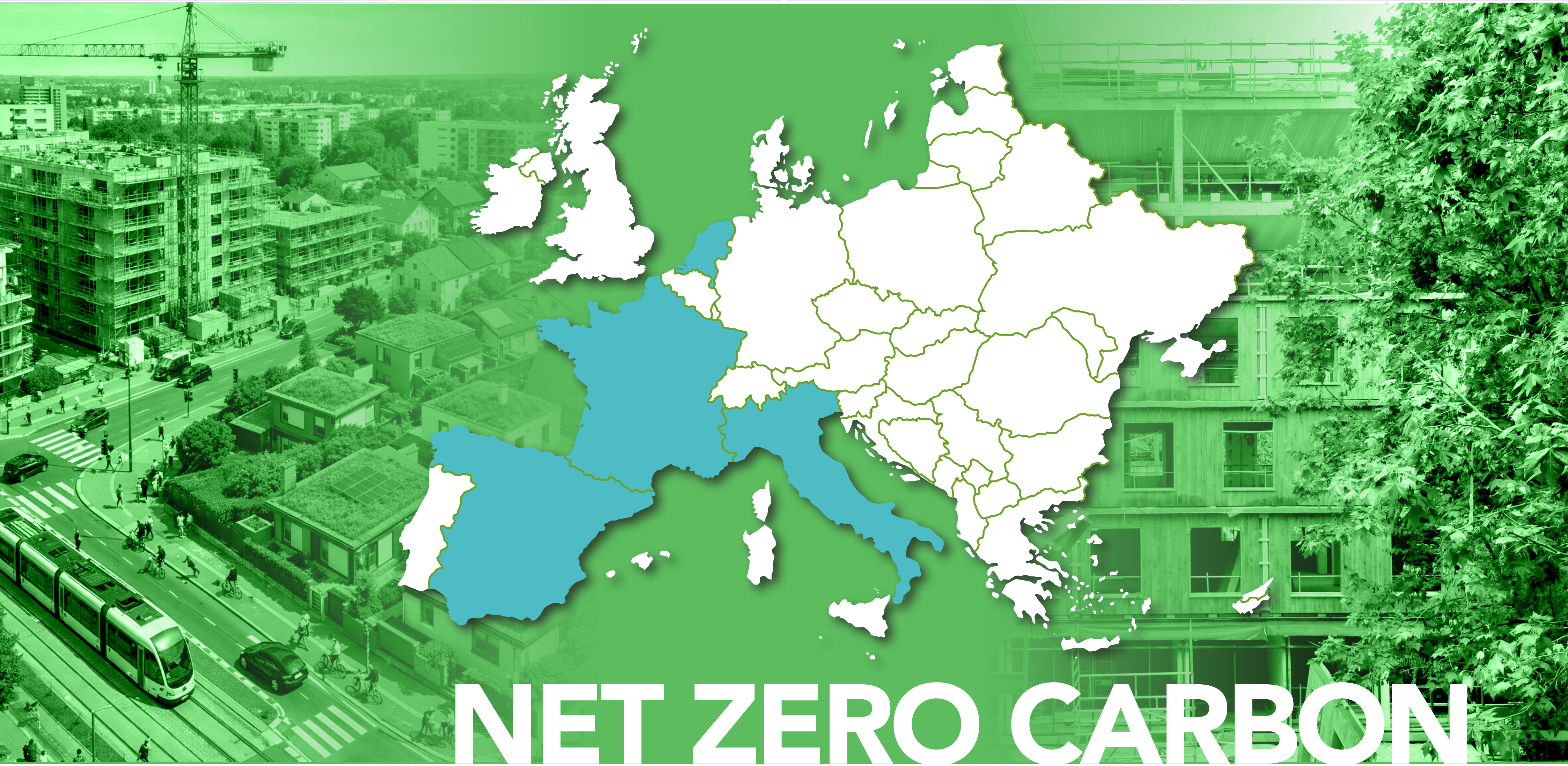

NET ZERO CARBON RENOVATION - EUROPE

WORLD GREEN BUILDING COUNCIL

#BUILDING LIFE

European Climate Foundation

IKEA Foundation

Laudes Foundation

RESEARCH PROGRAM

June 2025 - Indice A

Alliance HQE GBC FRANCE

Deerns

AIA ENVIRONNEMENT

PART 0

PROJECT STAKEHOLDERS

Alliance HQE GBC FRANCE — Deerns — AIA ENVIRONNEMENT

Alliance HQE-France GBC is a recognized association of public utility set up in 1996 which brings together stakeholders for a sustainable living environment.
Buildings, urban planning, and infrastructures at every stage of their life cycle – construction, operation, and renovation – are at the core of its DNA, in a transversal, balanced and multi-criteria vision combining quality of life, respect for the environment, economic performance and responsible management.

Its missions are:

- Innovate collectively and anticipate environmental challenges
- Improve knowledge
- Disseminate good practices
- Represent and promote the sustainable living environment

Created in 1928, Deerns is a global Engineering and Consultancy company, designing systems that make buildings work: healthy, sustainable, smart and future-proof solutions designed for Real Estate, Healthcare, Data Centres, Airports and Laboratories (Life Sciences and Electronics).

With projects delivered in +60 countries, our +750 experts, located in 16 Deerns offices, deliver high-quality services that range from:

- Low carbon & net zero energy building design through specialist engineering (MEP / mechanical and electrical design, building physics, vertical transportation and façade engineering)
- Strategic consulting
- Sustainability certification and advisory for decarbonisation and digital roadmaps (energy efficiency, smart infrastructure)
- Due diligences (Technical, Carbon, Digital)
- Project management and monitoring

Created to support cities and organizations in environmental and socio-health transitions, AIA Environnement is the division of the AIA Life Designers group dedicated to projects with high environmental value. The team brings together engineers and architects with expertise in environmental matters, sustainable development, and health-oriented urban planning.

Our 48 consultants work on architectural, urban, and territorial projects, including:

- Project management or Project Owner Assistance in environmental and low-carbon initiatives, particularly on certified operations
- Carbon assessments and life cycle analyses
- HQE audits
- Research projects (positive energy buildings, energy rehabilitation, urban farms, low-carbon expertise, environmental health, etc.)

Supported by:

World Green Building Council — #BUILDING LIFE — European Climate Foundation — IKEA Foundation — Laudes Foundation

Report Reviewed by:

GBCe Green Building Council España — DGBC Dutch Green Building Council — Green Building Council Italia (Build better, live better.)

PART 0

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PART 0

EXECUTIVE SUMMARY

Net Zero Carbon (NZC) Renovation Europe Report (2025)

NZC Renovation Europe Study stakeholders

As Europe moves towards its climate goals, the renovation of existing buildings plays a critical role in reducing carbon emissions. The NZC Renovation Europe project –led by **Alliance HQE-GBC**, **AIA Environnement** and **Deerns**– aims to scale up net zero carbon (NZC) renovation strategies across Europe by highlighting the state of play and challenges of a robust, life-cycle-based methodology across four (4) pilot countries: **France**, **Spain**, **Italy**, and **the Netherlands**.

NZC Renovation project goals

- Support the establishment and use of a harmonized approach to Whole-Life Carbon (WLC) assessment for building renovations.
- Identify how national contexts (regulatory maturity, energy mixes, data and tools availability) are impacting the renovation carbon outcomes.
- Feed and guide the industry the development of business models and policies to accelerate low-carbon renovation in Europe.
- Provide the market (both on the demand and on the expertise sides) with insights that allow for understanding of WLC impact features.

Methodology

The project used a Life Cycle Assessment (LCA)-based approach adapted from France's RE2020 framework, when used by other countries. Seven (7) building typologies were modeled across 4 European capitals to analyze indicators resulting for **embodied** and **operational carbon**, as well as **Carbon Return Times** (CRT) when investing in a decarbonized renovation.

Two adaptation parameters were used: **national energy emission factors** and key building **materials' carbon coefficients**.

Key findings

- **Carbon performance varies significantly** per country, even for identical buildings, due to differences in local energy mixes, data availability, reference tools and regulatory approaches.
- **Carbon Return Time** (i.e. how long it takes for energy savings to offset the additional renovation emissions) varies widely—from **6 to over 35 years**.
- The **lack of harmonization** in LCA methodologies, data scopes, and calculation boundaries across countries complicates building comparisons and investment decision-making.
- Certifications (HQE, LEED, BREEAM, VERDE) and market tools play a major role in promoting WLC assessments, especially where country regulations are still lacking.

STRATEGIC CONTRIBUTIONS

- Provides clarity for **carbon-conscious investment** by integrating WLC outcomes into asset valuation.
- Supports **policy harmonization** across Europe by highlighting gaps and best practices in national frameworks.
- Offers guidance for **strategic renovation planning**, enabling stakeholders to prioritize the most impactful actions.

NEXT STEPS (Phases 2 & 3)

- **Expand LCA scope** to include more variables (e.g., construction techniques, full material ranges).
- **Develop a European NZC Roadmap** with actionable solutions and policy guidance.
- Continue **stakeholder engagement** and promote awareness across the European building sector.

PART. 1

CONTEXT AND GOALS

Shifting towards whole-life carbon strategies in building renovations

Growing climate ambition and regulatory pressure

As climate goals tighten, real estate companies are increasingly setting targets to reduce the overall carbon impact of their buildings —both due to internal sustainability ambitions and to emerging stricter regulations. As part of this shift, companies are beginning to account for not only operational carbon (from energy use) but also embodied carbon (from materials used and construction/demolition processes).
This study highlights the factors that go beyond a building's intrinsic quality (e.g., designed solutions, materials) and that rely on the maturity and availability of methods, data, energy features and regulatory push.

An operational energy-efficient building renovation is not always an interesting whole life carbon-efficient renovation

Renovating for energy-efficiency does not always result in interesting Whole-Life Carbon (WLC) impact reduction and Carbon Return Time (CRT). Aligning performance, financial Return on Investment (ROI) and Carbon Return Time requires an understanding of the levers that enable one to achieve the expected performance results of such a renovation. When it comes to carbon, dealing with renovations is different and more complex than for new-builds.

Understanding the building parts and choices that most impact the carbon result in a renovation is key in order to target the most valuable strategies.
Recognizing this need, the Net Zero Carbon Renovation Europe project, co-led by Alliance HQE-GBC, AIA Environnement, and DEERNS, aims to enhance NZC renovation strategies across Europe.

This project examined France, Spain, Italy, and the Netherlands, comparing France's progress with other countries, in order to develop practical, scalable solutions while identifying key levers influencing carbon footprint and carbon time in different national contexts.

Origins of the NZC renovation research program

The NZC Renovation Program, launched in 2020, was initially designed to improve the life-cycle carbon performance of existing buildings.
This program broadly focused on measuring emissions, reducing them effectively, and increasing professional engagement in addressing whole-life carbon emissions from existing buildings. During its first phase (2020-2023), the project refined the methodology and conducted an in-depth study of seven case studies representative of the French renovation market.

In its 2022 publication, the goal was to identify effective levers for reducing carbon emissions in France's renovation sector. The outcomes of the 2022 French project phase can be found below:

- NZC renovation France – Booklet of low carbon levers for renovation (April 2022)
- NZC renovation France – Optimisations in selected generic Case Studies (April 2022)

NZC renovation Europe: scaling up to a European level and speeding up deployment!

In order to promote broader understanding and adoption of WLC considerations by the European real estate market, and to support stakeholders that own asset portfolios in different countries, the NZC Renovation initiative was expanded to the European level. Therefore, the NZC Renovation Europe initiative was launched to adapt the methodology developed in the first phase to a more diverse European context, considering local regulatory and market factors in 4 specific countries.(1)

NOTE (1): The data collection and analysis were performed between Nov 2024 and Feb 2025. Some country updates may have occurred between the Data analysis and the report launch

Shifting towards whole-life carbon strategies in building renovations

Carbon considerations when managing an international portfolio of assets: understand the country variables and the market maturity

The carbon outcome of the renovation of the **same** building varies depending on whether it is located in France, Italy, the Netherlands or Spain. Listed below are a few of the factors that impact the carbon emissions resulting from a renovation.

- **Geographic location** of the asset and its local **energy mix** or **climate region**.
- The **construction materials** used, and their regional manufacturing processes (which are also affected by the energy mix).
- **Regulatory requirements** or **certification** adoption dynamics.
- **Data availability** for use in the "carbon equation"
- **Standards** used and **perimeters of calculation** considered.

Input for carbon pricing & valuations:
Asset valuations are increasingly considering decarbonisation risks and costs. If carbon pricing considerations are adopted for assets comparison, there needs to be clarity on the variables that impact the carbon outcome result, and the required amount of carbon to mitigate or offset. As a result, for existing assets engaging a renovation, it becomes critical to know which factors influence the final carbon quantity that will be priced.

Heterogeneous dynamics and maturity when addressing whole-life carbon in buildings in Europe

This section of the report outlines the current state of play across France, Spain, Italy, and the Netherlands. It identifies key similarities and differences among these countries in terms of:

- National maturity in carbon assessment
- Availability of LCA methods, be it via regulations, market offerings or standards.
- Main drivers for adoption of LCA (e.g., green certifications or regulatory requirements)
- Benchmarks or targets available for LCA/embodied carbon
- Availability of databases and product information (EPDs)
- Building components considered in the LCA
- Scope of the LCA calculation (life stages considered)

The study includes a sensitivity analysis of European energy mixes based on the seven NZC Renovation business cases, assessing the impact of different national energy mixes on renovation outcomes. LCAs were used to assess how different European contexts affect the results, in comparison to the initial NZC project.

How can this report support your decarbonisation effort?

Are we comparing Apples with Oranges?

Understanding the current state of Whole-Life Carbon dynamics (regulations, standards, tools, data) in Europe and the levers currently pushing for its consideration, allow us to spot differences between countries in terms of adoption maturity and of strategies offered to market players for their building renovations.
The content of this report is intended to support different stakeholders and initiatives in addressing carbon reduction strategies in their existing building portfolio, taking into account their individual economic, climate and technical specifications.
By offering comparative insights into Whole-Life Carbon maturity, this report becomes an essential resource for companies seeking to improve the sustainability understanding and profitability of their building portfolios across Europe—today and in the future through new business models.

And there is no "one-size-fits-all" solution.

Leverage LCA (Life Cycle Assessment) adoption for renovations

- Facilitate carbon EU assets comparison by understanding what is considered in different national LCAs.
- Highlight national differences that make a same building has a different carbon outcome depending on its location.
- Reinforce the value of incorporating LCA methods early in the project planning stage, to optimize both cost and carbon performance.
- Encourage the market to adopt robust carbon accounting and reporting practices, enhancing credibility and transparency.

Contribute to European harmonization

- Help identify practical gaps and bridges in carbon life cycle considerations and executions.
- Share best practices and benchmarks that can guide EU policy discussions and national regulations in the harmonization pathway,
- Help unify carbon reduction efforts across borders, supporting a more consistent and predictable regulatory landscape for investors and real estate developers.

Improve carbon portfolio management across regions

- Highlight how variations in national energy mixes, regulations, and data availability can impact carbon outcomes, even for identical buildings.
- Allow for informed decision-making when prioritizing which assets to renovate first, and how to adapt strategies to each location.

Better strategic renovation planning

- Identify key factors that determine Carbon Return Time differences on renovation design and investments.
- Help decision-makers choosing the most cost-effective and carbon-efficient renovation strategies, tailored to each building's characteristics.

Building-specific approaches

- Demonstrate how different building types (offices, residential, retail, etc.) may require distinct solutions for reducing embodied and operational carbon.
- Support targeted interventions that address the unique technical and economic aspects of each property type.

Preparation for carbon pricing

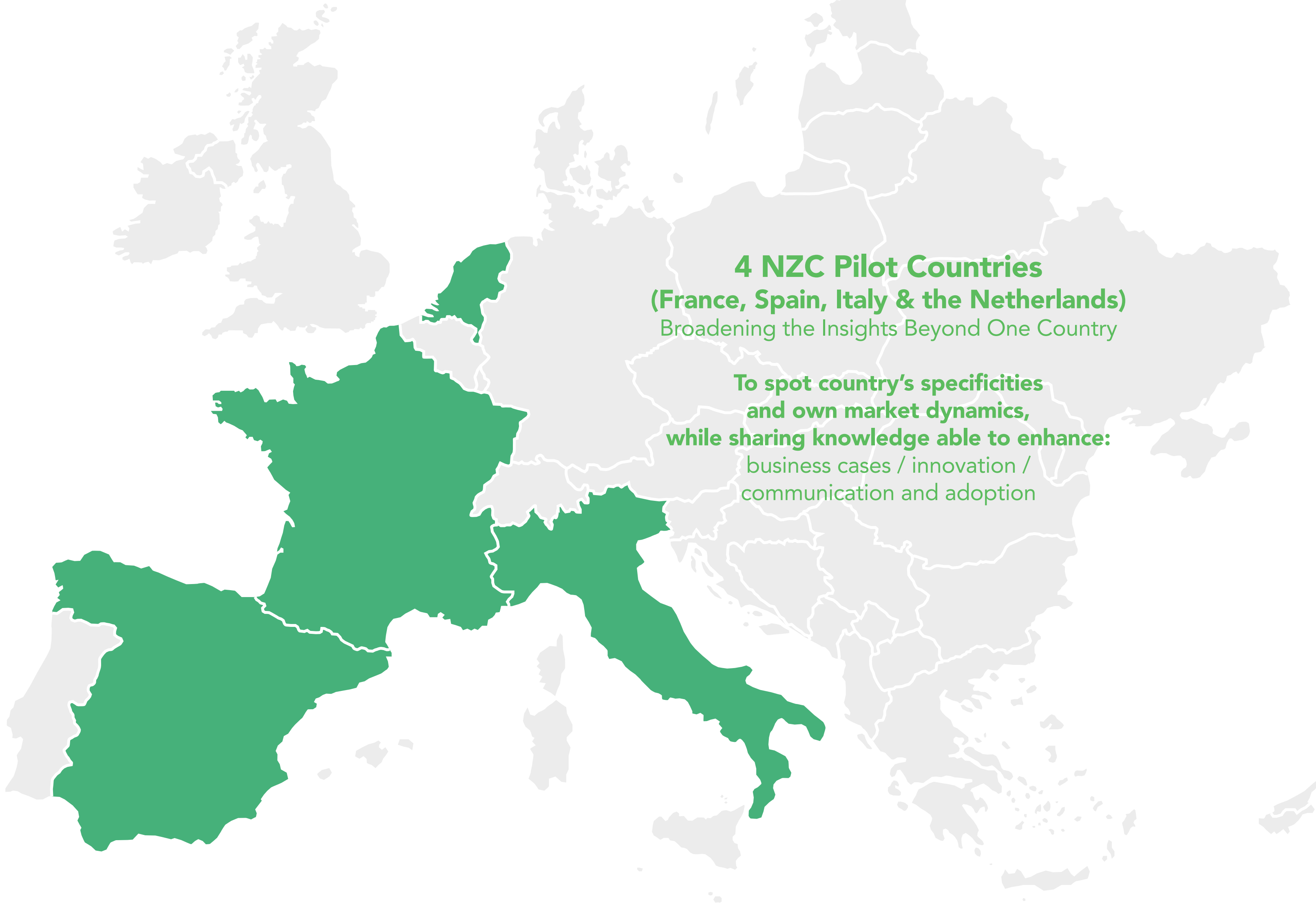
- Offer insights into how Whole-Life Carbon considerations can be integrated into asset valuations and financial models.
- Position organizations in understand Whole-Life Carbon local specificities, to proactively adapt to potential future regulations that impose a price on carbon emissions.

PART.2 EUROPEAN STATE OF THE ART

Our market analysis focused on a practical understanding of the whole-life carbon dynamics (regulation, tools, data, maturity of concept adoption) in Europe, from a practical perspective in terms of what experts are facing or using in each countries, and the levers currently pushing for WLC consideration in building design. For this stage, we focused on 4 countries:

FRANCE – ITALY
THE NETHERLANDS – SPAIN

The consultation of each country's sustainability experts and national Green Building Councils (GBCs), allowed the elaboration of a detailed comparative overview of whole-life carbon mechanisms and dynamics in building renovation, in a context where most mechanisms and tools are still mainly oriented toward new-build assets. The study focused on capturing real world practices and the tools that experts use or reference in the market.



Identifying each country's specificities and market dynamics

The research undertaken for this report was based on the analysis of each country's features and consultations with national experts using a common survey framework. This report presents a synthesis of the results in a simplified, aggregated form to make the findings easier to read and communicate to different types of audiences. The research delved into each country's features in terms of:

2.1) Availability of LCA methods, regulation & carbon limits:

- Carbon **regulatory maturity**, exploring the availability of an official LCA Methodology (recognized as national reference), of regulatory frameworks and the existence of carbon limits serving as guiding thresholds for the building market.
- Comparison of **adoption maturity** per country, for new and renovation market and the driver from certification schemes and market tools. Existence of benchmarks, targets or limit thresholds available for LCA/embodied carbon.

2.2) Certifications & schemes supporting LCA adoption in the country: Main drivers for adoption of LCA (green certifications or regulatory requirements)

2.3 & 2.4) Availability of EPD databases and LCA calculation tools: Availability of databases and product information (EPDs), as well as market presence of LCA tools allowing carbon impact calculation for buildings.

2.5) Calculation scope : building parts considered in the LCA: Elements and systems of an asset that enter in the perimeter of calculation of the carbon impact.

2.6 & 2.7) LCA standards and LCA indicators: LCA reference standards and the indicators considered in the calculation.

2.8) Life stages considered in the LCA of the building: Providing a perspective into variations between countries regarding boundaries and perimeter of LCA calculation in terms of a building's life-cycle stages, sqm definition and reference years for the study period.

COUNTRIES

- Netherlands
- Italy
- Spain
- France

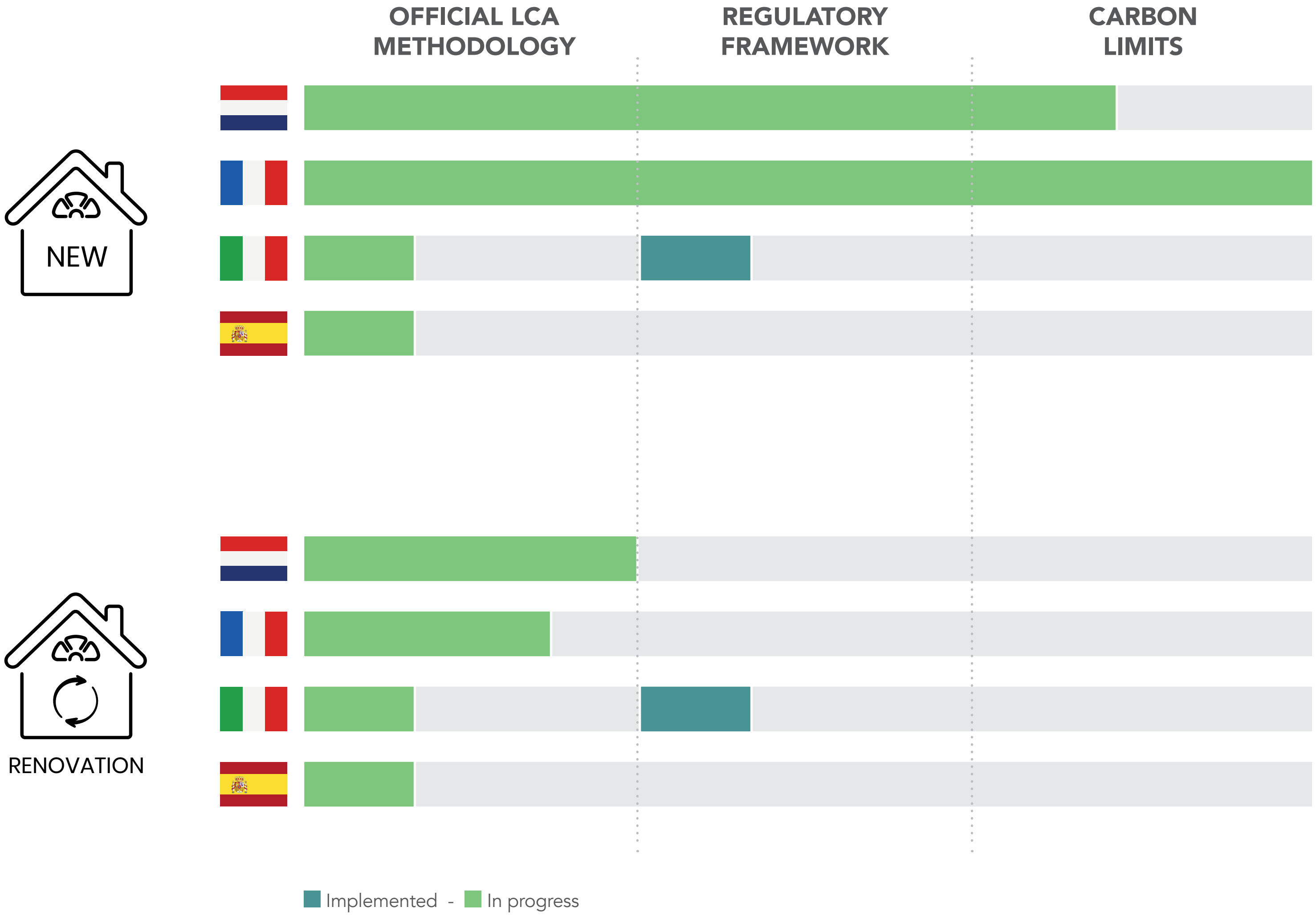
2.1 Maturity : Availability of LCA methods, regulation & carbon limits

The EU countries show a very heterogeneous status of adoption of Whole Life Carbon (WLC) criteria and of target limits (thresholds) in buildings.

While some countries already require **embodied and operational carbon limits** in their **national policy** and regulatory mechanisms (as it is the case of France and Netherlands), others still rely on **voluntary consideration of Green Building Certification** requirements (usually for market frontrunners), sustainability organisations' initiatives (GBC's) and/or EU reference frameworks (**Level's**).

These differences highlight the distinct status and progress of each country (and their market players), deeply driven by the push done by regulation but also by the availability of data and tools allowing for easy/practical WLC calculations.

The varying maturity levels and approaches across the EU underscore the need for harmonized strategies and data availability to effectively address whole life carbon impacts in building projects.



2.1 Maturity : availability of LCA methods, regulation & carbon limits

COUNTRY	REGULATORY LCA FRAMEWORK	OFFICIAL LCA METHODOLOGY	CARBON LIMITS (EMBODIED / OPERATIONAL)	RENOVATION METHODOLOGY	CERTIFICATION INFLUENCE
THE NETHERLANDS	Implemented: MPG (mandatory since 2013 for new buildings)	Implemented: Based on EN 15804 / ISO 14025 / ISO 14044 / EN 15978	In progress: No carbon-specific limits, but "shadow cost" thresholds; Paris Proof targets (voluntary)	In progress: Addendum to MPG (not mandatory yet)	In progress: DGBC (Paris Proof), private actors refer to targets
ITALY	In progress: No legal thresholds (except public sector)	In progress: LCA encouraged in public tenders; based on EN standards	Inexisting or emerging: No limits unless applying certification schemes (e.g. LEED)	Inexisting or emerging: No legal thresholds (except public sector)	Implemented: LEED, BREEAM, GBC reward LCA studies
SPAIN	In progress: LCA mandatory progressively from 2026. LCA may be required in municipal projects	Inexisting or emerging: National method & tool under development by MIVAU	Inexisting or emerging: No official limits yet; requirements via VERDE, LEED, BREEAM, Zero Carbon	Inexisting or emerging: No specific method	Implemented: Strong reliance on certification schemes
FRANCE	Implemented: RE2020 for new buildings; Old regulations for renovation (2007 addendum 2012)	Implemented: Based on EN 15978 + National specifics	Implemented: Limits for GHG (Ic_construction & Ic_energy); thresholds vary by year & new building type	In progress: HQE and BBCA methods exist No regulatory method exists	In progress: Voluntary labels (E+C- for Newbuild; HQE & BBCA for Newbuild & Renovation)

Implemented - In progress - Inexisting or emerging

2.2 Certifications & schemes supporting LCA adoption in the country

Sustainability rating schemes and certifications are clearly promoting Life Cycle Assessment (LCA) considerations and Whole-Life Carbon (WLC) strategies for the buildings applying for such schemes. However, the **adoption of certification schemes** varies significantly across European countries, being largely unable to penetrate markets where LCA regulation is still missing.

Nevertheless, some national schemes and international certifications are undoubtedly **driving the adoption of LCA** in countries **where it is not yet mandated by regulation**. Indeed, in some countries, those certifications are the only frameworks guiding the market, or serving as reference, for the integration of LCA considerations in the building design & construction process.

This situation highlights the practical role of global standards and schemes in encouraging or leveraging sustainable practices and the consideration of whole-life carbon impacts in building projects, in markets where national regulation is still under process of elaboration. The table on the right displays the main national and international schemes and certifications pushing for LCA adoption in new and existing projects in the studied countries.

INTERNATIONAL CERTIFICAITON	BREEAM, LEED	HQE, BREEAM, LEED	BREEAM, LEED, LCB INITIATIVE	BREEAM, LEED, LCB INITIATIVE
NATIONAL SCHEME	GPR materiaal, Het Nieuwe Normaal, BCI EXPERT	E+C- (ÉNERGIE POSITIVE & RÉDUCTION CARBONE), EXPLOITATION BBCA BAS CARBONE		VERDE
OTHER SCHEME		EU Taxonomy	EU Taxonomy	EU Taxonomy

2.3 & 2.4) Availability of EPD's databases and LCA calculation tools

Several European countries do not yet have an **official national EPD database or life cycle calculation tool** referenced as the national tool for conducting whole life carbon assessments in a harmonized manner for all assets in their country.
Often, where official tools and da-ta-bases are still lacking, national players rely on **private national/international tools (commercial tools)** that integrate their own sets of Environmental Product Declarations (EPDs) – generic or specific ones.
Reliable access to these tools and EPD databases is crucial for supporting accurate and relevant whole fife carbon calculations, at both early and final stages of building projects.
These resources enable assessments of the environmental impact of building materials and processes, facilitating informed decision-making and comparison between solutions and Buildings across Europe. **The level of accuracy varies depending on the extent of the EPDs databases and their EPD type**, as well as on the tool used.
By making detailed data on material impacts available, these tools help ensure that LCA calculations are robust and meaningful.

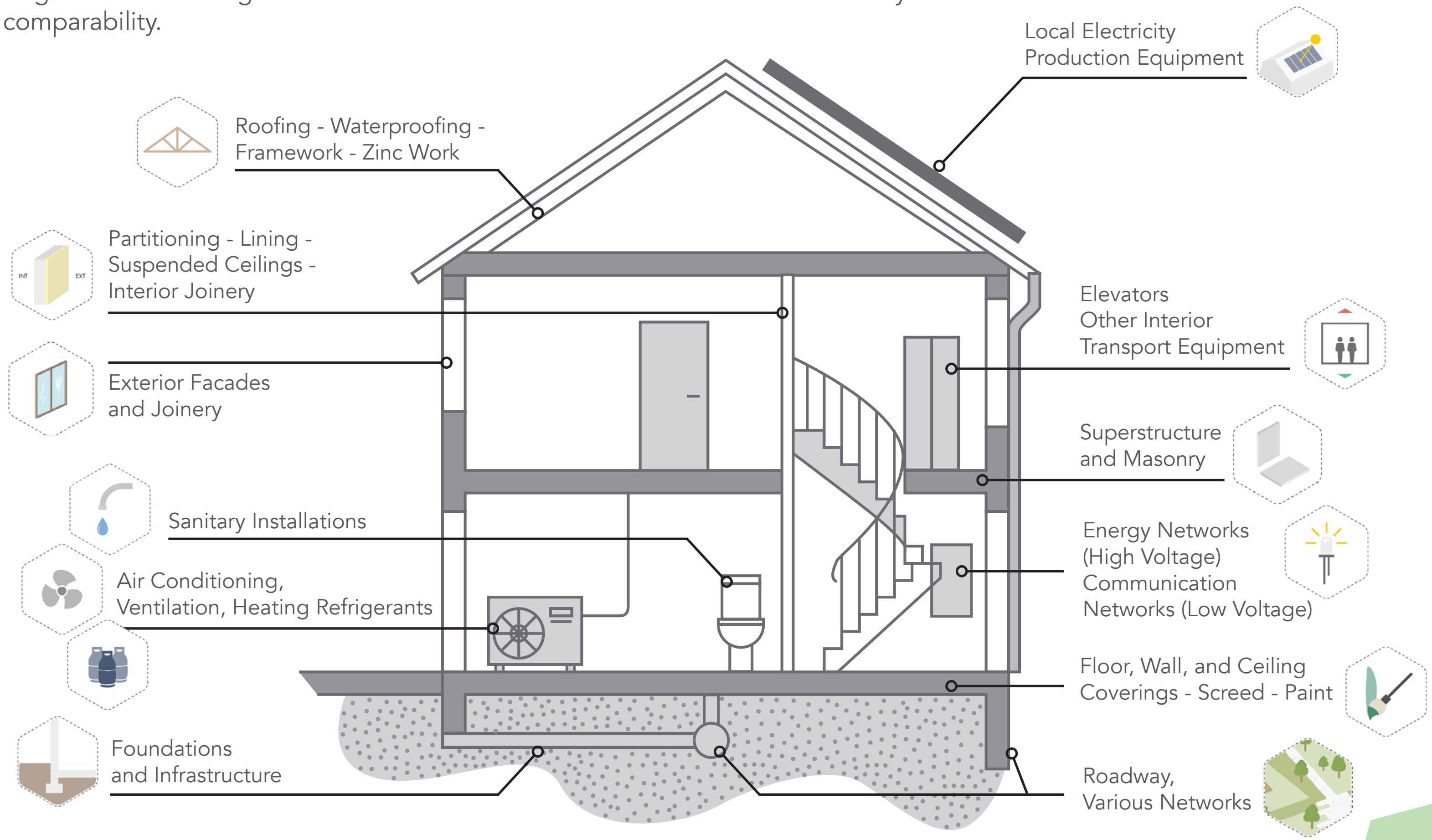
2.5) Calculation scope : building parts considered in the LCA

The **boundaries of Life Cycle Assessment (LCA) calculations** vary significantly across European countries, affecting which **building parts , elements and systems are considered** in a typical LCA.

Whether the perimeter of a LCA is defined at the country level (Regulation) or by the market (local / international certification scheme), it is crucial to **understand the variation** occurring in LCA boundaries (regarding what parts and systems of a Building are being considered), especially **when comparing buildings** in different locations across Europe, or using different calculation tools.

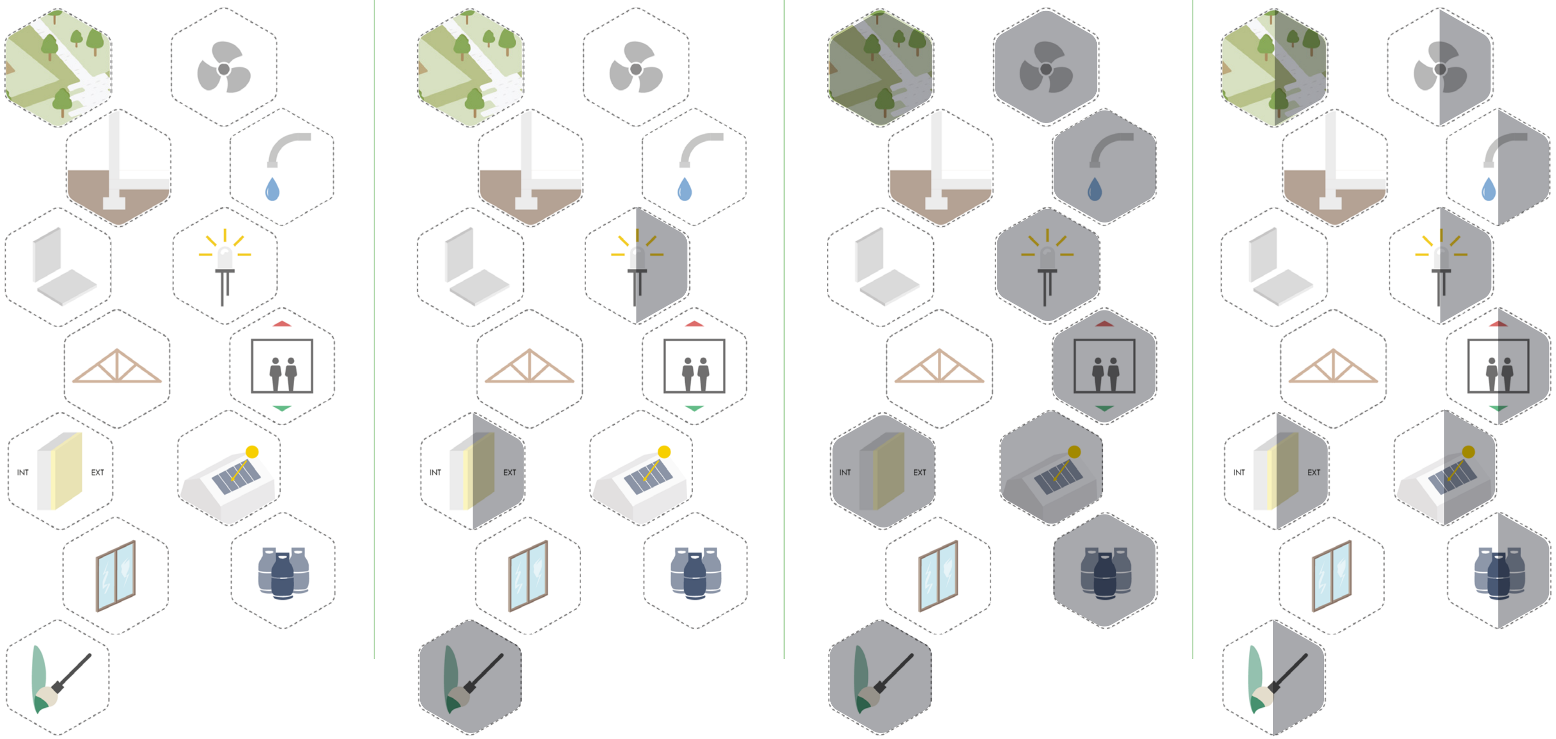
Indeed, one building's carbon outcome may be superior to another, not because of less sustainable material or design choices, but rather because **the amount of data and systems considered in the first one's calculations would be of broader perimeter than the latter**.

Recognizing these differences in LCA scope between countries or frameworks is key to make accurate comparisons and inform decisions about building projects and their carbon impact. The scope of LCA calculations in terms of elements and parts of a building that are considered in the equation can impact the overall assessment of a building's environmental performance. This highlights the importance of harmonizing LCA methodologies and boundaries across countries to ensure consistency and comparability.



2.5) Scope : Building parts considered in the LCA

RE 2020 (new build), HQE, BBCA / EU Taxonomy	MPG (Milieu Prestatie Gebouw)	LEED	BREEAM



Note : interior elements are optional

Included in the building LCA - Partially Included - Not Included

PICTURE LEGEND

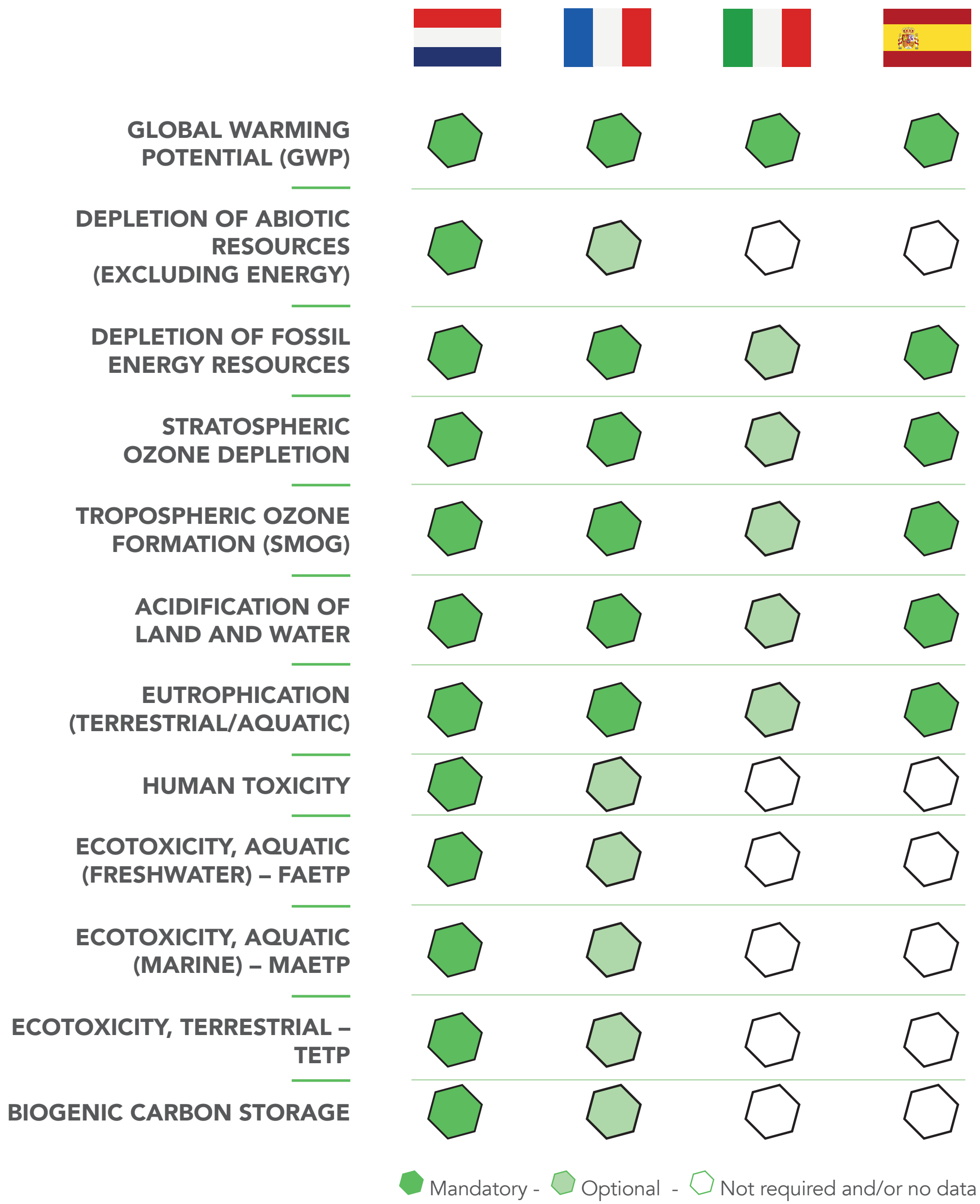
- Roadway, Various Networks
- Foundations and Infrastructure
- Superstructure and Masonry
- Roofing - Waterproofing - Framework - Zinc Work
- Partitioning - Lining - Suspended Ceilings - Interior Joinery
- Exterior Facades and Joinery
- Floor, Wall, and Ceiling Coverings - Screed - Paint
- Air Conditioning, Ventilation, Heating
- Sanitary Installations
- Energy Networks (High Voltage) - Communication Networks (Low Voltage)
- Elevators - Other Interior Transport Equipment
- Local Electricity Production Equipment
- Refrigerants

2.6) & 2.7) LCA standards and LCA indicators

At EU level, there are differences in the adoption and implementation of LCA standards, which emphasize the need for harmonized strategies to effectively address whole-life carbon impacts in building projects. These differences significantly impact the carbon outcomes of building renovations, namely when comparing buildings in different countries.

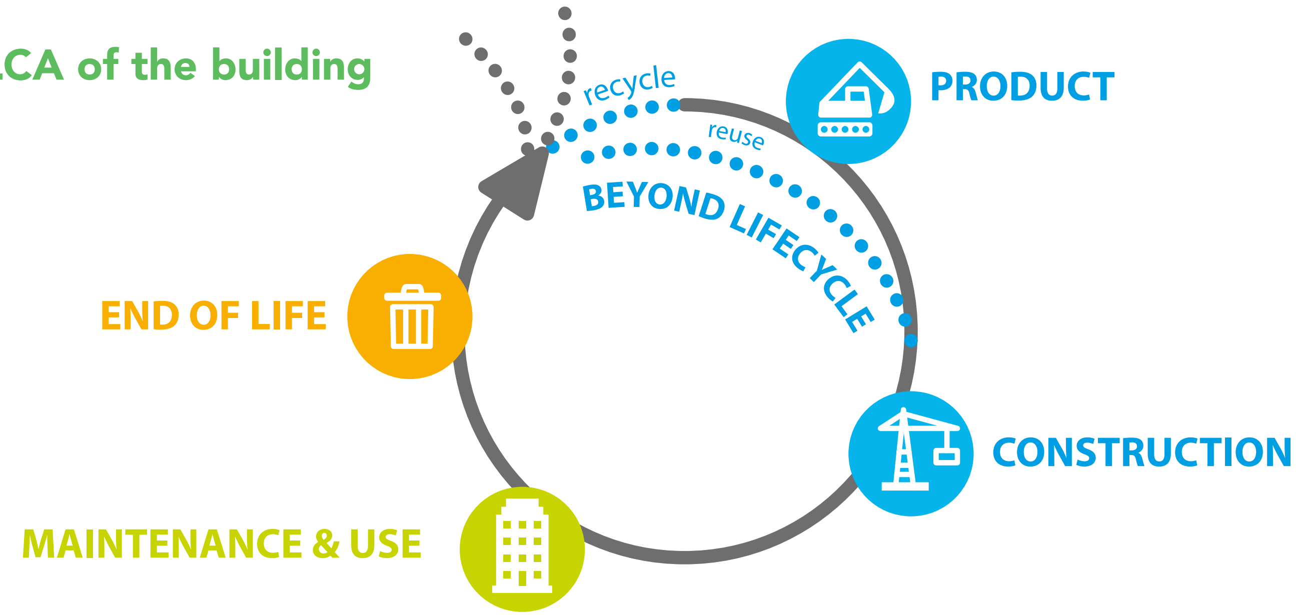
Indeed, whole-life carbon calculations **(LCA) will vary** because the **standards used as reference differ** from one country to another, but also because there is a **variation in the indicators considered**. Not all standards refer to the same perimeter / scope of indicators for the calculation. This means that a same outcome in terms of carbon, may not include the same impact indicators. The indicators scope of a LCA vary from one country to another. While some countries clearly state the indicators that shall be included in the calculations, other countries' market practices may be guided solely by the scope of indicators considered in a specific commercial rating scheme (building sustainability certifications).

It is worth noting (as illustrated in the image) that some indicators (from CMLIA method in NL (11 indicators) and being switched to EN15804-A2 soon (19 indicators) are mandatorily required in LCA assessment for buildings in the Netherlands, while being optional in France, and not at all required in Spain or Italy, because the usual national EPD's for materials do not provide data for such indicators. This variation results in **boundaries of the total carbon calculation that are not the same** across different countries. Therefore, to ensure accurate and meaningful comparisons, it is important to highlight what indicators we are including in the LCA scope: otherwise, a building may present a higher footprint, simply because the amount of impact indicators considered is broader than the set of indicators considered by another building or framework.



NOTE: *Biogenic Carbon Storage was considered Not required but became mandatory in Netherlands from July 1st 2025, after the data analysis process of this report, but updated since.*

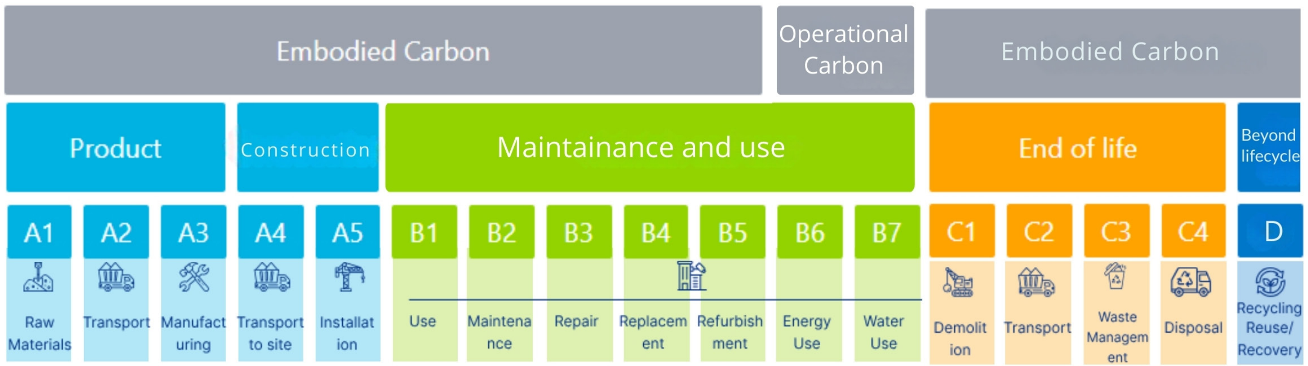
2.8) Life stages considered in the LCA of the building



It is worthy to note that **heterogeneous stages are considered in the building life cycle across different countries**, which can lead to varying carbon results, when comparing Buildings in different geographical locations.

This means that a building may reach a higher Carbon Impact, not just because its solutions choice and operations, but because it covers a **wider spectrum of stages or systems** within the calculation.

This highlights the **importance of understanding and addressing these variations in the carbon accounting** in order to achieve meaningful comparisons and carbon reductions, namely when defining strategies based on LCA considerations for renovations.



2.8) Life stages considered in the LCA of the building

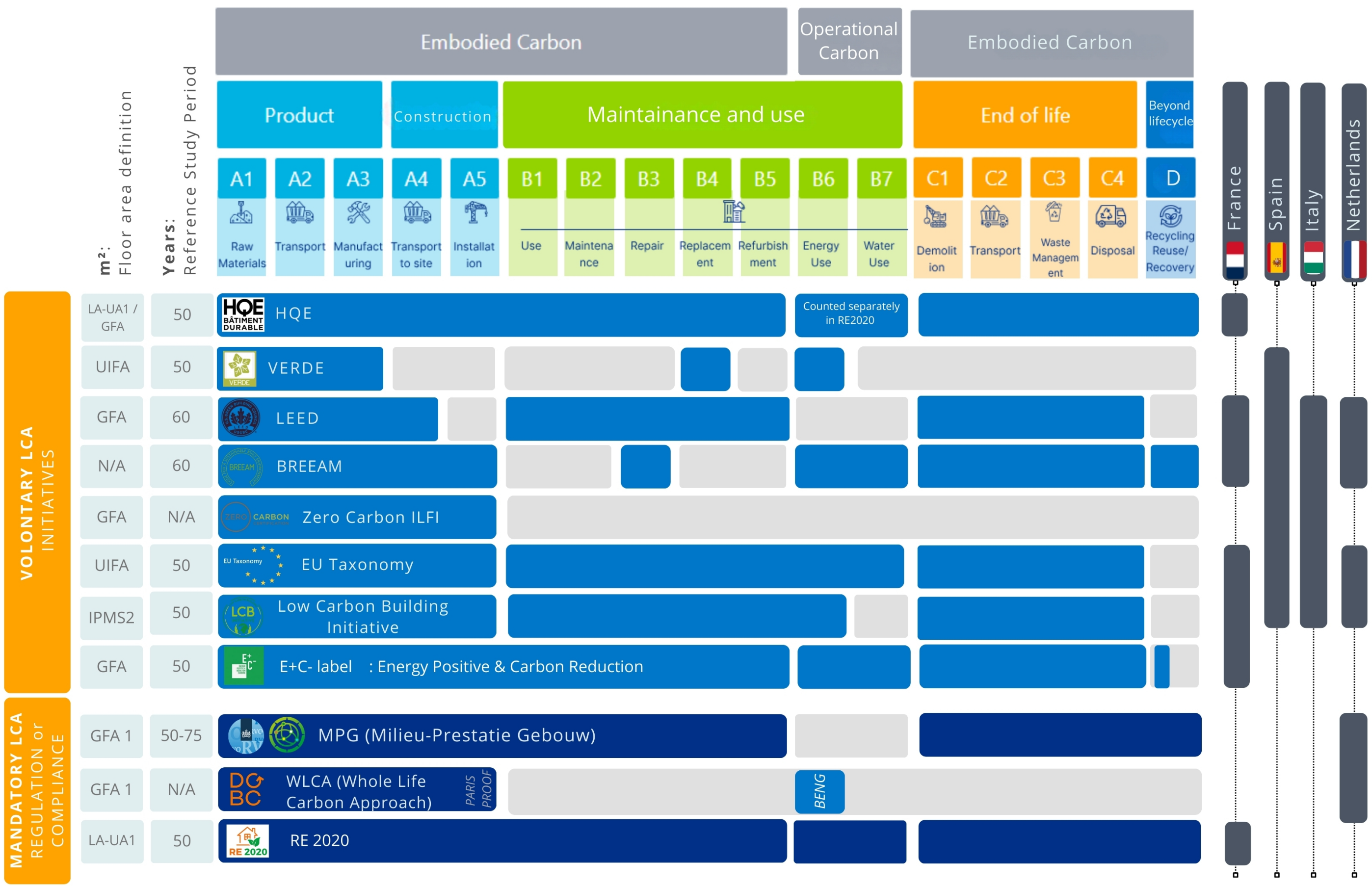
AREA DEFINITION

- **LA-UA1:** Livable Area / Usable Area (*specific to RE2020 – SHAB or SU)
- **GFA:** Gross Floor Area
- **GFA 1:** Gross Floor Area of all indoor areas of the building
- **UIFA:** Useful Internal Floor Area
- **IPMS2:** Vertical penetrations, structural elements, technical services, hygiene areas, Circulation areas, amenities and workspace -excluding H (balconies, covered galleries, internal car parking & storage rooms)

NOTES:

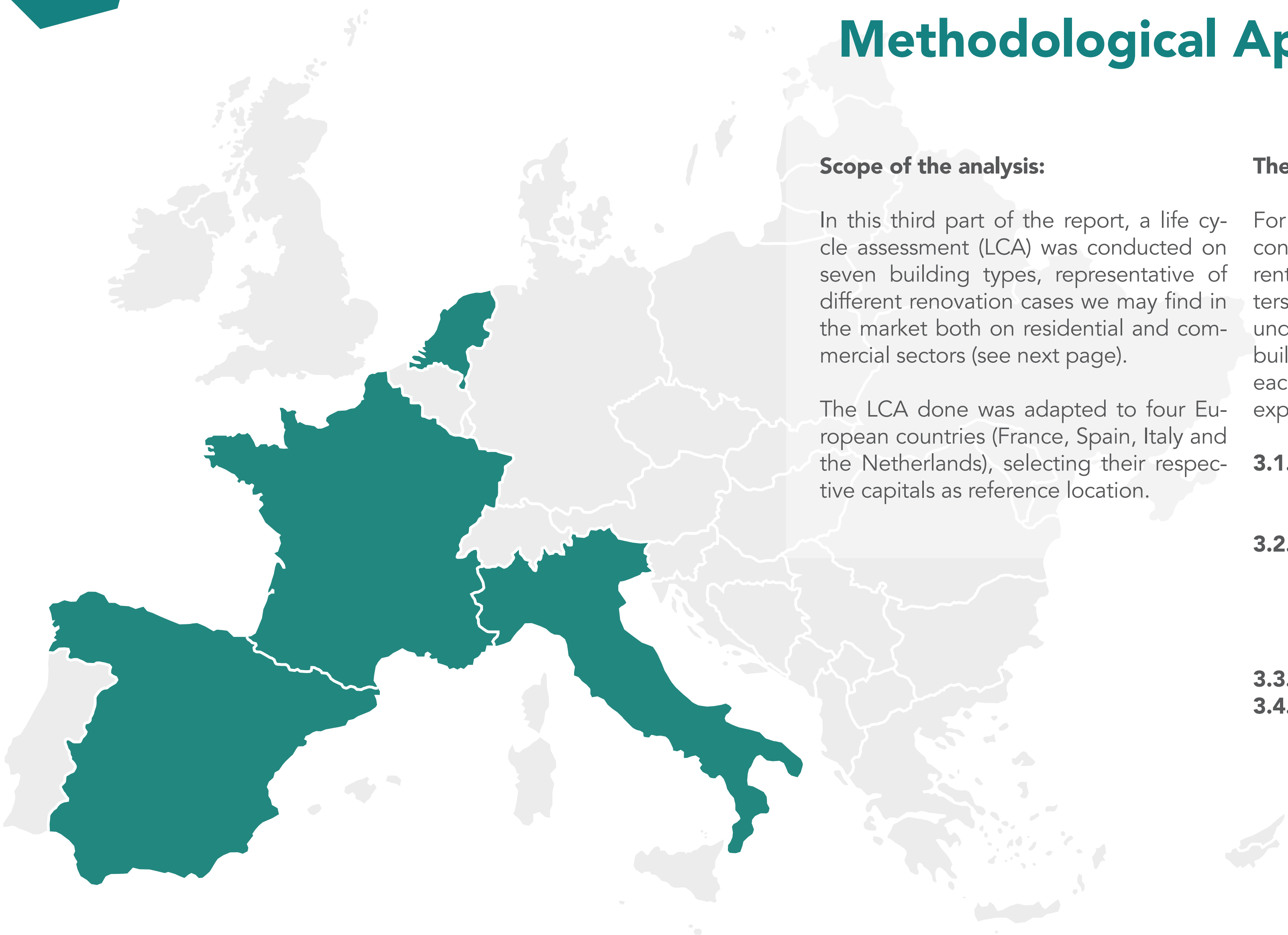
- The French local scheme of LCBI is called BBCA (original one)
- **E+C-** framework is progressively being replaced by RE2020
- **BREEAM** has different versions across Europe. In the analysis table we considered BREEAM International. BREEAM NL follows the Dutch regulation and therefore the MPG.

MANDATORY REGULATIONS AND OPTIONAL INITIATIVES FOR LCA



PART 3 RENOVATIONS: LCAs & MODELING

Methodological Approach



Scope of the analysis:

In this third part of the report, a life cycle assessment (LCA) was conducted on seven building types, representative of different renovation cases we may find in the market both on residential and commercial sectors (see next page).

The LCA done was adapted to four European countries (France, Spain, Italy and the Netherlands), selecting their respective capitals as reference location.

The fields of analyses:

For each selected case, the building was considered to be the same in the different countries, but the national parameters were customized in order to allow for understanding of how the location of a building impact the carbon outcome of each renovation. Chapter 3 of this report explores the following elements:

3.1. THE BUILDING TYPES, detailing the 7 building types serving as case studies
3.2. GENERAL METHODOLOGY OF THE RENOVATIONS: LCA & MODELING, stating the common ground for the LCAs calculated for each country.
3.3. "CLIMATE"-focused APPROACH
3.4. "CARBON COEFFICIENTS"-focused APPROACH

3.1 The building types (7 Case studies):

The Renovation Life-Cycle Assessments (LCA) were conducted on seven building types, representative of different renovation cases we may find in the market across both residential and commercial sectors.

The LCA conducted was adapted to each of the four European countries, selecting their respective capitals as reference location, namely Paris, Madrid, Rome, and Amsterdam. For each case, the building was considered to be the same, but the national parameters were customized in order to allow for understanding of how the location of a building (with its energy mix, materials' carbon coefficients and weather features) would impact the carbon outcome of each renovation.

A INDIVIDUAL HOUSING in spread urban area

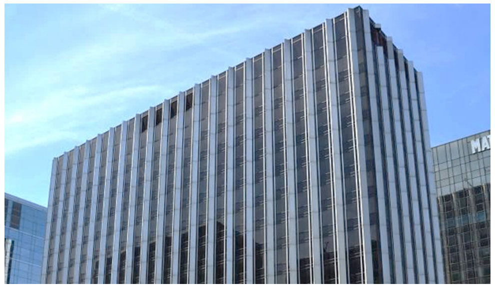
B MULTI-RESIDENTIAL BUILDING in suburban area

C RESIDENTIAL HISTORICAL BUILDINGS in city centre

D LARGE LISTED COMMERCIAL BUILDING IN REFURBISHMENT in city centre

E INDUSTRIAL BUILDING TRANSFORMED IN OFFICE SPACE

F COMMERCIAL BUILDING undertaking a MAJOR RENOVATION



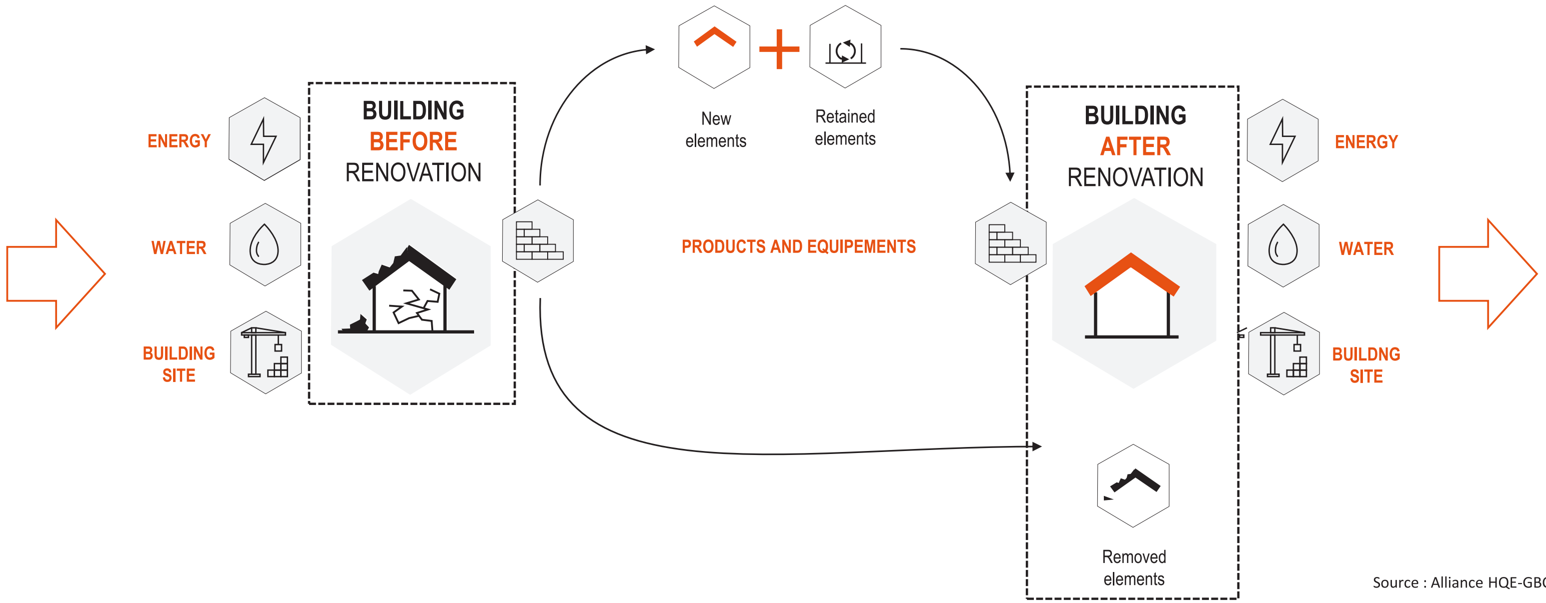
G GROUND FLOOR OFFICE SPACE IN REACTIVATION

3.2 General methodology of the LCA modeling of the renovations

In order to ensure comparability of results for each modeled building type, a uniform methodological framework was applied across all European contexts studied (France, Spain, Italy and the Netherlands).

Following a benchmark of national practices, the French RE2020 regulatory framework (currently applied to new constructions in France) was identified as the most comprehensive and structured approach among existing European regulations and therefore served as basis to premises.

For the incorporation of renovation-specific aspects, the methodology developed in the first NZC Renovation program (2022) was applied as the common basis. This methodology considers the carbon impact of "removed" and "retained" materials, adjusted according to their lifetime and year of installation in the building.



Source : Alliance HQE-GBC

All input assumptions related to energy, water and construction site impacts are based on the premises of the 1st NZC Renovation Project Report (2022) and derived from the data collection conducted on the seven generic case studies.

Dynamic environmental data (in compliance with RE2020 regulation) was used while capturing each country's reference values for carbon. This also allowed to include in the calculations the carbon sequestration of materials before their end-of-life phase.

NOTE: *The first NZC program (2022) had used static data instead, not dynamic data. Before adapting such data to different geographic locations in this study, the environmental data were sourced from INIES, the French EPD database (inies.fr).*

LCA factors & results adapted to each country

For this initial exploratory phase of the NZC Renovation Europe program, a simplified methodology was adopted: this allowed for better spotting the impact generated by each country specific features (or reference values). Only the specific LCA parameters were adjusted in order to reflect key differences between countries.
Two adaptation parameters were considered:

- **Energy-related** carbon **emission factors**, reflecting variations in each country's **energy mix** and their impact in carbon results.
- **Carbon emission factors** of the **main materials**, applied uniformly to the main carbon contributors in each project.

The assumptions considered for these two adaptation parameters are detailed in the following chapters.
All other parameters were assumed identical across countries in the modeling.

PARIS_Siège de la Drieat @ AIA Life Designers, architectes - photos : Axel Dahl

Study limitations

In order to individually analyze each impact lever, some factors were kept constant for all countries. This allowed to sense variations and spot their causes, which would not be possible if all parameters were modified simultaneously. Consequently, this first analysis **does not yet take into account** the:

- **Variations in construction techniques** between the 4 countries.
- **Differences in material and system selection**, which depend on local practices and national traditional systems specifics.
- Emission factors specific to **technical systems**.
- Emission factors related to **water use**.
- **Construction site**-related emissions.
- **Climate variations** within the studied countries (so far, only the climate of each country's capital city was considered).

These simplified assumptions may lead to significant discrepancies in the results. Phases 2 and 3 of NZC Renovation Europe Project program will aim to refine the assessment of parameters currently considered constant.

At this stage, **comparisons** are only **considered for**:

- **Energy-related** emission factors.
- **Architectural components**, in terms of order of magnitude, assuming that the emission factors considered are representative and that all other conditions remain equal.
- The **climate** in the selected European **Capital location**.

The results presented should therefore be interpreted with caution. They mainly illustrate trends related to differences in energy mix between countries and their impact in carbon outcomes for a same building in different locations.

In order to adapt the business cases of the NZC Renovation project to the context of each of the four European countries considered (France Italy, Spain, and the Netherlands), we chose to **focus on two methodological approaches**:

A 'CLIMATE'-focused approach

Adapting the business cases to the climate of each country, by using weather station data from the capitals, in order to:

- More accurately estimate **heating and cooling consumption**
- More accurately estimate **photovoltaic energy production**

B 'CARBON COEFFICIENT'-focused approach

Adapting the carbon impacts according to the databases used in the different countries, which allowed us to:

- Assess the **embodied carbon** of the **main materials** used in the building
- Assess the **carbon impact** of the different **energy production sources**

PARIS_Siège de la Drieat @ AIA Life Designers, architectes - photos : Axel Dahl

3.3 'Climate' focused approach - Unified degree days

To account for the climatic specifics of each country, we selected one weather station per capital and collected the corresponding data. This analysis allowed us to identify a key indicator: **Unified Degree Days (UDD)**, which measures the heating or cooling demand of a building based on temperature variations in that city. We estimated for each country **the cold UDD** (periods when the temperature exceeds 25°C and needs cooling) **and hot UDD** (periods when the temperature is below 19°C and requires heating).

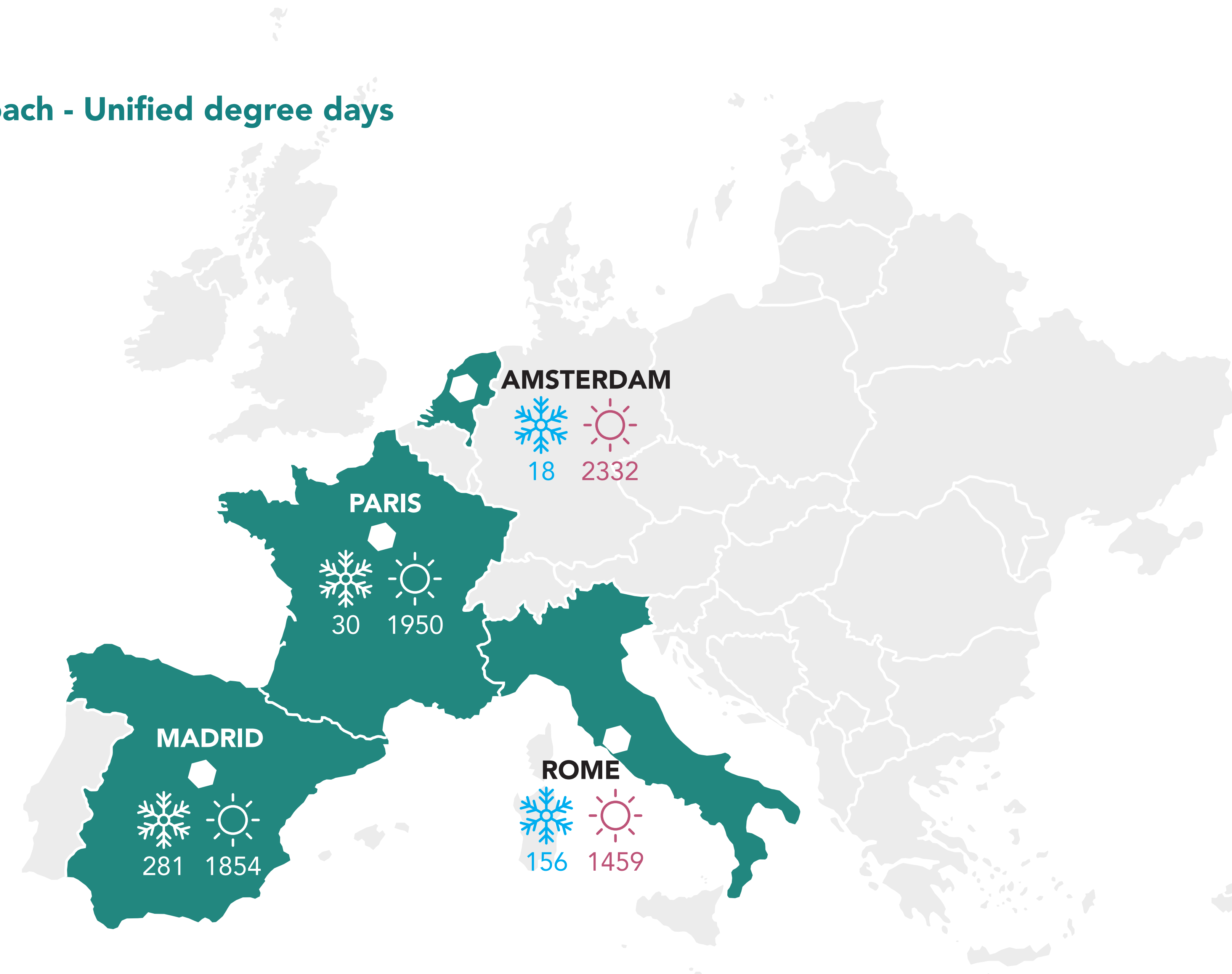
We used this indicator to estimate the **heating and cooling consumption adjusted to each country** for each business case.

LEGEND:

WEATHER STATION

UNIFIED COLD DEGREE DAYS above 25°C

UNIFIED HOT DEGREE DAYS under 19°C



Data source: EPW (EnergyPlus, Weather files)

3.3 'Climate' focused approach - Sun irradiance

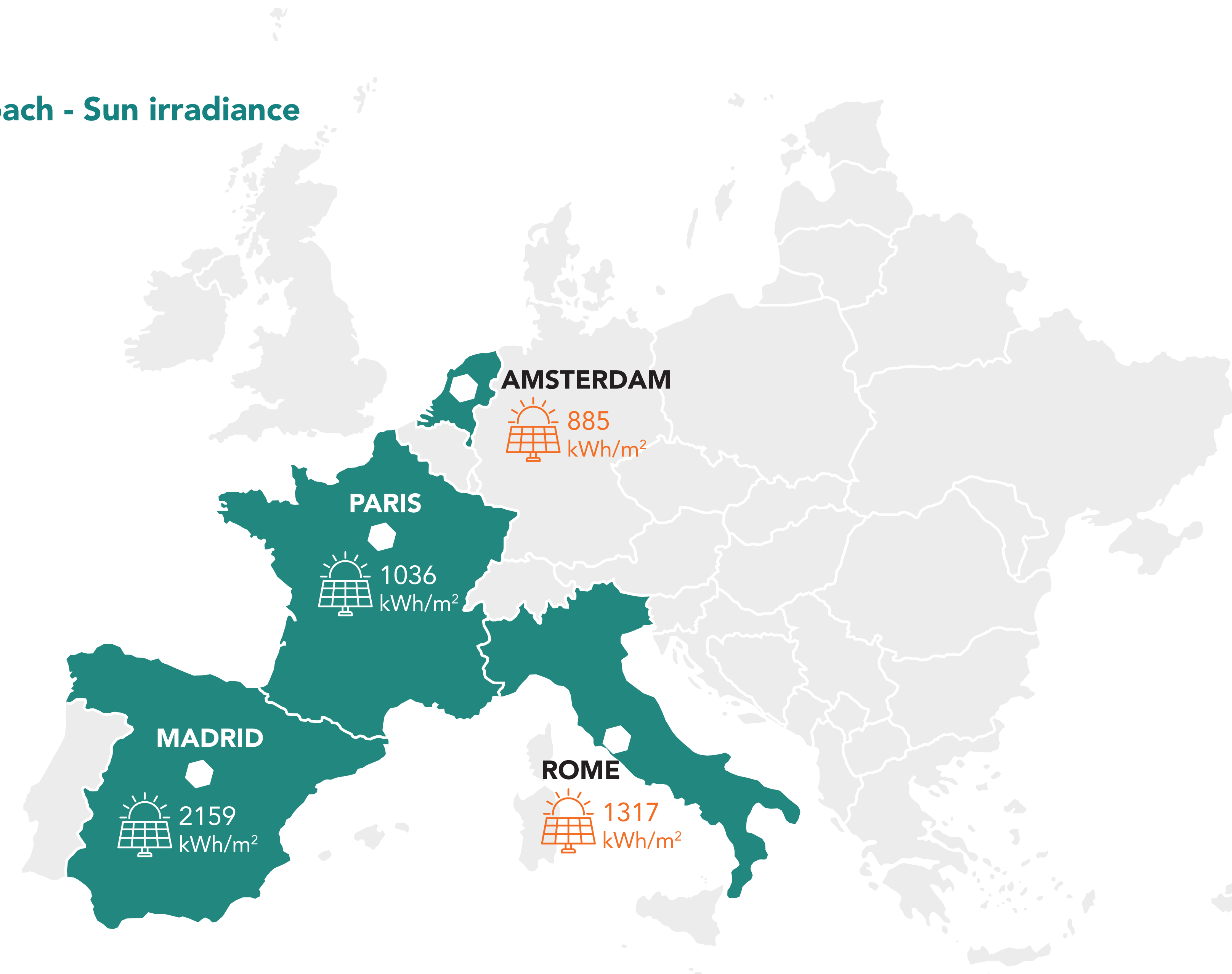
To adjust the electricity production of photovoltaic panels based on the climate of each country, we studied **the annual solar irradiation** indicator. This allowed us to more accurately estimate the photovoltaic (PV) energy production capacity for each country.

We determined **adjustment coefficients for photovoltaic production** in each country based on the annual irradiation.

LEGEND:

WEATHER STATION

DIRECT NORMAL IRRADIANCE
Annual sum, in kWh/m²



Data source: EPW (EnergyPlus, Weather files)

3.4 'Carbon coefficient' focused approach

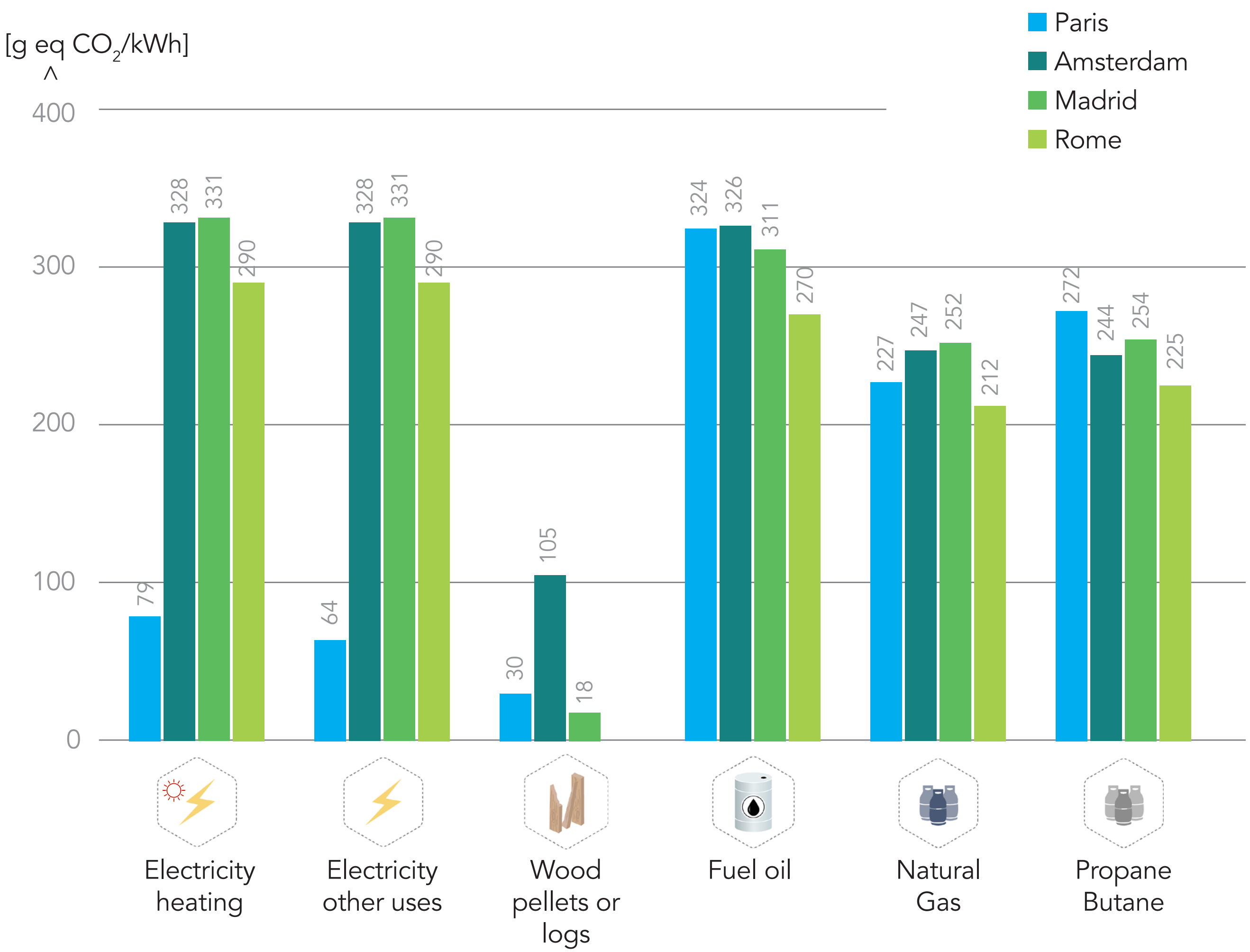
MAIN CARBON COEFFICIENT

At this stage of the study, only the main **carbon emission factors have been adapted to** the context of **each country**. For the 4 countries (France, Italy, Spain and the Netherlands), we listed an inventory of the primary carbon emission factors, by using their respective national databases and carbon conversion references. This allowed us to assess the **national sensitivity of carbon impacts** based on each country's energy sources (chart, right side).

For the **materials**, the **key components representing the buildings shell** were selected, and their **carbon emission factors** were estimated. The method consisted in comparing environmental data of main construction materials using France as the reference baseline. The observed variations in embodied carbon were then applied proportionally to the different construction lots in order to assess the relative impact of national contexts (chart, next page).

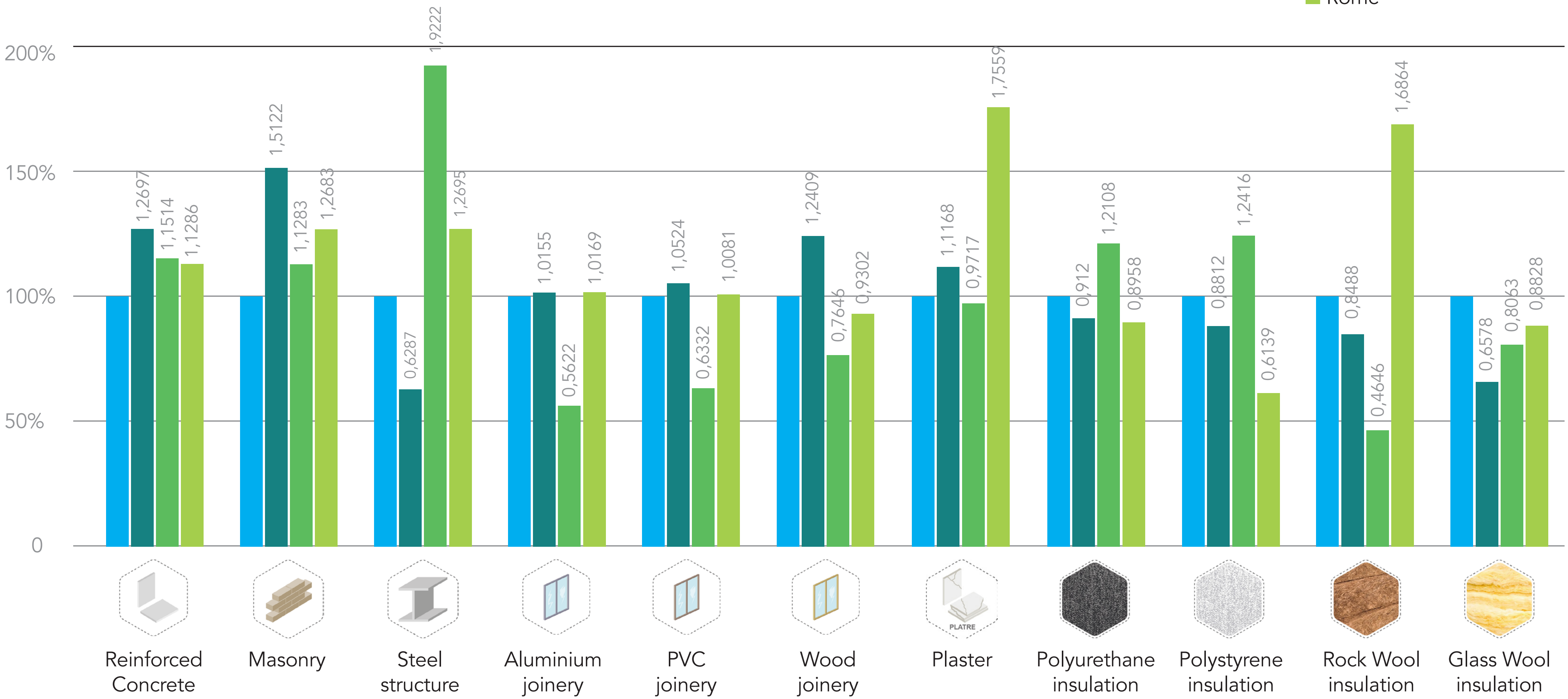
In a subsequent phase, this approach will need to be consolidated by ensuring the completeness and representativeness of the data.

MAIN CARBON COEFFICIENTS* OF ENERGY PRODUCTION



*Sources of carbon conversion factors:
France > INIES database; Netherlands > WEii method using average emission factors from co2emissiefactoren.nl (Dutch power generation mix); Italy > ISPRA – Italian GHG Inventory 1990–2022, National Inventory Report 2024; Spain > Royal Decree 390/2021 – CO_2 emission factors and primary energy conversion coefficients for building energy sources (RITE).

RELATIVE VARIATION (in %) OF EMBODIED CARBON IMPACT (COMPARED TO FRANCE'S CARBON COEFFICIENTS – reference 100%)



*Sources of carbon conversion factors: France > Base INIES; ITALY > Average Italian GWP from OneClick Databse; SPAIN > OneClickgeneric material; NETHERLANDS > Nationale milieudatabase generic Cat. 3 material

(Perimeter A1-3, B1-4, C1-2)

PART. 4 RESULTS AND MAIN FINDINGS

per Building Type & Country

4.1 LCA modeling of 7 building types (case studies):

The carbon analysis was performed for all the selected 4 countries and spotted the variations arising from dealing with different asset types (7) and locations (4).

A INDIVIDUAL HOUSING in spread urban area

B MULTI-RESIDENTIAL BUILDING in suburban area

C RESIDENTIAL HISTORICAL BUILDINGS in city centre

D LARGE LISTED COMMERCIAL BUILDING IN REFURBISHMENT in city centre

E INDUSTRIAL BUILDING TRANSFORMED IN OFFICE SPACE

F COMMERCIAL BUILDING undertaking a MAJOR RENOVATION

G GROUND FLOOR OFFICE SPACE IN REACTIVATION

A

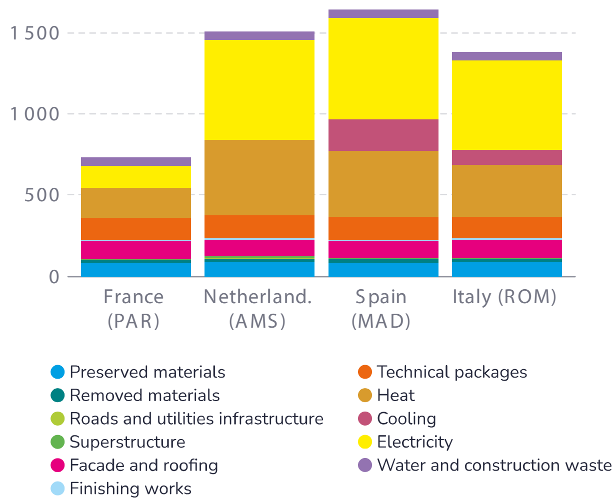
INDIVIDUAL HOUSING

without PV

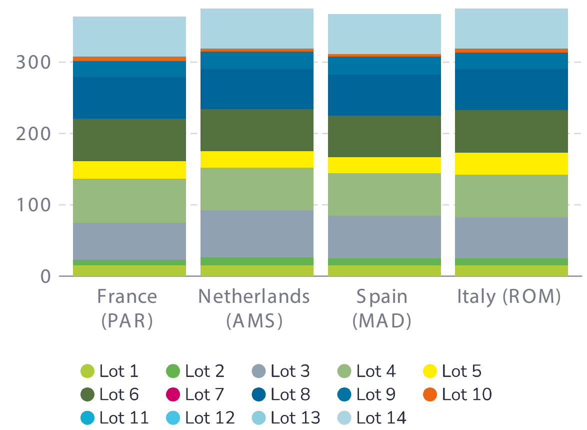
Building Construction Date: 1993
Usable Area: 78 m²
Adaptation of Embodied Carbon
(excluding technical equipment):

31%

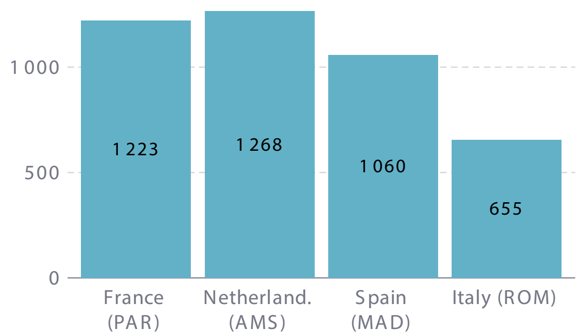
Carbon Footprint over 50 Years [kg CO2eq / m²]



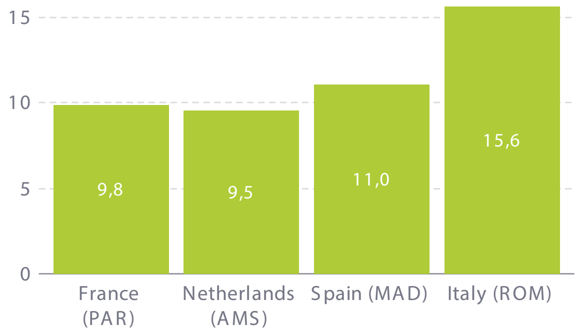
Embodied Carbon [kg CO2eq / m²]



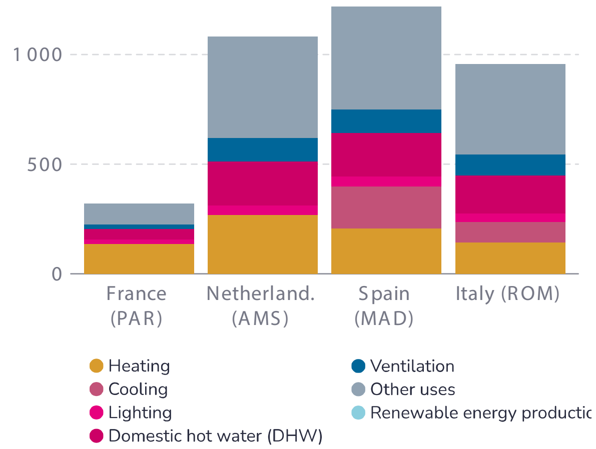
Carbon Footprint Reduction* [kg CO2eq / m²]



Carbon Return Time [years]



Energy Consumption Carbon Footprint [kg CO2eq / m²]



A

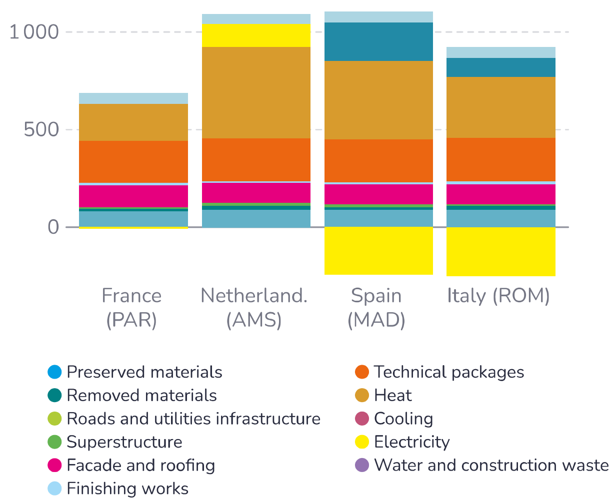
INDIVIDUAL HOUSING

with PV

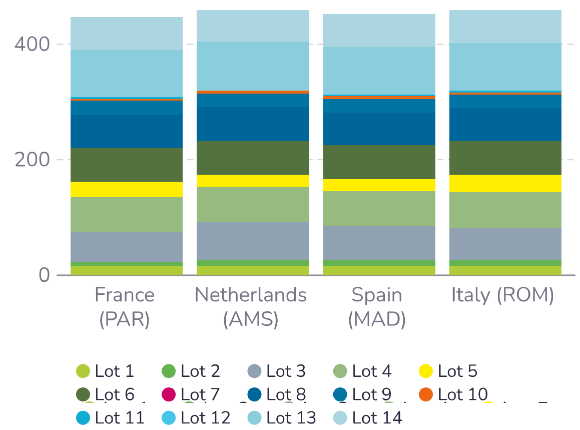
Building Construction Date: 1993
Usable Area: 78 m²
Adaptation of Embodied Carbon
(excluding technical equipment):

31%

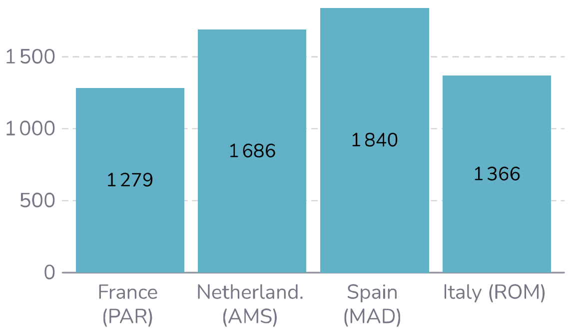
Carbon Footprint over 50 Years [kg CO2eq / m²]



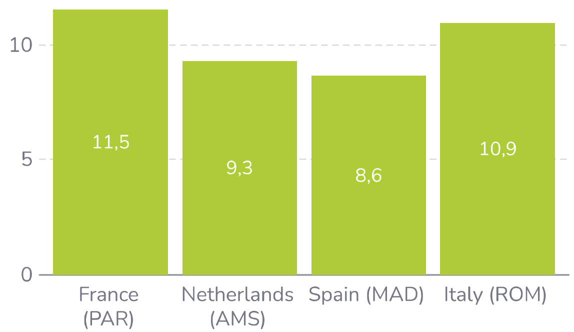
Embodied Carbon [kg CO2eq / m²]



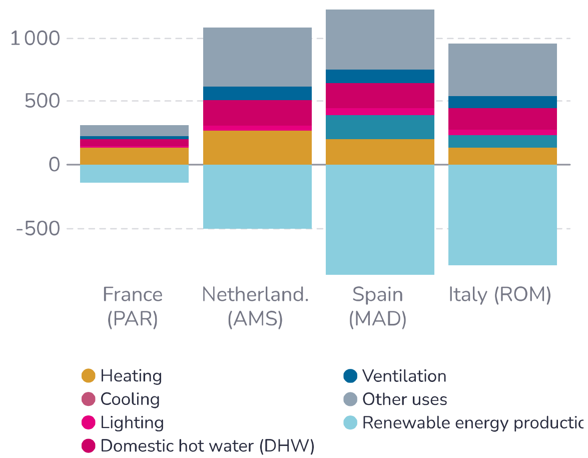
Carbon Footprint Reduction* [kg CO2eq / m²]



Carbon Return Time [years]



Energy Consumption Carbon Footprint [kg CO2eq / m²]



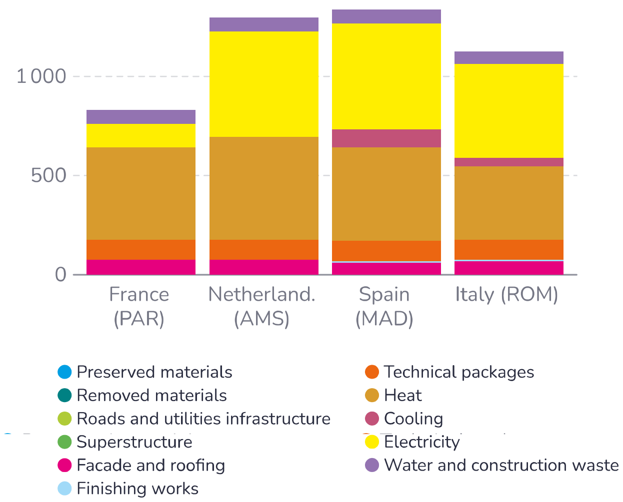
B

MULTI-RESIDENTIAL BUILDING IN SUBURBAN AREAS

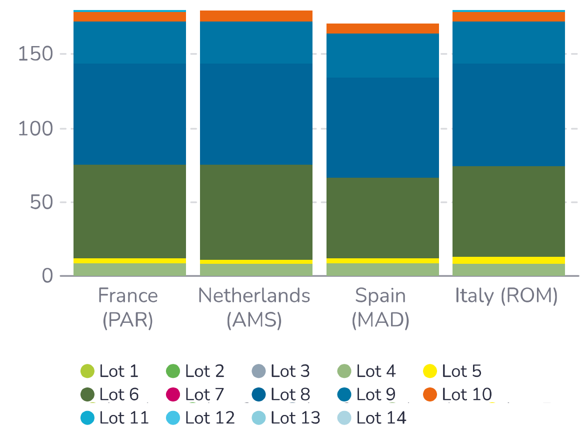
Building Construction Date: 1971
Usable Area: 5.722 m²
Adaptation of Embodied Carbon
(excluding technical equipment):

51%

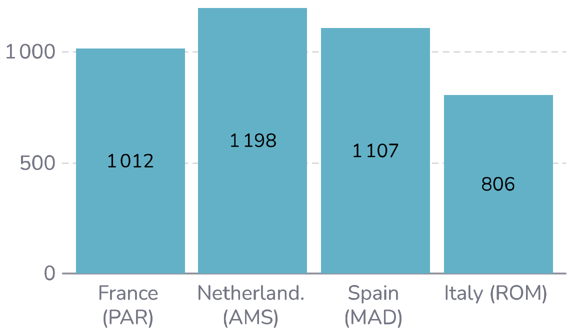
Carbon Footprint over 50 Years [kg CO2eq / m²]



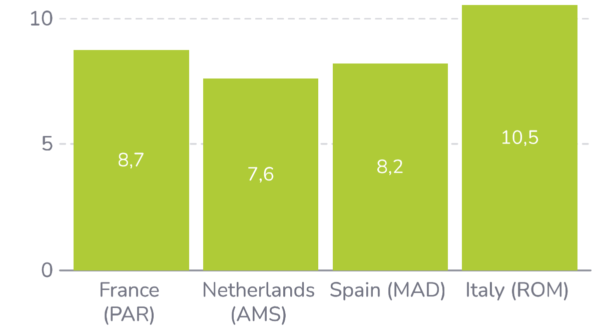
Embodied Carbon [kg CO2eq / m²]



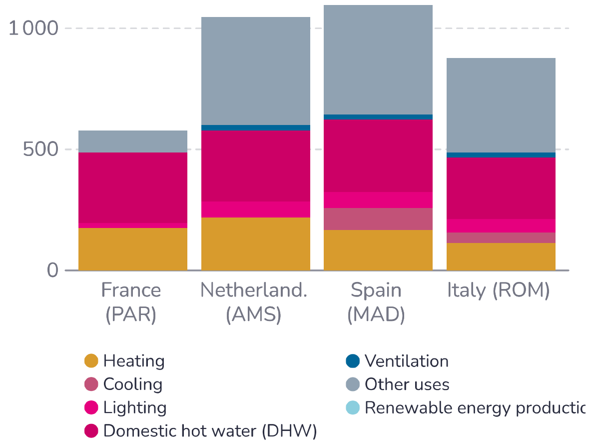
Carbon Footprint Reduction* [kg CO2eq / m²]



Carbon Return Time [years]



Energy Consumption Carbon Footprint [kg CO2eq / m²]



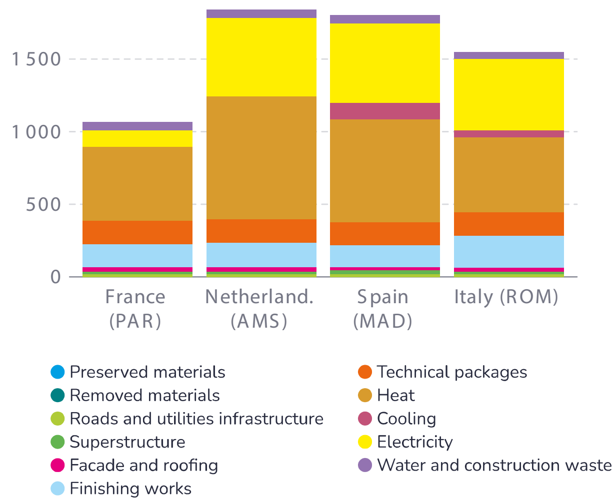
C

RESIDENTIAL HISTORICAL BUILDINGS IN CITY CENTER

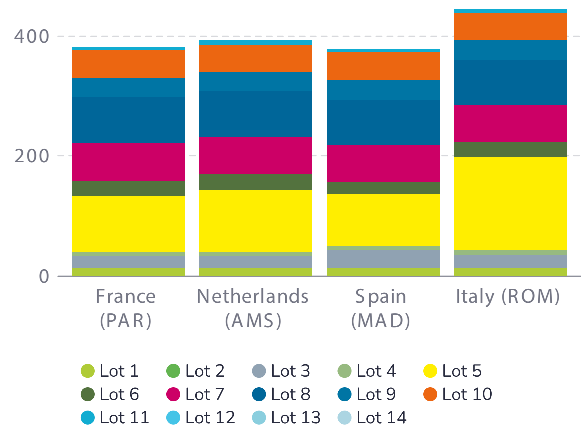
Building Construction Date: 17th century
Usable Area: 644 m²
Adaptation of Embodied Carbon
(excluding technical equipment):

37%

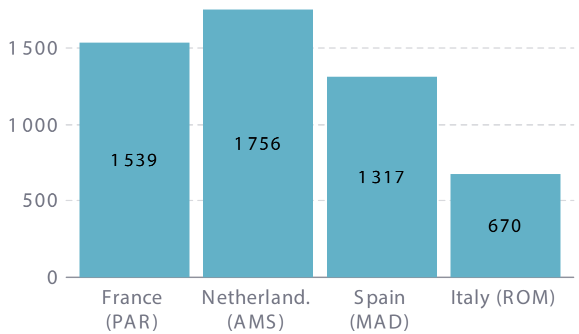
Carbon Footprint over 50 Years [kg CO2eq / m²]



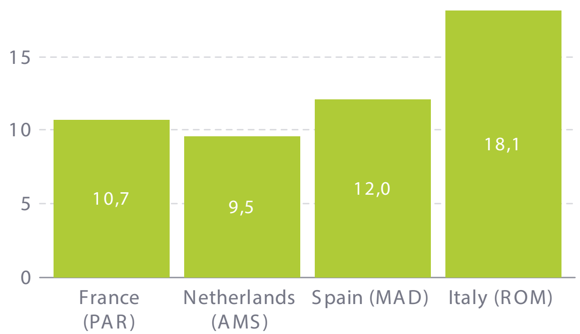
Embodied Carbon [kg CO2eq / m²]



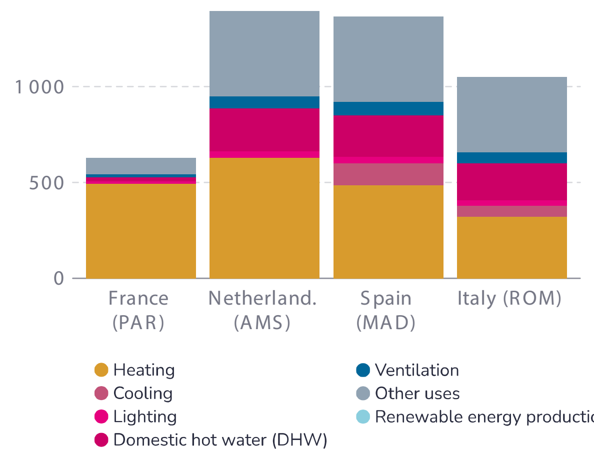
Carbon Footprint Reduction* [kg CO2eq / m²]



Carbon Return Time [years]



Energy Consumption Carbon Footprint [kg CO2eq / m²]



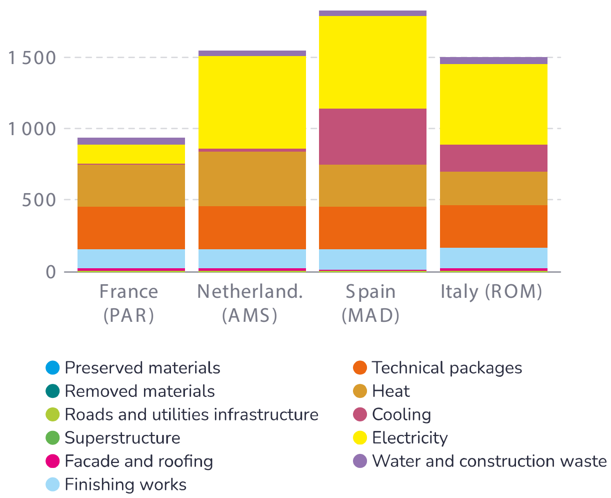
D

LARGE LISTED COMMERCIAL BUILDING IN REFURBISHMENT, in city center

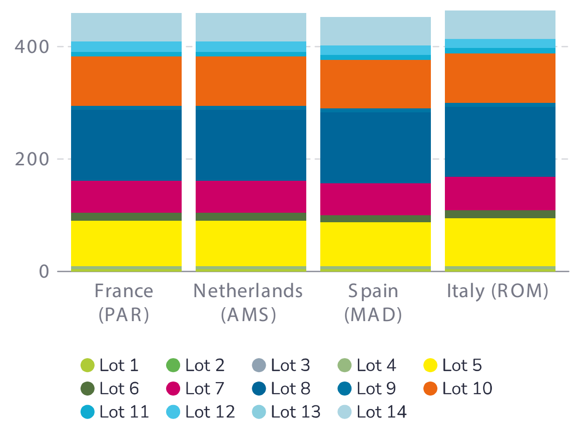
Building Construction Date: 1931
Usable Area: 9.165 m²
Adaptation of Embodied Carbon
(excluding technical equipment):

28%

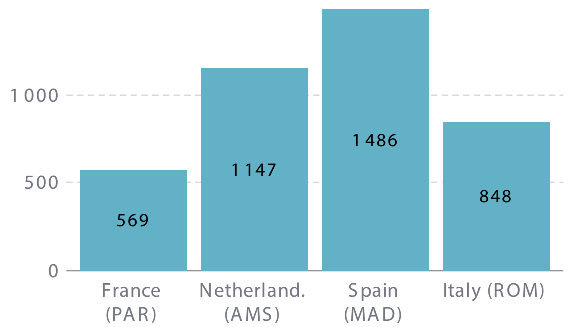
Carbon Footprint over 50 Years [kg CO2eq / m²]



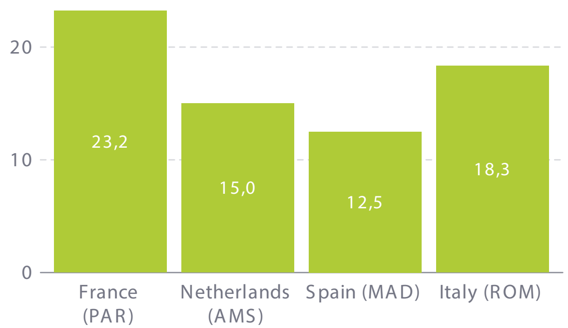
Embodied Carbon [kg CO2eq / m²]



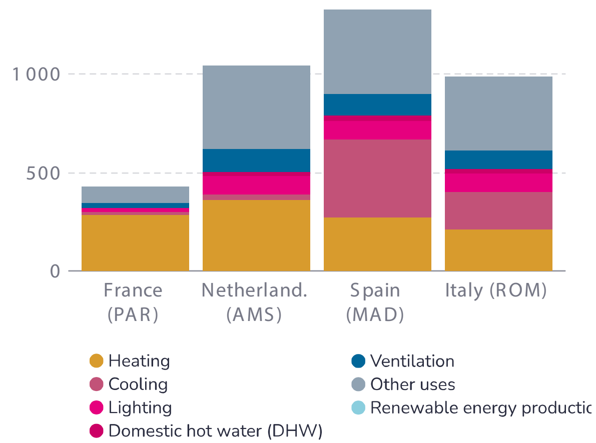
Carbon Footprint Reduction* [kg CO2eq / m²]



Carbon Return Time [years]



Energy Consumption Carbon Footprint [kg CO2eq / m²]



E

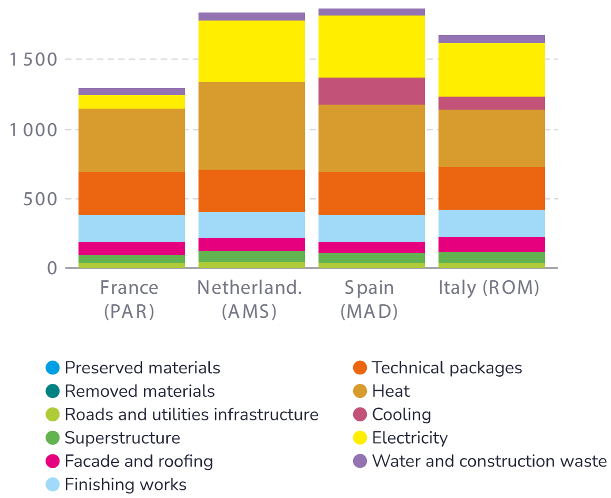
INDUSTRIAL BUILDING TRANSFORMED IN OFFICE SPACE

without PV

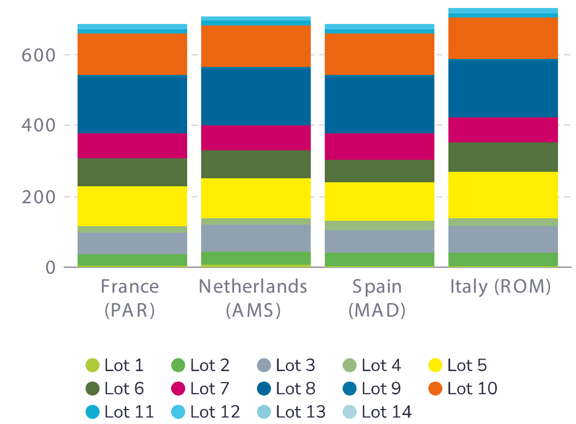
Building Construction Date: 1857
Usable Area: 4.042 m²
Adaptation of Embodied Carbon
(excluding technical equipment):

47%

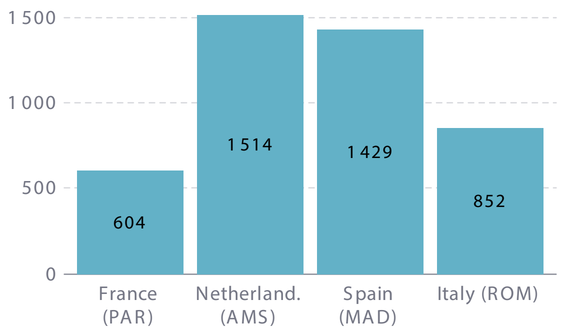
Carbon Footprint over 50 Years [kg CO2eq / m²]



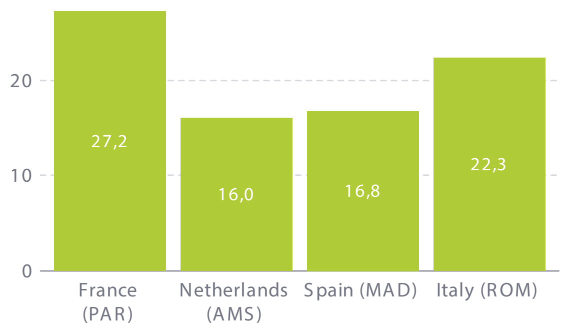
Embodied Carbon [kg CO2eq / m²]



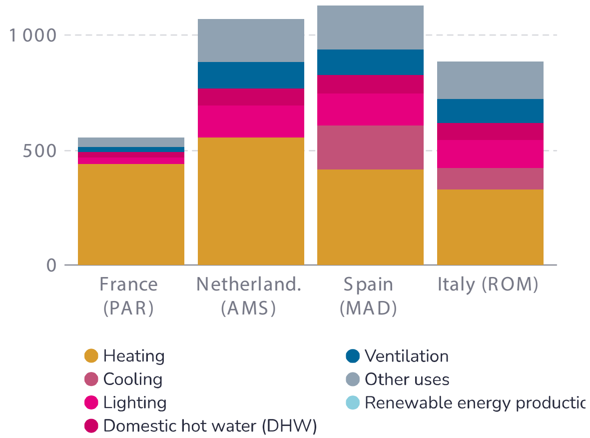
Carbon Footprint Reduction* [kg CO2eq / m²]



Carbon Return Time [years]



Energy Consumption Carbon Footprint [kg CO2eq / m²]



E

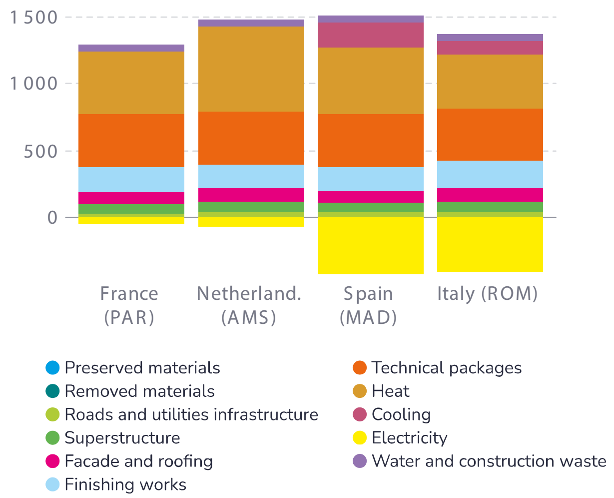
INDUSTRIAL BUILDING TRANSFORMED IN OFFICE SPACE

with PV

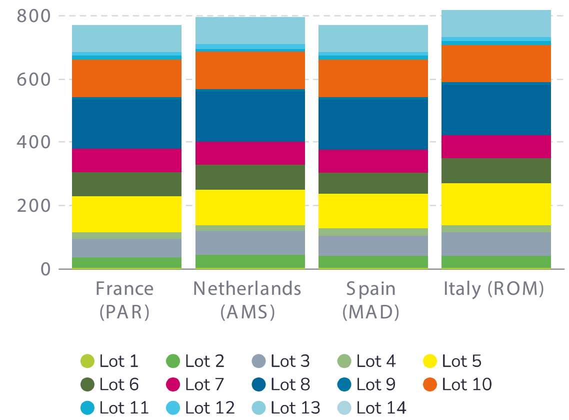
Building Construction Date: 1857
Usable Area: 4.042 m²
Adaptation of Embodied Carbon
(excluding technical equipment):

47%

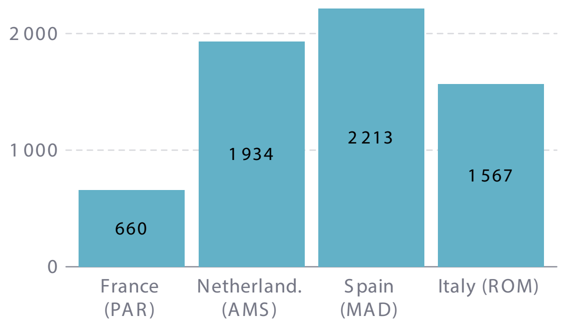
Carbon Footprint over 50 Years [kg CO2eq / m²]



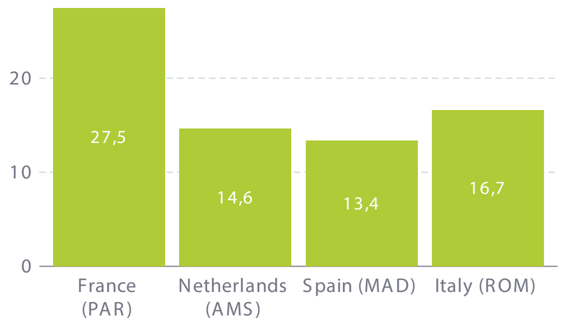
Embodied Carbon [kg CO2eq / m²]



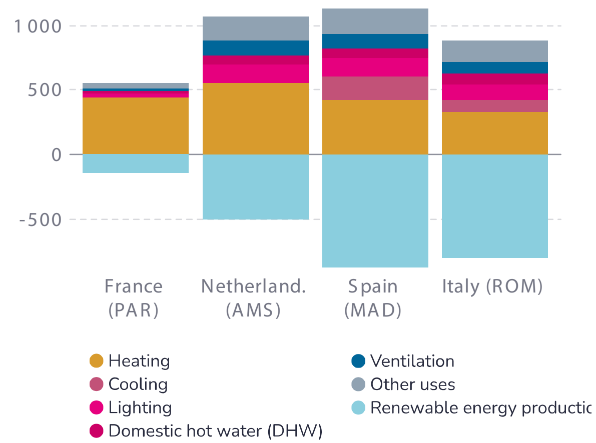
Carbon Footprint Reduction* [kg CO2eq / m²]



Carbon Return Time [years]



Energy Consumption Carbon Footprint [kg CO2eq / m²]



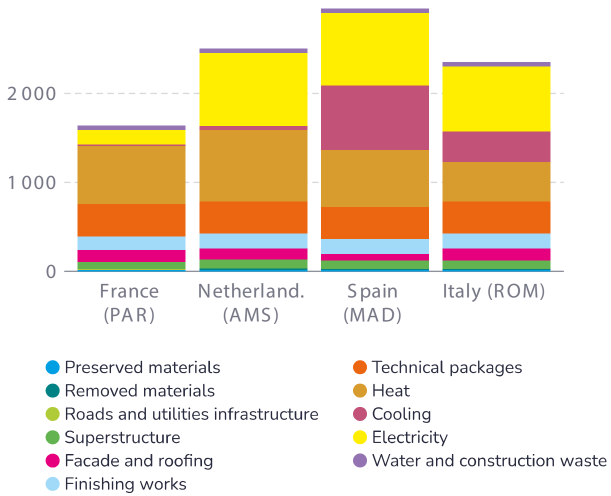
F

COMMERCIAL BUILDING UNDERTAKING A MAJOR R ENOVATION

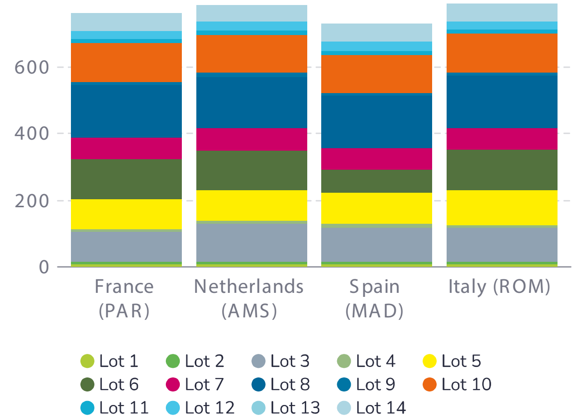
Building Construction Date: 1973
Usable Area: 20.659 m²
Adaptation of Embodied Carbon
(excluding technical equipment):

85%

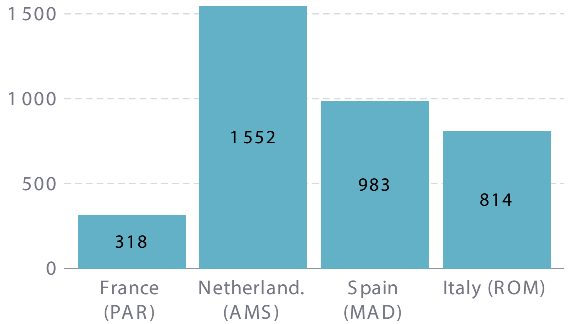
Carbon Footprint over 50 Years [kg CO2eq / m²]



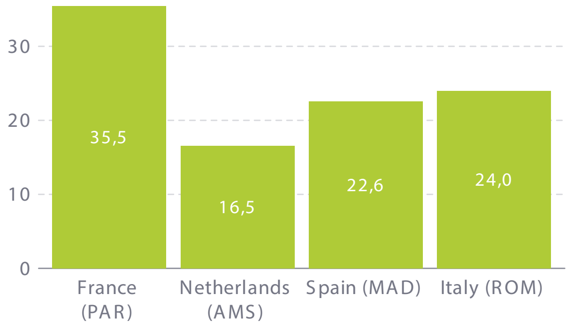
Embodied Carbon [kg CO2eq / m²]



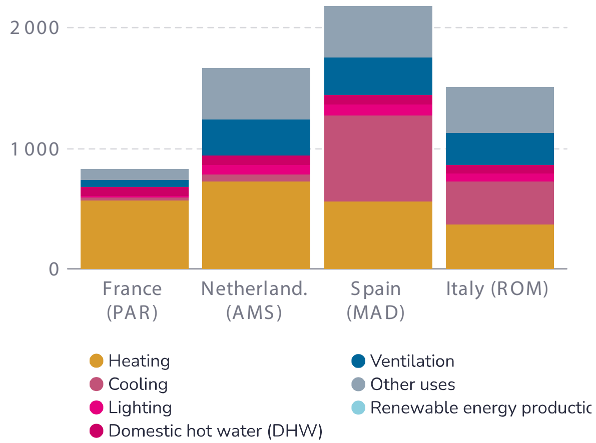
Carbon Footprint Reduction* [kg CO2eq / m²]



Carbon Return Time [years]



Energy Consumption Carbon Footprint [kg CO2eq / m²]



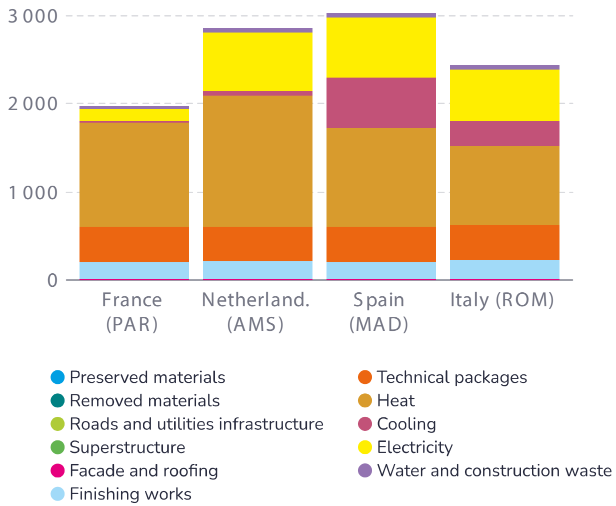
G

GROUND FLOOR OFFICE SPACE IN REACTIVATION

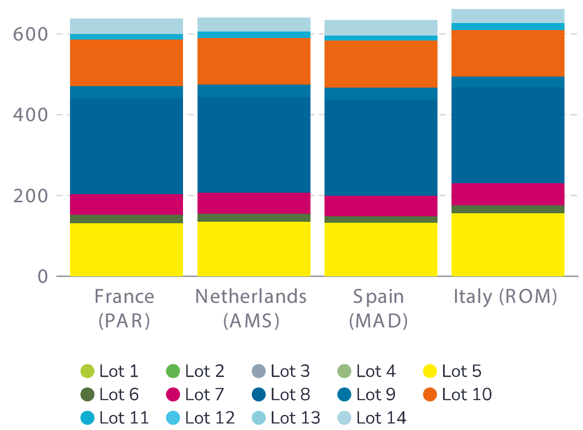
Building Construction Date: 1904
Usable Area: 71 m²
Adaptation of Embodied Carbon
(excluding technical equipment):

20%

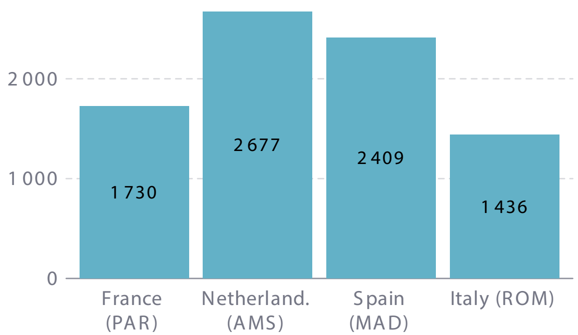
Carbon Footprint over 50 Years [kg CO2eq / m²]



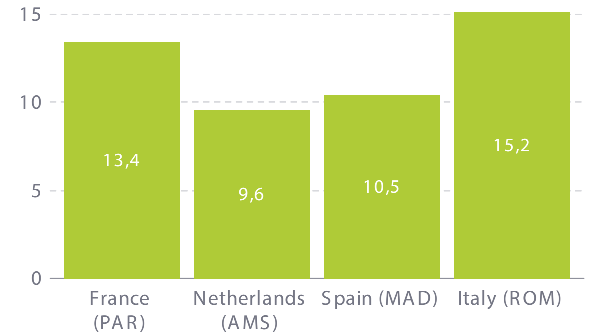
Embodied Carbon [kg CO2eq / m²]



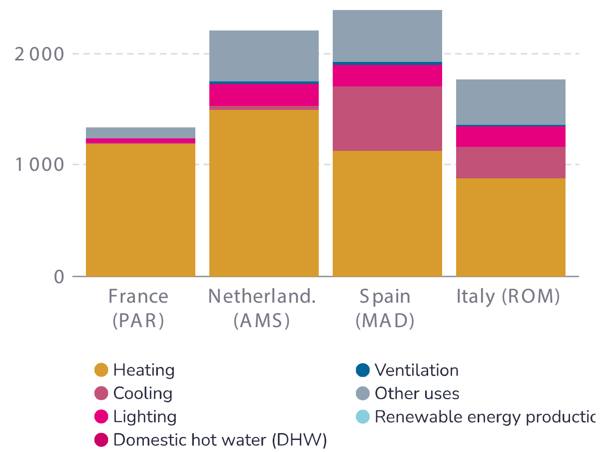
Carbon Footprint Reduction* [kg CO2eq / m²]



Carbon Return Time [years]



Energy Consumption Carbon Footprint [kg CO2eq / m²]



CARBON RETURN TIME [years]

HOUSING | **OFFICES**







	INDIVIDUAL HOUSING (without photovoltaic panels)	INDIVIDUAL HOUSING (with photovoltaic panels)	MULTI-RESIDENTIAL (Suburb)	RESIDENTIAL CITY CENTER	LARGE LISTED COMMERCIAL RE	OFFICE IN INDUSTRIAL BUILDING (without photovoltaic panels)	OFFICE IN INDUSTRIAL BUILDING (with photovoltaic panels)	COMMERCIAL RE HEAVILY RENOVATED	GROUND FLOOR OFFICE
PARIS	10 yrs	12 yrs	9 yrs	11 yrs	23 yrs	27 yrs	28 yrs	35 yrs	13 yrs
AMST.	10 yrs	9 yrs	8 yrs	10 yrs	15 yrs	16 yrs	15 yrs	16 yrs	10 yrs
MADR.	11 yrs	9 yrs	8 yrs	12 yrs	13 yrs	17 yrs	13 yrs	22 yrs	11 yrs
ROME	16 yrs	11 yrs	10 yrs	18 yrs	18 yrs	22 yrs	17 yrs	24 yrs	15 yrs

LEGEND : XX yrs [CARBON RETURN TIME years]

Without photovoltaic panels

With photovoltaic panels

REDUCTION OF THE CARBON IMPACT, OVER 50 YEARS (after renovation) [Kg CO2eq / m²]







	HOUSING				OFFICES				
	INDIVIDUAL HOUSING (Without photovoltaic panels)	INDIVIDUAL HOUSING (With photovoltaic panels)	MULTI-RESIDENTIAL (Suburb)	RESIDENTIAL CITY CENTER	LARGE LISTED COMMERCIAL RE	OFFICE IN INDUSTRIAL BUILDING (Without photovoltaic panels)	OFFICE IN INDUSTRIAL BUILDING (With photovoltaic panels)	COMMERCIAL RE HEAVILY RENOVATED	GROUND FLOOR OFFICE
PARIS	- 1223	- 1279	- 1012	- 1539	- 569	- 604	- 660	- 318	- 1730
AMST.	- 1268	- 1686	- 1198	- 1756	- 1447	- 1514	- 1934	- 1552	- 2677
MADR.	- 1060	- 1840	- 1107	-1317	- 1486	- 1429	- 2213	- 983	- 2409
ROME	- 655	- 1366	- 806	- 670	- 848	- 852	- 1567	- 814	- 1436

LEGEND : XXX [kg CO2 eq/ m² over 50 years]

Without photovoltaic panels

With photovoltaic panels

EMBODIED & OPERATIONAL CARBON IMPACT (energy related) OF THE RENOVATED ASSET OVER 50 YEARS [Kg eq CO2 / m²]

	HOUSING			OFFICES			
	INDIVIDUAL HOUSING	MULTI-RESIDEN-TIAL (Suburb)	RESIDENTIAL CITY CENTER	LARGE LISTED COMMERCIAL RE	OFFICE IN INDUSTRIAL BUILDING	COMMERCIAL RE HEAVILY RENOVATED	GROUND FLOOR OFFICE
PARIS	686	757	1010	890	1241	1596	1970
AMST.	1465	1224	1786	1504	1783	2465	2852
MADR.	1595	1266	1746	1784	1815	2917	3025
ROME	1337	1057	1495	1455	1620	2307	2432







LEGEND : EMBODIED CARBON OPERATIONAL CARBON (energy) XXX [kg CO2 eq / m² over 50 years]

PART. 5

CONCLUSIONS AND PERSPECTIVES

This report presents the findings from the 1st stage of the Net Zero Renovation Europe Project, which analyzed the current state of regulations, data, and tools related to the LCA approach for renovations in 4 European countries. This analysis highlights each country's maturity level (or readiness) to implement comprehensive whole-life carbon strategies for existing buildings.

In the 2nd stage, we conducted a preliminary assessment of 7 case studies to understand the impact of renovations on carbon footprint and return time across different countries, with common baselines and approaches but some country specify factors.

The next step will involve detailed modeling of each case study fully incorporating country-specific factors and systems and developing a European roadmap with solutions to reduce carbon emissions in the existing built environment that engage in renovation.

1

EU METHODOLOGY

Adaptation to a European context,
tools compatible with the approach
and the maturity level of each country

→ NEXT

2

EU BUSINESS CASES

Enhancing our understanding
of the carbon footprint
of renovation on a European scale

→ NEXT

3

NZC RENO EU ROADMAP

Relevant solutions to reduce
carbon emissions and net zero carbon
strategy in Europe.

ALL ALONG THE PROGRAMME:

CONSULTATION & COMMUNICATION

Raising awareness among building stakeholders about low-carbon renovation issues

5.1 Summary of main findings of the 1st step of NZC Renovation Europe Program

The first step of the project has identified major challenges related to the availability, harmonization of data, calculation tools, and regulatory frameworks across Europe.
The comparative analysis highlighted significant discrepancies in carbon assessments for renovations, mainly due to differences in each country's energy mixes and assessment boundaries (life stages or building parts considered).
The objective was therefore to bring visibility to aspects that allow the ability to establish the foundations of a standardized methodology, ensuring consistent evaluations and facilitating the selection of the most suitable decarbonization solutions for each building type, depending on its geographical or climate location.

Maturity of tools and national data
The study assessed the varying levels of regulation requirements on while life carbon, the adoption of Life Cycle Assessment (LCA) methodologies and carbon calculation tools, and well as the availability of data, largely or not.

It emphasizes the need for a harmonized approach to whole-life carbon assessment (including both operational and embodied carbon) to achieve true long-term decarbonization and comparable outcomes.

Carbon return time (CRT)
The time required to offset the initial emissions of a renovation through energy savings varies significantly between the 4 countries (ranging from 6 to over 35 years for a same buildings) highlighting the importance/impact of local energy mixes in the final carbon result.

Influence of the assessment boundaries and of the national energy mix
The carbon impact of a same renovation can differ greatly depending on the country where the building is located. It is strongly influenced by the national emission factors of the products/materials and by the national energy production. The boundaries of the assessments (extent of the considered life stages, systems/parts of the buildings considered).

Summary of main findings of the 1st step of NZC Renovation Europe Program

The LCA Modeling of the Assets Renovation highlights major differences in terms of carbon impact outcome and Carbon Return Time (time **required** to neutralize the impact of the supplementary carbon additional due to the renovation features). The countries' energy mix and the material heterogeneous carbon coefficients do play an important role in justifying these differences.

A Strong variation in Carbon Return Time (CRT) across countries, depending on building type and local energy context.

In Southern countries (Italy, Spain), housing shows longer CRT due to limited heating savings, whereas office renovations perform better thanks to substantial reductions in cooling demand or adoption of lower-carbon cooling solutions.

B The carbon impact of energy consumption during the use stage (operational carbon) is higher than the embodied carbon impact when looking at whole life carbon, but Carbon Return Time remains an important indicator.

In Italy, Spain, and the Netherlands, operational energy consumption not only represents a higher share of the total life cycle impact (more than 60%), but its absolute value is also greater compared to France.

C Don't ignore the impact of "cooling-related" energy consumption!

For offices, "cooling" energy consumption is a major impact issue in Italy and Spain, when compared to the other 2 countries
Accurate cooling demand mitigation is key to reduce carbon payback time.

D We need to model the embodied carbon impact more precisely for the next phase

Refining the methodological approach and variables would be needed, for a more accurate modeling of the carbon footprint of technical equipment.

E Photovoltaic (PV) energy production greatly reduces the carbon footprint of energy consumption in operational stage, which helps to decrease the Carbon Return Time of the renovation.

PARIS_Siège de la CNAV @ AIA Life Designers, architectes - photos : Axel Dahl

5.2 Study constraints and prospective developments

A Variations in construction techniques between countries

Specific and local construction techniques are not represented in the study and modeling. Indeed, as the key parameters were standardized in order to better identify specificities, the next step of the study would have to dive further in specific/traditional techniques, broadly used by a country, that may not have been addressed by the standard cases and materials/systems.

B National differences in materials and systems selection, which depend on specific local practices

We would advise considering a broader range of international environmental data (EPD info) to ensure that the orders of magnitude in this first NZC Renovation program phase are realistic.

C Emission factors specific to technical systems, water use, site-related emissions

The differences are currently considered minor for these items in the modeling performed in the 1st stage, but a more detailed assessment would need to be conducted in order to get more accurate data (instead of generic) of the emissions related to technical systems, water use and construction site.

D Climate variations within the studied countries

For each country's analysis, only the climate of the capital city was considered. It would be important to model/consider other climate zones of the studied countries, reflecting the buildings in locations other than the capitals.

E New business cases should be considered if recurring in any of the markets

It would be interesting to analyze other building types (renovation cases or asset types) that better reflect each country's market reality in terms of typical built environment or renovation cases (not covered by the 7 stated in this report).

5.3 Forward looking insights and next steps

Perspectives for steps 2 & 3:
The findings from this first step will serve as the foundation for the next stages of the NZC Renovation Europe Program, aiming to support investors and developers in:

- Gaining a detailed understanding of **regulatory frameworks and local incentives** to facilitate decision-making.
- **Implementing proven methodologies** to reduce renovation-related carbon footprints.
- Enhancing market **readiness for WLC** (whole-life carbon) assessments.

With the Energy Performance of Buildings Directive (**EPBD**) requiring lifecycle carbon measurement by 2028, the need for a harmonized approach has become urgent.

The work conducted in this first phase will help having broader insights and shape the roadmap for upcoming project stages, while supporting the evolution of public policies and market practices.

Step 2: Adding other EU business cases
The objective will be to refine and expand the analysis of the European renovation market by integrating more contextual data (building types, specific local materials, more detailed energy mixes). This phase will improve the understanding of carbon impacts and bring inputs to adapt LCA tools to the local specificities of each country.

Step 3: Crafting a Net-Zero Carbon (NZC) renovation EU roadmap
Building on the results of the studied business cases, this phase will focus on developing a concrete roadmap for low-carbon renovation in Europe.

It will identify the most effective solutions for CO_2 reduction in the existing built environment and support the spotting and adoption of strategies aimed at achieving carbon neutrality in the building sector, namely in for the renovation market.

Consultation & communication
Throughout the program, special attention will be given to raising awareness among the building sector stakeholders about the challenges of low-carbon renovation.
This phase will strengthen stakeholder engagement, ensure knowledge dissemination, and facilitate the adoption of the developed tools.
The sequencing of these phases will ensure a progressive and robust approach to accelerating the transition towards sustainable renovation practices at the European scale.

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