What are the challenges to maintain the transformation trajectory of the existing building stock on the major issues of adaptation and transformation related to Climate Change

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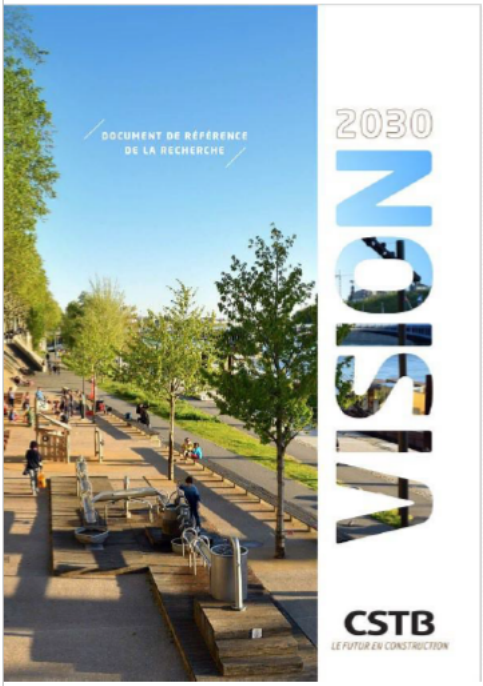
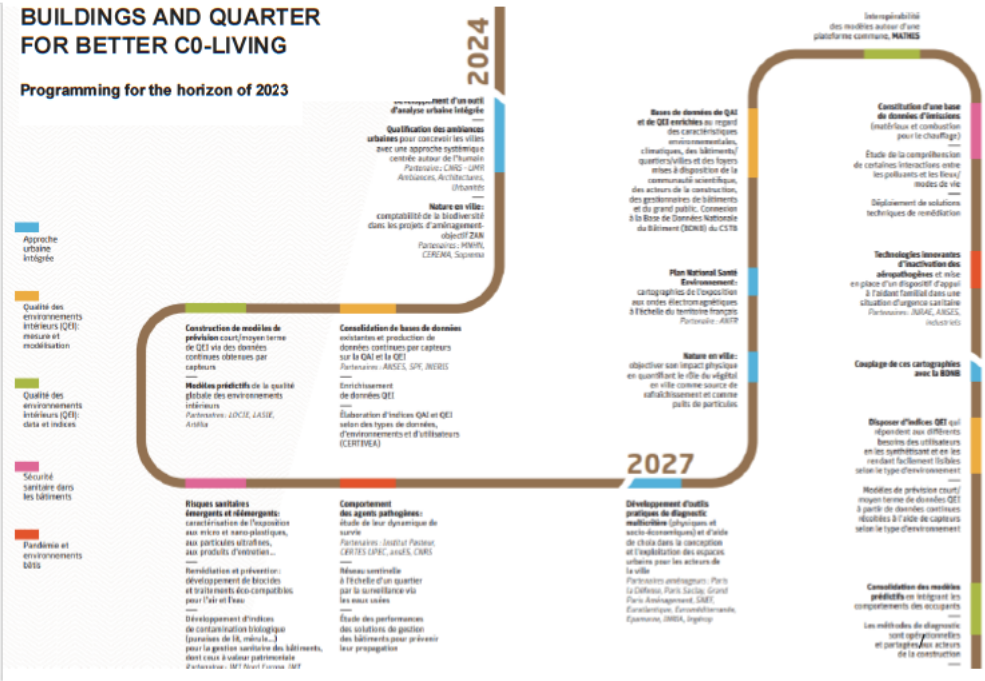
VISION 2030 CSTB R&D ROAD MAP





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5 Fields of Strategic Action
16 projects
For the Research of CSTB

Buildings and Quarters for better co-living
- > Inclusive urban analysis
- > Quality of interior environments: measuring and modernization
- > Quality of interior environments: data and indexes
- > Sanitary security of buildings
- > Buildings and Pandemic

Buildings and towns facing to the climate change
- > Mitigation of the climate change
- > Adaptation to the climate change

Renovation and reliability of construction
- > Knowledge of the park
- > Insite evaluation of performances
- > Multi-criteria rehabilitation
- > Knowledge of the field

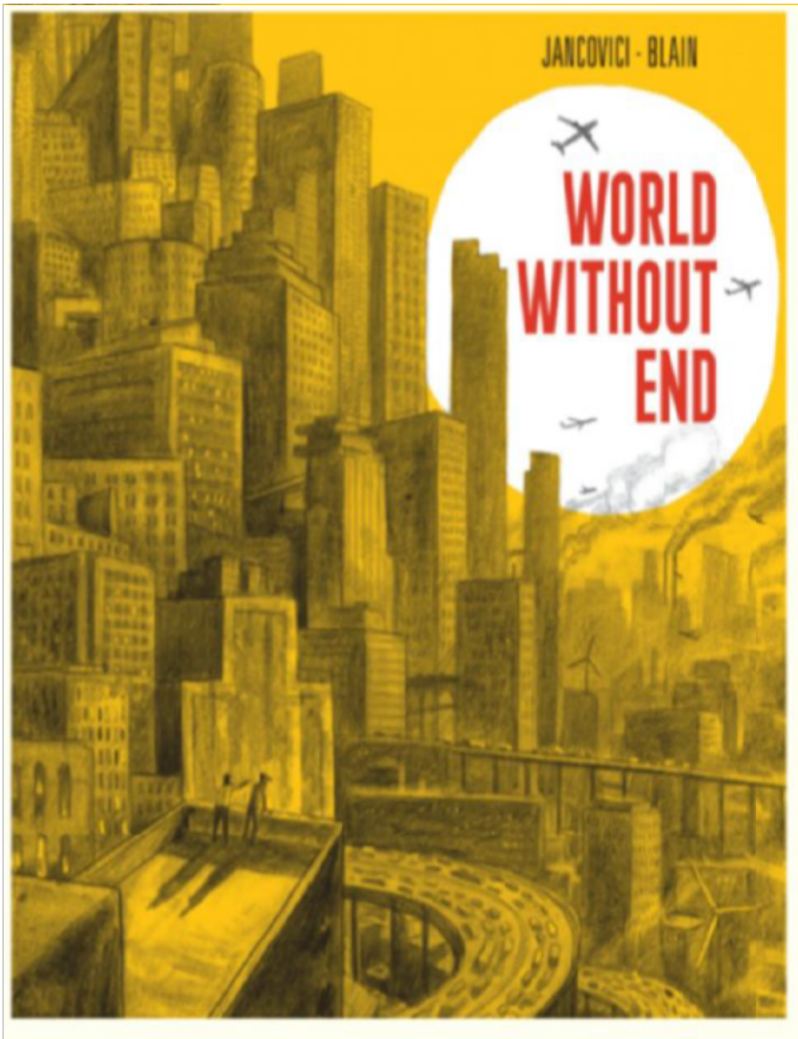
Circular economy and resources for building
- > Circular economy: Secondary raw materials – Conception Eco
- > Durability of performances
- > Management of waters

Performant construction products and systems
- > Evaluation multi-critères des produits & montée en compétence essais
- > Technology research

Digital transverse

Prospective transverse

/



Carbon print – Building field: 153 Mt eq CO2/year

Exploitation of buildings – direct and indirect emissions

8 Mt	75 Mt	20 Mt
Emissions of fluoric gas	Emissions connected to the energy consumption when combustion occurs in the building	Other emissions connected to consumptions (Electricity, Ground floor ...)

Residential	Tertiary
60%	40%
DPE	Tertiary decree

Products of construction and equipment

50 Mt

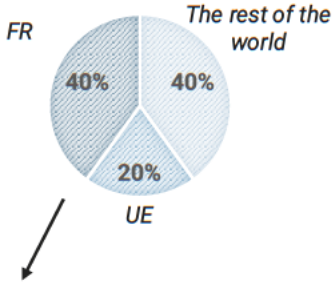
Extraction, manufacturing, transport, implementation, renovation, waste management

New construction	Renovation
80%	20%
Recognized in the RE 2020	

Across the French territory

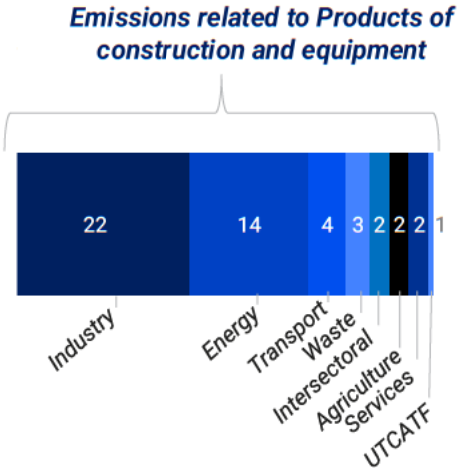
80%	Imported emissions 20%

Carbon footprint - Field of building
Emissions detailed par segment



New construction

The inches we need are everywhere around us. They're in every break of the game, every minute, every second.

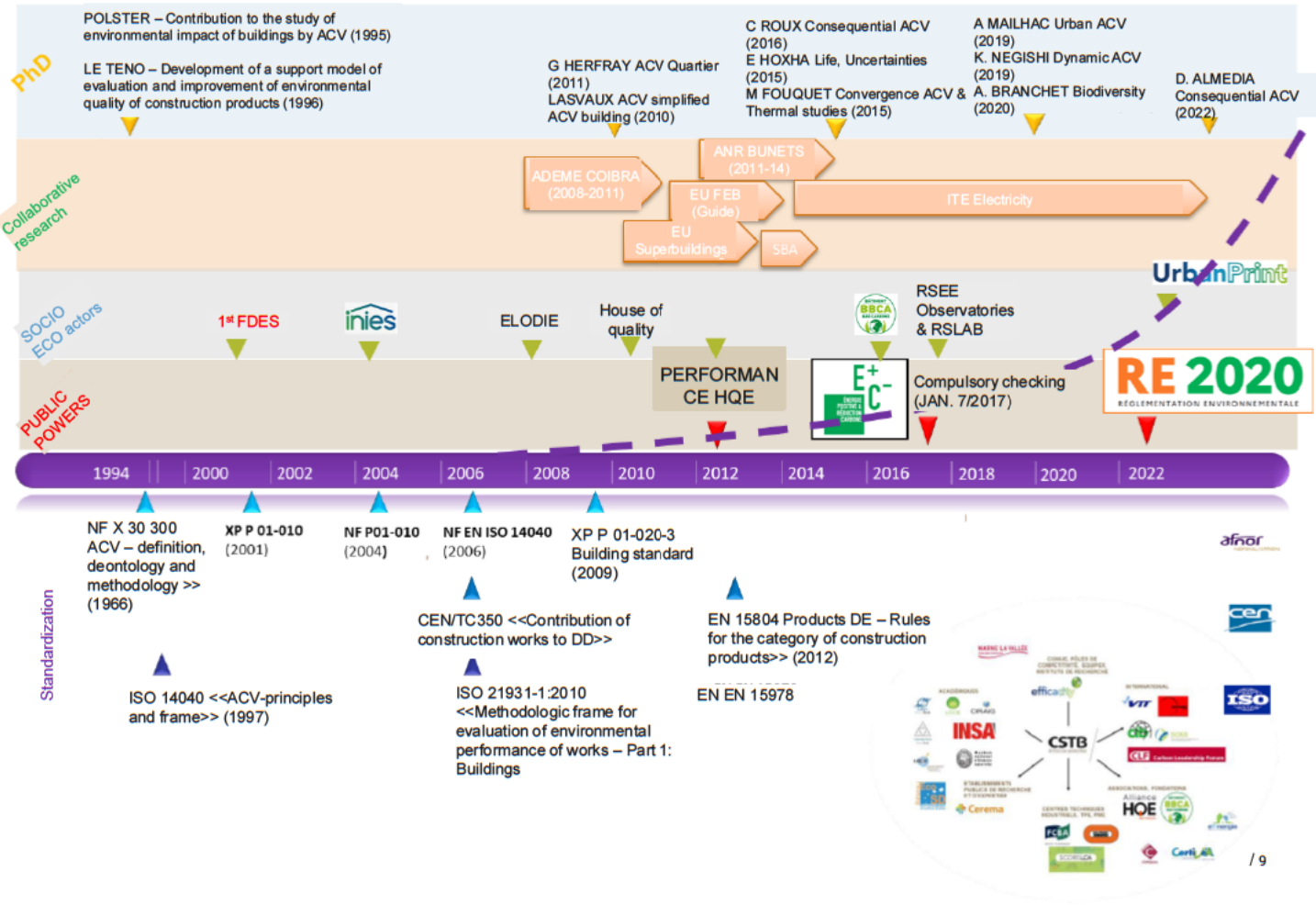


PELLAN M; LOUERAT M; HABERT G. A holistic perspective on the French building and construction GHG footprint, SB22

Source : calculé avec Exiobase v3.8.1, Base ADEME (facteur d'émissions), SDES (bilan énergétique)

Carbon threshold RE 2020

	Emission CO2 (Kg¥m2)
RE 2020: MI: Ic $_{energy}$ (over 50 years)	160
RE 2020: LC: Ic $_{energy}$ (over 50 years)	560
RE 2020: MI: IC $_{construction}$	640
RE 2020: LC: IC $_{construction}$	740



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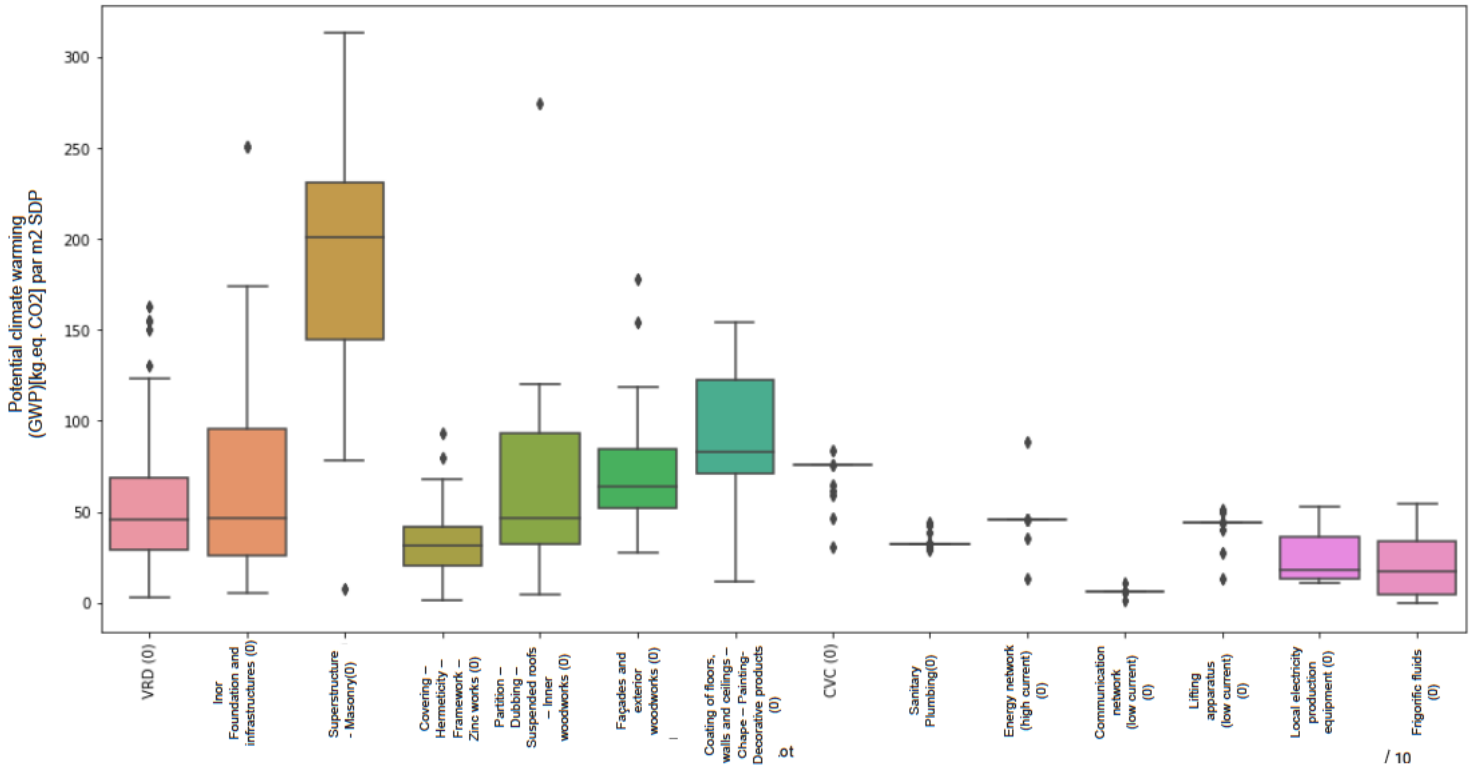
Statistical analysis [LC]

Study across 33 RSEEs, 44 buildings, 88 zones
Indicator 1 (scale: lot)



/ 10

GES emissions from buildings / order of magnitude

Building ACV

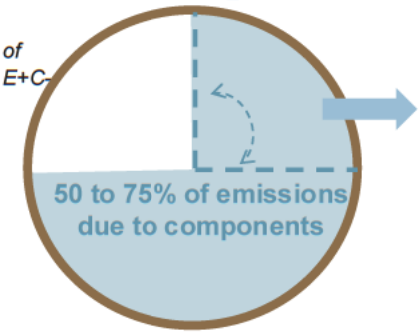
Distribution between exploitation and components?

ORDER OF MAGNITUDE FOR NEW BUILDINGS:

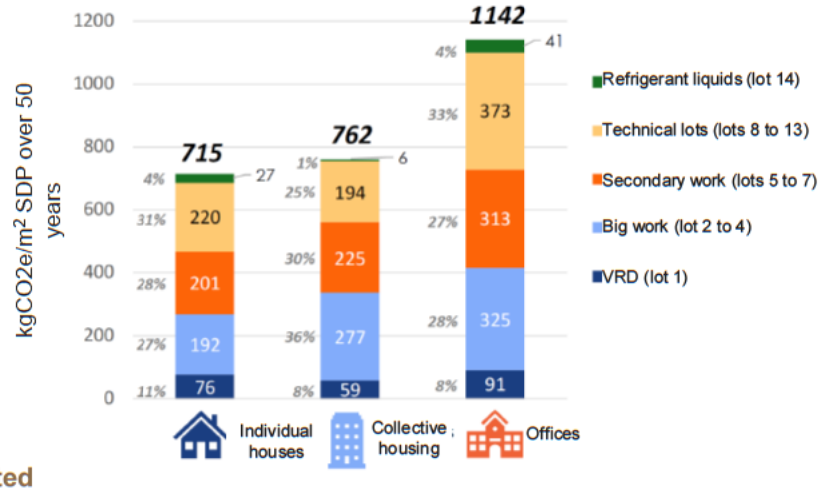
Over 50 years

1-1.5 tCO_2 eq./m^2

Source: Feedbacks of experience E+C-



Distribution of emissions among components



Sequestration and stockage on the plot:
~ 1 tree par 1m2 constructed and exploited

[hypothesis: absorption by 1 tree of 25kgeq.CO_2 per year]

Sources : Selmi, W. (2016). *Evaluation des services écosystémiques rendus par les arbres urbains. Etude de l'effet des arbres sur l'environnement urbain. Résultats de l'application du modèle i-Tree Eco à la ville de Strasbourg.*

Prescripteurs Hub Bas Carbone, 2020. Messages clés. Observatoire E+C-. 19 pages.

Cost/carbon focus equation

The hub of low carbon prescribers – IFPEB

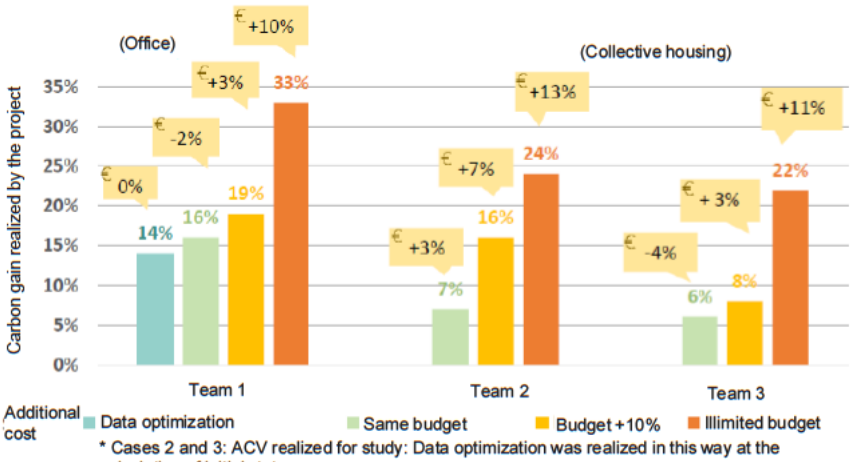
3 cases of study

Use of 3 existing designed projects and realized projects, to remain connected to the operational reality.

1 office building

2 buildings for collective housing

Carbon gain realized by the projects according to four scenarios



* Cases 2 and 3: ACV realized for study: Data optimization was realized in this way at the calculation of initial state

At low additional cost, the following was prioritized:

Reuse and frugality
Lots interiors
Woodworks and blinding

With a higher budget: the following were realized:

\+ Structural variants and facade

Low carbon variants can be more cost saving!

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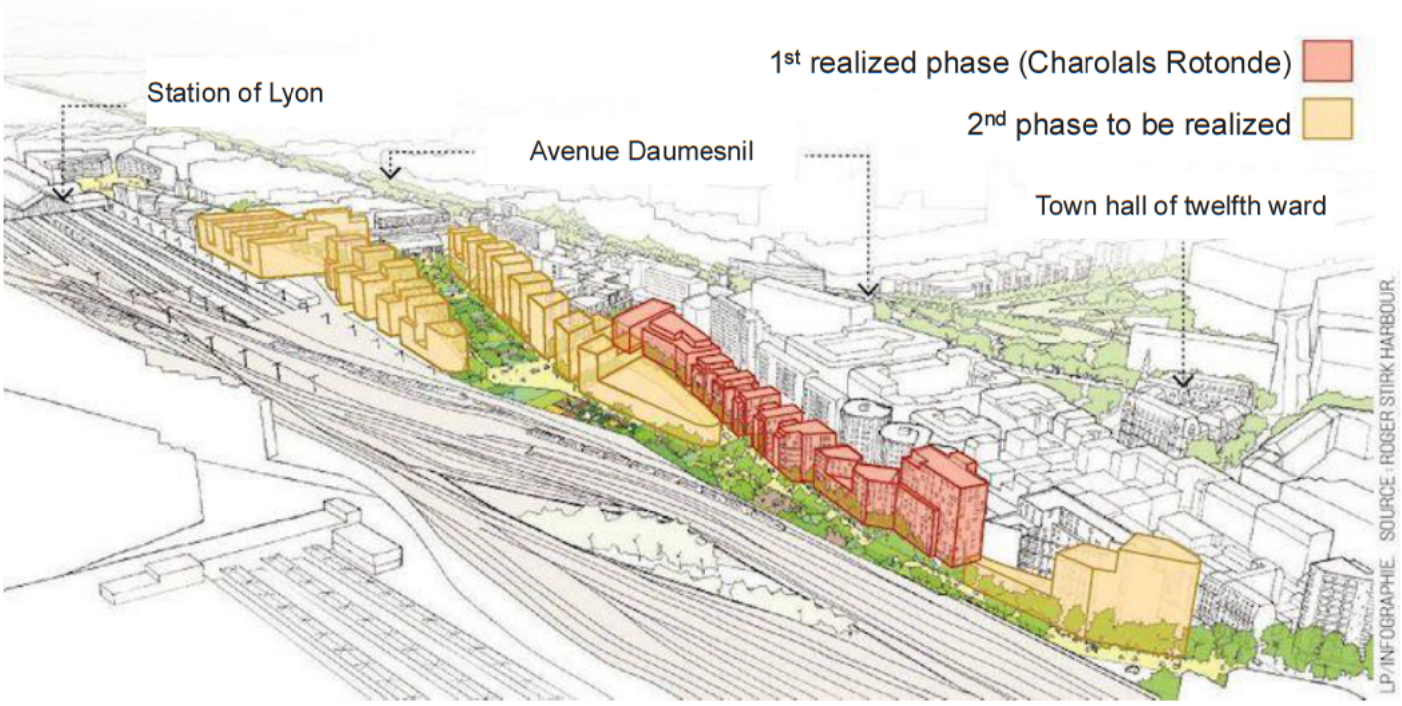
Over the building



Label BBCA quarter (User perimeters)

How much can my project reduce the footprint of dwellers of my quarter? What are the other sectors of impact which I can affect in order to improve my quarter, even if qualitatively?

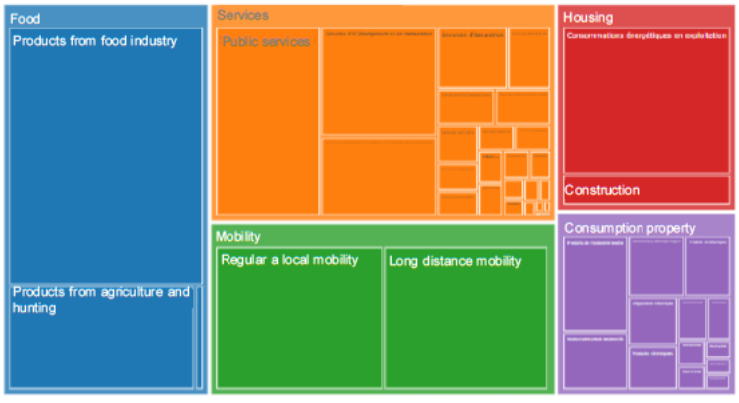
BBCA EVALUATION

Calculation of indicators BBCA Quarter

Dwellers footprint: Carbon impact of the way of living of an average dweller of the quarter, in terms of TCO2eq/dweller/year, through statistic approach.

Average carbon footprint of a dweller of the quarter
Potential climate warming (kg eq CO2/year)

Total carbon footprint of a dweller of the quarter



Performance of the quarter against the low carbon national trajectory (annual)
2028

Average carbon footprint of a dweller of the quarter
8,5 t.CO2e/year

Annual average carbon footprint of referential dweller
9,1 t.CO2e/year

Quarter Energy Carbon and Urban Footprint Method

Can be used for the phases before the conception up to the building site phases even if detailed data are not available, thanks to numerous data.

Adapted to new project, renovation or mixed.

ACV calculating principles of RE2020 and/or label E+C- are take into consideration.

Automatic feedback of geometries and characteristics of buildings existing from BDNB.

ACV powerful calculating models at the pace of the chronical time based on dynamic simulation engine and data base of the IRIS scale for the evaluation of ACV environmental impacts:

- Of buildings
- Of outside spaces
- Of systems and network
- Of mobility

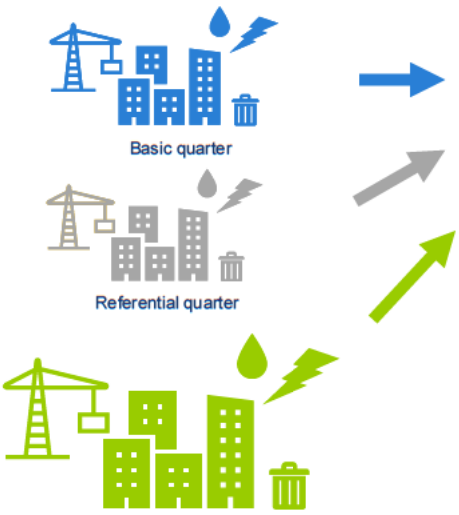
On the following constructors: energy, products of construction and equipment, waters, waste, building site, mobility.

Diagram of Shapley

What are leverages (available in Urban footprint) that still I could use to improve more my project?

EVALUATION OF THE POTENTIAL

Identification of used/not used leverages

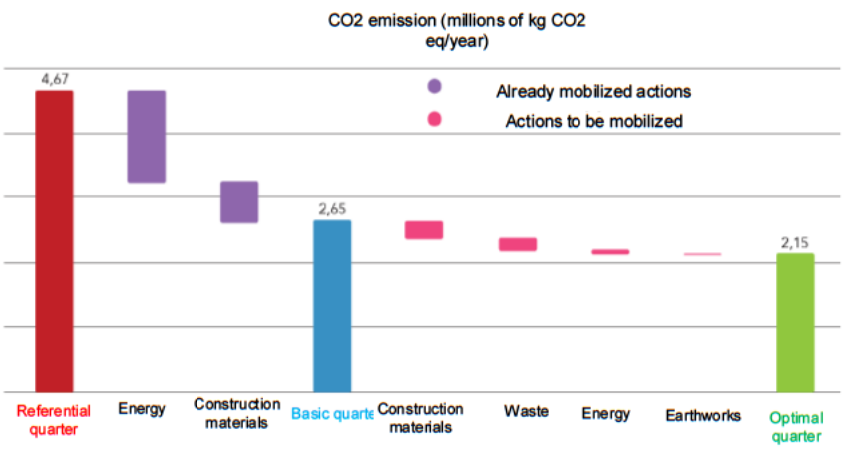


Optimal quarter

Calculated by a tool which can identify the combination of action leverages that are still available to attain the optimal in terms of carbon performance

Aide for the decision

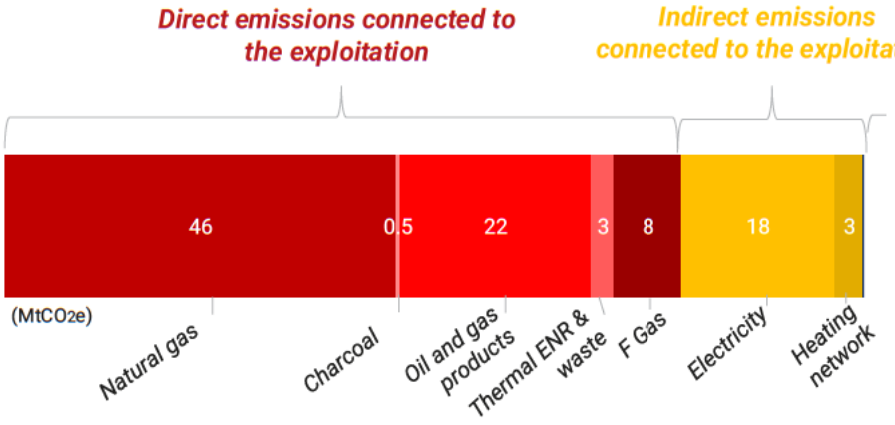
Sensibility analysis for evaluation of efforts realized by the basic quarter and room for possible progress. The most performant leverages are also evidenced in order to take action towards possible <<better quarter>>.



Emissions detailed par segment

$$\sum = 153 MtCO_2e$$

The existing park



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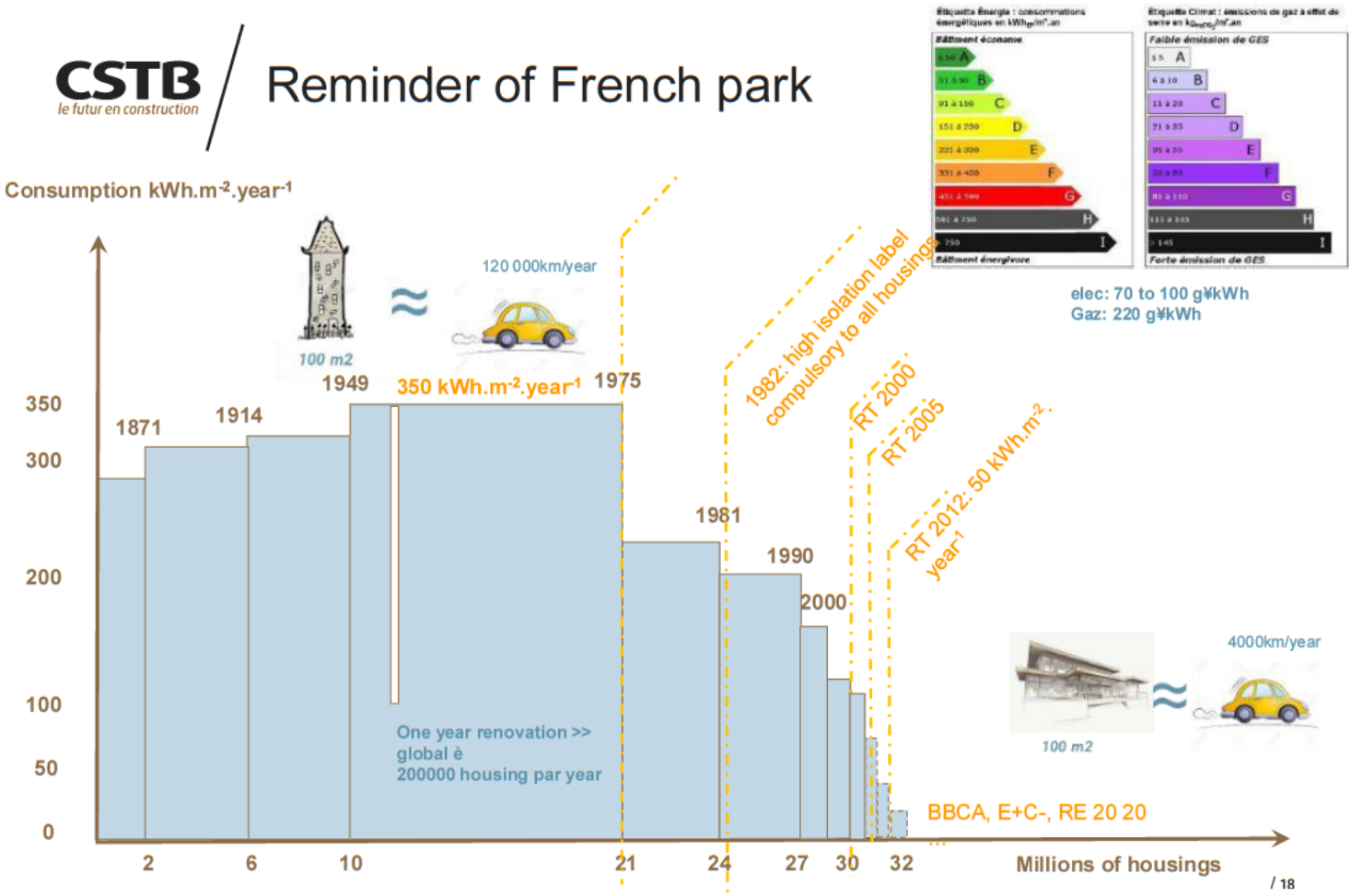
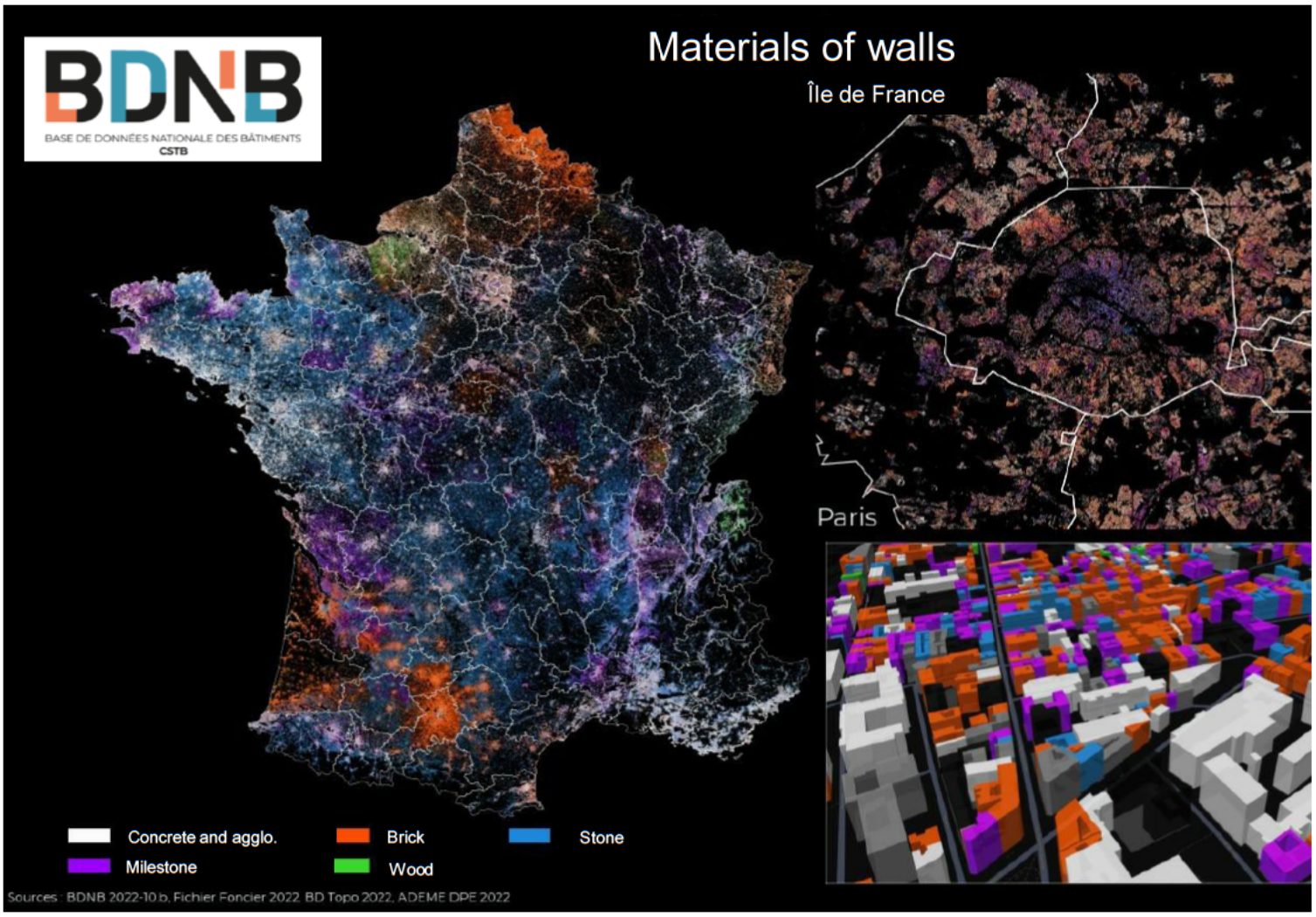
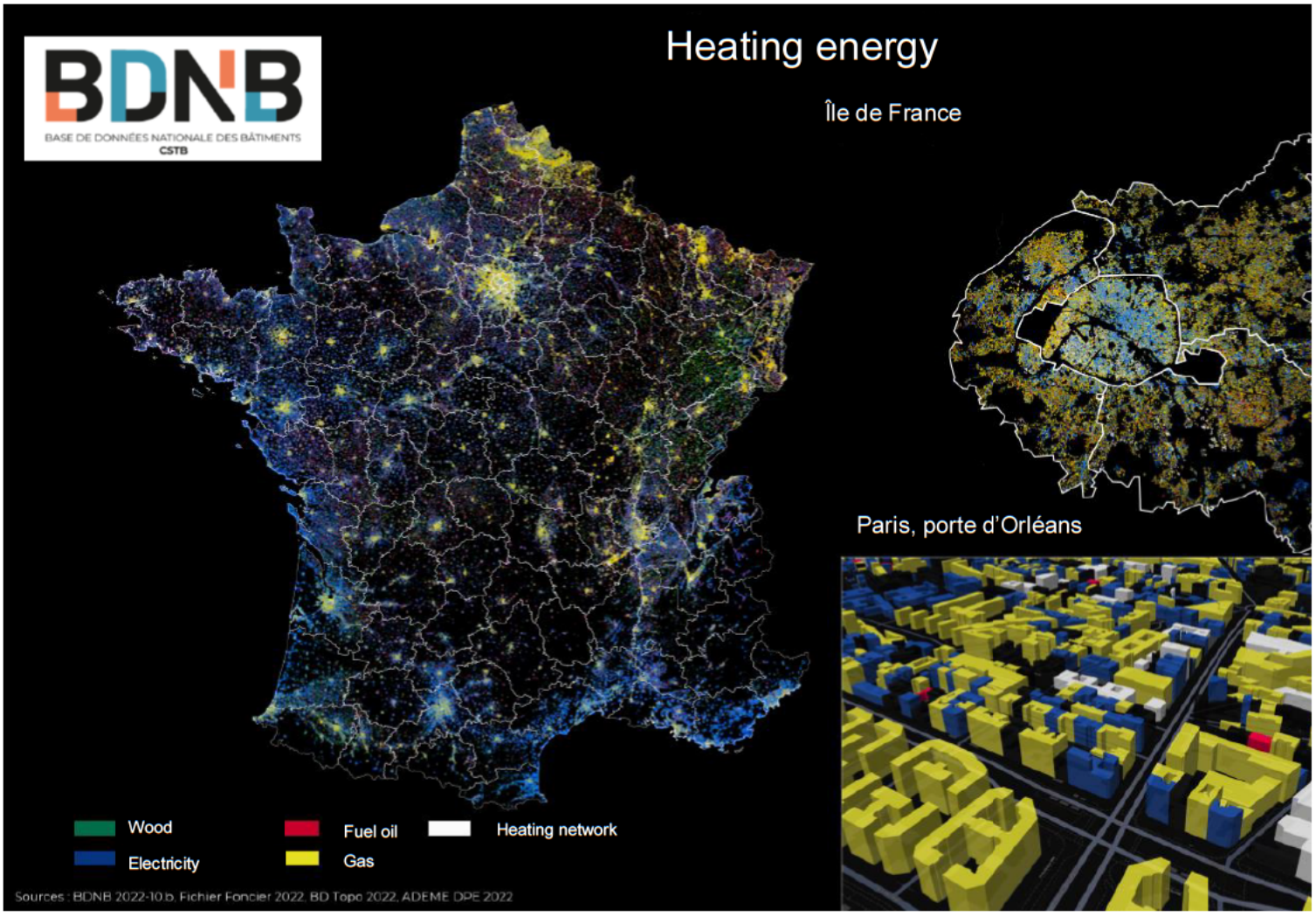
Source : calculé avec Exiobase v3.8.1, Base ADEME (facteur d'émissions), SDES (bilan énergétique)

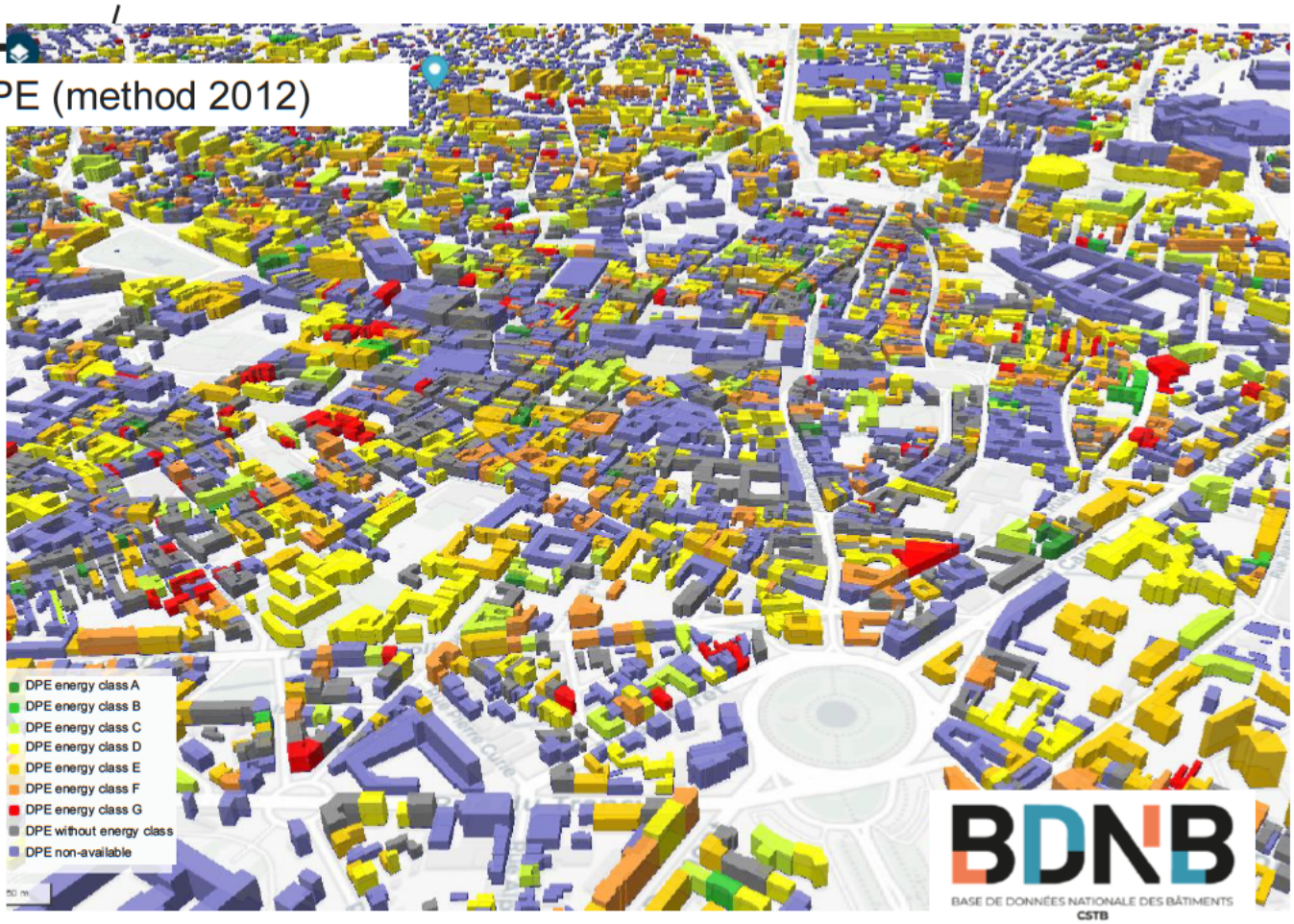
Reminder of French park



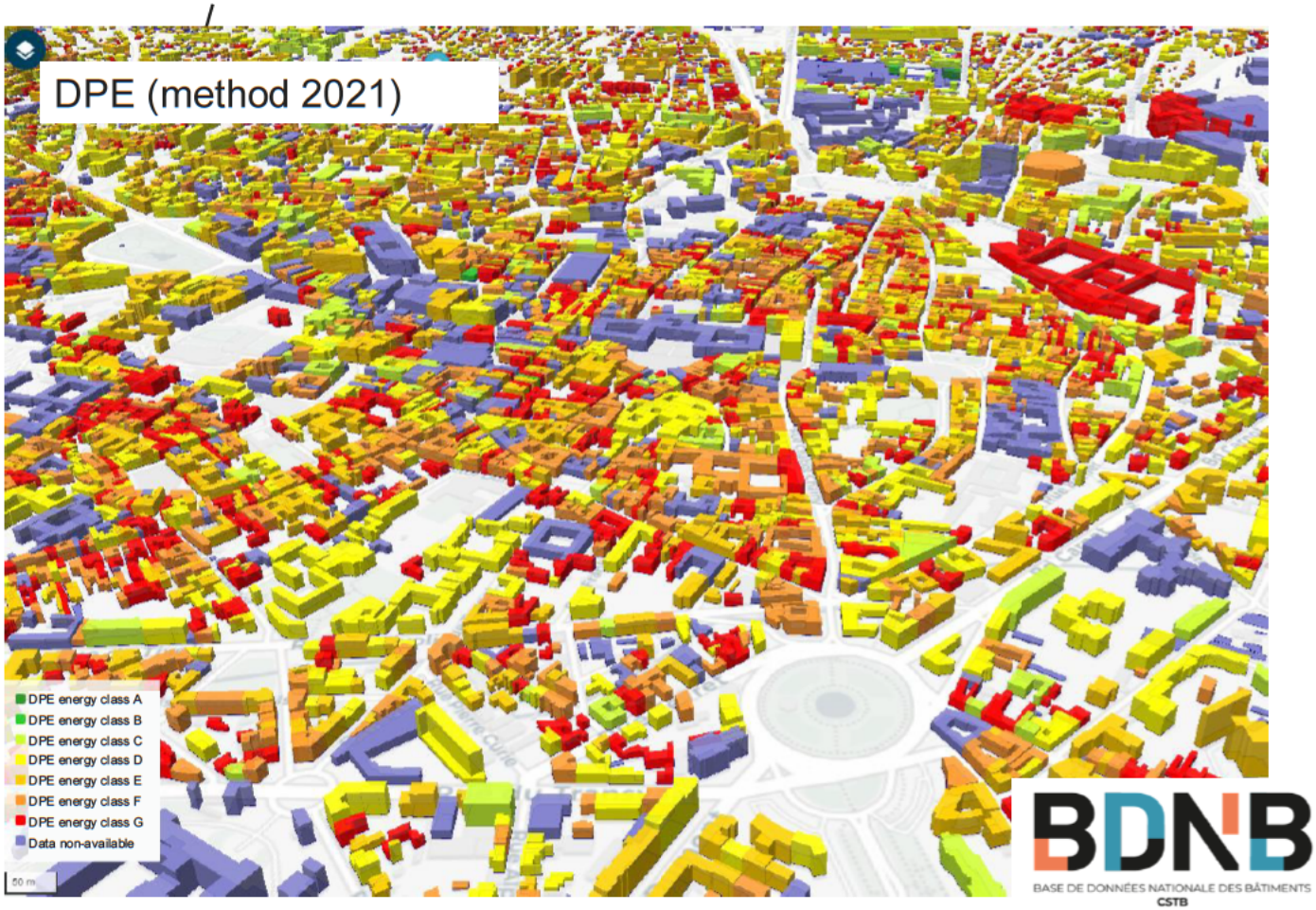

BDNB
BASE DE DONNÉES NATIONALE DES BÂTIMENTS
CSTB
Materials of walls
Île de France
Paris
Concrete and agglo.
Brick
Stone
Milestone
Wood
Sources : BDNB 2022-10 b, Fichier Foncier 2022, BD Topo 2022, ADEME DPE 2022


BDNB
BASE DE DONNÉES NATIONALE DES BÂTIMENTS
CSTB
Heating energy
Île de France
Paris, porte d'Orléans
Wood
Fuel oil
Heating network
Electricity
Gas
Sources : BDNB 2022-10 b, Fichier Foncier 2022, BD Topo 2022, ADEME DPE 2022

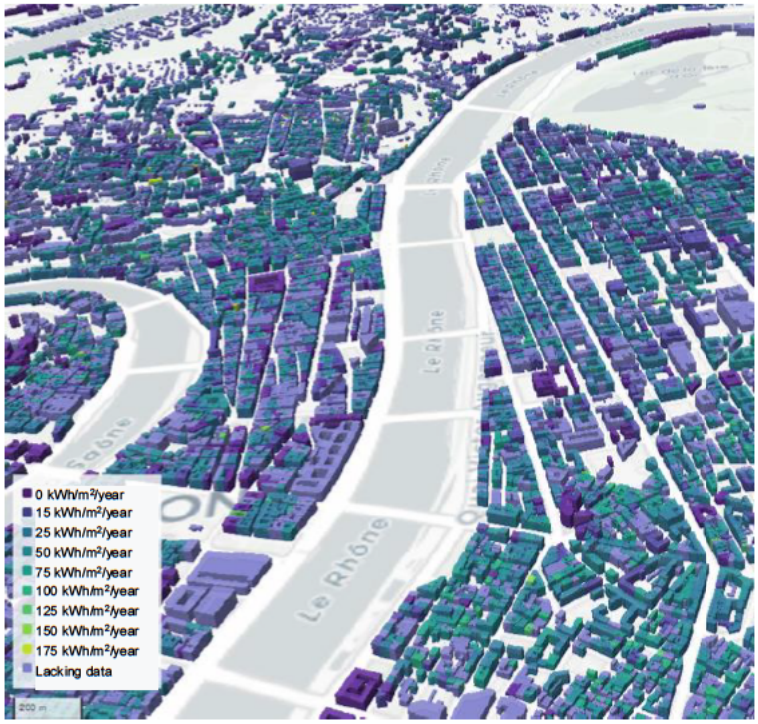
DPE (method 2012)



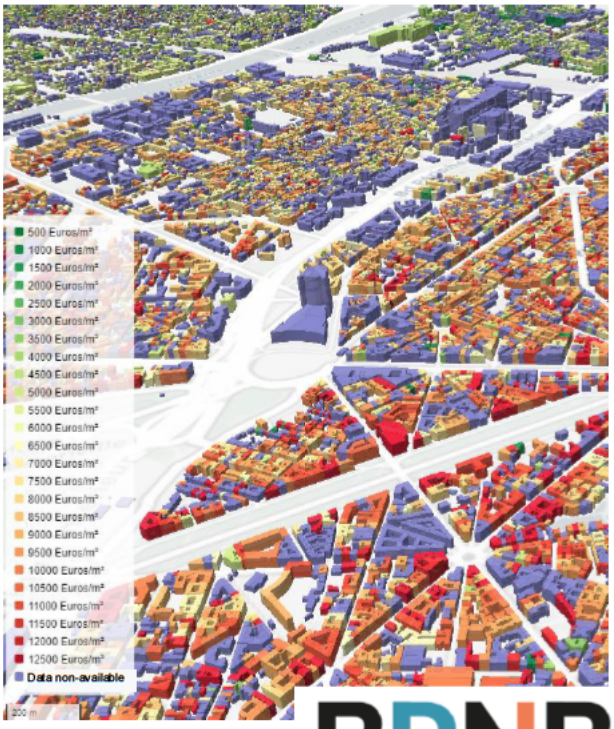
DPE (method 2021)



Electricity consumption par habitable m²



Sales price



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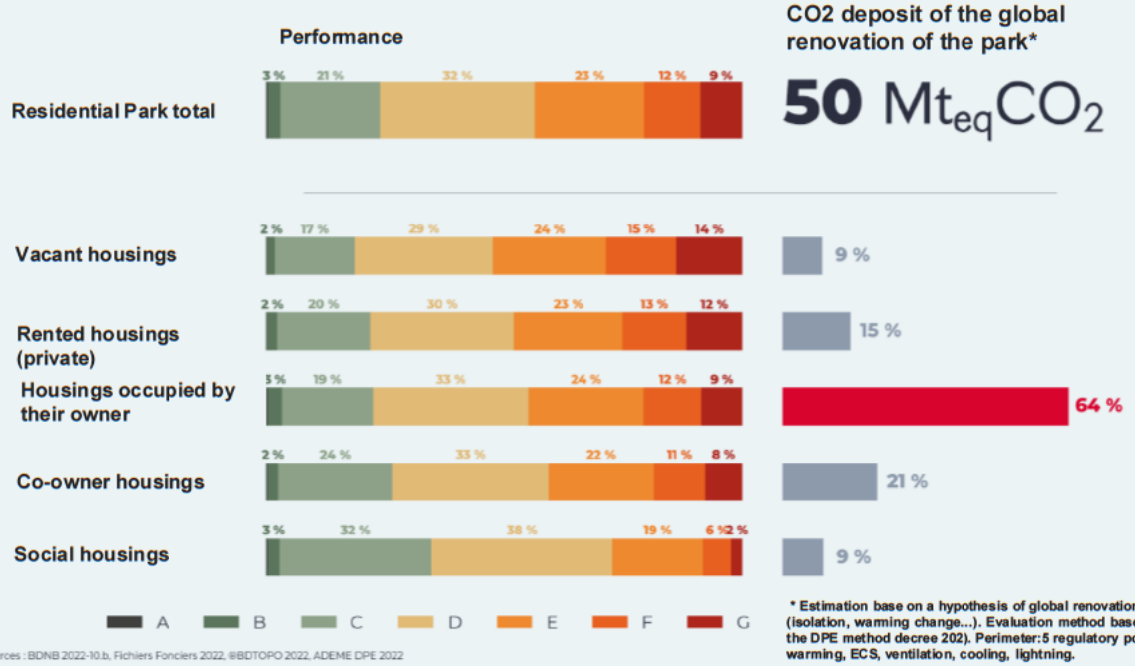

Sources : BDNB 2022-10.b, Fichiers Fonciers 2022, ©BDTOPO 2022, ADEME DPE 2022

* Estimation base on a hypothesis of global renovation (isolation, warming change...). Evaluation method based on the DPE method decree 202). Perimeter: 5 regulatory posts: warming, ECS, ventilation, cooling, lightning.

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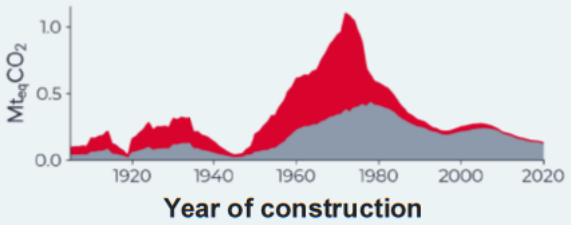
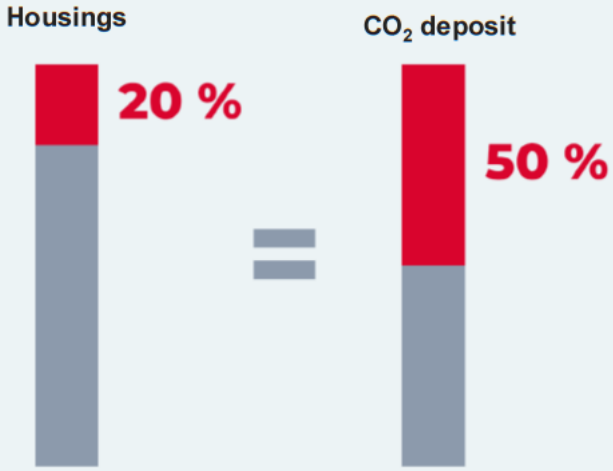
CO_2 deposit of the global renovation of the park*





* Estimations basées sur une hypothèse de rénovation globale (isolation, changement de chauffage...). Méthode d'évaluation basée sur la méthode DPE arrêté 2021. Périmètre : 5 postes réglementaires : chauffage, ECS, ventilation, refroidissement, éclairage.

Sources : BDNB 2022-10.b, Fichiers Fonciers 2022, ®BDTOPO 2022, ADEME DPE 2022

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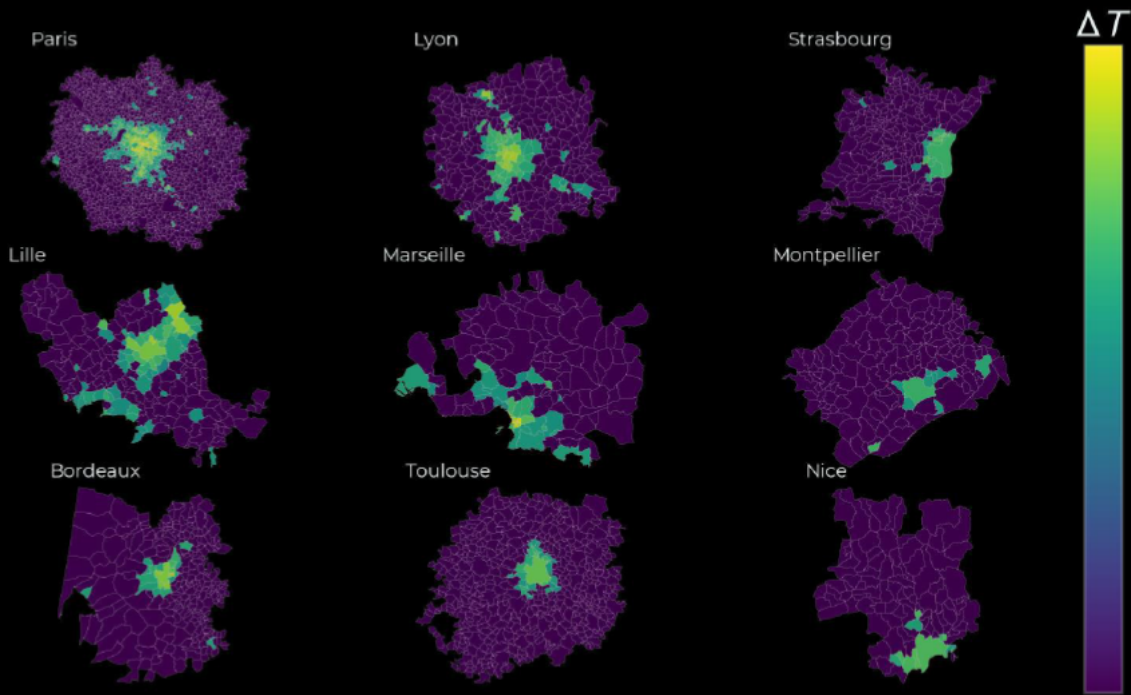
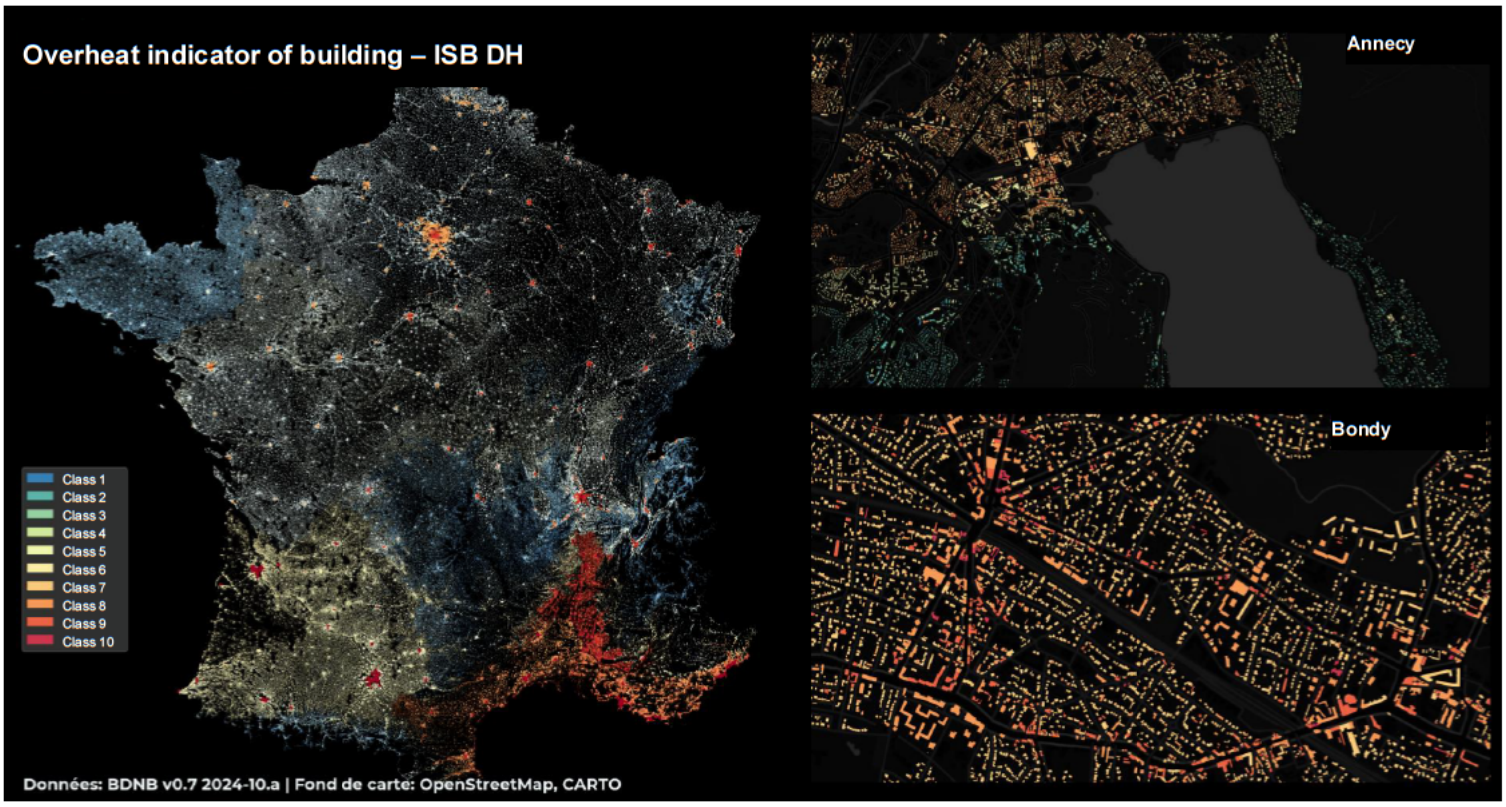
Urban heat islands

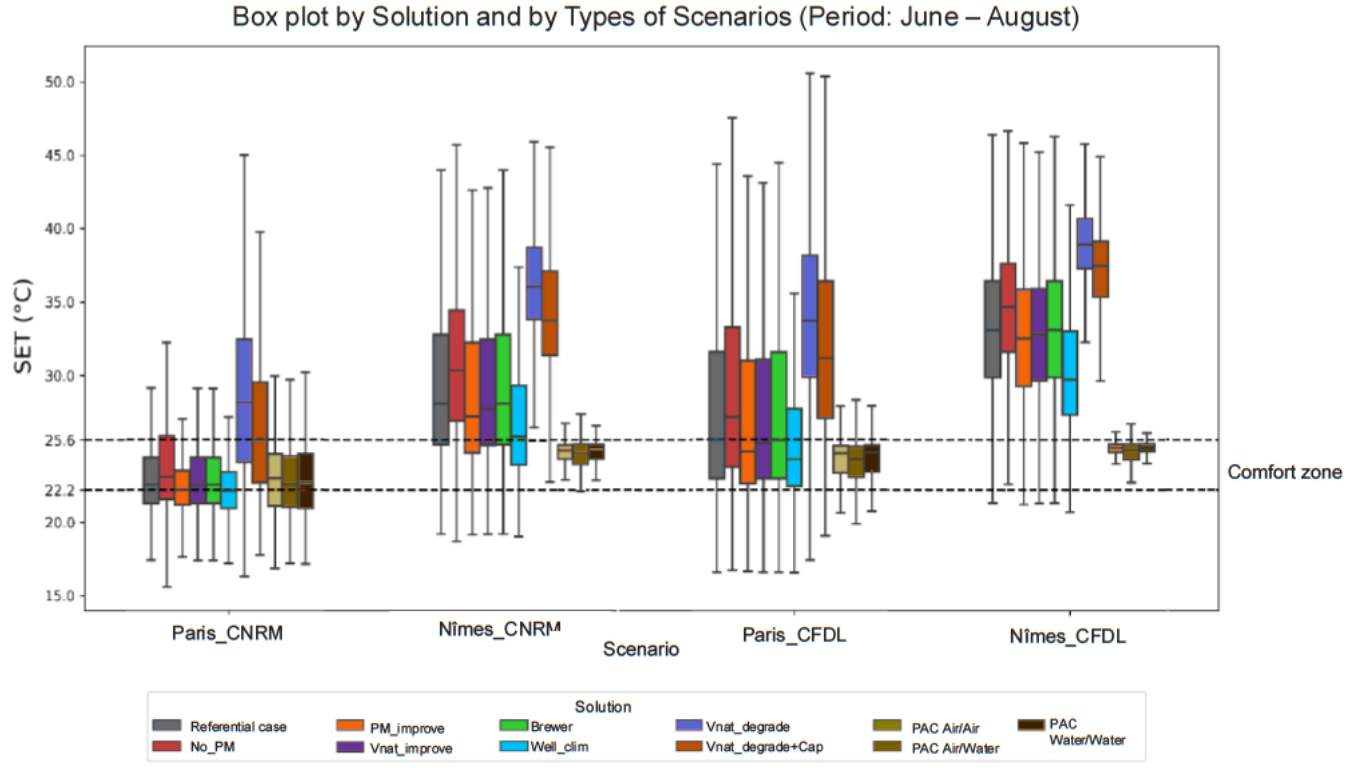


Sources : BDNB 2022-10.b, Projet Sat4BDNB, CSTB-CNES-CESBIO

Overheat indicator of buildings



Assure the conform in scenarios that could be critical



CRNM=Least hot model, GFDL=Hottest model

Project ICARE

Components of works

1. Accelerate realization and access to the **environmental data** for a clear choice at the various steps of the project
2. Create conditions to **secure** and, therefore, **accelerate** the appeal to the low carbon components
3. Decarbonization of industrial processes – Generalize actions of industrials in favor of decarbonization
4. Accelerate the use of low carbon weight components having a performance meeting with the demand
5. Rely on local resources and solutions
6. Optimize durability, reuse and recycling of construction components
7. Develop functionality economy

Renovation

1. Reinforce the efficiency requirement of the renovation
2. **Massif the global renovation**
3. Raise objectives of the renovation
4. Measure the performance

Use of buildings

1. Develop a **culture** of building exploitation and use which is sober and **low carbon**
2. Develop technical condition which is operational for exploitation of sober and low carbon buildings
3. Consume energy otherwise (better and at the good timing) in the exploitation phase
4. Facilitate the parceled densification and the multi-usage in an existing building

25 leverages, 120 measures for decarbonization of building sector

New construction

1. **Optimize m²**
2. **Enlarge the field of application of RE2020**
3. Green the building and the plot
4. Encourage the elevation
5. Develop **frugal architecture** to win on resources and consumption
6. Rethink of construction system to optimize the material quality

Transverse levers

1. Secure an optimum between deconstruction and renovation
2. Improve and complete the means proposed by financial actors to massif the building decarbonization in every and all scales
3. Favorize installation and utilization of very effective systems of renewable energy and recuperation in the building
4. Manufacturing in a workshop of construction bricks at a low level of carbon emission

https://www.planbatimentdurable.developpement-durable.gouv.fr/la-feuille-de-route-decarbonation-du-cycle-de-vie-a1673.html

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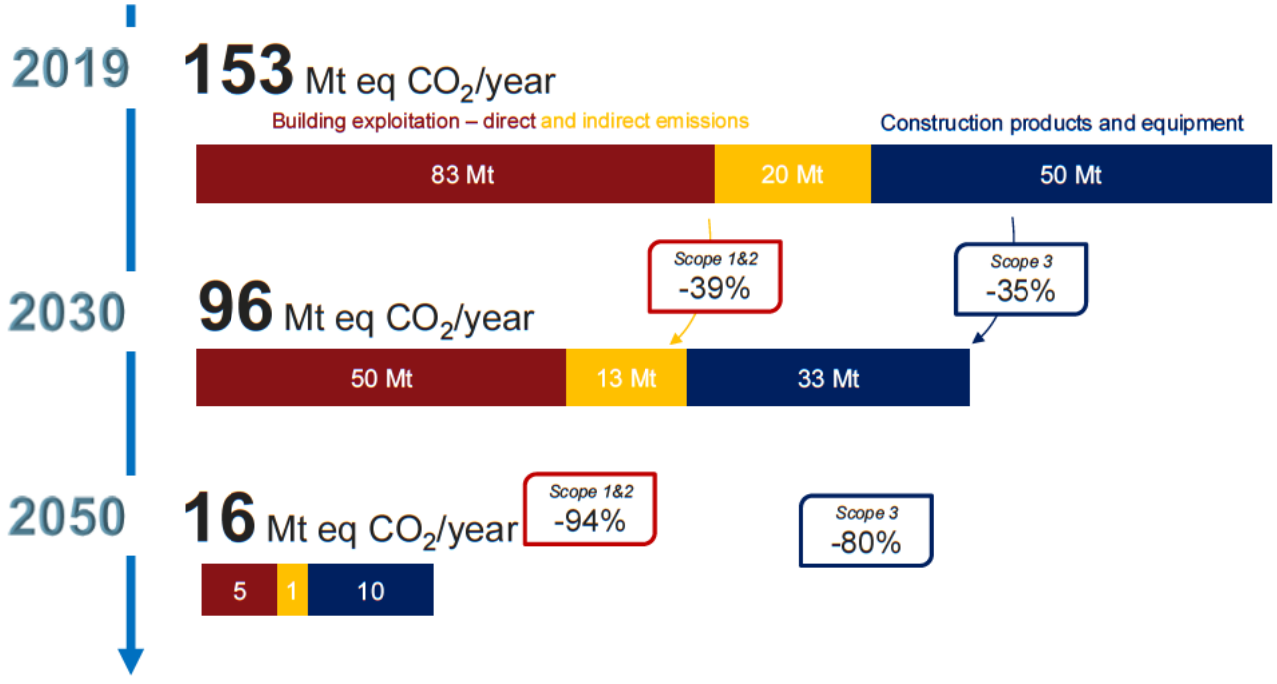
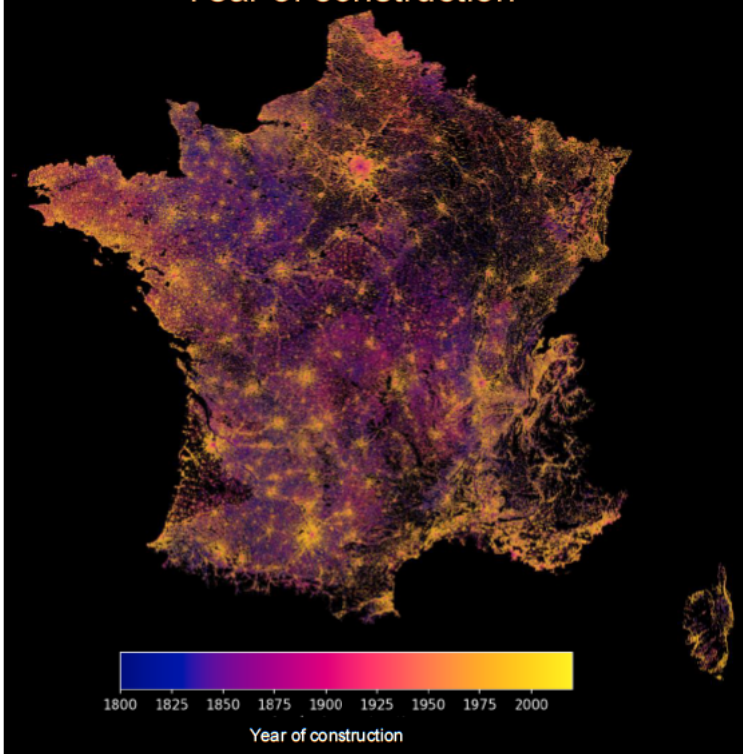
Carbon footprint of the sector

Objective 2030 and 2050

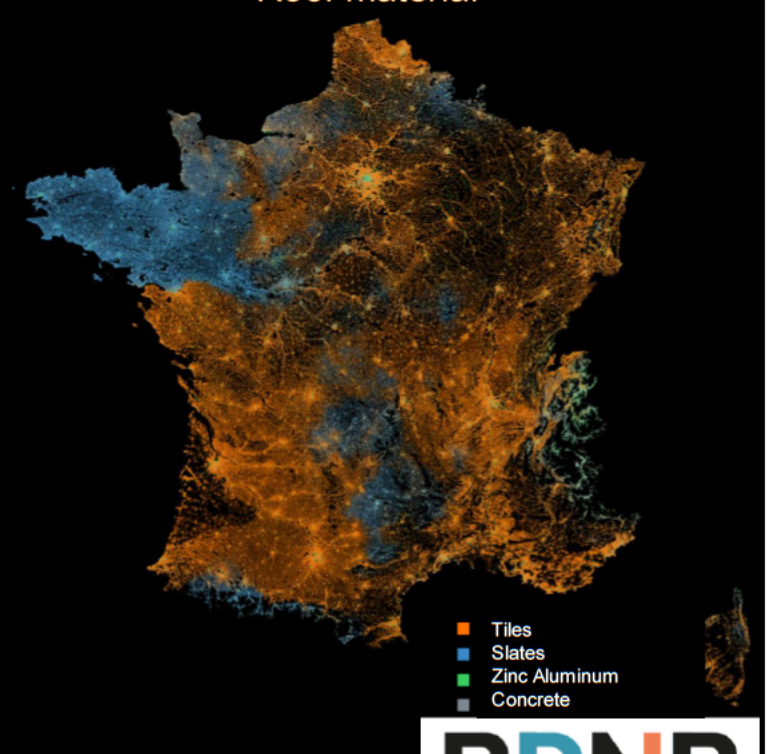


Thank you for your attention!!

Year of construction



Roof material



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