PVC to Deliver Sustainable Housing and Construction in Europe

Position Paper

VinylPlus
COMMITTED TO SUSTAINABLE DEVELOPMENT

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Executive Summary

PVC (Polyvinyl Chloride) products are essential to Europe's construction and infrastructure landscape. Widely used in applications such as window frames, flooring, cables, and piping systems, PVC delivers high-performance, cost-effective, and low-maintenance solutions that meet the technical demands of modern housing. Its insulation properties also contribute significantly to the energy efficiency of buildings.

With **70% of PVC products used in building and construction**, and over **80% of these produced in Europe**, the PVC value chain is deeply embedded in the EU's industrial fabric. PVC products are not only durable and affordable, but also scalable and circular, satisfying all three pillars of sustainability. They are manufactured locally, have strong environmental performance, and support long-lasting, low-maintenance infrastructure.

The VinylPlus sustainability certifications called **VinylPlus® Product Label** for PVC products, and **VinylPlus® Supplier Certificates** for PVC additives suppliers and PVC compounders, manage a multi-criteria, third-party sustainability certification scheme open to any PVC building and construction products and their additives.

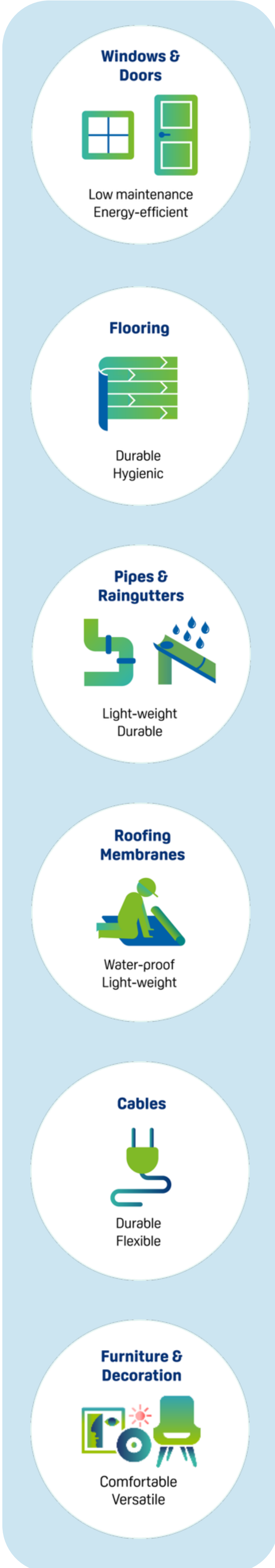
However, to fully unlock PVC's potential in addressing Europe's housing and construction challenges, policy action is urgently needed. The European construction sector remains relatively stalled, and outdated or inconsistent regulatory frameworks are creating investment risks and barriers to innovation and recycling.

VinylPlus® is the European PVC industry's commitment to sustainable development. We represent the entire PVC value chain established in the EU, from monomer production to recycling. We call on EU policymakers to consider the following:

- **Remove outdated or discriminatory regulatory barriers.**
- **Establish a coherent framework that supports innovation, recycling, and cross-border deployment of circular construction solutions.**
- **Address investment risks to enable long-term planning and industrial autonomy.**

The European PVC value chain offers a unique contribution to the Affordable Housing agenda, delivering hygiene, safety (including fire and chemical exposure protection), and sustainability through resource-efficient production and strategic industrial autonomy.

VinylPlus stands ready to support European authorities in all housing and construction-related initiatives, including the anticipated secondary legislation of the Construction Products Regulation, the Affordable Housing Plan, and related public procurement and State aid mechanisms.



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1. Policy Asks to Unlock the European Construction Sector

Prioritise Financial De-Risking of European Value Chains Supporting Construction and Housing

- **Maintain full State aid eligibility for energy-intensive actors** that enable circularity. For PVC, these include the chloro-alkali sector, producers of Vinyl Chloride Monomer (VCM) and producers of PVC.
- **Ensure trade defense tools** are strong enough to avoid carbon and cost leakage from imported construction materials. The PVC sector is exposed to significant increases of imports of PVC resin from China and South Korea, and imports of PVC flooring from China.
- **Expand EU support via InvestEU, cohesion funds, and CISAF to reward low-carbon**, circular materials like PVC. These should be specifically targeted as reenergizing the construction and renovation sector, which are key to achieve Affordable Housing.

Tackle Circularity and Waste Management Barriers on Construction Sites

- **Enforce and harmonize systematic pre-demolition and pre-renovation audits** across Member States, to maximize the identification of recyclable PVC components demolition or renovation.
- **Integrate waste management planning** early in construction and demolition projects, particularly in complex subcontracting environments, to enable the development of infrastructure and logistics for the effective separate collection of PVC components.
- **Encourage contractors to invest in proper material separation** for source-level sorting through clear legal frameworks and targeted economic incentives (e.g., under specific EPR schemes for building and construction waste), to help retain the full value of recyclable PVC and avoid downcycling or landfilling.
- **Request a CEN standard for the reuse and recycling of construction products**, thereby supporting the creation of a "stock exchange system" for recycled products in line with the upcoming Circular Economy Act (reference Construction Products Europe).

Tackle Regulatory and Market Access Barriers for the European Construction Sector

- **Streamline and harmonize product, waste and construction legislation** across Member States to reduce the uncertainty which is delaying the market entry of innovative construction products, particularly those used in modular and offsite building systems.
- **Accelerate the delivery of clear and adaptable product assessment** pathways under the Construction Products Regulation (CPR), to reduce the administrative costs and promote sustainable product design aligned with latest standards and guidelines.

- **Harmonise European standards for offsite-manufactured components**, including prefabricated PVC-based modules, to support consistent certification, rapid uptake, and unfettered cross-border deployment.

- **Deliver a streamlined and stable EU legal framework that includes circular economy and decarbonisation principles** as well as faster implementation of the Energy Performance of Buildings Directive (EPBD) (reference Construction Products Europe), by either transforming it into a Regulation or revising implementation timelines and funding instruments. In this context, the insulation properties of PVC products contribute to the overall energy efficiency of the building in which they are installed, thereby enhancing housing affordability over time.

- **Ensure that a revised Public Procurement Framework will prioritise circularity and sustainability in product requirements**, to shape the market behaviour and incentivise the housing sector to upgrade its building stock. There is a significant rise among the building investment funds to invest in buildings certified for their sustainability performance through green building labels like BREEAM, LEED or DGNB. The VinylPlus® Product Label and Supplier Certificates is BREEAM certified.

- **Ensure that private certification schemes, green taxonomy and EU Ecolabel criteria are science-based and non-discriminatory**. The exclusion of PVC, e.g., in furniture Ecolabel criteria, lacks scientific justification. Instead, sustainability schemes should reward the most circular and low-impact PVC products available on the market.

- **Establish a coherent, transparent and sustainable set of rules for substance management and material acceptance** to ensure a level playing field for PVC and other circular materials in construction. Ensure the REACH Restriction Roadmap apply consistent, science-based criteria by deleting the "PVC and its additives" entry based on the conclusion of the 2023 ECHA report. This will support recognition of PVC as a safe, circular material for affordable housing and prevent exclusion through non-legislative procurement or certification systems.

2. PVC Construction and Infrastructure Under the Sustainability Lens

Environmental Pillar – Resource-Efficiency and Effective Recycling

- Only ~43% of each PVC molecule is derived from petroleum/ethane feedstock, and the rest (~57%) comes from chlorine, which is obtained from salt. Because of this, the production of **PVC uses significantly fewer fossil resources** than many other fossil-based materials. PVC can also be produced using bio-based and recycled sources of carbon.

- Although the production of PVC resin includes some energy-intensive steps, the production of final **PVC products is often less or not energy-intensive**, as **PVC can be shaped at lower temperatures** than other construction and housing materials.

- PVC products' insulation properties contribute to the **overall energy-efficiency of the building** they are installed in. As **lightweight, easy to install and low-maintenance**, PVC products are more energy efficient throughout their service life.

- In addition to having a relatively **lower carbon footprint**[1], PVC products are among the most **resource-efficient products**, thanks to their very **long durability**. For example, PVC windows frames are highly durable and weather resistant and can last up to 40-50 years, before being recycled into new windows frames[2], and PVC pipes have proven to function as intended for more than 100 years.

- Unlike other materials, PVC is not only recyclable but **effectively collected and recycled** in the EU. VinylPlus has overseen the recycling of over **9.5 million tonnes of PVC since 2000**, with robust systems for windows, pipes, and flooring. And nearly 800,000 tonnes of PVC are recycled annually under a certified, traceable system.

- When PVC wastes need to be incinerated, the **chlorine recovered from PVC** can also be used **to recover critical raw materials** present in the incineration ashes of waste to energy plants.

- Many PVC construction products fulfil the VinylPlus® Product Label, which is a sustainability certification aligned with BREEAM and other state-of-the art construction requirements. PVC products that carry the **VinylPlus® Product Label are aligned with EU environmental standards and ecolabels**.

Economic Pillar – EU Strategic Autonomy and Competitiveness

- PVC is the only construction material which has an **entire value chain in Europe**, from resin production to conversion and recycling. More than 80% of PVC products used in the EU are **made in Europe**.

- As mentioned above, only ~43% of each PVC molecule is derived from petroleum/ethane feedstock, and the rest (~57%) comes from chlorine, which is obtained relatively cheaply from salt (via electrolysis), which is quite abundant in Europe. This makes **PVC less dependent on crude oil price fluctuations and raw material imports**.

- Because it captures close to 30% of the annual production of chlorine (a co-product of caustic soda and hydrogen) in Europe, it is a **key enabler of the chloro-alkali sector**, increasingly recognised as one of the most critical production sectors to Europe's strategic autonomy.

- PVC products carrying the **VinylPlus® Product Label** are **eligible for Green Public Procurement and Renovation Wave, New European Bauhaus, and CISAF-related funding**. They offer cost-effective, energy-efficient, hygienic and easy to install and maintain solutions, from window replacements to durable flooring that suits all types of surfaces.

Social Pillar – Affordability and Low-Maintenance

- PVC offers solutions of **intrinsic great quality at lower cost**. PVC has inherently good mechanical **strength and durability**, so less material is needed for a product to achieve a given function. Additionally, PVC can be formulated with a high variety of fillers, plasticisers,

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[1] Carbon Minds, 2024, Phase 1: Life Cycle Assessment of 6 key PVC sector products in Europe
[2] Zouhair Ait-Touchente, Maya Khellaf, Guy Raffin, Noureddine Lebaz, Abdelhamid Elaissari. Recent advances in polyvinyl chloride (PVC) recycling. Polymers for Advanced Technologies, 2024, 35 (1), ff10.1002/pat.6228ff. ffhal-04267777

stabilisers, and pigments which help to meet the strict requirements of a large number of building and construction products at an affordable cost.

- PVC contributes to **fire safety** (self-extinguishing properties), electrical insulation, and structural reliability. As such, PVC enables **resilient housing without compromising health or safety**.

- PVC delivers exceptional **stability and longevity** across a wide range of applications (including windows, piping, flooring). Its inherent durability reduces the frequency and costs of maintenance, which supports lower life-cycle costs for users overall. The **low price and low maintenance** of PVC products make them very accessible to all, meeting the "inclusivity" goal of a **"just" transition**.

- PVC construction products meet the technical and practical requirements applicable to **modular and other types of accelerated construction types** which are key to tackling the EU homelessness, housing and water supply crisis. They contribute to increased speed of (affordable) construction.

- In emergency and humanitarian situations (e.g. displaced populations or post-earthquake housing) PVC proves invaluable. Its **robustness, flexibility, and weather resistance** make it an ideal material for producing safe, **reusable tents, shelters, and protective membranes** that can be deployed quickly and withstand extreme conditions, offering immediate relief while ensuring long-term usability.

- PVC has proven its performance in the building and construction sector in Europe as well as in the US and Canada. Lightweight construction products like PVC ones enables **affordable housing through faster construction timelines and reduced structural loads** as an alternative method over traditional cement- or brick-based systems.

3. Examples of PVC Construction and Infrastructure Products and Their Main Features

Windows, Profiles, and Doors

Environmental performance (service life, energy efficiency, recyclability, recycled content, reuse, etc.)	Social performance (Safety, hygiene, maintenance)	Economic performance (Affordability)
Energy savings: Window replacement can easily save more than 15 % of the whole heating needs of the existing building stock, lowering household energy bills immediately. **Sustainability and circularity**: in the last 14 years, the European PVC window sector has increased the annual rate of PVC profiles recycled by nearly 4x, exceeding 390 000 tons of PVC profiles in 2024 alone, which prevented over 780 000 tons of CO_2 emissions being released in the atmosphere. **Durability**: PVC windows frames are highly durable and weather resistant and can last up to 40-50 years, before being recycled into new windows frames.	**Safety**: PVC windows frames' inherent fire-retardant properties and strong insulation contribute to both occupant safety and energy efficiency. **Hygiene**: Smooth, non-porous PVC surfaces resist mould, dirt, and bacterial growth, making them easy to clean and ideal for high-density or vulnerable housing settings. **Maintenance**: PVC windows frame can last up to 40-50 years. Their exceptional durability and weather resistance reduce maintenance needs and lifecycle costs, ensuring long-term affordability for occupants and housing providers alike.	**Affordability**: PVC windows benefit from low material purchase costs which keep renovation budgets down, while their minimal lifetime maintenance needs provide long term affordability benefits. **Speed of installation**: The modular and ready-to-use profile units are suitable for prefabricated units in serial renovations, which reduces construction time and the need for skilled construction labour. **Just and resilient transition**: thanks to its fully European value chain, PVC windows manufacturing directly supports stable jobs growth, boosting regional economies as renovation activities scale up.

Flooring

Environmental performance (Service life, energy efficiency, recyclability, recycled content, reuse, etc.)	Social performance (Safety, hygiene, maintenance)	Economic performance (Affordability)
PVC flooring combines **durability, hygiene, and design flexibility.** PVC flooring has a **service life** exceeding 20–30 years, significantly reducing environmental impact over time. Its resistance to abrasion, impact, and moisture makes it ideal for long-term use in affordable housing and public buildings. **Recyclability:** PVC flooring is fully recyclable, with active industry collection schemes and recycling capacity across Europe (120,000 tonnes in 2024). **Recycled content:** Modern flooring includes recycled PVC content without compromising performance or appearance. **Energy-efficiency**: Lightweight construction and low-temperature manufacturing help minimise embodied energy and transport-related emissions. Resilient floor coverings are simple and cost-effective to install and can be firmly fixed to the subfloor, floated or loosely laid on new or existing subfloors depending on the intended purpose.	**Safety**: PVC flooring meets stringent European safety and health standards. It is **self-extinguishing**, and does not sustain combustion, providing reliable fire performance. The smooth, non-porous surface **prevents bacterial growth** and allows easy cleaning with minimal chemicals. All current additives are REACH-compliant and carefully selected for safety and durability. Modern PVC floorings can offer acoustic insulation, anti-slip, and electrostatic dissipative properties, improving comfort and safety in homes, schools, and healthcare settings. **Maintenance:** minimal maintenance needs reduce costs and cleaning frequency, supporting a healthy and low impact living environment.	**Affordability**: PVC flooring provides excellent value for money through its long lifespan, low maintenance, and efficient installation. It supports **modular and prefabricated construction systems**, enabling rapid, cost-effective housing delivery. **Adapt to renovations**: Its adaptability to both new builds and renovations make it ideal for affordable and social housing. The European-based value chain strengthens local employment and supply security while reducing import dependency. The wide choice of designs, textures, and performance grades (Class 21–34) ensures affordability and suitability across housing, education, and healthcare sectors.

Pipes, Rain Gutters, and Fittings

Environmental performance (service life, energy efficiency, recyclability, recycled content, reuse, etc.)	Social performance (Safety, hygiene, maintenance)	Economic performance (Affordability)
Long service life: a meta-study conducted by the Austrian Polymer Competence Centre at Montanuniversität Leoben, confirmed that plastic pipes, including PVC-U, can have safe service lifetimes well above 100 years. The study summarised significant independent research from peer-reviewed journals, standards, reports, and studies on pressure and non-pressure applications.[3] **Recyclability:** recyclable up to 8 times without losing their performance[4]. **Carbon footprint:** recent peer-reviewed research has demonstrated that, for sewer pipes, PVC outperforms reinforced concrete and ductile iron by reducing the carbon footprint by approximately 45% and 35%, respectively.[5] **Recycled content use:** multilayer co-extruded pipes optimize uptake of recycled PVC in internal layers increasing the resource efficiency. Since 2000,	**Fire safety:** PVC is inherently self-extinguishing and does not require any additional flame retardants to meet most flammability requirements. Compared to other polymeric materials, PVC exhibits superior fire safety characteristics due to its inherent properties. It is less flammable, seldom continues to burn without a significant fire source, and has a notably lower heat release rate, which is crucial in controlling the intensity of a fire. This results in PVC generating less heat and at a slower rate than many materials, thereby reducing the rate and intensity of fire spread. Additionally, PVC's smoke production is generally lower in full-scale fire scenarios, as it burns less readily, which is vital for maintaining visibility and minimizing health risks during a fire. The smoke toxicity of PVC is also comparable to that of most commercial materials, indicating no increased risk of toxic fume generation.[9]	**Reduced lifecycle costs:** PVC-U pipes typically show a reduced lifecycle cost performance vs non-plastic pipe (purchasing, installation, operation, maintenance, and dismantling costs).[15]

[3] Pinter, G., Travnicek, L., & Arbeiter, F. (2024). 100 years lifetime of plastic pipes: Meta-study. European Plastic Pipes and Fittings Association. https://www.teppfa.eu/wp-content/uploads/2024-04-25-Meta-study-100-years-of-lifetime-of-plastic-pipes.pdf
[4] Fumire, J., & Tan, S. R. (2012). How much recycled PVC in PVC pipes? Plastic Pipes Conference XVI, Barcelona.
[5] McKinsey. (2022). Climate impact of plastics. https://www.mckinsey.com/industries/chemicals/our-insights/climate-impact-of-plastics
[9] Hirschler, M. M. (2017). Poly(vinyl chloride) and its fire properties. Fire and Materials, 41(8), 993-1006. https://doi.org/10.1002/fam.2431
[15] A. Marangoni, J Eng App Sci Technol, Volume 6(1): 1-5, 2024

Environmental performance (service life, energy efficiency, recyclability, recycled content, reuse, etc.)	Social performance (Safety, hygiene, maintenance)	Economic performance (Affordability)
880,000 tonnes of PVC pipes and fittings have been recycled. In addition, recycled PVC is safely used in new pipes. According to the latest Recovinyl Traceability Study, PVC pipes take up 11% of all PVC recyclate in Europe.[6] **Reuse opportunities:** for many years, DIY'ers have found creative ways to reuse PVC pipes for urban farming, musical instruments, football posts, roofing, and much more.[7] **Access to non-fossil energy:** PVC pipes have been demonstrated as suitable for distribution of sustainable gases (e.g. hydrogen) to households [8] and thus enable to reduce the household's carbon footprint.	**Hygienic Performance**: PVC-U pipes show excellent hygiene performance due to their corrosion resistance, smooth inner walls, and ability to deliver clean water without the rust associated with metal pipes. Post-1980s PVC-U pipes leaching levels in water far below the µg/l level. Diffusion coefficients of organic substances in a PVC-U matrix are order magnitude lower than in other polymer matrices[10] which leads to lower migration levels.[11] Being plasticiser-free, PVC pipes perform exceptionally well in terms of **microbial growth.**[12] This is due to the absence of migration and the excellent surface properties of these piping systems. Thanks to the absence of migration and low bacterial growth in PVC pipes, the **organoleptic properties** (related to taste and smell) of water transported in these pipes are generally very good over the service life of the pipes without specific maintenance.	

[6] VinylPlus. (2025). VinylPlus Progress Report 2025. https://www.vinylplus.eu/our-achievements/progress-report-2025/
[7] https://pvc4pipes.com/sustainability/pvc-pipe-reuse/
[8] R. Hermkens et al., Future-proof gas distribution networks, KIWA Report GT-170272, 2018, https://www.kiwa.com/globalassets/netherlands/kiwa-technology/downloads/kiwa-toekomstbestendige-gasdistributienetten-gt170272-2018-07-05-definitief1.pdf/
[10] P.V. Mercea et al. Migration of substances from unplasticized polyvinylchloride into drinking water. Estimation of conservative diffusion coefficients, Polymer Testing, Volume 104,2021,107385,https://doi.org/10.1016/j.polymertesting.2021.107385.
[11] Zhang, L., & Liu, S. (2014). Investigation of organic compounds migration from polymeric pipes into drinking water under long retention times. Procedia Engineering, 70, 1753–1761. https://doi.org/10.1016/j.proeng.2014.02.193
[12] Van der Kooij. D. & Veenendaal H.R. (2007). Assessment of the microbial growth potential of materials in contact with treated water intended for human consumption. https://cdn2.hubspot.net/hubfs/4206233/KIWA%20Assessment%20for%20Water.pdf

Environmental performance (service life, energy efficiency, recyclability, recycled content, reuse, etc.)	Social performance (Safety, hygiene, maintenance)	Economic performance (Affordability)
	The very low diffusion coefficients in the PVC-U matrix also make PVC pipes excellent barriers against contaminants present in the soil or groundwater.[13] PVC pipes also show a high chemical resistance against oxidising agent used in some countries as disinfectants in drinking water.[14]	

[13] A. Berens (1985), Prediction of Organic Chemical Permeation Through PVC Pipe, Journal AWWA, Volume77, Issue11 https://doi.org/10.1002/j.1551-8833.1985.tb05642.x
[14] Fumire; J. (2008). Resistance of PVC Pipes against Disinfectants, Plastic Pipes XIV. https://www.teppfa.eu/wp-content/uploads/2024-04-25-Meta-study-100-years-of-lifetime-of-plastic-pipes.pdf
https://plasticpipesconference.com/79881e21-d51a-4ef2-8ba3-105c63291aef

Membranes and Films

Technical description	Environmental performance including service life, energy efficiency, recyclability, recycled content, reuse	Safety, hygiene, maintenance	Economic performance and affordability
Weather-resistant high-performance films for outdoor applications: finishing window profiles and building components, Innovative films, sealing membranes, and roofing, cladding, and finishing in the construction industry. PVC floor coverings and interior surfaces for durable interior design.	For films in window and roof applications, **sustainability** is underpinned by cost-effective production, uncomplicated installation, and outstanding durability, which guarantees decades of use for the films and thus conserves resources. **Resistance and low maintenance:** the high corrosion and weather resistance also effectively protects the window frame, thereby extending its service life and reducing the need for frequent replacements, especially with roofing films. For flooring applications, these films withstand heavy everyday wear and tear and are easy to maintain. **This long service life** is a fundamental aspect of sustainability, as it minimizes the need for premature replacement and thus conserves valuable resources. **Energy efficiency**: the comparatively **low-cost production and easy installation** contribute to reducing the	**Safety:** PVC has been classified as non-hazardous by the OECD. This classification confirms that the material is harmless to health and can therefore be used without hesitation in sensitive areas such as living spaces, schools, or healthcare facilities. This property contributes significantly to improving the quality of life for many people and gives our customers the certainty that they can rely on environmentally friendly and safe materials. **Hygiene** is greatly enhanced by the easy cleanability and non-hazardous nature of films for floor coverings and furniture surfaces. Easy-care surfaces that do not release harmful substances actively contribute to a healthier and cleaner indoor climate. The smooth, non-porous surface of PVC films facilitates easy cleaning and hinders the growth of dirt, moss, or algae, especially in outdoor applications like window or roofing	**Affordability:** Renolit's PVC interior and exterior films, as well as other PVC film products like flooring and roofing membranes, offer exceptional value for money primarily due to their outstanding robustness and durability. PVC films act as a protective and design layer. They are insensitive to everyday wear and tear, maintaining their colour and aesthetic appearance for decades without weathering or abrasion. This inherent resilience means there's no need for costly repairs or premature replacements, whether for windows, flooring, or roofing. For films, their low weight simplifies the lamination process in window production, or the installation of roofing systems leading to more efficient and cost-effective manufacturing. Since the films are dyed throughout and produced with the desired surface structure, they eliminate the need for

Technical description	Environmental performance including service life, energy efficiency, recyclability, recycled content, reuse	Safety, hygiene, maintenance	Economic performance and affordability
	overall resource and energy consumption. Viewed over its entire life cycle, PVC has a positive energy balance. **Recyclability:** PVC films are recyclable. At the end of their long service life, old floor coverings and roofing films can be collected, processed, and used as high-quality raw material for the manufacture of new products. **Recycled content:** Many modern PVC film applications often already contain a significant proportion of recycled material, which further reduces the consumption of primary raw materials and significantly improves the environmental balance. Due to its outstanding mechanical properties PVC is recyclable up to 8 times without losing their performance[16].	films. This property ensures that the exterior films retain their attractive appearance throughout their long service life. **Fire safety**: PVC's low flammability contributes significantly to fire safety, as the material slows down the spread of flames in the event of a fire. PVC is inherently self-extinguishing and does not require any additional flame retardants to meet most flammability requirements. Additionally, PVC's smoke production is generally lower in full-scale fire scenarios, as it burns less readily, which is vital for maintaining visibility and minimising health risks during a fire. The smoke toxicity of PVC is also comparable to that of most commercial materials, indicating no	complex and expensive painting processes for window profiles. These efficiencies and savings ultimately result in a more affordable end product for the customer. For general PVC applications, the relatively low weight can also simplify logistics and installation, further contributing to cost efficiency. PVC's high durability, abrasion resistance, and mechanical strength ensure that products like flooring are high-performance and resilient, withstanding intensive use over long periods. This extended service life means fewer new purchases and installations, leading to a significant reduction in overall costs throughout the product's life cycle. The smooth and durable surface of PVC is also easy to clean, requiring minimal maintenance and thus

[16] Fumire, J., & Tan, S. R. (2012). How much recycled PVC in PVC pipes? Plastic Pipes Conference XVI, Barcelona; AIMPLAS. 2025. PVC Loop. Recyclability Study on Flexible PVC. https://vinylplushealthcare.eu/resource-item/pvc-loop-recyclability-study-on-flexible-pvc; Frank, A et al. (2021). Slow Crack Growth Resistance of reprocessed PVC. Plastic Pipes Conference PPXX, Amsterdam; Yarahmadi, Nazdaneh & Jakubowicz, Ignacy & Gevert, Thomas. (2001). Effects of repeated extrusion on the properties and durability of rigid PVC scrap. Polymer Degradation and Stability. 73. 93-99. https://doi.org/10.1016/S0141-3910(01)00073-8; Leadbitter, J., & Bradley, J. (1997, November 3–4). Closed loop recycling opportunities for PVC. IPTME Symposium, Loughborough University.

Technical description	Environmental performance including service life, energy efficiency, recyclability, recycled content, reuse	Safety, hygiene, maintenance	Economic performance and affordability
		increased risk of toxic fume generation[17].	lowering operating costs and saving time and money in the long term. PVC is notably resistant to a wide range of chemicals. This chemical resistance protects surfaces from damage, further extends durability, and prevents costly repairs or early replacement. PVC roofing membranes exhibit exceptional durability and are highly resistant to environmental influences such as UV radiation, mechanical stress, and various chemicals. This robustness allows for decades of use, significantly reducing the need for frequent renovations or complete roof replacements, minimizing total costs over the building's life cycle. In essence, the robust nature and long service life of PVC ensure that the initial investment pays for itself over the years, as follow-up costs for maintenance and replacement remain consistently low. This makes PVC an

[17] Hirschler, M. M. (2017). Poly(vinyl chloride) and its fire properties. Fire and Materials, 41(8), 993-1006. https://doi.org/10.1002/fam.2431

Technical description	Environmental performance including service life, energy efficiency, recyclability, recycled content, reuse	Safety, hygiene, maintenance	Economic performance and affordability
			economically attractive choice, providing high performance and significant savings across various applications.

(High Voltage and Telecommunication) Cables

Environmental performance (service life, energy efficiency, recyclability, recycled content, reuse, etc.)	Social performance (Safety, hygiene, maintenance)	Economic performance (Affordability)
Long service life: empirical evidence, manufacturer's declarations and laboratory studies[18] confirm a useful life ranging from 20–30 years to 50 years or more. **Recyclability:** PVC's recyclability and durability align well with the EU's circular economy objectives. Unlike most alternatives, PVC cables can be mechanically recycled at the end of their lifecycle without losing their properties. This is a key advantage, as mechanical properties of most alternative material cables, whether cross-linked or not, are significantly decreased when recycled. Since 2000, 1.8 million tonnes of PVC cables have been recycled within the framework of VinylPlus.[19] The EU PVC industry is continuing to innovate in recycling technologies, including advanced sorting and dissolution methods which separate PVC from other materials and remove legacy additives. These technologies will ensure	**PVC fire behaviour and safety characteristics:** PVC is difficult to ignite and does not sustain combustion. PVC is self-extinguishing and does not contribute to flame propagation. When burned, PVC can expand by up to 800% and carbonise in its external layer (similar to a meringue), creating a protective char that significantly slows fire propagation. PVC does not generate sparks or flaming droplets. PVC emits only minimal heat and would produce very little smoke in a real fire situation[21]. Well-formulated PVC cable compounds incorporating flame retardants and smoke suppressants achieve top classifications for smoke performance. Modern PVC cables can readily achieve Class s2 under EN 13501-6 standards [22] [23] [24] [25]. As leading fire-safety experts emphasise, in real-world fire scenarios the hydrogen	**Processability:** Extrusion ease even with different screw types, both in compression and tube mode (a very simple and reliable technology); controllable rheology; excellent productivity for PVC sheathing in terms of meters/hour of extruded cable, with benefits for plant productivity and therefore production costs. **Total Cost of Ownership of PVC cables:** a recent study carried out by Althesys examined cables with different quantities of PVC in specific applications (residential building, industrial building and telco data). Cables made with multiple PVC parts (PVCx2) showed the lowest total cost of ownership; this conclusion is confirmed for all investigated countries: France, Germany, Italy. The higher is the PVC contained in the cable and the lower is the TCO value.[28]

[18] Yannick, C.; Ngoie, M.; Francis, M.; Francis, K.; Mavé, K.; Edmond, T.; and Donatien, L. (2022), Performance Survey of PVC Insulation of LC/Gecamines Electrical Cables Subjected to Ageing and Its Life Span Evaluation. World Journal of Engineering and Technology, 10, 728-737. doi: 10.4236/wjet.2022.104047

[19] VinylPlus. (2025). VinylPlus Progress Report 2025. https://www.vinylplus.eu/our-achievements/progress-report-2025/

[21] Hirschler, M. M. Poly(vinyl chloride) and its fire properties. Fire and Materials. 2017, 41(8), 993–1006. doi:10.1002/fam.2431

[22] Delchiaro et al. (2024). Toxicity of PVC Cable Compounds During Combustion Compared to Halogen-Free Alternatives, 4th PVC4Cables Conference 2024, Prague. https://pvc4cables.org/wp-content/uploads/2024/12/sarti_2024.pdf.

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Environmental performance (service life, energy efficiency, recyclability, recycled content, reuse, etc.)	Social performance (Safety, hygiene, maintenance)	Economic performance (Affordability)
that only REACH-compliant materials enter the recycling stream, enhancing the quality and sustainability of recycled PVC. **Energy consumption and CO_2 emission:** An LCA study on *Energy consumption and CO_2 emission due to the lifecycle of PVC, XLPE and PE low-voltage electrical cables*, has been conducted by Dr. José María Baldasano Recio, University Polytechnique of Catalonia Barcelona/TECH.[20] The environmental indicators taken into consideration were: 1) energy consumption and 2) CO_2 emissions associated with each stage of the lifecycle of these three types of electrical cables analysed. In the case of PVC and PE, the possibility of introducing 25% of recycled materials into the composition of the cable has been contemplated. Cross-linked XLPE is not usually recycled due to its structure, so this option has not been considered. The predominant stage of the lifecycle of an electrical cable in energy consumption and CO_2 emissions is the stage of use. The energy losses due to the Joule effect have been estimated over a half-life of 50 years with a daily use of 8 hours, representing between 99 and 97% of	chloride (HCl) released during combustion breaks down rapidly and remains localised near the fire's origin. By contrast, carbon monoxide (CO) poses the greatest toxic hazard, reaching lethal concentrations well before any other combustion by-products.[26] The smoke released from PVC combustion is not more toxic than smoke from other carbon-based materials, including natural substances such as wood. While hydrogen chloride in the smoke is irritating, it provides an immediate warning of fire development and effectively acts as a natural escape alarm. Fire safety studies consistently show that the leading cause of fatalities in fires is the inability to control, confine, and extinguish the fire before it escalates. The heat release rate (HRR) is considered the *single most important variable in fire hazard*.[27] In this regard, PVC cables perform exceptionally well.	**Cost benefit analysis (CBA) on PVC cables recycling:** A 2022 CBA update[29] confirms a net benefits balance of recycling for all cases and countries (France, Germany, Italy). Comparing recycling vs. landfill the cable benefits increase in all countries and for all kind of cables recycling vs. incineration: the rise of power and gas prices reduces net benefits (still positive), for countries with higher energy prices (Italy) due to energy recovery (electricity and heat) during incineration. However, the possible future inclusion of incineration under ETS system could modify the results of CBA, improving the net benefit of recycling vs. incineration. For the cables, a key factor of CBA is the copper scrap price that increased of 62% between 2020 and 2022. Consequently, all solutions with copper recovery show a greater net benefit. The higher is the quantity of copper in the cable (electric vs. data), the higher is the net benefit.

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Environmental performance (service life, energy efficiency, recyclability, recycled content, reuse, etc.)	Social performance (Safety, hygiene, maintenance)	Economic performance (Affordability)
energy consumption and CO_2 emissions of the total cycle of life. Consequently, the value of the electric mix of the electricity generation of the territory under consideration becomes determinant. The electrical cable that presents the best results according to the environmental indicators considered is PVC with 25% recycled material in its composition. A new LCA study, currently under peer review, confirms that for PVC and PE cables there is no superiority of one material over the other. Nevertheless, in terms of circularity index (the indicator that measures the degree of circularity of a material) the recyclability of PVC cables represents a significant advantage.		

COMMITTED TO
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