



PVC

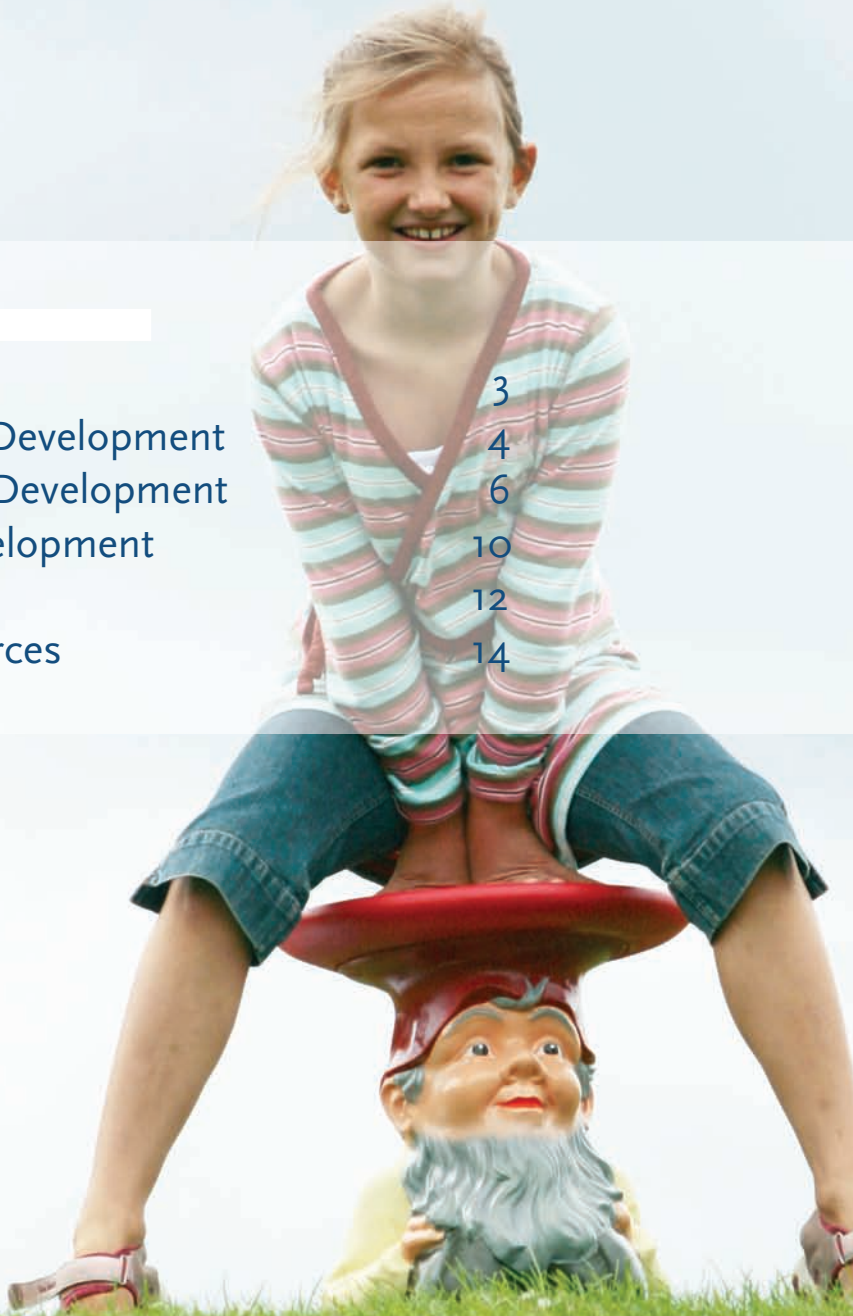
A Sustainable Plastic Material
With New Perspectives



ARBEITSGEMEINSCHAFT
PVC UND UMWELT E.V.

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Foreword

A Plastic Material Undergoing Change

In recent years the PVC industry has shown great commitment and realised important goals towards sustainability. Modern manufacturing methods and processing standards have not only resulted in reducing emissions, but also in enormous energy savings and improved working conditions. High-quality raw materials and optimised additives guarantee safe products for people and the environment. The responsible handling of resources and the establishment of a well-functioning waste management system are also among the key achievements of sustainable developments. This means that PVC products are very economical for consumers over their whole life-cycle. Plastic windows with insulated glass save energy and do not need to be painted. The use of easy-care floor coverings reduces cleaning costs. PVC pipes with especially smooth internal surfaces do not clog and are extremely resistant and long-lasting.

The ecological and social responsibility which is the guiding principle of the PVC industry is well received by consumers. Demand for PVC has risen considerably in the last ten years. It is not without reason that manufacturers, processors and recyclers of this plastic are investing heavily in new technologies and are continuously expanding their capacities: a reassuring signal to their employees who play a decisive role in this success.

Following the environmental discussions of the early 1990s, progress in sustainable development has led to a reassessment of the material in many areas. Many independent studies have assessed PVC as an eco-efficient plastic and have attested to its sustainable advantages for society over its whole life-cycle. PVC also scores well in comparison to rival products.

Since it was founded in 1988, the Work Group for PVC and the Environment (Arbeitsgemeinschaft PVC und Umwelt - AgPU) has carried out intensive dia-

logue on PVC with experts from the business community, academia, politics, environmental associations and the media and has encouraged many projects, successfully. Numerous federal states, local authorities, and municipalities have revoked earlier restrictions on procuring PVC and using it in publicly-funded building projects.

Werner Preusker

Managing Director

Arbeitsgemeinschaft PVC und Umwelt e.V.

Economic Development

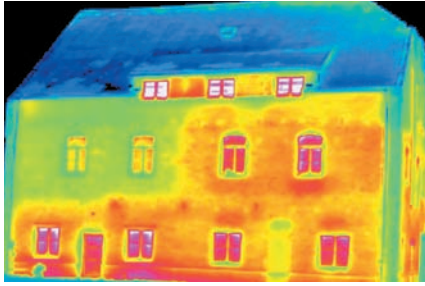


New technology: glazing bonded into the sash improves static and saves material.

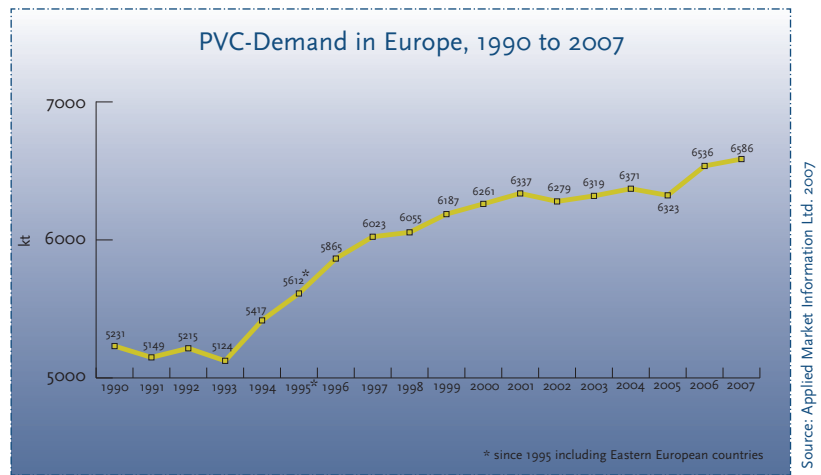
Economical from A to Z

One key competitive advantage of PVC products is its cost-effectiveness over its entire life-cycle. This can be seen very clearly using the example of energy-saving plastic windows. A study commissioned by PVCplus in Germany and the European PVC Window Profile and Related Building Products Association (EPPA) shows that the use of modern window systems with high heat insulation throughout Europe can save €13 billion per year after just five years.¹ The low purchase price and minimal care and maintenance costs over a lifetime of at least 35 years also make a positive economic impact; additionally, plastic frames do not need a regular coat of paint. Furthermore, new profiles can be made from used PVC windows. This creates a materials cycle that protects resources.

The cost-benefit analysis for other PVC products is similarly positive. Easy-care PVC floor coverings with special surface treatment reduce the use of water, detergents and energy. Overall, the maintenance costs can be reduced by up to 30% in comparison to other materials. In a survey commissioned by the Specialist Association of Flexible Floor Covering Manufacturers that questioned 142 architects, building project managers, wholesalers and fitters, elastic floor coverings received the best average marks in comparison to other solutions with respect to four important reasons of choice: easy cleaning and care, life-cycle costs, purchase price, availability.² Lightweight PVC pipes generate low transport costs, make laying easier (without lifting equipment) and hardly need any maintenance over their expected life of use of over 100 years. This is a key advantage because it is precisely the follow-up costs that play a much greater role in the economic assessment of products in comparison to the purchase price. For example, the costs for fitting a hospital ward with 100 square metres of surface-treated PVC floor covering are around €2,300. By contrast, the total costs for purchase and



Thermography: red spots show the high heat loss, e.g. through old windows.



cleaning over a period of 20 years are almost €37,000.

In turn, savings can be used for sensible ecological and social improvements, such as better thermal insulation of the building walls, using solar energy, or improving working conditions. This is how climate-neutral products that help with sustainability come about. Just small sums can bring about great benefits. For example, approx. 135 kg CO₂ are emitted in the production of a PVC window. To compensate for these emissions, only approx. €2 per window needs to be invested in CO₂-saving activities. If the building project managers use the investment costs saved in comparison to an expensive wooden window (€150 – 250) for the thermal insulation of the house, a great deal of energy can be saved. Moreover, the CO₂ emissions fall by several tonnes.³

Reducing Costs – Protecting Resources

In recent years, the PVC industry has realised tremendous cost reductions in production, use, recycling/waste and energy. Since the proportion of oil is comparatively low compared with other plastic products, precious non-renewable resources are spared. At the same time, the final products are very economical with great benefits, as is shown by the Technology Study conducted by the Fraunhofer Institute in Pfinztal, Germany.

“Especially taking into account a diverse requirement profile, one can often see that PVC is not only the right choice technically, but is also the safest and cheapest material. (...) PVC is a very good value for the money. Thanks to the composition of PVC from rock salt and mineral oil, the price of this material is also less dependent on the mineral oil price than other plastic prices.”⁴

In many cases, the positive cost-benefit ratio and high-quality standards have resulted in a re-

assessment of PVC and an increased use of the plastic. For example, the car industry returned to using PVC after alternative materials for instrument panels and cables proved in many cases to be either too expensive or technically inferior.

Ecological Development



Lightweight PVC pipeline systems on the "Freedom of the Seas" weigh only a fifth of metal solutions. This saves fuel and CO₂.

Ecological Development

10-Year European Programme

To achieve higher efficiency for their products, PVC manufacturers and processors - for example represented by the Arbeitsgemeinschaft PVC und Umwelt e.V. in Germany and by the Vinyls Group of the British Plastics Federation in UK - have cut their consumption of fossil fuels and energy and reduced the overall impact on the environment.

Furthermore, in 2000 the European PVC industry adopted its 10-year programme "Vinyl 2010" with specific goals to improve product management over the whole life-cycle.⁵ This programme enabled great progress in industrial safety and in health and environmental protection while safeguarding social welfare. Adherence to the goals is checked by independent third parties and documented in annual progress reports.⁶ "VINYL 2010" received recognition in October 2004 with its registration as an official member of the initiative "UN Partnership for Sustainable Development". The former EU Environmental Commissioner Margot Wallström officially recognised the monitoring structure of "Vinyl 2010".⁷

Success in PVC Manufacturing

As part of its voluntary commitment, the PVC industry has cut emissions in PVC manufacturing. To reduce emissions, the European PVC manufacturers signed two ECVM charters which specified precise limit values for the manufacture of PVC using the suspension (S-PVC) and emulsion (E-PVC) methods. This meant that for the first time uniform European standards for the production of vinyl chloride and PVC have been created which the German Federal Environmental Agency has described as "ambitious" in the positive sense of the word.⁸ The certification company Det Norske Veritas reviewed compliance with both charters in 2002 and 2004. CO₂ emissions and energy consumption have been greatly reduced through im-



Plastic roof membranes as a basis for environmentally friendly green roofs.



A small amount of film with great effects: the Berlin Television Tower in Germany as a football.



Light and stable: an aeroplane with sandwich construction and a foam core.

proved technologies, such as the establishment of a membrane electrolysis. Nowadays, PVC is mainly manufactured from oil and salt. In addition, coal or regenerative sources of raw materials, e.g. bioethylene, are alternatives.

Progress in the Use of Additives

Progress has also been made in the use of additives. For example, the PVC industry located in the original member states of the EU has not used cadmium stabilisers since 2001. By 2015, lead stabilisers are to be completely replaced in new production and, in an interim stage, reduced by 50% by 2010. Reduction already reached more than 20% in 2006. The use of lead stabilisers for drinking water pipes has already been stopped except in Greece, Portugal and Spain. The greater efficiency of additives in PVC manufacturing and processing, as well as the lower ecological and economic impact, encourage sustainable development.

Positive news comes from EU risk assessments. They have closely examined the effects of plasticisers on people and the environment in studies over many years. It has explicitly been confirmed that the two most commonly used plasticisers, DINP and DIDP, do not pose any risk to human health or the environment.⁹ Concerning DINP, the report stated:

“The end products containing DINP (...) and the sources of exposure (...) are unlikely to pose a risk for consumers (adults, infants and newborns) following inhalation, skin contact and ingestion.”¹⁰

There is thus no further need for limitations on the use of the substances. The ban on DINP in toys which children could put in their mouths went into effect in July 2005 for precautionary reasons. In view of the scientific facts and available alternative materials, EU Commissioner Günter Verheugen told the magazine ÖKO-TEST:

“There are also a number of harmless alternative materials with which plasticised PVC can be made. That is why a general ban on phthalates in PVC or on plasticised PVC cannot be justified according to present studies.”¹¹

Even in the sensitive field of medicine, PVC products, such as blood bags, drip tubes or oxygen tents have had a permanent place in patient care for decades. In the opinion of the German Federal Institute for Drugs and Medical Devices, a general ban on medical products containing DEHP, which is sometimes imposed, does not make sense.

Finally, these products are essential for recovery and health maintenance and even to sustain life and cannot thus be dispensed with easily. Moreover, alternative medical applications are not allowed to threaten the quality of medical care.¹²

Furthermore, the industry has developed new additives with the aim of further simplifying the processing of the material, improving the desired product properties, and continuously improving the impact on people and the environment.

Establishing Waste Management

The study “PVC Production, Consumption and Recycling Data for Germany, 2003” by CONSULTIC GmbH (marketing research company) illustrates that almost half of PVC waste was recycled. The share in material recycling was approx. 33%. In addition, 10% was treated by energy recovery and 2% by feedstock recycling¹³. Since June 2005, landfill sites have been closed down for organic waste in Germany. For that reason, different means of PVC recycling have become more competitive and the amount of PVC recycling will continuously increase.

Across Europe, over 37,000 tonnes of post-consumer PVC window profiles were recycled in 2006, a commitment that Professor Dr Andreas Troge,

A close-up photograph of a hand holding a large pile of white, irregularly shaped PVC window scrap pieces. The hand is wearing a silver metal watch. The background is dark and out of focus.

Ecological Development



Kurt Beck, Minister President of Rhineland-Palatinate/Germany, talking to Michael Vetter (Rewindo) about the recycling of used PVC window profiles.

President of the German Federal Environmental Agency, strongly emphasised:

"I therefore positively welcome the efforts of the PVC window profile manufacturers, which have now been ongoing for several years, to set up treatment capacities for scrap PVC windows and the high-quality recycling of these scrap windows."¹⁴

On the European level, the PVC industry supports PVC recycling with its "Vinyl 2010" voluntary commitment.

The energy recovery of PVC waste has been improved. Modern waste incineration plants recover chlorine in the form of hydrochloric acid, rock salt or brine. New technologies, such as the NEUTREC method from SOLVAY, have made important progress in reducing the chlorine input. Many studies prove that the proportion of PVC in domestic waste has no influence on the level of dioxin formation and thus on dioxin emissions.¹⁵ Modern plants reliably adhere to the stringent statutory amount of gas emissions.

PVC is an Eco-Efficient Material

The economic advantages of PVC products have generally been recognised. At the same time, many eco-audits give PVC a good score in terms of sustainability. This is also proved by an evaluation of over 230 eco-audits commissioned by the EU Commission. Published in 2004, the evaluation provides information on the life-cycle of PVC in comparison to rival materials. Accordingly, PVC should be classified as ecologically equivalent to other materials. The study thus comes to the following conclusion for windows:

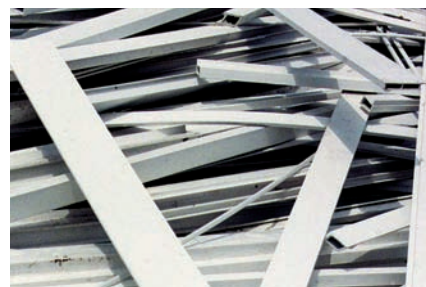
"For windows, one of the most important PVC applications, the available studies conclude that there is no "winner" in terms of a preferable material since most of the studies conclude that none of the materials has an overall advantage for the standard impact categories."¹⁶



Ecologically convincing: recycling PVC floor coverings.



Protecting valuable resources: recycling old PVC windows.



Now, PVC profiles in Switzerland were given the top classification "ecologically interesting" in "eco-devis NPK 371 Fenster" together with wooden frames.¹⁷ They are thus clearly ahead of wood-metal systems, which were classified as "of limited ecological interest".

In the field of floor coverings, most eco-audits consider the environmental impact of PVC and linoleum to be comparable. In 2007, the independent British institute, "Building Research Establishment", certified the low environmental impact of the PVC floor coverings of a leading manufacturer and attested that PVC floors had a similar environmental profile as other floor coverings, including linoleum and rubber.¹⁸ In the case of roofing membranes, the environmental impact of plastic solutions is less than that of bitumen membranes, according to other findings of the EU study.¹⁶

Lightweight plastic pipes are ideal for modernising and creating new sewage systems. They can be laid simply, cheaply and reliably and last for at least 100 years. Stable against corrosion and cheap to maintain, PVC pipes do not become clogged due to their smooth inner walls and allow the water to flow well. Innovative products, such as water pipes with a foam core also contribute to sustainable development thanks to the material savings. Anti-corrosion films for ships are another example. They delay the adhesion of algae and replace the previously used anti-fouling paints with tributyl tin compound (Orca Maritime, Norway). PVC-coated membranes for high-profile architectural projects, such as roofs of football stadiums or heparin-coated PVC tubes for better compatibility with the body tissue, also prove the innovative capabilities of the sustainable plastic. In general, flexible PVC products have a very low potential for allergies. They are therefore explicitly recommended for people with allergies because of their compatibility. This not only applies to many medical applications, such

as blood bags, tubes or wound dressings, but also to important building products such as plastic windows.

Reassessment of a Classic

Many decisions show that PVC is recognised as an eco-efficient material. A great deal of factual information from the PVC industry together with independent testimonials has brought about a reevaluation of the product. In Germany, for example, earlier restrictions in the procurement of PVC or in publicly-sponsored building projects have been eliminated or reduced in the states of Hesse, Mecklenburg-Western Pomerania, Thuringia, Lower Saxony, Berlin and Bremen. Some local authorities, such as in Leverkusen (2003) and Lübeck (2005), have revised former PVC bans. The most recent success is a decision by the Leipzig City Council (July 2007). After a 13-year PVC ban, windows, cables and pipes made of PVC can be used in municipal buildings such as for the renovation of schools. It is not only the great efficiency of PVC products that has convinced the decision-makers, but also the products' contribution to sustainable development with respect to ambitious environmental quality goals.

Similar tendencies could be seen on the European level. For example, in 2004, Denmark abolished tax on various unplasticised PVC products. In the Netherlands, the manual on sustainable construction from the Ministry of Housing and the Environment makes an explicit recommendation to use PVC products which are recyclable or made of recycle.¹⁹ Environmentalists appreciate the advantages of the material. Dr Patrick Moore, co-founder of Greenpeace stated:

"There is absolutely no evidence that vinyl damages human health or the environment" (...) Further, PVC is durable, low-maintenance, recyclable and performs well on LVA tests."²⁰



Social Development

Salvation for endangered corals with mini-nurseries made of PVC pipes.



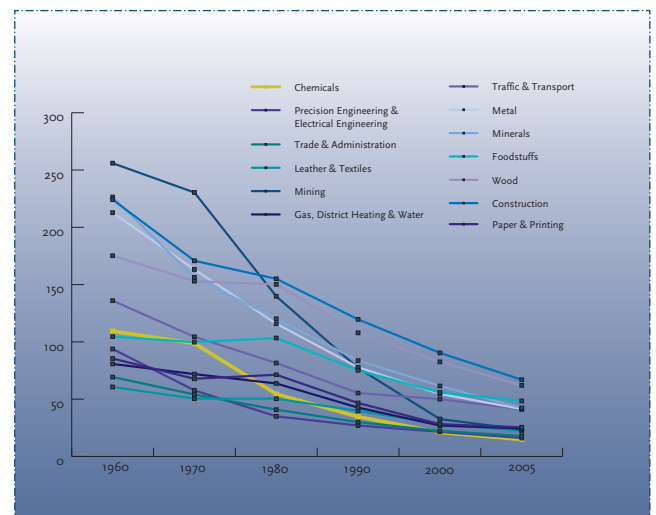
Recycling in the service of art: PVC gates from Christo's project "The Gates" being granulated.

Social Development

Advantages for Employees

The upward trend in the development of the PVC industry creates and secures jobs with competitive wage levels in the plastics industry. Added to this are good working conditions thanks to continuously improved manufacturing and processing methods that are also reflected in health and safety at work. The chemicals industry has a low accident rate in comparison to all manufacturing industries.²¹

Accident Rates in Different Industries in Germany



Standard of Living and Comfort

Low-cost products made of PVC enable a high standard of living, especially for less wealthy people at home and in developing countries. Economical medical products are indispensable all over the world for maintaining health and saving lives. Drinking water pipes made of PVC ensure permanent access to clean water. Thanks to their smooth surfaces there is also less biofilm. Bacteria e.g. has



Economical, long-lasting, safe: PVC sealing membranes used to refurbish swimming pools.



UNEP Director Klaus Töpfer (centre) with Christa Liedtke (Wuppertal Institut für Klima, Umwelt, Energie GmbH) and Werner Preusker (Managing Director AgPU) at the launch of the book "Materialeffizienz" ('The Efficiency of Materials').



For maximum stress with little material: the roof of the Gottlieb-Daimler Stadium in Stuttgart/Germany.

little chance to survive so that respective diseases are reduced. Furthermore, modern PVC applications represent high comfort. Plastic windows in many designs create a pleasant atmosphere in rooms and keep the noise out. Extremely aesthetic floor coverings with noise insulation ensure comfort. And innovative products in the field of design and fashion create beautiful effects.

Training

The PVC industry is making a great effort to ensure that there will be highly-trained staff in the future. Extensive information for school-children, parents and teachers provides insight into apprenticeships in the PVC processing and manufacturing industries.

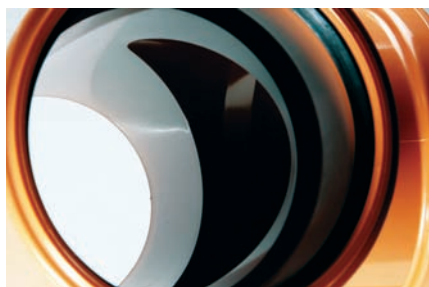
Summary



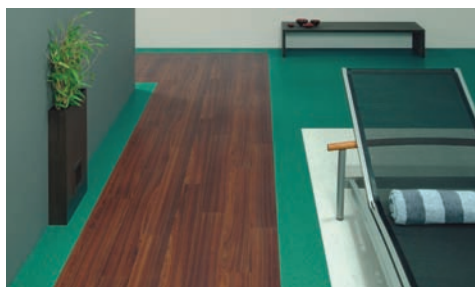
Summary

Growing populations, difficult living conditions in developing countries, the threat of climate change, limited resources, the enormous pressure of costs: all over the world, national governments are facing major challenges. And the world is demanding workable solutions for these urgent problems. Against this background, sustainability is very important. The PVC industry is facing this social, economic and ecological responsibility with great commitment. PVC products have proved their worth over many decades and have continuously been further developed. Because of its many material properties and its outstanding cost-benefit ratio, the plastic material has developed into a worldwide successful product with further growth potential.

- Thanks to the unique range of its properties, PVC opens up extensive possibilities for innovation. The material offers progress and advantages to society in a variety of applications: from the health system and building technology to the development of everyday goods. The favourable life-cycle costs save money that can be sensibly used for ecological and social improvements.
- Products from PVC have an impact on the environment during manufacturing, use and disposal just like those made of steel, glass or paper. In an overall comparison (life-cycle assessment, sustainability comparison), PVC products perform well – especially because of their durability and their comparatively low-energy requirements. Almost all of the overall evaluations published so far therefore reject phasing out PVC and recommend ecological improvements.
- In the last few decades, PVC has been the subject of numerous discussions and a wide range of studies with regard to many different aspects of its life-cycle. The tone which emanated from a large number of independent studies was that



Long-lasting, easy to lay, economical: PVC pipes with smooth bores.



Positive environmental results: floor coverings made of PVC.



Ideal for renovating old buildings: energy-saving windows made of plastic.

PVC is an eco-efficient material that offers society permanent advantages over its entire life-cycle if controlled responsibly.

- The low weight of the material leads to energy savings in areas of application such as packaging and transport. Lighter vehicles consume less fuel, lighter packaging leads to fuel savings in distribution, etc.
- Because of the long life of PVC, a useful life of over 100 years can be assumed for some applications – in spite of the impact of solar radiation, heat or chemicals. Long-lasting products need less maintenance and show a highly efficient use of resources.
- The PVC industry is continuously working on the sustainable development of its products over their entire life-cycles. Furthermore, the PVC industry is investing time and money in innovative new products, additives and technologies.

Photo References

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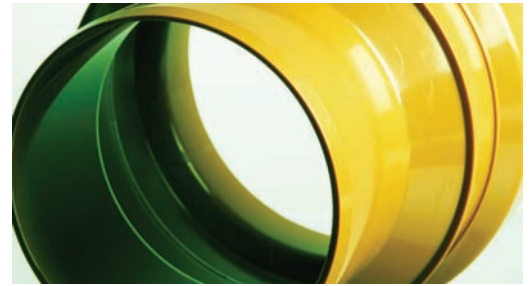
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Medical products made of PVC: indispensable in patient care.



Exceptional: PVC-coated membrane canopy for Pope Benedict during the World Youth Day 2005 in Germany.

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ARBEITSGEMEINSCHAFT
PVC UND UMWELT E.V.

Am Hofgarten 1-2
D-53113 Bonn
Fon + 49 228 91783-0
Fax +49 228 53895-94

agpu@agpu.com
www.agpu.com