Decommissioning guidelines

- Contact
- An incremental process
- RHU key features
- Waste hierarchy
- Shelter components

Version revised 231129

Contact us

Miguel Acebron Garcia de Eulate
Technical Support Manager

miguel.eulate@bettershelter.org

+46 702 99 18 24

We support partners before, during and after the implementation of our shelters.

Apart from technical support, we offer consultations on how you can adapt our shelters to meet your specific needs.

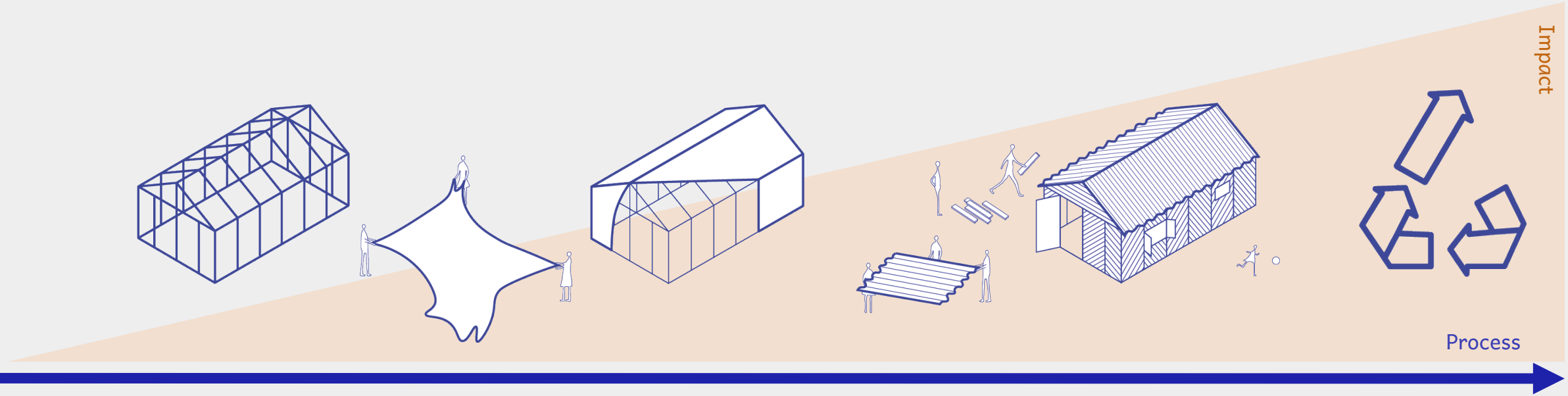
If you notice any inconsistencies in the content of this document or have any suggestions, please reach out.

An incremental process

DEPLOY

UPGRADE

UPCYLE



Frame	Tarpaulin / Panels	Local materials
Lifespan 10 years	Lifespan 1 year / 3 years	Thatch, plaster, CGI, mudbrick, concrete hollow block, reed mats, timber, bamboo etc.

Relief Housing Unit (RHU)

Relief Housing Unit (RHU)

A resistant shelter that arrives with all parts in flatpacks and is easy to assemble for immediate safety and dignity in emergency response.

Key Features

- 17,5 m^2
- Lockable door
- 4 windows & 4 ventilations
- Semi-hard and opaque plastic panels.
- 36 month lifespan
- 160 kg
- Solar-powered, portable lamp
- Assembly by a team of 4 in 5–6 hours without additional tools.

Performance

Wind
Up to 28 m/s or 101 km/h gust speed.

Rain
Passes artificial rain test – no leakage.

Snow
10.5 kg/m^2*

Fire
Fire and flammability protection:
Fire retardant materials allow for a minimum 2-minute escape time.

Applications

Shelter

Education

Health

Protection

Communal infrastructure

* Eurocode 1 - EN 1991 – calculations, 20 kg/m2 Internal test.

Waste hierarchy

General

The RHUs are designed to provide shelter for up to five people for at least three years. However, the lifespan of the shelter is often much longer.

The waste management systems in the regions where the shelters are used are often disrupted, of poor quality or non-existent. The collected waste is disposed of in landfills or incinerated. Poorly constructed landfills can lead to groundwater contamination and health problems.

These guidelines present different end-of-life strategies for the RHU, focusing on environmental, economic and technological values. Some of the information within these guidelines is based on theoretical concepts.

The most effective means to reduce the shelter's environmental footprint is to extend its lifespan. The steel frame will last longer than the roof and wall panels, and we encourage maintenance and repair first-hand, followed by refitting the frame with local material or tarpaulin.

Upcycle: waste hierarchy

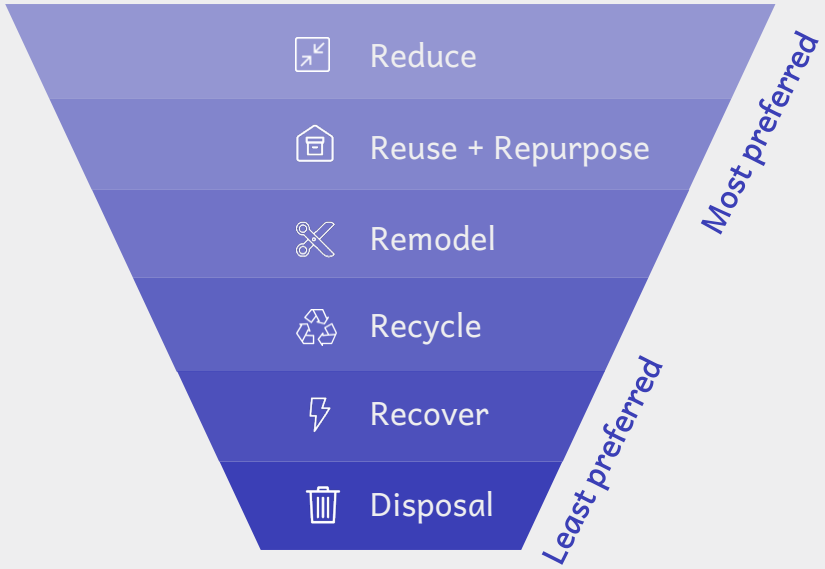


Figure 1. Waste hierarchy

The waste hierarchy is a priority order to guide how to manage waste. Better Shelter has adopted this model in its product development processes to reduce the number of ingoing materials and components in its product and packaging and to reduce future waste in the end-of-life stages of the product. Better Shelter added the step *remodel* to visualise using different elements as raw materials to obtain an output without going into a proper recycling mechanism.

Waste hierarchy

Reduce

Reduction of material is the highest priority of the waste hierarchy. It decreases the amount of produced material and thereby reduces the amount of waste.

This priority is incorporated in the design phase, during which Better Shelter makes strategic design decisions to limit the amount of material and ensure its use is as environmentally friendly as possible.

Extending a product's lifespan can reduce materials and the environmental footprint per shelter.

The lifespan can also be extended by replacing or repairing broken parts (see, for example, the Maintenance Manual). A spare parts kit with each RHU can be used to repair eventual damages as a first response to avoid replacing the entire RHU.

If the roof, walls and panels lose functionality, the best practice is to refit the steel frame with local materials. Shelters that the residents own are often in better shape due to continuous repairs and maintenance.

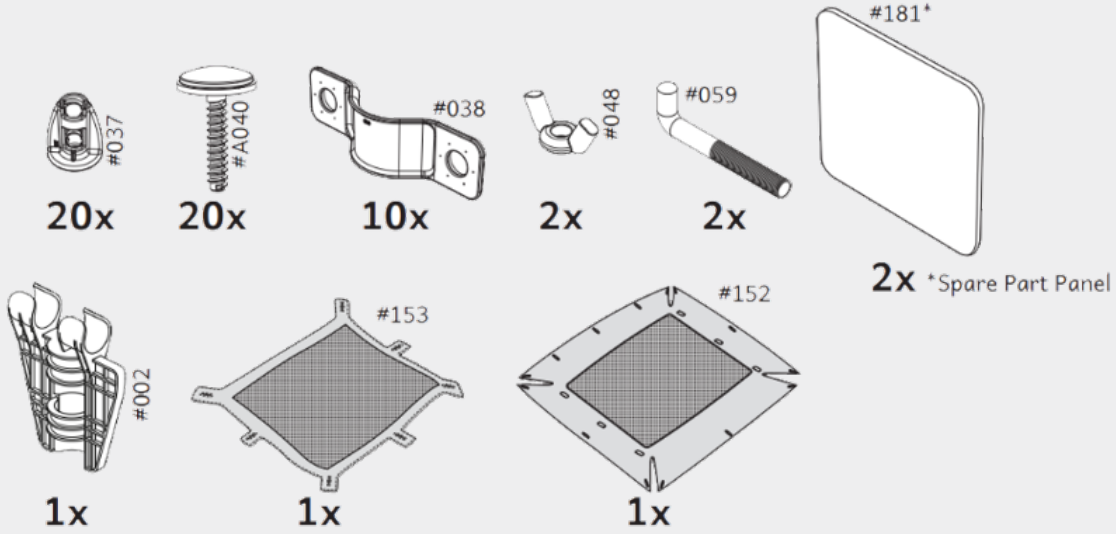


Figure 2. Reduce: spare parts provided within the RHU

Waste hierarchy

Remodel

RHU components, like wall panels, can be used as materials for other things, even if damaged.

As a reference, different remodelling measures are ordered by their cost-effectiveness: value added vs energy and resource costs for their production.

During the remodelling process, the density of the material (i.e. the plastic panels) will increase significantly and thus its fire load.

- Furniture (manual processing, low energy consumption). UV exposure can affect the integrity and flexibility of certain materials, making them harder to work with.
- Flakes (mechanical shredding, low energy consumption): thermal insulation filler for walls and roofs in buildings or hot water pipes. Fire safety must be especially considered, as the chambers in which these flakes are filled can generate a chimney effect, accelerating the burning of these particles.
- Molded objects (mechanical shredding, thermal cohesion): bricks, stool, tiles, corrugated roof. Special additives may be required to provide these parts with adequate cohesion, making this process more complex.

Recycle

61 % of the shelter's weight can be directly recycled to its raw material with the proper recycling processes.

All steel and aluminium articles and packaging are recyclable, and all plastic material that is not reinforced or contains additives: the door, door frame, door canopy, window hatches, ventilation hatches, windows and ventilation frames, gable profiles and gable hats.

Figure 6. Remodel – Furniture: sink made from shelter parts

Figure 7. Remodel – molded objects: Recycled corrugated tetra pack roofing system. External referencemoulded

Waste hierarchy

Reuse and repurpose

The RHU can be disassembled after a period of use and reassembled in a different location upon need. In most cases, the RHUs are reused for other purposes when no longer used as a shelter to live in. This is enabled by the shelter's modular design and by not containing any glued joints. All components can also be disassembled and reused in other combinations.

The unit can be reused as

- Storage facilities: the inside of the walls can be reinforced if used as storage of valuable goods.
- Livestock: more entry points or ventilation openings can be cut out from the panels if needed.
- Shading areas: panels can be removed to achieve better airflow through the unit.
- Local material upgrade: the steel frame can be used on its own with local materials.
- Varied-sized shelters: the modularity of the shelter allows for the creation of larger and smaller units.
- Reuse of individual parts: parts can be individually used for the same or other functions.

Figure 3. Reuse: Shelter extension

Figure 4. Reuse of door

Figure 5. Reuse and Repurpose: A structure used as a vaccination point was *relocated in 14 places and then upgraded to a final destination as a side building of a small hospital.*

Waste hierarchy

Recover – Incineration

With and without energy recovery

Incineration is a waste method that vastly reduces the mass of waste. It is preferred in countries with a lack of space. 11 % of waste is incinerated globally.

The advantages and disadvantages of incinerating plastics strongly depend on the incineration facility. Incineration can be a relatively environmentally beneficial strategy if incinerated in a facility with energy recovery and collection of toxic substances.

More than 90 % of the waste in low-income countries is either disposed of in landfills or openly burned. With that in mind, incineration with energy recovery is unlikely to be commonly available. If the plastics are openly burned, it can cause both health and environmental problems.

Energy recycling of plastic parts and cardboard can be more beneficial than material recycling. However, it depends on the incineration facility and waste-to-energy efficiency. For glass, steel and aluminium materials, recycling is always preferred.

Disposal – Landfills

A landfill is where waste material is disposed of by burying it and covering it with soil. Landfills are the least preferred waste method according to the waste hierarchy.

Nevertheless, landfilling is the most common waste disposal method in the world.

Sanitary landfills and dumping are two different landfill strategies. A sanitary landfill is more environmentally friendly than dumping because it is controlled to avoid leaking of environmentally abusive substances into the ground.

Non-sanitary landfills could lead to leachates that may contain high amounts of toxic substances in the environment. These can be potential sources of groundwater contamination.

Recommended end of life-treatment

To summarise, table 1 below shows recommendations on how to prioritize the end-of-life strategies for different parts of the RHU. Reduce is not included since it relates to the design and production of the unit.

	Metal parts	Plastic & Electronics	Cardboard/paper
1	Reuse	Reuse	Reuse
2	Recycle	Recycle	Recycle
3	Sanitary landfill	Incineration with energy recovery	Incineration with energy recovery
4	Dumpsite	Incineration without energy recovery	Incineration without energy recovery
5		Sanitary landfill	Sanitary landfill
6		Open burning or dumpsite	Open burning or dumpsite

Table 1. Recommended end-of-life treatment for the holder of the unit, segmented in metal and plastic parts (1=Most Preferable 6=least preferable)

As a rule, all materials used in the RHU should be disposed of in accordance with local legislation and as stipulated by the corresponding authority. It is the operational organisation's responsibility to follow the guidelines and applicable legislation for the disposal of waste.

Above is an overview of all parts of the shelter, the tools, and the packaging. Of each (group of) part(s), the material and the Resin Identification Code (RIC) as defined by the European Commission (EC) are provided. This enables the recycling of a large number of homogeneous parts if recycling systems are locally available.

Shelter components

Plastic components	Material	Group	Resin id. code
Door, door frame, door canopy, window hatch, ventilation hatch	ABS copolymer	Shelter	
Panels; wall, roof, gable, top gable, spare part	Polymer blend with flame retardant	Shelter	
Plastic sheet floor	LDPE/HDPE	Shelter	
Plastic joint, bolt, bracket, mosquito net hook	Reinforced nylon	Shelter	
Plastic gable profile, window frame, ventilation frame, ridge hat, lock housing plates	PP	Shelter	
Mosquito nets, curtain	Polyester	Shelter	
Plastic bags	PE	Packaging	
Ground template	PP	Tools	
Plastic nut, puncher	Nylon	Shelter, Tools	

Metal components	Material	Group	Resin id. code
All joints, all pipes, wires, bolts, nuts, hinge parts, lock slide bar, turnbuckles	Steel	Shelter	
Hammer, drive steel, anchor drive steel, ground template	Steel	Tools	
Ground anchor, PV panel bracket	Aluminium	Shelter	

Paper based components	Material	Group	Resin id. code
Manuals, spare part label	Paper	Tools	
Boxes, end caps, fillers	Cardboard	Packaging	

Electronic components	Material	Group	Resin id. code
LED-lamp[4], PV-panel, cable	Electronics, LiFePO battery	Shelter