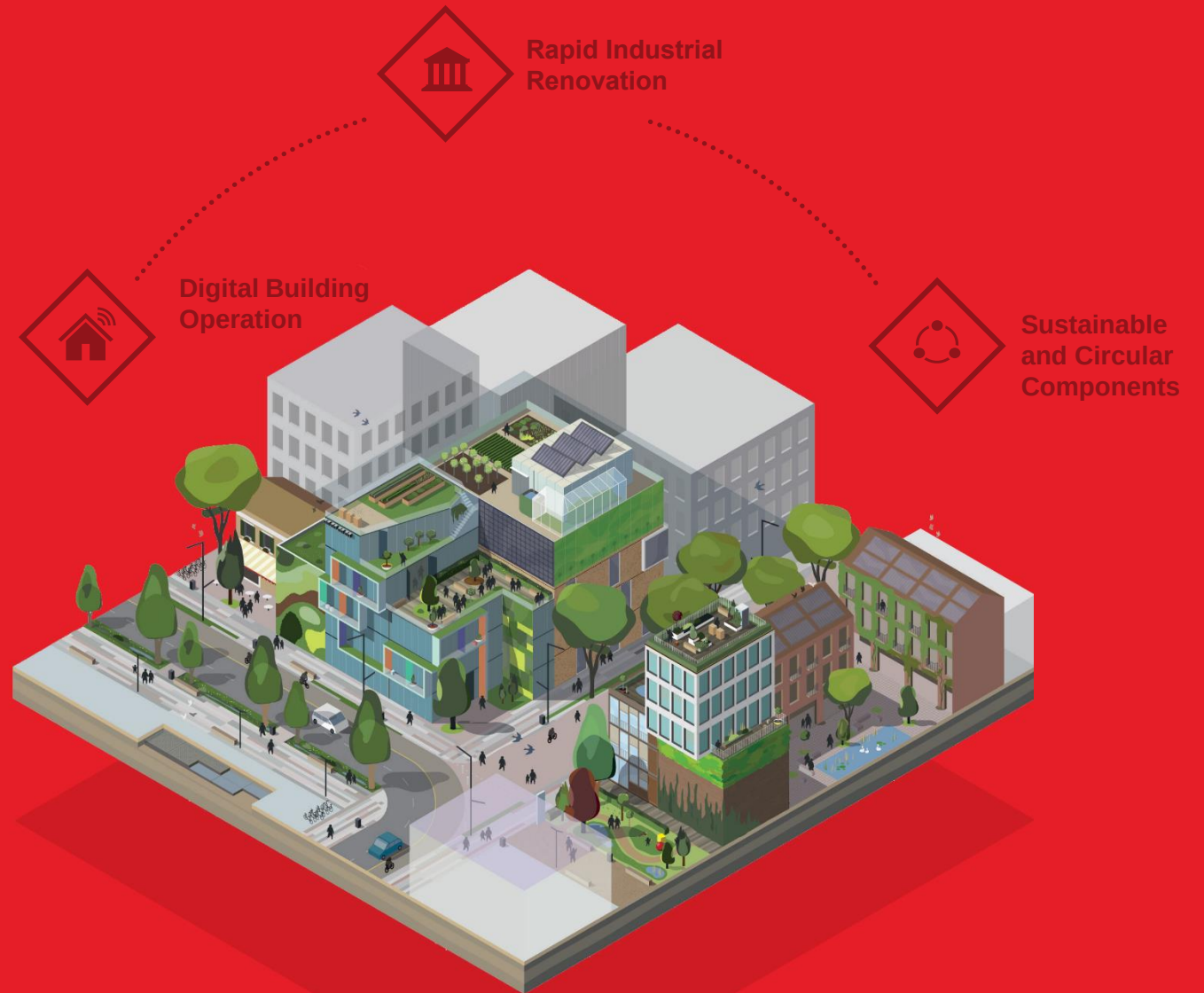


Future of Buildings Market Analysis



Final Report

04.01.2023

The program

The project serves as an open innovation platform bringing together complementary companies that identify and develop new (joint) business opportunities in the building industry.

Project Partners



8 partners

Jointly shaping the future of the industry

3-5 years

horizon for strategic opportunities

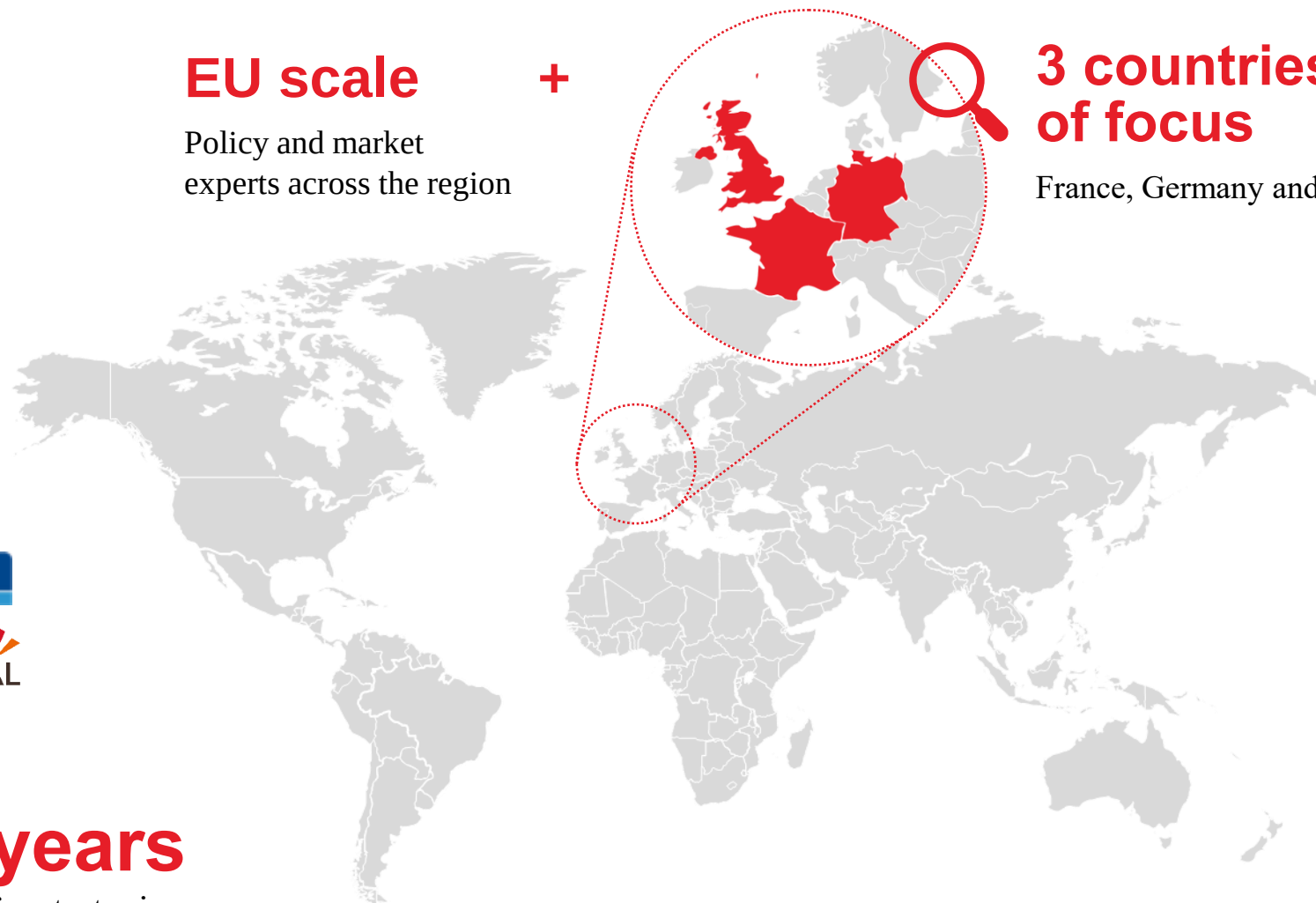
EU scale

Policy and market experts across the region

+

3 countries of focus

France, Germany and UK



Market Analysis done by ARUP



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Aim of the project

The project brings together complementary companies that collaboratively identify and develop new (joint) business opportunities across three fields of play:



Rapid Industrial Renovation

Both regulatory and market push towards rapid renovation based on industrialized techniques and innovative business models.



Digital Building Operation

New services offerings during building operations enable new opportunities to create and capture value.



Sustainable and Circular Components

The shift to a circular economic model stimulates new business models and reshapes the construction ecosystem.

+50



Policy and market expert interviews at European and national scale

12+

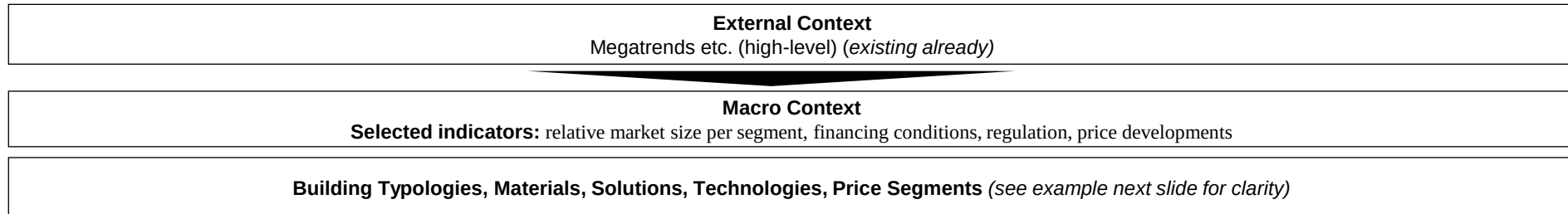


Individual and collective workshops with partners

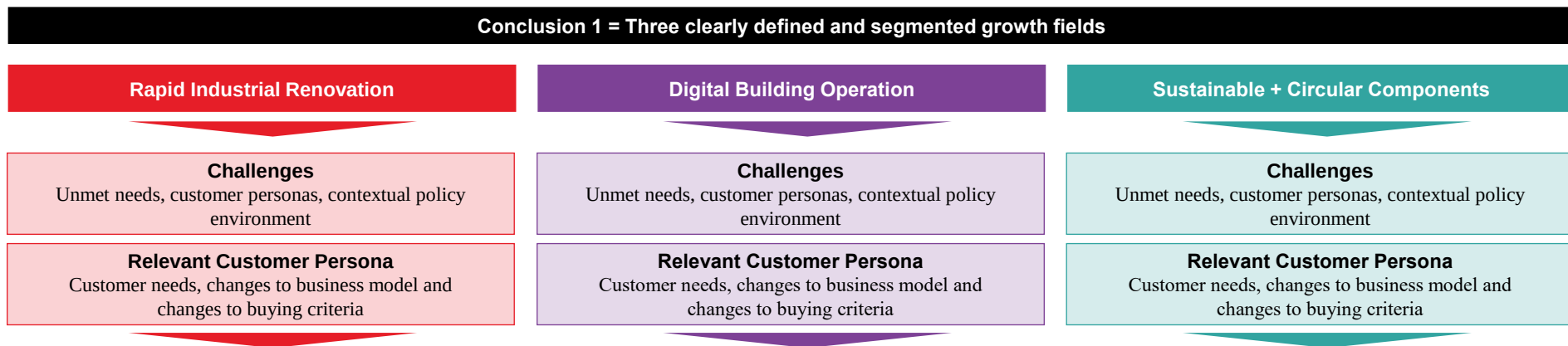
Methodology



Define



Analyse



Synthesize



Management Summaries



Management Summary (1/6)

Key EU Policy Insights

Rapid Industrial Renovation



Upgrade of building stock with poor energy performance

- From EPC label G to label F by 2030 (public and non-residential buildings by 2027)

Mandatory solar PV integration and energy efficiency standards

- For existing and new public, commercial buildings + new residential buildings
- Faster permitting process

Introduction of Building Renovation Passports

- Support building owners on milestones for renovation
- Based on smart metering technologies

Transformation of heating and cooling systems

- Doubling of deployment rate of heat pumps at EU scale
- Ramp up production of necessary equipment

Inclusion of emissions from buildings in EU ETS under study

- Separate new ETS in buildings and road transport
- For distributors that supply fuels for consumption

 [More details on policies for Rapid Industrial Renovation](#)

Digital Building Operation



Digital Building Logbooks & Product Passports

- Includes Building Renovation Passports, Smart Readiness Indicator, Level(s) and EPCs

Standardised and digital Energy Performance Certificates (EPCs)

- Provides clear framework for technical specifications
- Data-based assessment of performance of assets

Compliance with data sharing and integration formats

- Digital instructions on use, remanufacture and recycling
- Data sharing and integration to public databases

Digitalisation of workflows in the construction sector

- BIM in public procurement
- Regulatory components framework for 3D-printing
- Smart metering technologies

Smart grids and energy communities / neighbourhoods

- Member States invited to consider district heating solutions, smart grids, etc. to increase energy efficiency

 [More details on policies for Digital Building Operation](#)

Sustainable and Circular Components



Minimum secondary material requirement and recovery of waste

- Recovery of construction & demolition waste
- Minimum recycled plastic content and upscale bio-based plastics

New eco-design and energy labelling requirements

- Substantiation of green claims (Footprint methods)
- Implementation of instruments: GPP and Eco-label, EPREL

Empowering consumers

- Revision of EU consumer law: Enhancement of transparency / information
- Have „right to repair”, material rights

Setting a well-functioning market for secondary raw materials

- Monitoring application of end-of-waste criteria for waste streams
- Market observatory for key secondary materials

Accelerating hydrogen-powered supply chains

- Relevant funding for hard-to-decarbonise industries
- EU-wide hydrogen projects and regulatory framework

 [More details on policies for Sustainable & Circular Components](#)

Management Summary (2/6)

Key National Policy Insights

	Rapid Industrial Renovation 	Digital Building Operation 	Sustainable and Circular Components 
 France	Compliance with the Positive Energy Buildings Standard (BEPOS) Mandatory energy efficiency standards and integrated solar and green techniques Financial and advisory support schemes for building renovation	Digital measuring of energy performance in buildings Compliance with data sharing and integration formats Smart grid and community supply of energy	Reducing operational and embodied carbon Eco-design guidelines and producer oriented incentivizing schemes for changing/reusing materials Sorting, reuse and recovering of construction waste
 Germany	Upgrading energy efficiency standard for residential and non-residential buildings Transformation towards a heat generation based on renewables Controlled emissions regulation in the building sector	Implementation of digital measurement, assessment tools and certification schemes Digitalisation of workflows and existing stock in the construction sector Increase number of smart heating systems in buildings and local smart grids	New eco-design and energy labelling requirements Empowering consumers Decarbonisation and accelerating hydrogen-powered supply chains
 UK	Upgrading building stock with poor performance and energy efficiency standards for all types of buildings Transformation of heating and cooling systems and heat networks Ventilation in non-domestic and domestic buildings and mitigation of overheating in domestic buildings	Standardised Energy Performance Certificates (EPCs) and smart metering technologies Smart technologies for energy storage and heating networks Digitalisation of workflows	Decarbonization of existing and new construction and hydrogen-based components Eco-design, energy labelling policies and sustainable practices Recovery of waste heat and resources

 [Details on country-specific policies on Renovation in France, Germany and UK](#)

 [Details on country-specific policies on Digital Building Operation in France, Germany and UK](#)

 [Details on country-specific policies on Sustainable & Circular Components in France, Germany and UK](#)

Management Summary (3/6)

Emerging Client Personas

Challenge 1



Public-privately held secondary raw material management company facilitating a region's circular transition through closing material loops across industry sectors.

 [More details on this persona](#)

Challenge 2



Enabling quick and cost-effective renovation of predominantly 1980ies housing stock through standardised components and solutions that go without a separate architect.

 [More details on this persona](#)

Challenge 3



Asset owner of commercial buildings in mid-level locations aiming to partially retrofit some of his assets for optimised performance and to integrate activities such as retail and build-to-rent.

 [More details on this persona](#)

Challenge 3



Specification manager of a SME in need of technical solutions that meet the specific requirements of private homeowners for digital operations.

 [More details on this persona](#)

Challenge 4



Private homeowner aiming to renovate her home in the outskirts of a main city in France to make sure its value does not decrease.

 [More details on this persona](#)

Challenge 5



Public-privately held secondary raw material management company facilitating a region's circular transition through closing material loops across industry sectors.

 [More details on this persona](#)

Management Summary (4/6)

Consolidated Customer Challenges

Consolidated challenge	Typology / Geography	Target customer persona	Key aspects
1. Holistic services for sustainable single-family housing retrofit to homeowners – B2C	- Residential (single-family housing) - France	Private homeowners	- Describe benefits across cost, energy, water, health & indoor climate - Frictionless experience
2. Holistic services for sustainable housing retrofit to homeowners – B2B	- Residential (multi- and single-family housing) - Germany	- Builders - Architects	- Role of off-site prefabrication - Interaction with designers, installers, etc. along the value chain
3. Realising the value of digital twins for office and industrial typologies – B2B	- Office and industrial - No specific geography	- Facility manager - Asset owner - Developer	- Role & value of digital twins in building operation - Reduce energy & water use - Enable equipment reuse
4. Sustainable Offerings and Circular Value Chains: Reduce, Reuse, Repair – B2C	- Residential (single-family housing) - France	Private homeowners	- Whole-life customer r'nship - Go to market for sustainable and circular products - Product recovery
5. Sustainable Offerings and Circular Value Chains: Reduce, Reuse, Repair – B2B	- Multi-family residential or no specific typology - France or Germany	- Installers - Waste management companies	Route to market of reused / renewed products for architects, contractors and installers.

Management Summary (5/6)

Future Value Pools

Rapid Industrial Renovation



Total addressable market (TAM) for deep renovation-related products for residential buildings in France in 2026:

€400bn

Of which individual houses:

€290bn

Of which apartment blocks:

€110bn

- ▶ **4,41 million properties** to be renovated until 2026, increasing to total of 14,2 million in 2034
- ▶ **7,1% CAGR** of renovation market until 2029 with strong focus on tenanted segment
- ▶ Owned segment of market to follow until 2034
- ▶ **€400 bn partner-relevant construction** value pool until 2026

Digital Building Operation



Total addressable market (TAM) for digital twins of large residential, offices, retail and health buildings in Germany in 2026:

€160-300M
500,000-1,000,000 sqm

- ▶ **25% of the global market** for digital twins could be located **in Europe** by 2026
- ▶ The digital twins market **for healthcare, residential & offices and retail** sectors will approach or exceed **€300M in 2026**.
- ▶ The area of **newly built healthcare buildings** is expected to **decrease** in the next years. New construction of **residential and offices** is expected to **continue growing**

Sustainable and Circular Components



Total addressable market (TAM) for roof windows in France in residential buildings in 2026

€15M

Total addressable market (TAM) for motorization components in France in residential buildings in 2026

€7M

- ▶ Market shares ranging from **2% - 5%** per partner product group could be possible by 2026.
- ▶ Furthermore, alignment with the **EU Taxonomy** will play a role in these typologies. Our estimated market size could therefore be an **underestimate**.
- ▶ **Information gaps** around location and condition of installed components limit the potential refurbished market.

Management Summary (6/6)

Strategic Recommendations

Rapid Industrial Renovation



- ▶ Target deep renovations of **outdated, residential properties in the tenancy market first** (B2B), then expanding to the owned segment (B2C)
- ▶ The strong **policy push and requirements on energy performance** would shape a market focused on upgrades to façade and roof, as well as building systems
- ▶ Investigate potential of **circular materials and products** for integral renovation of residential typologies

Digital Building Operation



- ▶ High potential for digital twins focusing on office buildings with **low EPC rates, high operational and embodied carbon and high vacancy rates**.
- ▶ High pressure on **energy prices in Germany** resulting in opportunities per class of office and type of ownership.
- ▶ Smart water management will become an integral part of digital twins – **reducing water consumption and higher monitoring and reduction of pollution is a key policy agenda at EU level**

Sustainable and Circular Components



- ▶ Develop **digital capacity to track location and availability** of installed products to facilitate secondary component market.
- ▶ Improve **product durability** and expected lifetime to increase likelihood of second product life
- ▶ Compelling value propositions which **reduce embodied carbon, waste and cost** can be unlocked through creative **product recovery and refurbishment models**.

Detailed Studies





Rapid Industrial Renovation

Field of play #1



Digital Building Operation

Field of play #2



Sustainable and Circular Components

Field of play #3



Rapid Industrial Renovation

Field of play #1

1. Policy Scan – Overall EU
2. Policy Scan – Individual countries
3. Emerging Customer Personas
4. Challenges
5. Market Analysis



Many governments want to accelerate renovation programs using industrialized construction techniques

Overview of top 5 requirements at European level



Rapid Industrial Renovation

Most policies and regulation are still aiming at maximising the operational energy efficiency. Several national programs incentivise industrial manufacturing techniques to accelerate renovation programs. A shift to whole-life carbon thinking is recognizable.

Requirement	Key Aspects	Key Policies	Market Influence
+ Upgrade of building stock with poor energy performance	From EPC label G to label F by 2030 (public and non-residential buildings by 2027)	- Renovation Wave (2020) - Taxonomy (2020) - Proposal for a revision of the EPBD (*)	Owners of poorly performing buildings will have to accelerate renovation of property
Mandatory solar PV integration and energy efficiency standards	- For existing and new public, commercial buildings + new residential buildings - Faster permitting process	- REPower EU (2022) - Renovation Wave (2020) - Solar Energy Strategy (*)	Integrated generation and demand management services through e.g. Smart grids
Introduction of Building Renovation Passports	- Support building owners on milestones for renovation - Based on smart metering technologies	- Renovation Wave (2020) - Proposal for amending the RED, EED and EPBD (*)	Future material replacement services due to increased pipeline visibility and smart tech
Transformation of heating and cooling systems	- Doubling of deployment rate of heat pumps at EU scale - Ramp up production of necessary equipment	- REPowerEU (2022) - Renovation Wave (2020) - Proposal for amending the RED, EED and EPBD (*)	More demand of individual and large-scale heat pumps, primarily for residential typologies
Inclusion of emissions from buildings in EU ETS under study I	- Separate new ETS in buildings and road transport - For distributors that supply fuels for consumption	- Renovation Wave (2020) - Fit for 55 (2021)	Supply chains and logistics of construction and demolition with bio-based fuels

Source Arup Policy Review, Expert Interviews, Partner Kick-off Workshop

(*) Revision/policy at stage of proposal under review (not in force) which might suffer modifications in the approval process.



Rapid Industrial Renovation

Field of play #1

1. Policy Scan – Overall EU
- 2. Policy Scan – Individual countries**
3. Emerging Customer Personas
4. Challenges
5. Market Analysis



France requires for all buildings since 2022 a positive energy performance and energetical retrofit for existing buildings



Overview of top 3 requirements in France



Rapid Industrial Renovation

Maximum limits for CO2 emissions, energy and heat consumption apply to all new buildings constructed from 2022 onwards. Energy diagnoses must be provided. Larger buildings require green roofs and PV systems. Different subsidies are available for retrofitting existing buildings.

Requirements	Key Aspects	Key Policies
+ Compliance with the Positive Energy Buildings Standard (BEPOS)	- Energy production of a house must be higher than its consumption - Max. CO2 emissions at 4 kg/m2 year and individual building - Total energy consumption of max. 100 kWh per m2 - Min 32% of renewable energy in buildings by 2030. - Renovation of all thermal flats of the private sector by 2025 with 500,000 flats per year since 2017.	- RE2020 (RE2020) - Plan de renovation énergétique des bâtiments (2021) - Loi relative à la transition énergétique et la croissance verte (LTECV) (2015)
obligation / certainty Mandatory energy efficiency standards and integrated solar and green techniques	- Renovation to energy class D until 2034 for buildings to be rented - Heating consumption at maximum 12 kWep per m2 - Compulsory energy performance diagnostics at moment of sale or rental - Solar panels and green roofs must be integrated in large buildings (commercial > 500m2, office > 1000m2)	- Loi Climat et Résilience (2021) - Diagnostic de performance énergétique (DPE) (in force in 2023)
I Financial and advisory support schemes for building renovation	- Establishing a network of supporters for low-income houses - Energy renovation can request under certain conditions public financial aids such as MaPrimeRénov, Coup de pouce économies d'énergie, chèque énergie, etc. - The "éco-prêt à taux zéro" is a zero-interest loan for up to 50,000€ for the energetic building renovation of households	- Loi Climat et Résilience (2021) - Plan de Relance (2020) - Loi de Finances (Art. 86, 2022)

Experts insights:

Very strong push for energy efficiency renovation steered by French policy is creating a big opportunity for renovation.

“RE2020 is prescribing maximum limits of energy use. It is a significant advancement for regulating the environmental impact in construction

“Communicating the environmental impact of products to people is something that will be common language in 5 years.

Source Arup Policy Review, Expert Interviews

(*) Revision/policy at stage of proposal under review (not in force) which might suffer modifications in the approval process.



Germany is pushing ahead with energy renovation through investment and the use of energy efficient solutions

Overview of top 3 requirements in Germany



Rapid Industrial Renovation

Germany wants to drive the sustainable transformation of the building sector through increased subsidies and CO2 pricing. Incentives will be created through investments in efficient building design and the intensified integration of renewable energies in renovations and new construction.

Requirements

Upgrading energy efficiency standard for residential and non-residential buildings

Transformation towards a heat generation based on renewables

Controlled emissions regulation in the building sector

Key Aspects

- The central measures are tax incentives for energy-efficient building renovation measures, as well as the federal subsidy for efficient buildings (BEG) and the promotion of serial renovation.
- Tax relief by 20% of energy efficient renovation costs as well as funding up to 20% of the total cost.
- A new building must have a final energy demand of no more than 45-60 kWh/m² per year.

- Reduction of the permissible annual primary energy demand for new buildings from the previous 75 percent of the primary energy demand of the reference building to 55 percent (GEG).
- From 2026 onwards, installations of pure oil heating systems in buildings will no longer be permitted.
- In new construction projects for residential and non-residential buildings, a certain percentage of the building's heat supply must be covered by renewables.

- Fixed CO2-Pricing for the building sector from 2021 onwards (25€ per tonne CO2, from 2025 = 55€), consequently increases price for oil and gas.
- The following applies to new buildings: electricity generated from renewable energies close to the building must cover at least 15% of the demand.

Key Policies

- Strategy on Energy Efficiency (2019)
- CO2 Building Rehabilitation Programme
- Market Incentive Programme (MAP)
- Long-term renovation strategy (LTRS)
- Climate protection law

- Buildings Energy Act (GEG) (2020)
- Long-term renovation strategy (LTRS)
- Strategy on Energy Efficiency (2019)
- Recovery and Resilience plan (DARP) (2021)

- Buildings Energy Act (GEG) (2020)
- Long-term renovation strategy (LTRS)
- Nationales Emissionshandelssystem (nEHS)
- Strategy on Energy Efficiency (2019)

Experts insights:

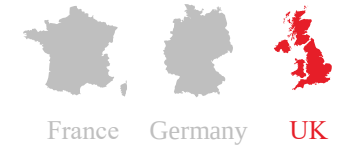
Emerging players in the renovation sector push strongly for the integration of prefabrication systems across the board.

“The most attractive areas for business in Germany are modular prefabrication and renovation in the building stock.

“The new generation of prefab companies will completely move away from the traditional installation concepts. That's something very demanding from them.

Source Arup Policy Review, Expert Interviews

(*) Revision/policy at stage of proposal under review (not in force) which might suffer modifications in the approval process.



United Kingdom has opted for a decarbonisation of the building stock levered by economic incentives

Overview of top 3 requirements in United Kingdom



Rapid Industrial Renovation

United Kingdom has developed specific policies on renovation of the building stock in the last years, specially focused on decarbonising domestic buildings. This transition is aimed to be fair and just, providing economic incentives at different steps of the value chain.

Requirements

+ obligation / certainty ↓ I	Upgrading building stock with poor performance and energy efficiency standards for all types of buildings
	Transformation of heating and cooling systems and heat networks
	Ventilation in non-domestic and domestic buildings and mitigation of overheating in domestic buildings

Key Aspects

- All homes to meet EPC E rating by 2020 and EPC C by 2025 for new tenancies and by 2028 for all tenancies in private-rented sector
- Potential introduction of regulations to end installation of new fossil fuel heating systems in existing off-grid homes from 2026
- Potential inclusion of backstop date for all homes to meet Net Zero minimum energy performance standard before 2050
- Capital grants to households and small businesses to support the installation of biomass boilers
- Heat Network (Metering and Billing) Regulations that ensure that more heat network customers are metered and billed accurately, based on their consumption
- Development of Heat Networks Market Framework
- Financial aids and economic incentives to tackle energy poverty
- Ventilation requirements and extract rates per area in a housing unit, to be delivered through mechanical, natural or a combination of both systems
- Indoor air quality and monitoring advised in office buildings
- Requirements for domestic buildings to limit excessive solar gain and remove excess heat, to be calculated through the Simplified Method or the Dynamic Thermal Modelling Method

Key Policies

- Heat and Buildings Strategy (2021)
- Future Buildings Standard (*)
- Home Upgrade Grant
- Heat and Buildings Strategy (2021)
- Future Buildings Standard (*)
- Home Upgrade Grant
- Social Housing Decarbonisation Fund
- Future Buildings Standard (*)
- Future Homes Standard (*)
- Ventilation: Approved Document F (2021)
- Overheating: Approved Document O (2021)

Experts insights:

The UK has an overall pathway for renovation, although low-detailed policy and funding are driving a market-steered retrofit movement.

“Meeting minimum energy efficiency targets is a main driver. Energy costs not a big driver for retrofit, as energy prices are very small compared to other aspects.

“Pretty strong in modular construction of bathrooms as modular component for newly erected buildings.

“Material choices in the last decades have been different to Germany and France.

Source Arup Policy Review, Expert Interviews

(*) Revision/policy at stage of proposal under review (not in force) which might suffer modifications in the approval process.



Rapid Industrial Renovation

Field of play #1

1. Policy Scan – Overall EU
2. Policy Scan – Individual countries
- 3. Emerging Customer Personas**
4. Challenges
5. Market Analysis



Home owners renovating today to avoid future high energy or environmental costs and reduce heat stress



Key activity / profile

Private homeowner aims to renovate the envelope and the systems of her single-family house in Southern France. Extreme heat in summer and stronger winds and rainfall in winter while energy prices are rising force her to invest today in her house.

“ During the heat waves this summer, our AC was constantly running. Being costly and unsustainable, I would like to renovate, maybe also with help from national fund MaPrimeRenov".

Customer needs

- #1 Cost certainty and high convenience in customer journey with quantified confirmation of performance
- #2 Increased value of house through renovation/improved quality of space/increased area
- #3 Solutions have to correspond to guidelines of national funds: environmental, healthy, affordable



Key changes to customer experience

- Emergence of trust-worthy, technical expert as a single point of contact to give reassurance for receiving a high-value for money product
- Suppliers are able to provide the customer with the quantified benefits of the renovation, ideally independently certified



Key changes to buying criteria

- Growing interest in sustainable products to access national funding
- Preference for products that are quickly and locally available, and accessible to DIYers or with low technical expertise



Willingness to pay

€ Low €€ Medium €€€ High



Competitors / Actors across Europe

Non-applicable

Region of focus



Step in value chain

- 1 Design
 - ✓ Developer
 - ✓ Advisor
 - ✓ Designer
- 2 Construction
 - ✓ Manufacturer
 - ✓ Contractor
 - ✓ Installer
- 3 Operation
 - ✓ Asset owner
 - ✓ Asset manager
 - ✓ End user
- 4 End of life
 - ✓ C&D waste manager

Turnkey Renovation Company in Germany



Key activity / profile

Enabling quick and cost-effective renovation of predominantly 1980ies housing stock through standardised components and solutions that go without a separate architect.

“ We buy, renovate and sell mid-range homes, using proven quantification of benefits to appeal to families facing rising bills. Providing planning inhouse allows us to standardize our approach and cut costs.

Customer needs

- #1** High performing components with appeal to end customer/ branded identity
- #2** Integrated planning tools tailored to typical typologies being refurbished
- #3** Verified product data makes it easy to show compliance & unlock support funding



Key changes to customer experience

- Avoiding complexities of custom-made renovation through buying old building stock and renovating it effectively to a general appealing taste.
- Focusing on creating a pipeline of buyers, to whom I offer a limited range of customization options
- The relationship with suppliers continues from project to project and involves more data sharing



Key changes to buying criteria

- Product with low technical complexities and high integration amongst systems
- Products offering best performance rather than slickest design



Willingness to pay

€ Low €€ Medium €€€ High



Competitors / Actors across Europe

EU Turnkey companies (e.g. Turnkey Retrofit)

Region of focus



Step in value chain

1 Design

- ✓ Developer
- ✓ Advisor
- ✓ Designer

2 Construction

- ✓ Manufacturer
- ✓ Contractor
- ✓ Installer

3 Operation

- ✓ Asset owner
- ✓ Asset manager
- ✓ End consumer

4 End of life

- ✓ C&D waste manager



Rapid Industrial Renovation

Field of play #1

1. Policy Scan – Overall EU
2. Policy Scan – Individual countries
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- 4. Challenges**
5. Market Analysis



#1

Holistic services for sustainable single-family housing retrofit to homeowners – B2C



Describe your challenge and its market

How to reach customers directly, providing frictionless customer experiences and direct customer relationships?

Key aspects:

- # Single-family housing
- # Seamless customer journey
- # Energy efficiency and self-sufficiency
- # DIY culture
- # Healthy homes
- # Customer awareness of indoor climate benefits for renovation (health, daylight, wellbeing, productivity)
- # Internet platforms

Partners involved:



What is the specific problem / unmet need?

Think of the customer personas

Problems:

- Customers who buy direct from suppliers get a detailed, knowledgeable service with low convenience – they have to buy one product at a time
- Customers who buy indirectly through architects and builders get a high convenience service with low levels of detail and knowledge on specific product performance and benefits

Needs:

- Customers a high-convenience integrated service with high levels of detail and knowledge on benefits and performance
- Friction-free access to information and combined sustainability solutions



Who has the need?

Think of the customer personas

- Private homeowners



Why is this a problem?

Think of e.g. contextual policy environment

- Inability to find high convenience, high quality retrofit solutions is a major barrier to homeowners choosing to pursue a retrofit
- Customers choose to remain in homes with high energy bills, low levels of natural light, high water use, and poor indoor air quality
- Customers run the risk of having to rapidly respond to changing policy environments, at greater cost to themselves and with a lower-quality outcome



Where is the challenge most urgent?

Think of geographic markets



France



Germany



UK

#2

Holistic services for sustainable housing retrofit to homeowners – B2B



Describe your challenge and its market

How to work with industry partners to support them in providing frictionless customer experiences for residential typologies?

Key aspects:

- # Multi-family (flats) and single-family housing
- # Off-site prefabrication
- # Interaction with architects, builders, installers
- # Energy efficiency and self-sufficiency
- # On-site water reuse (irrigation, grey water)
- # Healthy homes
- # Customer awareness of indoor climate benefits for renovation (health, daylight, wellbeing, productivity)
- # Internet platforms

Partners involved:



VELUX®

REXEL



GOLDBECK

somfy.



What is the specific problem / unmet need?

Think of the customer personas

Problems:

- Builders, architects and other players currently offering one-stop shop services for building renovation have a low-level of technical knowledge, do not have the capacity for prefabrication and struggle to articulate to customers the benefits of retrofit beyond price
- Builders and architects often prioritise managing their own risk to providing the customer with a high convenience, high quality product
- Suppliers are currently only able to provide installer support for their own products (integration remains with builders and architects)
- Builders and architects often do not have the digital skills need for advanced digital building integration

Needs:

- Builders and architects need to understand how they benefit from providing a more integrated, prefabricated service
- Builders and architects need help providing digital services and integrations to customers
- Builders and architects need help to be able to articulate to customers product benefits to include impact on energy bills, water use, indoor air quality and daylighting



Who has the need?

Think of the customer personas

- Builders
- Architects
- Installers



Why is this a problem?

Think of e.g. contextual policy environment

- Inability to find high convenience, high quality retrofit solutions is a major barrier to homeowners choosing to pursue a retrofit
- Customers choose to remain in homes with high energy bills, low levels of natural light, high water use, and poor indoor air quality
- Customers run the risk of having to rapidly respond to changing policy environments, at greater cost to themselves and with a lower-quality outcome
- Prefabrication equipment has high capital requirements and needs specialist skills for its benefits to be fully realised



Where is the challenge most urgent?

Think of geographic markets



France



Germany



UK



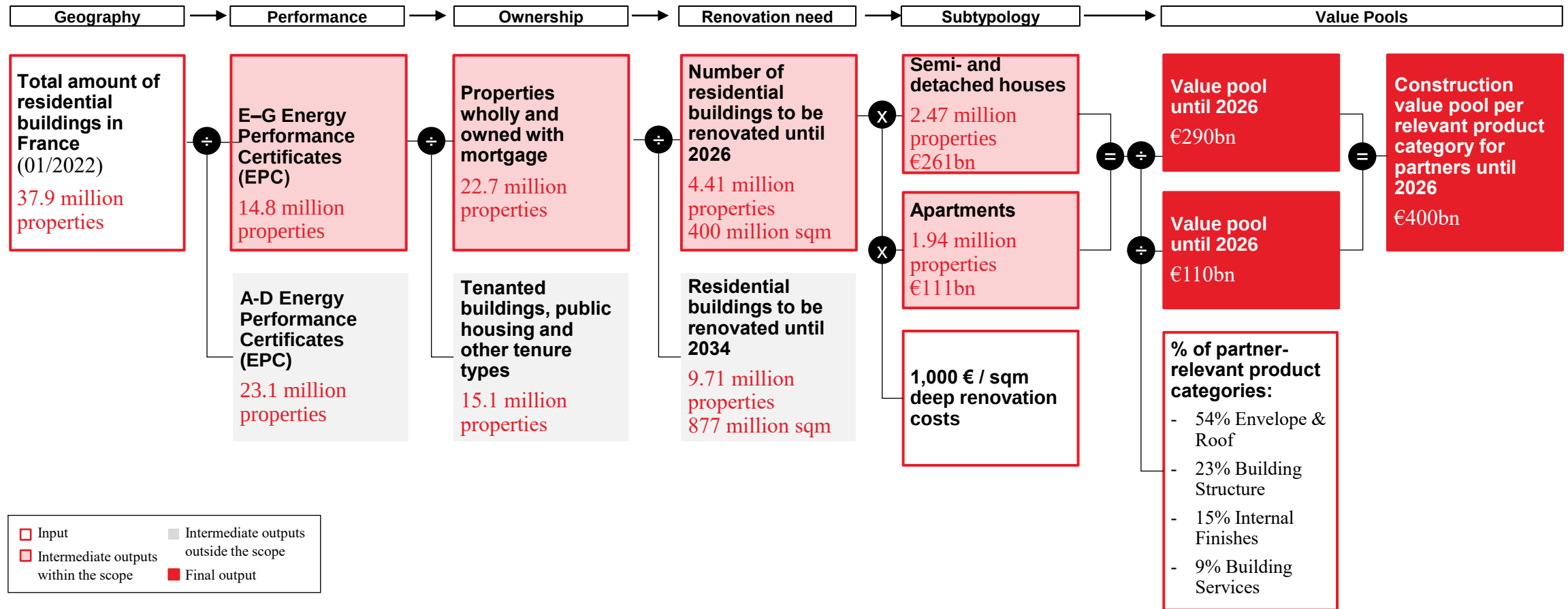
Rapid Industrial Renovation

Field of play #1

1. Policy Scan – Overall EU
2. Policy Scan – Individual countries
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What is the total addressable market (TAM) for deep renovation-related products for residential buildings in France in 2026?



In EPC classes E, F and G, a combination of policy drivers and high energy prices will drive renovation activity until 2026.

Ownership ²	A	B	C	D	E	F	G
 Wholly Owned	0%	0%	5%	10%	10%	30%	40%
 Mortgage	0%	0%	5%	10%	10%	30%	40%
 Tenanted (Market Price)	0%	0%	5%	10%	10%	30%	70%
 Tenanted (Reduced Price)	0%	0%	5%	10%	10%	30%	70%
 Others	0%	0%	5%	10%	10%	30%	40%

- ▶ From 2025, real estate transactions and new tenancy of properties will require EPC rating F or above
- ▶ Tenanted properties will face a strong need for renovation, starting from 2024 to phase out EPC class G until 2025
- ▶ Renovations will continue to increase, as F and E will be targeted

Indicative

For **tenanted properties**, 60% of EPC G, 25% of EPC F, and 10% of EPC E tenanted properties will need deep renovations.

Similarly, policy will impose a minimum renovation rate of **2,5%** a year¹ for EPC class properties in G, F and E in years 2025, 2028 and 2034 respectively.

This renovation rate will be too slow, to meet decarbonisation targets, so we anticipate policy to accelerate this by up to a factor of 4.

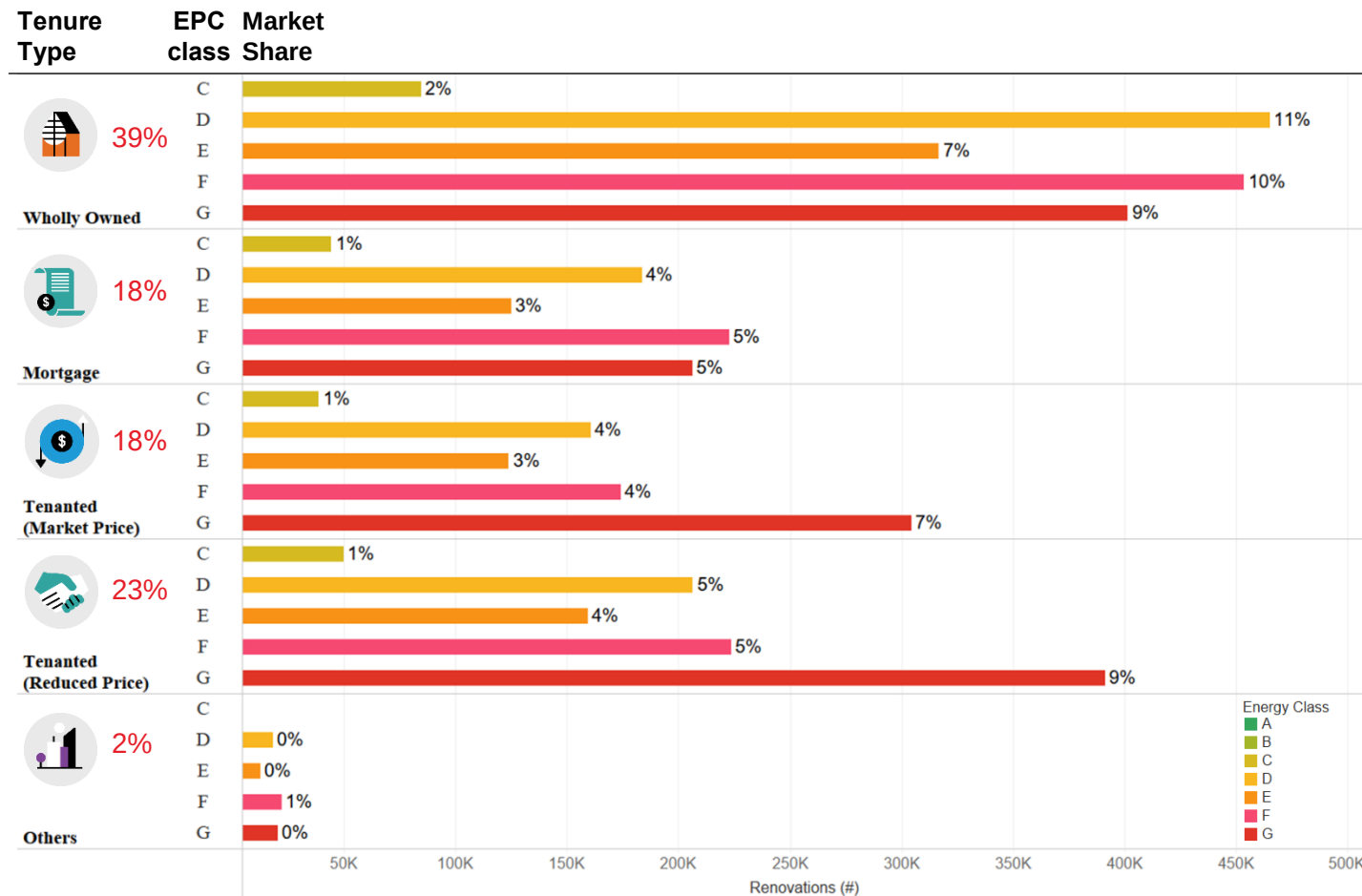


- ▶ **Market Feedback 1– Mechanical Services Designer, London**
“Meeting minimum energy efficiency targets is a key main driver. Energy costs are not a big driver for retrofit, as energy prices are very small compared to, for example, rent in large cities.”
- ▶ **Market Feedback 2– Industrialised construction company, Germany**
“Costs are most important concerning new products and solutions.”

(1) French property transactions amount to between 800.000 – 1.000.000 a year, on a housing stock of nearly 40.000.000. French property: analysis of the market. <https://www.notaires.fr/en/housing-tax-system/french-property-market/french-property-market-analysis>

(2) Tableaux de l'économie française: Ownership type per building typology: wholly owned, owned with mortgage, tenanted at market price, tenanted at reduced price, other, Édition 2019 [Propriétaires - Locataires - Tableaux de l'économie française | Insee](#)

4,4M – or 11,6% – of French properties are willing to, or are required to, be renovated by 2026.



Indicative

The largest segment for renovation is wholly owned properties, at 39% of properties willing or required to renovate.

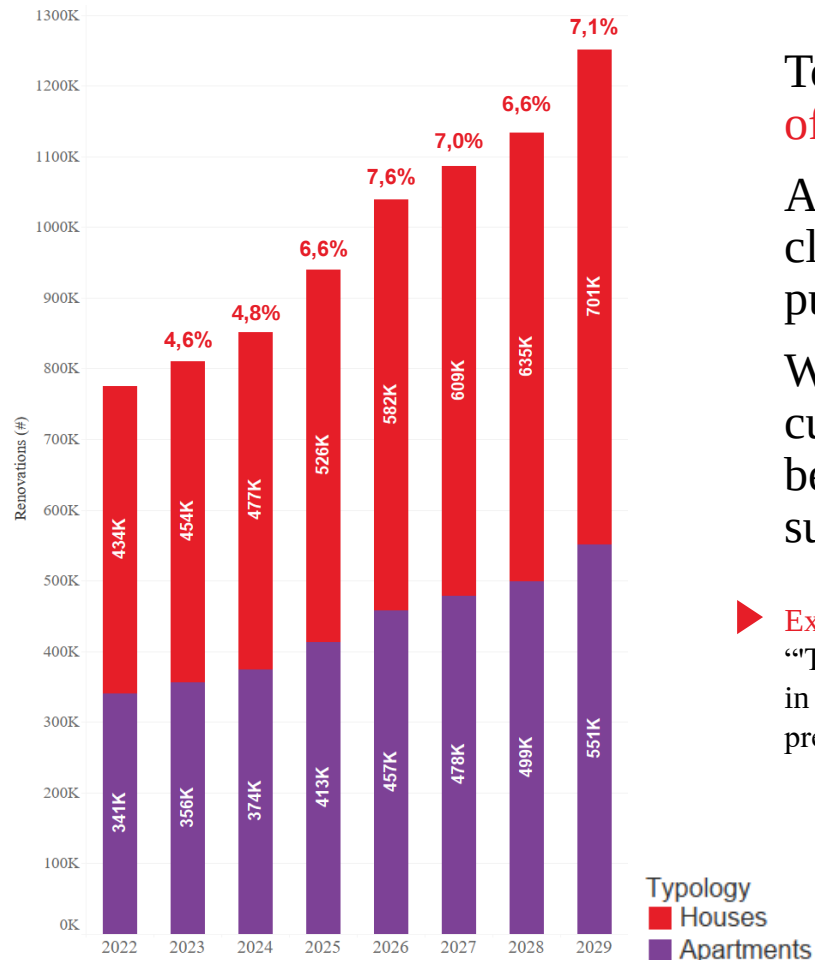
Of these, 68% demand a deep retrofit, at EPC E or below.

40% of the market is in the socially rented sector.

► **Market Feedback 1 – Director of Energy & Environment, Research facility for buildings**
 “Lower carbon, smarter design and more economic use must be more rigorous to reach actually a maximum of 26 Mio tons of CO2 by buildings in 2050 compared to 100 Mio tons of CO2 today. If we continue as of today, we won't reach that goal.”

► **Market Feedback 2 – Director of Energy and Environment, Developer**
 “Law of Zero Net Artificialization [2018] aims to reduce sealed surfaces and urban sprawl and will enhance the renovation of old buildings.” ()

The recent French policy change imply a CAGR of 7,1% until 2029 in the residential deep renovation market.



To meet the policy targets, the deep renovation market will need a **CAGR of 7,1% between 2022 and 2029**.

After 2029, the rate slows until the policy relating to properties in EPC class E begins to impact the market around 2033 and 2034, pushing the rate to new highs.

What remains unclear in the data is how this renovation activity interacts with current DIY and professional renovation activity, which currently lies between 400.000-500.000 properties per year but many of which are not sufficient to improve performance to **EPC D or better**.

► **Expert insight - Senior Policy Officer, DG Environment, European Commission**
“The member states have to submit national renovation plans in the new proposal – in there they can detail the type of support they are giving for things like prefabrication.”

Cumulative construction value of renovation activities between 2022 and 2026 in France estimated to be €400bn.



Between 2022 and 2026, the construction value pool is at **€400bn**.

For all partners, the largest segment for renovation is **envelopes and roofs**, at an average of **54%**.

23% of the market is in the **building structure**, **15%** in **internal finishes** and **9%** in **building services**.

- ▶ **Market Feedback 1– Sustainability Officer, Facility management company**
“Communicating the environmental impact of products to people is something that will be common language in 5 years. Countries need greater clarity about the main contributors to emissions in their countries according to the different sectors”.

Management Summary

Deep Renovations in France Residential Market

Key Conclusions

- ▶ 4,41 million properties to be renovated until 2026, increasing to total of 14,2 million in 2034
- ▶ 7,1% CAGR of renovation market until 2029 with strong focus on tenanted segment
- ▶ Owned segment of market to follow until 2034
- ▶ €400 bn partner-relevant construction value pool until 2026

Strategic Recommendation

- ▶ Target deep renovations of outdated, residential properties in the tenancy market first (B2B), then expanding to the owned segment (B2C)
- ▶ Responding to policy and energy performance, focus on upgrades to façade and roof, as well as building systems
- ▶ Investigate potential of circular materials and products



Digital Building Operation

Field of play #2

1. Policy Scan – Overall EU
2. Policy Scan – Individual countries
3. Emerging Customer Personas
4. Challenges
5. Market Analysis



Industry leaders are moving to digital building operation, however a large-scale industry adoption will take time

Overview of top 5 requirements at macro level



Digital Building Operation

The overall digitization of built asset operation, as well as the entire supply and value chain, is the key objective of the European Union. Large-scale adoption and diffusion will remain a challenge due to the fragmentation and current low levels of digital maturity in the wider industry.

Requirement	Key Aspects	Key Policies	Market Influence
+ Digital Building Logbooks & Product Passports	Includes Building Renovation Passports, Smart Readiness Indicator, Level(s) and EPCs	- Renovation Wave (2020) - Proposal for a Regulation on Ecodesign Requirements (*) - Proposal for a revised CPR (*)	Certified, traceable and transparent EU trading of sustainable buildings / components / materials
Standardised and digital Energy Performance Certificates (EPCs)	- Provides clear framework for technical specifications - Data-based assessment of performance of assets	- Renovation Wave (2020) - Taxonomy (2020) - Proposal for amending the RED, EED and EPBD (*)	Data-based and objective certifications through integration of smart metering technologies
Compliance with data sharing and integration formats	- Digital instructions on use, remanufacture and recycling - Data sharing and integration to public databases	- Renovation Wave (2020) - Strategy for Data (2020) - Proposal for a revised CPR (*)	- New corporate data responsibilities - Integrated services due to data interoperability
Digitalisation of workflows in the construction sector	- BIM in public procurement - Regulatory components framework for 3D-printing - Smart metering technologies	- Renovation Wave (2020) - Proposal for a Regulation on Ecodesign Requirements (*)	Faster workflows from design to operation and real time extraction of KPIs for improvement of value chains
Smart grids and energy communities / neighbourhoods	Member States invited to consider district heating solutions, smart grids, etc. to increase energy efficiency	- REPower EU (2022) - Proposal for amending the RED, EED and EPBD (*)	Upscaling of solutions and diversification of services through interaction with other assets / sectors

Source Arup Policy Review, Expert Interviews, Partner Kick-off Workshop

(*) Revision/policy at stage of proposal under review (not in force) which might suffer modifications in the approval process.



Digital Building Operation

Field of play #2

1. Policy Scan – Overall EU
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Following EU legislation, digitised information exchange and advances in smart grid technology are pivotal in France



Overview of top 3 requirements in France



Digital Building Operation

Remotely accessible information on primary energy and hot water consumption, as well as annual information to tenants, is mandatory. France aims to be a European leader in smart grid technology. Digital tools to control indoor climate, energy efficiency and prior life-cycle assessment are key.

Requirements	Key Aspects	Key Policies
+ Digital measuring of energy performance in buildings	- Building occupants must be informed about the energy performance of their buildings since October 2020 - Conventional primary energy consumption cap (CEP standard) of 2.3 KWhEP/(m2/year). If summer discomfort requires a later installation of an AC, coefficient will be higher, and penalties may apply	- EU Energy Efficiency Directive (*) - RE2020 (2022) - Loi pour l'évolution du logement, de l'aménagement et du numérique (Loi ELAN, (2018))
obligation / certainty Compliance with data sharing and integration formats	- INIES database provides CO2 base figures for dynamic Life-cycle assessment (A-D) that must be conducted for every building starting from 2023 - Connected homes and access to very high-speed broadband eased as operator does not need to prove anymore existence of previous service provision - Digital logbooks (carnet numérique) compiling ll information on implemented and necessary renovation	- RE 2020 (2022) - Loi ELAN (2018)
I Smart grid and community supply of energy	- France as leader with Germany on smart grids with operational sites as demonstration projects in four different départements in France - Newly installed energy and hot water meters must be remotely read, this applies to all meters from 2027	- Loi LTECV (2015) et Loi ELAN (2018) - Loi de transition énergétique pour la croissance verte (LTECV, 2015) - EU Energy Efficiency Directive (*)

Experts insights:

Fostering the deployment of digital tools to achieve the climate and carbon reduction targets in France placed by the law

“New digital building log books that bring together all information on a building (carnet numérique du bâtiment) will be mandatory for all buildings since the beginning of 2023.

“Digital models will help identify where reductions of CO2 demanded by RE2020 can be obtained.

Source Arup Policy Review, Expert Interviews

(*) Revision/policy at stage of proposal under review (not in force) which might suffer modifications in the approval process.



Germany drives standardisation and digitalisation of the construction industry to tackle energy efficiency

Overview of top 3 requirements in Germany



Digital Building Operation

The further development and integration of digital tools is intended to make a significant contribution to the “digitalisation of the construction industry” across all areas. Large-scale assessment systems support monitoring and provide guidelines.

Requirements

Implementation of digital measurement, assessment tools and certification schemes

Digitalisation of workflows and existing stock in the construction sector

Increase number of smart heating systems in buildings and local smart grids

obligation / certainty

I

Key Aspects

- Energy certificates like the Energieausweis are becoming more reliable: calculations must be inspected, and information provided by owners must be carefully checked. CO2 emissions of the building must be stated
- BNB (Bewertungssystem für nachhaltiges Bauen) assessment instrument to measure the sustainability level of (new-built) public buildings

- A series of software tools like Quickcheck developed in order to indicate potential savings for air conditioning and ventilation systems in non-residential buildings
- Greater integration of BIM programmes for increasing energy efficiency and calculating performance of buildings. Research projects are planned
- Installation and roll out of smart metering since 2020. By 2032 every meter needs to be “modern and smart.”

- Newly installed heating systems and large air conditioning and ventilation systems should be equipped with sensors and meters.
- Pilot programme „Wärmenetzsysteme 4.0“ acts as a smart control for heat grids and heat storage.
- Further development of energy efficiency networks to tackle know-how transfer along businesses.

Key Policies

- BNB (2019)
- Strategy on Energy Efficiency (2019)
- Buildings Energy Act (GEG) (2020)

- Strategy on Energy Efficiency (2019)
- Buildings Energy Act (GEG) (2020)
- GDEW (2016)

- Strategy on Energy Efficiency (2019)

Experts insights:

Digital operation of buildings is constrained in Germany by data management and privacy protecting the users of buildings.

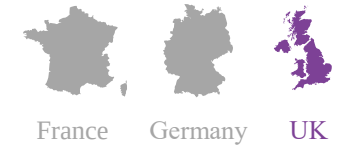
“Particularly in Germany they are anti any proprietary products and they want to make it completely open

“Germany is more conservative because of data privacy

“Solutions that we could roll out in other regions in office buildings like building usage has to be done anonymized. (...) To do it there has to be a data consultancy loop.

Source Arup Policy Review, Expert Interviews

(*) Revision/policy at stage of proposal under review (not in force) which might suffer modifications in the approval process.



Smart technologies are considered to be key for United Kingdom to deliver their ambitious energy targets

Overview of top 3 requirements in United Kingdom



Digital Building Operation

The UK has taken on the challenge of achieving an effective ‘Green Industrial Revolution’ that entails, among others, the building sector. Smart technologies are considered to be key for this, as well as the policy framework to deploy them, which is under development.

Requirements	Key Aspects	Key Policies
+ Standardised Energy Performance Certificates (EPCs) and smart metering technologies	- Integration of data extracted from smart metering technologies in EPCs to provide additional information about the features of a property (under study) - Digital register for EPCs and their underlying data - Policies on smart and flexible technology to achieve Net Zero to be developed in the 2020s - Government-supported initiatives to integrate smart metering technologies to increase energy efficiency (SMETER, The Smarter Tariffs)	- Energy Performance Certificates for buildings Action Plan (2020) - Heat and Buildings Strategy (2021)
obligation / certainty Smart technologies for energy storage and heating networks	- Upcoming four-year smart meter policy framework with fixed minimum annual installation targets for energy suppliers - At least £100 million of innovation funding for energy storage and flexibility innovation programmes ‘Secure by design’ approach as minimum baseline for future energy smart appliances and EV chargepoints	- Heat and Buildings Strategy (2021) - The Ten Point Plan for a Green Industrial Revolution (2020) - Smart Systems and Flexibility Plan (2021)
I Digitalisation of workflows	- Mandatory BIM Level 2 Implementation - Programme concluded to develop Digital Twins at National scale	- Heat and Buildings Strategy (2021) - Smart Systems and Flexibility Plan (2021) - National Digital Twin Programme - Digital Built Britain (2015)

Experts insights:

Implementation of digital tools in the UK is led by frontrunning investors wanting to migrate from facility management to “workplace”.

“The word workplace is being utilized a lot more by CEOs and CFOs because they are starting to see the value.

“It's actually going back to staff recruitment and staff retention.

“Banking, financial services and insurances is probably the top one, so it's in commercial spaces.

Source Arup Policy Review, Expert Interviews

(*) Revision/policy at stage of proposal under review (not in force) which might suffer modifications in the approval process.



Digital Building Operation

Field of play #2

1. Policy Scan – Overall EU
2. Policy Scan – Individual countries
- 3. Emerging Customer Personas**
4. Challenges
5. Market Analysis



Property owners acknowledging the importance of digital services to attract tenants aiming to have better workplaces



Key activity / profile

Asset owner of commercial buildings in mid-level locations aiming to partially retrofit some of his assets for optimised performance and to integrate activities such as retail and build-to-rent.

“ Our company invested years ago in regional commercial assets which are facing increasing risks around stranded assets and market obsolescence.

Customer needs

- #1 Real-time information both on the planning progress and financials
- #2 Increasing market appeal, energy performance and capital value of portfolio
- #3 Modelling tools for material and emissions to comply with company's ESG criteria



Key changes to customer's business model

- Making sure that the workplace is more appealing than working from home
- Shifting to a longer-term perspective based on more stable tenant relationships created by broader range of services
- Providing real-time data to demonstrate to tenants' indoor air quality status and overall performance



Key changes to buying criteria

- Investment in technology to create targeted value-add services to tenants while allowing for future flexibility
- Alignment between the building features and the ESG criteria of his company and of the tenants'.



Willingness to pay

€ Low €€ Medium €€€ High



Competitors / Actors across Europe

Pension funds | Insurers | SFOs / MFOs

Region of focus



Step in value chain

- 1 Design
 - ✓ Developer
 - ✓ Advisor
 - ✓ Designer
- 2 Construction
 - ✓ Manufacturer
 - ✓ Contractor
 - ✓ Installer
- 3 Operation
 - ✓ Asset owner
 - ✓ Asset manager
 - ✓ End consumer
- 4 End of life
 - ✓ C&D waste manager

Digital tools for optimising energy performance, temperature set points through remote management of residential buildings



Key activity / profile

Specification manager of a SME in need of technical solutions that meet the specific requirements of private homeowners for digital operations.

“ Clients are asking for digital tools to reduce energy bills and guard against extreme weather, while also complying with the national ceiling for primary energy consumption (CEP). ”

Customer needs

- #1** Smart tools adjusting indoor climate and energy consumption
- #2** Digital measures to control ventilation, heat loss and heat gain
- #3** Meet customer interest for control of noise, light and climate conditions in roofs



Key changes to customer's business model

- Buying from producers of digital solutions that are integrable, user-friendly and are potentially AI-capable
- Selling integrated packages of digital tools that optimize automatically room temperature, energy and water use as well as lighting



Key changes to buying criteria

- Data collection and communication technology (i.e. internet-connected sensors) that is interoperable so that he can demonstrate primary energy consumption (CEP), indicator of bioclimatic needs and thermal comfort threshold will be respected



Willingness to pay

€ Low €€ Medium €€€ High



Competitors / Actors across Europe

SME Installers | Digital tools manufacturers

Region of focus



Step in value chain

- 1 Design**
 - ✓ Developer
 - ✓ Advisor
 - ✓ Designer
- 2 Construction**
 - ✓ Manufacturer
 - ✓ Contractor
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Digital Building Operation

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#3

Realising the value of digital twins for commercial typologies – B2B



Describe your challenge and its market

How to help industry partners across the value chain realise the value of having a digital twin in commercial typologies?

Key aspects:

- # Office and industrial buildings
- # Role & value of digital twins in building operation
- # Reduce energy & water use
- # Interaction with facility managers, asset owners, developers
- # Energy efficiency and self-sufficiency
- # On-site water reuse (irrigation, grey water)
- # Digital platforms

Partners involved:



What is the specific problem / unmet need?

Think of the customer personas

Problems:

- Split incentives: the organization paying for the digital twin (the developer) does not realise the value it unlocks through improved performance, reduce maintenance costs and product reuse
- Creating a digital twin – both the file itself plus the compliant specifications to ensure the required products communicate with the digital twin – is a specialist and expensive process, due to low levels of interoperability
- Digital twins are designed and created without sufficient input from facility managers
- Reuse is made difficult without detailed operation and maintenance history

Needs:

- A clear articulation of the costs and benefits of adopting digital twins – during design, construction, commissioning, operation and end-of-life
- Simplified and standardized specifications and commissioning procedures for digital twins and internet-connected products
- Interoperable, multi-system smart building solutions



Who has the need?

Think of the customer personas

- Facility manager
- Asset owner
- Developer



Why is this a problem?

Think of e.g. contextual policy environment

- The Renovation Wave policy is requiring digital passports for all renovated buildings
- Early-adopter customers are expecting optimal performance between people, technology and work space in their workplaces
- All industry actors are under pressure to reduce emissions (to reduce energy costs, reduce water use and reduce carbon footprints), requiring well-commissioned, operationally-optimised buildings
- Policy makers are seeking to reduce waste, meaning policy will be forthcoming regarding product reuse under the EU's Circular Economy Action Plan



Where is the challenge most urgent?

Think of geographic markets



France



Germany



UK



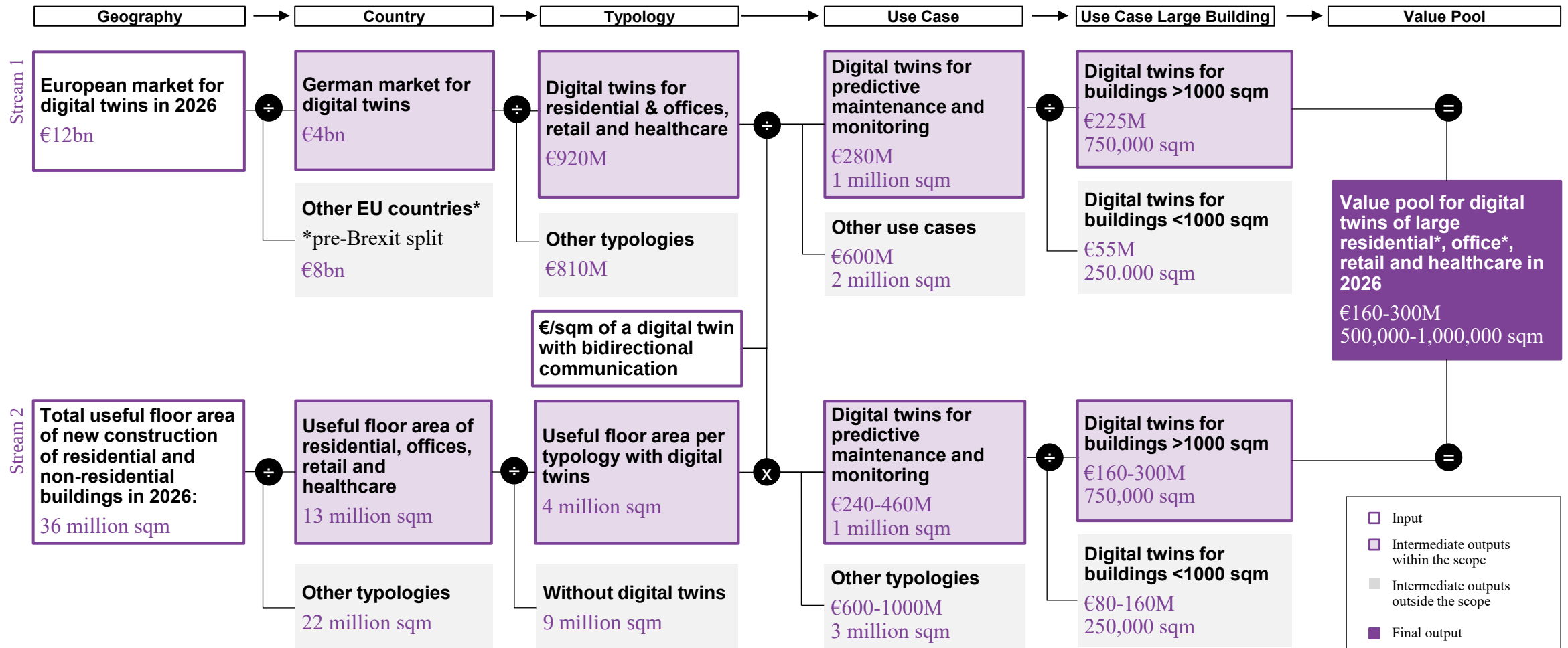
Digital Building Operation

Field of play #2

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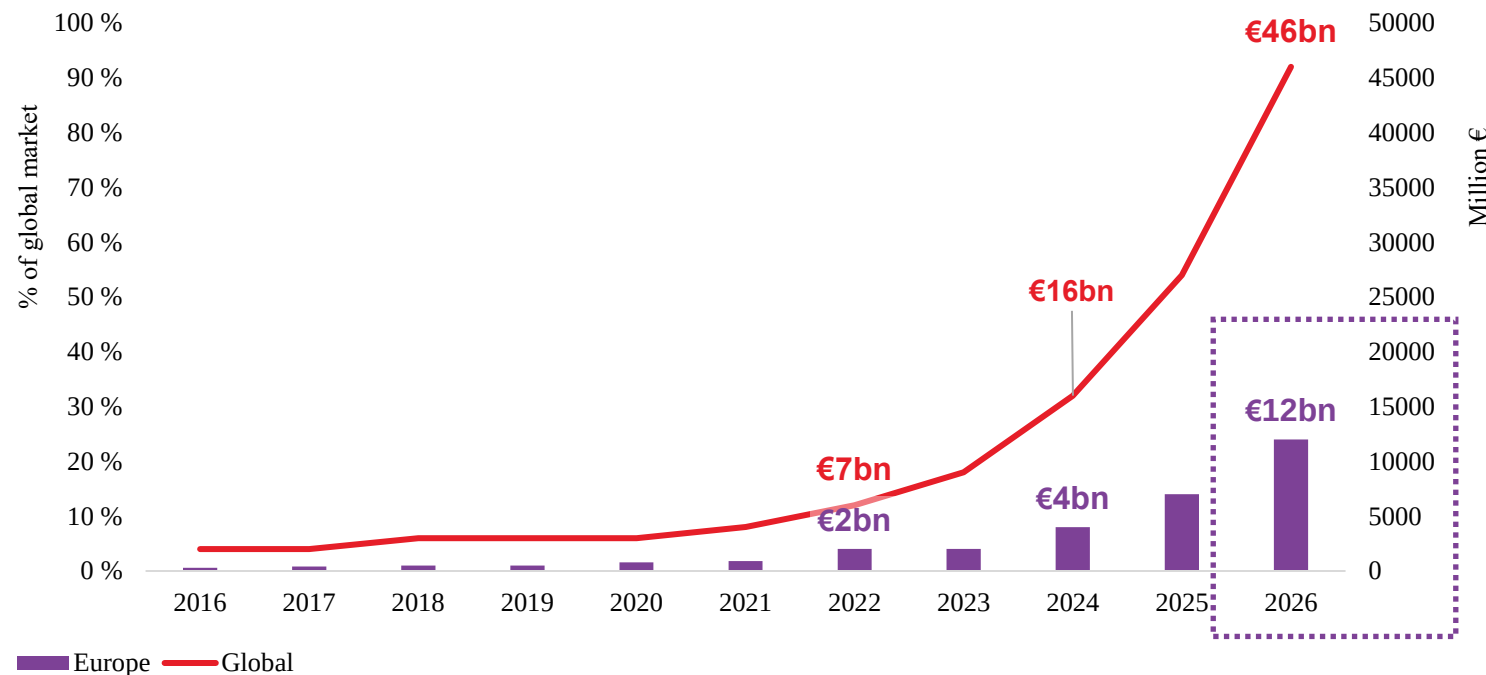


How big will the addressable market for digital twins for large residential, offices, retail and health buildings in Germany be in 2026?



More than 25% of the global market for digital twins could be located in Europe by 2026

Market volume in €



Indicative

Upcoming **tightening regulations** at European level, specially on **energy performance** of buildings, set the landscape for the growth of the digital twin market.

- ▶ **Revision of the EPBD, EED and RED to include Minimum Energy Performance Standards and harmonised EPCs** – EPCs will be required to be updated and issued in digital formats every 5 years. By 2027, the new EU energy directive will use actual building energy performance to assign energy labels to bring greater clarity and transparency across the built environment.
- ▶ **Implementation of Digital Building Logbooks**– repository for all relevant data from buildings, including Smart Readiness Indicator to measure the capacity of buildings to use information and communication technologies and electronic systems to adapt the operation of buildings to the needs of the occupants and the grid.

- (1) Global Digital Twin market to grow from 6.9 billion USD in 2022 to 73.5 billion by 2027 - Markets & Markets (<https://www.marketsandmarkets.com/Market-Reports/digital-twin-market-225269522.html>)
- (2) European market for digital twins would grow at around 40% CAGR from 2021 to 2027 - Market research (<https://www.marketresearch.com/Knowledge-Business-Value-KBV-Research-v4085/Europe-Digital-Twin-Type-System-14696004/>)

Healthcare, residential & offices and retail could account for 25%¹ of the market for digital twins

Stream 1

Typologies analysed



Healthcare

Digital twins in healthcare are rapidly expanding and expected to account for around 10% of the market



Residential and offices

The residential and office sector could potentially account for 10% of the digital twins market



Retail

The retail market for digital twins could account for 5% of the total share

Use cases of digital twins



Predictive maintenance and performance monitoring

Digital twins used to avoid unexpected breakdowns of systems or equipments²



Business Optimisation

Diverse use of digital twins aiming to optimise processes within companies



Inventory Management

Digital twins that enable better tracking of products, reduced overproduction, etc.



Product Design and Development

Digital models mainly used to examine product performance, simulate manufacturing process and verify design feasibility.³



Others

(1) The market for healthcare, residential & office and retail sector has been calculated extrapolating the split per use from the global market share - Grand View Research (<https://www.grandviewresearch.com/industry-analysis/digital-twin-market>). The results show that these sectors could potentially account for 25% of the market for digital twins in Germany.

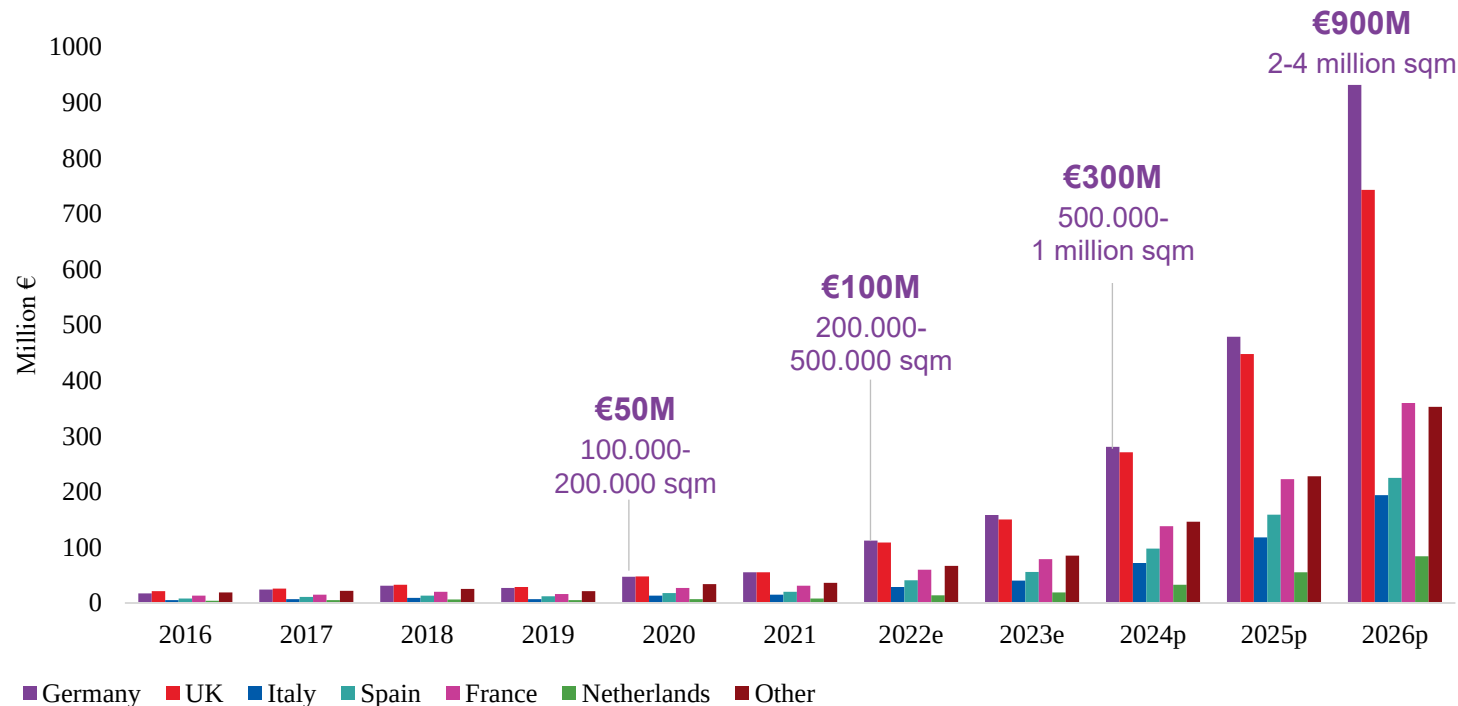
(2) Y. You, C. Chen, F. Hu, Y. Liu, Z. Ji; Advances of digital twins for predictive maintenance (<https://www.sciencedirect.com/science/article/pii/S187705092200357X>)

(3) C.K. Lo, C.H. Chen, Ray Y. Zhong; A review of digital twin in product design and development (<https://www.sciencedirect.com/science/article/abs/pii/S1474034621000513>)

Germany will likely lead the European and UK digital twin market in 2026 for healthcare, residential, offices and retail

Indicative

Market volume and share within the European market for healthcare, residential, offices and retail



Future services in Germany related to digital twins in the healthcare, office and retail sectors³ will be shaped by data privacy and security. The urban realm will be a relevant field of growth for digital twins at scale.

- Deployment of secure and interoperable smart meters – The Act on the Digitisation of the Energy Transition heralds the launch of smart meters with binding protection profiles to ensure data protection, security and interoperability.
- Market Feedback 1 – Digital Lead at AEC advisory and design company – “In Germany there are a lot of checks and balances relating to the data privacy of users. All the solutions that could rollout in other regions theoretically could be applicable in Germany, but there has to be a data privacy consultancy loop. (...) This is a challenge in Germany, which in the long term is going to be good, but it’s definitely hindering innovation”.

(1) The total market for digital twins in Germany could reach 1.161 million € by 2027 - Market research (<https://www.marketresearch.com/Knowledge-Business-Value-KBV-Research-v4085/Europe-Digital-Twin-Type-System-14696004/>)

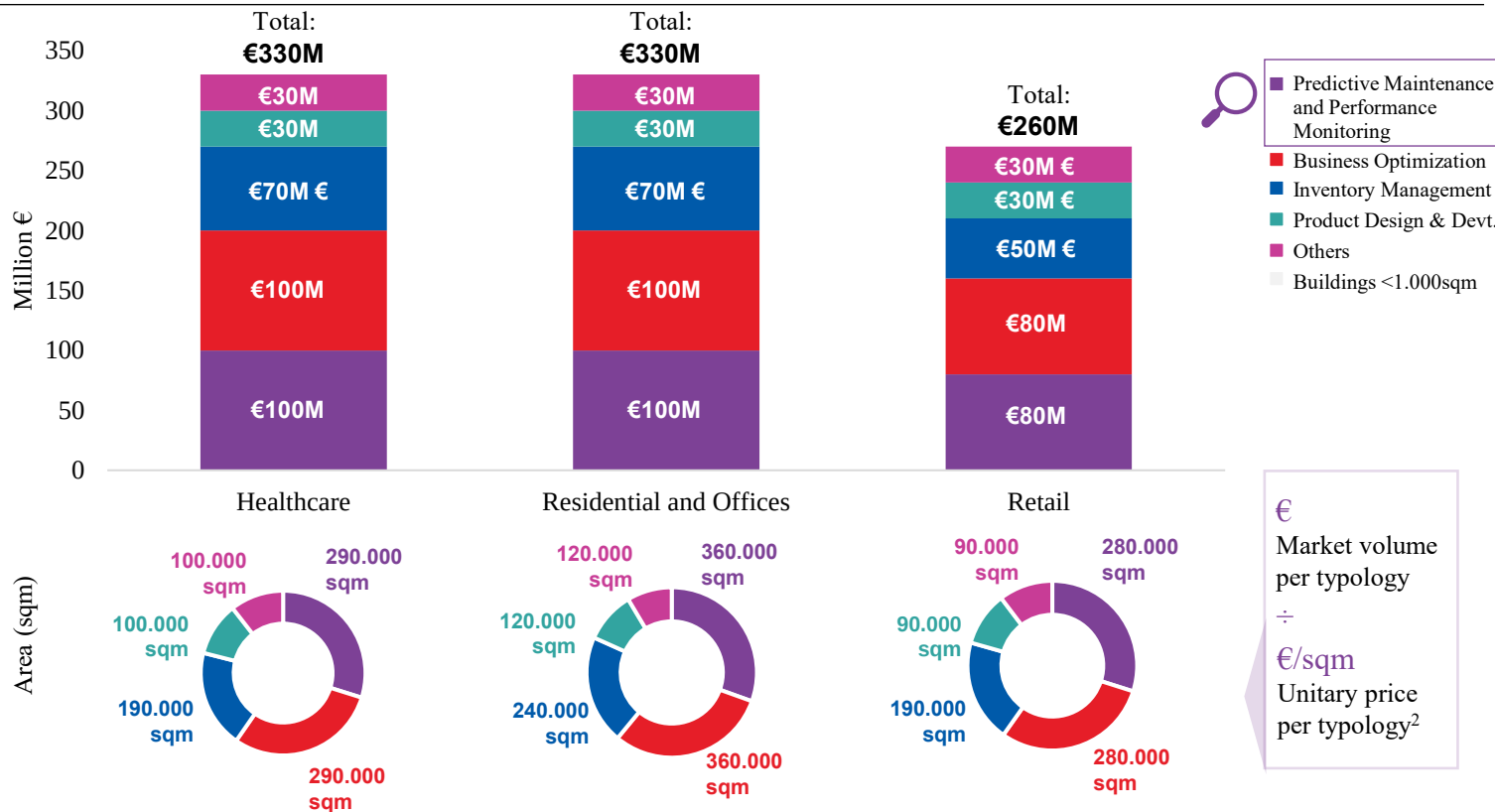
(2) The market for digital twins in Germany could overcome UK's market in 2022 - Graphical Research (<https://www.graphicalresearch.com/industry-insights/1484/europe-digital-twin-market>)

(3) The market for healthcare, residential & office and retail sector has been calculated extrapolating the split per use from the global market share - Grand View Research (<https://www.grandviewresearch.com/industry-analysis/digital-twin-market>). The results show that these sectors could potentially account for 25% of the market for digital twins in Germany.

The market for these sectors will approach or exceed €300M in 2026, with Healthcare, Residential and Offices leading the way

Indicative

Potential market and construction volume adopting digital twins per typology and use, 2026



Digital twins aimed for **predictive maintenance and performance monitoring** could account for approximately **30%¹** of the share of the market volume per typology in 2026.

- Ease of maintenance is a priority for future customers demanding digital building operation services – one third of experts interviewed highlighted ease of maintenance as the main unmet need for emerging customers for digital building operation, followed by operational optimisation.
- Market Feedback 1 – Director of Energy and Environment, Developer – “Carbon (reporting) is highly requested by emerging customers, but the availability on the market is not given (...)”
- Market Feedback 2 – Architect and Engineer– “Today's customer needs of digital building operation tools are primarily saving energy and resources”.

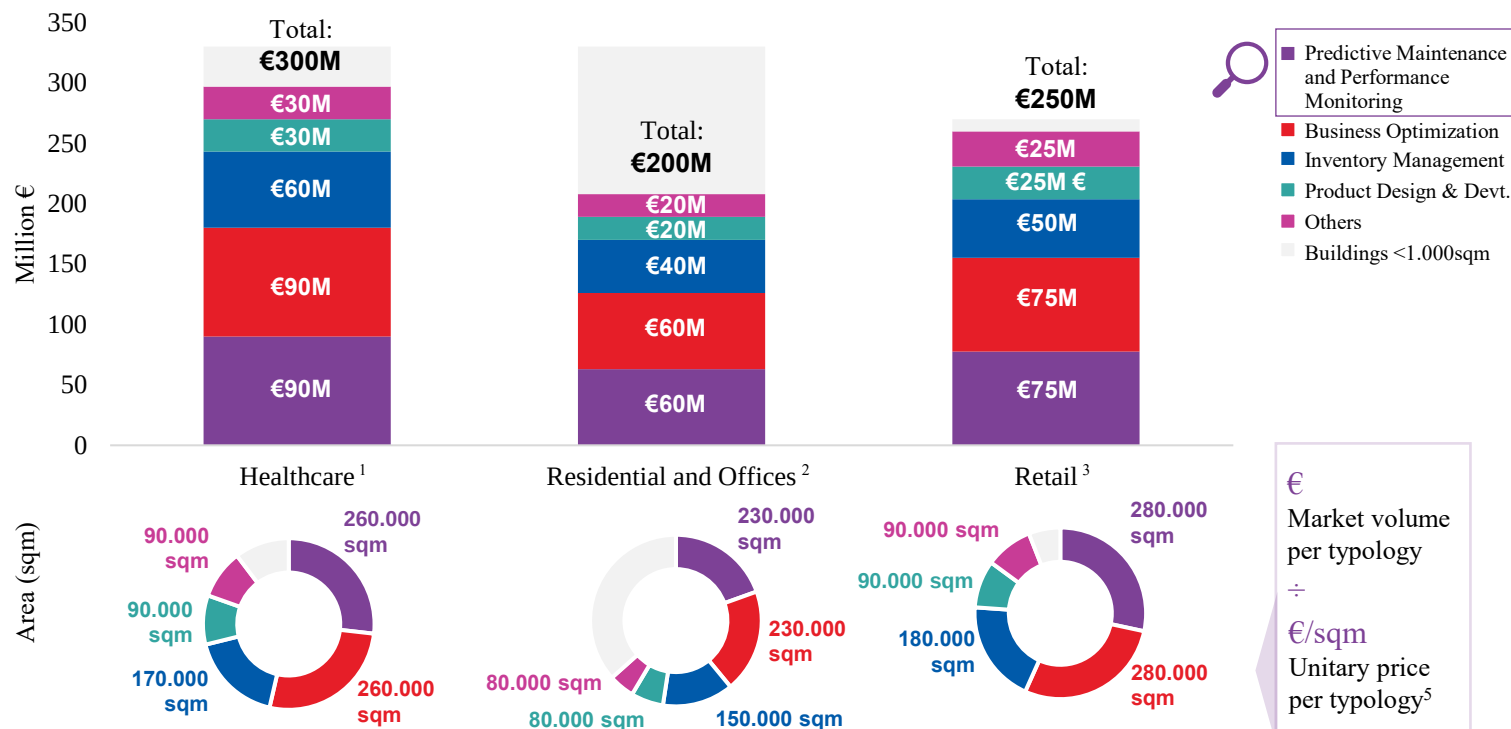
(1) The split between typologies has been estimated extrapolating the split per use in the global digital twin market –Source: Market Research (<https://www.marketresearch.com/Knowledge-Business-Value-KBV-Research-v4085/Europe-Digital-Twin-Type-System-14696004/>)

(2) The area has been estimated dividing the market per typology by the median value of the unitary price of a digital twin with bidirectional communication for each of the typologies (offices and retail: 210-400 €/sqm; healthcare 250-600€/sqm) based on expert assessment.

When considering buildings with a greater useful floor area than 1.000 sqm, the market for healthcare is the highest

Indicative

Potential market and construction volume of buildings >1.000sqm adopting digital twins per typology and use, 2026



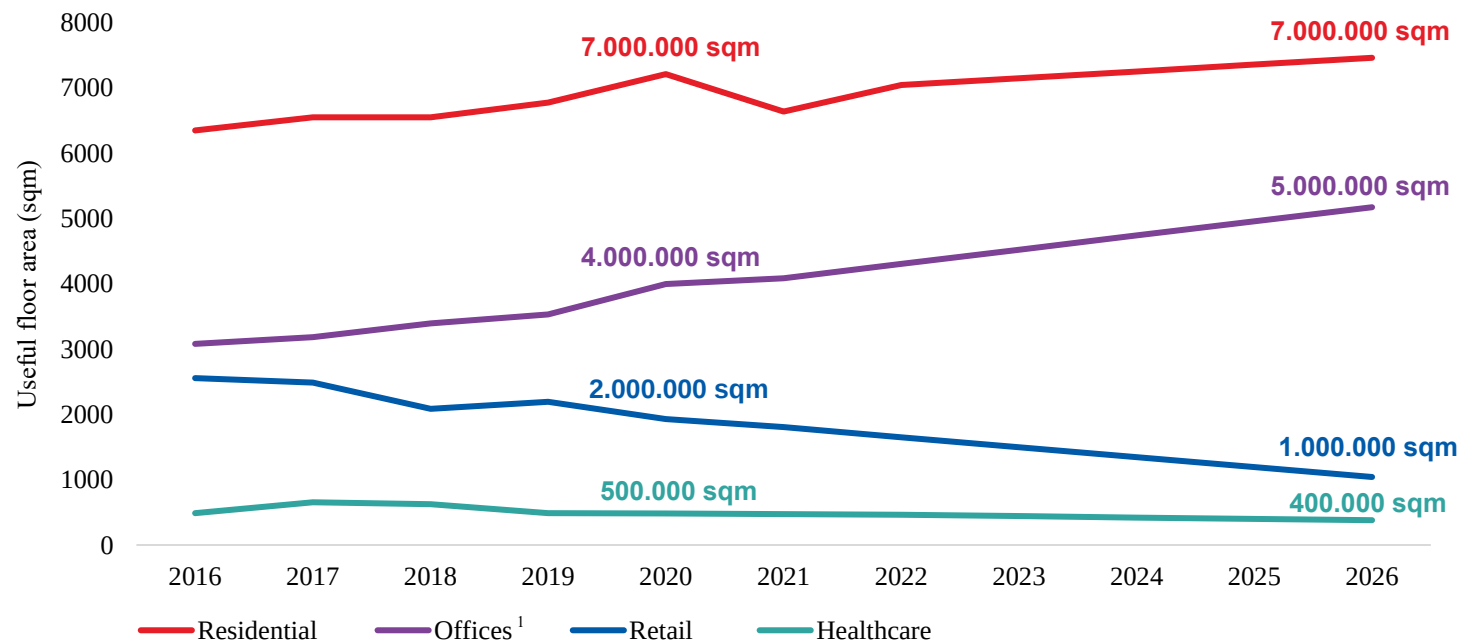
Approximately two thirds of large residential and office buildings are predicted to have a useful floor area greater than 1.000 sqm.

- Most of healthcare and retail buildings would have a useful floor area greater than 1.000 sqm – the average size of healthcare and retail buildings in Germany would be 3.000 sqm and 2.700 sqm respectively⁴.
- The complexity of digital twins for healthcare buildings is higher – the commercialisation price to develop a bi-directional digital twin in healthcare are assessed to be 250-600€/sqm, whereas for offices and retail would be 210-400€/sqm⁵.
- Germany is promoting the digitisation of the healthcare sector – policies like the E-Health Act , which came into force in 2016, are expected to open the way to more digital health services and systems.

(1) Healthcare buildings over 1.000 sqm has been estimated to be 90% of the total - Expert assessment
(2) Residential and office buildings over 1.000 sqm has been estimated to be around two thirds of the total – Expert assessment, BP Paribas (<https://www.realestate.Bpparibas.de/en/market-reports/office-market/germany-at-a-glance-q3-2019>; <https://www.realestate.Bpparibas.de/en/market-reports/office-market/germany-at-a-glance-q4-2021>)
(3) Retail buildings over 1.000 sqm have been estimated to be 97% of the total – Expert assessment, BP Paribas (<https://www.realestate.Bpparibas.de/en/market-reports/retail-investment-market/germany-at-a-glance-q3-2019>)
(4) ENOB:dataNWG, Typologie der Nichtwohngebäude in Deutschland (<https://datanwg.de/downloads/tools/typologie/>)
(5) Offices and retail: 210-400 €/sqm; healthcare 250-600€/sqm - Expert assesment

However, the useful floor area for new construction of healthcare buildings is expected to decrease in the next years

Useful floor area of residential and selected non-residential typologies in new construction in Germany, 2026²



Until 2026, the floor area for new construction² of **residential and offices** is expected to **increase**, whereas new construction of **retail and healthcare** buildings will experience a **decrease**.

- ▶ In spite of the COVID-19 pandemic and its impact on office spaces, the volume in new construction is not expected to decrease in the next years – the focus on future office design will be promoting employee interaction with a focus on data and health protection³.
- ▶ The state has been reluctant to invest in healthcare construction in the medium term – the public sector is not meeting their investment obligations in these facilities, while private operators seem to have been restrained in the last years³.

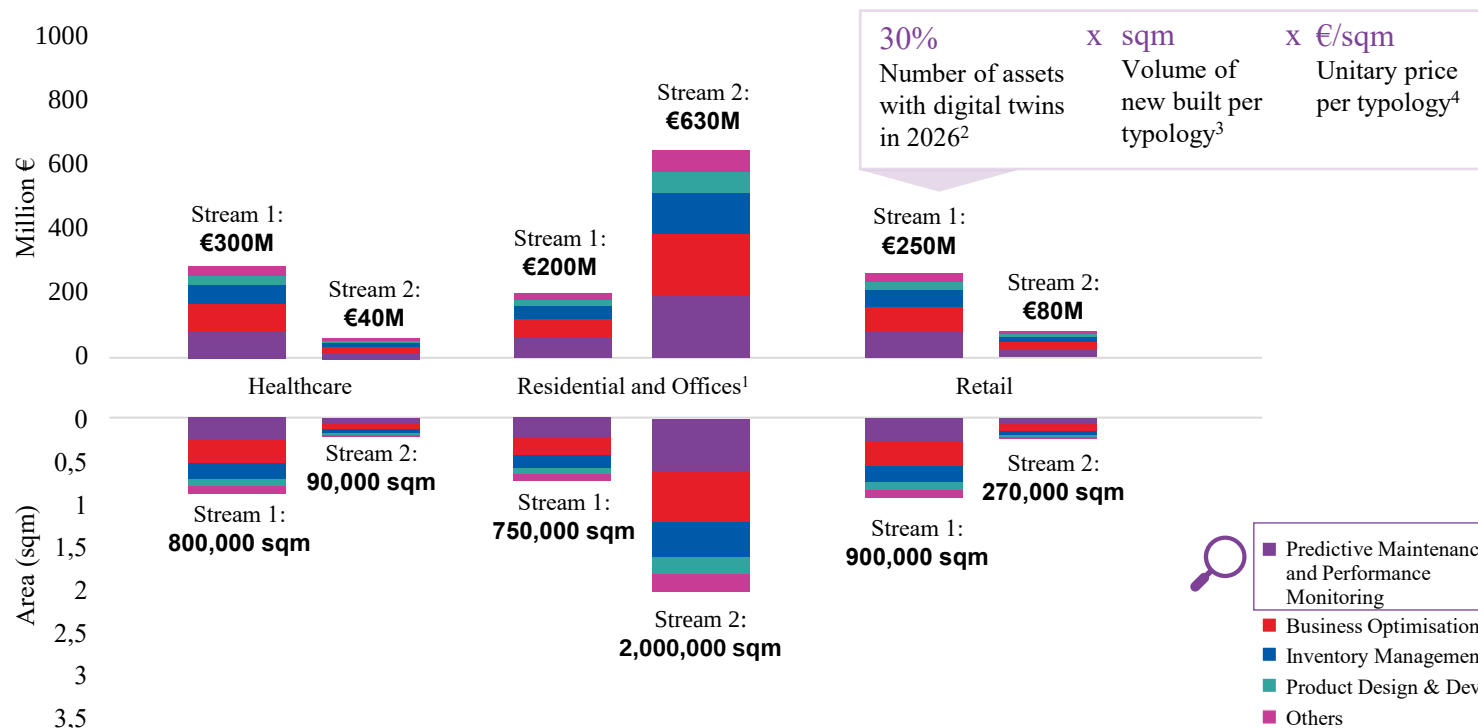
(1) Hotels & Restaurants included in calculation for comparability with Stream 1, which referred to this category as “Commercial” and included offices, hotels & restaurants.

(2) Useful floor area prognosis based on past data from 2016-2021 – Destatis, Bautätigkeit 2016-2020 (https://www.destatis.de/DE/Themen/Branchen-Unternehmen/Bauen/_inhalt.html#sprg239534)

(3) Euroconstruct (2021)

When looking at large buildings, residential and offices account for more than 80% of the share of digital twins

Potential market and construction volume of buildings >1.000sqm adopting digital twins per typology and use, 2026



Indicative

The total market and volume for both streams is consistent – however, the split per typology differs as a result of the positive or negative trend in the growth per typology until 2026.

▼
Total Stream 1 for buildings over 1.000 sqm:

€750M

2,560,000 sqm

Of which for predictive maintenance and performance monitoring:

€225M

730,000 sqm

▼
Total Stream 2 for buildings over 1.000 sqm:

€520-1000M

2,450,000 sqm

Of which for predictive maintenance and performance monitoring:

€160-300M

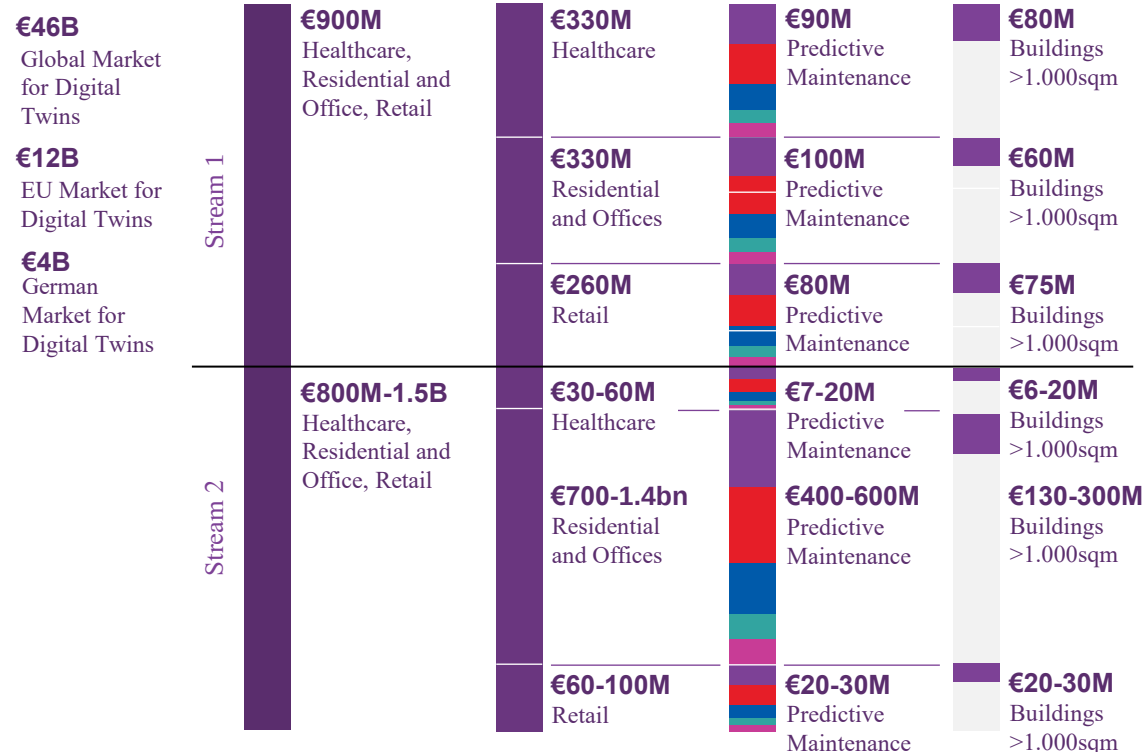
730,000 sqm

- (1) Hotels & Restaurants included in calculation for comparability with Stream 1, which referred to this category as "Commercial" and included offices, hotels & restaurants - Destatis, Bautätigkeit 2016-2020 (https://www.destatis.de/DE/Themen/Branchen-Unternehmen/Bauen/_inhalt.html#sprg239534)
- (2) Prognosis based on market growth of digital twins and initial assumption that in 2016 „less than 1% of assets had one (digital twin)“ – IET (<https://www.theiet.org/media/8762/digital-twins-for-the-built-environment.pdf>)
- (3) Useful floor area prognosis based on past data from 2016-2021 – Destatis, Bautätigkeit 2016-2020 (https://www.destatis.de/DE/Themen/Branchen-Unternehmen/Bauen/_inhalt.html#sprg239534)
- (4) Offices and retail: 210-400 €/sqm; healthcare 250-600€/sqm - Expert assesment

The market of digital twins for predictive maintenance of large buildings⁵ will have a turnover within the range of €160-300M

Indicative

Market cascade for 2026



■ Predictive Maintenance and Performance Monitoring
 ■ Business Optimisation
 ■ Inventory Management
 ■ Product Design & Devt.
 ■ Others

The market for digital twins for predictive maintenance in large office buildings could reach up to €300M by 2026.

- ▶ The growth of the market for healthcare typologies may not be linked to construction – German players like Siemens offer services for process optimization, material flows, logistics and better human-robot interaction¹.
- ▶ The demand for construction of new office buildings is expected to continue growing with new approaches to design and facility management – facility management associations are embracing the concept of ‘workplace’ to respond to the increasing demand for more sustainable, ESG-compliant and healthier office spaces^{3 4}.
- ▶ The price per sqm for healthcare is higher than that for other typologies, both for construction² and for development of digital twins⁴ – the value pool for this typology is likely going to be restricted to big players, both in the demand and supply side.
- ▶ Data privacy hinders rapid growth of emerging services related to digital operation – new responsibilities and roles will emerge regarding data management and data consultancy⁴.

(1) Siemens, Digital Twin and Simulation (<https://new.siemens.com/global/en/markets/pharmaceutical-life-science-industries/pharma-industry/focus-topics/digital-twin.html>)
 (2) Euroconstruct 2021
 (3) IWFM, What is Workplace Management? (<https://www.iwfm.org.uk/about/what-is-workplace-and-facilities-management.html>)
 (4) Interviews and expert assessment
 (5) Residential, offices, retail and healthcare

Management Summary

Key Conclusions

- ▶ More than 30% of the global market for digital twins could be located in Europe by 2026. Germany will likely lead the European and UK digital twin market in 2026 for healthcare, residential, offices and retail
- ▶ The market for these sectors will approach or exceed €300M in 2026, with Healthcare and Residential & Offices leading the way. When considering buildings with a greater useful floor area than 1.000 sqm, the market for healthcare is the highest.
- ▶ However, the useful floor area for new construction of healthcare buildings is expected to decrease in the next years. The market for residential and offices linked to new construction is higher than healthcare and retail
- ▶ Digital twins for predictive maintenance of large healthcare, residential, offices and retail buildings could have a turnover within the range of €150-300M

Strategic Recommendations

- ▶ High potential for opportunity for digital twins focusing on office buildings with low EPC rates, high operational and embodied carbon and high vacancy rates.
- ▶ Focus on Germany due to high pressure on energy prices resulting in opportunities per class of office and type of ownership.
- ▶ Germany also has a strong focus on smart networks and smart grids which could shape interesting opportunities both at portfolio level and at neighbourhood scale.
- ▶ Smart water management will become an integral part of digital twins – reducing water consumption, higher monitoring and reduction of pollution is a key policy agenda



Sustainable and Circular Components

Field of play #3

1. Policy Scan – Overall EU
2. Policy Scan – Individual countries
3. Emerging Customer Personas
4. Challenges
5. Market Analysis



The urgent need to decarbonize the sector will accelerate the adoption of circular economy principles

Overview of top 5 requirements at macro level



Sustainable and Circular Components

Policies will affect value chains both up- and downstream. Mandatory requirements from 2023 onwards will accelerate the overall adoption of circular design, digital tagging and tracking as well as the overall decarbonization of supply chains (Scope 3 emissions).

	Requirement	Key Aspects	Key Policies	Market Influence
+ obligation / certainty ↓	Minimum secondary material requirement and recovery of waste	- Recovery of construction & demolition waste - Minimum recycled plastic content and upscale bio-based plastics	- Renovation Wave (2020) - Taxonomy (2020) - Waste Framework Directive (2008)	- Reduction of waste along value chains - Increased innovation in materials
	New eco-design and energy labelling requirements	- Substantiation of green claims (Footprint methods) - Implementation of instruments: GPP and Eco-label, EPREL	- CE Action Plan (2020) - Proposal for a Regulation on Eco-design Requirements (*)	Regulatory measures so that devices are designed for energy efficiency and durability, reparability
	Empowering consumers	- Revision of EU consumer law: Enhancement of transparency / information - Establishment „right to repair“ and material rights	- CE Action Plan (2020) - Proposal for a Regulation on Eco-design Requirements (*)	Enhanced integration of the consumer along the lifespan of products
	Setting a well-functioning market for secondary raw materials	- Monitoring application of end-of-waste criteria for certain waste streams - Potential market observatory for key secondary materials	- CE Action Plan (2020) - Renovation Wave (2020) - Proposal for a revised CPR (*)	Increased accessibility to secondary raw materials facilitated by public bodies
	Accelerating hydrogen-powered supply chains	- Relevant funding for hard-to-decarbonise industries - EU-wide hydrogen projects and regulatory framework	- REPowerEU (2022) - Renovation Wave (2020) - Strategy for Energy System Integration (2020)	Decarbonisation of supply chains of materials used in construction (e.g. steel) may raise product prices

Source Arup Policy Review, Expert Interviews, Partner Kick-off Workshop

(*) Revision/policy at stage of proposal under review (not in force) which might suffer modifications in the approval process.



Sustainable and Circular Components

Field of play #3

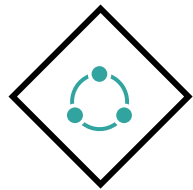
1. Policy Scan – Overall EU
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From 2022, whole life cycle analyses for buildings and second life strategies for construction products mandatory in France



Overview of top 3 requirements in France



Sustainable and Circular Components

The construction sector is facing major obligations through mandatory life-cycle assessment and the gradual reduction of CO2 emissions (Scope 3) for all new buildings between 2022 and 2031. Manufacturers will have to review their product portfolio to avoid fines for barely recyclable materials.

Requirements	Key Aspects	Key Policies
+ Reducing operational and embodied carbon	- Mandatory life-cycle analysis (A-D) for reducing embodied carbon in entire lifespan (50 years) of new buildings with gradually lower emission targets over time. - Construction-related emissions (scope 3), threshold at 640 kg CO₂/m²/year in 2022, 530 in 2025, 475 in 2028 and 415 in 2031 for single-family homes, for apartment buildings 740 kg CO₂/m²/year in 2022, 650 in 2025, 580 in 2028 and 490 in 2031.	RE2020 (2022)
obligation / certainty Ecodesign guidelines and producer-oriented incentivizing schemes for changing/reusing materials	- Producer-pays schemes and a bonus-malus framework reinforces transition incentives for producers of construction materials (as of 2022) - Producers of certain sectors (among them construction materials) have to present new strategies for a second life of their products between 2021 and 2024	Loi anti-gaspillage pour une économie circulaire (2020)
I Sorting, reuse and recovering of construction waste	- In-depth diagnosis of waste before demolition for recovery of materials - Involvement of construction sector to check technical, health-related and environmental performance of reused materials - Extended producer responsibility for the collection of waste	La feuille de route économie circulaire (FREC, 2021)

Experts insights:

France as frontrunner on embodied and operation carbon assessment in buildings.

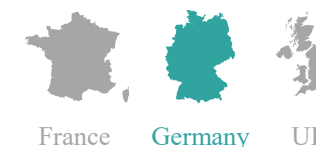
“France, Finland and Denmark are already establishing whole life carbon limits at national level.

“Wood market becomes large-scale and quite professional. There are resource centers where one can turn to find materials, but would need to expand and professionalize further.

“Lower carbon, smarter design and more economic use must be more rigorous to reach the (carbon) targets.

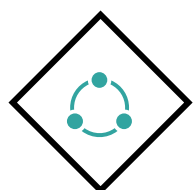
Source Arup Policy Review, Expert Interviews

(*) Revision/policy at stage of proposal under review (not in force) which might suffer modifications in the approval process.



Germany is widely promoting guidelines and frameworks for circular energy production and use

Overview of top 3 requirements in Germany



Sustainable and Circular Components

In addition to the transfer of EU eco-design and energy label guidelines, Germany is above all trying to inform society on a broad scale and encourage it commit to the energy transition. In addition, investment funds are being made available for widespread decarbonization solutions like hydrogen.

Requirements	Key Aspects	Key Policies
+ New eco-design and energy labelling requirements	- The EU ecodesign and energy labelling for specific product requirements are transferred, monitored and described by the national laws EVPG and EnVKG. - The improvement of the legal framework, e.g. through the further development of demanding award criteria for the "Blue Angel" eco-label.	- Strategy on Energy Efficiency (2019) - Ressourceneffizienzprogramm - Energieverbrauchsrelevanten Produkte Gesetz (EVPG) (2019)
obligation / certainty Empowering consumers	- Improved consumer information for products and services - Measures for climate protection and energy saving (electricity and heat) in private households - Communication and activation campaign of the BMWi with the motto: "Germany does it efficiently" - Infocampaign for new energy label. Additionally, implementing software tool that supports with energy efficiency comparison between products	- Strategy on Energy Efficiency (2019) - National programme for sustainable consumption
I Decarbonisation and accelerating hydrogen-powered supply chains	- Funding programme that tackles national decarbonization on various levels. - Programme of CO2 Prevention and use in primary industries through CDA – CCU – CCS. - Promoting the purchase of highly efficient fuel cell heating appliances in the Energy Efficiency Incentive Programme (APEE) since 2016. - Investing €1.5 billion in green hydrogen at all stages of the value chain.	- National Hydrogen Strategy (NWS) (2020) - Strategy on Energy Efficiency (2019) - National Decarbonisation Programme - Recovery and resilience programme (2021)

Experts insights:

Reactive approach to changes in European regulation regarding carbon and cities as pilot projects for circularity in Germany.

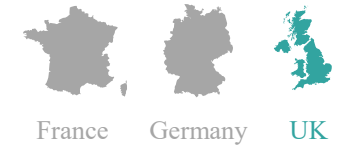
“In Germany, I have understood, they are very cautious (in capping carbon). They are more sitting in the back and seeing what the Commission is cooking.

“If regulations were less prescriptive, it would be better for circularity.

“Districts and cities are frontrunners (in circularity) in Germany.

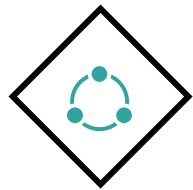
Source Arup Policy Review, Expert Interviews

(*) Revision/policy at stage of proposal under review (not in force) which might suffer modifications in the approval process.



Almost all heating systems aimed to be low-carbon by 2050 in United Kingdom

Overview of top 3 requirements in United Kingdom



Sustainable and Circular Components

The delivery of Net Zero by 2050 in the UK is shaped to create growth in markets focusing on phasing out gas for heating and cooling systems and the substitution of fossil fuels with sustainable supply sources. Public funding will enable driving change both up and downstream.

Requirements

obligation / certainty

Decarbonization of existing and new construction and hydrogen-based components

- Legislation requiring all large or listed UK businesses to report their annual carbon emissions and energy usage
- Potential introduction of regulations to end installation of new fossil fuel heating systems in existing off-gas-grid homes from 2026. Consultation on off-gas grid regulations for non-domestic buildings from 2024
- Hydrogen trials and innovation programs to explore feasibility for home heating and hydrogen-ready boilers

Eco-design, energy labelling policies and sustainable practices

- Energy-related products policy framework to set better minimum environmental performance standards for products with potential for emission reduction (to be developed)
- Energy technology government list (ETL) of energy efficient products (updated yearly)
- Upcoming UK Green Taxonomy (under development)

Recovery of waste heat and resources

- Development of Combined Heat and Power (CHP) policies under study (second phase of consultation scheduled for 2021)
- Partnerships with authorities and industry to support commercially viable low-carbon sources like energy-from-waste plants

Key Aspects

Key Policies

- Heat and Buildings Strategy (2021)
- The Ten Point Plan for Green Industrial Revolution (2021)
- The Building Regulations (2010)
- Future Buildings Standard (*)

- Heat and Buildings Strategy (2021)
- Energy Technology List

- Heat and Buildings Strategy (2021)
- The Building Regulations (2010)
- Drainage and Waste Disposal: Approved Document H (2015)

Experts insights:

High level of prefabrication maturity as enabler of circularity in the UK. The main driver is still meeting energy efficiency targets

“Circularity in the UK is driven by affordability and systemized construction, which is an enabler for circularity

“Meeting the minimum efficiency targets is the main driver.

“Compliance with energy and carbon targets is essential and more impactful than costs associated with energy savings

Source Arup Policy Review, Expert Interviews

(*) Revision/policy at stage of proposal under review (not in force) which might suffer modifications in the approval process.



Sustainable and Circular Components

Field of play #3

1. Policy Scan – Overall EU
2. Policy Scan – Individual countries
3. Emerging Customer Personas
4. Challenges
5. Market Analysis



Home owners aiming to increase the value of their property to align with market demands and trends



Key activity / profile

Private homeowner aiming to renovate her home in the outskirts of a main city in France to make sure its value does not decrease.

“ I would like to renovate my house and integrate sustainable elements that would increase its value as my neighbours have done, but I do not know where to start.

Customer needs

- #1 Reliable advisory on sustainable products and their benefits
- #2 Low maintenance elements and guarantees of performance
- #3 Low costs, with a clear articulation of impact on value



Key changes to customer experience

- Understanding the value behind choosing, for example, low carbon solutions over the usual
- Providing certainty on price, programme, quality and energy performance
- Being involved in the process to make key decisions, but also trusting the retrofit will perform as promised and will achieve regulatory compliance



Key changes to buying criteria

- Increasingly price sensitive due to inflation
- Concerned about the risk of not meeting new regulations and how it might impact resale value
- Keen to ensure her home is attractive and fashionable, meaning she is interested in having the latest technology as well as sustainable products



Willingness to pay

€ Low €€ Medium €€€ High



Competitors / Actors across Europe

Non-applicable

Region of focus



Step in value chain

- 1 Design
 - ✓ Developer
 - ✓ Advisor
 - ✓ Designer
- 2 Construction
 - ✓ Manufacturer
 - ✓ Contractor
 - ✓ Installer
- 3 Operation
 - ✓ Asset owner
 - ✓ Asset manager
 - ✓ End consumer
- 4 End of life
 - ✓ C&D waste manager

Waste management company closing material loops across industry sectors of a region



Key activity / profile

Public-privately held secondary raw material management company facilitating a region's circular transition through closing material loops across industry sectors.

“ We provide industry clients with secondary materials from their region through closing material loops across different sectors.

Customer needs

- #1** Reliable data on quantity and quality of secondary materials in area of operation
- #2** Continuous and anticipatory information on raw material demand of industry
- #3** Effective solution to match demand and supply of secondary raw material



Key changes to customer experience

- Helping clients to dispose waste the right way as integrated service
- Providing downstream clients with (secondary-) raw materials



Key changes to buying criteria

- Increased importance of transparent data on material quality
- Predictability and reliability of supply
- Ability of suppliers to deliver on demand, allowing waste management company to minimize dead-storage problem



Willingness to pay

€ Low €€ Medium €€€ High



Competitors / Actors across Europe

Material Scouters (e.g. Concular) | Secondary materials marketplaces (Globechain, Rotor DC)

Region of focus



Step in value chain

- 1 Design**
 - ✓ Developer
 - ✓ Advisor
 - ✓ Designer
- 2 Construction**
 - ✓ Manufacturer
 - ✓ Contractor
 - ✓ Installer
- 3 Operation**
 - ✓ Asset owner
 - ✓ Asset manager
 - ✓ End consumer
- 4 End of life**
 - ✓ C&D waste manager



Sustainable and Circular Components

Field of play #3

1. Policy Scan – Overall EU
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- 4. Challenges**
5. Market Analysis



#4

Sustainable Offerings and Circular Value Chains: Reduce, Reuse, Repair – B2C



Describe your challenge and its market

How can we demonstrate to our customers the benefits of sustainable and circular products? How can we build whole-life customer relationships in order to recover our product?

Key aspects:

- # Single-family housing
- # Whole-life customer relationship
- # Route to market of reused / renewed products for single-family homeowners
- # Return on investment for owner
- # Product maintenance, repairability and recovery

Partners involved:



What is the specific problem / unmet need?

Think of the customer personas

Problems:

- Circular products often do not offer homeowners reduced costs, improved performance or better aesthetics
- Circular products offer benefits primarily at points of maintenance and end of use – and these are not key buying criteria
- Homeowners cannot access affordable, convenient repair services (existing providers are incentivized to remove and replace instead)

Needs:

- Value proposition for homeowners in which they benefit from the advantages of circular products
- Cost-effective repair service
- Friction-free access to information and combined circular solutions



Who has the need?

Think of the customer personas

- Private homeowners



Why is this a problem?

Think of e.g. contextual policy environment

- Existing policy steers private economy investments into sustainable/ circular products (Taxonomy compliant investments) – however majority of housing stock is held by a large number of private homeowners which currently have to invest in circular products/ services based on good-will
- Large quantities of home automated elements installed in the 90ties will reach end of life soon and producers/ installers need to prepare an appropriate strategic response to them
- Producers will increasingly have to take over responsibility for products at end of life. Providing maintenance and product returns will help meet these requirements.



Where is the challenge most urgent?

Think of geographic markets



France



Germany



UK

#5

Sustainable Offerings and Circular Value Chains: Recover, Repair, Reuse – B2B



Describe your challenge and its market

How do we work with our industry partners to recover and resell our products?

Key aspects:

- # Commercial and multi-family residential
- # Whole-life customer relationship
- # Route to market of reused / renewed products for architects, contractors and installers
- # Return on investment for owner
- # Product maintenance, repairability and recovery

Partners involved:



What is the specific problem / unmet need?

Think of the customer personas

Problems:

- Installers do not have the skills or resources to repair products
- Installers have no alternative but to resort to waste management companies to dispose of removed products
- Waste management companies have no incentive to return products to manufacturers
- Buyers and installers associate second-hand products with lower reliability and worse performance

Needs:

- Installers need skills and resources to repair products
- Installers need to be aware of return schemes
- Waste management companies need incentives to return products
- Buyers and installers need reassurance that refurbished products provide predictable reliability and guarantee performance



Who has the need?

Think of the customer personas

- Contractors
- Installers
- Waste management companies



Why is this a problem?

Think of e.g. contextual policy environment

- Upcoming eco-design policies fostering circularity through improved durability, reusability, upgradability and reparability
- EU Taxonomy integration of circularity in design, production, value recovery and support through technology and capability-building
- Scarcity of resources and global warming
- High inflation and a growing economic crisis are making customers more price conscious
- Product recovery alleviates pressure on global supply chains of materials



Where is the challenge most urgent?

Think of geographic markets



France



Germany



UK



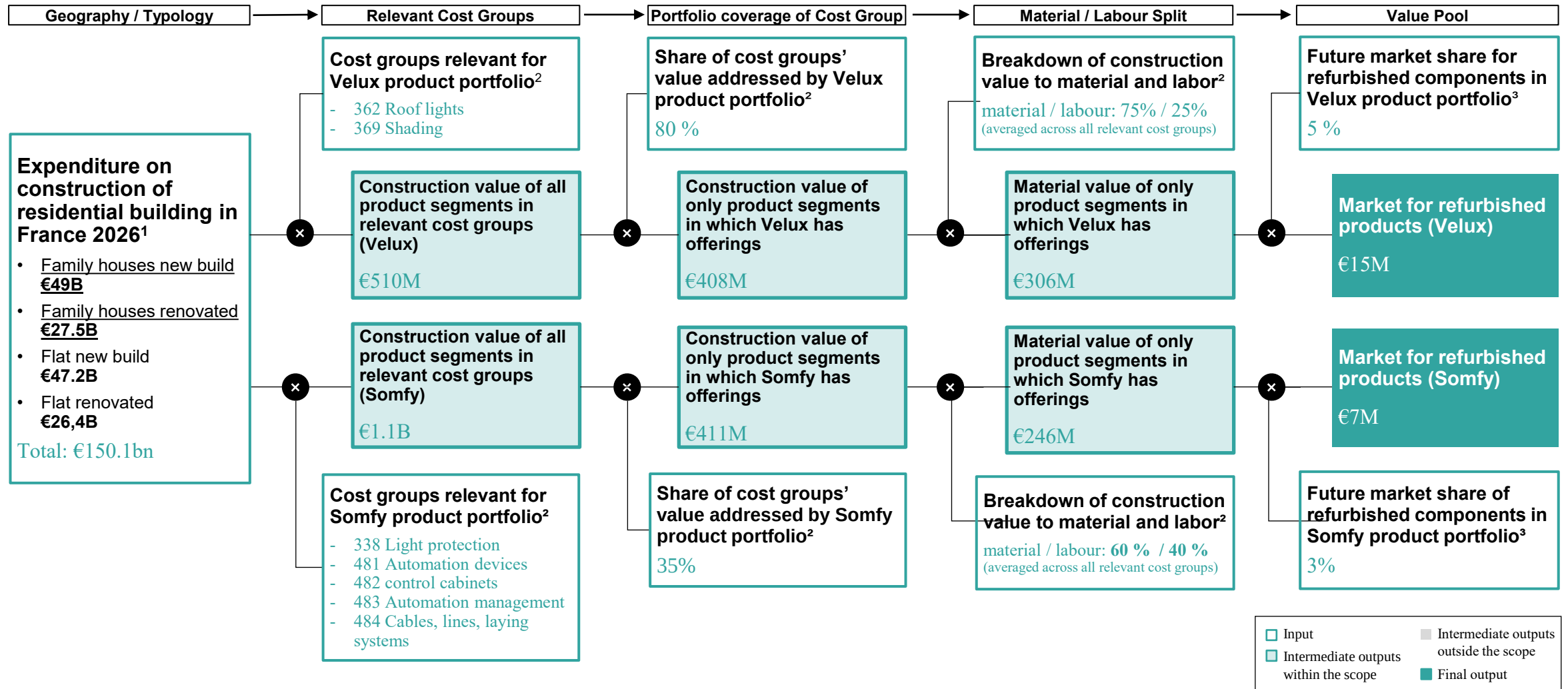
Sustainable and Circular Components

Field of play #3

1. Policy Scan – Overall EU
2. Policy Scan – Individual countries
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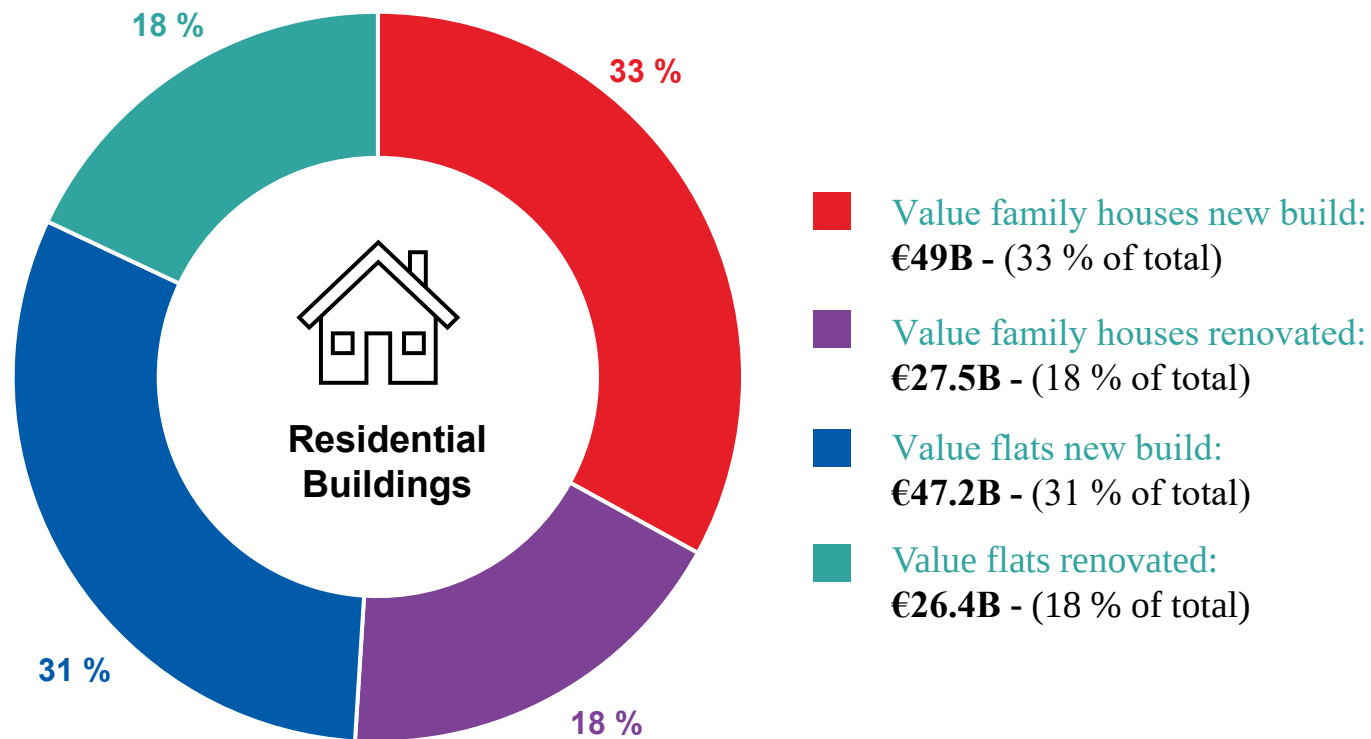


How big will the market for refurbished motorization components/ roof windows be in France in residential buildings in 2026?



Single family homes make for the biggest share of construction value in France – in renovation as well as in new build

Construction value for residential buildings in France – new build & renovation (2026)

**Indicative**

Projected construction value for **new build** and **renovation** activity in the residential sector is expected to grow by 1%-2% between 2022 and 2026

In 2026, in the sub-typology of **single-family houses**, the value could be **€77B**.

- ▶ Of which **€49B** is new build
- ▶ Of which **€28B** is renovation

Similarly for **apartments** the value could be **€74B**.

- ▶ Of which **€47B** is new build
- ▶ Of which **€26B** is renovation

The construction value addressable by Velux and Somfy is both €410M

Cost groups relevant for partner product portfolio Value addressable by partner's product portfolio

Indicative

VELUX®

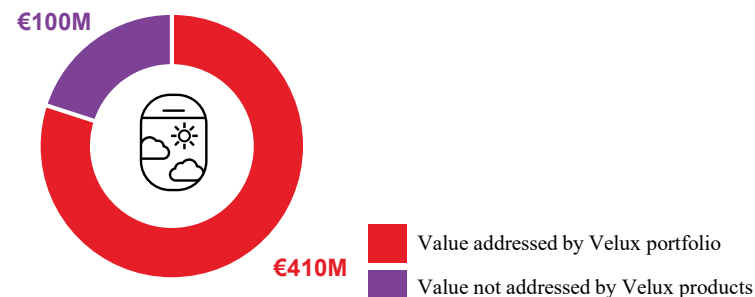
Costs groups relevant for Velux

- 362 Roof Openings
- 369 Shading for Roof Openings

Arup expert-based assessment based on current understanding of partner portfolio

Projected construction value of relevant cost groups in 2026:

500M+



Refers to the total value of the relevant cost groups, which Velux' product portfolio could address – not to be mixed with Velux' market share within this segment

somfy.

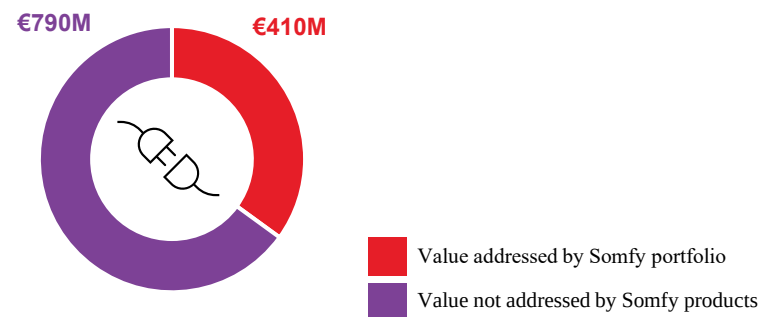
Cost groups relevant for Somfy

- 334 Exterior wall opening
- 338 Light protection
- 481 Automation devices
- 482 control cabinets, automation focus
- 483 Automation mgmt.
- 484 Cables, lines and laying

Arup expert-based assessment based on current understanding of partner portfolio

Projected construction value of relevant cost groups in 2026:

1.2B+



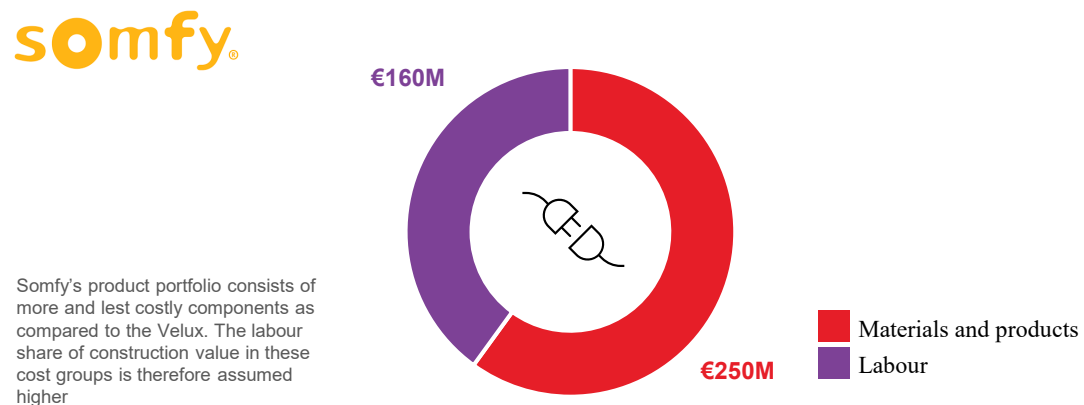
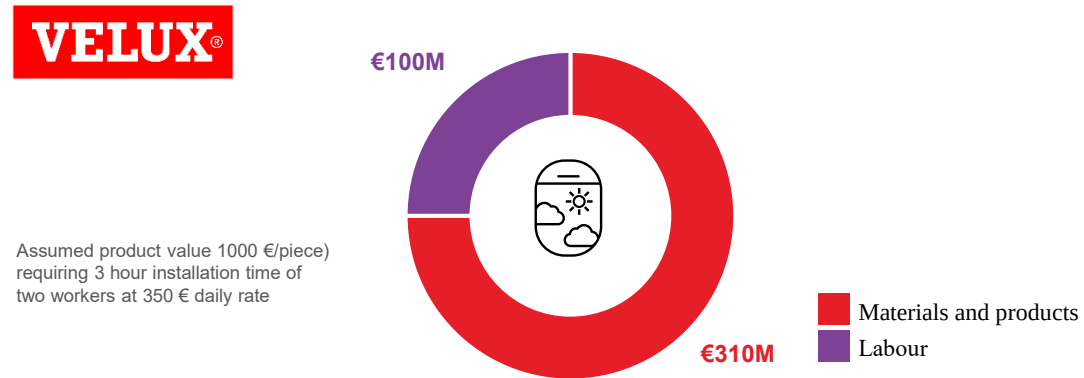
Refers to the total value of the relevant cost groups, which Somfy's' product portfolio could address – not to be mixed with Somfy's' market share within this segment

Size of partner's product portfolio determines addressable value of construction value

- The construction value of segments into which Velux's and Somfy's products are sold in 2026 is projected to be €510M and €1.2B respectively.
- Somfy's products are present across a larger segment of the construction industry, Velux's products address a larger proportion of their relevant segments.
- Therefore the addressable value is, coincidentally, the same for each partner, at €410M.

The market for products being sold into these cost groups has an estimated value of €310M and €250M respectively

Breakdown of construction value to material and labour 2026



Sources: Arup assessment, expert interviews

Indicative

The share of construction value for quality components is relatively high compared to labour costs in assessed segments



- Breaking down the construction value into only that which relates to products, the value for each partner in these construction segments is €310M and €250M for Velux and Somfy respectively.
- The split between plant, labour and material varies greatly depending on whether a project is new build, or renovation, and in the latter case whether the work is, for example, a significant intervention in a building, or a like-for-like replacement.

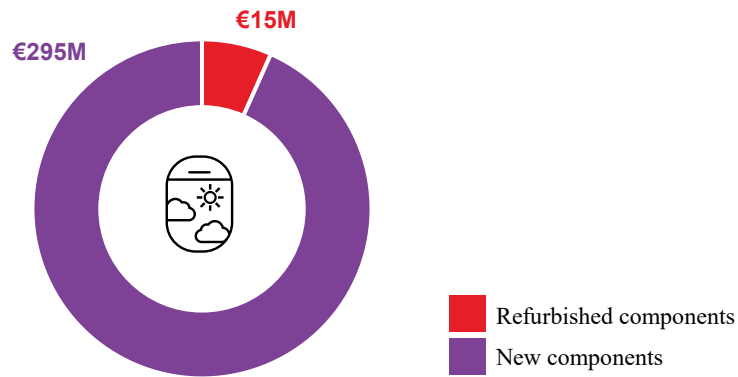
The split between plant and labour assumed to the left are therefore based on assessments from our experts, considering the more common and higher value interventions.

We estimate the market penetration of refurbished components could reach 5% and 3% respectively

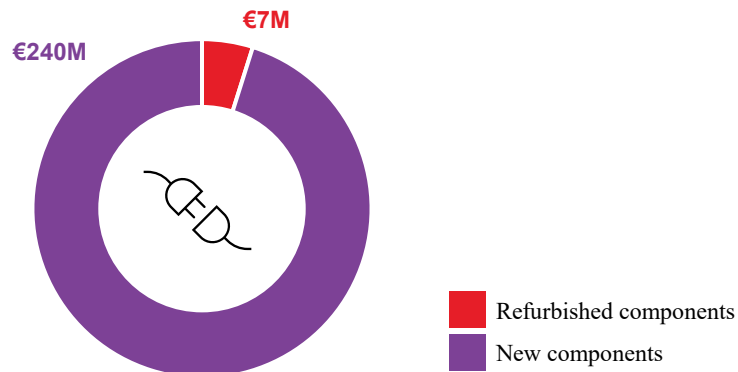
Estimated market share for refurbished components in partner product portfolio

Indicative**VELUX®**

- High value, manually operated components, make the largest share of Velux' product portfolio and age well, as they are less failure prone.
- This may translate into an estimated of 5% market share for refurbished components.

**somfy®**

- Electric elements with moveable parts generally have a shorter expected life span and are more fastly phased out by technological innovation.
- High quality components, however may maintain value and justify maintenance and repair.
- This may translate into an estimated of 3% market share for refurbished components in Somfy's portfolio in 2026.



Policy Insight



The policy environment on refurbished components is not specific. In the absence of firm policy, our assessment is that market shares of 5% and 3% per partner product group could be possible by 2026.

Very moderate market sizes for refurbished components, however with stable growth potential



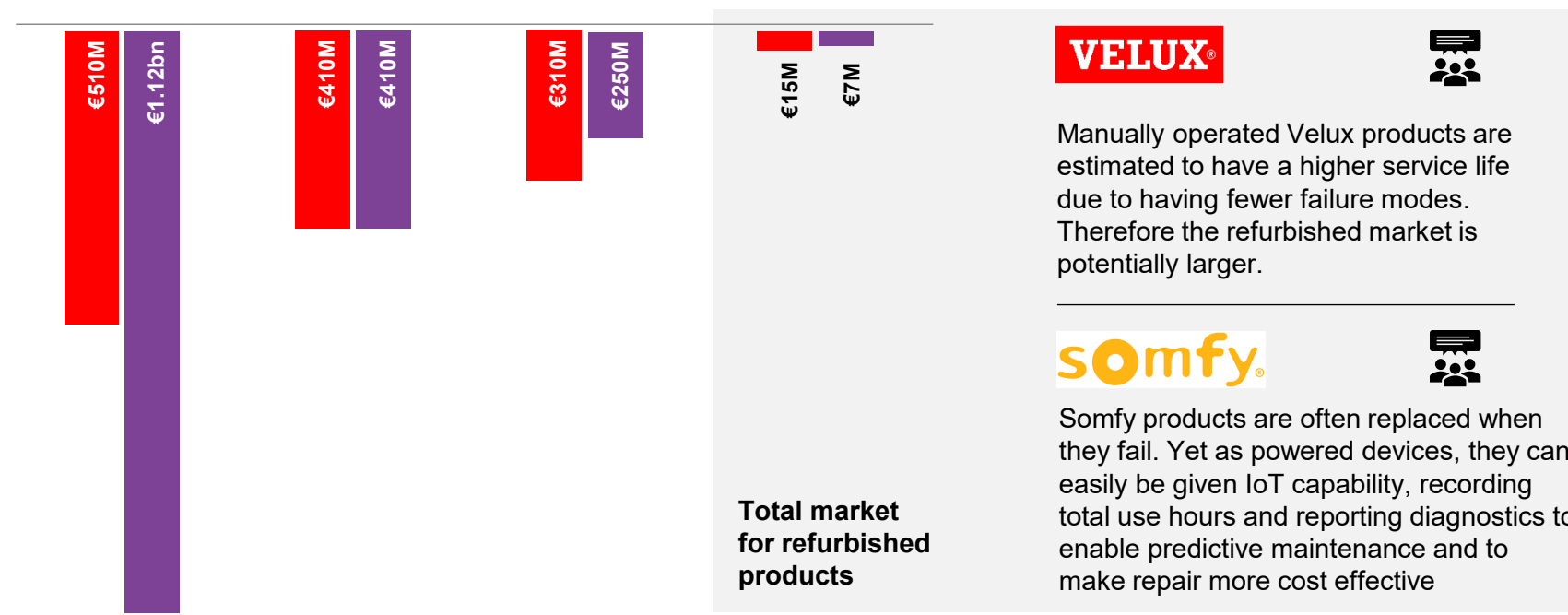
- These shares suggest market values of €15M and €7M for Velux and Somfy respectively in France.
- The most significant driver for uptake will be **partner ambition** in providing these solutions. Compelling value propositions which **reduce embodied carbon, reduce waste and reduce cost** can be unlock through creative **product recovery and refurbishment models**.

A market for refurbished products will emerge slowly in this decade, with a value of €22M in these product segments

Value pool for reselling refurbished components of Velux / Somfy product portfolio in 2026

Indicative

Strategic Recommendation



- Develop digital capacity to track location and availability of installed products to facilitate secondary component market.
- Improve product durability and expected life time to increase likelihood of second product life
- Design products for simple in-/exstallation to fuel uptake of secondary market

Construction value of all product segments in relevant cost groups

Construction value of only product segments in which partner have offerings

Material value of partner relevant product offering

This study did not address the availability of preinstalled Velux and Somfy products arising from refurbishments, replacements and failures. This supply-side aspect limits the potential size of the refurbished market. Therefore a key data gap to be plugged is the location of installed product, and the likelihood in a given year it will become available for refurbishment and reselling. Such an approach turns potential liabilities into assets.

Management Summary

Key Conclusions

- ▶ The policy environment on refurbished components is not specific. In the absence of firm policy, our assessment is that market shares ranging from **2% - 5%** per partner product group could be possible by 2026.
- ▶ Furthermore, alignment with the **EU Taxonomy** will play a role in these typologies. The taxonomy criterion of **50% reused or recycled content** will be hard to reach without refurbished product offerings. Our estimated market size could therefore be an **underestimate**.
- ▶ In all related partner's product portfolios, information gaps around location and condition of installed components hinder the update of a seamless secondary component market. This **supply-side aspect** limits the potential size of the refurbished market.

Strategic Recommendation

- ▶ Develop digital capacity to track location and availability of installed products to facilitate secondary component market.
- ▶ Improve product durability and expected lifetime to increase likelihood of second product life
- ▶ Design products for simple **in-/exstallation** to facilitate uptake of secondary market
- ▶ The most significant driver for uptake will be **partner ambition** in providing these solutions. Compelling value propositions which **reduce embodied carbon, reduce waste and reduce cost** can be unlock through creative **product recovery and refurbishment models**.

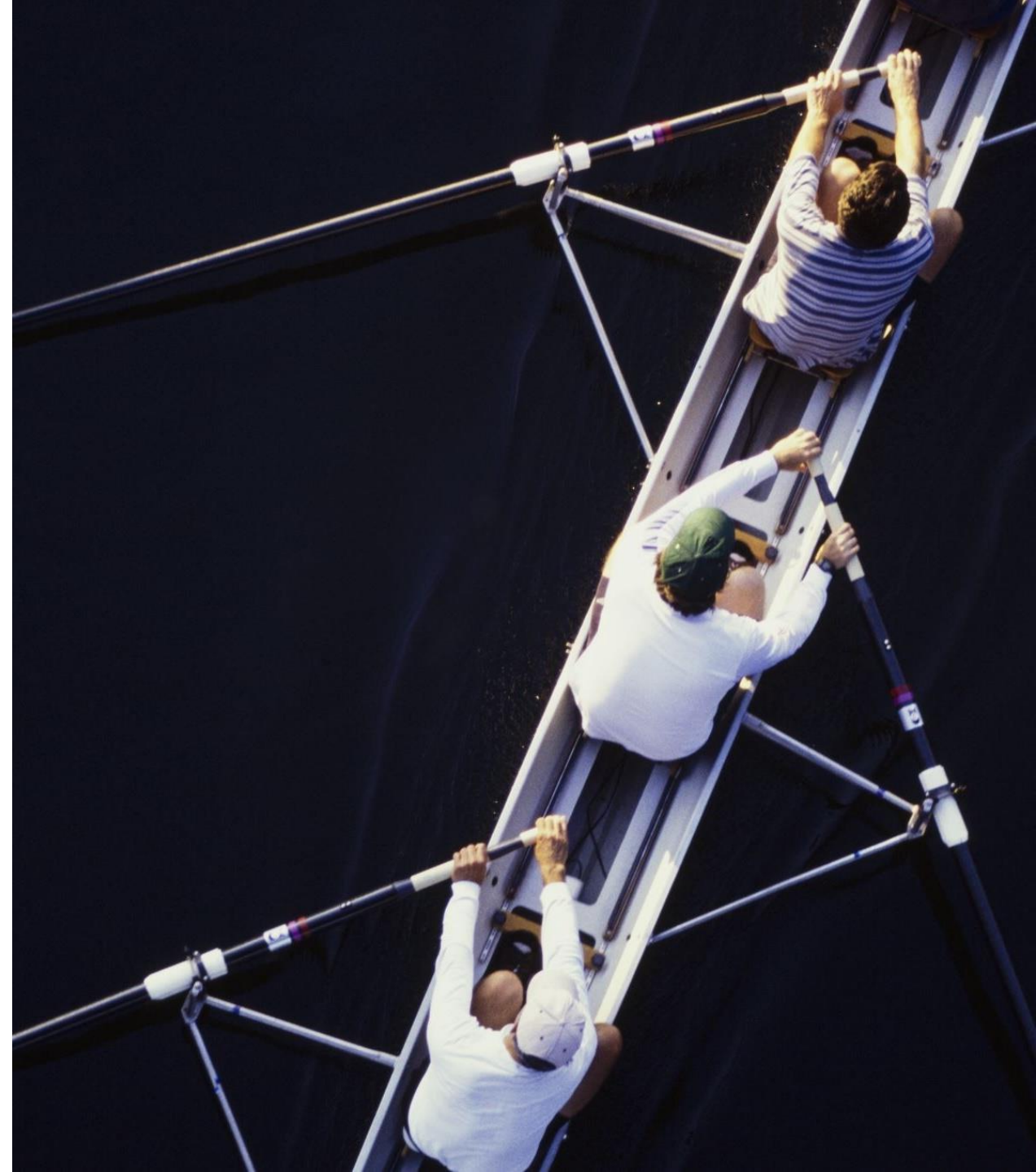
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We unlock Value Creation
Opportunities from the transition
to a circular economy.

Arup Foresight + Strategy & Insights

We bring clarity, insight and rigour to your biggest decisions.

Whether you're investing in a new product, contemplating a new business model or service, or adopting more sustainable ways of working, we can help.



Explore how we help our clients

Our service lines



We are circularity advisors

We develop industry-specific guidelines for circularity and help private and public sector clients including financial institutions developing their strategy, portfolio shifts or investment plans.



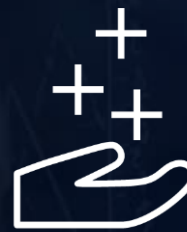
We create catalytic pilots

We create new coalitions and platforms across the value chain by connecting capital and investments with a new and sustainable demand side to create real-world and scalable pilots.



We provide market intelligence

We provide detailed information on defined new markets and growth fields based on our deep analytical expertise and in collaboration with our partners and Arup Ventures.



We accelerate transformation

We help organizations build the internal knowledge, capacity and skills they need to drive internal and external change in collaboration with our Transformation Advisory discipline.

Five systems change fields

We deliver value added services from strategic advise to design implementation

Corporate Circular Economy Strategy



European Industry Consortium CE Strategy

Circular Property Strategy



European Space Agency – Capacity Utilisation

Public Policy CE strategy



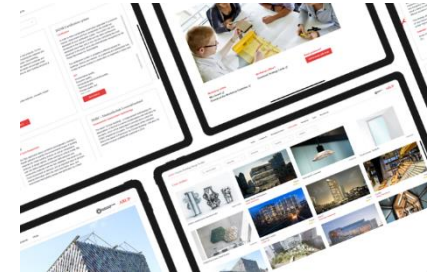
German Government – Circular Scenarios

Circular Cities Strategy



Urban Tech Republic – Circular Tegel Airport

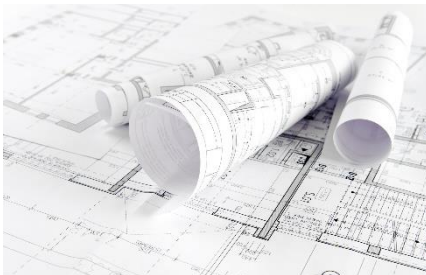
Networks and Circularity Platforms



Ellen MacArthur Partnership CBT



Circular Retail Ecosystems Strategy



VGP – Global Circular Design Guidelines



European Investment Bank Circular Policy Scan



Arup + Enel Circular Cities Strategy



European Circular Economy Business Models

Our global partner ecosystem

We can only meaningfully contribute to sustainable development if we work in partnership with others.

Arup FSI collaborates with globally influential bodies and institutions to push for step-change outcomes in issues like climate resilience, energy efficiency, the circular economy agenda and the push for greater infrastructure resilience.



Ellen MacArthur Foundation

Global knowledge partnership on built environment themes for over six years.



World Green Building Council

Close Alignment with WGC on all topics related to the Built Environment.



World Business Council for SD

Developing thought leadership together with WBCSD – e.g. on whole life carbon assessments.



Urban Land Institute

Global partnership with ULI to explore and leverage sustainable urban development.



Madaster

Kennedy Partnership with Madaster to make material passport for buildings and assets the industry standard.



Concular

Partnership with Concular to leverage large scale uptake of material salvage and reuse strategies.



ETH Zurich

Research partnership with ETH Zurich, Department of Circular Construction.

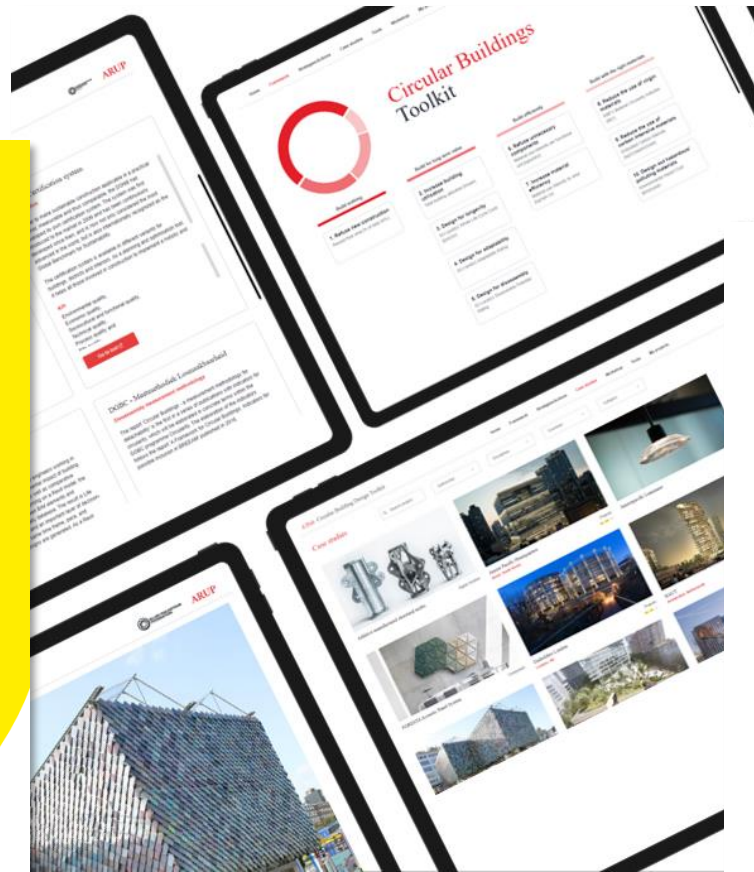


World Economic Forum

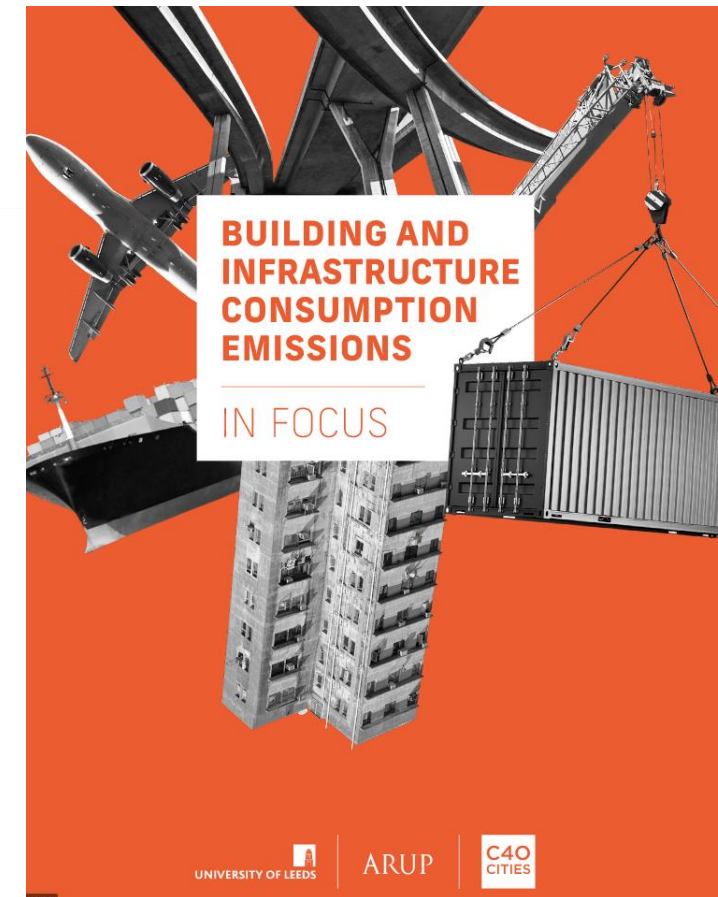
Partnership with WEF to drive the industry uptake and adoption of CE principles at scale.

Our Thought Leadership

Our team (co-) authored and developed award-winning thought leadership pieces and tools that influence our clients and partners globally



FROM PRINCIPLES TO PRACTICES:
FIRST STEPS TOWARDS A
CIRCULAR BUILT ENVIRONMENT



Our clients

We have trusted relationships with world leading partners



Our firm

Dedicated to sustainable development, Arup is a collective of 16,000 designers, advisors and experts working across 140 countries. Founded to be both humane and excellent, we collaborate with our clients and partners using imagination, technology and rigour to shape a better world.

A black and white portrait of Ove Arup, an elderly man with glasses, wearing a suit and tie, looking slightly to the right.

Shared values

Our creative spark and intellectual independence has been there from the very beginning. These shared values, like the firm's name, are essentially derived from the beliefs and convictions of the firm's founder, the engineer and philosopher, *Ove Arup*.

Global presence



89 offices

33 countries

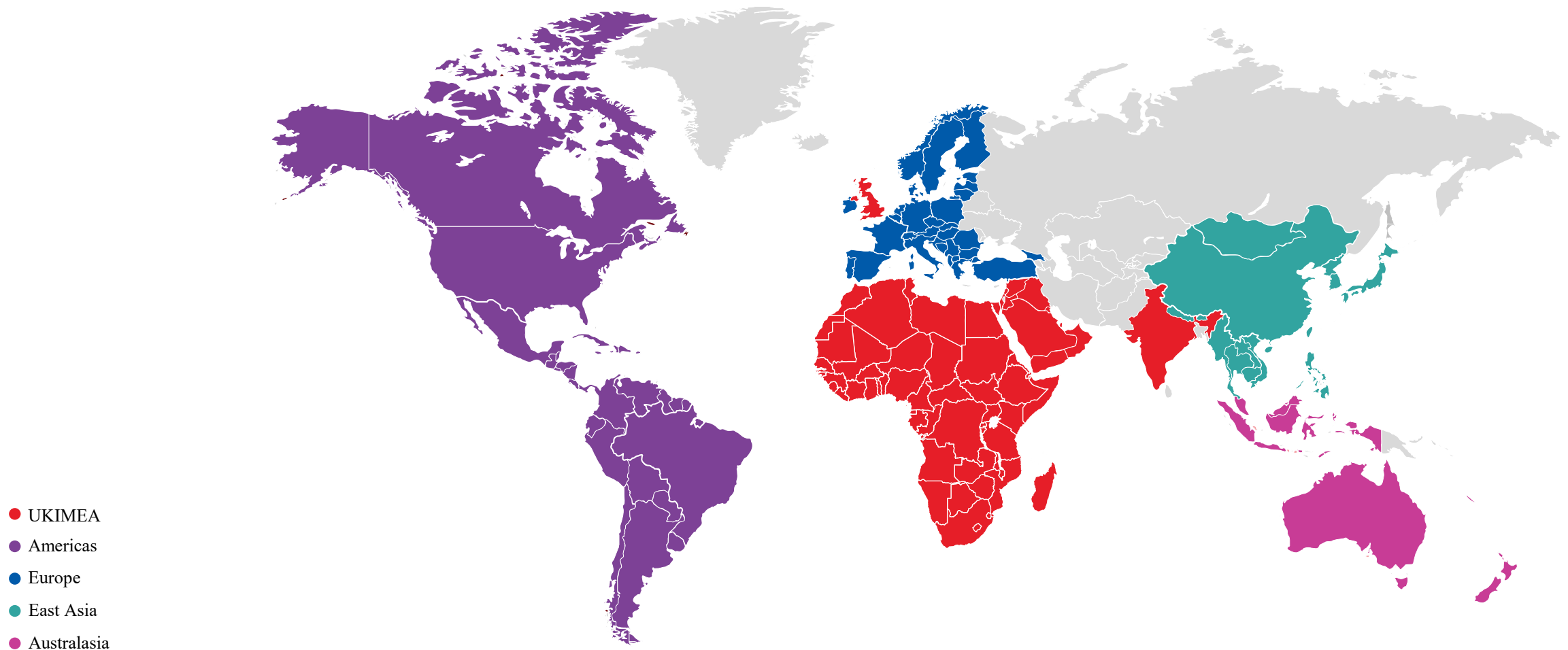
\$3.2bn* turnover

75 yrs of profitable trading debt free

15,000+ people

*as at Mar 2021 *19/2020 financial year*

Five regions



Sustainable Development Goals (SDGs)

Our work and our business strategies are aligned with all 17 UN Sustainable Development Goals, across all parts of our business.

This helps define how we shape a better world.



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Arup have not undertaken any design or engineering works and have not contributed to the development of any project(s). Arup does not provide legal advice.

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