CIRCULAR RENOVATION IN AFFORDABLE HOUSING

REPORT FROM WORKSHOP AT
THE INTERNATIONAL SOCIAL HOUSING FESTIVAL
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Housing Europe
The European Federation for Public,
Cooperative and Social Housing
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HOUSING EUROPE

Introduction

For a better, and more sustainable future, we need to change the way we design new homes and renovate existing ones. The built environment is responsible for 40% of final energy consumption in the EU. The embodied energy in buildings accounts for up to 60% of a building's life cycle energy, with a collateral embodied carbon footprint. 25%-30% of waste streams generated in the EU derive from construction and demolition, based on an outdated and unsustainable linear "take, make, waste" model. This needs to change.

The EU has made reducing carbon emissions from the built environment one of the pillars of its environmental ambitions for the coming years, supported by the EU Green Deal and the Renovation Wave.

Faced with the need of maximising energy savings while reducing their carbon footprint, social housing providers have shown an increasing willingness to move towards circular solutions when renovating their building stock.

However, the lack of awareness of (1) the products available on the market; (2) their real impact on performance and savings and (3) cost, is making social housing providers reluctant to invest in circularity at a greater scale. This session, thus, aims to demystify circular design and renovation in a way that is engaging and interactive for attendees.

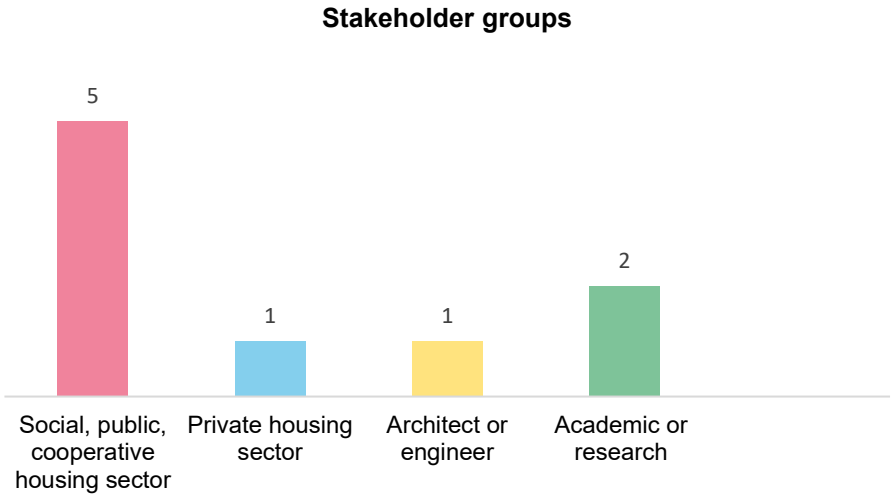
The International Social Housing Festival 2022 organised by Housing Europe during 14th-17th June gathered public, cooperative, social housing providers, city authorities, EU policymakers, bankers, urbanists, architects, and researchers in Helsinki to celebrate smart housing policies and discuss how we can overcome the multiple challenges ahead of the sector. As part of the Festival, the organising team facilitated a workshop titled ***Circular renovation of affordable housing: let us show you how!*** aimed at exploring how social housing providers can plan and successfully execute circular building renovations in a resource and cost-efficient way.

Following a need finding exercise to identify local resources and challenges, participants drew from the catalogue of measures and products developed by the Horizon 2020 innovation projects HOUSEFUL and Drive 0 to co-design a circular renovation concept for social housing matching their regional context. The methodology used is described in the next section.

Ultimately, the workshop aimed to raise awareness and provide social housing providers with the knowledge and tools necessary to support informed decisions to roll-out circular renovation in social housing buildings.

Participants

Participants were split in groups according to the European region where they were based: Northern, Western and Central-Easter Europe. Most participants worked in the social, public, cooperative housing sector.



Northern Europe group

Western Europe group

Central-Eastern Europe group

Methodology

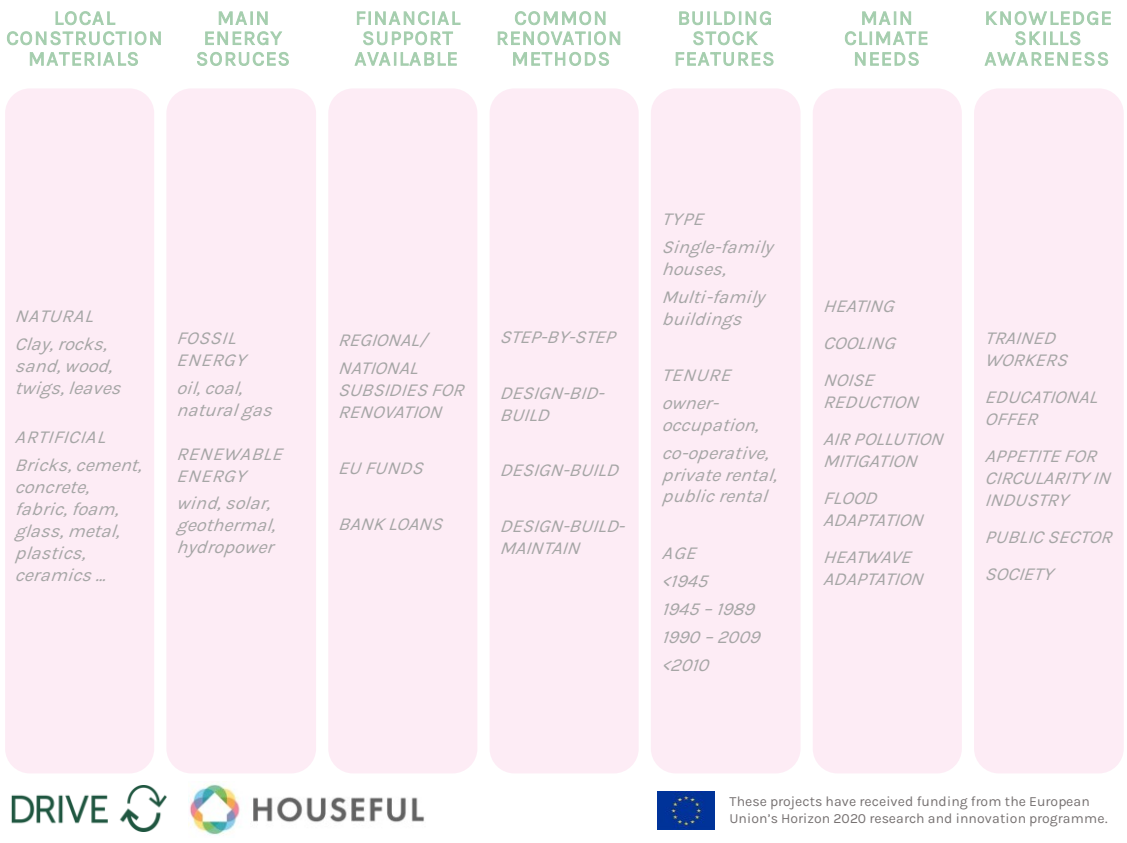
The workshop was divided into two main exercises:

i. Need finding

Participants of the three identified regions were asked to map their local circular renovation context, with a focus on the social housing sector. Post-its were used to write and stick ideas into the canvas. The dimensions assessed were:

- Local construction materials
- Main energy sources
- Financial support available
- Common renovation methods
- Features of the building stock
- Climate needs
- Knowledge, skills and awareness

This first exercise paved the ground for the second one, as it allowed participants to create an overall picture of the available resources, needs and readiness toward circular housing renovation in their region. With this in mind, it became much easier to think of the most appropriate circular measures to be used for their own social housing renovation project.



Canvas used for the Need Finding exercise

ii. DIY: design your own circular renovation concept for social housing

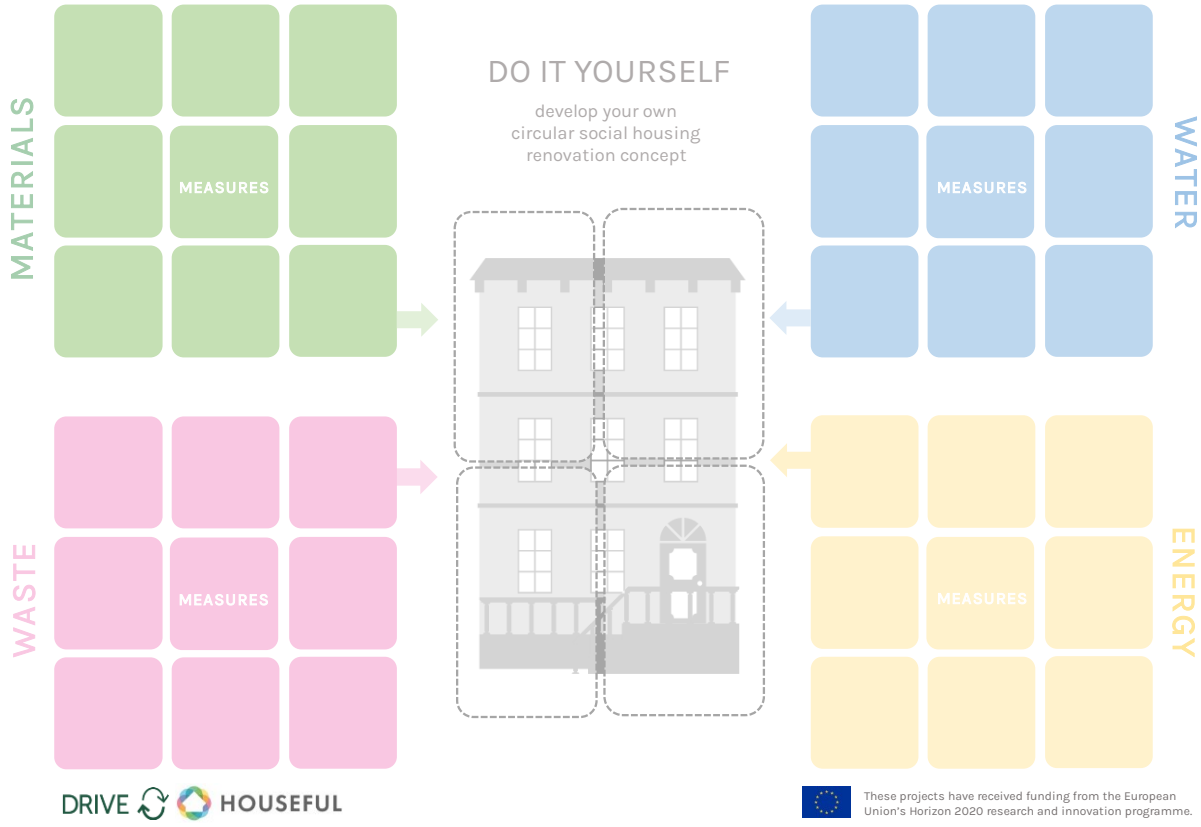
For the second exercise, a set of poker-size cards was prepared presenting all circular measures that have been developed to date by the technical suppliers of the HOUSEFUL and DRIVE 0 projects. While some of these have already been installed and tested in real-life housing renovation scenarios, others continue to be work in progress. Measure cards included a short description, an illustration and were classified into four groups: materials, water, energy and waste (see below a sample from each group). The measure cards were accompanied by a brochure showcasing the products and corresponding suppliers associated with the different measures (see below a sample for the materials brochure).

Sample of measure cards

Sample of circular products brochure

Based on the regional context drawn in the first exercise and the circular measures presented, groups were then asked to co-design a circular renovation concept for a social housing project.

All circular measure cards were placed in their matching category area by the facilitator (materials, water, waste and energy). Participants had to pick the most appropriate cards based on the regional resources, needs and readiness previously identified and placed them in the middle of the canvas (see below).



Canvas used for the DIY exercise

Working groups

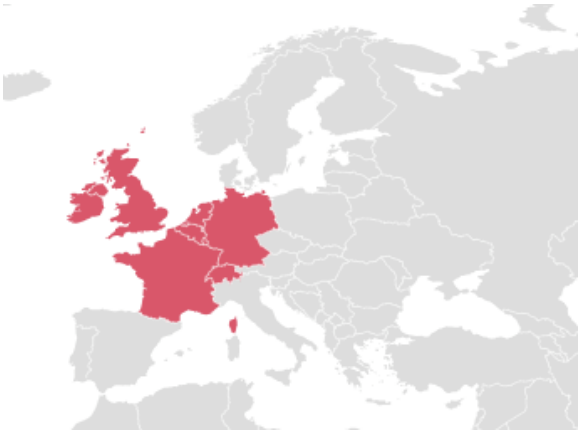
Results and regional overview

The following circular renovation measures were chosen by the different groups during the workshop based on the needs identified in their region:

Overview of selected circular renovation measures by region

Category	Subcategory	Western	Northern	Central-Eastern
Materials	Building Materials Passport		✓	✓
	Reusing existing building materials			✓
	Reusable, recyclable or dismountable materials and/or products			✓
	Using bio-sourced materials	✓	✓	
Water	Harnessing rainwater			✓
	Reusing greywater		✓	
	Reusing blackwater		✓	
	Reuse of un-segregated water			
Waste	Biogas production	✓	✓	
	Compost production			✓
	Reduce waste and facilitate waste management		✓	✓
	End-of-life waste management		✓	
Energy	Renewable energies	✓		✓
	Insulation	✓	✓	✓
	Green walls and roofs			✓
	Energy efficient windows	✓	✓	✓
	Shading	✓		✓
	Hot water, Heat and/or cold generation		✓	✓
	Prefabricated, multifunctional and integrated skin solutions		✓	✓

Western Europe



The Western European Region was represented at the workshop by experts from the Netherlands, Belgium, and France. These are countries which have **generally high shares of social and affordable housing** (up to 30%). Thus, the potential and the need for social housing to be central to plans for the transition to a more circular economy in the built environment is clear.

i. Need finding

Group participants were able to agree on a number of common points. In terms of the **climatic needs, 'heating', rather than 'cooling'**, was the main need in most homes over the course of the full year. Dealing with **air pollution** and ensuring that homes offer healthy environments for residents was also important in many urban areas. In recent years, **extreme weather events, such as storms and flooding**, have become more common, and homes need to be adapted to better protect households and their communities.

With regard to construction materials, even modern **buildings rely on highly unsustainable and extraction-based materials** such as cement, clay tiles and bricks, and metals such as steel. Natural and bio-sourced materials are not as plentiful as in other parts of Europe, though materials such as **hemp and wood are gaining more attention**. The idea of 'Buildings as Materials Banks' (BAMB), meaning that the materials in a building can be viewed as a 'store' of value and can be reused, is also becoming a more popular concept amongst architects and building owners, especially in the Netherlands where the concept was first developed.

Finally, while some **financing schemes** have been developed to support sustainable building renovations, these **are generally not designed specifically to promote circular methods of renovation**; though they can be used for this purpose. The lack of specific financing schemes for circular renovation points to the fact that circularity is still not seen by policymakers as a standalone issue, but rather as a sub-set of renovation or building development activities.

ii. Circular renovation concept

In terms of which circular products and solutions were well adapted to the regional context, the Western Europe group had doubts about how 'market-ready' some of the options were. This reflects a number of factors, including perceived incompatibility with local regulations or standards. For example, **treating and reusing water was flagged as a likely issue** by participants. Issues like building insurance for homes that use reused and recovered materials were also discussed.

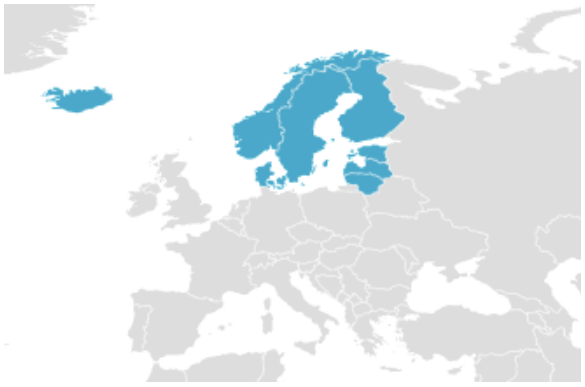
The use of bio-sourced materials was seen as something essential going forward, with agreement that the region had significant untapped potential in this regard. **Finding a productive use for organic waste from homes** was also supported, with biogas being one option if access to the municipal infrastructure is granted. **Passive solutions for heating and cooling such as energy-efficient windows and pre-fabricated insulation façades were also seen as being essential,** and indeed, they are already becoming more common in the construction sector. **On-site energy production** was also viewed as being a common-sense approach, especially given the strong fall in the cost of solar panels in recent years.

Overall, though, the result was that the Western Europe group chose a more 'limited' circular renovation than the other groups.

Selected circular measures in the Western group

Category	Subcategory	Western
Materials	Using bio-sourced materials	✓
Waste	Biogas production	✓
Energy	Renewable energies	✓
	Insulation	✓
	Energy efficient windows	✓
	Shading	✓

Northern Europe



The Northern European Region was represented at the workshop by experts from Iceland and Finland. These are countries which have very different historical approaches to housing, with the former historically focusing on owner-occupiership (currently around 80%), with relatively small social and cooperative housing sectors, while in the Finnish case, the social and affordable housing sector accounts for over 20% of the housing stock. Available building materials, construction techniques, and design norms are also quite different.

i. Need finding

The Northern European climate is defined by **long periods of cold wintery conditions**, including heavy snowfall and freezing temperatures in some places. Thus, **'heating'** has historically been the main challenge when it comes to providing good quality homes. However, **global warming has brought new challenges**. In Finland, warmer summer months require heat adaptation strategies for buildings. In Iceland, melting glaciers have caused flooding and increased precipitation, which can cause landslides, amongst other issues.

While Finland is around three-quarters forest, non-biosourced, **extractive materials like cement, concrete, sand and glass are still at the core of most modern buildings**. Extractive materials are also the basis of housing in Iceland, where metal facades have also been common in-house construction. The use of wood in both countries, and **a conscious effort to reduce the use of concrete**, are current trends in the development of new homes.

In terms of the energy supplied to homes, Iceland is in the enviably position of having access to sufficient geothermal and hydropower resources to cover most household energy needs. These are the basis of **district heating** networks there. In Finland fossil fuels are still widely used to produce energy, while the use of nuclear power is planned to be upscaled in the coming years. **Biofuels** (from forestry) are also an important part of the Finnish energy system.

In Finland, the Housing Finance and Development Agency (ARA) provides affordable loans for the development of housing. In Iceland, special loans for the development of social housing are also available. However, as in the Western European Region, participants were **not aware of financing schemes to specifically support circular development or renovation**.

When it came to the development of the affordable housing stock, the presence of ARA, but also Finland's system of cost-based social housing helped to support a **"Design-build-maintain" approach**, where homes are built with the very long-term in mind, thus requiring the use of long-lasting materials.

Both the Finnish and Icelandic attendees felt that there is a need to increase the requisite skills and knowledge in order to implement circular solutions in the built environment. Therefore, without specific training and awareness raising efforts, progress on circularity could be slow moving.

In terms of recent changes in needs, COVID has influenced the **demand for single-family homes**, as households search for more space. The **excess savings** seen by many households during the lockdowns has also seen property prices increase, as people have access to larger down payments.

ii. Circular renovation concept

In terms of the products and solutions that were chosen by the Northern European group, there was quite a lot of enthusiasm, with some participants unfamiliar with some of the solutions. Thus, **there is a 'knowledge gap' to be overcome** with the use of some solutions.

With regard to materials, participants were supportive of the concept of **having mandatory building materials passports**, in order to force the adoption of new thinking when it came to the development of buildings. **End-of-life waste management** was also seen as important. **Upscaling the use of bio-sourced materials, especially wood,** was also seen as being both necessary and feasible. However, this must be based on sustainable forestry practices. Unlike the Western European Region, no concerns were raised about potential regulatory issues in the reuse of water. A lack of sunlight for much of the year means **solar energy may not be the most economically sound investment to make**. However, with the need for heating in the colder months, **a focus on insulation** was emphasised. Lastly, **hot water, heat and/or cold generation was considered a key measure** for both countries.

Selected circular measures in the Norther group

Category	Subcategory	Northern
Materials	Building Materials Passport	✓
	Using bio-sourced materials	✓
Water	Reusing greywater	✓
	Reusing blackwater	✓
Waste	Biogas production	✓
	Reduce waste and facilitate waste management	✓
	End-of-life waste management	✓
Energy	Insulation	✓
	Energy efficient windows	✓
	Hot water, Heat and/or cold generation	✓
	Prefabricated, multifunctional and integrated skin solutions	✓

Central and Eastern Europe

The Central and Eastern European Region was represented at the workshop by experts from Slovakia and Poland. These are countries where **housing was for a long time largely state-developed**, often meeting quite low standards of thermal comfort. At the same time, **in the early 90s, former communist states privatised their housing stocks *en masse*, meaning that today home-ownership predominates, and the availability of public housing is limited**. Although, the cooperative housing sector is large in many countries in the region. The region does also include Austria, which has one of the most sophisticated and comprehensive systems of social housing provision in Europe.

i. Need finding

The Central and Eastern European **climate is overall 'moderate'**, though with some areas experiencing very warm summers (southern part), and very cold winters (northern part). Climate change has also led to more extreme weather events, including heavy rain and flooding. At the same time, **a reliance on polluting fossil fuels**, as well as the presence of heavy industry, in many countries negatively impacts the air quality. In the case of Poland, the use of coal is still common.

Construction in the region has been defined by the use of unsustainable extractive building materials; such as cement, clay, bricks and metals. However, **wood has also been used,** and is becoming more popular in some parts of the region.

Most people in former communist states live in multi-family buildings, with most built in the 1945-1989 period. These are typically of low thermal quality and therefore **the need for renovation is significant**. The skills and knowledge to do this in a circular way is lacking, and thus public investment in training and so on is required.

There are opportunities for many parts of the region though. As an area that tends to have lower levels of development and household incomes, **access to the likes of EU structural funds is proportionally higher**. This is good news in the context of the current focus by the EU on financing the green transition.

ii. Circular renovation concept

In terms of the circular concept that was developed by the group, there was **a very strong emphasis on energy efficiency, insulation, and passive solutions**. This is not surprising given the overall low energy rating of a large part of the building stock. The possibility to make use of building roofs to generate renewable energy was also supported in this regard.

With a high level of waste from the construction sector, as older buildings are demolished or renovated, the need to rethink the current approach, and to look to circular solutions of waste management and prevention were also discussed. In this regard, there was noted **potential for the reuse of existing materials**; though the issue of certifying these materials was mentioned.

With regard to water, the main solution was to **harness and use rainwate**r. The potential for modifying current systems to facilitate grey or black water treatment and reuse was uncertain, with legislation and regulations perhaps being one issue.

Selected circular measures in the Central-Eastern group

Category	Subcategory	Central-Eastern
Materials	Building Materials Passport	✓
	Reusing existing building materials	✓
	Reusable, recyclable or dismountable materials and/or products	✓
Water	Harnessing rainwater	✓
Waste	Compost production	✓
	Reduce waste and facilitate waste management	✓
Energy	Renewable energies	✓
	Insulation	✓
	Green walls and roofs	✓
	Energy efficient windows	✓
	Shading	✓
	Hot water, Heat and/or cold generation	✓
	Prefabricated, multifunctional and integrated skin solutions	✓

Conclusions

The workshop was overall quite successful. It succeeded in its main stated ambition to first 'inform' and then 'engage' participants. The general feedback from participants was that they enjoyed the gamified activities, and that they found it to be an effective way to learn. Some participants even expressed an interest to run follow-up events with colleagues, based on the same structure.

In terms of the main messages coming from the event, it is clear that **interest in 'circularity' as a principle is high**; in part thanks to increased discussion of the topic in recent years, including at the EU-level. This message is then feeding down to the practitioners in the built environment.

However, the "**interest" in circularity is not necessarily being matched by 'knowledge' of circular solutions and processes**. While passive building standards and solar panels have successfully become mainstream, participants were completely unfamiliar with many of the solutions and products presented at the workshop. Keeping in mind that all attendees work in the area of housing, in one way or another, this suggests that significantly **more work needs to be done in order to raise awareness of these solutions.**

Another important take-away from the workshop was that, **the social, public and cooperative housing sector have a strong willingness and appetite to experiment and implement innovative renovation solutions**. Having said that, **current public procurement rules, to which many housing providers are held to, often reward price over sustainability**. This poses major obstacles to the upscaling and replication of successful innovative renovation practices. In this regard, stimulating a critical mass of demand for more sustainable goods, services and process with instruments such as the so-called Green Public Procurement (GPP) is key to accelerate the transition in the sector.

One of the ways in which this can be facilitated over the short-to-medium term is by **increasing the number of lighthouse circular projects**. This is particularly important given how often the issue of skills and training was mentioned by participants in the workshop.

Projects like HOUSEFUL and DRIVE 0 have an important role to play in generating the skills, knowledge and awareness. Their true success will be measured in terms of how many 'follower' buildings they can inspire to apply their solutions.

In that regard, while the workshop showed that many challenges remain, if policymakers are motivated, cognisant of local needs and opportunities, and can be clear and relatable in their messaging, there is an audience of people there to listen, learn, and adapt their practices in order to move us further along the road to a meaningful circular transition in the built environment.

Annex

Summary of needs identified in Western Europe during the workshop:

Local construction materials	Clay: bricks, tiles Building materials: wood frames, bricks, tiles Recyclable materials: concrete
Main energy sources	NL: natural gas, solar, wind BE: nuclear, gas, wind, solar FR: gas (bio and fossil), solar, nuclear
Financial support available	EU funds, national funds Social housing providers also have access to private financing
Common renovation methods	NL: Step by step, design-build
Building stock features	NL: 30% social housing 50% owner-occupied BE: single-family houses + apartments in larger cities FR: 20% social housing In both France and Belgium, a ban on renting poor performing energy rated homes either is, or will soon, exists
Main climate needs	Heating, air pollution in cities, material scarcity, labour force to make transition, flood adaptation, enormous increase of energy costs
Knowledge skills awareness	Trained workers, awareness in the construction sector Lack of standardisation of renovation process

Summary of needs identified in Northern Europe during the workshop:

Local construction materials	Iceland: sand, wood (natural); concrete and cement (artificial) Finland: wood, concrete, cement, glass
Main energy sources	Geothermal, hydropower, oil, nuclear power
Financial support available	Finland: renovation subsidies in ARA (state support), EU funds Social bonds, state support, bank loans, bonds ARA
Common renovation methods	Design-bid-build Design-bid-maintain
Building stock features	Single-family houses Owner-occupation Private rental
Main climate needs	Finland: mostly heating Cement reduction
Knowledge skills awareness	Directive for circular maintenance renovation

Summary of needs identified in Central-Eastern Europe during the workshop

Local construction materials	Natural: clay, sand, wood Artificial: concrete, bricks, cement
Main energy sources	Coal, atomic
Financial support available	EU funds Regional/national funds
Common renovation methods	Design-bid-build
Building stock features	Multi-family buildings Owner occupation 1945-1989
Main climate needs	Heating, cooling, air pollution, flood adaptation
Knowledge skills awareness	Public sector, society

The DRIVE 0 concept is based on developing circular deep renovation solutions and supporting consumer centred business models for 7 specific study and demonstration cases as real environments. The solutions include innovative technical products, innovative construction processes, combined with process optimisation and digitalisation (with BIM as a main carrier) and innovative business models. The selected cases are already in preparation and each them has a specific local driver for the need of a holistic and circular deep renovation, which is translated in case specific challenges and tasks and case specific key performance indicators.

The results of the project are expected to trigger and average of 75% of energy savings from deep renovation (a total of 0,645 GWh/year) and greenhouse gases emissions reduction (total 20868,3 tCO2-eq/year). All renovated buildings in the pilots are renovated to a level of NZE or 'zero on the meter'. However, the DRIVE 0 holistic circular renovation strategy will lead to a total high performance of the renovated buildings, including energy, indoor environmental quality and wellbeing.

DRIVE 0 will also allow to reduce the time needed on site for renovation works by 20% compared to current national standard practice. The use of prefabrication and plug & play smart connectors can lead to an important cost/output optimisation with a more than 35% improvement compared to the traditional renovation process. Prefabrication can lead to an enhanced quality control of the automated BIM controlled production process which drives a reduction of construction failure costs to less than 5% compared to the traditional 15 to 20%. The application of prefabricated components reduces the number of stakeholders involved in the deep renovation process (e.g., the replacement of the traditional contractor by direct application b by direct application by subcontractors) leading to possible cost savings of 10%.

The HOUSEFUL project is an EU HORIZON 2020 funded initiative. Its core aim is to "develop and demonstrate an integrated systemic service (HOUSEFUL Service) composed of 11 circular solutions". In simple terms, the project has developed, implemented, and is currently testing a highly-circular system for building renovation. This includes practical solutions to reduce the use of new raw materials, plan for the future deconstruction of buildings (in order to reduce waste at the end-of-life phase), collect, treat and reuse rainwater and wastewater, convert bio-waste into bio-gas, make the most of nature-based solutions (NBS), and renovate buildings to be as efficient as possible, by using passive standards and techniques. Renewable energy generation is also key to the success of the HOUSEFUL Service.

The package of circular measures developed in HOUSEFUL will have the expected result of reducing the amount of construction waste destined for landfills from 40%, to 10%. It will allow for the recovery and reuse of over 95% of organic food-waste from homes, as well as the capture, treatment and reuse of over 90% of rain, grey, and black water. Non-renewable-based primary energy consumption will also fall by at least 50%, which will contribute to a roughly 60% reduction in CO_2 emissions from the homes.

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DRIVE 0 has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 841850.

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