4) Water Efficiency

fbr, Association for Rainwater Harvesting and Water Utilization

WATER EFFICIENCY

- Introduction
- Potentials to avoid wastewater
- Water efficiency at consumer level
- Water saving devices and technologies
- Water audits

INTRODUCTION

What is water efficiency?

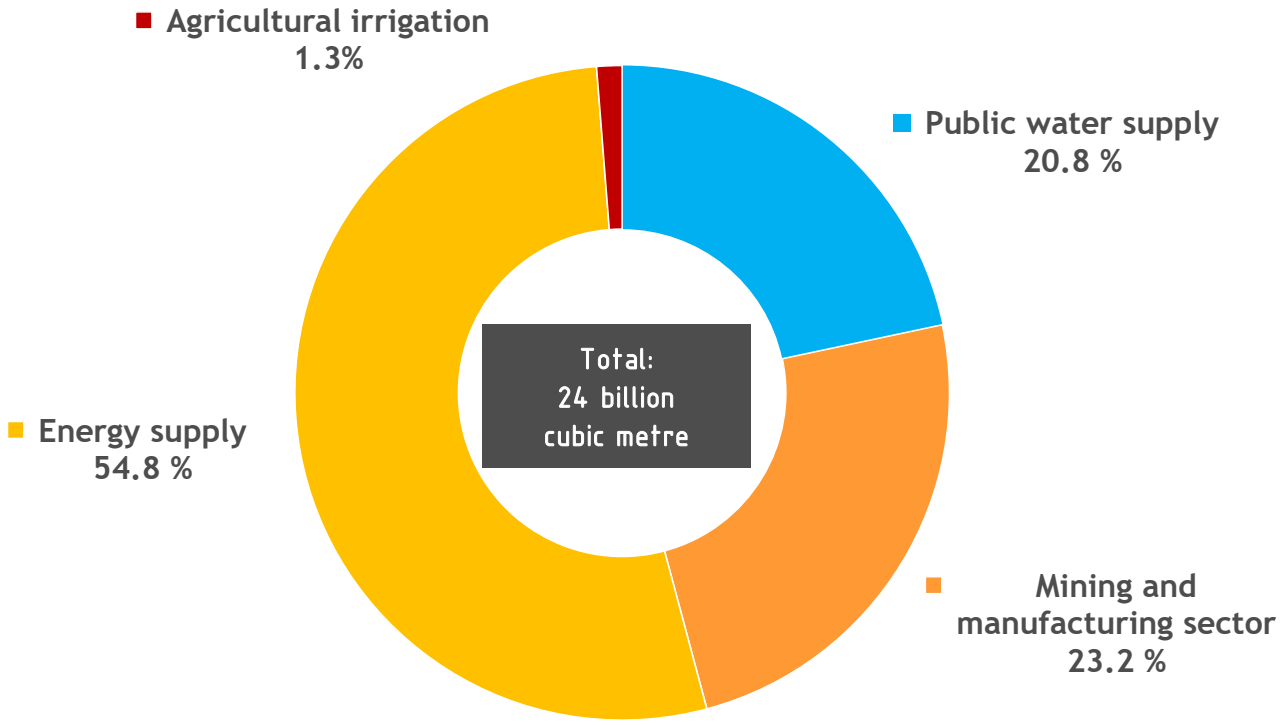
- Water efficiency is the reduced use of water possibly in all water-consuming activities and sectors without comfort or functionality loss
- It leads to significant savings in water and energy and to less wastewater production
- Water efficiency solutions focus not only on reducing the amount of potable water used, but also on reducing the use of non-potable water (e.g. use recycled water for toilet flushing, irrigation, etc.)
- Water efficiency can be achieved at various levels and sectors (private, public, industry) and includes sensible/economical water use, extensive installation of water-saving devices and techniques, water recycling, rainwater harvesting, just to name a few
- The biggest water-users in the home are bath tubs, showers, toilets, washing machines and taps

Priorities in water efficiency

1. Avoid wastewater generation
2. Reduce water consumption
3. Recycle water
4. Reuse

INTRODUCTION

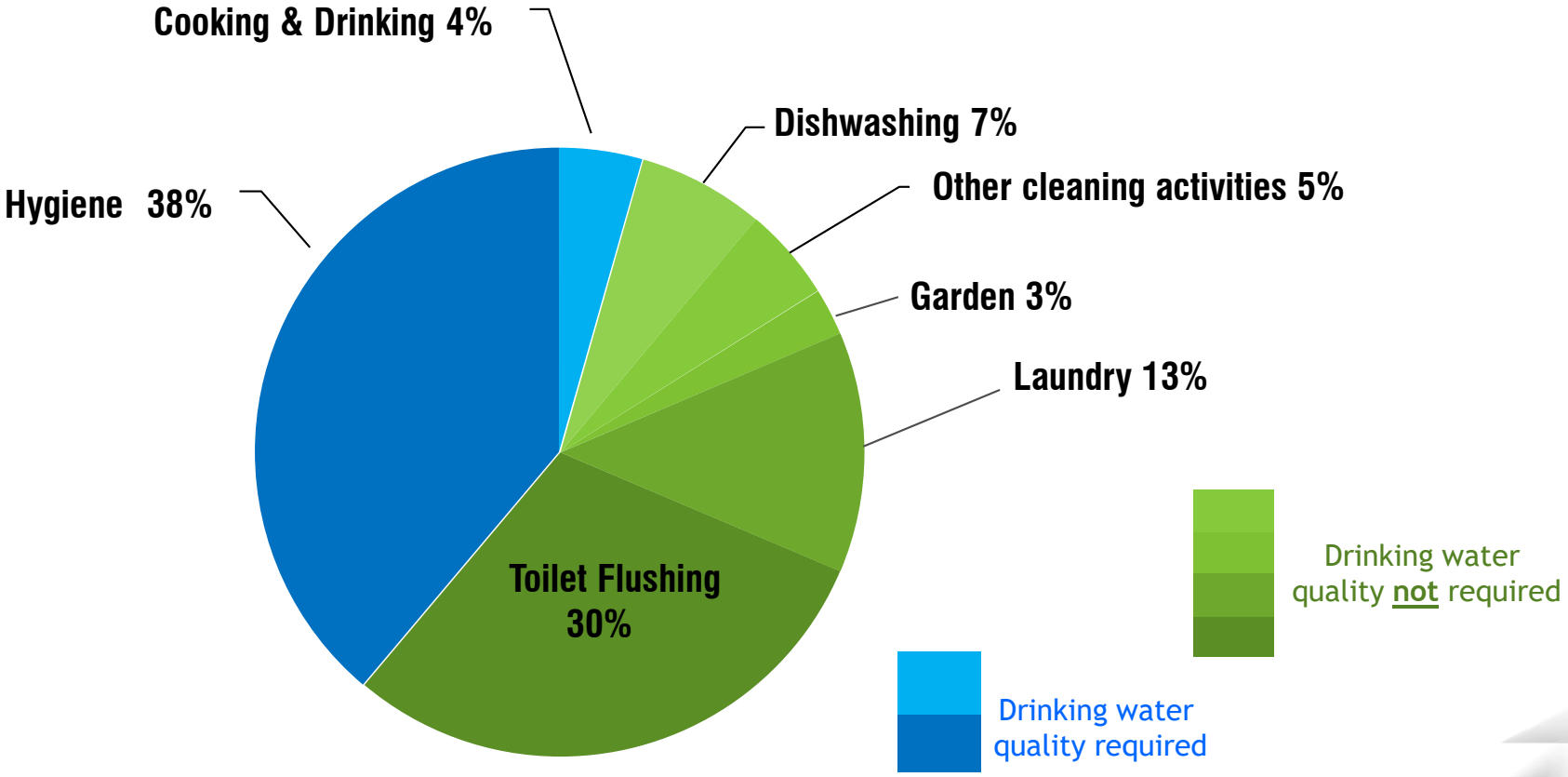
Water extraction of the different sectors in Germany (2016)



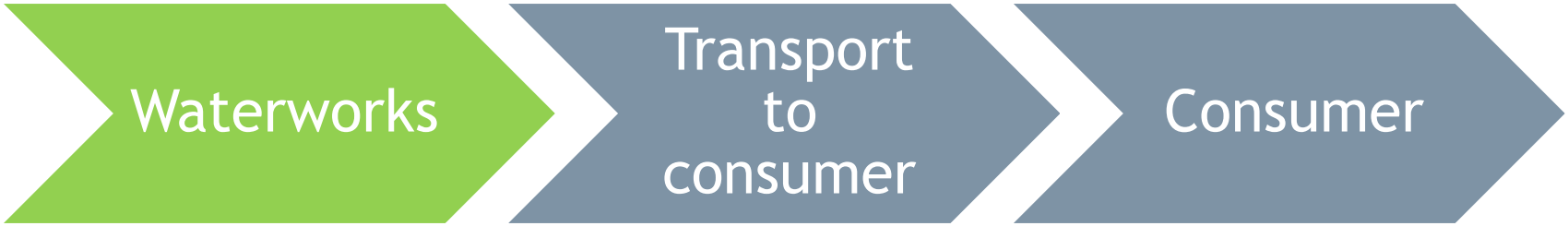
(Source: German Federal Statistical Office. Fachserie 19, R. 2.1.1 & 2.2, Wiesbaden, for several years)

INTRODUCTION

Water consumption in housholds: approx. 50% of the household water demand need not be served by drinking water



POTENTIALS TO AVOID WASTEWATER

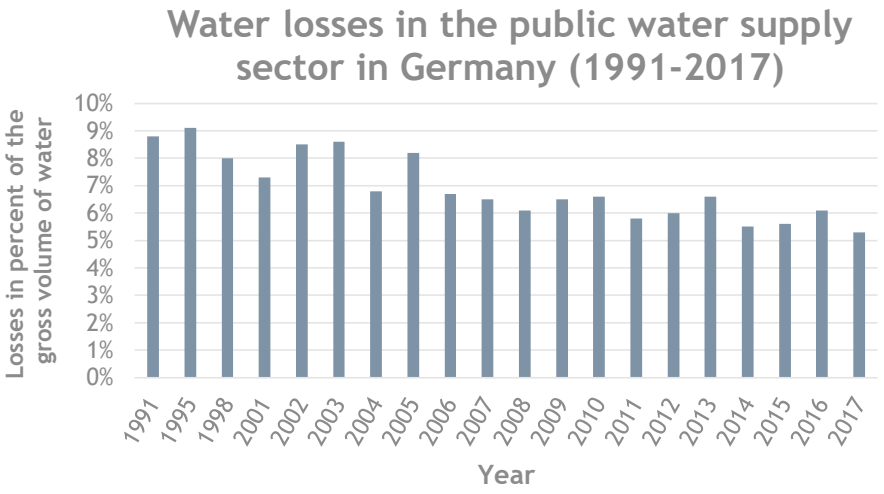


- Optimisation of the water extraction and water supply processes
- Avoid oversizing of pipeline network to reduce pipe flushing/cleaning
- Consumer information on water saving

POTENTIALS TO AVOID WASTEWATER

Waterworks → Transport to consumer → Consumer

- Investment in high quality pipeline networks
- Detection and prevention of leakages/water pipe damages



(Source: German Federal Statistical Office; BDEW)

POTENTIALS TO AVOID WASTEWATER

1. High-quality pipework installations in the building services (tube material and thermal insulation)
2. Identify/repair water leakages and losses at home
3. Installation of water metres and monitoring of water consumption
4. Installation of water-saving fixtures and products
5. Installion of water-saving appliances
6. Greywater recycling and rainwater harvesting (see **Modules 2 & 3**)
7. Consumer awareness and behaviour

Consumer behaviour

Water efficiency begins at home with conscious individual behaviour in handling water. For example:

- Fix dripping taps and faucets and repair leaks
- Have a short shower instead of a bath
- Turn off the tap while brushing teeth
- Use full load in the dishwasher and washing machine
- Wash fruits and vegetables in a bowl rather than under a running tap

Pipework installations

- A good insulation of pipework prevents unnecessary water consumption as a result of shorter waiting intervals for the cold or warm water to flow (saves water and energy)

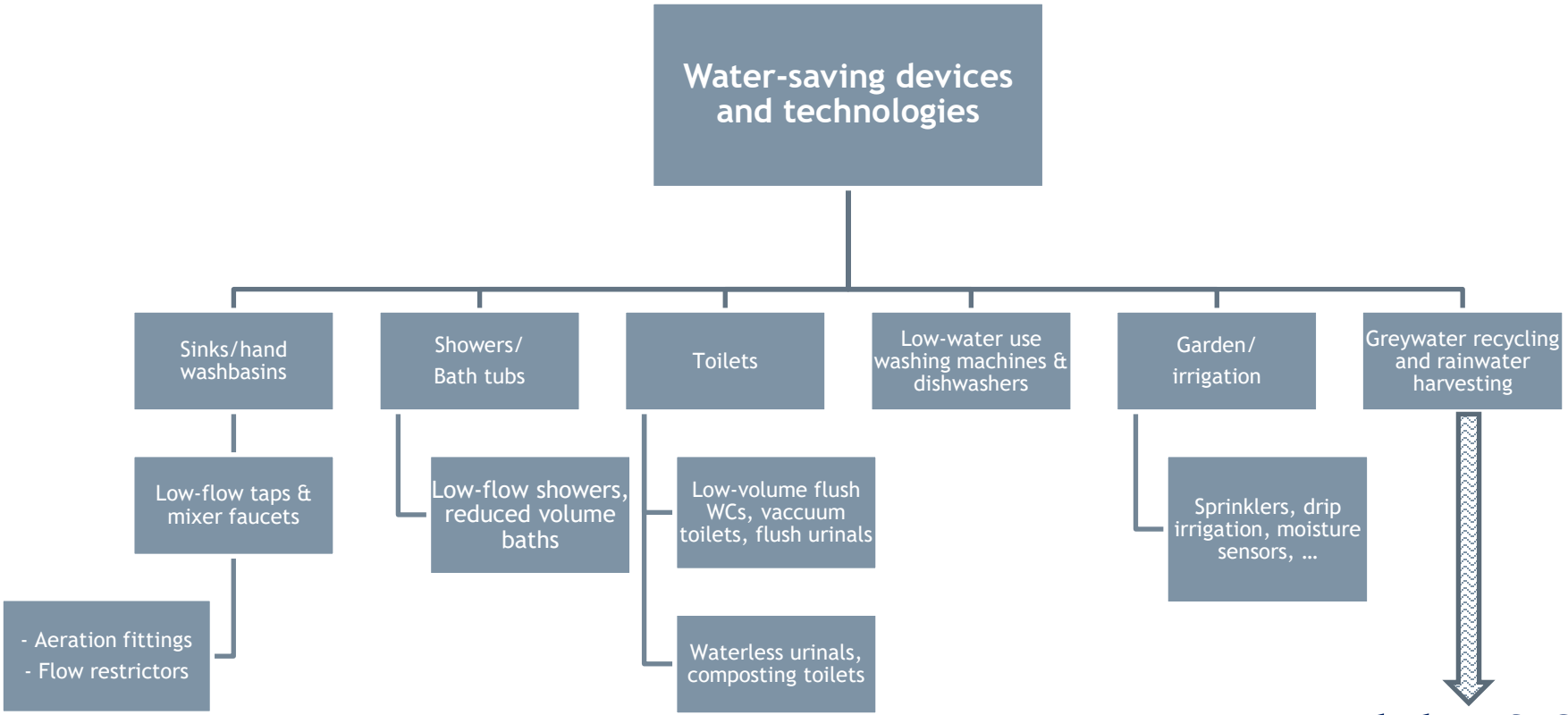
Monitoring using water metres

- Is mandatory to monitor real water consumption

Consumption recording (Water metre) → Regular reading (manually or automatically → Assessment of water consumption

Metering encourages consumers to use less water and not to waste the resource. It creates awareness as to how much water is used, as evident by the customer's bill.

WATER-SAVING DEVICES & TECHNOLOGIES



Modules 2 & 3

Low-flow taps and fixtures

- Low-flow taps and fixtures use aerators or restrictors to reduce the amount of water flow independent of water pressure
- Aerators apply the aeration technology which mixes air to the water flow to reduce the amount of water released
- Flow restrictors are designed to limit the amount of water air that comes out of a tap or other dispenser
- Tap-water use can be reduced from a standard 15-18 l/min down to as little as 3-4 l/min
- They can be fixed onto almost any domestic water tap
- Kitchen sink taps fixed with flow regulators can achieve a flow rate of less than 6 litres per minute without compromising the water pressure, compared to the 15 litres per minute flow rate in typical kitchen water taps without regulators
- They can reduce water consumption by more than 60%

FLOW AERATORS AND RESTRICTORS (FOR DIFFERENT FLOW RATES 3 – 10 L/MIN)

Flow aerators and restrictors reduce the amount of water passing through the pipe without reducing water pressure or affecting the wash and rinse effect. They are available with different flow rates and outlets (spray or aeration)

Bubble and needle spray aerators

FLOW AERATORS AND RESTRICTORS (2)

Flow restrictor inside tap inlet

Typical outlet flow restrictor components

Flow restrictors that are installed in faucets are typically either screwed onto the tap or installed inside the faucet. Many of them have aerated nozzles that produce a fine mist of water rather than a solid flow

(Source: Neoperl)

LOW-FLOW MIXER FAUCETS

LOW-FLOW MIXER FAUCETS

Taps with built-in eco-click and thermo-regulating valves achieve savings in both water and energy consumption

Section through a click tap with a water brake (built-in click-stop technology) and a hot water temperature regulation
(Source: Water efficiency in new homes. NHBC Foundation 2009)

AERATED LOW-FLOW TAPS

Use a mixture of air and water. Water is formed as droplets rather than a continuous spray.

(Source: Neoperl)

LOW-FLOW SHOWERHEADS

The aeration technology is also applied to showerheads to achieve a flow rate of less than 5 litres per minute

DUAL FLUSH TOILETS

3/6 litre dual flush cistern

Dual flush cisterns have been developed to accommodate different flushing requirements. The recommended capacity is 4.5 litres or less for a full flush, and less than 3 litres for a half flush. They can save more than 60% of water compared to conventional toilets (BCA, 2007)

(BCA (2007) Green Building Design Guide – Air-conditioned Buildings. Singapore: Building and Construction Authority)

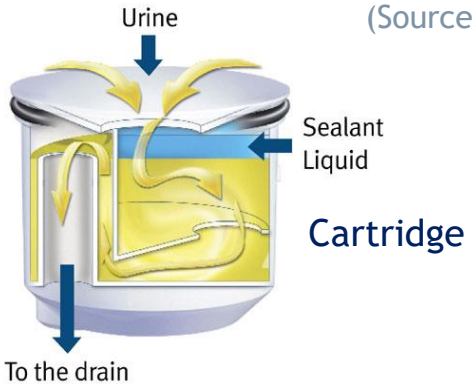
FLUSH URINALS

(Source: Schell, GmbH)

A water-efficient urinal with a standard 300 mm width only requires less than 0.5 litres of water per flush

WATERLESS URINALS

Different odour traps



(Source: Falcon Waterfree Tehnologies)

Waterless urinals with sealant liquid

- The sealant liquid, with a specific gravity of 0.8, floats on top of the urine contained in the trap building up an effective odour barrier. Urine immediately penetrates the sealant liquid and flows to the drain
- Urine precipitates are collected in a cartridge or inner cylinder of the trap
- The system drains by gravity
- Maintenance consists of cleaning the urinal bowl and regular exchange of the cartridge or sealant liquid. The required exchange frequency depends on the number of users

Other waterless urinal systems

- **Microbiological Systems:** replaceable cartridges use the action of microbes to break down urine into odourless components and use the trap or u-bend as the seal against odour from the drains
- **Valve Barrier Systems :** replaceable cartridges or in-built traps have a one-way valve or siphon to prevent foul air from entering the washroom

COMPOSTING TOILETS

Sawdust composting toilets (waterless)

LOW-WATER USE WASHING MACHINES AND DISHWASHERS

Use full-loads for washing machines and dishwashers!

Front-end loading washers use 30-50% less water, as well as 50-60% less energy to operate, compared to toploading washers

Washing machines

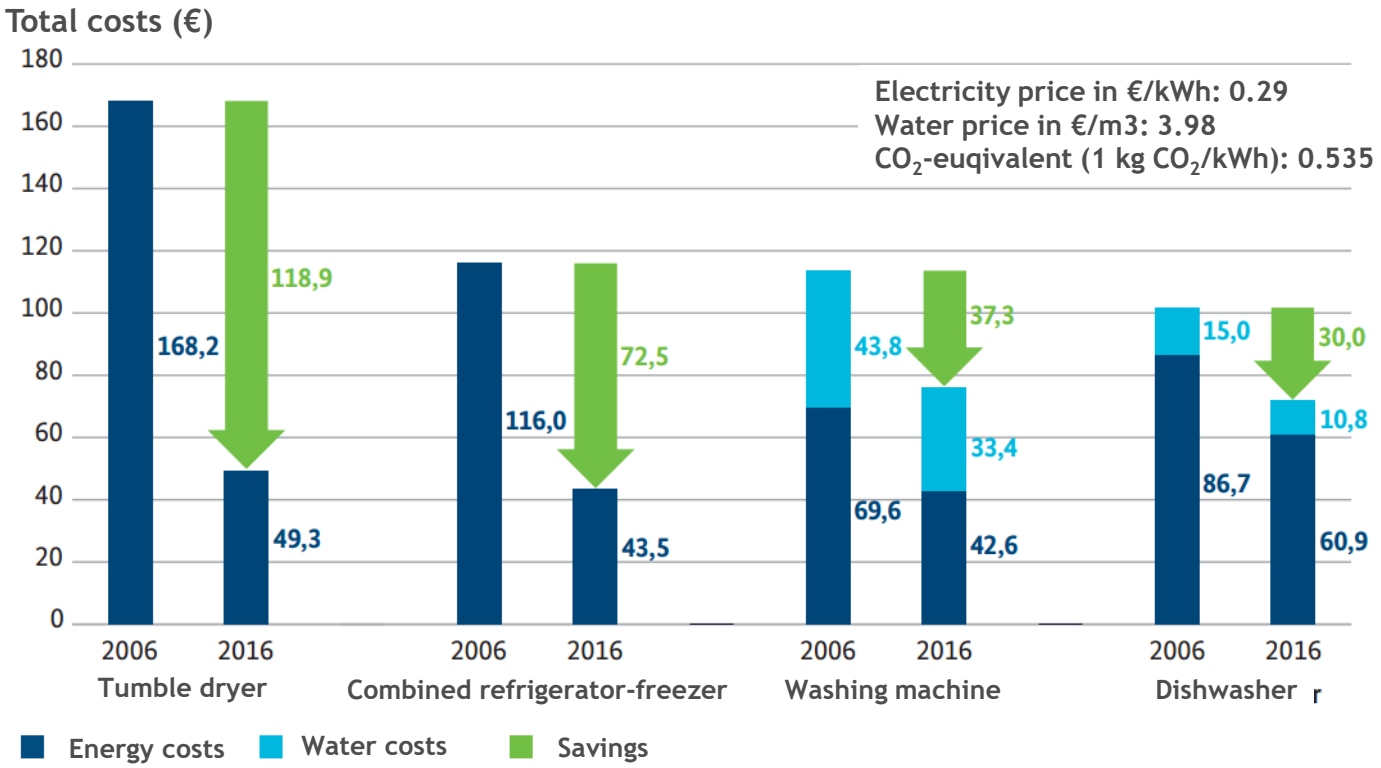
	Litres of water
Best	33
Worst	72

Dishwashers

	Water use on a main programme	Water use on an energy saving programme
Best full-sized dishwasher	10 litres	7 litres
Worst full-sized dishwasher	21 litres	17 litres

WATER-SAVING DEVICES & TECHNOLOGIES

Annual energy and water costs of efficient household devices compared to 10-year old devices



(Source: https://www.bmwi.de/SiteGlobals/BMWI/Forms/Suche/DE/Servicesuche_Formular.html?resourceId=180050&input_=180004&pageLocale=de&selectSort=score+desc&templateQueryStringListen=wasserkosten)

DRIP IRRIGATION SYSTEMS, GARDEN HOSE NOZZLES AND SPRINKLERS

(Source: Gardena, GmbH)

Drip irrigation systems use 30% - 50% less water than sprinkler irrigation systems. They supply water directly to the roots of plants at a slow speed, thus keeping water run-off and evaporation rates to a minimum

Other water-saving irrigation technologies and measures

- **Rain (moisture) sensors** can reduce watering needs. The system can be turned back on when hygroscopic sensors in the ground dry out
- **Time clocks** and **pre-set flow limiters** can be used to minimise over-use
- Advanced water-saving irrigation technologies also include automated controls that can be used with rain sensors. Irrigation is stopped when rain is detected
- The irrigation frequency needs to be programmed to fit the weather and seasonal requirements
- It is also recommended to identify opportunities for zone control, so that plants with different types of water needs are irrigated separately

WATER AUDITS

- Water audits is an inventory system of all water uses in a facility
- They identify each point of water use and estimate the quantity of water used at each of these points
- They also identify and quantify unaccountable water losses and possible leaks
- Based on the inventory, ways are shown for potential water savings and the implementation of cost-effective water-saving measures
- Water audits can also help in identifying potential uses for alternative water sources
- Conducting a water audit saves money by reducing a facility's water bill

Required data

- Water audit is achieved in stages:
  - Quantification of water consumption
  - Quantification of water losses
  - Water balance calculations

- Gather baseline data by mapping all water points and usage areas showing locations and equipment where water is used
- Verify water uses, estimate hours and rate of use
- Compare estimated water use with consumption data from water bills
- Look for leaks and ways to reduce water use
- Estimate costs of fixture change-outs and new equipment and compare with estimated savings for water, wastewater and energy to calculate potential payback period

Procedure

- Specific techniques to identify, measure, and verify all water consumption and loss
- Techniques to identify and control apparent losses in metering and billing operations and recover missed revenues
- Steps to implement a leakage and pressure management program to control real losses, conserve water and contain costs
- Planning steps to assemble the proper resources, information and equipment to launch a sustained accountability and loss-control program
- Approaches for setting short-term and long-term goals and measure return on investment