

Building Materials Passport

Materials passports contain information about the quality, origins and location of materials and products used in the construction of buildings and other construction objects. All in such a way that owners and/or managers of real estate and infrastructure always have up-to-date information on the financial and circular value, toxicity, demountability and reuse potential of the materials and products applied in their properties.





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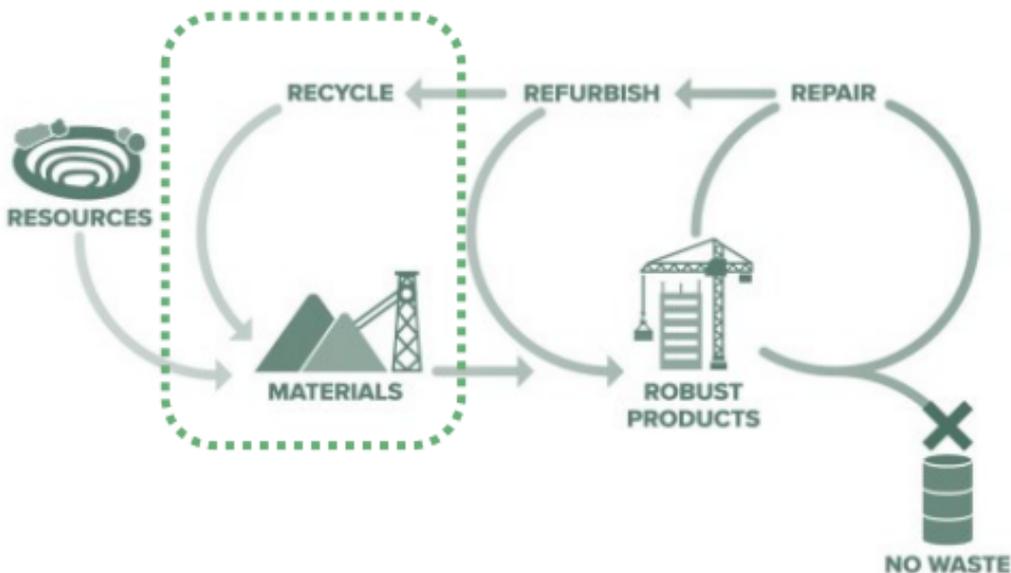


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Reusing existing building materials

The CO₂ produced for the manufacture of structural concrete (using ~14% cement) is estimated at 410 kg/m³ and uses finite resources. Likewise, around 10-12 kg of CO₂ are emitted to process one kg of raw steel. Reusing existing building materials can therefore reduce emissions, but also help to retain the value of buildings over their lifetime and support the local economy.





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Reusable, recyclable or dismantlable materials and/or products

Materials, such as concrete, timber, roof tiles and bricks, can be used to produce prefabricated, fully reusable buildings. It can be done by maximising the amount of valuable materials recovered; designing reusable building components; improving Construction and Demolition Waste (CDW) management through digitisation; and increasing the acceptance of CDW-based products. CDW-derived materials can be effectively reintroduced in the production cycles of concrete and timber components with a replacement rate of 50-85 %.





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Using biosourced materials

Using building materials based on natural and renewable sources is more sustainable and circular than materials based on finite and/or carbon intensive exploitation. For example, 'Hemp Concrete' is made by mixing lime and hemp. It is used to insulate walls and roofs, and to make insulating coatings.





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Reusing greywater

Greywater is wastewater from non-toilet plumbing systems, such as wash basins, washing machines or showers. It can be separated with retrofitting measures in existing buildings. Greywater can be treated using innovative nature-based solutions for indoor application in multi-level green walls with minimum energy cost ($<1.5\text{kWh/m}^3$) and disinfected using commercial O₃/UV systems for $>90\%$ water reuse.





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Harnessing rainwater

Rainwater can be pre-treated with nature-based solutions (NBS) on the façade or roof area. While some water may be lost through evaporation, it is possible to retain >95% rainwater for reuse in buildings.





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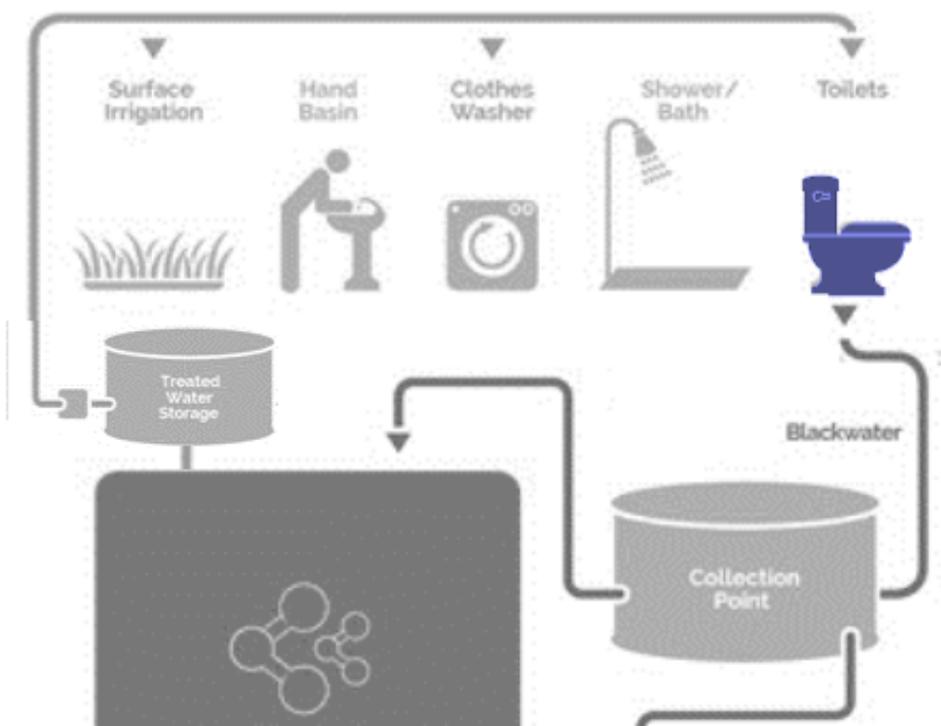


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Reusing blackwater

Blackwater is wastewater from toilets. It can be separated with retrofitting measures in existing buildings. Blackwater can be used to produce biogas or compost. This can be consumed directly in a building, or else sold for a profit.





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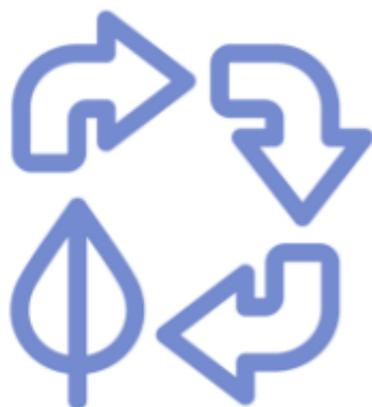


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Reuse of un-segregated water

Wastewater can be combined in one single pipe with kitchen-shred organic waste from all floors of an existing building. The liquid fraction of this combined WW can be separated from the solid fraction with a separation unit. The liquid fraction can be treated with NBS indoor allowing >95% water reuse. The effluent water can further be disinfected and used for toilet flushing, urban gardening and compost production. The solid fraction can be used for biogas production.





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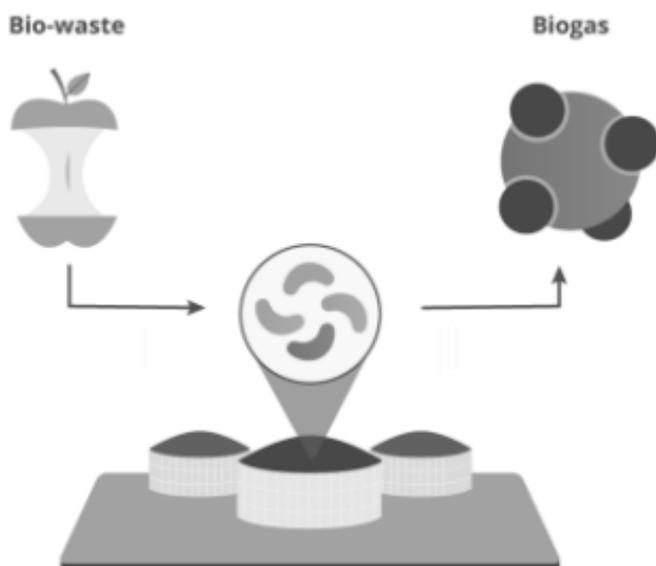


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Biogas production

Solids from blackwater and organic waste from kitchens and gardens can be used to produce biogas. The generated biogas can be used for cooking or heating. The gas is stored in inflatable and impermeable fabrics. This energy storage can be further used for potential grid injection, or combustion in a natural gas boiler and can support the NZEB or passive house claim to reach full autonomy even in winter months.





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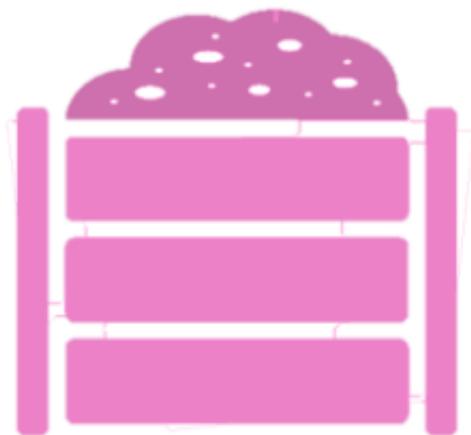


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Compost production

Stabilised blackwater from anaerobic digestion systems can be used as compost for local gardening, substituting or competing with commercial compost.





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Reduce waste + facilitate waste management

Reduce waste and facilitate high-quality waste management by choosing products and systems that can be easily reused, repaired, recycled or recovered. When recycling, products and systems should be upcycled too. Make use of easy to dismount elements; Prescribe in procurement contracts that waste should be separated on site to facilitate recycling; Use simple and recyclable products.



Reversible connections



Bolts

+ strong, can be reused
- size, cost



Screws

+ easily removable
- limited reuse



Magnets

+ keeps component whole
- structurally weaker



Semi-reversible connections



Nails

+ speed of assembly
- difficult to remove



Rivet

+ speed of assembly
- difficult to remove



Staple

+ speed of assembly
- difficult to remove



Irreversible connections



Glue

+ strong and efficient
- difficult to separate



Welding

+ strong
- impossible to separate



Cement mortar

+ strong
- difficult to separate



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End-of-life waste management

Building analysis can help to achieve maximum recovery and valorisation potential of existing materials in buildings (i.e. envelope, facade, etc) at refurbishment or demolition stage, providing demolition guides to guarantee the best and safety management of waste streams. This end-of-life service includes the selection of safety procedures for disassembly and reuse of non-hazardous materials in construction elements, aiming to achieve a potential reduction in 30% of in construction & demolition waste (CDW).





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Renewable energies

24 m² of solar panels (south) convert solar energy into 4,800 kWh of electricity that can be used in the home or fed back to the main grid. 18 m² of solar panels (north) convert solar energy into 2,000 kWh of electricity that can be used in the home or fed back to the main grid. Roofs with a southeasterly to southwesterly orientation are often very suitable for PV panels. Roofs with a northerly orientation are often only moderately suitable for PV panels.





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Insulation

There are several ways to insulate buildings, both on the inside and outside (best option), and both of them will achieve a remarkable reduction in energy consumption, with greater comfort and lower costs. In existing buildings, roof insulation is often installed between purlins. Facade insulation can be improved by filling the cavity in the wall with insulation, but to create a well-insulated facade the most common solutions are insulating panels.





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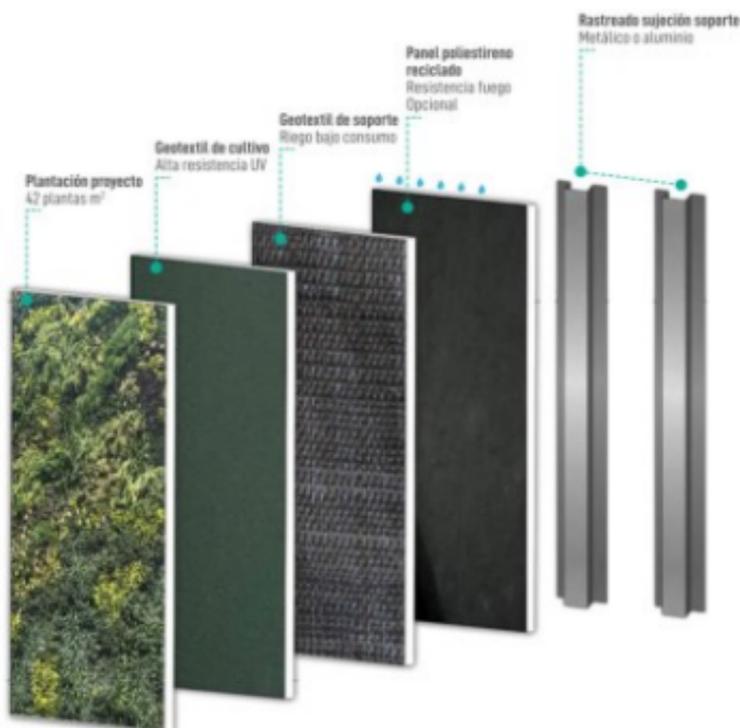


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Green walls and roofs

A green roof or facade buffers and absorbs rainwater, insulates the home, increases biodiversity and reduces the heat island effect. Evaporating water cools the home and makes solar panels more efficient.





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Energy efficient windows

It is recommended the double-glazed casement, tilt-and-turn windows and HR+++ or HR++ glass (3 or 2 panes of glass separated by an insulating gas). Very well insulated windows help save energy and increase comfort.





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Shading

In the summer months, overheating can occur since direct sunlight enters through the windows. It is important to avoid the latter, by using sunscreens such as overhangs, slats, awnings, blackout curtains or deciduous vegetation.





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Hot water, Heat and/or cold generation

It is important to replace Domestic Hot Water, heating and cooling systems using fossil fuels with others using renewable energy. It is advisable to install electrical systems and combine them with renewable energies.





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Prefabricated, multifunctional and integrated skin solutions

Prefabricated façade systems reduce on-site delivery times and, at the same time, allow for bespoke design. These are more sustainable solutions because much less waste (consumption efficiency) is generated in manufacturing and installation compared with traditional façades: natural and human resources are optimised by reusing established processes. Indeed, there is higher quality and control at each project phase and the different regulatory requirements (thermal, acoustic, fire, etc.) are better achieved.





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