



# The Green Book of Fibreglass Windows



## 1.0 Introduction

"Sustainable Development stands for meeting the needs of present generations without jeopardising the ability of future generations to meet their own needs" (European Commission 2015)

In this Green Book we bring you BOAVISTA Windows' and the market's best practices regarding the sustainability of fibreglass pultruded profiles throughout their life span.

More and more, sustainability must be one of the main concerns of all architects and designers, as the world population continues to increase and its impact on climate is exponential. One of the main goals of sustainability is to ensure that all human beings, now and in the future, prosper whilst enjoying quality of life.

The European Commission is one of the key world players to have developed strategies and policies in order to fight against climate change and to promote low carbon footprint economy. (European Commission 2015) ; In the UK, the Green Building Council, for example, is a leading organisation which campaigns for sustainable built environment, working to influence policy makers to create more eco-friendly legislation and regulations (UK Green Building Council 2016); one of the major OECD concerns is green growth and sustainable development (OECD 2016).

The governments of the major world economies have developed sustainability strategies to stimulate the reduction of energy consumption, waste production and water usage, not only to reduce the impact on the environment but also to improve efficiency.

Most people have heard of the 3 R of sustainability some time in their lives, probably in primary school: Reduce, Reuse and Recycle. Lately, another R has been added to the trio: Re-think.

The main purpose of these 3 R's is to re-educate people regarding sustainability.

BOAVISTA Windows is number one in Europe for fibreglass window systems. Based in Portugal, the brand is based on strong values: innovation, sustainability, design. Our motto is "Design for the Future", and our activities are always done with that in mind.



## 1.1 Boavista

BOAVISTA WINDOWS is the leading brand in Europe for fibreglass window systems and one of the most innovative window manufacturers of the moment. Produced from fibreglass, our window systems have a very low carbon footprint and an outstanding thermal performance and an long lasting durability.

Boavista Windows is the brand of fibreglass window frames, with a strong set of core values

## EFFICIENCY + INNOVATION + SUSTAINABILITY

We at BOAVISTA aim to create a positive impact in society and in our daily lives through our active support of sustainability. Innovation in building design plays a significant role in tackling this global issue. And our fibreglass window frames make an important contribution to sustainable building design with design capacity, BOAVISTA is an innovative brand focused on designing great windows with as little metallic elements as possible.

BOAVISTA WINDOWS are the perfect choice for any 21st century construction project.

### 3. Fibreglass pultruded profiles

Fibreglass is a composite material reinforced with high quality glass fibres. Materials are the stuff of design and the main advantage of a composite material is the potential to combine the very best characteristics of each individual component into one new product. The principle being that the sum of the whole is greater than the sum of its component parts.

Developments in production now mean that any fibreglass product is impervious to chemical degradation, resistant to high and low temperatures and will have outstanding durability.

BOAVISTA windows serve their practical purpose to the highest standards while expressing the vision of sustainability and having both visual and tactile appeal. You can take great comfort that their thermal and acoustic performance mean you have chosen an environmentally responsible product.

The future of building design must be based on the use of high quality, ecologically responsible products to ensure low carbon buildings.

BOAVISTA fibreglass windows are the future.

### 4. The base materials of fibreglass

The base material of BOAVISTA fibreglass windows is silica sand which is an abundant natural resource. Fibreglass is one of the materials traditionally used for naval construction, both in light boats and in large ships.

Fibreglass windows have low embedded energy, meaning the total energy required to produce a BOAVISTA window from raw material to delivery is low.

Fibreglass windows maintain their installed condition, quality of finish and colour for years and years.

Fibreglass windows are designed for sustainability. Ensure your building design takes a longer view. Invest in a long lasting and easy to care for product that will also ensure significant long term savings in maintenance costs and energy bills.

## 5. The production system

The fibreglass profiles that we use in all BOAVISTA windows are produced through a technology called PULTRUSION.

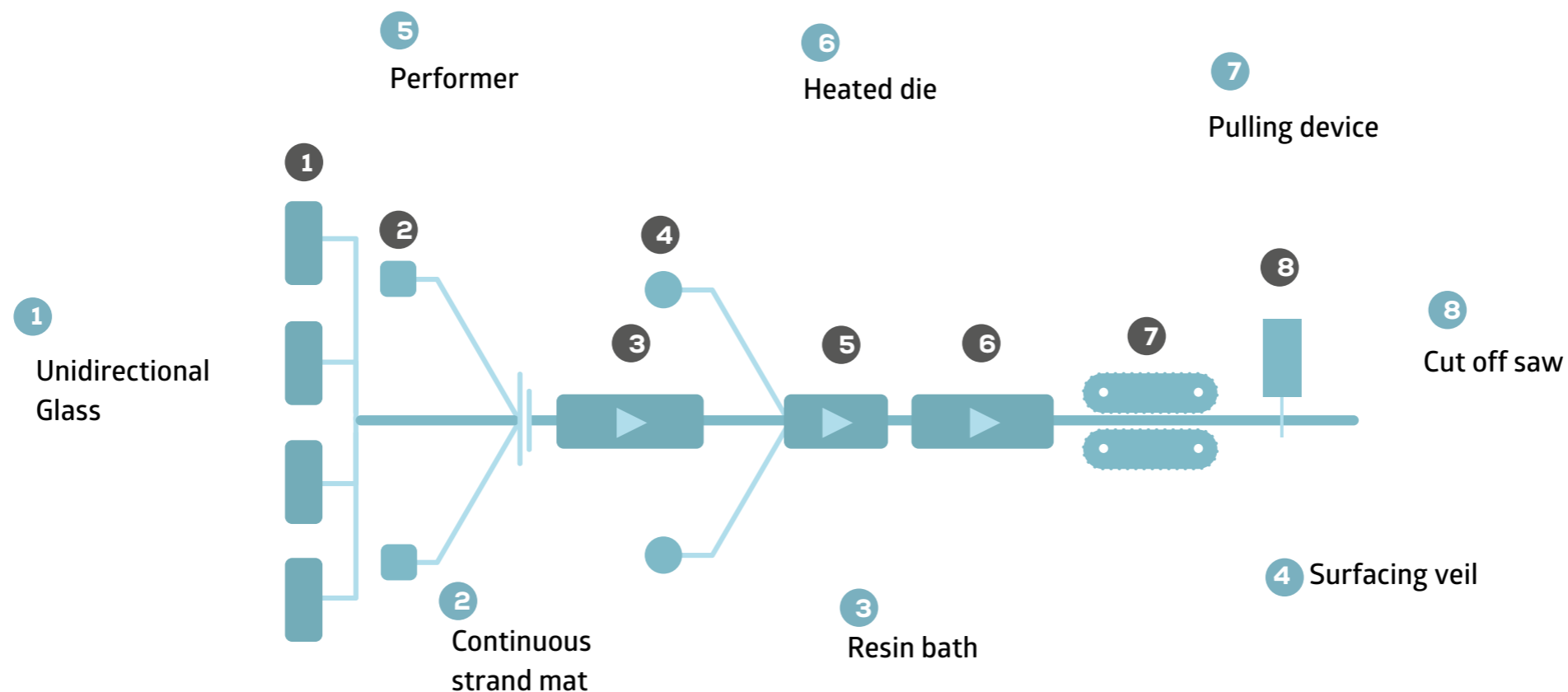
The following schematic illustrates the production system of fibreglass pultruded profiles.

Pultrusion is a continuous and automated production process, using a single machine. Raw materials are fed in one end and a finished profile exists on the other. There is even an integrated saw to cut profiles to desired length.

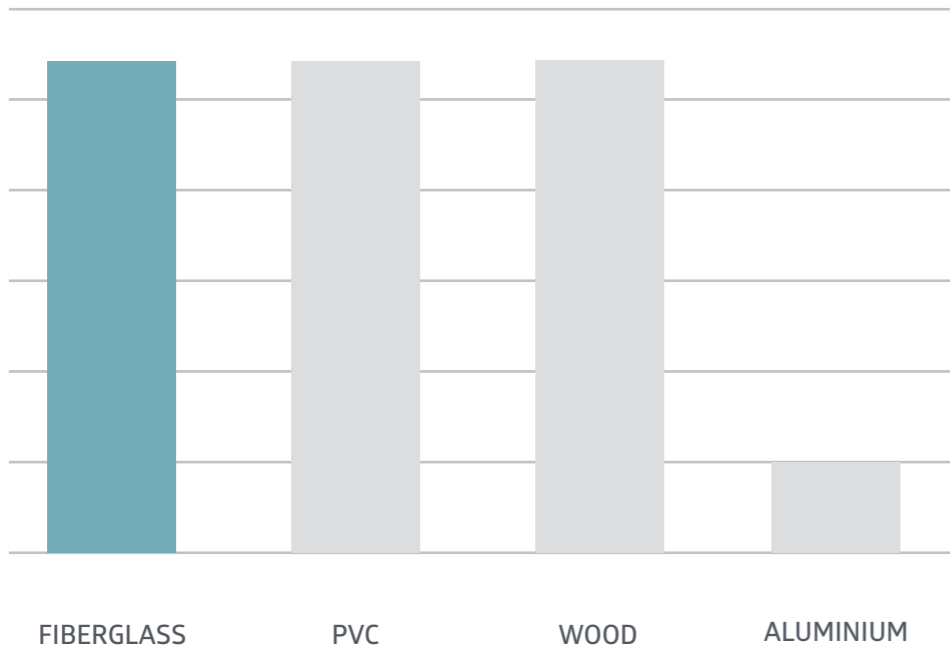
## 6. The characteristics of fibreglass window systems

BOAVISTA fibreglass windows play a perfect role in high quality ecological design. They serve a practical purpose while addressing our mutual concern for sustainability. They are eco-friendly throughout all the phases of their lifecycle.

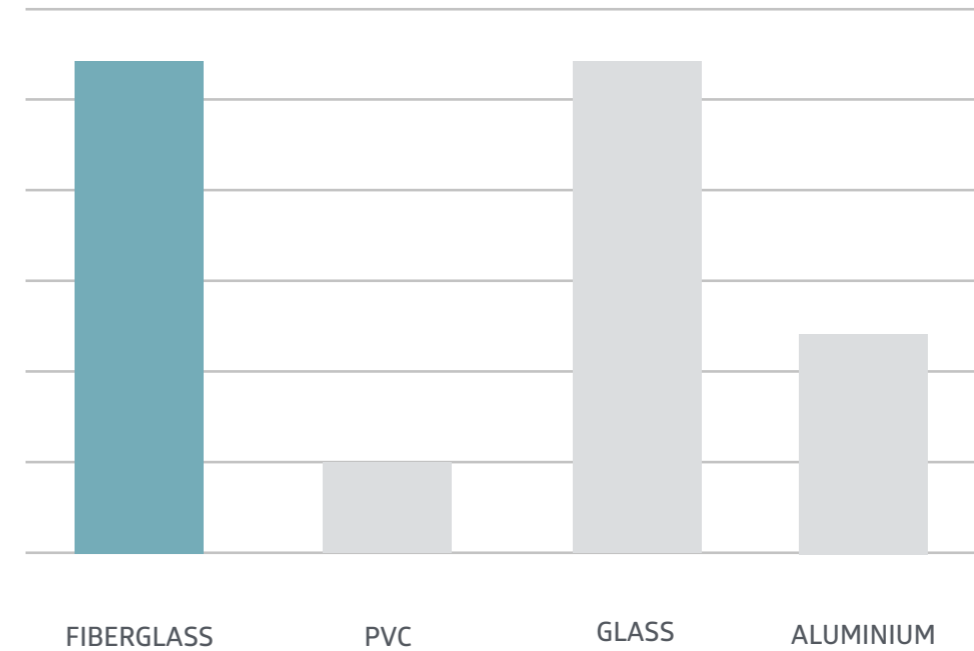
Fibreglass windows have excellent proven thermal performance and will ensure excellent energy efficiency .



### thermal Resistance



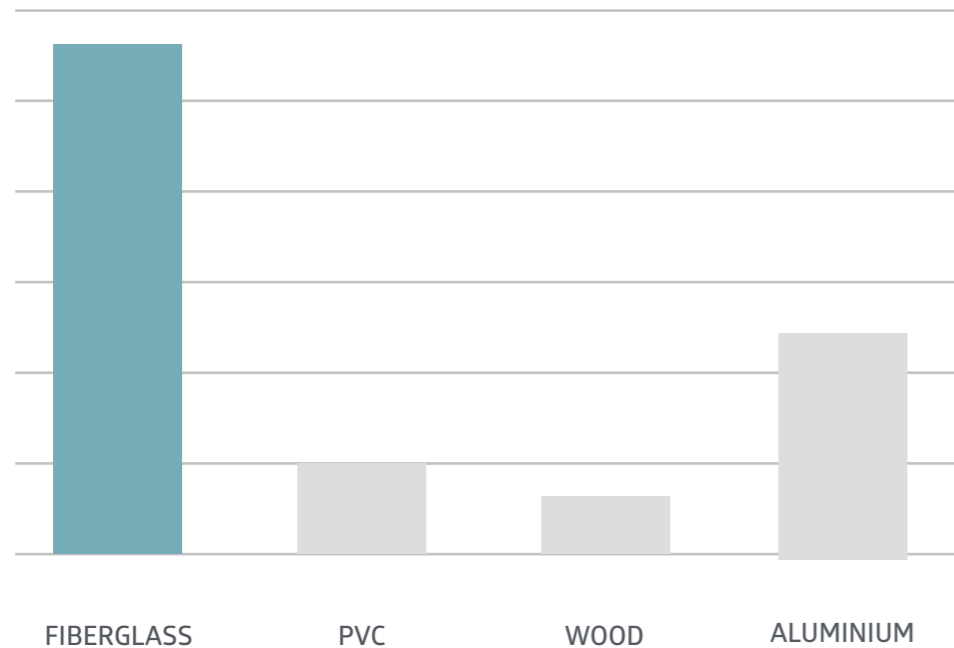
### Dimensional Stability



One of the great advantages of using fibreglass as the base material for window frames is the fact that, due to the high percentage of glass fibres, it expands and contracts at approximately the same rate as the glass units themselves. This means that the window will perform as a whole and will not have cracks and looseness, which often occur in aluminium or wooden windows.

- ✓ low thermal conductivity
- ✓ low electric and acoustic conductivity
- ✓ high dimensional stability very similar to glass
- ✓ not fragile at low temperatures

### Resistance/ Weight Ratio

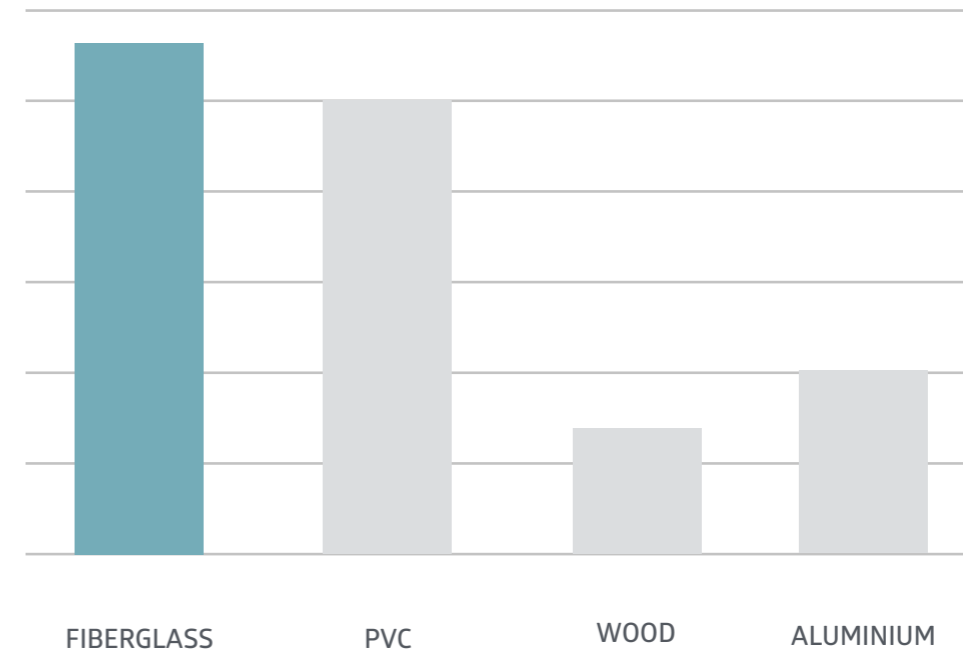


Fibreglass is very light when compared to other materials.

Fibreglass pultruded profiles are often used for structural purposes when other materials cannot be used, either because of the corrosion risk or due to the weight of the profiles themselves. One good example is the refurbishment of existing structures inside hydraulic dams, where it is not possible to enter with motorized vehicles and all structural elements have to be carried by hand.

BOAVISTA fibreglass windows are ideal to be used in aggressive environments where more traditional materials struggle to perform because they will not deteriorate in damp or salty air or when exposed to the variability of weather conditions we experience in coastal areas.

### Resistance to Corrosion/ Rot



Fibreglass is a stable material, with a low chemical reaction to the elements. It is therefore highly resistant to corrosive environments such as ocean fronts and polluted sites. It is also the perfect material to be used in direct contact with metallic elements of all types, as it does not suffer from oxidation or metallic contamination, as other materials would (such as aluminium). Fibreglass profiles can be adjacent to copper plates, for example, without having to use any separation layers.

- ✓ excellent weight / resistance ratio
- ✓ excellent resistance to rot
- ✓ excellent resistance to corrosion
- ✓ excellent mechanical properties



The following table summarises the mechanical characteristics of fibreglass profiles and other frequently used materials.

Mechanical Properties	Fibreglass	Wood	uPVC	Aluminium
Specific weight (kg/dm <sup>3</sup> ) /Dens	1.7-1.8	0.51	1.38	2.5
Tensile Strength (MPa)	200-300	4-6	1.38	213
Elasticity modulus (GPa)	12-20	-	2.7	69
Flexural Strength (MPa)	200-300	8-16	76	213



## 7. Fibreglass Window systems from BOAVISTA

BOAVISTA windows is offers a portfolio of 4 types of windows, as follows.

### 7.1 BWTT 60 - Tilt and Turn System

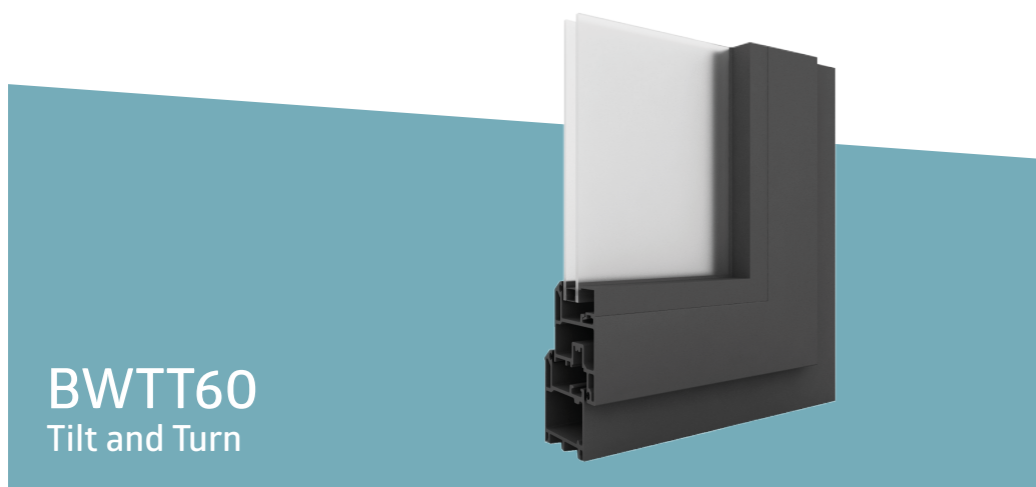
The BWTT 60 Tilt-and-Turn BOAVISTA window stands out for its high performance, versatility and easy integration in any project.

The window allows a variety of combinations and solutions that will meet any needs.

The weatherstripping is formed by a twofold neoprene seal so that water tightness and the longevity are assured.

#### Main advantages

- Available in a large array of sizes and configurations;
- Excellent thermal and acoustic performance;
- Top-of-the-line hardware.



### 7.2 BWSL 45 – Sliding Window

The Sliding window is an excellent system with a large array of applications thanks to its modular configuration and high thermal performance.

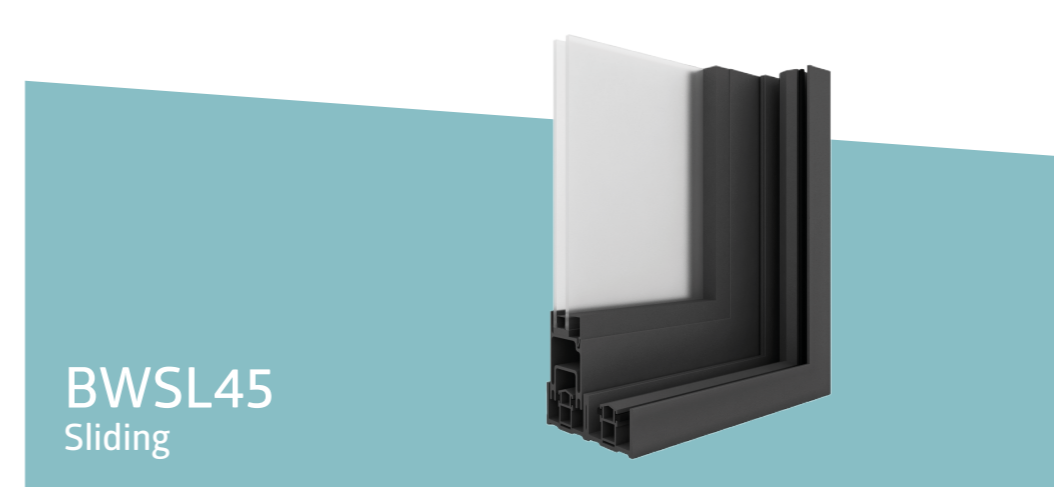
The sliding motion is robust and perfect for optimizing inner building space. It can be combined with fixed sashes and other systems like the Tilt'N'Turn.

The watertightness of the window is assured through a twofold weather-strip.

It uses standard hardware with one locking point that can be upgraded to two or three points as well as a cylinder lock to increase security.

#### Main advantages

- Multiple configurations of up to 6,5m2 per pane;
- Upgradable hardware for increased security;
- Potential Reduced visibility of the frame to maximize view and sunlight.



### 7.3 BWS 35 – Single Hung Sash Window

OurSash window was developed for the refurbishment of old buildings but it can also be used in new projects. With a fixed upper sash, it uses a practical operating system that combines lifting as well as tilting of the lower sash. This tilting action ensures easy cleaning of the outer side. The sash window has a special twofold weather-stripping to combine efficient water tightness with easy use. Also, its twin spring system keeps the sash safely in place when opened.

#### Main advantages

- Perfect for refurbishments;
- Tilting mode for easy cleaning;
- Easy and safe to use.



**BWS35**  
Single Hung Sash

### 7.4 BWO 60- Outward Opening Casement Window

The BWO 60 window is the casement system of Boavista. Available in several configurations, it is perfect for you to build your traditional bay windows or to include in your modern house.

#### Main advantages

- Slim and modern design
- Exclusive minimal handle
- With crank option for hospitality projects



**BWO60**  
Casement

## 8. The 3 R of Sustainability

### 8.1 Reduce, Reutilize, Recycle

Sustainability and lifecycle analysis of products stands on the 3 R's: Reduce, Reuse and Recycle. (Evans s.d.)

By reducing, reusing and recycling, each one of us can save money, energy and natural resources. (US Environmental Protection Agency 2016).

The 4<sup>th</sup> R is also important: Re-think.

### 8.2 Reduce

According to the US Environmental Protection Agency, the best way to reduce waste is to not produce it at all. Reduction is the first step to a sustainable life and should be practiced amongst our daily routines. It is very important to keep in mind that, even what seems abundant and endless, may one day be subject to shortage. We live in a fast changing world where economies change faster and faster, with direct impact in our lives.

Reduction can be looked at in several ways:

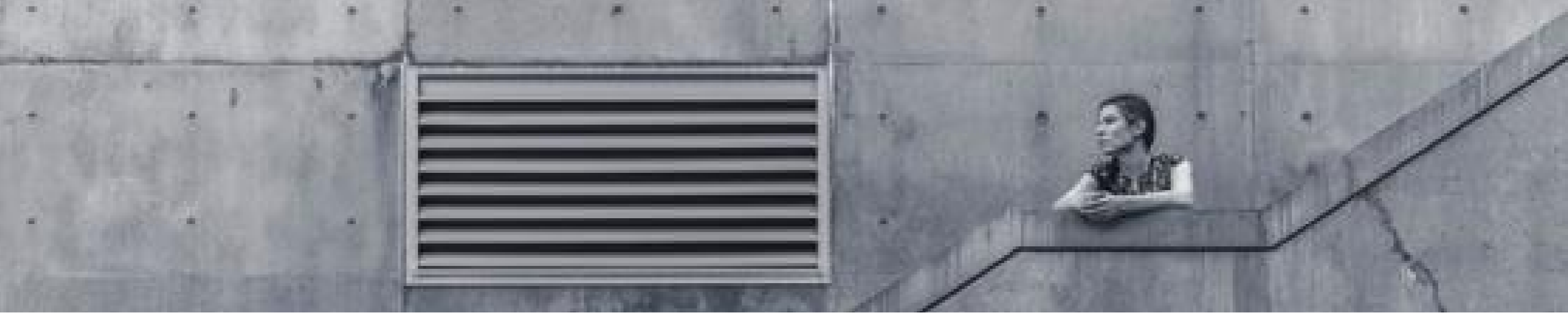
At BOAVISTA, we believe that we can produce construction products that minimize the use of other products and services in the future, by reducing the need for maintenance or repair.

Fibreglass profiles consume a low quantity of energy, because pultrusion is a low energy consumption manufacturing system.

The whole production system is designed to optimize material use, to reduce any waste; each window frame is manufactured from bars that are cut into short lengths that have been calculated in advance.

BOAVISTA systems are very simple. What does this have to do with Reduction, may you ask? Well, it means that there is as little waste as possible.

BOAVISTA systems are painted after being cut and drilled. Many window fabricators know what nightmare it is to manage stocks of profiles in different colours left from different projects. Each architect has a preferred RAL colour for each project. Since most window systems made of other materials come in minimum quantities of each colour, many times the window manufacturers are faced with the problem of managing very specific coloured profiles that are no longer needed, and that will end up being sent to recycling plants. By painting all window profiles after cutting and drilling, the colour-stock problem does not exist. All profiles can be used in any colour.



### 8.3 Reuse

The leftover profiles and already used profiles can be re-used in several different ways.

Fibreglass profiles have a longer life span than other materials due to the fact that they are highly resistant to corrosion. While other materials, such as iron and steel, have a low resistance to the ocean breeze and salted water..

With a long life-span, existing windows can be taken out of a wall where they are no longer used and re-sold or re-used in another construction project, such as in sheds shelters, eco-modules and other eco-friendly construction. Nowadays, Salvage Building Materials marketplaces are more and more used to cut costs in new construction and in refurbishments.

Apart from the use of the window as a whole, it is also possible to dismantle the window and re-use and recycle all the materials separately. The use of fibreglass waste in concrete composites is wide spread (Job 2014) and provides the new concrete with better features.

So, when your windows no longer have a function as windows, they will carry working as bridges and buildings for future generations.

### 8.4 Recycle

Glass is 100% recyclable, as it loses almost no qualities when melted and used to produce new glass. All glass used in BOAVISTA Windows' fibreglass profiles is recycled. This glass represents 70% of our profiles' material, overall.

Fibreglass profiles that are no longer in use are currently being used to reinforce polymers and other composite materials, in order to produce lumber, that can be used in decking, fencing and others. (Lyons 2007)

It can also be used as a part of wood particle board, in order to provide it a greater resistance when compared to other wood particle boards.

### 8.5 Re-think – The Forth R.

We are living the end of an ice-age, rushing towards by humans in what is called Global Warming. El-Niño and La Niña are climate phenomena more and more frequent, often affecting the daily lives of all people. With an increasing risk of flooding and high winds, the world is facing fast-paced change from which we cannot return but that can be delayed.

At BOAVISTA we believe that each one of us can contribute to slowing down the climate change we are experiencing. We work daily to bring you more sustainable products, with a lower energy consumption and lower carbon footprint. We aim to decrease our impact on the planet.

We are also great fans of minimalism: doing more with less is a great way to produce beautiful products using as little material as possible.

Being a very versatile material, fibreglass pultruded profiles are a great material to re-think architecture and re-think building materials.

Some steps have been taking towards using fibreglass profiles in light structures and to substitute traditionally pollutant materials, such as steel beams.



Bridge, Kolding Denmark



Water Treatment Center



Dessalination Central, Dubai



Swimming pool



The fact that fibreglass is nearly inert allows its combined use with other materials that would otherwise not fit in the same façade, for example. Using mixed recycled materials in facades is a good way of introducing texture and interesting features into existing buildings.

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## Fibreglass + Copper + Stone + wood

### Vertical gardens

Its high resistance to humidity makes it the perfect material for vertical gardens for your flowers and vegetables.



### Earth Sheltered buildings

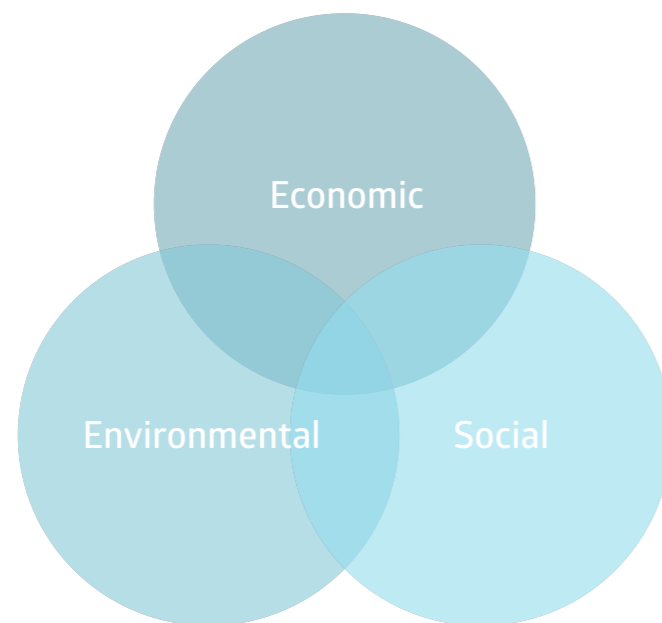
The characteristics of fibreglass make it an optimal material for Earth Sheltered Buildings. These type of buildings are built in the ground in order to have lower energy consumption. Due to the constant contact with the ground, fibreglass windows may be more suitable than other materials, as they are more resistant and stable.

See below the example from (Sustainable by Design 2012)



## 9. The Triple Bottom Line

The triple bottom line concept was first introduced to the world in 1994 by John Elkington and states that all companies should keep in mind 3 bottom lines: Economic, Social and Environmental impacts of their activities. This concept is represented by 3 circles of the same size. Where the 3 circles cross is where SUSTAINABILITY is. (Triple Bottom Line 2009)



These bottom lines can be summarized in 3 P's: Profit, People and Planet.

The Economic bottom line is based on Profit.

The Social bottom line is based on People.

### PROFIT:

Buy local: at BOAVISTA, we try to buy as much as we can from within a 50km radius of the construction site.

Our suppliers are certified and fully compliant: they are socially responsible.

### SOCIAL:

BOAVISTA collaborates with social institutions, having supplied free of charge several windows for refugee homes.

BOAVISTA believes in a good environment for the work place too. We believe in equality and in empowering the younger professionals. Our age average is of 29 years old.

BOAVISTA keeps regular internship programmes for young architects and design students.

### PLANET:

This book speaks for itself!





The choices we make define  
who we are. Choose smarter,  
think ahead!  
Choose BOAVISTA



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