris », Éditions Direction des Espaces Verts et de l'Environnement, May 2021, page 6, document © Apur.

71 Ha
footprint of Parisian train stations

3,2 Ha
of outdoor public space

207
Trees in open ground

0,5Ha
of planted areas

0,35
average albedo

Climate adaptation and Resilience

3 benefits from planting



Reduce the impact of **heat waves** on the comfort felt around stations.



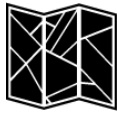
Connect **public spaces** to the **ecological rail corridor**, reintroduce **biodiversity** and the green networks around stations.



Enhance the **presence of water** in and around station perimeters and reduce the overall volume of rainwater discharge into a network that is now saturated, subject to major flood and pollution hazards.

Climate adaptation and Resilience

Planting guidelines and commitments



Respect Paris City nature paths



Respect for the specificity of each planting site / adaptability of the revegetation project



Choices must be based on the robustness and durability of local plants ("local plant" label)



Preservation of certain land funds as "refuge zones" of biodiversity



Diversification of strata, age classes and species of plantations within planted areas



Integration of productive, active, edible vegetation and learning support on certain locations



Revegetation strategy to benefit from the Paris Rainwater plan (abatement of current rainfall and zero discharge)

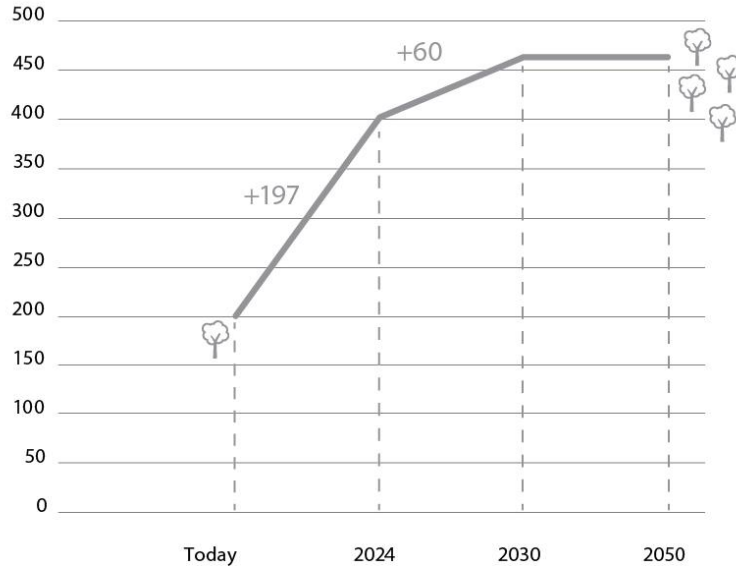


Supply of watering needs by the ENP network or rainwater recovery.

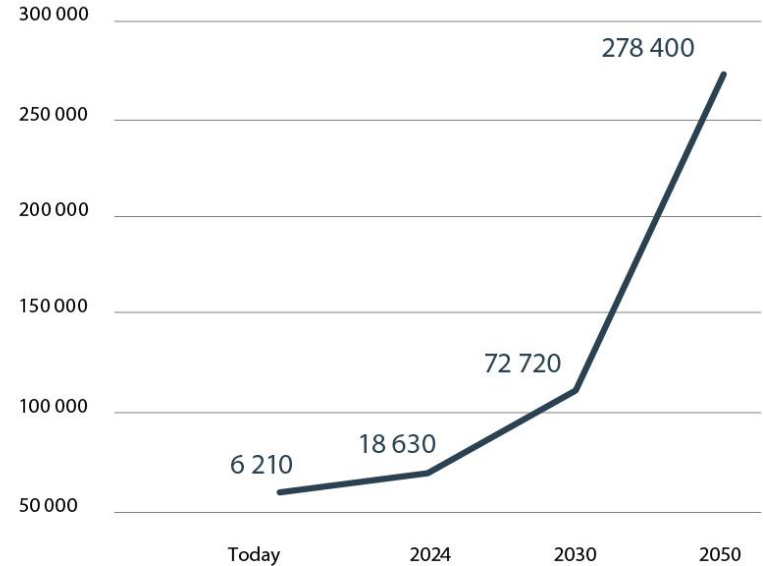
Trajectory for planting

Quantity of CO2 absorbed per year by the planted trees

Nb of trees



Carbon sequestration (eq. kgCO₂e/year)



Climate adaptation and Resilience

Albedo – actions on materiality and colorimetry

Albedo is the reflective power of a surface, i.e. the ratio of reflected light energy to incident light energy. Its measurement varies from 0 to 1.

The average albedo calculated for Parisian stations is 0.35, i.e. the solar energy reflected back to the sky is 35%.

The higher the albedo, the better the thermal performance of the material to fight the urban heat island effect.



Planting must be **combined** with improving the albedo ratio to ensure effectiveness against the urban heat island effect.



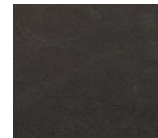
16,9 Ha
Ballast



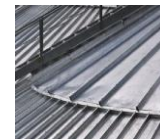
10 Ha
Grey concrete



2,3 Ha
Grey granite



15,9 Ha
Asphalt



22,5 Ha
Zinc roofs



1,2 Ha
Light color paving

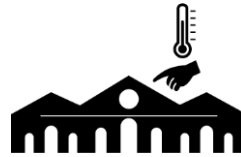
Climate adaptation and Resilience

Albedo improving guidelines



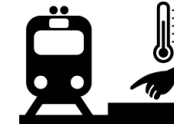
Interior floors

On floors, install clear materials and repaint some existing coatings.



Roofs

Use of the "cool roofing" process on flat roofs not subject to heritage constraints

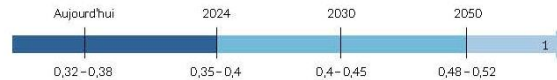


Platforms

- For qualitative, noble and reusable materials: painting in a light color to improve albedo.
- For low-quality materials (asphalt): paint to improve albedo in the short term and then replace by another material with a higher albedo.

NB. At the same time, consider the **heritage** value of the station the **maintenance** of the building

From 0,35 average albedo to 0,52



Climate adaptation and Resilience

First designs with improved albedo

Light color paving



Bicycle hall at Gare du Nord – Horizon 2024



Gare de Lyon, redevelopment of the Louis Armand square, 2017

Trajectory for Climate adaptation and Resilience until 2050

The matrix represents evolution of the major Paris train stations short, medium and long term. For each station, the footprint of the maps of the greening trajectories, planned or potential, with regard to site constraints and the inventory of available surfaces.

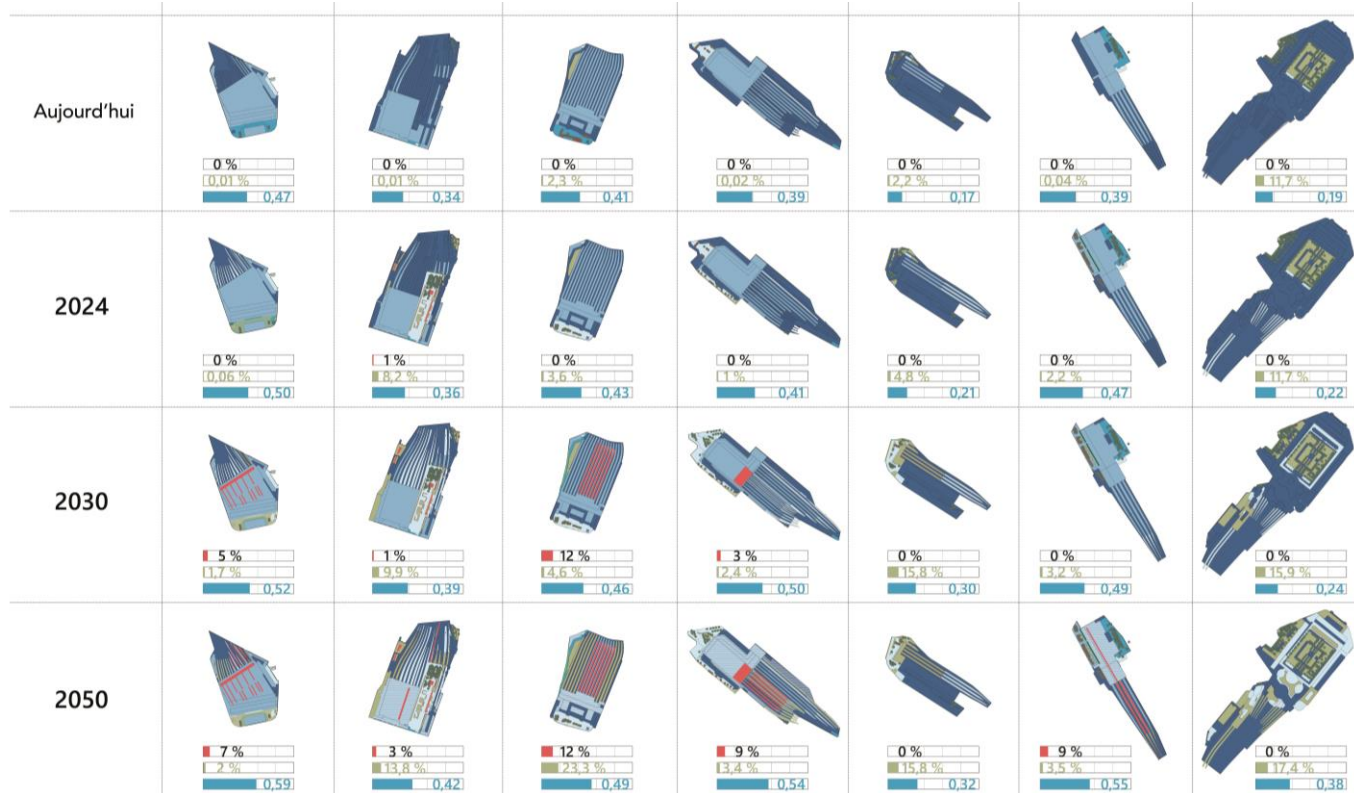


The matrix represents the evolution of the albedo of major Parisian stations in the short, medium and long term. It includes, for each station, the cartographic footprint of the albedo improvement trajectories, planned or potential.



* Projet StationHord intégré à la matrice, sous réserve de modification en cours
 ** 2050 : Vision prospective ne faisant pas l'objet d'engagement dans le présent protocole

Trajectory table 2023 - 2030 - 2050



Founded in 1997, AREP brings together multiple skills in architecture, urban planning, design, engineering, programming, flow, consulting and project management.

Customer-oriented, the agency provides concrete answers to the major challenges of the ecological emergency through its EMC2B approach and contributes to research, public debate and the evolution of practices through its publications, particularly through its magazine POST.

Established in France and abroad, AREP has nearly 1,000 employees with 30 different nationalities.

AREP, inventing a post-carbon future



Contact

Mélanie-Lan DOREMUS

AREP Vietnam
Architect – General Director
melanie.doremus@arep.fr
+84 96 3995698

AREP



www.arep.fr