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BAMB IN PRACTICE

BAMB IN PRACTICE

Practical real-life examples tested and demonstrated the project tools in various settings, including a transformable wooden building and training unit achieving nearly zero waste (B.R.I.C, Brussels), a circular refurbishment of a concrete framed building for multiple uses (CRL, Brussels), a transformable steel-framed building module with exchangeable components (GTB Lab, Heerlen), and an interactive traveling exhibition showcasing Materials Passports and circular materials (REMs).

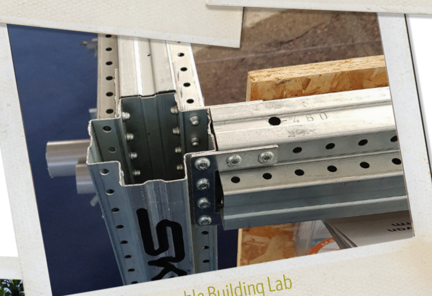
The BAMB pilots and prototyping have demonstrated that BAMB tools and methodologies can prevent upward of 75% of all waste generated and raw material used over the course of several building transformations. By investigating new design, manufacturing, construction and maintenance approaches for dynamic and circular buildings, the pilots demonstrated that buildings can function as banks of valuable materials. BAMB tools do help to preserve the buildings, components and materials' residual value, which makes it possible to capitalize on them by high quality reuse and recycling strategies.

Rerversible Experience Modules (REMS) pilot

Build Reversible in Conception (B.R.I.C.) pilot

Rerversible Experience Modules (REMs) pilot

Circular Retrofit Lab (CRL) pilot

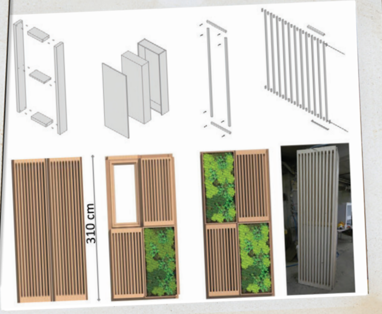


Green Transformable Building Lab (GTB-Lab) module

Build Reversible in Conception (B.R.I.C.) pilot

New Office Building pilot

Green Transformable Building Lab (GTB-Lab) module



Green Design Centre (GDC) - Facade reversibility options

REBURG - THE WORLD'S MOST CIRCULAR CITY

Imagine a city where the concept of 'buildings as material banks' is fully developed:
• A city where buildings are designed to be easily transformed and disassembled in to smaller parts for other purposes!
• A city where information on buildings and building products is shared in order to get building materials and products into valuable technological and biological cycles and eliminating the concept of waste;
• A city where circular businesses are thriving by creating mutual benefits for building professionals, manufacturers, financers and building users through sustainable product service systems.
Something for the far future, you would think.
Visit http:// Reburg.world to find out how such a circular city could look like and what the first signals of change are... It's already happening today!"

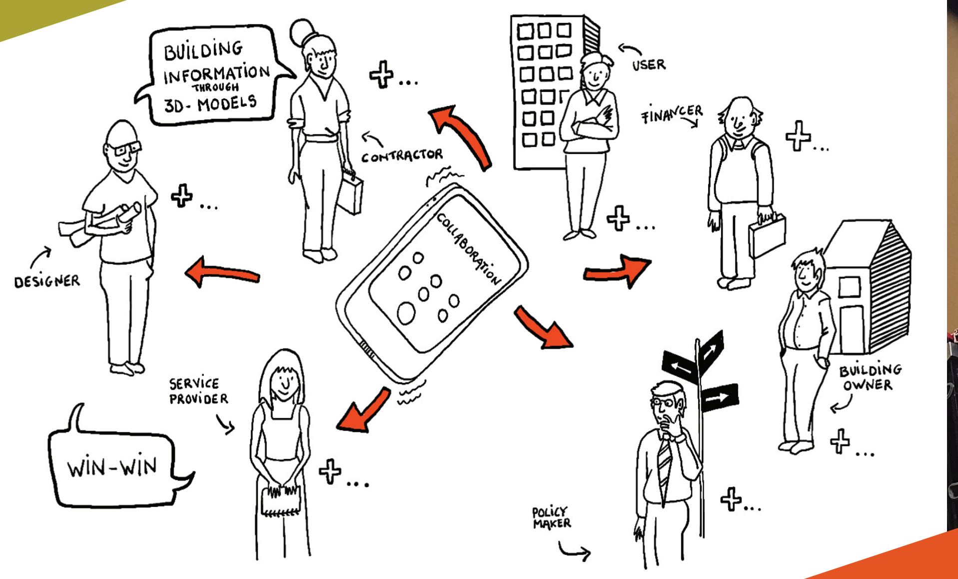
FRAMEWORK FOR POLICIES, REGULATIONS AND STANDARDS

FRAMEWORK FOR POLICIES, REGULATIONS AND STANDARDS

According to BAMB, the Systemic Changes required for a circular built environment are:
• Change in design culture from mono-functional buildings to material banks;
• Change in value definition from financial cost & benefit to societal added value;
• Change in collaboration across all actors from a chain to a network.

Throughout BAMB, the impact of current policies, standards and regulations on the implementation of circular and dynamic buildings have been considered and analysed. Research has been undertaken at different policy levels (EU, national, regional, and local) and for different links in the circular value network and the results have been collated and analysed. Best practices from around the world which illustrate behaviours and mechanisms that would support the move to a dynamic and circular built environment were gathered. Success factors and gaps were identified.

This work, along with interactions with different stakeholders and policy platforms, has led to the development of recommendations for the future development of policies, standards and legislation that will better favour the applicability of dynamic and circular building design. Key recommendations which should be taken into consideration when planning future policy and regulation for the circular economy include the following:
• Existing EU level laws on energy performance, waste management and construction product regulations should be extended to support the implementation of dynamic and reversible buildings by integrating Materials Passports and Reversible Building Design Principles;
• Clear and measurable objectives should be set;
• External environmental and societal costs should be integrated in the value calculation of any new policy;
• Public procurement should be used to promote change and should be harnessed as a mechanism to internalise external costs. Public Procurement should also support new types of business models and ownership which will lead to other types of collaboration;
• The use of a mixture of legislative, taxation and budgetary measures should be considered in order to promote the transition to dynamic buildings;
• Authorities should ensure that room for experimentation is included in policy and regulation;
• A collaborative approach in developing policy should be taken to ensure that policy changes take into account the reality of stakeholder groups and that targets set for actors are appropriate and likely to be adopted.



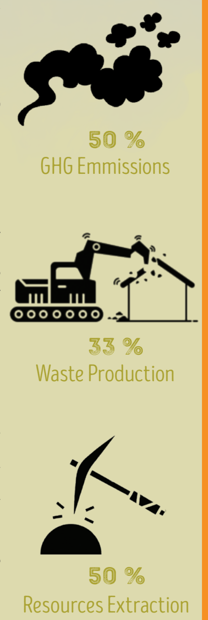
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 642384.

BAMB
BUILDINGS AS MATERIAL BANKS

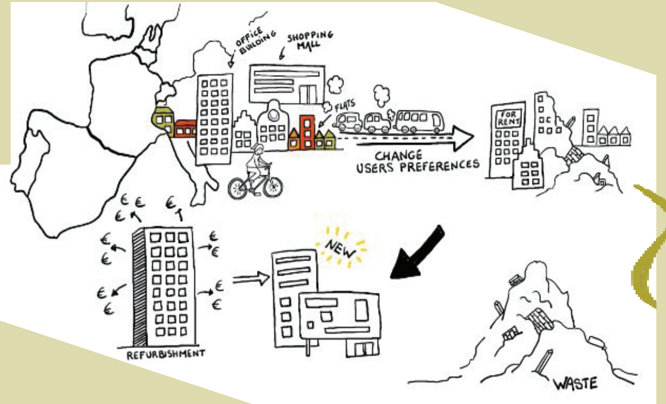
THE CHALLENGE

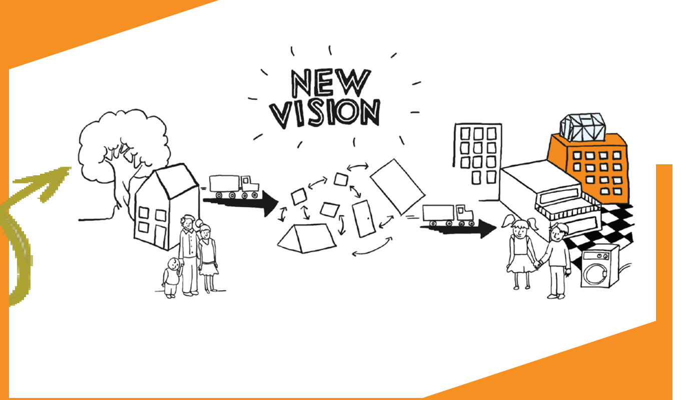
The construction and use of buildings account for about half of all the extracted materials[1] as well as half of the total energy consumption[2], about a third of our water consumption[3] and generates about one third of all waste in the EU[4]. The building sector accounts for 50% of global greenhouse gas emission[5] which makes it the largest single contributor to greenhouse gas emissions globally. These negative impacts result from a traditional linear approach which predominates in the construction supply chain. Nowadays, when societal or user needs change, these linear and mono-functional buildings usually become outdated or even obsolete at 20% - 30% of their potential life span resulting in a high rate of building vacancy and premature demolition.

We need to act differently as in the coming decades greater rates of urbanization are expected and significant infrastructure investments are to be made. Experts suggest that on a global scale, 60% of the buildings that will exist in 2050 are yet to be built, and in emerging economies such as India, this figure reaches 70% by 2030[6]. We need to change the building industry from its non-sustainable linear and static thinking of Take - Make - Dispose.



[1] COM (2011) 571, [2] COM (2007) 860, [3] COM (2007) 414, [4] UNEP-IETC, 2002 , [5] European Commission (DG ENV) - SR1 Final Report Task 2, February 2011, [6] NRDC-ASCI, Constructing Change, 2012





THE BAMB PROJECT
BUILDINGS AS MATERIAL BANKS

In the BAMB project, 15 partners from 7 European countries worked together with one mission - enabling a systemic shift in the building sector where dynamically and flexibly designed buildings can be incorporated into a circular economy. Within BAMB, buildings are considered as temporary repositories of valuable building products, systems and materials that can be recovered for other applications. Only a limited amount of primary resources have to be imported to keep the cycle running and only a limited amount of materials end up as waste that needs to be disposed. Instead of imposing an environmental burden and a cost, buildings are therefore a bank of valuable resources.

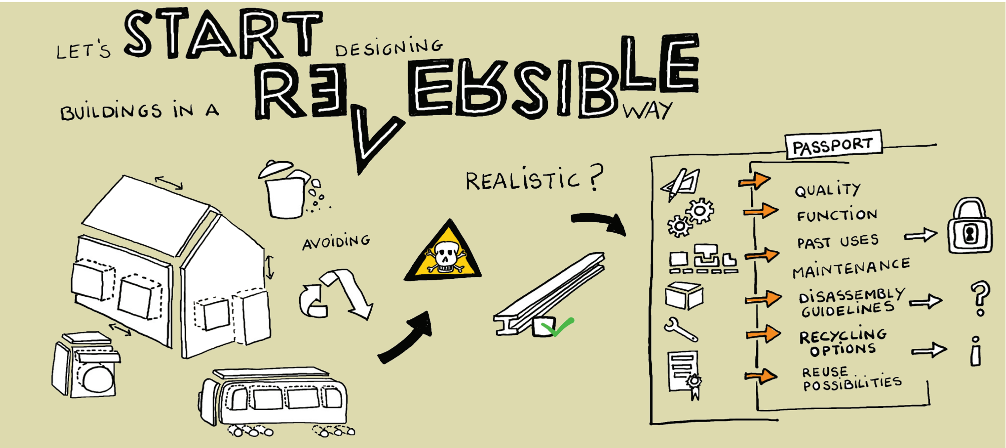
BAMB has developed and integrated tools that can enable the systemic shift of the building sector into a circular industry based on Reversible Building and Materials Passports, supported by new business models, policy suggestions, management propositions and decision-making models. During the BAMB project, these new approaches have been demonstrated and refined with the inputs from 6 pilots.

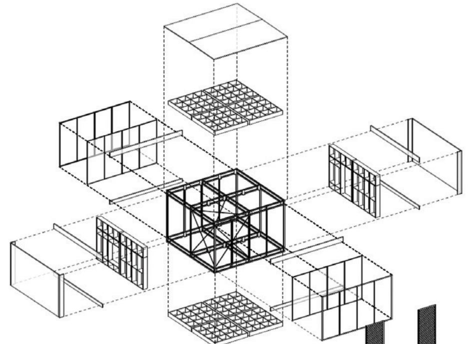
REVERSIBLE BUILDINGS

Reversible Buildings (RB) can be adapted to changing user needs and requirements, and facilitate the reuse of building components in the same building(s) or in other applications. RB are designed and assembled in such a way that they are easily disassembled into smaller independent parts or components without causing damage to other building parts and materials. By doing so, material resources are used in a highly productive way. Waste is avoided and the life span of the building components is extended. This concept is not restricted to new buildings, it is also applicable to refurbishment projects.

RB is a backbone of circular economy in construction, it is a driving force behind circularity of building materials and their potential multiple value propositions for future applications. Design solutions that can guarantee high transformation potential of building and high reuse potential of its materials are identified as reversible and circular. To make RB a reality, the use of reversible connections is imperative! Moreover, functional separation of materials and disassembly and life cycle coordination will determine the recovery value of building products. A series of indicators that allow the quantification of reversibility by checking technical Reuse Potential of building elements (8 indicators) and building level Transformation Capacity (12 indicators) was developed. Reuse Potential and Transformation Capacity determine ultimate reversibility of buildings and their ability to be modified to meet new use requirements without demolition and with high recovery value of building products.

In order to guide building (system) designers, product developers and to inform building owners about the reversibility of buildings and building products an inclusive toolkit for the design and assessment of RB on multiple levels was developed. This toolkit consists of Transformation Capacity and Reuse Potential assessment tools as well as the reversible building design protocol with a virtual simulator.

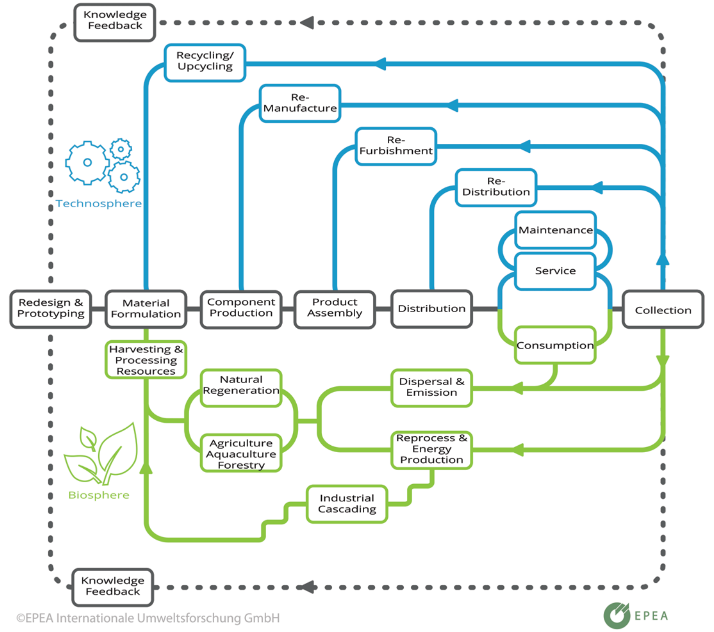




GTB-Lab

GTB-Lab + ODS Klockner

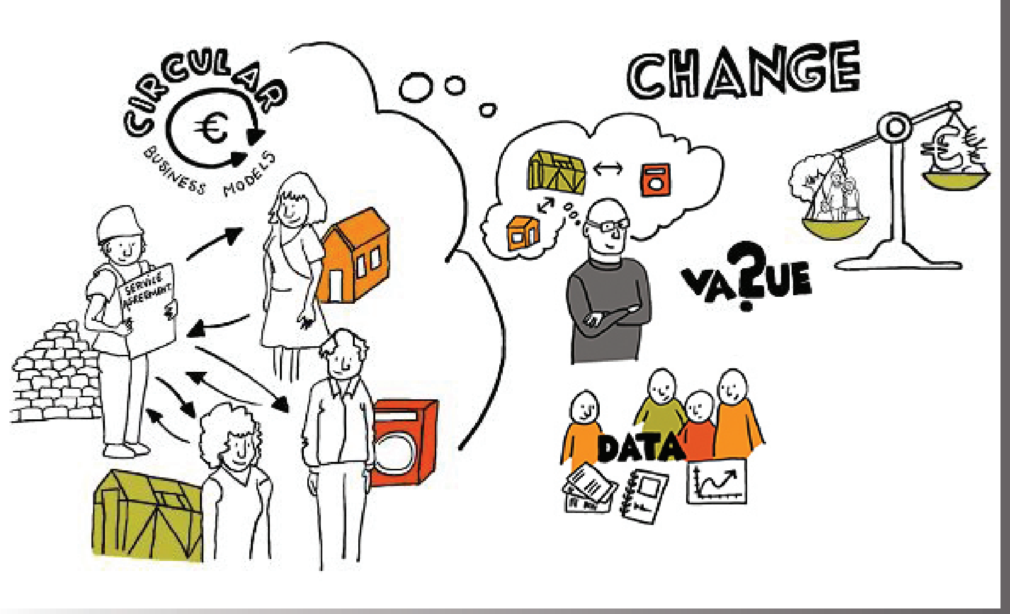
REVERSIBLE BUIDINGS



MATERIALS PASSPORTS

Materials Passports are data sets related to products that provide information about the circularity of those products. Synergizing with Reversible Building Design and product design, Materials Passports aim to optimise reuse and to maintain residual value of products over time. Doing so by documenting information relevant during reuse decisions, such as information on technical and health characteristics of products, data on current and historic use of installed products, or guiding information on how to maintain and (dis)assemble a product in order to facilitate reuse, reprocessing or recycling of the product as a whole or of its components. BAMB developments on Materials Passports are being employed in ongoing initiatives to help the emerging Materials Passports ecosystem move towards standardisation and harmonisation. This in order to enable optimal collaboration between the diverse parties active in this ecosystem, such as product manufacturers, building evaluation platforms, product libraries and market places.

MATERIALS PASSPORTS



BUSINESS MODELS

A business model describes the way 'how companies actually make money' by defining the value proposition and build up an understanding if the model is economically viable. This is done by providing insights on how to create value, and deliver the offerings to the target customers segments, including potential revenues generated. In BAMB, the focus was on how the project results would need to connect to the different business models of the users (or roles) in the construction industry and what is needed to operationalize this from a BAMB result point of view.

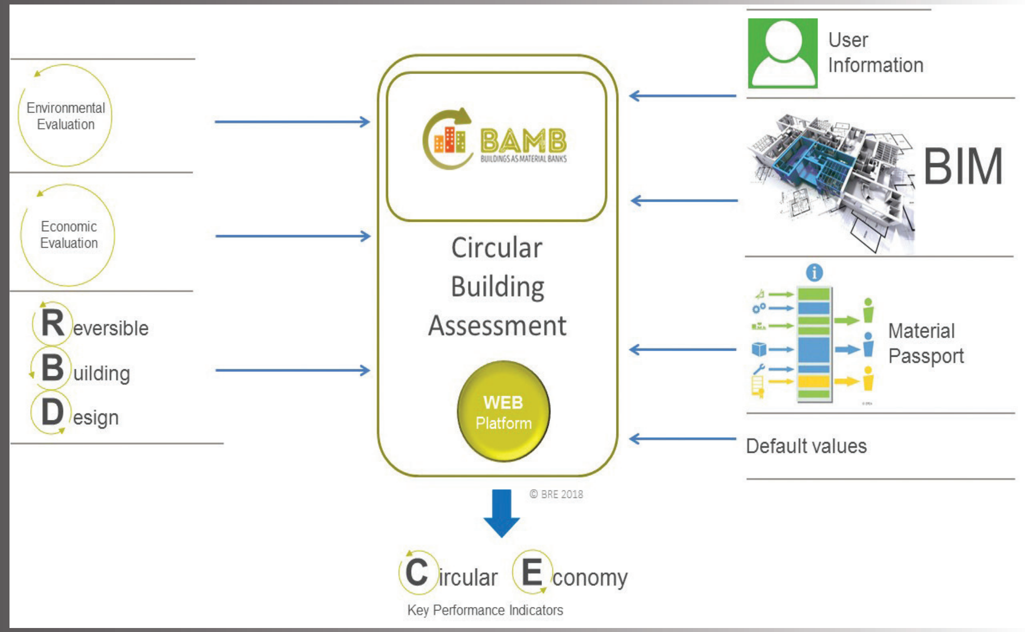
The concept of material banks contains many business opportunities for the different roles in the built environment where new or existing value propositions towards customers are reinforced with strategies to create closed material or component loops and ways to intensify collaboration within the industry value network. It was found that Reversible Building Design can reduce investment risk and that Materials Passports can help to lower financial barriers for building component re-use. A valuation method was developed to monetize such risk reduction benefit into a premium in the building market value, which can lead to increased market demand for reversibly designed buildings.

BUSINESS MODELS

CIRCULAR BUILDING ASSESSMENT TOOL

Construction and refurbishment projects require many decisions regarding the building configuration and choice of building products and components. In order to support decision-making processes in an effective way, the performance and added value of design options for the user(s) and society should be carefully considered before making a selection. The Circular Building Assessment (CBA) approach has been developed to evaluate the potential whole life sequences of using reclaimed products instead of new (reused content), implementing design for deconstruction principles (increased reuse potential), and extending the life of buildings through increased adaptability and flexibility (improved transformation capacity). Such an assessment requires a multiple life cycle approach, in which aspects, such as environmental impacts, financial costs, health consequences and social value are modelled.

The context of each building or asset is very important in determining the optimal outcomes across these aspects, as is the data availability from early concept through to detailed design stage. Enabling data acquisition and making certain decisions early in the design process have been key in delivering a user-friendly CBA software platform. The prototype platform simplifies the Circular Building Assessment process, whereby building and building product data are extracted via building information model export files, materials passports and other supporting databases. This data is combined to automatically calculate and report circular building design scenarios compared to a business as usual, linear, baseline scenario. Further work to develop automated, commercially available, CBA software will enable this decision making support for clients, designers and their advisors to be readily accessible.



CIRCULAR BUILDING ASSESSMENT