

As well as its energy efficiency, do not lose sight of a building's water efficiency

By using peripherally treated greywater with the help of GEP greywater systems, about 10% of all the operating costs can be saved, even in residential buildings with ultra-modern energy systems.

Important building blocks in "green" building technology: Greywater usage

The topic of energy efficiency is on everyone's lips and is rightly enjoying a high level of importance in the media, in politics and in society. Renewable energies and fossil fuels are being used efficiently together. The cooperation and coexistence of different energy sources and the peripheral usage often offer the most economic solutions. The development in water management is similar: Here too, the usage of rainwater and greywater together with the economic use of drinking water complement one another. In this way, the total drinking water consumption in private German households has fallen by about 15% in the last 15 years to 122 litres per head and day. This can primarily be attributed to improved washing machines and dishwashers with eco-functions, the use of water-saving fittings and WC cisterns with start/stop functions and 2-volume flush cycles. Aside from these measures, the total drinking water consumption of private households, residential homes, hotels and campsites, sports facilities and commercial operations can now be reduced by a further 50% straight away. By installing and operating peripheral rainwater and/or greywater usage systems in the building technology, ecological ideals can be complemented meaningfully with economic interests. As well as the clear relieving of the burden on the natural water balance due to a reduced drinking water requirement, not inconsiderable savings can also be achieved in the operating and incidental costs.

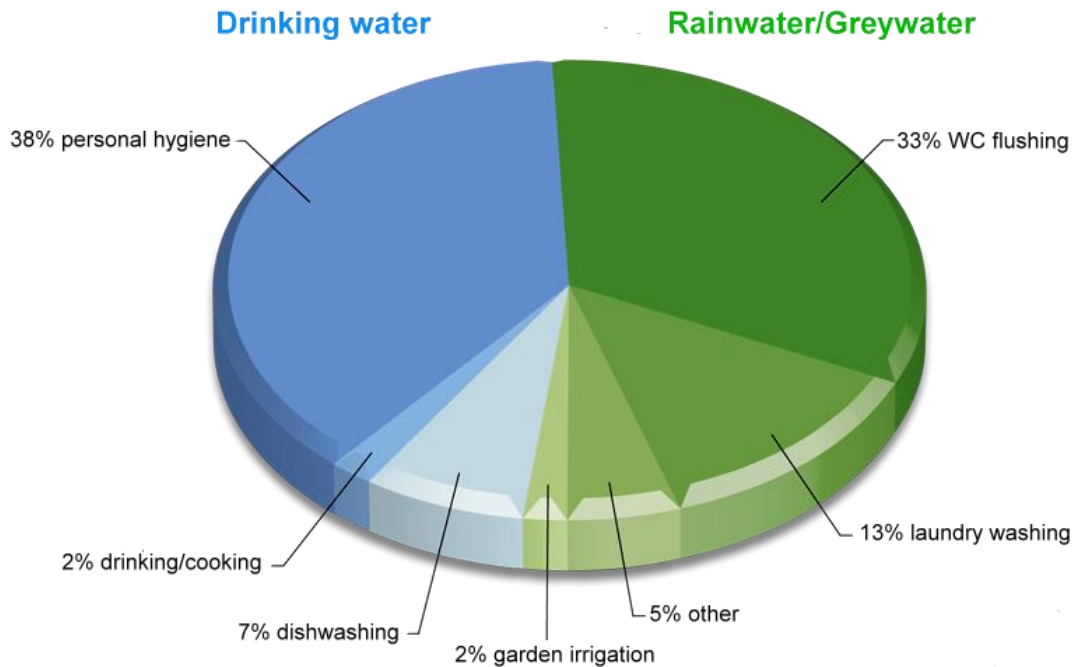


Figure 1: About half of the daily drinking water consumption can be saved through greywater recycling and using rainwater, without any loss of comfort.

Dual saving effect with greywater usage

The rainwater usage systems have proven themselves time and again in private, commercial and industrial applications. If rainwater usage systems only save the drinking water substituted by rainwater once (sewage costs continue to arise), then greywater usage effectively saves the costs of the drinking water once and the costs of the wastewater once. In actual fact, water is saved and not just replaced.

This dual saving effect is one reason why more and more decision-makers are using greywater treatment systems as a complement and replacement for rainwater usage, as the yield from greywater is constant.

What is greywater and for what can it be reused?

In contrast to rainwater, greywater arises irrespective of the weather and is available day in, day out. In terms of quantity, this amounts to about 50% of all domestic wastewater and includes the drains from the showers, bathtubs and basins. Furthermore, it also includes the wastewater from washing machines.

In comparison to the other wastewater which contains faeces and fats, this flow of wastewater can be classified as slightly contaminated and can be treated in peripheral compact recycling units in just a few treatment steps. The process water created in this way can be used to flush toilets, for cleaning purposes, for the washing machine and to water the garden without any loss of comfort or concerns about hygiene.

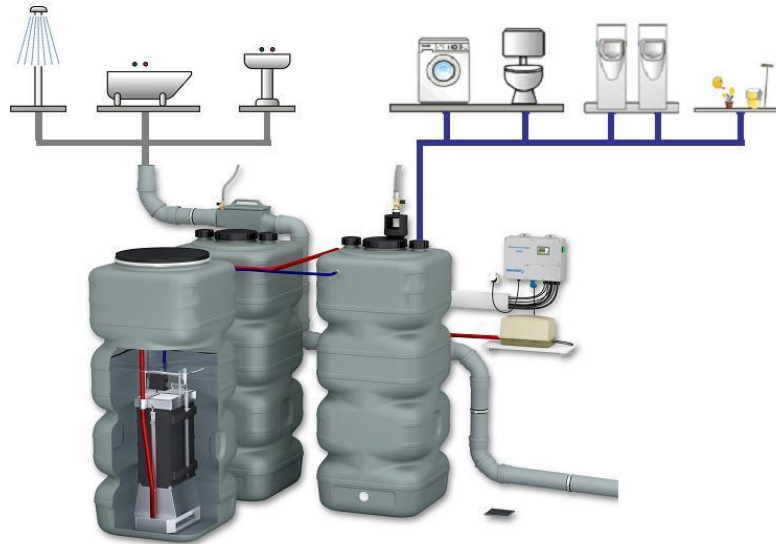


Figure 2: Flow diagram of a GEP greywater system
The greywater is collected (grey), treated and reused as process water (blue).

Throughout the world, a huge range of systems are used for greywater recycling. These do not all satisfy the hygienic demands to our standards. For successful integration of the systems into the household building services, it is essential that high-quality and safe procedures are used. The *GEP Watemanager*, which has been further developed by DEHOUST, is characterised by the quality of the process water and the operational safety.

Family-run DEHOUST is consistently pressing ahead with the developments of the GEP and has been successfully committed for many years in the field of greywater usage. The company's own container technology and experience in the manufacture of plastic containers combined with the experience of GEP in water management led to greywater systems which set new standards with regards the technology, design, assembly, user-friendliness and service. The new generation of systems from DEHOUST is marketed under the *GEP* brand and offers a good price-performance ratio as well as being easy for the installer to fit and providing a high level of operational reliability.

Competitive alternative investment

The largest investment barrier in the past was not any concerns regarding the generated process water quality, but rather the purchase price. Thanks to the newly developed modular design of the *GEP Watemanager*, the manufacturing process can be designed more effectively, meaning the list price could be reduced considerably.

To illustrate the annual saving potential with the aid of greywater usage, an economic consideration of a modern KfW-60 residential building with 35 inhabitants is to be carried out below. The treated greywater is used for WC flushing, washing machines and watering the garden.

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The savings in operating costs achieved with the help of a GEP greywater system are shown in the following table.

Table 1: Annual saving in operating costs in a residential building with 35 inhabitants as a result of a GEP greywater system.

Type of system	GWA 2.000/75
Inhabitants	35
Daily process water requirement per inhabitant [m ³ /inhabitant*d]	0,055
Annual process water requirement [m ³ /a]	703
System costs	€ 9.950,00
Installation costs, 2nd pipe network, start up	€ 4.975,00
Total investment	€ 14.925,00
Interest on capital [2% p.a.]	€ 298,50
Maintenance/repair costs [3% of investment]	€ 447,75
Energy costs per year [2 kWh/m ³ including booster pump]	€ 281,05
Total annual costs	€ 1.027,30
Saving per year with a drinking water/wastewater charge of 4/m³	€ 1.783,20

Payback period about 8 -10 years.

Prices for commercial consumers without VAT.

If the annual saving created by greywater usage is compared with the typical operating costs of a modern KfW-60 residential building, then it becomes clear that almost 30% of the water costs or 10% of the entire operating costs can be saved.

Table 2: Typical operating costs of a KfW-60 residential house with 35 inhabitants.

Resource	Specific demand	Total annual demand	Price	Annual costs
Drinking water/wastewater charge	122 L/inhabitant*d	1.558,55 m³/a	4 €/m³	6.234,20 €
Heating/hot water	60 kWh/m²*a	875 m² (25 m²/inhabitant*a)	0,06 €/kWh gas	3.150,00 €
Electricity	1.200 kWh/inhabitant*a	42.000 kWh/a	0,20 €/kWh electricity	8.400,00 €
Saving potential by using grey water	55 L/inhabitant*d	703 m³/a		1.780,00 €

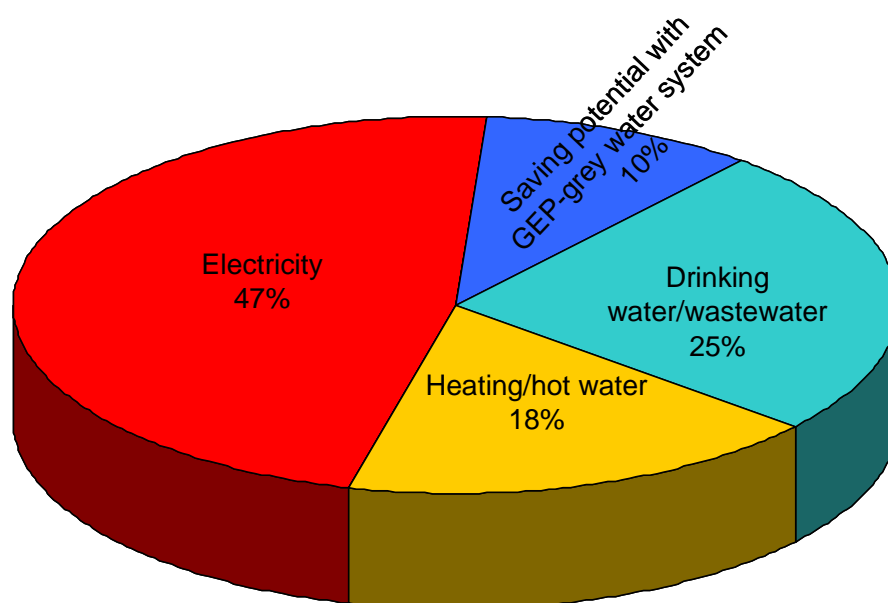


Figure 3: Typical distribution of operating costs for a modern KfW-60 residential building with 35 inhabitants.
The costs can be reduced by 10% by using greywater.

The integration of the treated greywater into the building technology should be considered a real alternative investment - even in direct comparison to alternatives in building technology, such as photovoltaics and solar thermal energy.

The amortisation time of the complete GEP greywater system will be between 8 and 10 years for the residential building considered above. If subsidies are authorised by local authorities, the pay-back period is considerably reduced.

For larger buildings, such as hotel complexes, considerably greater savings potentials can be achieved. We really recommend investors carry out a feasibility study on greywater usage for all large-scale buildings.

Top operational reliability through **BMT** recycling technology and **GSM** remote monitoring

In addition, with regards operational safety, DEHOUST does not make any compromises at all, working exclusively with quality components. The *GEP Watermanager* works with the *BioMembranTechnology (BMT)* that has been specially adapted by *GEP*, which is currently the most modern and safest treatment procedure in greywater usage.



Figure 4: Use of the *BioMembranTechnology*, even in sensitive areas.
Here in the Städtisches Krankenhaus Nettetal (hospital)

The heart of any GEP greywater system is the ultra-efficient membrane activated sludge process with immersed ultra filtration modules, which clean the greywater in an environmentally-friendly way using purely bio-mechanical procedures with an optimised energy use of just 1.5 kWh/m³. Afterwards, the water is available again as absolutely clear, odour-neutral and, above all, sterile process water - it is also possible to store the water in the process water container or in cisterns for several weeks without problems. Independent water analyses confirm that even the strict hygienic quality requirements of the EU Bathing Water Directive 76/160/EEC are consistently exceeded multiple times.



Figure 5: In terms of optics and senses, process water cannot be differentiated from drinking water.
 Left: Greywater before the treatment process;
 Right: Greywater after the treatment process.

In this context, it is important that no lingering loss of water quality can occur, in contrast to other treatment procedures, as the impregnable physical dirt and germ barriers of the membrane filter remain permanently active. Even in cases of a power outage or total failure of the biology or of individual system units, the process water remains clear and sterile.

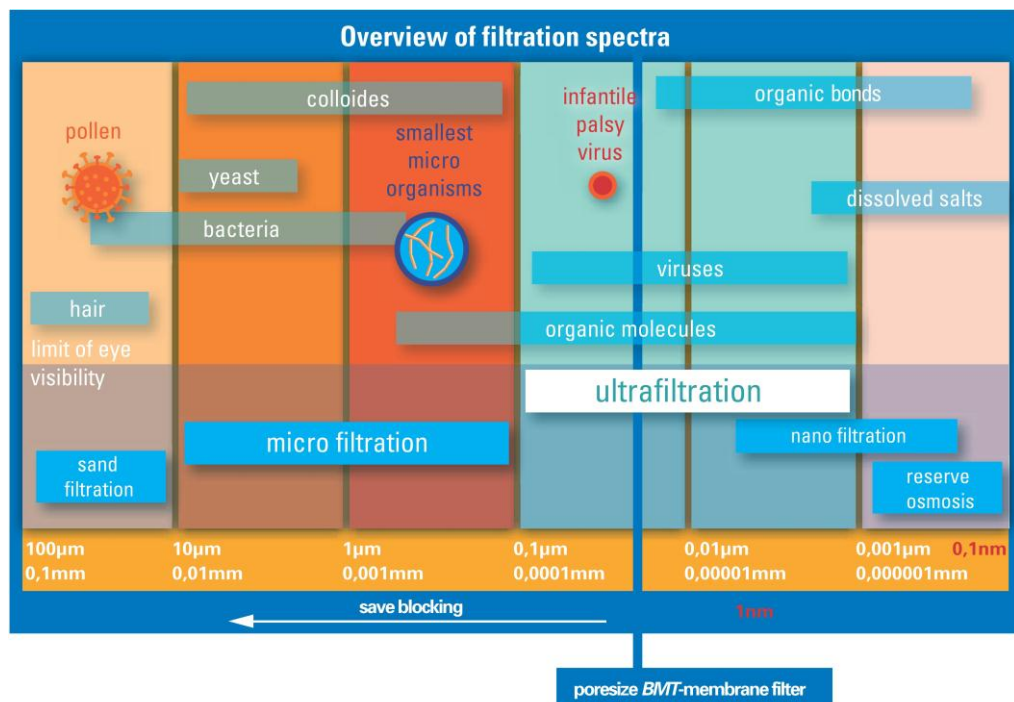


Figure 6: The *BMT membrane filter* used by DEHOUST represents an insurmountable physical barrier for particles, sludge and germs.

If an operational malfunction occurs, rapid reactions are required to ensure the operator is not unnecessarily upset and to make sure that costly water, which has already been paid for, does not disappear into the sewage system. For this reason, DEHOUST offers a remote monitoring system based on GSM technology for all *GEP Watermanagers*; all relevant system and operating data is available to the customer via the GEP web portal. Any deviations from the normal status can be recognised early on and the relevant measures can be introduced with the operator and fitter. If malfunctions occur, the operator, technical fitter and DEHOUST are informed by SMS and/or email; the documentation contained in the web portal means the necessary steps can be easily and quickly deduced. GSM technology has proven itself as a cost-reducing technology. Each *GEP Watermanager* comes as standard with an isolated fault indicator contact for connection to the central building control system.

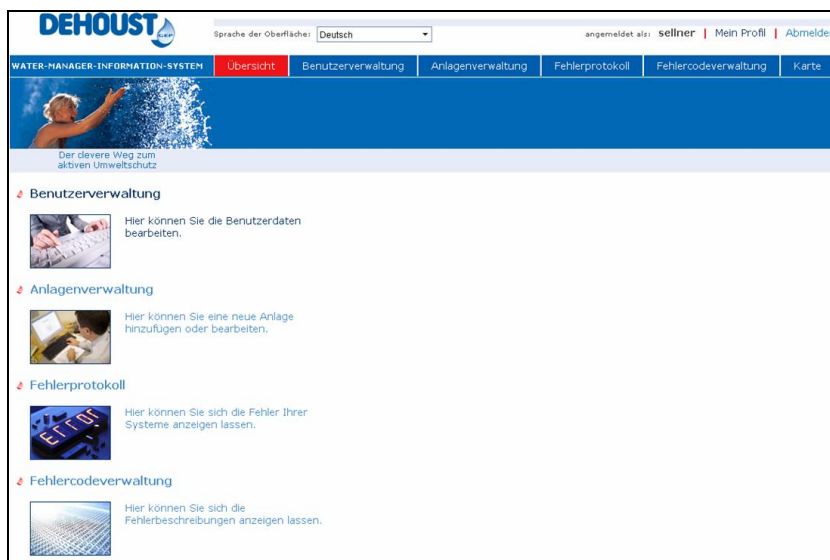


Figure 7: With the GEP web portal, operators, fitters and service partners are kept informed at all times about the status of the GEP Watermanager.

Simple assembly and operation

Manufacturers in the building services industry rapidly earn a bad reputation with unsophisticated systems, which exasperate the fitters and cause customers dissatisfaction. DEHOUST is known for its well-engineered and practical products and allows the experiences and suggestions of the building services industry to be incorporated into its latest developments in a self-critical manner. Extensive consultation in the run-up is also part of the service provided by DEHOUST, together with the shared development of special solutions for very special projects. All standard components of the *GEP Watermanager* can be transported manually and fit through (almost) any cellar door. Of course, the systems can also be equipped with subterranean tanks.

All greywater systems are delivered ready-to-assemble with plug-in connections and with extensive, building-specific installation instructions. For this reason, the assembly and installation of the systems is no problem for specialised building services companies. Of course, DEHOUST's technicians are also available if required. They can provide a general induction into the system technology and give exact explanations of the maintenance work. The latter is limited to routine visual checks of the coarse filter and the ventilator units.

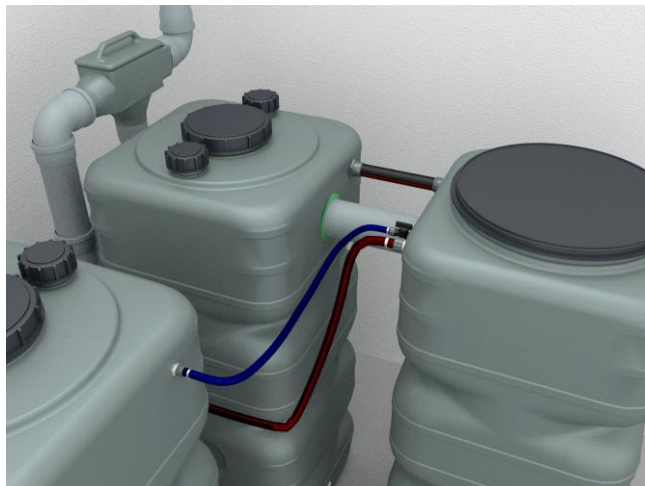


Figure 8: Rapid and simple assembly of all system components takes place thanks to defined plug-in connections.

Due to a natural cover layer being formed on the filter membranes during the treatment process, it is recommended that the filter modules are replaced after a good one to two years of operation in order to guarantee full treatment capacity. The contaminated membrane filters are replaced cost-effectively for thoroughly cleaned replacement filters - in this way, individual membrane modules have a life span of up to 10 years through recycling.

The fully-automated control unit puts the system into operation independently after it has been started-up and changes into actual treatment mode after a run-in phase. Various process parameters can be manually adjusted by authorised specialists to meet the actual system requirements. The additional incorporation of rainwater into the entire system is no real issue, as this is provided as standard in each control unit. A relevant rainwater package can also be installed subsequently into each GEP greywater system as an additional module.

Sustainable water management made easy

All GEP greywater systems by DEHOUST can be operated without problems with drinking water, process water and rainwater flows. The sensible incorporation of the two resources of greywater and rainwater into the domestic water cycle is considered by DEHOUST to be the most sustainable current variation of peripheral water management. For this reason, the *GEP Watemanager* is made up of greywater

management, rainwater management, drinking water supply in accordance with DIN EN 1717, booster station, SPS control unit and remote monitoring technology.

Increasing demand for intelligent water management

In the region of Mainz alone, a total of 8 new large-scale GEP greywater systems with treatment capacities of between 2,000 and 6,000 litres per day were put into operation in 2010



Figure 9: One of a total of 8 new GEP greywater systems for the Mainz Student Welfare Organization since the beginning of 2010.

The convincing greywater technology from DEHOUST is also used in a new Tübingen residential building. The residential building offers space for a total of 100 inhabitants and was opened in February 2012. The greywater is collected from a total of 3 buildings, treated and reused for WC flushing and washing machines. The GEP greywater system has a treatment capacity of 4,000 litres per day.



Figure 10: As well as the heat pump technology, greywater usage provides a considerable reduction in costs.

Since September 2011, the new rail yard in Darmstadt has been recycling 6,000 litres of greywater a day to flush WCs and clean its road vehicles. In total, 500 employees are provided with process water by the system.



Figure 11: GEP greywater system for waste disposal plant in Darmstadt.

However, peripheral water concepts from DEHOUST are becoming more and more in demand internationally as well. In June 2011, a large-scale GEP greywater system was commissioned in Liverpool. In an office building, up to 12,000 litres of greywater are treated daily from the basins in order to flush WCs. The office building offers workplaces for about 1,000 employees.



Figure 12: Use of a GEP greywater system for an office block on Man Island, Liverpool, England. The greywater system is operated over 2 levels and recycles a maximum of 12,000 litres of greywater per day.

However, even in very remote places, such as an alp in Austria, GEP greywater technology is successfully used. The smallest greywater system from DEHOUST treats the greywater from 15 inhabitants at a good 1,500 m height.

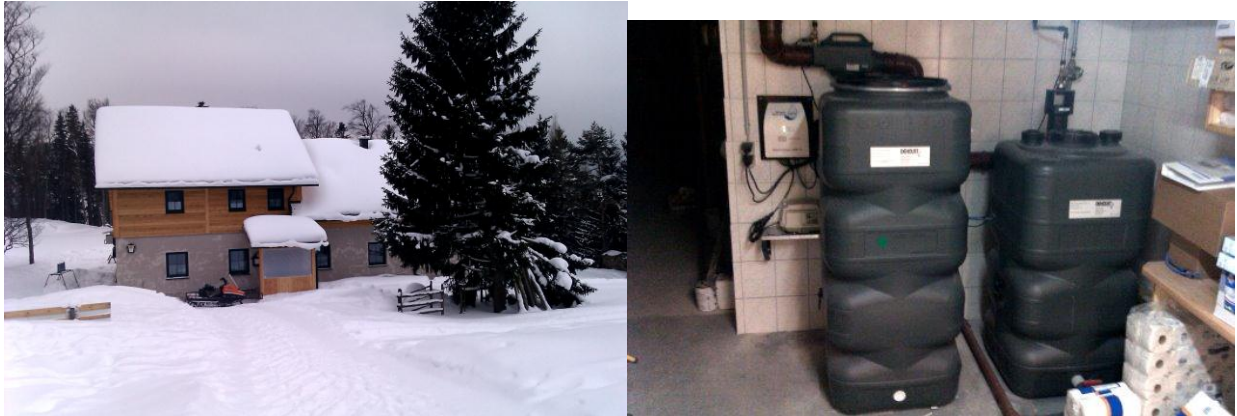


Figure 13: Austrian chalet with greywater usage at a height of 1,500 m.

Extensive care during the design procedure and in the after sales service by DEHOUST

In all projects completed to date, the specialists from DEHOUST have always enthusiastically accompanied interested parties in matters concerning planning, design, commissioning and knowledge.

With the newly developed greywater module tanks, which are produced by DEHOUST in Leimen, DEHOUST is manufacturing systems which can be planned in a standardised manner and easily installed. As a result, the consultation and training efforts for planners and fitters are reduced and greywater usage combined with rainwater usage can be established more quickly on the European market.

For more information, please feel free to visit

our websites at www.gep.info und www.dehoust.de!