DIGITALEUROPE

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# Digital building transformations for Europe's green renovations: Sustainable living and working

## Executive Summary

The digital transformation of buildings and cities is key to achieving the European climate goals, while directly improving our quality of life.

Buildings contribute about 40% to EU energy consumption and 36% to greenhouse gas emissions. Fortunately, building automation systems can slash those emissions by 30%, but this requires bold initiatives. Public investments in 'deep renovations'[1] could trigger 3 to 4 times as much investment from the private sector.[2]

Improving buildings and cities will have huge impact on our lives. We spend about 80% of our lives in buildings, and in 2050, an expected two-thirds of the world population will live in towns.

DIGITALEUROPE applauds the Commission's ambitious Renovation Wave, and urges for particular focus on the following:

- **Revision of the Energy Performance in Buildings Directive** (EPDB)**.** Setting minimum energy performance standards should reflect a sophisticated strategy for energy savings –beyond building envelope[3] renovations only– powered by interconnected technologies including reporting and direct feedback to building users.
- **Secured investments** in digital buildings. DIGITALEUROPE welcomes the initiative to mark digital buildings projects under the 'renovate'

[1] European Commission (2015): A cost-effective renovation which leads to a refurbishment that reduces both the delivered and final energy consumption of a building by a significant percentage compared with the pre-renovation levels leading to a very high energy performance.

[2] BPIE (2020). Covid-19 recovery: Investment opportunities in deep renovation in Europe

[3] A building envelope is the physical separator between the conditioned and unconditioned environment of a building including the resistance to air, water, heat, light, and noise transfer.

**DIGITALEUROPE**
Rue de la Science, 14A, B-1040 Brussels
T.+32 (0) 2 609 53 10 / www.digitaleurope.org / @DIGITALEUROPE
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flagship, and encourages pressure on building-related aspects of each EU country's national plans for buildings renovations.[4]

- **Ensure a beneficial impact on environmental, economic and social sustainability**. The EU must create green jobs while making the Renovation Wave happen, by encouraging public private partnerships projects for digital reskilling and upskilling to make the smart environment a feasible investment.

- **Promote Building Information Modelling (BIM) in public procurement** by basing public procurement on the MEAT[5] principle. Digital solutions based on ecosystems of Digital Twins will prove key to reaching the green goals efficiently.

At the same time, more needs to be done to create the required clarity and to make sure Europe will strike the right balance between public guidance and innovation.

While aiming for carbon neutrality and post-Covid-19 recovery, the Renovation Wave should also aim to make Europe a global leader in buildings innovation.

Therefore, further steps should include a broad range of stakeholders involved in the digital transformation of buildings. The Renovation Wave should:

- **Align globally through frameworks and standards.[6]** Determine at the EU level a consistent framework for cooperation. The EU should align with developments in international standards when determining data models, protocols, standards for data management and integration, essential for interoperability. By agreeing on common standards within, Europe can become a world leader.

- **Make sure data sharing initiatives relevant for construction facilitate business to achieve the full potential of data sharing for building operation while respecting existing contractual agreements.** Cross-Sectoral data sharing should be incentivised, based on case-by-case voluntary agreements, and open to all actors globally.

- **Set out clear rules for digital in public procurement guidance.** Setting concrete targets for the adoption of digital methods and technologies like

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[4] long-term building renovation strategy (LTRS), national energy and climate plans (NECP) and aspects of the EPDB

[5] Most Economically Advantageous Tender

[6] For example: ISO 37120:2014 Sustainable development of communities – indicators for city services and quality of life; ISO 14001:2015 for Green Building certifications; ISO JTC1-SC41-IoT for internet of things; JTC1-SC42-AI for Artificial Intelligence.

BIM and Digital Twins will give the construction industry the needed confidence to invest in this area.

- Beyond the Renovation Wave, **continue to promote the role of digital-enabling technologies in improving the decarbonisation of buildings**, including IoT and software**.**

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# 1. The digital building transformation: green jobs, better living

There are already some leading initiatives transforming the building sector in Europe, as showcased in Case studies of digital buildings from DIGITALEUROPE members. They offer a vision of the future of buildings, where data-driven innovations offer more for building owners and users by reducing wasted space, material and energy.

Much can be gained because right now, 30% of projects do not meet the original objectives, 92% of planners say that not all information is available when plans are made, and 37% of materials used in construction become waste. Already, pioneering projects provide evidence on how to answer to these challenges, but the technologies need to be embraced though investment and standardisation.

## 1.1 BIM and Digital Twins improve where we work and live

BIM is a methodology which contains people, processes, technology and standards. Continuous optimisation of buildings' operation is a major goal of facility management and their customers. With these technologies, buildings can be made ready for sustainable working and living, while creating sustainable jobs. A connected building can achieve better comfort, convenience and safety while reducing waste.

Critically, most of the $CO_2$ emissions come after the design phase. Digital technology is the enabling factor of a cross-collaboration between architects, engineers, services and contractors at all phases of a building life cycle (design and operation). Digital will allow to link data from operational processes (usage data of the building), infrastructure data (asset management) and data dedicated to energy and performance management for the building end-users and city or grid operators.

Implementing Digital Twin capabilities in, for instance, a factory, an airport, or a machine plant enables users to simulate before implementing, continually view the operations, accurately predict using modelling, perform what-if analyses, document and communicate better, and integrate disparate systems.[7]

While at home, digital building occupants can benefit from interfaces and displays to ensure better accessibility, as well as remote and automated controls to adjust the building environment like lighting, shading, heating and smoke alarms. It uses a broad range of smart sensors, Internet of Things/ and Actions (IoT/ IoA) devices, edge and cloud computing to create its Digital Twin - a digital representation of its static and dynamic parameters - to provide information

[7] (2020) Developing Applications with Oracle Internet of Things Cloud Service, 2020, link

needed to meet the optimisation goals. Lessons learned from this valuable feedback can be looped back into further planning, and uncover weaknesses to be fixed.

## 2. Decarbonised and connected buildings

**Buildings must be net-zero carbon by 2050**, with intermediate milestones, meaning they are zero-carbon throughout their entire lifecycle. This shall trigger a revolution in the building industry, which needs to rethink buildings for optimal performance.

Digitisation comes as a key enabler to combine efficiency, sustainability, and decarbonisation within the building environment. Firstly, it greatly supports the improvement of energy efficiency and the integration of renewable energy. At the same time, it empowers renewable installations to provide flexibility services using data management. Secondly, it provides tools toward achieving zero-carbon in new-built construction. Digital is particularly competitive and disruptive to bring efficiency on brownfield buildings and plants and infrastructure, through retrofitting and upgrading. You can deploy digital solutions in weeks, not months.

**Buildings must become the powerhouse of the cities, optimising energy use and the load profile at building/district level for local communities and providing services to grid operators and Energy/Power markets.** Building integration within Grids and Microgrids will be key to manage system and market complexity through use of IoT for connected products and sensors, edge control and cloud software platforms allowing to provide dedicated advanced services. Digital will be the glue which will allow the overall system to run in an optimised way, as efficient as possible from a system cost & rate payer point of view.

The Renovation Wave initiative already defines some important principles, but to reach its ambitious goals the Commission should increase the pressure. This can include:

- **In cooperation with industry, develop methodologies and indicators to measure the potential of digital,** thereby delivering trust and accelerating the use of these technologies.
- **Mandatory CO2 reduction target for the building stock** (targeting the building stock with the higher-level potential first).
- **Support the deployment of critical technologies to accelerate decarbonisation, digitisation & electrification**: e.g. BMS, heat pump, solar panel, storage.

# 3. The technology is ready: now we need frameworks, global standards, and open innovation incentives

## 3.1 An EU level framework for cooperation, aligned with global developments

**DIGITALEUROPE welcomes the Commission's plan to set minimum energy performance standards at EU level through revising the Energy Performance of Buildings Directive.** This will enable developments in integrated technology, data interoperability, and eventually equitable value chains. Importantly, minimum energy performance standards should go beyond mere thermal renovations, instead they should reflect a more sophisticated strategy for energy savings that utilises the massive potential of interconnected technologies including reporting and direct feedback to building users**.** Ultimately, this increases transparency for users and owners.

**This requires a data-model approach of the building's energy performance.** DIGITALEUROPE supports the plans as set out in the Renovation Wave for integration of Energy Performance Certificates, Smart readiness Indicators and Renovation Passports in the Digital Building Logbooks. Digital should play a key role in aligning the various tools.

**The Commission must defend its goals for the energy efficiency of buildings by pushing for timely and ambitious national long-term deep renovation strategies.** When planning renovations, all specialisations need to be integrated, from design to brick & mortar to electricity, HVAC, even till dismantling (including recycling).[8] Critical for the Renovation Wave to reach its goals in time is an approach to harmonisation that fosters innovation by aligning with existing global standards. Therefore, we need to:

- **Promote the development of an EU strategic digital value chain to support digital twins as a platform and as a tool.** The Renovation Wave envisages several funding streams, important stones are left unturned by not considering digital buildings as Important Projects of Common European Interest (IPCEI) or to support the creation of a business coalition for digital buildings. Similarly to the European Battery Alliance (looking to bring together all players for the development of a

[8] For example, Siemensstadt 2.0 demonstrates what smart city infrastructure could look like. In this system, a digital energy twin (SiDiTwin) could accompany the development of sustainable energy supply concepts, with CO2-optimal solutions, that all can be evaluated and managed virtually first and in real-time when in operation.

battery business in Europe), such an initiative could tackle a two-fold challenge:

- Creating an EU marketplace to boost deep renovation projects stimulated by the upcoming Renovation Wave with a specific goal to increase the number of connected and decarbonised buildings in Europe.
- Develop a public-private partnership to facilitate the deployment of digital technologies across the building chain in Europe.

- **Have clarity on the ambition to boost availability of building stock data in areas like energy, manufacturing, fabrication and construction.** Sustainably opening-up the European market for digital building innovators requires that these Important stakeholders are involved in the early stages of conceiving the framework for the free flow of building data. Regardless of the configuration of data sharing facilitation, to reach the full potential of innovation, some key principles should be leading. DIGITALEUROPE's recommendations on the data strategy[9] highlight that the data sharing initiatives should take into account:
  - **Fostering a partnership culture between public and private sectors.** This should be based on case-by-case voluntary contractual arrangements to best achieve the full potential of data partnerships.
  - **Assurance for companies regarding their data sharing activities.** For instance, that they can join data partnerships without falling under antitrust legislation.
  - **Data sharing initiatives should be based on non-discriminatory, collaborative and transparent rules.** Data platforms and other marketplaces should be reliable and open to all actors. Pilot projects should precede possible scale-ups.
  - **The European Single Market should remain connected to the rest of the world by leveraging global standards.** Potential regulation and self-regulatory schemes should consider the global data framework and exchanges.

[9] DIGITALEUROPE (2020). response to the EU Data strategy consultation

## 3.2 Interoperable and globally aligned common data models, protocols and open standards

A common understanding of data is essential to avoid data shifting or copying, and to ensure quality assurance. Buildings need to "speak the same language" across the EU, and preferably the world. Therefore, centralised uniform data structures and machine-readable semantics are key. This would enable interpretation-free access to all virtual data.

There is an opportunity for the EU to become a leader in digital buildings by developing globally aligned interoperability standards and models. The EU could encourage standardisation outside its borders too, increasing the effects of the digital transformation in buildings. A good example in this case is the CEN/TC 442 framework.[10]

The intention of the Renovation Wave to work towards a format for uniform machine readability resonates with the need for harmonisation. The EU should support ongoing private-sector efforts to develop voluntary standards for data formats, data quality, and descriptions of datasets, and should continue to foster APIs for data access. **These standards should be developed through a consensus-based, market-driven, transparent processes that build on existing standards from the International Standards Organization (ISO) and other leading international standards bodies.**

Furthermore, it is important to highlight that ISO-IEC-JTC1 (the Joint Technical Committee between ISO-IEC) is conducting relevant work in particular on IoT and related technologies, as well as AI.[11] More broadly, JTC1 is consolidating ontologies with a unified approach and a defined meta-architecture allowing for economies of scale and helping to serve multiple markets without the need of specific changes for each region.[12]

It is key to promote such global standards that European actors support and contribute to. For instance, with the Digital Twin Definition Language (DTDL), which is based on the open W3C standards, users can define their own vocabulary and build their twin graph in self-defined terms. [13] These languages

[10] CEN. CEN/TC 442 - Building Information Modelling (BIM)

[11] Specifically the JTC1-SC41-IoT and JTC1-SC42-AI

[12] In this field there are cooperations among multiple standardisation bodies. For example, ISO/IEC JTC1, ETSI, oneM2M and W3C are collaborating with AIOTI on accelerating adoption of semantic interoperability in the IoT. This is elaborated on in more detail in: Two Joint White Papers on Semantic Interoperability Targeting Developers and Standardization Engineers, 2019, link

[13] The Digital Twin Definition Language is a language for describing models and interfaces for IoT digital twins and is based on open W3C standards such as JSON-LD and RDF which allow for easier adoption across services and tooling. More information can be found in: Understand twin models in Azure Digital Twins, 2020, link

harness the potential of globally available, unlimited computable resources, IoT innovations, and AI applications in edge and cloud computing.

Already available data from the Building Management System and the IoT data (sensors and actuators) need to be documented in the relevant agreed standards. Here are some key takeaways for determining a common set of protocols, standards and models:

- **A change in the planning process.** Instead of a temporal sequence in the design we need to plan in parallel together on "one system." This requires a different tendering practice. The planning process should deliver the digital version of the project before anything is built, and the physical artifact should be the twin from the digital. That way new delivery models like takt production and collaborative project delivery methods gain more ground in the industry and help with the transformation.
- **A link between the many existing databases** to build machine readable, unique relations. We do **not** need a new monster database by copying data to hold it twice.
- **A globally valid solution**. The EU can and should take a pioneering position in adopting rules for the handling of data (rights/ duties) in the different phases.

## 3.3 A public procurement framework fit for the digital age

For the mass adoption of digital methods and technologies like BIM and Digital Twins the construction industry needs to be confident to invest throughout the EU.

**DIGITALEUROPE welcomes the initiative for a unified EU framework for digital permitting.** We encourage a push for construction projects throughout the EU to move to digital methods. We should encourage inclusive technology, democratised data and construction companies to join forces and think about their cooperation and open innovation beforehand.

When drafting the recommendation to promote BIM in public procurement, and conceptualising a methodology for cost-benefit analyses, the Commission could draw inspiration from these recommendations:

- **An adjustment of the public procurement guidance is a good place to start.** This should focus on moving national implementations of the public procurement directive towards necessary parallel (simultaneous), coordinated planning across all trades. This should Increase the impetus for EU Member States to put in place long-term, digital-first renovation strategies of their building stocks. Tendering processes should include

quality (wellbeing, air quality) sustainability and flexibility. For instance, ideally all public EU tenders (e.g. from Cities), both new and renovations should have BIM included with a coordinated overall design.

- **A roadmap for digital technologies in buildings that supports or mandates the roll-out of digital design and operating tools with BIM in digital construction work and renovation work.** The roadmap should promote digitisation of license permits in the EU and identify other digital tools providing added value in terms of circularity, efficiency and flexibility. The Renovation Wave initiative already defines some important principles, but to reach its ambitious goals the Commission should increase the pressure. This can include:
  - **A voluntary contract template** that describes the rights around the data, which sets an example for other projects.
  - For building projects as part of public tenders, **making simulation testing and data sharing ("building twice") mandatory in handover processes.** For example, in handovers between design and start of construction, start of occupation or operation, and start of dismantling.
  - **A European building code including BIM.**[14]

## 3.4 Galvanising support for investments in digital buildings

DIGITALEUROPE applauds the initiative to mark digital buildings projects under the 'renovate' flagship, and shares this green ambition. In *How to spend it: A digital investment plan for Europe*, targets are set for saving 26 billion tonnes of $CO^2$ emissions by digitalising resource intensive sectors, by 2025. Digitalising buildings is key because according to estimates, 15.8 billion tonnes can be saved from the electricity sector. Our recommendations to best achieve this are:

- **Leverage budgets from Next Generation EU and national recovery plans to kickstart the digital transformation of buildings.** This should be directed at BIM and Digital Twins projects because these innovative solutions will have the greatest overall return on investment in the long run. In the near future grants, technical assistance, project development support and loans can kickstart the digital transformation of the European building sector.
- **Use the Recovery Fund to allocate extra spending for retrofitting older publicly owned buildings.** This will extend the benefits of BIM and

[14] The UK system is more advanced in this regard

Digital Twins to renovation projects for social housing, schools, hospitals and town halls. Digital public-private partnerships should be a key pillar in such renovation strategies. The public sector must lead by example, partly because many Member States have not yet presented their long-term renovation strategies under the revised Energy Performance of Buildings Directive. It has been established that the required budgets will be large. At the same time, they have great potential for the mobilisation of private investments.

## 3.5 The twin challenge of jobs and green buildings

Beyond the environmental benefits, these investments will create jobs for a wide range of skilled workers, from architects, designers, installers, construction workers to data engineers and other technicians, both in cities and rural areas.

**Making the digital transformation happen while creating green jobs depends on public private partnership in upskilling workers and attracting new talent.** We need training programmes to speed up the value chain adaptation.

The timeliness of the  Pact for Skills makes for an ample opportunity to address the lack of digital skills that are necessary for unlocking the digital buildings potential. It is key that the Pact embrace all those who need a new set of skills to stay or re-enter the job market, including construction. To ensure alignment with other initiatives, a single reference platform for all stakeholders should be created.[15]

Signing up to the Charter and demonstrating commitment to the Pact for Skills should also grant signatory organisations a role in the planning programmes. For instance, in the planning of the Operational Programmes and priorities for the European Social Fund+ and European Regional Development Fund, starting with a deeper involvement in ESF+ advisory committees at national and regional level.

# 4. Case studies of digital buildings from DIGITALEUROPE members

## 4.1 Siemens: Smart Office

Siemens has launched a white paper on the Smart Office aiming for future proof solutions for your office and the environment. The ambitious vision includes

[15] DIGITALEUROPE (2020). DIGITALEUROPE's recommendations on the Pact for Skills

advisory and performance systems, fire safety, security, automation and optimisation.

Not the least, Siemens has identified how the smart solutions could help us through and beyond the Covid-19 pandemic. For instance, in 600 Siemens offices, reaching 100.000 employees, the Comfy smart office app will be deployed for safe return to the workplace. Comfy supports companies to develop smarter, more personalised workplaces for a better employee experience. Its insights offer businesses an analytics dashboard to better understand how offices are being used, informing a smarter, data-driven strategy for future workplaces. In doing so, it lays the foundation for future-proof digital workplaces.

Read more about Siemens' Smart Office white paper.

## 4.2 Panasonic: Future Living Berlin

On July 1, 2020, Panasonic announced the start of its innovative, $CO_2$-saving energy solution for the smart city project, Future Living® Berlin.

The urban beacon is an important project in the company's wider smart cities portfolio, which contribute to its focus on the decarbonisation of society. Savings goals become a reality through the installation of smart energy solutions including Panasonic's highly efficient air to water heat pumps, photovoltaic (PV) panels and storage batteries integrated into an intelligent and efficient energy management system. Read more on Future Living Berlin.

Another Panasonic Europe project transformed their own headquarters in Germany into connected building as a showcase and test bed for technologies for increasing comfort and sustainability. Among other parameters office and parking space occupancy, air quality and energy consumption are monitored. The data is used to provide information to facility managers and employees.

## 4.3 Schneider Electric: EcoStruxure

This digital solution is IoT-enabled, plug-and-play, open. This platform has an interoperable architecture. It can be applied in homes, buildings, data-centres, infrastructure and industries. It introduces innovation at every level from connected products to edge control, and apps, analytics and services.

The platform has already been implemented on more than 480.000 sites, saving up to 80% of engineering costs, 75% in maintenance costs, and critically up to 50% in carbon footprint. For instance, EcoStruxure helps Veolia Water save energy without sacrificing flexibility and reliability at their wastewater treatment plant. Read more on EcoStruxure.

## 4.4 Microsoft: Azure Digital Twins

In Azure Digital Twins, you define the digital entities that represent the people, places, and things in your physical environment using custom twin types called models. You can think of these model definitions as a specialised vocabulary to describe your business.

For a building management solution, for example, you might define models such as "building", "floor", and "elevator". You can then create digital twins based on these models to represent your specific environment.

Digital Twins Definition Language is a language for describing models for Plug and Play devices, device digital twins, and logical digital twins. Using DTDL to describe any digital twin's abilities enables the IoT platform and IoT solutions to leverage the semantics of each digital twin. This technology unlocks the power of information sharing for the twin digital and green transitions. Read more about Azure Digital Twins.

FOR MORE INFORMATION, PLEASE CONTACT:

Ray Pinto

**Digital Transformation Policy Director**

ray.pinto@digitaleurope.org / +32 472 55 84 02

Vincenzo Renda

**Senior Policy Manager for Digital Industrial Transformation**

vincenzo.renda@digitaleurope.org / +32 490 11 42 15

Thomas Hellebrand

**Policy Officer Digital Transformation**

thomas.hellebrand@digitaleurope.org / +32 492 46 78 17

## About DIGITALEUROPE

DIGITALEUROPE represents the digital technology industry in Europe. Our members include some of the world's largest IT, telecoms and consumer electronics companies and national associations from every part of Europe. DIGITALEUROPE wants European businesses and citizens to benefit fully from digital technologies and for Europe to grow, attract and sustain the world's best digital technology companies. DIGITALEUROPE ensures industry participation in the development and implementation of EU policies.

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