

w e i v v i e w framing the

window frames for a sustainable future



Window frames for a sustainable future



Lydia Wilson

view

“Look out,
your choice of window frames could seriously
affect the health of our planet.”

Greenpeace



introduction

Window frames may not be the most attractive topic for a glossy brochure, but before you close up and file the subject away in your mind under 'least important', stop for a second. Consider what modern building materials are doing to the environment. Consider the waste and the toxins we plough into the atmosphere, rivers and the land with every piece of plastic developed for our own use. And consider the massive amounts of energy required to make a material whose lifespan is, at best, fifty years.

If there wasn't already a viable alternative, PVC-*u* could, perhaps, be justified as simply another in a long line of man-made, environmentally damaging products designed to make our lives more comfortable. But there is already a proven building material that is one of the oldest, most environmentally friendly products known to man: wood.

This booklet puts forward some of the arguments ignored by plastic window salesmen over the years, but it aims to inform rather than indoctrinate. It is everyone's own responsibility to choose products that will protect, rather than pollute, the planet.

Unplasticised¹ Polyvinyl Chloride (PVC-*u*)

*“PVC-*u* has taken a huge slice of the 800 million pound window market by out-competing wood on price, technical specification, maintenance and product image. .PVC-*u* windows are one of the most ‘heavily sold’ items in our consumer society. In the last six years [1993-99], the PVC-*u* industry has spent over 500 million pounds on advertising, as against 25 million pounds by other kinds of window frame manufacture.”*

**Rod Nelson, research and information officer at Soil Association Forestry.
Local Government News, September 1999**

90 per cent of replacement windows are double glazed PVC-*u* units, according to the British Plastics Federation², but this incredible success is demonstrably at odds with the product’s technical and environmental qualities.

A PVC-*u* window has absolutely no advantage over a properly-fitted wooden one. In fact, wooden windows have been refined, tried and tested over centuries of use, and remain the most environmentally friendly, versatile, energy efficient and aesthetically pleasing window frame yet to be invented by man. As long as the wood is properly finished and maintained, just as a PVC-*u* product has to be properly reinforced and cleaned regularly, wood beats PVC-*u* on every performance indicator there is.

PVC-*u* manufacturers are constantly striving to improve the structure of their window frames, but, compared to wood, PVC-*u* remains a weak material. It tends to bend under its own weight, which is why PVC-*u* frames are bulky and require internal steel strips to strengthen them.

*PVC-*u* windows: (clockwise from top left) protected by paper, degraded, discoloured, unsuitable replacement (original wooden window frames right)*

¹ Unsoftened

² The trade association which represents the plastics industry in the UK



view



"It is sometimes said that wooden joinery requires more maintenance than aluminium or PVC. This prejudice has been superseded because of the developments in finishing products and the growing understanding that there is no such thing as a material which does not need any maintenance..."

Engels N.V., supplier of PVC-u and timber windows

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The maintenance-free myth

When double-glazed PVC-*u* replacement windows were first mass-marketed in the UK in the 1960s and 70s, their biggest selling-point was that, unlike down-market old timber, the new material would last indefinitely, no-maintenance guaranteed. One ambitious slogan shouted, “You only fit double glazing once so fit the best...” However, thirty years later, the customers who fell for the first hard-sell are often unpleasantly surprised to find a new generation of salesman trying to flog them a PVC-*u* upgrade to replace their once-in-a-lifetime purchase.

There is no such thing as a maintenance-free building product that will last any length of time: PVC-*u* window frames need to be cleaned every six months or dirt imbeds itself in the material. They do not weather attractively, and prolonged exposure to ultra-violet light from the sun ‘chalks’ the surface, making it grainy and dirt-retentive. Pollution and sunshine eventually combine to yellow the surface and attack the structure, making the frames increasingly brittle and prone to cracking.

Compare this to the performance of a 28-year-old *unmaintained* softwood window frame at the Building Research Establishment in England: it showed no signs of flaking, peeling or cracking and, although it showed some discolouration, structurally it was completely sound.

It remains a common misconception, however, that wooden window frames are troublesome to maintain and that PVC-*u* windows are durable and value-for-money. They aren’t. Properly coated and periodically painted wooden windows will last for a hundred years or more, current generation PVC-*u* will begin to degrade and discolour after only twenty.

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Price isn't everything

“ There is hardly anything in the world that some man cannot make a little worse and sell a little cheaper, and the people who consider price only are this man's lawful prey.”

John Ruskin

view

A 1993 report prepared for Carlisle Council concluded that the cost, taken over its lifetime, of a well-crafted softwood window was lower than its PVC-*u* counterpart. This comparison is rarely necessary, however, because when a wooden frame does start to deteriorate, the unsound pieces can be replaced with new bits of wood at a fraction of the cost of a replacement PVC-*u* window. Only in the most extreme cases will wooden windows need to be completely replaced rather than simply repaired, but this is very conveniently omitted from PVC-*u* sales patter.

Carlisle Council's independent audit also reported: "Timber windows have been found to be efficient, have generally proved popular with tenants and are environmentally more friendly. After installation, the heat-saving properties of timber windows are better than in PVC-*u* versions."

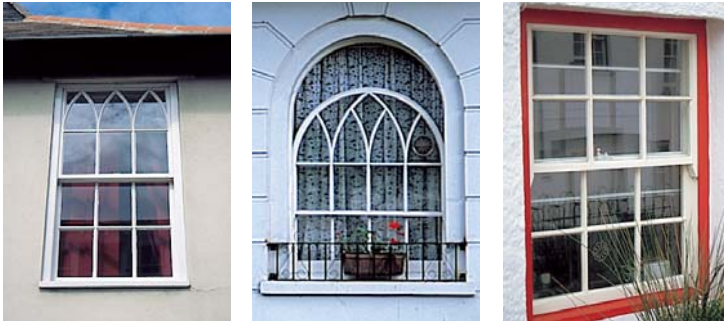


*Degraded parts of a wooden window can be removed and replaced for a fraction of the cost of a replacement PVC-*u* window*

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Wooden window frames: the long-lasting Old Reliant

No other material lasts like it: wood has been around for millions of years, and wooden window frames well-constructed now will outlive generations of man-made materials.



Timber windows utilising all the present technologies provide a product that will last, *at a conservative estimate*, 60 years if periodically maintained. Older windows coated with now-banned lead paint have already lasted twice as long and longer. John Hedgecock of the British Woodworking Federation explains:

“Wood is the only material that can factually make a claim to long life, because no other material has been in use for so long.”

Wooden frames are also technically suited to the job: as the table opposite shows, wood naturally retains heat better than aluminium or PVC-u, and it does not warp at extreme temperatures.

Frame Type	Glazing Type	U Value (W/m ² K)
Wood	Single	4.5
	Double	2.7
PVC- <i>u</i>	Single	5.3
	Double	3.0
Aluminium (with thermal break)	Single	5.2
	Double	3.4

From **Guide to Specifying Wood Windows** British Woodworking Federation June 1990
 N.B. the higher the U Value, the more heat is lost.

Modern wood finishes, although they contain environmentally unfriendly chemicals, eliminate any significant difference in the non-maintenance longevity of wood compared to PVC-*u* because they protect the wood from insect penetration and moisture damage.

The Nordic Timber Council, which promotes Scandinavian wood abroad, advises: "There is little or no risk of decay in timber when its in-service moisture content remains at a level of 20-22 per cent or less. Wood dried and kept under this level of moisture will be perfectly usable without the need for preservatives."³

³ Nordic Timber Council *Fact File 7: The Durability of Nordic softwoods*

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Wooden frames: part of Ireland's heritage

Although it is perhaps not widely appreciated, our architecture is just as distinctive as the traditional dances, songs, stories or rituals that define the character and history of us as people. How often have you seen the whitewashed gables and pretty proportions of vernacular cottages or ornamented townhouse terraces on postcards defining Ireland for tourists? And how many times have you heard people talk fondly of the beautiful old houses and shops that historically shaped our streetscapes? Why do you think well-maintained historic towns like Hillsborough, County Down, attract so many tourists? The answer lies in the unique mix of architectural characteristics which traditional Irish buildings display, and traditional windows - **the 'eyes' of a building** - form the centrepiece of these defining traits.

Nessa Roche, author of 'The Legacy of Light - a history of Irish windows', writes:

"Ordinary buildings in Ireland rely greatly for their beauty and ornamentation on the arrangement of their windows. These buildings, with their harmonious blend of windows and proportions, form the quietly attractive streets and towns that are a pleasing backdrop to our daily lives. It is not just the shape of the windows that creates this visual harmony. It is the pleasantly aged timber and glass, the appearance of the sash or casement, the mellowed old brick and stone, all gently rounded and softened by centuries of life, that together create the character of a building or street."



view

Most of the listed buildings in Northern Ireland have wooden sash windows. These will be between one and two hundred years old, and will last another hundred if professionally repaired and looked after. However, throughout Ireland, PVC-u is slowly ravaging old buildings which do not have the protection of listed status (and some which do), imposing slick, clean-edged plastic upon the quirky, well-aged charm of the original material. The original wooden frames were, of course, designed to live, breathe and match the original materials in the building, which makes their replacement with PVC all the more tragic.

An historic building starts to lose its integrity when any part of its original fabric is replaced - what's more, there is rarely a sound reason for replacement because the original stone, wood and glass are usually of better quality than their equivalent modern materials. The craftsmen who helped build 18th and 19th century houses often used the best of local materials, and delighted in distinguishing their work from others using ingenious artistry and a craftsmanship which has proved long-lasting and unique.

Repair will nearly always be less costly than replacement, and far more valuable to the community, not only helping to preserve the character of an area but also keeping its local traditional skills alive too.

Buyers are increasingly attracted by properties with period features, especially, according to a broad survey of estate agents, if they pre-date 1930. Replacing these quirky, non-standardised features with clean-cut, production line products will reduce the appeal, and hence the price, of the property, in much the same way as would replacing the leg of an antique table with a modern material like MDF.

Peter Pearson, an Irish architectural historian, explains: "Living with old uneven floorboards and ancient plaster is part of the charm of being in a historic building. If it is all replaced and made new, even and shiny, the sense of age and feeling of history have gone. Nowhere is this more obvious than in the windows, part of the public façade which addresses the street and says much about the character and beauty of the building."

Many building materials are generally thought to increase in beauty as they age, but this does not apply to plastics. They can be repainted with special PVC-u paint, but this destroys the 'no-maintenance' selling point upon which PVC-u salesmen so depend. Advice published by the British Plastics Federation Windows Group warns contractors and home-owners that the replacement, without planning permission, of original windows with plastic copies in a listed building is an offence punishable by imprisonment or fine. The same may also apply to buildings within a conservation area.

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Extending the frame life: restoration

“Old windows that rattle and don’t shut properly are perceived as dangerous weaknesses in our defences against theft and the elements. When a salesman sucks his breath through clenched teeth before breaking the news that your windows have ‘come to the end of their useful life, love’ the temptation to deal them the coup de grace in favour of the spanking new and wipe-clean option may be irresistible.”

Ros Byam Shaw, ‘Restoration of the Old Glass Order’, Daily Telegraph, March 2000

It is no longer valid to replace any wooden window for energy or draught-saving purposes. An over-simplistic past emphasis on double-glazing as a cure-all for energy loss has led to irreplaceable loss of historic fabric. This is especially tragic when you take into account that traditional buildings tend to have small windows relative to wall area, and those walls are usually thicker than modern houses.

Research by English Heritage has revealed the economic lunacy of ripping out old windows and replacing them: it takes 60 to 100 years for double glazing to pay for itself in saved energy costs. **Secondary glazing can reduce up to 20 per cent of heat loss, but lagging your loft, where most heat in the building is lost, will see a much quicker return on your investment. In all but the worst cases, old windows can be repaired, draft-proofed and re-hung to slide smoothly and shut snugly at a fraction of the cost of installing new windows.** While one might pay around 500 pounds to replace a wooden sash window with a double-glazed plastic one, a restoration company like Ventrolla will fully restore it and charge from about half the price. Restoration will typically entail repairing weak joints, restoring pulleys, replacing cords and weights where necessary and draught-proofing, although a properly-fitted sash window should not be draughty. Swollen sashes can be planed down, windows painted shut can be freed with a razor, and if a timber frame is rotting, damaged areas can easily be replaced. There is an increasing number of companies now specialising in the restoration of old windows.

There is simply no practical or aesthetic excuse, then, for nostalgically harking back to the architecture of past ages while we oversee irreparable damage or loss of historic fabric through alteration of an historic building in our custody.

view

Restoration is cheaper than replacement



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Life-cycle considerations

As the planet becomes increasingly polluted with waste from the consumer goods upon which industrialised nations depend, there is growing awareness and research into the environmental cost of the products we consume.

The energy used in making a window frame is embodied in the house for which it is made: replacement of the window frame for any reason other than its total failure is therefore a waste of energy. In fact, it is not enough to add up the energy saved by a replacement window from the time it was installed - the energy required to make the new window must also be counted.

Dr Richard Murphy, of Imperial College in London, recently completed a comparative analysis of the environmental impact of aluminium, PVC-*u* and wooden window frames, based on a 30 and a 60 year life-cycle. Environmental parameters included carbon dioxin emissions, global warming potential, ecotoxicity, human toxicity and resource use over a 60-year life. Although the wood had been treated with toxic preservatives, on every single parameter, timber windows came out vastly better for the environment than PVC-*u* or aluminium.⁴

In 1998, Nike, the US trainer manufacturer, announced a removal of all PVC⁵ from its products. A spokesman explained at the time, “The issue for us with PVC is a lifecycle one. At Nike, we believe in looking at the entire product and resource lifecycle. The pure PVC polymer is not toxic, but its lifecycle is very hazardous to human health and the environment.”⁶

Numerous businesses have either eliminated or begun working towards a phase-out of PVC in products or facilities, including Volvo, Saab, Braun, Ikea, the Body Shop and Swedish construction companies JM and Svenska Bostder. Many other organisations, including the London Underground, have banned the use of PVC cabling because it releases dangerous toxins when burned.

⁴ Rod Nelson *Wood for windows* Local Government News, September 1999

⁵ PVC is the same as PVC-*u*, but with plasticisers to make it soft and flexible

⁶ Nike *PVC Phase-Out POV/Talking Points and Q & A* 1998

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PVC-*u* and the environment

The production and disposal of any type of PVC creates toxic chemicals. These are released twice: once during manufacture - a process which uses up many times the amount of energy required to produce a wooden frame - and again when the material has to be disposed of - by incineration or in landfill sites. These chemicals end up in the environment and add to the level of persistent toxins and organochlorides that build up in the air, soil, water, food chain and human bodies.

When PVC is manufactured, burned or recycled in high temperature processes, dioxin is formed. In fact, when any substance is burned, dioxin is produced, but PVC is inextricably linked with dioxin emissions because of its chlorine base.

*More chlorine is used to make PVC than any other product, making PVC more responsible for the global spread of dioxin than any other material.*⁷

Dioxin is presently being linked by some scientists to health defects including diabetes, testicular atrophy, increasing counts of cancer, immune system impairment, birth defects, endometriosis and problems with cognitive development. A rise in similar afflictions in wildlife has already been linked to man-made environmental toxins. The US Environmental Protection agency has found dioxin to be 300,000 times more potent a carcinogen than DDT, which was banned in the US in 1972.

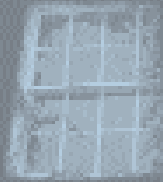
Burning one tonne of PVC creates 0.9 tonnes of waste salts. These are still toxic.

New technology allows the recycling of limited parts of old PVC-*u* windows, but not without the addition of more chemical additives and stabilisers. "It is the environmental questions raised by PVC which should really cause specifiers to think very carefully before they stipulate the use of PVC for windows."⁸

⁷ Source: *Greenpeace*

⁸ Rod Nelson *Wood for windows* Local Government News, September 1999

view



Slick, clean-edged plastic sits uneasily in well-aged buildings, and its disposal is an environmental time bomb:



PVC incineration waste scars the Danish countryside

Photography: (c) Greenpeace/Christensen

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Where does your expired PVC-u window frame go?



Photography: (c)Greenpeace/Baatz

Expired PVC-u window frames await disposal in Rahden, Germany

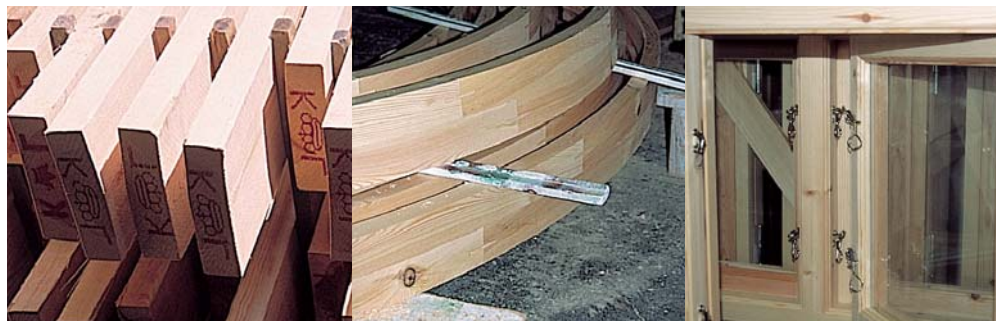
Three European Commission studies on PVC and PVC-u waste management, published in April 2000, stated that PVC waste volumes will almost double over the next twenty years. Mechanical recycling, the reports found, will “not contribute significantly” to reducing the waste mountain, while some forms of PVC incineration will produce higher volumes of solid waste residue than went into incinerators.

Significant quantities of PVC additives will continue to leach out of landfills in the future, the reports concluded, and PVC recycling levels are unlikely to reach more than 18 per cent. Greenpeace sees the reports as vindication for their long-running anti-PVC campaign. According to a spokesman, “**Landfilling of PVC is a ticking time-bomb, incineration creates even more hazardous waste than there was before, and recycling is not a solution.**”

The EU reports are expected to strongly influence future PVC policy in Europe.

Wood and the environment

Wood can also be environmentally damaging, if it is unsustainably harvested. Unfortunately, the industry has yet to consolidate against unscrupulous sellers flogging wood from centuries-old forests. Older trees have a natural density and longevity which would, ideally, always be used for wooden frames. This is, however, absolutely environmentally unsustainable.



Buyers should look for the Forest Stewardship Council's logo ('FSC-approved') on products, which means the wood has come from a sustainable forest. If FSC-approved products cannot be sourced, consumers should choose window frames from timber which does not originate in old-growth forests. Younger trees can be sustainably grown, but need more environmentally damaging preservatives to protect them and prolong their use.

Wood remains, however, our only renewable, recyclable, waste-efficient and biodegradable building material. It is also energy-efficient in production: converting timber into a usable building material takes far less energy, and therefore generates less carbon dioxide, than virtually any alternative including aluminium, steel, concrete and PVC.⁹

⁹ Timber Trade Federation

Window frames and fire

There is now rising concern at the toxic effect of PVC-*u* in buildings in fire situations. A 1993 report by scientists at the German Environment Protection Agency concluded: “In recent years it has become clear that PVC gives rise to dioxins and furans - a fact that not only causes environmental damage but also results in major problems for worker safety and high decontamination costs in the wake of fires.”



Photography: (c) Greenpeace/Lowson

A fire in a PVC factory in Hamilton, Canada, leads to the emission of noxious toxic gases

An open letter written by the Secretary of the British Fire Brigades Union in 1997 reaffirmed European fears: “The Fire Brigades Union is now particularly concerned about the safety of PVC-based building materials that are used in the construction and fitting out of buildings, when involved in fire. . . There now exists a substantial body of evidence which shows that the combustion of PVC in a fire leads to the release of dioxins and furans which may then be spread over a wide area by the smoke plume from the fire.”

Tests carried out by the Nordic Timber Council on the behaviour of wood in fires found that it did not collapse suddenly or unpredictably in fires in the way that other building materials do.¹⁰ This is because wood tends to burn slowly when ignited and, instead of turning to ash, forms an outer layer of charcoal that protects the inner heart of the wood from the fire’s worst effects.

¹⁰ Fact File 8, Nordic Timber Council: Nordic softwood’s performance in fire

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Timber & PVC-u: the big picture

TIMBER	PVC-u
Inherent structural strength of material	Material needs reinforcement, which is sometimes omitted by budget manufacturers
Huge variety of colours, finishes, sustainable timber species can be used	White or simulated wood grain finish
Cleaning cycle up to 2 years	Cleaning cycle 3-6 months
Surface discolouration fixable during maintenance	Discolouration irreparable, apart from with special PVC-u paint
Frame damage repairable by carpenter/craftsman	Damaged removable parts can be replaced if original system supplier available. Fixed element damage not easily repairable
Relatively dimensionally stable under temperature extremes	Distortion can occur under temperature extremes especially if internal/ external differential is great
Susceptible to moisture uptake if surface coatings damaged	Not affected by moisture
Hardware can be easily fixed to frames	Reinforcement required to hold hardware correctly
Replacement of hardware easy	Damaged hardware difficult to replace because models change so quickly
Wide range of standard windows	Not usually produced in standard range sizes
Environmentally sustainable	Finite source of base material (oil)
Low energy costs in production	High energy costs in production

Adapted from table of comparisons between timber and PVC-u windows supplied by

British Woodworking Federation



Conclusion

It will take a long time to persuade consumers that PVC-*u* is damaging our planet, especially with the multi-million pound might of the plastics industry backing it. But the idea is slowly catching on: a wooden window frame saves energy both in use and production, uses a minimal amount of finite resources, is reasonably easy to maintain and repair, lasts longer than any product currently available and biodegrades or can be recycled at the end of its useful life. No other material meets these requirements and has hundreds of years of use to prove it.





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