



Consumer Preference for the Use of Aluminum Window to Wooden Window for Sustainability Marketing in the 21st Century

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Abstract: *Letting light into a cave or crude structure allowed its inhabitants to better perform tasks and navigate their surroundings, alerting them to the day's cycle and keeping them in sync with it – something that we understand is vital to human health and emotional health and wellbeing. Aluminum window frames are valued for their slim profile but durability, along with their low maintenance and strength. Due to their lightweight construction and strength, aluminum window frames are able to be configured in a variety of ways. This makes them beneficial for multi-panel systems or large windows. However, aluminum frames are not recommended in wet areas or areas that have high levels of salty water and air due to their corrosion. Wood frames are the most common choice for frames as they can be painted a solid colour or stained and sealed*

Keywords: Wood frames , aluminum window.

INTRODUCTION

Windows: From our earliest times, the need for light has been central to our needs as humans. Letting light into a cave or crude structure allowed its inhabitants to better perform tasks and navigate their surroundings, alerting them to the day's cycle and keeping them in sync with it – something that we understand is vital to human health and emotional health and wellbeing.

The window frame is the portion of the window that holds the glazing and sits between the glazing and the wall of the building when installed. The frame can be fairly simple in a non-operable window to very complex with numerous moving parts in an operable, multi-pane window. Overall, the main function of a frame is to hold the panes of the window in place— with the aid of spacers—and hold the window into the wall of a building. Taking into account the frame as well as the glazing when choosing a window is vitally important in ensuring that the energy efficiency of the window is suitable. Looking at the U-values of windows along with their frames can provide a more complete idea of how well a window will insulate. (Energy.Gov. April 28, 2015). In addition, the choice of the right window frame, especially a modern window frame, can cut air infiltration in a home down to nearly zero by covering cracks and creating a good seal.

Window frames can be made out of a wide variety of materials, and can be made solely out of one material or a composite of numerous materials. The most common frame types are

wood, vinyl, aluminum, and more recently fiberglass frames. Composite frames include vinyl or aluminum clad wood products, wood clad vinyl products and other combinations to meet a variety of demands (Window & Door April 28, 2015).

Window frames Throughout the early medieval period, the great majority of windows were unglazed. In timber-framed buildings they were simple openings in the structural frame. Wider openings were often sub-divided into two or more 'lights' with plain or moulded mullions. Vertical wood or iron bars were inserted to keep out intruders. Taller windows might be sub-divided horizontally with transoms. Glass was extremely expensive and rare and was not considered a fixture. Timber shutters were widely used for security, privacy and to reduce draughts.

Aluminum: Aluminum window frames are valued for their slim profile but durability, along with their low maintenance and strength. Due to their lightweight construction and strength, aluminum window frames are able to be configured in a variety of ways. This makes them beneficial for multi-panel systems or large windows. However, aluminum frames are not recommended in wet areas or areas that have high levels of salty water and air due to their corrosion. In addition, the welded joints can weaken over time, resulting in cracking and breaking. However, compared to vinyl, fiberglass, and wood frames aluminum frames are the least energy efficient as they conduct heat well. To reduce this, some companies have equipped aluminum frames with thermal breaks that separate the interior and exterior surfaces of the frame to reduce heat transfer (samphina.com.ng).

Wood: Wood frames have been used extensively in window frame construction for their warm look, insulating properties, and the ability to paint them to refresh how the frames look. Wood frames are the most common choice for frames as they can be painted a solid colour or stained and sealed. However, compared to vinyl and fiberglass frames, wood frames require more maintenance including regular sealing, staining, and painting. Although affordable, they may not provide the highest levels of insulation and are prone to cracking, in turn letting untreated air and water into the home. Timber is the traditional construction material. Using timber as a construction material is environmentally sound. Forests are being protected well in most parts of the world through proper forest management schemes, that is, for every tree that is cut, two trees are planted. It is also understood that younger trees have a greater tendency to carry out the photosynthesis process hence making them more environmentally friendly. Therefore, the constant harvesting and replanting of trees is more beneficial in reducing carbon dioxide and increasing the supply of oxygen than simply leaving mature trees standing.

Sustainability is defined as; A development or practice which does not reduce the long-run productivity of the natural resource assets on which a country's income and development depend. To achieve the goals of sustainability it is required to adopt a multi-disciplinary approach covering a number of features such as; energy saving, improved use of materials, reuse and recycling, and emissions control. All countries should take action, with developed countries taking the lead; encourage and promote the development of a 10-year framework of programmes in support of regional and national initiatives to accelerate the shift towards sustainable consumption and production to promote social and economic development within the carrying capacity of ecosystems by addressing and, where appropriate delinking economic

growth and environmental degradation through improving efficiency and sustainability in the use of resources and production processes, and reducing resources degradation, pollution and waste (Johannesburg, September 2002.<http://www.johannesburgsummit.org>)

Recycling and/or reuse, is one of the most important features of sustainable development because it provides numerous environmental advantages such as; saving in embodied energy; reduction in demand for virgin materials and hence in depletion of natural resources; reduction in landfill requirements, and reduction in pollution generated from mining/ manufacturing processes. Sustainability has a significant economic aspect as well; for example, it can bring considerable savings through the implementation of energy-efficiency measures, reduction of material consumption and waste generation through enhanced re-cycling

REVIEW OF RELATED LITERATURE

Aluminium vs uPVC Windows (Pros and Cons Reviewed) <https://www.shiredoors.com>
Aluminium vs uPVC windows – it's a longstanding debate as to which is better, and for homeowners it can be a tough decision to make when considering the installation of new windows.

Durability of uPVC vs aluminium windows

uPVC (unplasticised Poly Vinyl Chloride) has been a popular choice for window frames since the 1980s. It's a very durable material and resistant to rot, which means it has a long lifespan and requires very little maintenance. However, frames can degrade over the years, albeit at a much slower rate than timber windows, and tend to require replacement after 20 to 30 years.

Aluminium is also a highly durable material, but high quality aluminium windows can last up to 45 years because they don't degrade in the same way that uPVC can. Unlike other metals, aluminium will not rust.

Technology has come a long way over the past couple of decades, and these days aluminium windows and doors feature innovative thermal breaks within the frames, which prevents too much heat from being conducted. Aluminium and uPVC windows are pretty secure, and significantly more so than timber windows which can be vulnerable to forced entry if they degrade. The level of security a window provides tends to be based on the quality of the locks installed with it.

Now a days, researchers all over the world are focusing mainly on alluminium because of its unique combination of good corrosion resistance, low density and excellent mechanical properties. The unique thermal properties of aluminium composites such as metallic conductivity with coefficient of expansion that can be tailored down to zero, add to their prospects in aerospace and avionics. The choice of Silicon Carbide as there in forcement in aluminium composite is primarily meant to use the composite in missile guidance system replacing certain beryllium components because structural performance is better without special handling in fabrication demanded by latter's toxicity (Richards Demeis 1989) Recently aluminium-lithium alloy has been attracting the attention of researches due toits good wettability characteristics (Huda et al 1993)In addition, literature also reveals that most of the

published work has considered aluminium-based composites with their attractions of low density, wide alloy range, heat treatment capability and processing flexibility. Many of these features are also exhibited by magnesium-based systems and with its lower elastic modulus. Many of the composite fabrication processes are common to both Al and Mg based systems (Doychak 1992)

Pros of Aluminium Windows according to <https://www.integrawindows.com.au/2019>

- **Strength** – the top advantage of aluminium as a material has to be its absolute strength. This allows for slimmer frames and makes it long lasting as a material option. This also makes them top when it comes to security.
- **Low Maintenance** – very much like uPVC, aluminium is a low maintenance material that once installed requires nothing to maintain its durability and appearance. No need to re-apply a finish to maintain the colour or to prevent rust.
- **Recyclable** – if you're looking to improve your carbon footprint then choosing a recyclable material such as aluminium (or uPVC) is a way to do that.

Cons of Aluminium Windows

- **Poor energy efficiency** –Aluminium is a very good conductor of heat, meaning that unlike a material like uPVC (or timber), it is the least energy efficient material to use for a window or door frame.
- **Condensation** – following on from the above, because aluminium is such a good conductor of heat, this makes them susceptible to condensation forming.
- **Aesthetics** – a pro of timber windows, but a con for aluminium windows. Aesthetically, there isn't as much versatility in the appearance and design of aluminium windows compared to timber or uPVC windows.

Pros of Timber Windows

- **Aesthetics** – traditionally timber frames have been a popular choice for many years for those looking to invest in the outward appearance of their property. When comparing to a 'plastic' material, you may find it difficult to compare (even with the 'timber' finishes that uPVC can offer in a variety of colours).
- **Flexibility** – no we don't mean the wood is flexible, but more that the appearance of the wood is actually flexible. With timber you can easily change the colour or finish of the window frame or door, something that you can't do with other building materials. If you're indecisive or find yourself changing colours a lot, this is a big win for timber.
- **Longevity** – wooden windows, if maintained properly with a lot of love and care, can last for many years, outliving most other materials.

Performance of wooden windows

1) Thermal performance

Wooden windows must be energy efficient under the Building Regulations. These Regulations apply to both commercial and domestic properties. To meet these requirements, the wooden windows supply house double or triple glazed glass panels. Furthermore, wooden windows are sealed. This means wooden windows are waterproof. Many people assume that wood will not score as highly as PVC-U when it comes to thermal performance

2) Weather performance

Due to climate change people have experienced in recent years, the need for high performing wooden windows from a weather perspective has never been so apparent.

3) Security performance

Wooden windows supplies are fitted with ground floor window locks. This is particularly important since many home insurance policy will not pay out if ground floor windows are not fitted with locks.

4) Acoustic performance

Under the Building Regulations, windows must be designed to prevent the passage of noise from leaving and entering the property. The regulations also apply to the refurbishment of existing properties.

Generally, single and even double glazing are not effective when it comes to sound insulation. If sound insulation is important, it is advisable that customers to invest in triple glazing or 'double windows'.

Benefits for sustainability of wooden window

Wood is obviously natural and completely sustainable. In fact, it's the sole source of naturally renewable building materials available today. Trees are highly efficient at absorbing carbon dioxide into the atmosphere. The process where trees absorb carbon dioxide from the environment is known as the 'carbon sink' effect. When trees reach maturity, their ability to carry out carbon sink is diminished. When trees reach this age, they are ripe for harvesting. Sustainable forest management actually helps to protect the environment by improving carbon sink (<https://www.bebingtonglazing.co.uk>)

Advantages of aluminium windows (<https://www.theecoexperts.co.uk>)

It's cheaper than timber. While aluminium is generally more expensive than PVC, it's also much more affordable than timber. This is a no-brainer, considering aluminium is tougher and more durable than wood.

The frames are thinner. Aluminium has a phenomenal amount of inner strength, although it doesn't like to talk about it. This means it can be slender and still offer the same support as a bulky chunk of timber or PVC, allowing more space for glass. Not only does this give you a better view of the great outdoors, but glass is a very talented insulator.

It lasts a long time. During spells of icy cold and intense heat, many window frames contract and expand, slowly losing their shape and eventually needing to be replaced. In particular, PVC loves warping in the sunlight, and wood can't wait to start rotting. On the other hand, aluminium remains strong and stable, typically lasting around 25-30 years (or longer). Maintenance is minimal.

You'll be better protected. This inner strength comes with one more advantage; aluminium will be your guardian angel. Its natural robustness means it can withstand attacks far better than wood or plastic, so you can rest easy in your metal fortress.

It's eco-friendly. Aluminium is 100% recyclable, so when you're finally ready to get rid of your metal friends, they will be ready to go all over again.

Disadvantages of aluminium windows (<https://www.theecoexperts.co.uk>)

A poor insulator? It used to be the case that aluminium was one of the worst materials for keeping the heat in, but polyamide thermal breaks (that go between the internal and external layers of aluminium) have helped to deal with that. "Thermally broken" aluminium windows can now compete with high-end PVC and timber equivalents.

Prone to condensation? Again, thermal break technology has put this one to bed.

Weak soundproofing? If keeping the world's noise out (and your noise in) is a priority, PVC frames tend to be a bit more effective. However, it's worth noting that the majority of a window's soundproofing is determined by the glass, not the frame.

Susceptible to salt corrosion? Aluminium just hates the seaside, it's true. If your windows are near sea air and saltwater, the frames will start to corrode, but there are easy ways to prevent this. For instance, regular cleaning will keep the salt away, and a lick of powder-coated paint will add an extra layer of protection.

CONCLUSION

It has been found that aluminium windows have the highest level of embodied energy as compared to other windows. Timber windows have been estimated to possess the lowest embodied energy.

Timber windows need to be painted or stained periodically to keep them protected from weathering impacts. A price comparison of windows is quite an involved process due to a

number of factors such as the quality of product and marketing tools such as, discounts and incentives. However, the general perception is that aluminium windows are more expensive than the rest of the candidate windows. Aluminium-clad timber windows.

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