

National and Kapodistrian University of Athens

Physics Department

GROUP OF BUILDING ENVIRONMENTAL RESEARCH

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Energy Efficient
and Circular
Renovation

Energy Efficient Renovation and beyond

----- (the objectives include)

- Reduced operational Energy
- Reduced embodied energy
- Reduced embodied CO2 – Net Zero Carbon footprint
- Enhanced IAQ
- Mitigation of Climate Change
- Circularity processes

...and beyond:

- Enhancement of seismic performance and user's safety
- User satisfaction and awareness
- Architectural aesthetics
- Minimization of landfill waste

overall Urban rehabilitation

EUROPEAN PROJECTS

Group of Building Environmental Research



Project title: Pro-GET-OnE

Implementation dates: 01/05/2017 – 30/04/2021

Project value: 5.064.600 €

Recipient /contracting Entity: European Commission , H2020

Summary description of project: Proactive synergy for Greater Efficiency On buildings' Envelopes aims to combine in a same integrated system based on pre-assembled components the highest performances in terms of: i) Energy requirements ii) Safety – by using appropriate steel structures to reduce horizontal loads and implementing the structural safety while supporting the new envelopes.

H2020 ProGETone Pilot Case study :



University campus , Athens
Greece

Opportunities :

- Fast process- Prefabricated façade — plug 'n play systems
- Increased energy efficiency, acoustics and comfort
- A step towards sustainable cities, and societies
- The enhancement of indoor air quality
- The increase of seismic safety
- The increase of living space for the user
- Increased real estate value



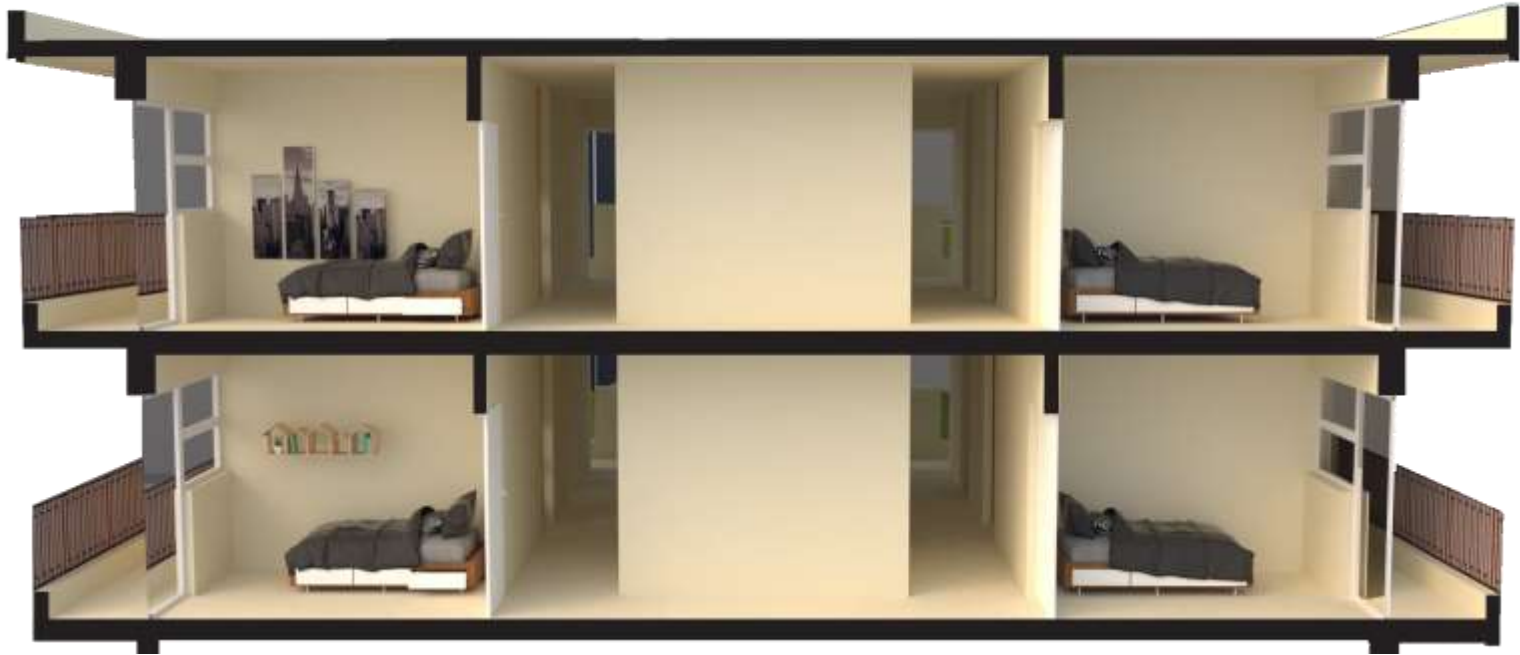






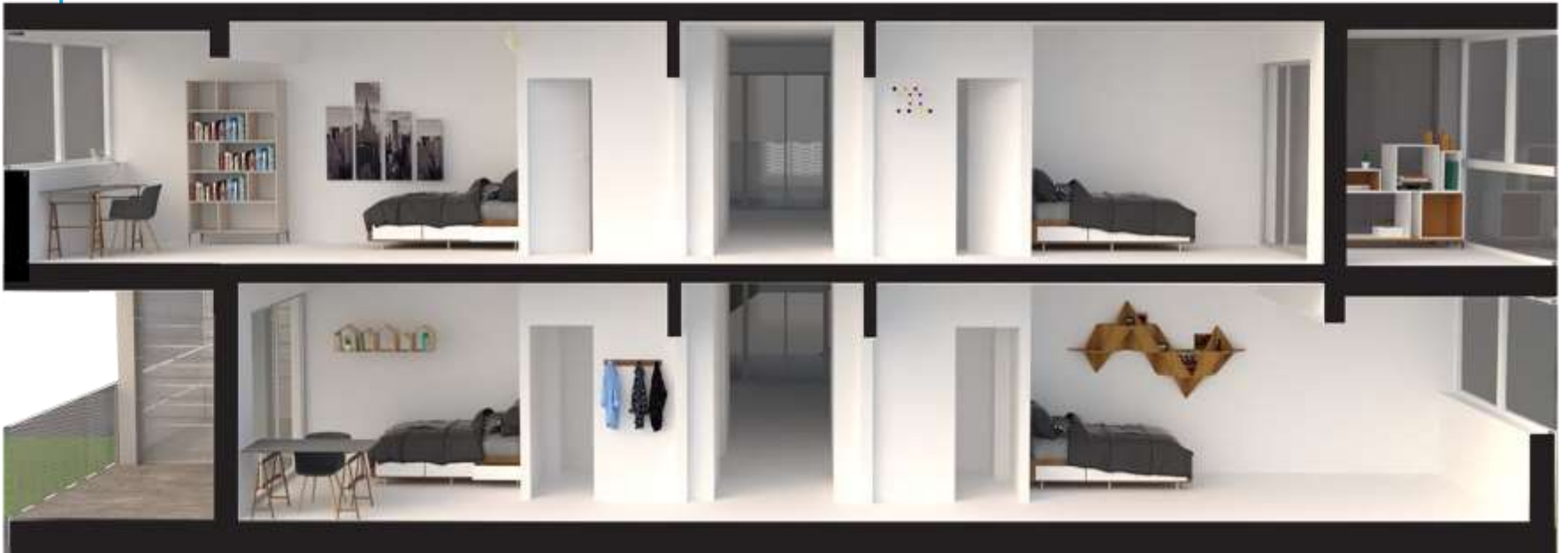


Rooms layout



virtual reality & visual effects

Rooms layout



virtual reality & visual effects





























Project title: DRIVE 0

Implementation dates: 01/10/2019 – 30/09/2023

Project value: 4.750.641 €

Recipient /contracting Entity: European Commission , H2020

Drive 0 project 841850

Summary description of project: The DRIVE 0 concept is based on developing circular deep renovation solutions and supporting consumer centered business models for 7 specific study and demonstration cases as real environments. The selected cases are already in preparation and each of these cases have a specific local driver for the need of a holistic and circular deep renovation.

Objectives

Why: decarbonization of the EU building stock and acceleration of deep renovation processes by enhancing a consumer centered circular renovation process in order to make deep renovation more attractive for consumers and investors, environmentally friendly and cost effective.

How: By combining the need for a circular building industry with the identification of specific local drivers to trigger and to motivate end-users for deep renovation, supported by an anthropology based and environmentally friendly approach to make it costumer-centred and respectful of local geo-material areas and implementing urban mining and material banks.

A circular deep renovation, which contributes to a circular built environment, is based on 100% life cycle renewable energy, and all materials used within the system boundaries are part of
infinite technical or biological cycles with the lowest quality loss possible



RECYCLE AND REUSE BUILDING MATERIALS - CIRCULARITY

For **nZEB** and **0-carbon** goals the overall environmental impact of a building
From cradle – to – grave

The use of recycled building materials can:

- Reduce embodied CO₂
- Reduce embodied energy
- Conserve natural resources
- Reduce CO₂ emissions
- Reduce the cost for the new infrastructure
- Lower the cost for waste management
- Reduction of landfill space required
- Local availability/ lower impacts of transport, fossil fuels necessity
- Lower the overall environmental impact

Recycling Buildings

1. *Concrete*
2. *Gypsum*
3. *Wood*
4. *Glass*
5. *Metals*
6. *Aggregates*
7. *Plasterboard*
8. *Plastics*
9. *Floor and wall coverings*
10. *Insulation*



Construction and demolition waste are one of the heaviest in the EU accounting for **25%-30%** of all waste generated

Demolition recycling is an important step in a building's life cycle, as recycling can divert over **90%** of the building's material from the landfill.

Concrete buildings, when demolished, can serve as an excellent source of new building materials, with local availability of aggregates

Circular Renovation Process

7 Representative counties – 9 demonstrators

Slovenia (2 cases)

Netherlands

Estonia

Spain

Greece (2 cases)

Italy

Ireland

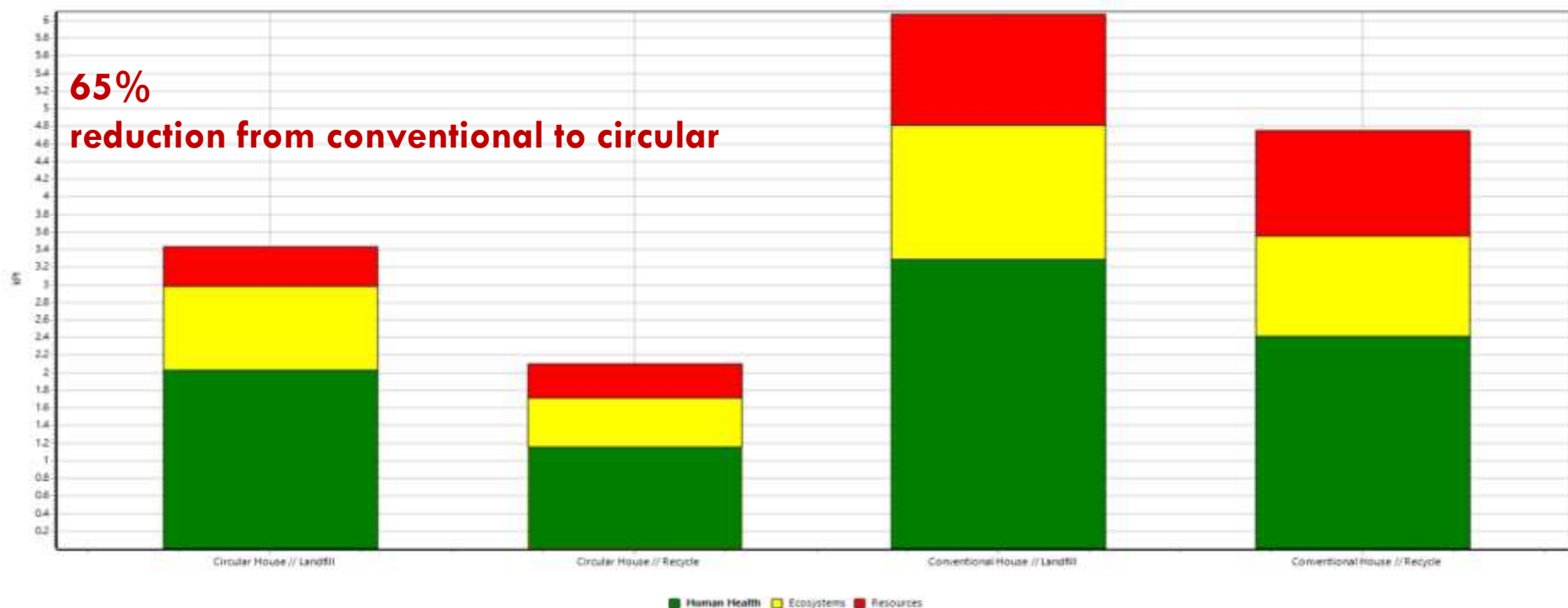
Compare the use of conventional building materials / recycled building materials (circular) in the construction phase

Two end scenarios :
landfill
recycle scenario



All Scenarios

%	Conventional House with disposal scenario: Landfill	Conventional House with disposal scenario: Recycle	Circular House with disposal scenario: Landfill	Circular House with disposal scenario: Recycle
Total	100.00	78.25	56.51	34.60
Human Health	54.20	39.87	33.44	18.95
Ecosystems	25.21	18.62	15.68	9.19
Resources	20.76	19.77	7.33	6.46



Method: ReCiPe Endpoint (H) V1.13 / Europe ReCiPe H/A / Single score
 Comparing 1 p 'Circular House // Landfill', 1 p 'Circular House // Recycle', 1 p 'Conventional House // Landfill' and 1 p 'Conventional House // Recycle';

Thank you for your attention

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