



REHAU SUSTAINABILITY BROCHURE

DISPELLING THE MYTHS OF PVC



REHAU SUSTAINABILITY

INTRODUCTION

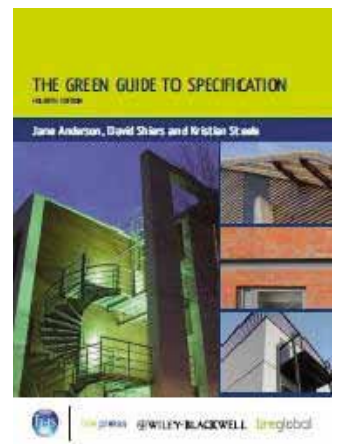
There has been much controversy surrounding the manufacture, use, recycling and sustainability of PVC.

¹ Vinyl Council at Form & Function 2006

Its use has been under intense and hostile attack for a number of years, primarily because of its association with chlorine chemistry. Much of this argument has been emotionally driven rather than based upon scientific scrutiny. Indeed, Dr Moore, Greenpeace co-founder has said “Further, PVC is durable, low-maintenance, recyclable and performs well in LCA (life cycle assessment) tests.”¹

Recent independent research by the Building Research Establishment (BRE) has resulted in PVCu being awarded an A+ environmental rating for commercial windows. This is highlighted in the most recent Green Guide published by the BRE to inform architects and specifiers of the environmental impact of building products.

The aim therefore of this brochure, is to provide information to support the use of PVC as a safe, reliable, cost-effective, sustainable and recyclable material.



REHAU SUSTAINABILITY

WHAT IS PVC?

² Windows – A Transparent Case for PVC (BPF)

³ Fact Sheet – Euro Chlor

⁴ Specifier Briefing - The Open & Shut Case for PVC-U - BPF

⁵ Specifier Briefing - The Open & Shut Case for PVC-U - BPF

One of the world's oldest plastics, it has evolved since the 1940s to become a universally used, cost effective, adaptable, safe and environmentally efficient material. Effectively, salt and oil derivatives are combined to produce a plastic material which is specified for a broad range of applications across various market sectors.²

Polyvinyl chloride (PVC) is a versatile and safe material for the modern world. Its unique properties make PVC the material of choice in many applications, including construction, transportation, electronics and health.³

Dispelling the myths

Myth - Illegal to produce PVC in 2006

Truth - Untrue, PVC is still being produced today.

Myth - PVC needs regular painting

Truth - PVC-U windows are tough, durable and long life. The Building Research Establishment (BRE) states a service life of at least 35 years. PVC-U windows and doors are low maintenance with no need to be painted or treated like windows made from alternative materials. With advanced design and styling, PVC-U windows and doors can be specified to perfectly complement every housing type from traditional to modern. Over 80% of home owners and residents prefer PVC-U to any other option.⁴

Myth - It is high maintenance

Truth - No, a wipe over with a soapy cloth is all that is required.

Myth - Extremely difficult to recycle

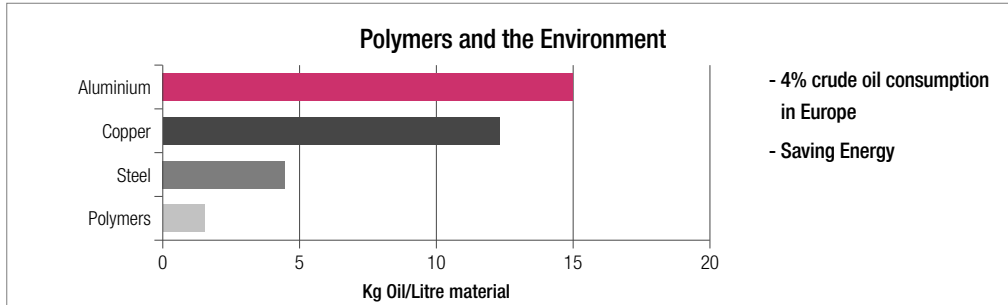
Truth:

- Over 19,000 tonnes of PVC-U window waste material were recycled in the UK in 2008
- In the UK, the Recovinyl Scheme has developed an infrastructure of 100 collectors and 20 recyclers of PVC construction materials to recycle products at the end of their service lives. A study by the Government funded Waste and Resource Allocation Programme (WRAP) suggests that some alternative materials are practically impossible to recycle efficiently, due to the paints, solvents and putties used to install and protect them during their service lives.⁵



REHAU SUSTAINABILITY

DISPELLING THE MYTHS



⁶ Specifier Briefing - The Open & Shut Case for PVC-U - BPF

⁷ Windows – A Transparent Case for PVC

⁸ Counterpoint – Patrick Moore and the future of the environment April 06

Myth - PVC is not sustainable as it is made of chlorine

Truth - PVC is the world's most researched polymer with numerous life cycle studies conducted in the UK and the EU indicating the material is as sustainable as any other option. The major ingredient of PVC is common salt – an abundant natural resource - 50 quadrillion tonnes of salt in the worlds seas!⁶

Myth - PVC production operations are "Dioxin Factories"

Truth - The industry is strictly regulated. It's very low contribution to dioxin levels is confirmed by recent inventories of dioxin sources in the UK. The highest dioxin concentration allowed from industrial discharge is 0.1ng/cubic metre omission. UK studies suggest that as much as 14% of the total UK annual emissions can be attributed to Bonfire Night celebrations on November 5th. 'A Review of Dioxin Emission in the UK', published by Her Majesty's Inspectorate of Pollution (HMIP) in 1995 concurs that iron, steel and non-ferrous metals production are seen as the dominant contributors. According to the report, more dioxins are released to the atmosphere through sources involving the combustion of wood than are produced by the entire halogenated chemicals industry.⁷

Myth - PVC production is extremely energy intensive

Truth - Energy used in manufacture is low compared to other materials e.g. aluminium. The manufacture of one cubic decimetre of PVC requires only two kilogrammes

of mineral oil, for a cubic decimetre of steel, as much as five kilos of oil and for a cubic decimetre of aluminium, even as much as 15 kilogrammes of oil. Even in comparison with other polymers, PVC comes out well, necessitating on average about half as much oil in production. Furthermore, the oil contained in PVC products can be used to generate energy in incineration plants even after several decades.

Myth - PVC is the "poison plastic"

Truth:

- Sept 06 Epidemiological study conducted by Institute of Occupational Medicine (IOM) workers exposed to PVC dust
- Death rate lower in PVC workers than general population
- No evidence that PVC dust causes lung cancer or heart disease.

Myth - PVC is dangerous in accidental fires

Truth:

- PVC is difficult to ignite
- If ignited PVC self extinguishes
- PVC will not spread flame on its own
- Low rate of heat release.

IF FIRE DOESN'T START OR SPREAD IT WON'T KILL!!

PVC will burn in a fire but if you remove the source of ignition PVC goes out, which is why, for example, it is mandatory to use it for insulation on all wiring and in a conduit through which wires and electricity pass.⁸



PVC AND SUSTAINABILITY

WHAT IS SUSTAINABILITY?

Development that meets the needs of the present generation without compromising the ability of future generations to meet their needs. (1987 Brundtland Report “Our Common Future”)
This encompasses a combination of environmental, social and economic criteria, the ‘Three Pillars of Sustainability’.

⁹ Specifier Briefing – The Open & Shut Case for PVC-U – BPF

¹⁰ Voluntary commitments Sustainable Development from the PVC industry

Any assessment of the environmental impact of a product needs to look at the full life cycle including end of life disposal and/or reuse.

PVC is the world’s most researched polymer with numerous life cycle studies conducted in the UK and the EU indicating the material is as sustainable as any other option. The major ingredient of PVC is common salt – an abundant natural resource.⁹

We believe that polymer products have a valuable part to play in sustainable development. Most polymer building products have a long life expectancy and are readily recycled at the end of their life into new products.

The European PVC industry is working towards two key aims:

- Improving quality of life and adding value to society through PVC products and innovations that assist with sustainable economic growth;
- Introducing new practices that protect the integrity and diversity of the environment based on the principles of sustainable development.¹⁰

PVC AND SUSTAINABILITY

WHAT ARE THE 'THREE PILLARS OF SUSTAINABILITY'?

¹¹ Voluntary commitments Sustainable Development from the PVC industry



Social

The PVC industry contributes to modern society with a variety of goods carrying added value, many of which play a role in economic and social development.

- The PVC industry adds value to society through the significant employment and wealth it creates.
- The industries directly linked to PVC production such as converters and machinery manufacturers as well as the polymer producing industry, are significant employers. PVC directly and indirectly supports over 530,000 jobs throughout Europe.

All economies benefit from the use of PVC as it provides access to a range of products and services, from affordable home improvement to medical equipment. This helps to improve living standards and promote economic well being, particularly in developing countries and emerging markets.¹¹

Economic

- The contribution that PVC makes to economic development around the world is reflected in the relationship between consumption and Gross Domestic Product (GDP).
- PVC consumption generally outpaces GDP in many countries with the difference being most marked in developing economies and emerging markets. This is largely a result of natural growth in consumer demand for products and services (e.g. construction, transport, packaging and healthcare).
- The European PVC Market reached 9.62 million tonnes in 2005.¹²
- PVC provides long-lasting and cost-effective solutions for roofing, window frames, electrical equipment, flooring, wall-coverings and even complete pre-fabricated houses. The use of PVC in these applications brings reduced maintenance costs (e.g. no repainting of window frames) and improved living standards (e.g. affordable double-glazing systems).¹³
- PVC-U windows and doors provide exceptional cost-effectiveness. A group of housing authorities in the UK carries out regular surveys of the cost of window systems and these show PVC-U's continuing economic benefit both in capital and maintenance costs – typically around 30% compared with softwood alternatives.

Experience in Germany shows typical savings over 25 years of more than 20% against hardwood and more than 50% against aluminium alternatives.¹⁴

At the macro level the PVC Industry contributes:

- £17.7 billion per annum
- 2.1% of UK GDP
- 21.7% by volume into Building & Construction.

At a micro level:

- PVC-U window industry supply chains in the main:
 - Starts and finishes in the UK
 - Windows are manufactured locally
 - Use local labour for installation
 - Best value solution of any window material
 - At time of purchase
 - And during life cycle.

Thus contributes to the local economy.

PVC-U windows are:

- Best value for money
 - Lowest cost of any window material
 - Lowest cost during life
 - Low maintenance
 - No painting
 - Little resident disruption
- Recyclable.

¹² Top RGH Marketing Services

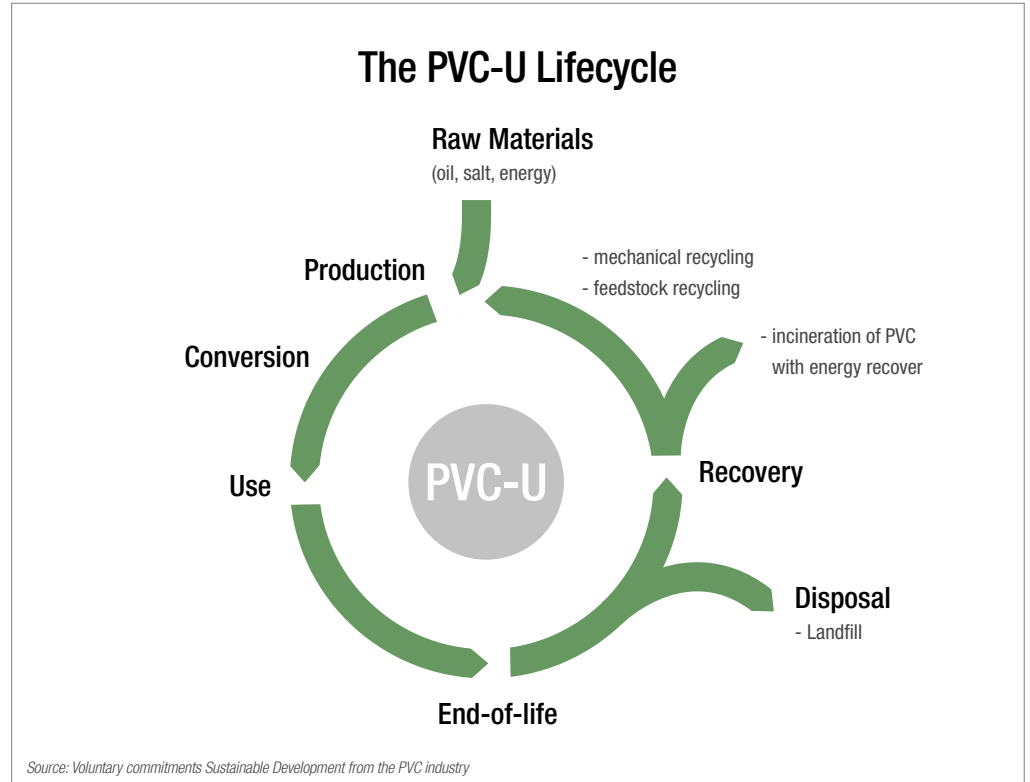
¹³ Voluntary commitments Sustainable Development from the PVC industry

¹⁴ Specifier Briefing – The Open & Shut Case for PVC-U – BPF

PVC AND SUSTAINABILITY

WHAT ARE THE 'THREE PILLARS OF SUSTAINABILITY'?

¹⁵ Voluntary commitments Sustainable Development from the PVC industry



Environmental

The European PVC industry is pursuing an integrated approach aimed at minimising environmental impacts associated with each stage of the PVC lifecycle.

In implementing this approach the industry has voluntarily set tough environmental standards for production and is developing improved solutions for the end-of-life management of its products.¹⁵

PVC-U windows are:

- Low impact on the environment
- Fully recyclable
- Extruders like REHAU process own waste and collect waste cut-offs from fabricators
- Post consumer waste collection

- BRE endorsed, minimum 35 years life expectancy an A+ rating for commercial windows has been awarded in the most recent BRE Green Guide
- Manufactured in the UK
- High performance
- Use only 4% of world's oil compared to 86% for heating and transport.

PVC AND SUSTAINABILITY

COST COMPARISONS



¹⁶ Windows – A Transparent Case for PVC - BFP

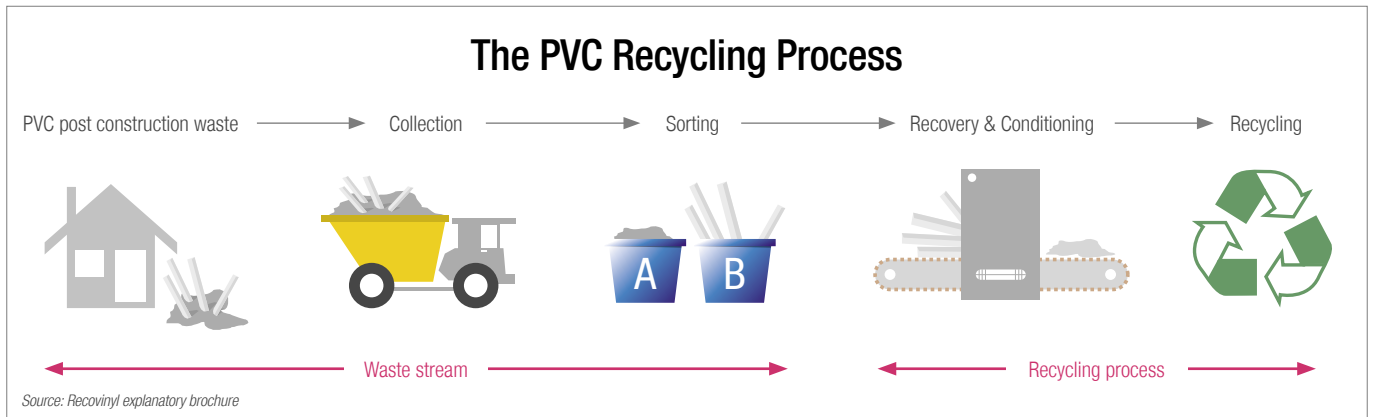
While it is very difficult to generalise about costs which will vary for all materials in terms of product quality and market conditions, the Northern Consortium of Housing Authorities in the UK has carried out a regular survey of costs of window systems. The Consortium has accumulated a considerable amount of data for the lifetime cost of window frames made from different materials. Their data shows that over a 30 year period, the total capital and maintenance costs for a softwood window will be 33% more than for a window in PVC-U, assuming a 10% bank interest rate in a scheme involving 30 windows.

An industry study compiled in Germany by AgPU (PVC industry organisation in Germany) has shown that total investment and maintenance costs for hardwood systems over a 25 year period were 23% more than PVC-U, and aluminium systems were

57% more expensive. It is difficult to transfer the results of cost comparisons in one region to the situation in another. However, the marked success that PVC-U windows have enjoyed in the UK market clearly demonstrates their cost-effectiveness in relation to competing materials.¹⁶

REHAU SUSTAINABILITY

RECYCLING PVC



¹⁷ www.pvcawareness.com

¹⁸ Windows – A Transparent Case for PVC

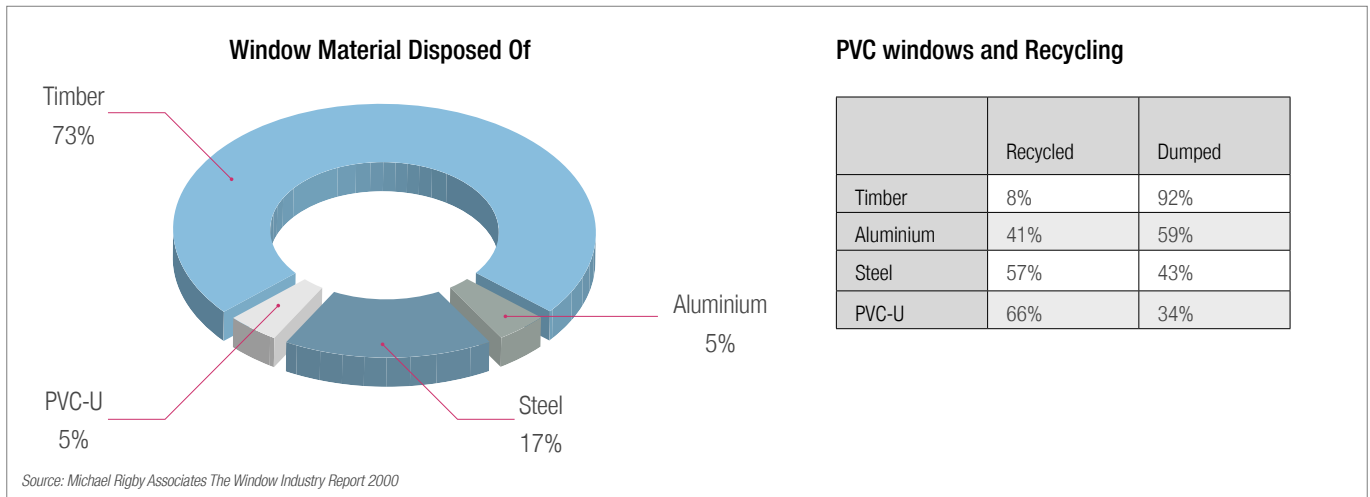
It is claimed that PVC is not recyclable. This is simply not true. PVC is an ideal polymer for recycling, unlike many other materials PVC can be recycled simply by chipping the waste material and extruding into new products.

The European PVC Industry is pledging to recycle increasing quantities of post-consumer PVC window waste as part of the Vinyl 2010 Voluntary Commitment*. The industry has committed to recycle 50% of the collectable available quantities of post-consumer PVC window waste by 2005. One of the barriers to cost-effective recycling of post use products – regardless of the materials involved – is the ability to retrieve economically meaningful quantities of used products to supply a recycling scheme with its feedstock. In Germany, PVC-U windows were commercially introduced some 15 years before they were in the UK. Hence German companies have now developed proven technologies to recycle post-use PVC windows, which may arise as demolition wastes, for example. In the UK, however, tonnages have been traditionally modest because PVC-U products last so long and there simply hasn't been enough feedstock yet to input effectively into the recovery and recycling processes. As post-use PVC windows are slowly becoming more available in sufficient quantities, then the European Industry can apply the appropriate technology to recycle them in commercially viable and environmentally beneficial schemes, as part of the Vinyl 2010 Voluntary Commitment.¹⁸

*Vinyl 2010 puts the PVC industry's voluntary commitment into practice. Signed in 2000, it is a 10 year plan to deliver continuous improvement in product stewardship across the PVC lifecycle. Principle elements of the pledge are to cut raw material and energy consumption in manufacturing; minimise the environmental impact of resin production; develop a comprehensive waste management strategy; ensure that all plasticizers can be safely used; and assess potential risks linked to lead as stabiliser while working toward replacement by 2015.

Implementation through Vinyl 2010 emphasises clear recycling targets; significant investment in scientific and technical research; increasing practical knowledge; and transparency through annual reports and by the active involvement of external stakeholders.¹⁷

The European PVC industry is working to develop environmentally responsible solutions for managing its products at the end of their lifecycle. A number of recovery options are available before final disposal, with the appropriate mix defined by the most cost-effective and efficient process for each waste stream.



Mechanical Recycling

Mechanical recycling makes sense where sufficient quantities of homogeneous, separated and sorted waste are available. Products such as pipes, roof coverings and window profiles are currently being recycled in this way in a number of EC member states. The PVC industry is seeking to expand these recycling programmes across Europe through a number of activities included within its Voluntary Commitment.

Feedstock Recycling

This is particularly suited to mixed plastics waste.

A number of feedstock recycling technologies are currently under development. All are based on the principle of breaking down PVC into its chemical components, which can then be recovered for re-use within a range of industrial processes to manufacture new products. In the case of a PVC rich feedstock, hydrochloric acid is one of the main components recovered via this method. This can be used as a raw material in the PVC production process.

Incineration with energy recovery

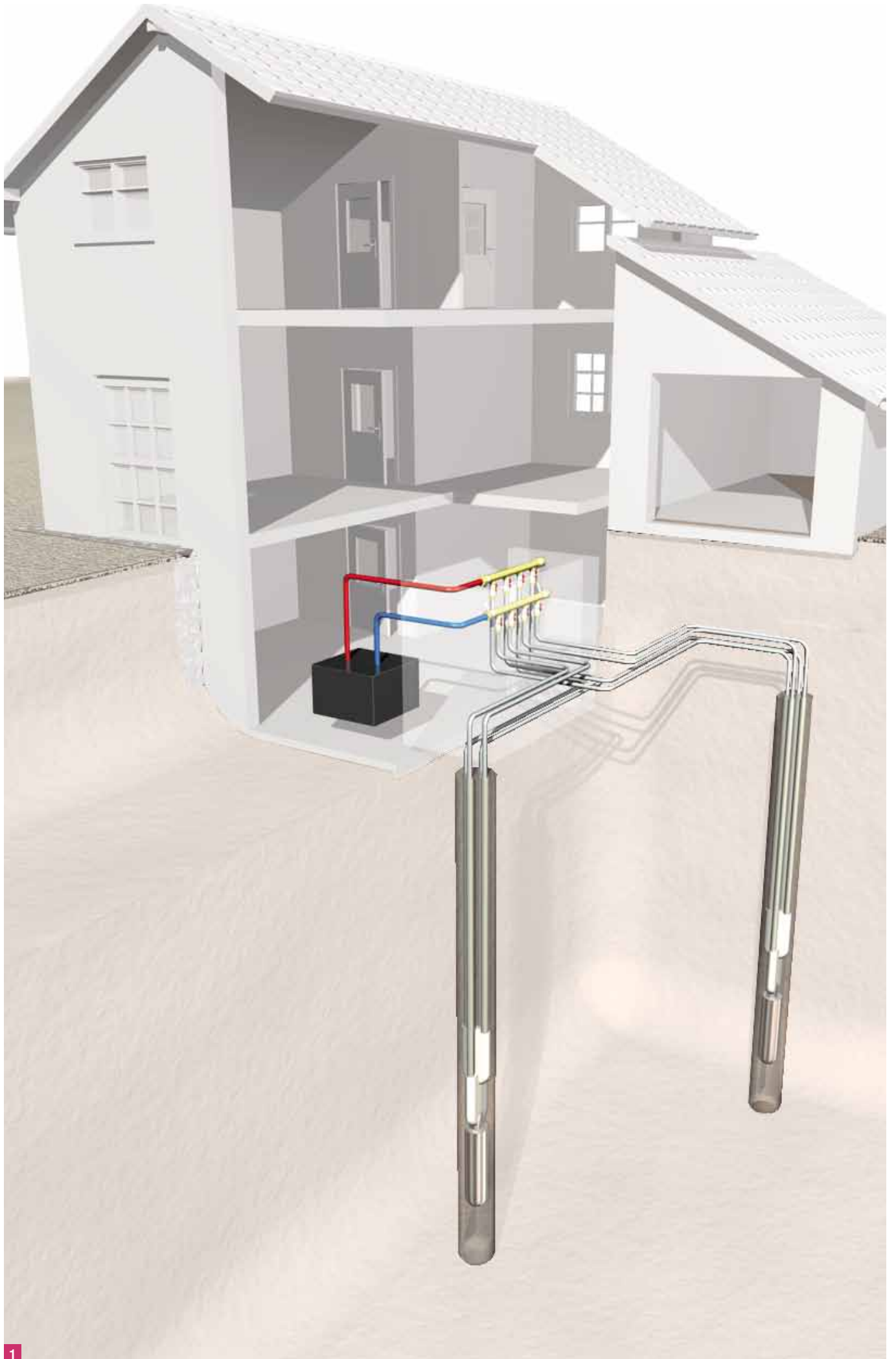
This ensures that the calorific value of oil used in PVC production is recovered, potentially after many years of efficient service.

Incorporating PVC waste in controlled municipal incinerators reduces the need for additional fuel. A number of independent studies have demonstrated that adding PVC to an incinerator waste stream in which chlorine is naturally present does not increase the generation of potentially harmful emissions.

PVC usually represents less than 1% by weight of the material handled in a typical municipal waste incinerator.¹⁹

Within REHAU's controlled process, we recycle 80% of the manufacturing offcuts. This comprises waste generated within our plants from the manufacturing processes of our customers. All this waste material is recycled to make new window profiles. Our continental parent company and partners are even more advanced since they convert 11% of the post consumer waste into new window profiles and other high grade products. In the UK the majority of the installed PVC windows are still in place and as the volume of recyclable material becomes available the amount of PVC recycling from the replacement windows will dramatically increase.

¹⁹ Voluntary commitments Sustainable Development from the PVC industry



ENVIRONMENTAL CREDENTIALS

THE GREEN BUILDING PROGRAMME

REHAU is a partner with The Green Building Programme – a voluntary programme initiated by the European Commission in 2005. The programme intends to raise awareness and trigger additional investments in energy efficiency and renewable energies among owners of non-residential buildings and to give advice and public recognition to those, who are ready to implement ambitious measures in their buildings, resulting in substantial energy savings. These savings not only contribute to the European fight against climate change, but also make good business sense as it will reduce energy costs.

1 Geothermal heat collector/probe

²⁰ www.eu-greenbuilding.org

In its Green Paper on Energy Efficiency, the European Commission identified the building sector as an area, where important improvements in energy efficiency can be realised. According to the Green Paper, the building sector accounts for more than 40% of the final energy demand in Europe. At the same time, improved heating and cooling of buildings constitutes one of the largest potentials for energy savings.

Green Building gives information about energy efficiency and renewable energies in non-residential buildings, encourages building owners to participate in the programme and create publicity and recognition for those, who successfully participate in the programme.

Initiated by the European Commission and implemented with the help of National Contact Points in presently 10 European countries, Green Building is the most important campaign for the promotion of energy efficiency in non-residential buildings in Europe.²⁰

ENVIRONMENTAL CREDENTIALS

ISO 14001

²¹ www.iso14000-iso14001-environmental-management.com



REHAU's manufacturing process complies with ISO 14001.

ISO 14001 was first published in 1996 and specifies the actual requirements for an environmental management system. It applies to those environmental aspects which the organization has control and over which it can be expected to have an influence.

ISO 14001 is often seen as the corner stone standard of the ISO 14000 series. However, it is not only the most well known, but is the only ISO 14000 standard against which it is currently possible to be certified by an external certification authority. Having stated this, it does not itself state specific environmental performance criteria.

This standard is applicable to any organization that wishes to:

- implement, maintain and improve an environmental management system
- assure itself of its conformance with its own stated environmental policy (those policy commitments of course must be made)
- demonstrate conformance
- ensure compliance with environmental laws and regulations
- seek certification of its environmental management system by an external third party organization
- make a self-determination of conformance.²¹



REHAU ENERGY AND WATER SOLUTIONS

GO GREEN

As sustainable design practices and environmental stewardship become increasingly important in today's market, REHAU is already engineering smart, integrated solutions for residential and commercial building to meet these needs.

REHAU has championed solutions for environmentally friendly production of energy for many years. Through our unique program diversity, we provide comprehensive and cost-lowering systems and in so doing set forward-looking trends for others to follow:

Energy efficiency can be split into three steps:

Reduce energy losses by improving the thermal performance and air tightness of the building fabric. REHAU's energy efficient window and curtain walling systems play an important part in this.

Ventilation losses can be reduced significantly by using a mechanical ventilation system with heat recovery. Combining this set up with a REHAU Ground Air Heat Exchanger can pre-warm the air in winter and pre-cool the air in summer by using the constant ground temperature at 1.5m below ground.

Distributing the energy efficiently inside a building via a surface heating and cooling system can reduce the energy consumption by 6-12%. REHAU's underfloor system package with intelligent controls will maximise the benefits on energy consumption and increase comfort levels at the same time.

Generate energy in a sustainable and efficient manner via renewable energy sources. REHAU's wide range of Ground Source solutions from vertical probes to energy piles, horizontal collectors or Helix probes can provide a tailored solution for nearly every project.

Our goal is to design integrated systems that enhance quality of life whilst conserving resources throughout the product lifecycle. REHAU provides reliable, long-lasting polymer systems that address sustainable design priorities such as energy efficiency, comfort, health and safety.

REHAU products are:

- Designed with the long-term in mind
- Economically and environmentally beneficial
- Designed with sustainable elements as individual products and with the capability to be integrated as a full system in order to optimise performance whilst minimising cost.

The following demonstrate that REHAU's construction products add value and reduce cost when used as a total system. It's not just about picking one or two energy efficient products, careful integration is fundamental to producing the best possible results.



1



2



3

1 RAURAIN Rainwater Harvesting
The sustainable resource

2 AWADUKT Thermo
Ground-to-air heat exchanger system for controlled ventilation

3 Polytec 50S
Curtain Walling System - thermally efficient

4 RAUGEO - Ground Source Energy Solutions
Reliable and sustainable

5 AWADUKT PP – Sewer Pipe
REHAU heavy duty polypropylene sewer pipe systems

6 REHAU RAUSIKKO
Stormwater management systems

7 Underfloor Heating
The preferred modern-day energy efficient heating solution

8 AWASCHACHT Manhole Shaft System LBC
Prevention rather than cure

9 RAUTHERMEX
Pre-insulated pipe for local and district heating

10 Biogas
Renewable energy production

11 Windows
BFRC "A" Rated Energy efficient window systems.



4



5



6



7



8



9



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11

REHAU ENERGY AND WATER SOLUTIONS

GO GREEN

REHAU Polytec 50 Curtain Walling

Energy efficient window systems

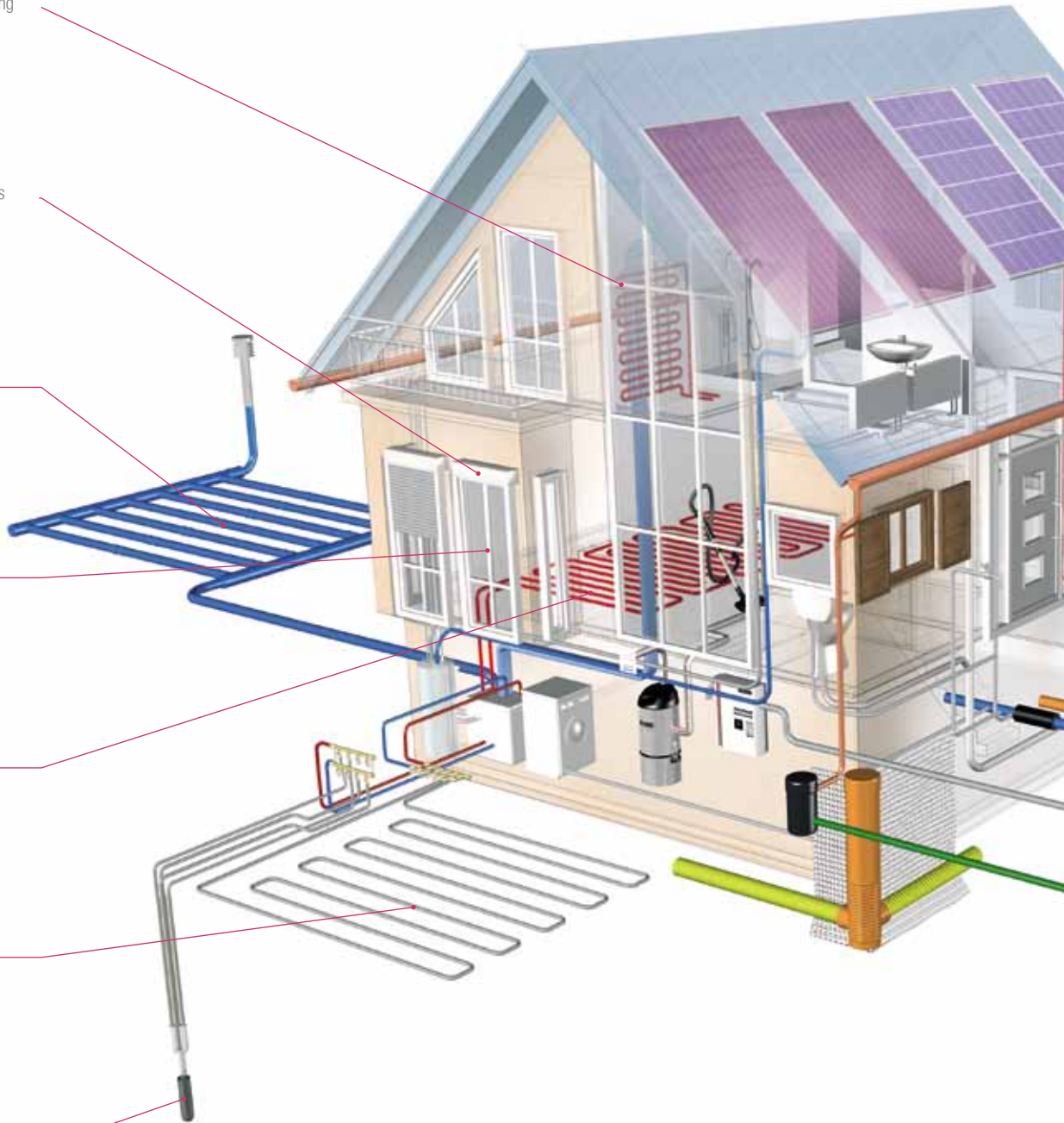
AWADUKT Thermo
Ground to air heat exchanger

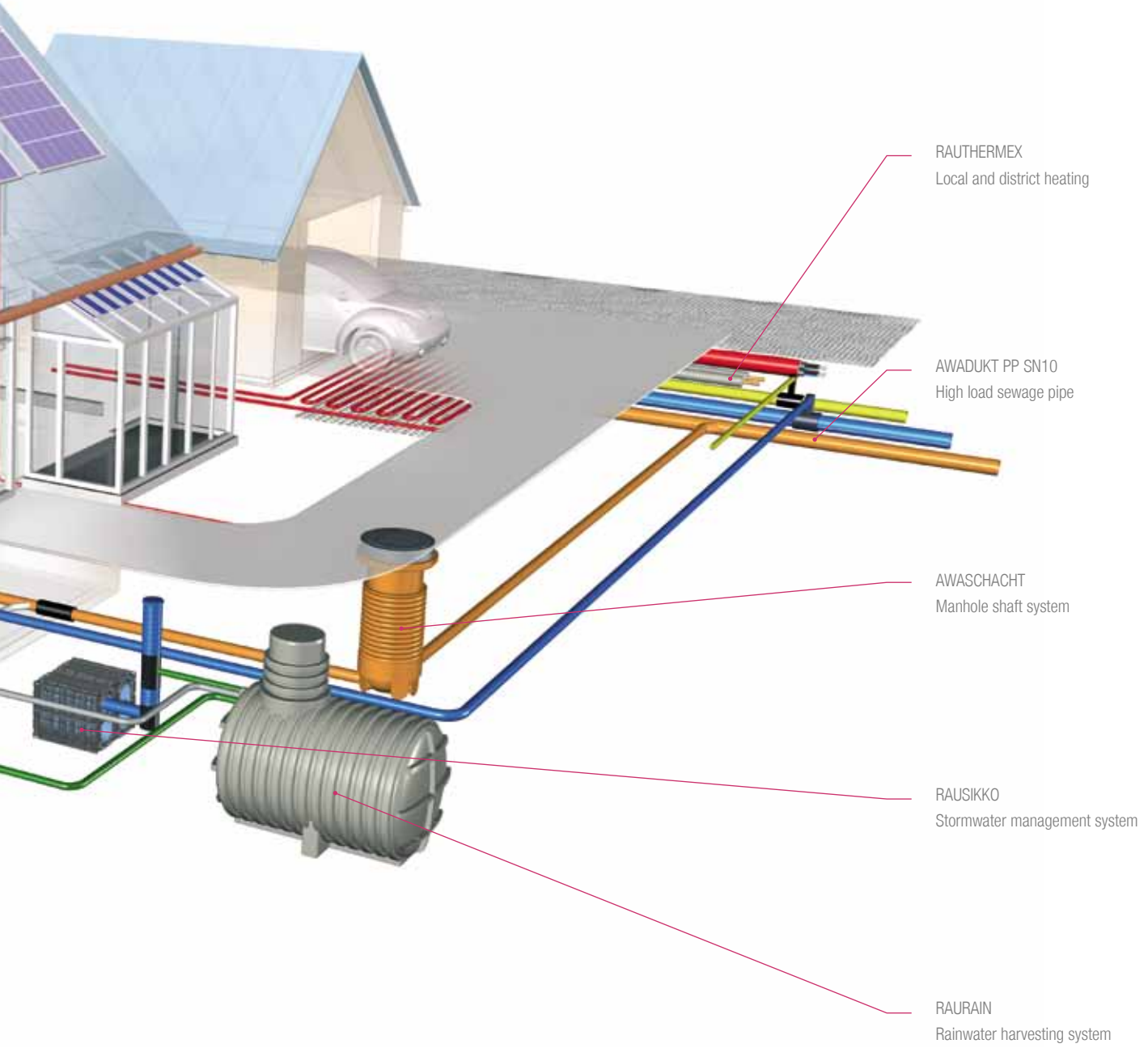
BPRC 'A' rated
windows and doors

Underfloor heating and
cooling systems

RAUGEO
Ground heat source collector

RAUGEO PE-XA
Ground source heat probe





REHAU SUSTAINABILITY

USEFUL REFERENCES

Website Links

www.pvcwareness.com
www.vinylindesign.com
www.vinyl.org
www.abc.net.au/rn/counterpoint
www.bpfwindowsgroup.com



www.rehau.co.uk



www.bpf.co.uk



www.eu-greenbuilding.org



www.vinyl2010.org



www.recovinyl.com



www.ecvm.org



www.axionrecycling.co.uk



www.bre.co.uk
www.thegreenguide.org.uk

European Governing Bodies

The European Council of Vinyl Manufacturers (ECVM)

Represents the European PVC producing companies and is a division of the Association of Plastic Manufacturers in Europe (APME).

Avenue E van Nieuwenhuysse 4, B-1160 Brussels

Tel: + 32 2 676 74 43

The European Council for Plasticisers and Intermediates (ECPI)

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www.ecpi.org

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