



# REDUCES

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## Good practices for product-life extension in Valencian Community region

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**Buildings**

*“In the built environment, it’s all about maximising utility of resources — extending product life or providing a proper end-of-life recovery.”*

—Nick Cliffe, Innovate UK

Circular economy

# Product-life extension in the building sector

# Product-life extension

## Why the focus on the building sector?



**Construction** and **demolition** projects generate about a third of the total waste in the EU, with a significant share being landfilled (BioIntelligenceService 2011).

With buildings being more energy efficient during their use phase, the relative importance of **embodied energy** and **natural resources** is becoming more significant to enhance resource efficiency of buildings (Crowther 1999; Thormark 2002).

To save embodied energy and resources, a range of strategies that **cycle resources at product, component or material level** (Stahel 1994, 1997; Cooper and Gutowski 2017; Allwood et al. 2011).

Figure 1: A vision for a circular built environment

Source: ARUP&Ellen Macarthur Foundation. 2018

# Product-life extension

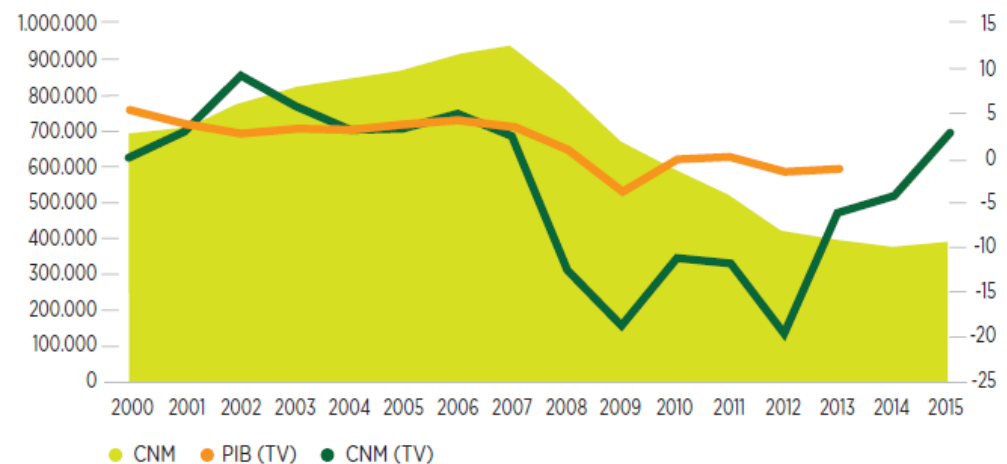
## Why the focus on the building sector?

Therefore, the **construction sector** has been identified as one of the three high-potential sectors to seize these economic and environmental benefits (EllenMacArthurFoundation 2017).

In **Spain**, the main promoter of the increase in the material needs of Spain in the first decade of the 21<sup>st</sup> century has been the **construction sector** (Morató et Al. 2017)

Figure 2: National Consumption of Materials (CNM), and Rates of change (TV) of CNM and Gross Domestic Product (PIB) in Spain

Source: Morató et Al. 2017



# Product-life extension

## General term

- Products are used according to their original purpose for as long as possible or repaired and refurbished for **multiple re-uses**, thus **reducing** the need for purchasing and manufacturing **new products**.



## Related to building sector

- A core of circular strategies is the extension of the useful life of products (Stahel 1994), in the case of buildings e.g. through **renovation and retrofitting** (Adams et al. 2017).
- However, for the construction sector to transition towards a circular economy requires systemic innovation throughout the value chain (Ness and Xing 2017). **Resources** recovered at the end-of-life (components or materials) need to be **reintegrated** into the value chain.

# Product-life extension

Product life extension requires an increased emphasis on the **design phase** of the product life cycle (Bocken et al., 2016).

- This translates for example into **standardisation** of **components** in terms of size or material. In the building sector, e.g. product life extension is put to use by **designing modular components used in construction**. These standardised components can be re-used in new buildings or repurposed and used in infrastructure or in another industrial sector (ARUP, 2016).

Material &  
component  
manufacture

**Design &  
planning**

Construction

In-use &  
refurbishment

End-of-life

Illustration of the construction value chain for buildings based on Adams et al. (2017) and Kibert (2004) highlighting the phases that will be of focus in these Good practices

# Product-life extension

Product life extension in the building sector refers to **prolonging the life of the asset**, i.e. the buildings, by designing them to last for a longer period of time.

- For instance, the use of **durable materials** and **high construction standards** can increase the life span of the building leading to reduced maintenance costs. Businesses in the construction sector may increase their circularity by paying more attention to the **design-phase**, anticipating the possibility of **re-use** and **re-purposing** parts of the buildings (ARUP, 2016).

# Product-life extension

**Designing for longevity** ensures the long-term durability, utilisation and value of assets:

- Reduce maintenance costs
- Extend the economic viability of a building or structure
- Standardised components **manufactured off-site** to higher quality control standards can minimise the risk of structural faults and reduce long-term maintenance requirements.

**Designing for longer lifespans** also reduces waste and helps ensure assets are used optimally throughout their life cycles

- By designing **flexible building cores**, developers can enable assets to switch use at a later date, from commercial to residential, for example



# Other potentials

## Decreasing resource usage

Off-site construction and modular components **reduce the amount of waste produced on-site** and enable **reuse** and **repurposing**.

Components and materials can be **reused** for the construction of new buildings, **repurposed** for application in infrastructure or transferred for use in other industrial sectors.

Using **alternative material inputs**:

**Sustainable, renewable materials** can replace materials that are heavily processed, and hard to reuse and recycle.

# Product-life extension

## **SUMMARY** of examples for the **BUILDING SECTOR**

- ✓ Renovation and Retrofitting
- ✓ **Resources recovered** at the end-of-life (components or materials) need to be reintegrated into the value chain.
- ✓ **Design-phase**, anticipating the possibility of re-use and re-purposing parts of the buildings
- ✓ **Standardised components** → re-used in new buildings or repurposed and used in infrastructure or in another industrial sector
- ✓ Use of durable materials and **high construction standards**
- ✓ **Flexible building cores**

# MODULAR CONSTRUCTION

**Modular construction** comprises manufacturing **building components, and sometimes whole buildings**, off-site as transportable pieces. This improves quality as much of the work is completed in factory conditions.

The building is then assembled on-site, in such a way that users are unable to determine whether the modules meet. This method has the potential to considerably **reduce cost, time on site and waste generated** compared with traditional on-site construction methods.

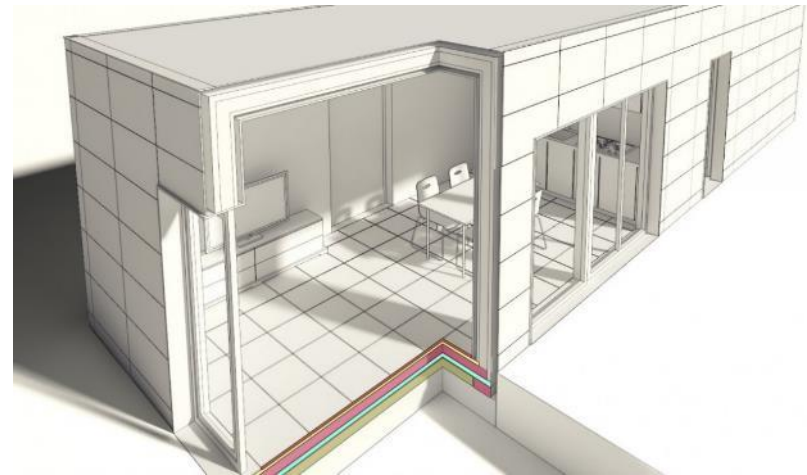
# good practice #1

# INH A U S



# Reusable, rebuildable and industrialized buildings that REDUCE environmental impact of building sector

## Short summary



Full construction of houses in a factory with reusable building materials that are moved to the plot of land and can be installed to a different place afterwards

# Detailed information

- ✓ All productive activity occurs in a single space → it allows to **control** all the **processes** (high quality)
- ✓ After-sales service is included in the price, so several revisions are included to keep and **maintain** the house in good conditions during more time:
  - Inspection 1. One year after finishing the home
  - Inspection 2. Two years after the previous one, that is, three years after use
  - Inspection 3. At three years of the previous one, that is to say at six years of use
  - Inspection 4. At four years of the previous one, that is to say at ten years of use.
- ✓ 82% materials (dry construction) can be unscrewed and **reused** for another building or the same building in another place
- ✓ **Recyclable** materials are used
- ✓ **Water** consumption is very low
- ✓ **Waste** management is controlled, and the volume of waste is very small

## Detailed information

- ✓ They work directly with the **supply chain**, so displacements on site are reduced.
- ✓ **Neighborhood and environmental impact** is reduced given that the time of installation on site is very reduced
- ✓ They have **employability** programs. E.g., they have reached an agreement with the Chamber of Commerce in to train 25 people every 3 months. Therefore, young people with difficulties to find work are taught in 150h to manufacture a modular house with their system.
- ✓ Construction **workers over 50** are employed because in the factory they do not have to lift weight.

## Evidence of success (results achieved)

- ✓ From 5 to 82 people working as staff in 3 years time
- ✓ 60 people subcontracted
- ✓ Agreement with the Chamber of Commerce

# Potential for learning or transfer

- This business model is located in Almussafes (Valencia, Spain). This model can be transferred to other regions of Spain and Europe so that a network of buildings whose life is extended and that can be reused is increased.
- Finally, the construction sector needs to improve recyclability of material aspects, so if this model is transferred, the rate of regional recyclable building materials and the regional CE skilled workforce would be increased.



# Link to policy instrument

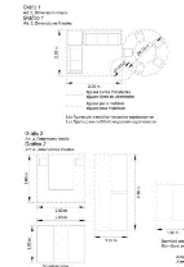
The updating of the policy instrument selected, “**DECREE 151/2009**, of October 2, of the Consell, by which the **basic requirements of design and quality in housing and accommodation buildings** are approved”, has a lot to learn of this best practice in relation to:

- New models of tenure, **use and maintenance of residential buildings** and **continuous regeneration** of housing:



- this type of buildings have an after-sales service that includes several revisions to keep and **maintain** the house in good conditions.
- Indeed, the building can be moved to another place to **extend** its life or if it is not productive in a location, for instance in hotels.

# Link to policy instrument



- **Products and processes with low environmental impact and reduction of the environmental impact of the housing construction:** in this practice, the house is a product with reduced environmental impact given that it is produced in a factory, all the processes are controlled and the waste production and water consumption is very limited in comparison with regular building construction processes.
- **Efficient management of resources used:** they work directly with the supply chain
- Promotion of the **secondary raw material market:** 82% of the materials used are reusable

# CE results obtained

## Quantitative

- m2 of circular buildings
- % reusable materials
- % recycled materials used
- n. of businesses with improved attitude towards CE
- n. of businesses with improved knowledge about CE
- n. of trained people on CE = 100 (2019)
- n. of CE FTE
- n. of CE Jobs = 82 (2019)
- n. of CE Jobs over 50
- N. of CE Jobs (female)
- n. of CE companies = 1
- n. of CE cooperations = 60

## Qualitative

- High rate of life-extended buildings given the quality (factory produced), maintenance carried out and the flexibility in location
- High rate of reusable and/or recycled materials
- Low construction impact on the plot area
- Increased rate of local/regional CE jobs
- Increased CE employability of people over 50
- Increased CE skilled workforce.
- Increased collaboration with public administrations (Agreements)

# inHAUS good practice





# good practice #2



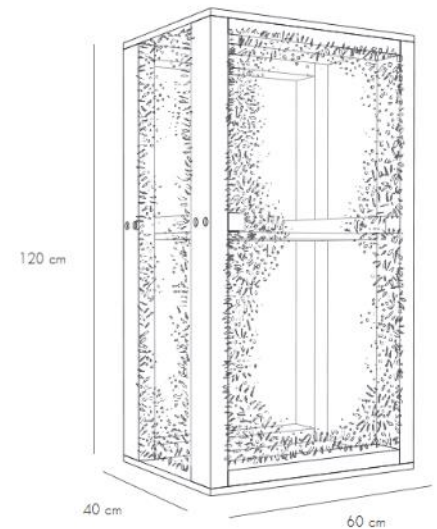
**okambuva.coop**  
bioconstrucción

# Prefabricated rice straw **modules** for sustainable building construction by a circular economy business model

**ALFAWALL**<sup>diy</sup>

## Short summary

Okambuva build houses with prefabricated rice straw **modules**, provides the data sheet with technical-environmental characteristics and offers training for DIY



# Rice straw in Comunitat Valenciana





# Detailed information

- ✓ These modules are produced by an **associate labour cooperative** that act as an independent collective for the promotion of professional Sustainable Building. But they also offer a platform for cooperation, research, experimentation, training and services, combining the experiences and personal, professional and academic objectives of its members.
- ✓ These modules are made of **natural materials** that can be found **locally**.
- ✓ Over 75,000 - 90,000 tons of straw are being produced per year in l'Albufera de Valencia, a natural park 10 kms far from Valencia city. This straw has traditionally been burnt, being consequently a source of air pollution every year. That is why the use of straw, in this case of rice, with sustainable building purposes helps extend the life of this product.



# Detailed information

- ✓ These modules can also be produced by following the **training** courses the cooperative offers to both, **professionals** and **final users** (a **DIY** manual has is available on their platform).
- ✓ They contribute to developing job creation and recovery of local economies by using local materials.
- ✓ They have a reduced impact on the environment because they use natural resources. Indeed, they have a positive impact on health of inhabitants
- ✓ These modules make the building have a high energy efficiency because of their thermal insulating capacity.
- ✓ They can be used in both new and refurbished buildings.
- ✓ Using these modules, the price of a building is reduced in comparison with the use of artificial materials (concrete), and it can be decreased if the user collaborates in the construction of the house.

## Evidence of success (results achieved)

- ✓ Different construction systems have undergone to adapt to contemporary construction regulations, giving rise to a type of quality architecture that responds to the new demands of energy efficiency and sustainability. The cooperative has participated in more than **25 projects** based on sustainable building principles, with more than **5 buildings** having used this type of modules.
- ✓ Currently they are building a project in Meliana with the collaboration/participation of **Meliana City and Valencia City**.

## Potential for learning or transfer:

Buildings built with these types of modules are usually private houses. Public administrations could take advantage of these type of modules to be used in **public spaces and buildings** such as schools, libraries, community centres, and they could be included with a positive score rating in public tenders.

These modules can be used for both, **new and refurbished buildings** what is translated into a higher potential to be transferred.

# Link to policy instrument

The updating of the policy instrument selected, “**DECREE 151/2009**, of October 2, of the Consell, by which the **basic requirements of design and quality in housing and accommodation buildings** are approved”, has a lot to learn of this best practice in relation to:

- **Advanced materials, products and processes with low environmental impact:** considering this best practice, this module is a product that uses natural resources; therefore, it has a low environmental impact.
- **New models of tenure, use and maintenance of residential buildings and continuous regeneration of housing:** the buildings built with this type of modules require awareness of users for being prepared to a different and higher maintenance of the building



# Link to policy instrument

- **Efficient management of resources used:** the modules are produced with straw coming from local suppliers. The owners can collaborate in the construction of the modules and the building.
- **Renewable energies in housing:** this module is usually allocated in green buildings whose philosophy includes the use of renewable energies

# CE results obtained

## Quantitative

- m<sup>2</sup> of circular buildings
- % recovered resources
- n. of businesses with improved attitude towards CE
- n. of businesses with improved knowledge about CE
- n. of trained people on CE
- n. of CE companies = 1
- n. of municipalities with improved CE knowledge

## Qualitative

- High rate of **life-extended buildings** given the modularity of components and maintenance carried out
- High rate of **resources recovered** (rice straw) [*Extension of the life of a product that otherwise would be lost*].
- Increased CE skilled workforce.
- Higher amount of aware and skilled final users.
- Increased rate of municipalities aware of CE business models.
- Reduction of air pollution.



# okambuva good practice



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## Thank you!

Questions welcome



*Project smedia*