

# Profile of the German Water Sector

## 2015



#### **Edited by**

Association of Drinking Water from Reservoirs (ATT)  
German Association of Energy and Water Industries (BDEW)  
German Alliance of Water Management Associations (DBVW)  
German Technical and Scientific Association for Gas and Water (DVGW)  
German Association for Water, Wastewater and Waste (DWA)  
German Association of Local Utilities (VKU)

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info@wvgw.de · www.wvgw.de

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## Foreword

With the “Profile of the German Water Sector 2015” the ATT, BDEW, DVGW, DBVW, DWA and VKU in agreement with the German Association of Cities (Deutscher Städtetag – DST) and the German Association of Towns and Municipalities (Deutscher Städte- und Gemeindebund – DStGB) provide an up-to-date picture of water supply and wastewater disposal in Germany. It gives the interested public and decision makers extensive, detailed information about the water sector’s performance, the great variety of its tasks and the current challenges it faces. Like the previous three editions since 2005, the fully up-dated Profile 2015 demonstrates that the modernisation strategy pursued equally by the government and by the water sector itself is also taking effect in an increasingly difficult environment.

The Profile documents the high performance of the German water sector in European and international comparison with regard to safety, quality and sustainability of the supply and disposal services, eco-

nomic efficiency and customer satisfaction. It is essential to maintain the high level of performance achieved to date and to bring about improvements wherever possible and required.

The associations promote the continuous improvement process in the companies through benchmarking and recommend their members participate in benchmarking projects (Associations’ Declarations 2003 and 2005). Benchmarking means to compare oneself and improve by learning from the other participants in a comparison group.

Benchmarking, the transparent documentation of performance through the water sector’s Profile, and continuous development are the pillars of the sector’s permanent improvement which it implements in its own responsibility. This concept was acknowledged and supported by the German Federal Government in its 2006 report on the modernisation strategy for the German water sector.

## Summary and core statements

### Performance

In Germany the citizens always have drinking water available in excellent quality and sufficient quantity. In addition to the comfortable resource situation in Germany as a water-rich country, the high technical standards and a range of voluntary measures by the water sector contribute to the protection of natural resources. Wastewater treatment in Germany is also at a very high level. In contrast to many EU countries, almost 100 percent of the wastewater is treated to the highest EU purification standard. Through their work, drinking water suppliers and wastewater utilities thus contribute significantly to preventive and comprehensive water protection.

Performance characteristics of the water supply and wastewater disposal in Germany are long-term safety of supply and disposal, high drinking water

quality, high wastewater disposal standards, high customer satisfaction and careful management of water resources under consideration of economic efficiency. These aspects are considered in the 5-pillar benchmarking concept. Through the nationwide application of benchmarking, the utilities have significantly improved in all areas.

To remain sustainable, the water sector needs to be efficient, to cover costs and be transparent for the customers. Benchmarking projects are a key instrument here. The main prerequisites for the success of the benchmarking and performance indicator projects are confidentiality and voluntariness, but also the consistency and compatibility of data. For this purpose, the performance indicator systems of the sector are continually developed.

08



Approved technical standards and adherence to strict legal requirements lead to the high quality and the long-term safety of the German drinking water supply and wastewater disposal.



## Organisation and economic efficiency

In Germany, water supply and wastewater disposal are core duties of public services in the general interest within the competence of the municipalities or other public corporations. Their democratically legitimised bodies take the strategic decisions with regard to the forms of organisation, participations and cooperation. Germany has a varied supply and disposal structure comprising public and private sector companies.

The German water sector is one of the largest customers for the private sector, as planning and construction contracts are awarded to a large extent to outside companies. The water utilities have realised that it is optimally qualified employees with their sector-specific knowledge and skills that keeps the utilities viable in the long-term. Therefore, they have continually invested in the education of young people for many years, often beyond their own needs.

Fees, drinking water quality, environmental requirements as well as water abstraction rights and discharge rights are subject to strict state control; cost coverage is anchored in law. The increases in fees for drinking water and wastewater have mainly been below the inflation index for many years. Safety of supply and drinking water quality are of utmost importance for the customers and almost all consider the fees paid for this to be appropriate.

The specific regional and local parameters determine the supply and disposal conditions on site. Water supply and wastewater disposal therefore always require locally adapted solutions. This, combined with the different legal requirements of the federal states, results in different efforts and costs. Taking into account the respective water consumption and performance standards, customers in Germany spend less on their drinking water than customers in comparable European countries.

In Germany, water supply and wastewater disposal are core duties of public services in the general interest within the competence of the municipalities or other public corporations. Their democratically legitimised bodies take the strategic decisions with regard to the forms of organisation, participations and cooperation. Germany has a varied supply and disposal structure comprising public and private sector companies.

Fees, drinking water quality, environmental requirements as well as water abstraction rights and discharge rights are subject to strict state control; cost coverage is anchored in law. The charges and prices are largely determined by the specific regional and local context. They have mainly developed below the inflation index for many years.



## Tasks and challenges

The requirements put on modern, sustainable water management are increasing steadily. It's no longer just a matter of providing drinking water and treating wastewater. The comprehensive approach is increasingly gaining in importance, with the aim of achieving a sustainable, integrated water management. Thus, in addition to drinking water supply and wastewater disposal, among other things, the maintenance and protection of water bodies, the landscape water regime and coastal protection and flood control are among the tasks of a functioning water sector. In addition, the changes in social priorities influence the work of the water sector. Thus, energy consumption and efficiency, and resource protection are becoming increasingly high profile. Concomitant conflicts of use with the water sector need to be solved through social consensus.

As a result of our modern industrial society and sophisticated analytics, anthropogenic micro pollutants can be detected better in groundwater and surface water. There is considerable need for research on their effects on humans and the en-

vironment. This challenge cannot be dealt with solely by the water sector. When dealing with micro pollutants, the focus needs to be on preventing their input at the immediate source. Where this is not possible, the polluter pays principle needs to be applied.

Water consumption has been decreasing significantly for decades. Nevertheless, the utilities have to provide appropriate capacity for peak demand and an infrastructure which is able to cope with this. Therefore, political demands for further reductions in water consumption are not reasonable, especially in water-rich Germany.

Demographic and climate change together with continuously decreasing water consumption pose great challenges for the German water sector. The German water sector meets these challenges by developing solutions that are adapted to the respective conditions. It proves that it can meet these challenges thanks to its comprehensive technical, economic and scientific expertise and its practical research activities.



Demographic change, the looming climate change, the sophisticated detection and the minimisation of the input of anthropogenic micro pollutants, as well as conflicts of use with industry, agriculture and energy policy objectives are the current challenges faced by the German water sector. Drinking water supply and wastewater disposal face these tasks and work locally to achieve flexible and adapted solutions that comply with the social consensus.

# PART A – Framework Conditions



# 1 The water sector's framework conditions

**Germany has a comfortable resource situation. The protection of the valuable resource water is an existential public task. The water supply and wastewater disposal utilities support the state considerably in its task of protecting the water bodies in the long term.**

## 1.1 Water availability in Germany

We live in a water-rich country. The 80.5 million inhabitants have 188 billion cubic metres of fresh water available per year, which is renewed in our temperate humid climate through rainfall.

However, the level of precipitation varies regionally. It tends to rain more in the West than in the East. Whereas Berlin/Brandenburg receives 590 mm per year, in Baden-Württemberg it's 938 mm per year. Regions of high and low precipitation are frequently close to one another in geographical terms. For instance, the city of Düren with a precipitation level of about 622 mm per year and the city of Wuppertal with about 1,200 mm per year are only around 100 km apart (Source: German Weather Service, 2009).

Not only the precipitation levels vary regionally. Also the availability and quality of the groundwater differs. Hydrological, geological and hydro-chemical differences and anthropogenic influences are responsible for this.

In a highly industrialised, intensively farmed and densely populated country like Germany, the water resources are subject to a variety of utilisation requirements and major burdens. To nevertheless ensure the best possible quality of the water bodies is the responsibility of the state, supported by the utilities of the water sector.

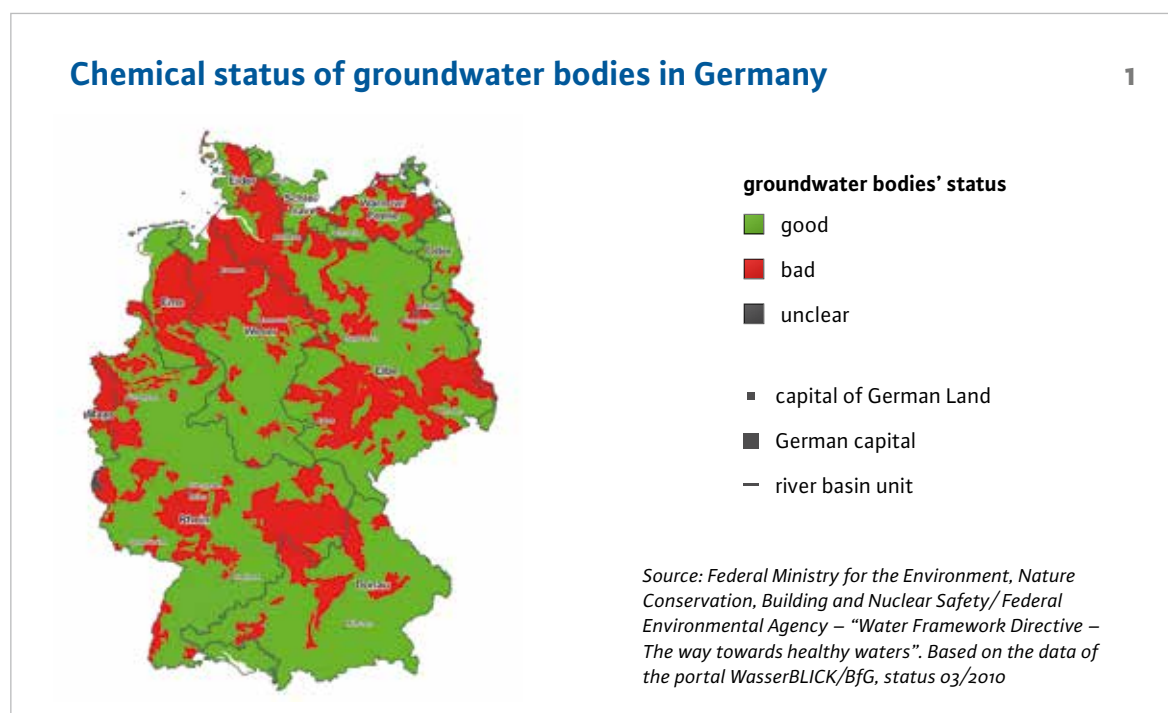
## 1.2 Water management duties

The requirements put on the use of water are increasing steadily. It's no longer just a matter of providing water. The comprehensive approach is increasingly gaining in importance, with the aim of achieving a sustainable, integrated water sector. Thus, in addition to drinking water supply and wastewater disposal, among other things, the maintenance and protection of water bodies, the landscape water regime and coastal protection and flood control are among the tasks of a functioning water sector.

Nationwide protection of water bodies is the responsibility of the state. European targets in the EU Water Framework Directive (EC-WFD; 2000/60/EC) demand the "good status" of water bodies. Figure 1 shows that the chemical status of groundwater needs to be improved even further in Germany. In many areas of Germany, however, prescribed EU targets for achieving high quality standards will not be achieved through the second and third generations of management plans and programmes of measures in accordance with the EC-WFD until 2021 or 2027. The biggest challenge is, as ever, the pollution caused by nitrates. This is also clear in the 2nd Report on the Implementation of the EC Nitrates Directive (91/676/EEC) in which the EU Commission establishes that in Germany there are still areas where there is as yet no improvement in the groundwater quality and thus additional meas-

ures are required. In addition to nitrate pollution, findings regarding pesticides and their degradation and transformation products in the water bodies present a problem for water protection. This is cur-

rently also confirmed by the Federal Government's National Action Plan for the sustainable use of plant protection products.



Furthermore diffuse phosphorus pollution of the flowing, and in particular the standing, water bodies from agricultural land use contributes to eutrophication and increased nutrient enrichment with various adverse consequences.

In many places, farmers and water supply utilities have recognised this problem and have often been cooperating successfully for many years in the interests of preventive drinking water resource protection. This is of prime importance, as there is no alternative to the existing drinking water catchment areas and the current drinking water supply. Nevertheless, the polluters of the water bodies need to be held more responsible. There is a need for action that clearly goes beyond voluntary co-

operation. Thus, it is necessary that agricultural law ensures that the requirements of water law are met. In addition, the authorisation procedure for plant protection products needs to be developed with regard to the interests of water protection.

Especially the 18,780 water protection areas, which occupy about 14 percent of the land area of Germany (Source: WasserBLICK/Federal Institute of Hydrology, 2014), contribute to the precautionary protection of drinking water resources. Here, stricter requirements, that go beyond the normal, comprehensive conservation of water bodies and which are geared towards the precautionary protection of drinking water resources, apply to potentially hazardous water uses and facilities.



## 2 Structural and technical framework conditions

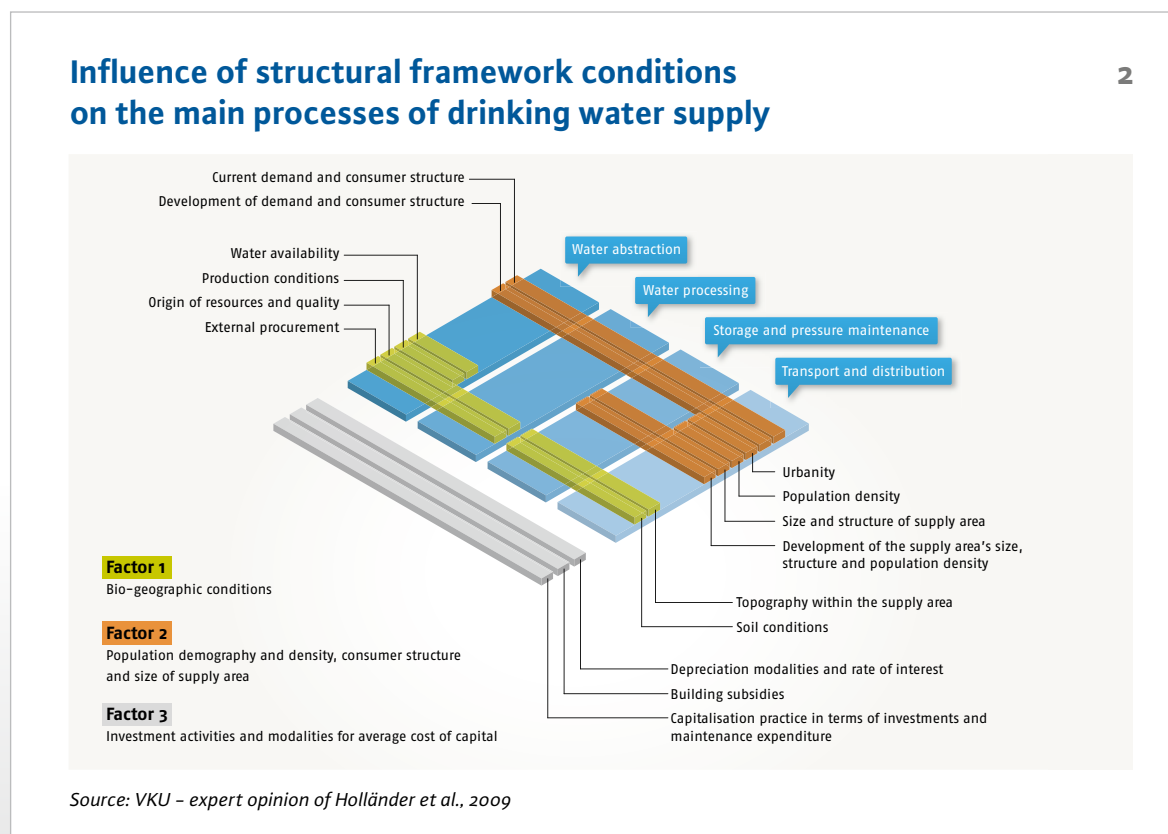
The specific regional and local framework conditions determine the local conditions of supply and disposal. Treatment and distribution of water and collection and treatment of wastewater are directly dependent on climatic, geological, hydrological, topographical and settlement-geographic conditions which vary considerably in their regional or local forms.



The expenditure required for the provision of drinking water depends on the local availability of the water sources (spring, ground, surface water) and quality of the raw water. These are influenced, among other things, by climate, vegetation, land use (agriculture, industry, etc.) and by substances occurring naturally in the water (e.g. frequently iron and manganese) attributable to geological influences.

As far as wastewater disposal is concerned, the technical design of the sewer system depends above all on the local soil and slope conditions. Both in the water supply and in the disposal of wastewater, the altitude conditions determine the number and kind of plants required (e.g. high-level tank, pump stations, pressure reduction and pressure boosting plants) and their energy consumption.

The VKU expert opinion of Holländer et al. (2009, 2013) shows how the structural framework conditions affect the drinking water supply. Figure 2 illustrates how external conditions, for example urbanity, population density, topography and water availability, impact the respective main processes in the provision of drinking water. While the conditions resulting from factors 1 (bio-geographic conditions) and 2 (including population demography and density) directly affect the four main processes of the drinking water supply, factor 3 (investment activities and modalities for average cost of capital) has an overall influence on the costs of the water supply utility, without any difference in the effectiveness on the main processes.



The specific regional conditions exist on site and cannot be influenced by the supplier. However, they largely determine the technical complexity and thus the cost of the provision of drinking water. Comparisons of pricing and charges that do not take these structural differences into account are not able to provide any reliable information about the appropriateness of local water drinking or wastewater fees.

Demand forecasts are of great importance in planning long-lasting and complex infrastructures.

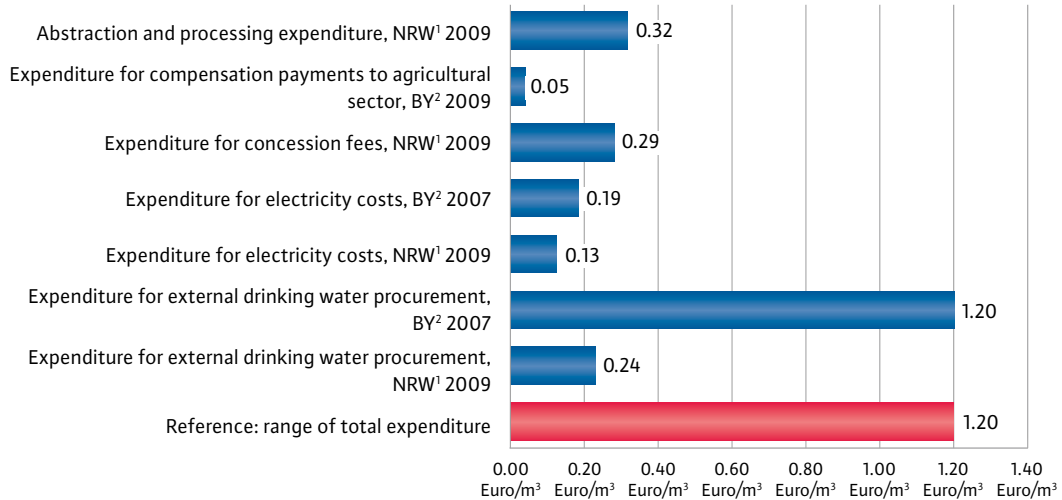
Demand structures, population (see Chapter A 5.3) and requirements from industry and commerce may vary considerably over time. For instance, water demand has decreased since the 1980s due, among other things, to the change in customer behaviour and the increasing utilisation of water-saving devices and fittings.

Water supply and wastewater disposal therefore require locally adapted solutions. This, coupled with various legal requirements, leads to different expenses and costs (see Figure 3).

### Comparison of the range of overall expenditure and different expenditure variables (in Euro per cubic metre)

3

Results from public benchmarking reports (drinking water)



<sup>1</sup> North Rhine-Westphalia

<sup>2</sup> Bavaria

Source: IGES/TU Berlin Study on behalf of BDEW, 2010



### 3 Legal, economic, political framework

**In Germany, water supply and wastewater disposal are core duties of public services in the general interest and are the responsibility of the municipalities, or other public corporations. Their democratically legitimised bodies take the strategic decisions with regard to the forms of organisation, participations and cooperation.**



### 3.1 Role of the municipalities

The German Basic Law (Article 28 Para. 2) and most constitutions of the federal states ensure the local self-government of municipalities. Self-government comprises all matters concerning the local community. Local self-government means autonomy in terms of bylaws, supreme power in terms of organisational, personnel, financing, regional and planning issues of cities, municipalities, associations of municipalities and administrative districts in accomplishing the tasks assigned to them. Municipal regulations and the water laws of the different federal states stipulate that drinking water supply is usually and wastewater disposal is always an obligation of the municipalities. On this basis, municipalities decide on the local implementation and organisation of water supply and wastewater disposal for the citizens' benefit. Based on the different constitutional provisions of the federal states, different forms of business organisation are possible for the implementation of water supply and wastewater disposal on the municipalities' own responsibility as part of their organisational sovereignty. The forms of organisation are usually as follows:

- **Ancillary municipal enterprise:** Operation by municipality within the framework of the general municipal administration.
- **Owner-operated municipal enterprise:** Operation by municipality as special asset with independent accounting (economic autonomy).
- **Institution under public law:** Economically and legally autonomous public utility.
- **Autonomous company:** Private company with the municipality as shareholder (legal and economic autonomy).
- **Operations management model/operator model/cooperation model/public-private-partnership model:** Transfer of plant operation

to a private operator while the performance of public tasks and sovereign obligations rests with the municipality.

With a view to effectively realising drinking water supply and wastewater disposal, municipalities may join forces, also in associations, for cooperation. Usually, this cooperation takes place on a voluntary basis within the meaning of municipal sovereignty through inter-municipal cooperation in the form of

- **Special-purpose associations** as public corporations,
- **Institutions under public law** as joint enterprises of several municipalities or
- **Water and soil associations** within the meaning of the federal law on water and soil associations (Water Association Act).

To some extent, municipalities (such as in North Rhine-Westphalia) are members of **water management associations** subject to **special laws**.

Public-law forms of business are special-purpose associations, institutions under public law, water and soil associations, special-law associations as well as ancillary municipal enterprises and owner-operated municipal enterprises. Private forms of business organisation comprise autonomous companies or cooperation models in the form of GmbH or AG (limited liability companies and stock corporations). Here, the majority of shares is mostly held by municipalities. The municipalities or their representatives in the association's bodies decide on the form of business organisation for supply and disposal utilities and on pricing (prices or charges, see Chapter A 3.6). In accordance with the responsibilities determined by bylaws, they continue to establish the utilisation prerequisites for all property owners in cities and municipalities.



In addition to these compulsory tasks, municipalities have to fulfil partial tasks regarding the implementation of environmental laws issued by the government and the federal states. In accordance with the regulation of competencies of the respective federal state, the lower water authorities or the water management offices implement the water rights within urban districts and cities not attached to districts as the lower instance of the water management administration.

Among others things, the lower water authorities approve wastewater systems, wastewater treatment plants, small sewage works, wastewater and rainwater discharges, use of water bodies, such as abstraction from groundwater and surface water and exceptional approvals for water and medicinal spring protection areas. Furthermore, as supervisory/executive authorities they are responsible, among other things, for sewage treatment plants, water supply facilities, registration of private wells, flooded areas, water and medicinal spring protection areas as well as for the Wastewater Levy Act and the wastewater register. The municipalities and special purpose associations, institutions under public law, water and soil associations and water management associations subject to special laws are responsible for maintaining water bodies. Municipalities ensure the provision of water for fire-fighting.

Cities not attached to districts, and urban districts as lower-tier public health authorities are furthermore involved in drinking water quality assurance. Within the scope of planning law, the cities and municipalities also contribute to the development of water management matters for their settlement area. In this way, they make an essential contribution to the local development and implementation of water management matters. This takes account of local and regional requirements. Through the election of municipal councillors and mayors, citizens participate in these processes in a democratic manner.

### 3.2 Requirements for the protection, management and use of the water bodies

**“Water is not a commercial product like any other but, rather, a heritage which must be protected, defended and treated as such.”**

*(extract from the recitals of the European Water Framework Directive)*

Since 2000, the European Water Framework Directive (EC-WFD; 2000/60EC) has provided the central regulatory framework for the protection, management and use of water bodies and water resources in Europe. It defines far-reaching objectives with regard to the chemico-physical, biological-ecological and quantitative status of groundwater, surface water and coastal waters. These objectives are to be achieved by a cross-sector management approach comprising a series of basic management and protection principles:

- The management and protection of water bodies must look at the boundaries of natural river catchment areas to take the interdependencies of the hydrologic cycle into consideration as far as possible.
- Combined approaches consisting of quality standards for water bodies and limit values for emissions into water bodies.
- Cost recovery and polluter-pays-principle: This means foregoing the subsidisation of water prices and charges, taking account of environmental and resource costs for prices and charges, and assigning costs according to the polluter-pays-principle.
- Integrated management of groundwater and surface waters.
- Concentrated and diffuse sources of pollutions of water bodies need to be given equal consideration in management and for the implementation of measures.

Water supply and wastewater disposal are also incorporated in this framework. Water abstraction and wastewater discharges must not affect the condition of the water bodies.

The EU Water Framework Directive requires Member States to ensure the protection of drinking water resources in order to bring about a reduction in the level of purification treatment for the production of drinking water. In addition, the EU Water Framework Directive defines one of its major objectives as the avoidance of a further deterioration in the condition of the water bodies.

The EC-WFD was implemented in German law through the Water Resources Management Act and the water laws of the federal states and through additional implementing ordinances.

§ 47 para. 1 of the German Water Resources Management Act implements the prohibition on deterioration in national law and substantiates this requirement. Accordingly, the groundwater is to be managed in such a way that deterioration of its quantitative and its chemical state is avoided and any significant and sustained trends of increasing concentrations of pollutants due to the impact of human activity are reversed.

The German Water Resources Management Act governs the further rights and duties of water supply and wastewater disposal with regard to the utilisation and protection of water bodies. The aforementioned Act defines in § 50 the public water supply as a service in the general interest. Wastewater disposal, which has always been recognised as a public service, is defined as a public-law duty. Both services therefore entail great social importance and responsibility. At the same time, the Water Resources Management Act stipulates the prin-

ciples for careful use of water, priority supply from local water resources and the reduction of water losses from distribution systems. Furthermore, the Water Resources Management Act provides the basis for the designation of water protection areas. Moreover, it requires that generally acknowledged rules of technology be taken into consideration for water supply and wastewater disposal, and prescribes state-of-the-art purification for direct wastewater discharges.

In their water laws, the federal states can issue rules which deviate from German federal law in terms of water supply and wastewater disposal, unless these are related to certain substances or plants, in order to respond flexibly to specific supply and disposal situations (“deviation competence”).

### 3.3 Requirements for drinking water

While the EC-WFD, the Water Resources Management Act and the water laws of the federal states regulate the role of water supply and wastewater disposal as part of the hydrologic cycle, the Infection Protection Act forms the legal basis for securing and monitoring the supply of high-quality and safe drinking water. Its basic requirements are given by the Drinking Water Ordinance 2001, which, at the same time, transposes the European Drinking Water Directive into German law, for example in terms of

- the quality of the drinking water (e.g. for chemical or microbiological parameters),
- water treatment (e.g. with regard to admissible processes and treatment substances),
- the obligations of the water suppliers and the operators of drinking water installations (e.g. inspection duties and reporting to the responsible authorities)

- the obligations of the responsible authorities (e.g. concerning the surveillance of the drinking water),
- the mandatory requirement to minimise chemical substances in drinking water (tightening of European standards) and the mandatory requirement to minimise microorganisms.

For the fulfilment of these requirements, the German Drinking Water Ordinance recommends complying with the generally acknowledged rules of technology. Legal requirements and technical rules make drinking water one of the best-analysed and best-tested foods.

### 3.4 Requirements for treatment of the wastewater

The European Directive on urban wastewater treatment (91/271/EEC) defines uniform minimum standards for the EU Member States for the treatment of municipal wastewater. It defines stricter requirements for so-called “sensitive areas”. Almost the whole of Germany is identified as a “sensitive area”. This Directive has been transposed into German law by the Water Resources Management Act, supplemented by the water laws of the federal states.

The German Wastewater Ordinance regulates the implementation of the EC Urban Waste Water Directive and the Water Resources Management Act in Germany. The Wastewater Ordinance defines

- sampling method and site,
- requirements for analysis and measurement procedures.

It determines minimum standards for domestic wastewater and for all industrial and commercial sectors in terms of

- parameters for which samples have to be taken,
- the purification results for given parameters.

The Wastewater Ordinance requires that state-of-the-art methods be used for direct discharges, and leads to an excellent technical standard of wastewater treatment in Germany.

The determination of analysis methods ensures a uniform level of surveillance. If the treated wastewater is discharged into water bodies with even higher demands on the treated wastewater to be discharged, stricter requirements (based on the Water Resources Management Act and the water laws of the federal states) may be defined for the treatment results in the public notice issued by the water authority. The compliance with these requirements is monitored by the authorities of the federal states.

### 3.5 Technical self-administration

In the rapidly changing and increasingly complex technological world, the legislature confines itself in its legislation to the determination of basic requirements and thus defines the legal framework, the observation of which is monitored and enforced by the public authorities.

In the German Technical and Scientific Association for Gas and Water (DVGW) and the German Association for Water, Wastewater and Waste (DWA), over 3,000 volunteer experts from utilities and waste disposal companies, industry, engineering, administration and science develop technical rules. The professional public is included in the development to a large extent through transparent procedures. In this way, the set of rules receive their professional legitimacy and acknowledgement as generally recognised rules of technology, referred to in the laws and regulations through so-termed

technology clauses. On a national level, cooperation takes place with other standardisation organisations like DIN and VDI, on a European and international level with CEN, CENELEC and ISO.

In this way, the state is relieved of tasks, which the sector develops and applies within the scope of technical self-administration with a high level of quality and innovation and on the basis of a large consensus. This cooperation principle is the cornerstone of German technology and environmental law. The “standardisation policy concept” of the German Federal Government is explicitly committed to technical self-administration, with respective strengthening seen as an important instrument for reducing bureaucracy.

### 3.6 Prices and charges

Towns and municipalities may develop the water supply in private or public-sector forms of organisation. They can choose either a public legal form of organisation, such as an owner-operated municipal enterprise for their water utilities, transfer the task to an institution under public law or a special purpose association or opt for a private organisational model, such as a public utilities company as a GmbH. The form of organisation determines the customer relationship.

A public-law customer relationship can only be selected by public water utilities. As consideration for the supply of drinking water, among other things, these companies collect user charges and contributions for the creation and renewal of water supply facilities. If a water utility carries out delivery to its customers under private law, it can invoice its customers in particular for water prices, construction grants and house connection costs for the supply of drinking water. Private-sector delivery relations

can be selected independently of the organisation form, that is, a water utility organised under public law can also charge private sector fees.

Wastewater disposal is a sovereign obligation of the local authorities required to dispose of wastewater. So far, this has mainly been based on the public statutes approved by the municipal constitutions of the states with connection and use obligations and the collection of contributions and charges as detailed in the Local Rates Acts of the states. In a few exceptional cases, the wastewater disposal is also carried out on a contractual basis with private-sector fees.

In the following, the word “fees” is used as a generic term for all public and private law payments that are claimed and rendered as compensation for goods and services.

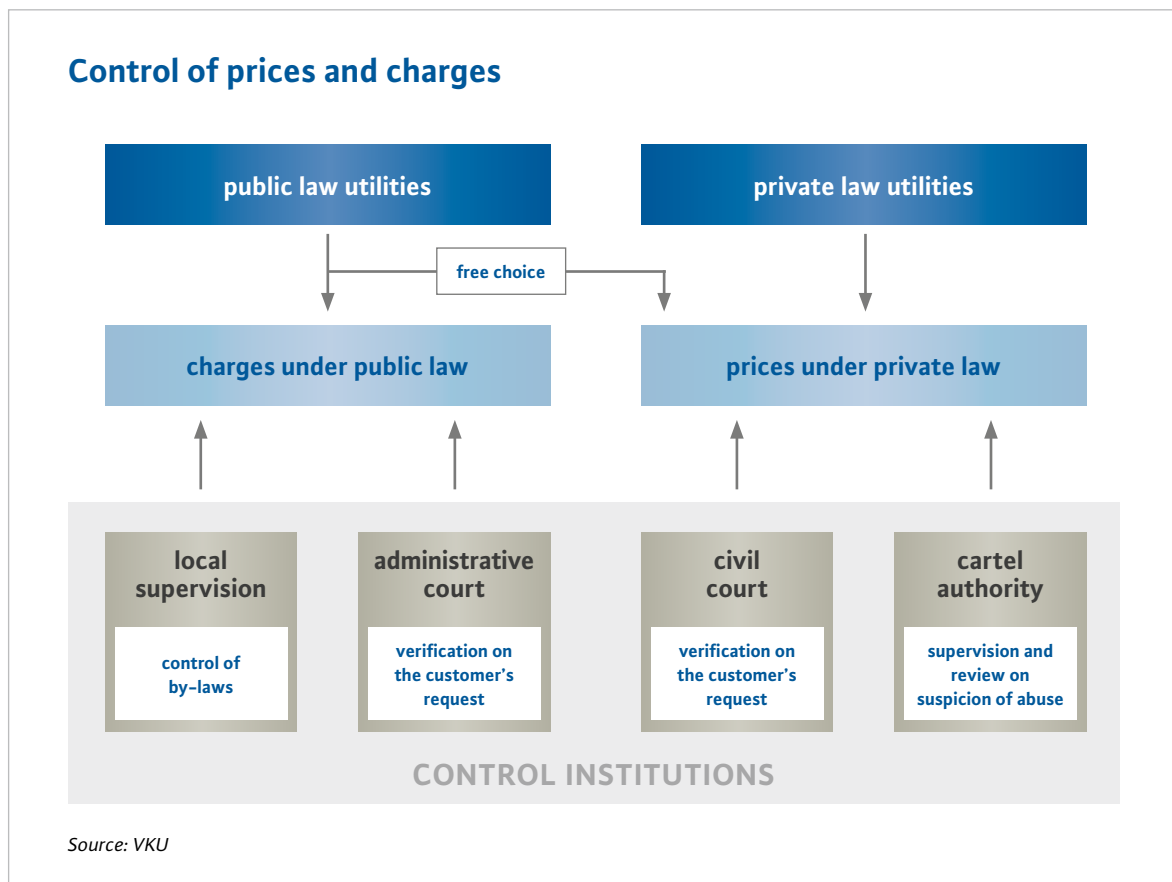
#### 3.6.1 Legal framework

In Germany, **charges** are subject to concrete legal provisions. The Local Rates Acts and municipal regulations of the federal states determine the framework for the calculation of charges. Accordingly, the following principles of public financial conduct are essentially applied:

**Principle of equivalence (proportionality):** Charges must be in due proportion to the service provided in return (Local Rates Act).

**Principle of cost recovery:** All costs associated with water supply and wastewater disposal must be covered by the charges or contributions. Long-term insufficiency or surplus cover is not admissible (Local Rates Act).

**Prohibition of cost overrun:** The estimated revenue from charges must not exceed the likely cost of the facility (Local Rates Act).



**Principle of equality or equal treatment:** Arbitrary discrimination of consumers is to be excluded (Local Rates Act).

**Economic principles:** Charges must be calculated in accordance with economic principles and methods (Local Rates Act).

These may include

- **The principle of preservation of net real-asset values:** The calculation must ensure that there is no technical deterioration of supply and disposal in the long term. Value conservation is ensured by indexing the acquisition costs or the

cost of production through the actual replacement value or the current replacement value and by paying adequate interest on the necessary equity capital.

or

- **The principle of real capital preservation:** The calculation must make sure that the supply and disposal duties are upheld. Value conservation is ensured through depreciation of acquisition and production costs and payment of adequate interest (including inflation adjustment) on the necessary equity capital.



**Interest on equity capital:** Most Local Rates Acts of the federal states stipulate an adequate rate on the deployed capital to avoid an inflation-triggered decrease in value, thus ensuring economic freedom of action and maintaining the real-asset values of municipal utilities. Interest is paid on the basis of either real capital preservation or the preservation of net real-asset values.

As a rule, there are generally no specific legal requirements for **calculating the water prices**. However, according to the rulings of the German Federal Supreme Court, the principles applied to the calculation of charges are to be applied in the same way to the calculation of prices. In isolated cases, the Local Rates Acts explicitly provide for application of the rates of charges to fees under private law, for example, § 7, para. 9, clause 2 of the Local Rates Act for Rhineland-Palatinate.

For the collection of charges or prices a comprehensible and coherent, and therefore verifiable calculation of costs is required. The associations provide various aids for this such as guidelines and calculation tools.

### 3.6.2 Control of charges and prices

Fees are subject to extensive regulatory and judicial control. What control mechanisms apply depends on the nature of the contractual relationship.

Citizens can have their notification of charges checked by the administrative courts for legality and appropriateness of the level of the charges. The municipal supervisory authority checks the legal foundations of the charges.

For the levying of charges, the principles of public financial law and the Local Rates Act of the states apply. Charges and contributions may only be levied on the basis of a by-law. The resolution on mu-

nicipal by-laws in general and thus also on the level of charges is the responsibility of the elected local councillors. Thus the citizen also has considerable codetermination rights, which means that charges are democratically legitimised. All municipal regulations give the municipal supervisory authority a general right to information from the municipalities, some municipal regulations even provide for a legal right of information for the charge-paying citizens. Against this background, there is no need for antitrust price abuse control. In the framework of the 8th amendment to the German Act against Restraints of Competition (GWB) it was therefore established that the rules on antitrust price abuse control do not apply to charges and contributions.

The pricing decisions for the water supply in privately organised utilities are mostly taken by the Supervisory Board. In municipal utilities, the elected local councillors ensure the citizens have considerable codetermination rights here.

The antitrust review of water prices is the responsibility of the cartel authorities of the federal states or, in case of cross-border activity, the Federal Cartel Office. Under the German Act Against Restraints of Competition, the methods of the comparative market concept and cost control are on an equal footing. In the context of the comparative market concept, the authorities check whether price abuse has occurred, because a water utility demands less favourable prices or business conditions than similar utilities. Here, the water utility may justify itself by demonstrating that the difference is based on objective circumstances non attributable to it. The cartel authority on the other hand needs to demonstrate the comparability of the company taken as reference. However, according to rulings by the Federal Supreme Court, the requirements for establishing this similarity are minor (“rough viewing”). For the cost control, the

authority checks whether a water utility demands fees that unduly exceed the costs. As part of the review of § 31 of the German Act against Restraints of Competition, the costs associated with sound management are to be recognised.

In the context of antitrust price checks, the cartel authorities have to come to an understanding with the responsible supervisory authority. This requirement of the Act against Restraints of Competition serves to prevent one-sided cost considerations and take adequate account of the particular conditions of the supply of drinking water. In the same vein, the Federal Ministry of the Environment and the Ministry of Health have recently published their “Catalogue of preventive services of the water supplier for protection of the water bodies and health” in the Federal Gazette.

Alongside antitrust supervision there is the fairness control in accordance with § 315 German Civil Code, which consumers can assert through the civil courts. Here, the court checks the appropriateness (fairness) of the agreed price of water in relation to the performance, the water supply. Here again, the test is based on the principles and foundations of public financial management.

### 3.6.3 Cost and tariff structure

One main feature of water supply and wastewater disposal is the large-scale infrastructure with a long service life of up to 80 years for the plants and even longer for reservoirs. Consequently, this high technical expenditure is reflected in the cost structure.

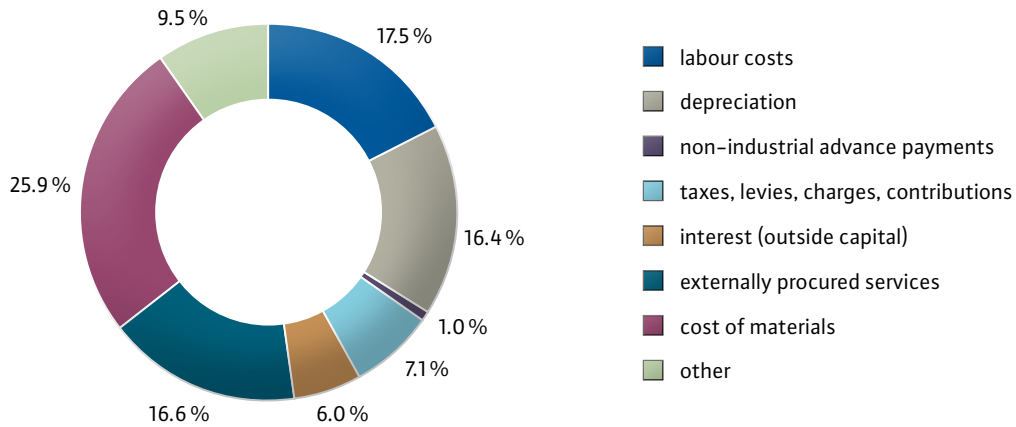
On the one hand, the construction, extension and renewal of this technical infrastructure cause high capital costs (such as depreciation and interest on investment). On the other hand, operation and maintenance of the facilities generate labour costs and cost of materials which also have a considerable share in overall costs.

A further cost position is the concession fee which may be levied by the municipalities. The concession fee is paid for the use of public transport routes and land. Here, “use” means the installation and operation of pipes. For those companies that pay a concession fee, on average, this accounts for about 10 percent of the water suppliers’ costs and is determined by the Ordinance on Concession Fees.

### Cost structure in water supply in 2011

5

Shares as percent



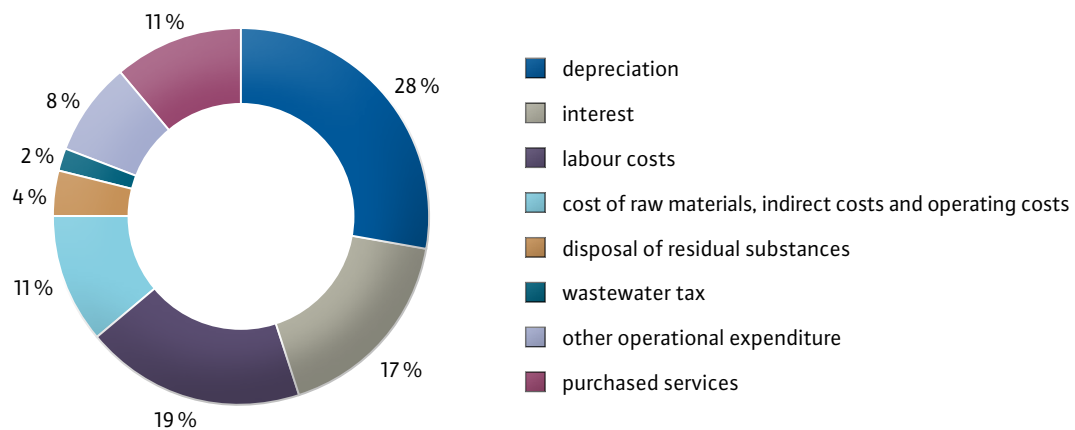
Source: German Federal Statistical Office, Fachserie 4, Reihe 6.1, 2011, published in 08/2013

26

### Cost structure in wastewater disposal in 2012

6

Shares as percent, weighted according to the population registered



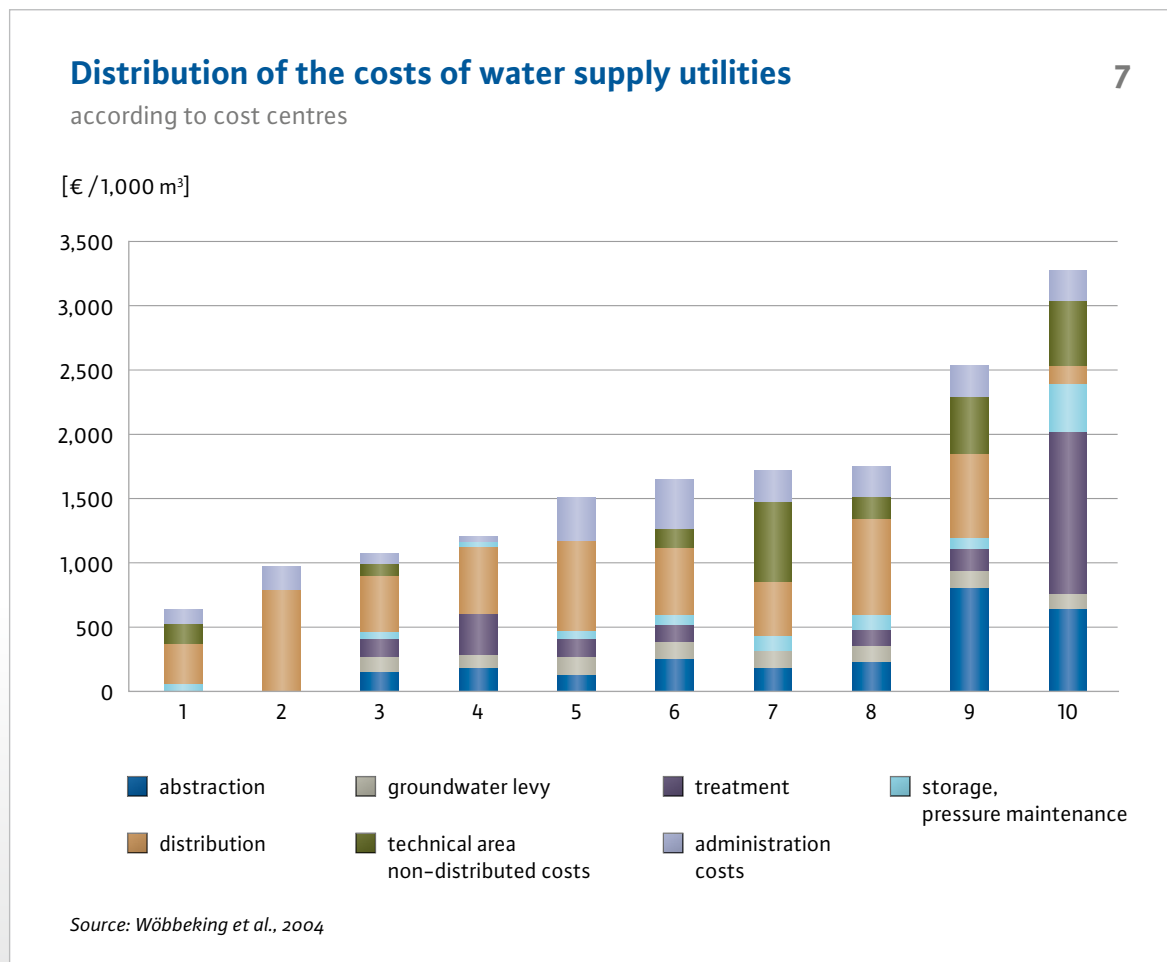
Source: DWA Economic Data 2014

The operation and maintenance of plants are cost variables which are largely independent of real water and wastewater quantities. The average share of fixed costs for supply and disposal is between 70 and 85 percent.

This cost structure is not normally included in the pricing. Prices and charges mostly consist of a volume-independent and a variable fee component together. Here, the volume-independent fee component is traditionally low. However, the conversion of the pricing is gaining significance both for water suppliers as well as wastewater disposal utilities. Many utilities have already adapted their

fee systems or are planning to change the existing system in order to achieve a better approximation to the actual cost structure by increasing the amount of volume-independent revenue. Publications by the water associations provide assistance in the preparation and implementation of such a model conversion.

Average costs are significant only to a limited extent because the real costs per value chain can vary considerably from one utility to the next. Based on the example of water supply, this is illustrated in Figure 7 for ten different utilities.



Water suppliers with comparable overall costs can have a very different cost distribution across the value-added steps. The level of costs of a water supplier depends on the regional conditions of supply (e.g. topography, quality of raw water, population density, demography, geology, climate, legal requirements) – (see also Chapter A 2). They essentially determine the level of the local water price or water charge. Also in wastewater disposal, fees are always to be seen in their local to regional context. Due to the differences, a simple comparison of prices or charges is not expedient. Moreover, it is clear that most of the costs cannot be influenced by the supplier.

### 3.7 Special charges (water abstraction levies, compensation payments, wastewater tax)

In Germany, drinking water prices and wastewater charges are additionally increased by special state charges like the water abstraction levy or the wastewater tax. The utilities pay the water abstraction levy and the wastewater tax to the respective federal state and have to invoice this accordingly through the water fee and wastewater charge.

On a national average, the water abstraction levies, which are collected in 13 federal states, accounted for 4.6 percent of the fees for customers in 2007 (Source: VEWA-Studie 2010). The highest water abstraction levies are charged by Berlin at 31 cent for 1,000 litres. The total receipts of the federal states from the water abstraction levies are roughly €350 million p.a. (Source: States budgets, 2013 and 2014).

Depending on the federal state, the income generated by the water extraction levies is used to support different areas (e.g. ecological measures that primarily focus on the protection and restoration of water bodies, the maintenance of dikes or investment in flood protection). In some states the income is not tied to a specific statutory purpose (see Figure 8).

In addition, in some federal states, farmers receive compensation payments for water-friendly management in water protection areas or catchment areas of water abstraction plants. These costs also form part of the water fee for the customers.

The state raises an extra statutory levy (wastewater tax) for discharging wastewater into a water body, which is ultimately borne by the charge payer. The wastewater tax accounts for more than 2 percent of a citizen's annual wastewater costs (Source: DWA Economic data 2014, data for 2013).

From 2005 to 2007, the federal states collected total average receipts from the wastewater tax of €300 million p.a. (Source: VEWA-Studie 2010). The wastewater tax level is measured according to the loads of the admissible wastewater substances discharged. The possibility of reducing the wastewater tax by further reduction of the discharged loads below the admissible levels provided further incentive for utilities to optimise their plants. This has, however lost its original steering effect due to the high standard of wastewater treatment in Germany.



## Overview of the regulations of the federal states on water abstraction fees 8

Federal state	Taxation elements <sup>(1)</sup>	Level of fees in Cent	Minimum threshold/ p.a.	Tied purpose	Total revenue in €/p.a.
Baden-Wuerttemberg	GW, SW	5.1 ct/m <sup>3</sup> <sup>(2)</sup>	4,000 m <sup>3</sup> <sup>(3)</sup>	from 1.1.2015: yes	about 60 million (2013)
Bavaria	There are no legal regulations for a water abstraction fee				
Berlin	GW	31 ct/m <sup>3</sup>	6,000 m <sup>3</sup>	yes	about 51 million (2013)
Brandenburg	GW SW	10 ct/m <sup>3</sup> 0.2 ct/m <sup>3</sup>	3,000 m <sup>3</sup>	yes	about 20 million (budget 2014)
Bremen	GW, SW <sup>(4)</sup>	5 ct/m <sup>3</sup>	4,000 m <sup>3</sup>	no	about 4.45 million (2013)
Hamburg	GW	13.8 bzw. 14.9 <sup>(5)</sup> ct/m <sup>3</sup>	10,000 m <sup>3</sup>	no	about 14.96 million (budget 2014)
Hesse	The regulations for the water abstraction fee were repealed in 2003				
Mecklenburg-West Pomerania	GW SW	5 ct/m <sup>3</sup> 2 ct/m <sup>3</sup>	2,000 m <sup>3</sup>	yes	about 5 million (2013)
Lower Saxony	GW, SW	5.1 ct/m <sup>3</sup> <sup>(2)</sup>	260 €	yes	about 42 million (2013)
North-Rhine Westphalia	GW, SW	5 ct/m <sup>3</sup>	3,000 m <sup>3</sup> or 150 €	to some extent	about 110 million (2013)
Rhineland-Palatinate	GW SW	6 ct/m <sup>3</sup> 2.4 ct/m <sup>3</sup>	10,000 m <sup>3</sup> 20,000 m <sup>3</sup>	yes	about 20 million (2013)
Saarland	GW	7 bzw. 6 ct/m <sup>3</sup> <sup>(6)</sup>	35 m <sup>3</sup> / supplied E*a or 200 €	yes	about 3.3 million (2013)
Saxony	GW, SW	1.5 ct/m <sup>3</sup>	2,000 m <sup>3</sup>	yes	about 8.6 million (budget 2014)
Saxony-Anhalt	GW, SW	5 ct/m <sup>3</sup>	3,000 m <sup>3</sup> or 100 €	yes	about 11.1 million (budget 2014)
Schleswig-Holstein	GW, SW	8 or 12 ct/m <sup>3</sup> <sup>(7)</sup>	200 €	zu 70 %	about 5.54 million (2013)
Thuringia	The regulations for the water abstraction fee were repealed in 1999.				
(1) GW = groundwater SW = surface water		(5) 13.79 ct/m <sup>3</sup> for surface water extraction; 14.85 ct/m <sup>3</sup> for abstraction from deeper groundwater			
(2) increase on 1.1.2015		(6) Reductions for EMAS and ISO 14001 certified utilities			
(3) given abstraction for water supply		(7) Reduced rate for the commercial sector from a quantity purchased of 1,500 m <sup>3</sup>			
(4) 100% groundwater abstraction for public drinking water supply: fees for surface water abstraction: €0.005/m <sup>3</sup> to 500 million m <sup>3</sup> and €0.003/m <sup>3</sup> from 500 million m <sup>3</sup> onwards		Sources: Water laws and regulations of the federal states, budget plans of the states			

### 3.8 Fiscal law

There is no uniform taxation for water supply and wastewater disposal in Germany. While water supply is fundamentally subject to a reduced uniform turnover tax rate, taxation of the wastewater disposal sector is more differentiated.

Public wastewater disposal utilities as sovereign undertakings are exempt from corporate income and turnover tax. If a utility responsible for wastewater disposal uses a private third party to discharge this obligation, the latter is subject to the full turnover tax rate with the possibility of input-tax deduction.

## 4 Forms of business organisation and size structure

Germany has a varied supply and disposal structure comprising public and private sector companies.

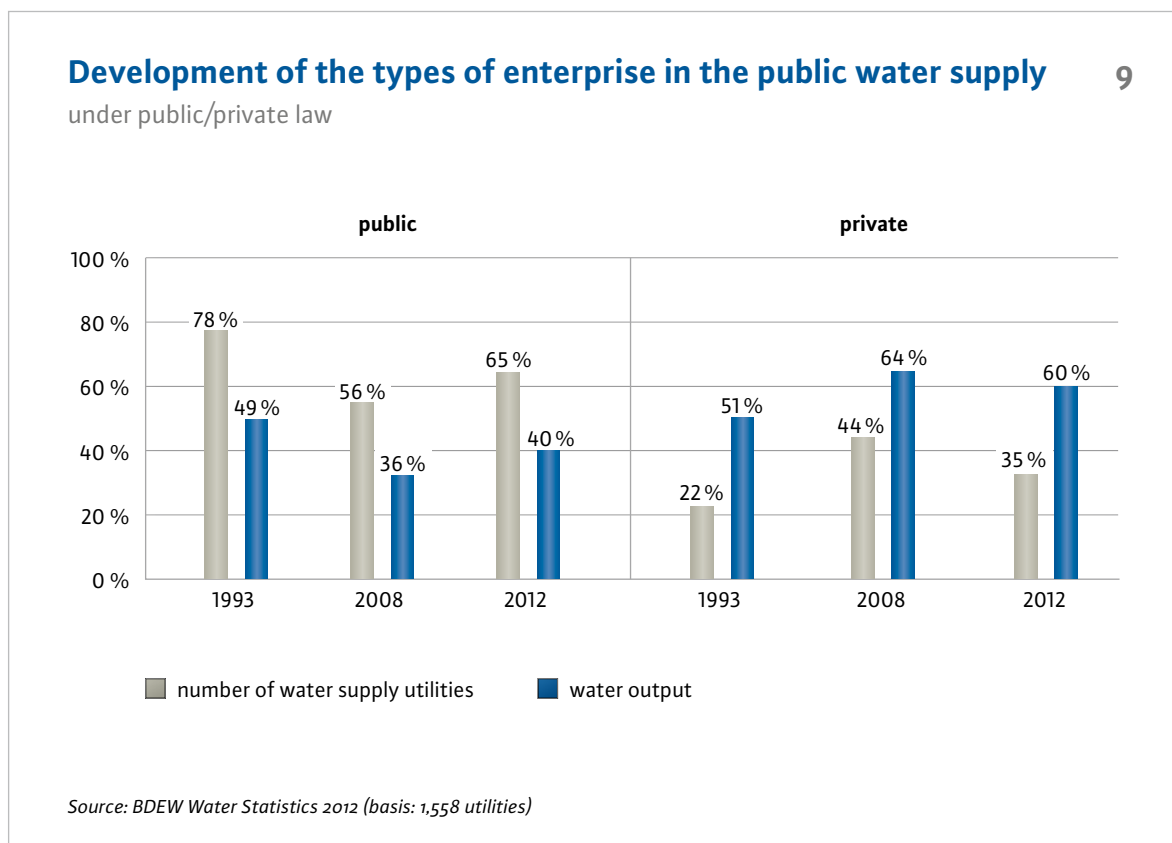


In total, there were approximately 6,065 water supply enterprises and utilities in 2010 (Source: German Federal Statistical Office 2013). These are mainly small ancillary municipal utilities and owner-operated municipal utilities.

The following statements for water supply refer to the 1,558 utilities covered by the BDEW Water

Statistics 2012 representing 75 percent of the water output in Germany.

In the water supply sector, public and private forms of organisation have co-existed for decades see Figure 9).



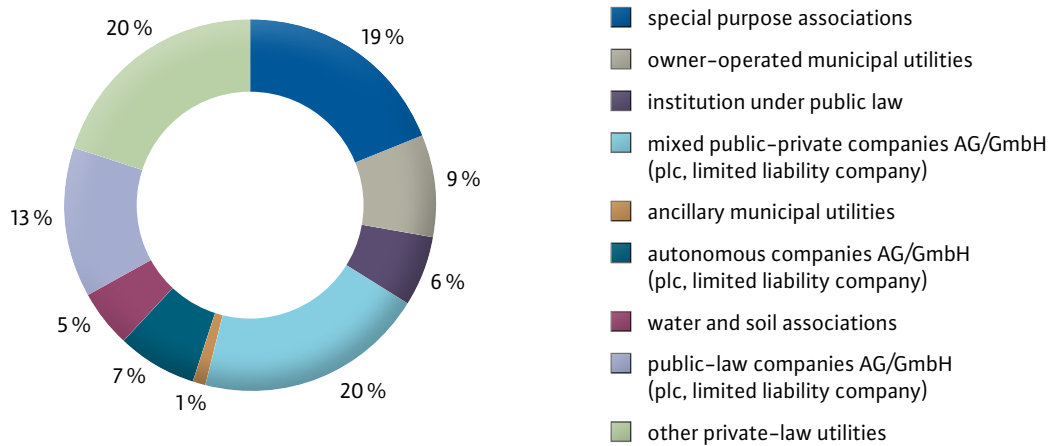
Related to the number of utilities, public sector companies account for 65 percent in 2012, while the share of private sector companies amounts to 35 percent. Related to water output, public sector companies account for 40 percent whereas the share of private sector companies amounts to 60 percent (2012; types of enterprise see Chapter A 3.1).

In the public sector companies, the special-purpose associations prevail, whereas ancillary municipal utilities account for 1 percent. In 1993, the share of owner-operated municipal utilities totalled 29 percent; in 2012, it amounted to 9 percent (see Figure 10).

### Types of enterprise in the public water supply 2012

10

Shares related to water output



Source: BDEW Water Statistics 2012 (basis: 1,558 utilities)

32

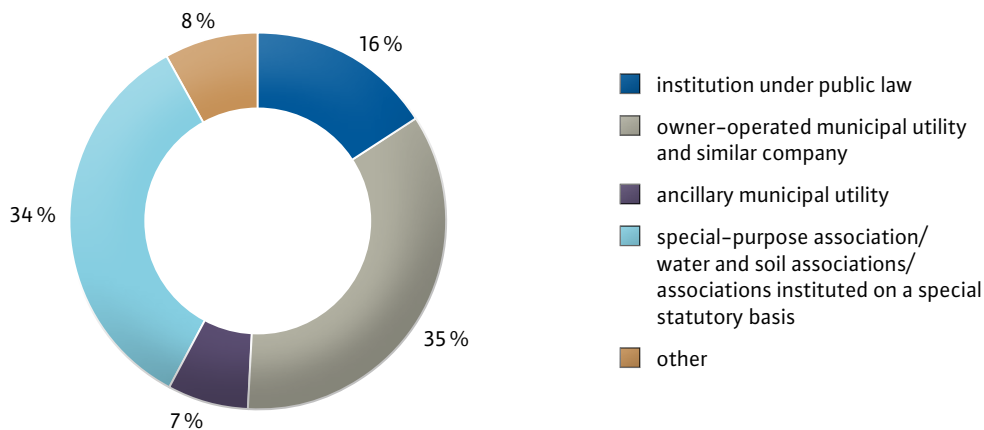
Among the private sector companies, mixed public-private companies in the form of AG/GmbH (plc, limited liability company) prevail (20 percent), i.e. companies with private participation.

In contrast to drinking water supply, wastewater disposal in Germany is predominantly carried out by utilities under public law. The largest share is held by owner-operated municipal utilities as well as special-purpose and water associations (see Figure 11).

### Types of enterprise of wastewater disposal 2014

11

weighted according to the population connected to the sewerage system



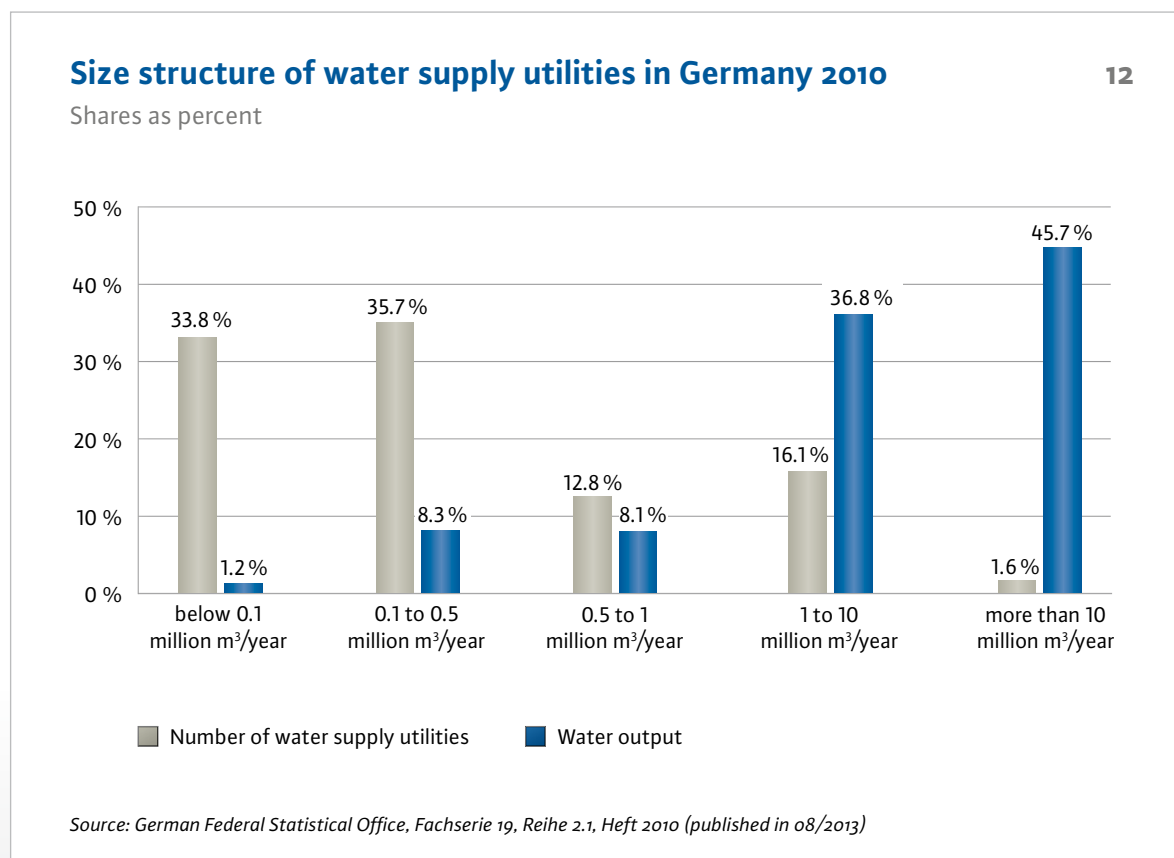
Source: DWA Economic Data 2014

In total, there are more than 6,900 wastewater disposal utilities in Germany. The data on wastewater disposal were collected by the DWA Economic Data survey, which covered 506 wastewater disposal utilities representing 50 percent of the German population. The undertakings not covered are predominantly operated by municipalities in the legal form of ancillary municipal utilities and owner-operated municipal utilities.

Private wastewater disposal utilities are mainly active in the operative business by means of management or operator contracts.

Related to the number of inhabitants, the share of private companies in wastewater discharge is 5 percent, and in wastewater treatment 6 percent.

In the drinking water sector, mostly small utilities supply a relatively small number of inhabitants in rural areas. In contrast, a small number of utilities usually supply a large number of inhabitants in urban conurbations. Half of the water output is therefore supplied by approximately 100 utilities (less than 2 percent of the utilities). In this way, the corporate structure reflects the settlement structure in Germany (see Figure 12).



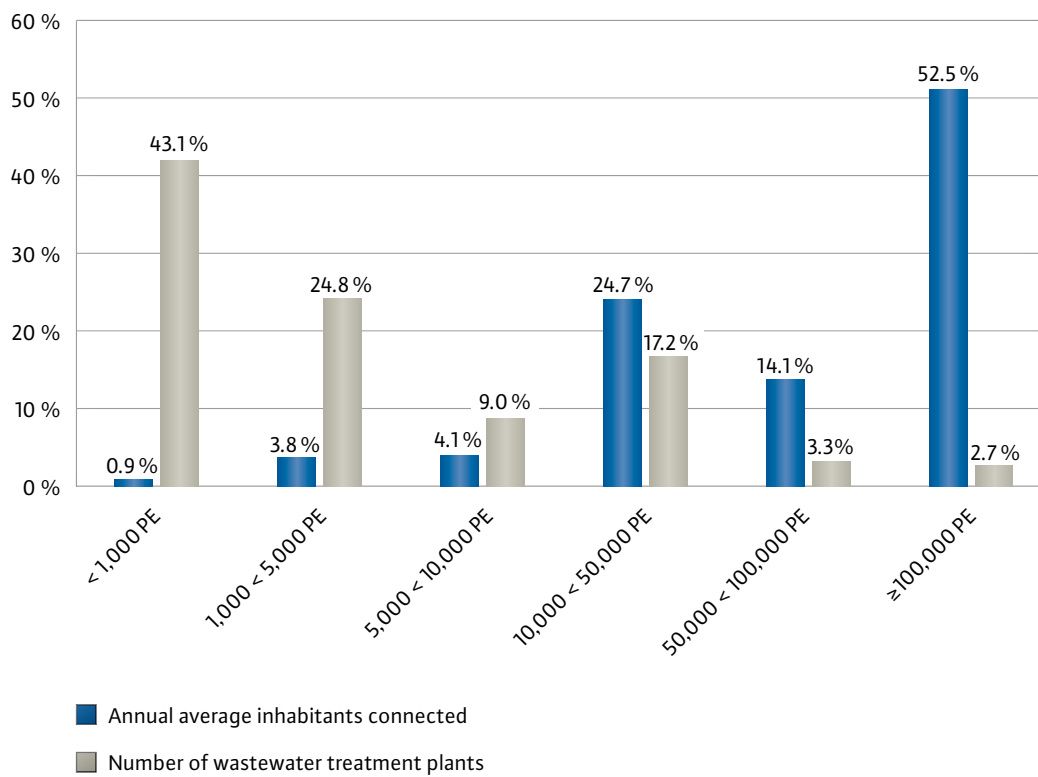
The structure is similar for the operators of wastewater facilities. In conurbations, a small number of

large facilities dispose of the wastewater of a large number of inhabitants.

### Size structure of wastewater treatment facility operators in Germany 2010

13

PE = total number of inhabitants and population equivalents as a percentage



Source: German Federal Statistical Office, Fachserie 19, Reihe 2.1., Heft 2010 (published in 08/2013)



## 5 Current developments and challenges

Consumers in Germany are careful with drinking water. Since 1990, water consumption has decreased considerably and continues to decline. However, utilities must ensure the availability of adequate supply and disposal capacities to cover peak demand. Political demands for further reductions in water consumption are not reasonable.



**Demographic and climate change together with continuously decreasing water consumption pose great challenges to the German water sector. Uniform solutions cannot be adopted due to the regional and local differences in impact.**

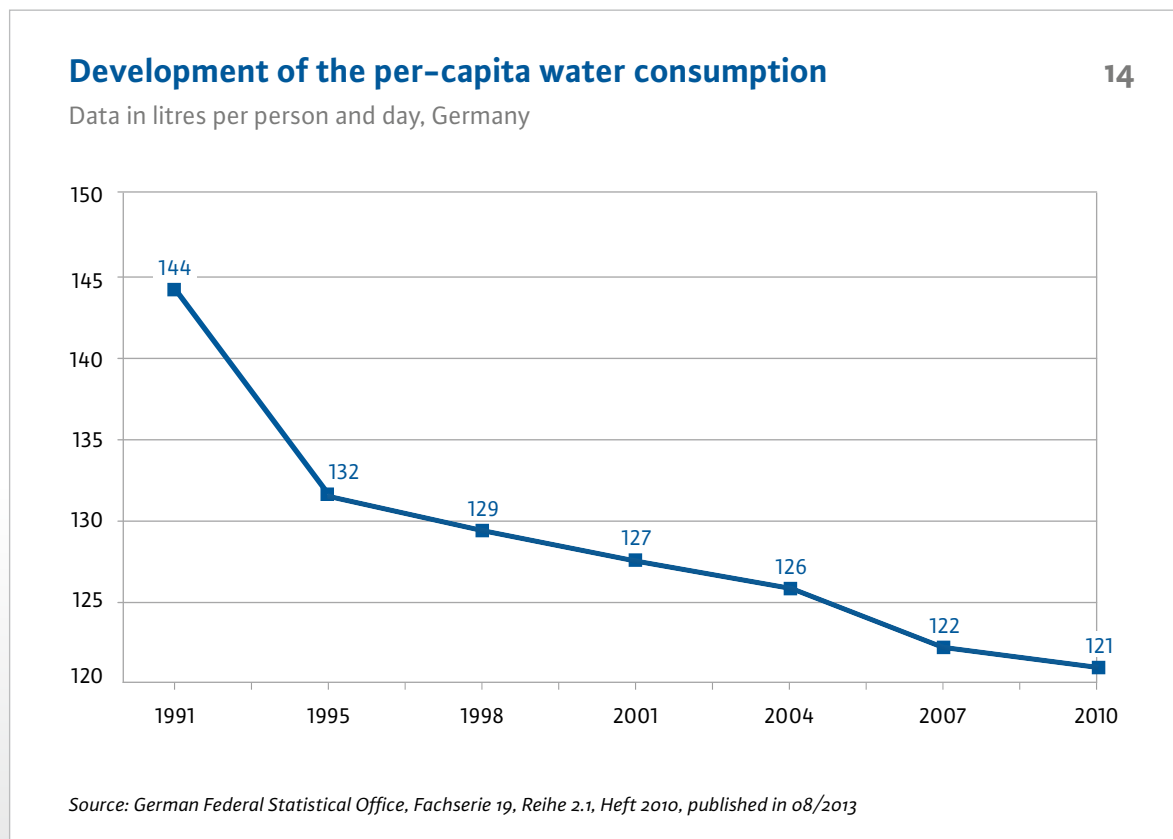
**Where micro pollutants are concerned, priority has to be given to avoidance at the immediate source (emission control). Where this is not feasible, account has to be taken of the “polluter-pays-principle”.**

### 5.1 Decline in drinking water consumption

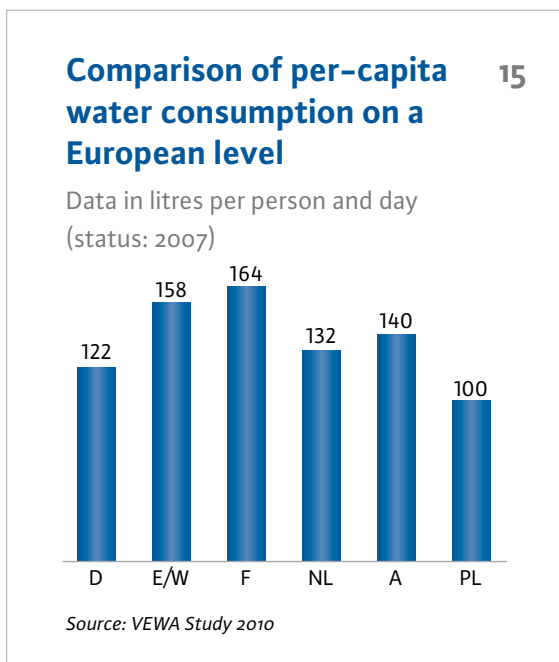
In Germany, drinking water is used economically, carefully and ecoconsciously. The careful use of drinking water is embodied in the Water Resources Management Act and has been practiced for dec-

ades. Problems in terms of drinking water wastage or, as in many other European states, water shortage do not exist in Germany.

The average per-capita consumption in Germany has decreased by 16 percent since 1990. It is currently 121 litres per person and day (See Figure 14).



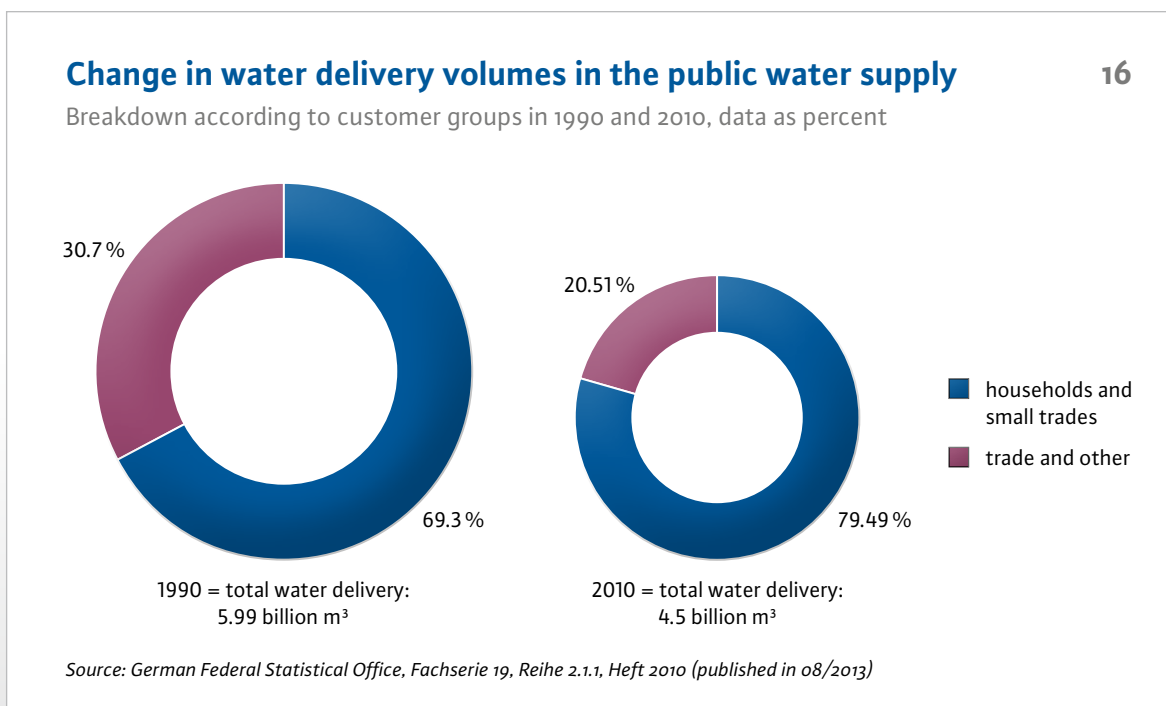
In European comparison, German per-capita consumption is lower than in many EU Member States (see Figure 15).



From 1990 to 2011, the volume of water supplied by public utilities to the customers decreased from 5.99 billion to 4.43 billion cubic metres, i.e. by 26 percent (Source: BDEW Statistics). This volume corresponds to around three quarters of lake Chiemsee in Bavaria.

The largest customer group consists of households and small trades. They purchase almost 80 percent of the water deliveries of the public water supply (see Figure 16).

The reasons for the sinking water consumption in Germany include changed consumption patterns in the population and the development and use of water-saving fittings and household appliances. The volume of water delivered by public water supply utilities to industry is also continuously decreasing due to changed production processes and increasing self-production.



In Germany, industry covers 94 percent (Source: German Federal Statistical Office, 2010) of its water demand through its own production. The share of industry supplied by public water supply utilities in, for example, England and Wales, the Netherlands, Austria and Poland, is substantially higher than in Germany and is well over 20 percent (Source: VEWA Study 2010).

Meanwhile, the considerable decrease in per-capita consumption and water deliveries to industry partly leads to under-usage of facilities. As a result, for instance, intensive flushing of the affected water mains is necessary to avoid deposits and corrosion as well as hygienic problems attributable to longer hydraulic residence times and lower flow velocities.

Nevertheless, utilities need to maintain the capacities required to cover peak demand, particularly during longer droughts. In the light of a forecast increase in drought periods due to climate change, it can still be assumed that peak demand will continue to grow in terms of volume and duration. This means that, despite a decline in water consumption, utilities have to keep the necessary infrastructure available without being able to downsize the mains or shut down facilities such as high-level tanks or pump stations.

Political demands for further reductions in water consumption or funding of adequate measures are therefore not reasonable in Germany. They may lead to technical and hygienic problems necessitating cost-intensive solutions.

## 5.2 Recruitment of skilled staff

Optimally qualified employees with their unique knowledge and skills are what keep companies viable in the long-term (see Figure 17). The utilities of the water sector have recognised this and have been investing continually in the education of young people for many years, often providing training beyond their own needs. At the same time, it is difficult for many utilities to find suitable junior staff.

The competition for talented young employees will become tougher in future also for the companies in the water sector. Due to demographic changes, there are ever fewer school leavers. According to the current training report (2013) of the Federal Ministry of Education and Research, by 2025, the number of graduates from the general education system will have stabilised at low levels in some regions. In others, it will continue to recede. (Source: Federal Institute for Vocational Training (BIBB)). In addition, ever fewer school leavers aspire to vocational training, but go to the universities.

## Training professions in the water sector

17



Source: dysign/D.Wübbeling (DBVW)

39

### 5.3 Demographic change

Aging, decline in population and migration movements are a challenge to the water sector. According to forecasts, the population in Germany will decrease from approx. 80.5 million today to about 65 to 70 million in 2060 (Source: German Federal Statistical Office 2009). At the same time, the age structure is shifting towards older people. In 2060, one in three German citizens will be 65 and older and one in seven even 80 and older.

In many regions, today's negative trend in the population development will continue, whereas others will, in parts, see a considerable growth in population, requiring adjustments in the infrastructure, with corresponding investments (see Figure 18).

In some regions, the decline in population additionally exacerbates the infrastructural problems already caused by the decreasing quantities of water purchased. Many utilities have already initiated short to long-term precautions and planning measures. These include, among other things, increased flushing of mains, adjustment of dimensions or even deconstruction of networks and facilities, and schemes for decentralised wastewater disposal.

Fundamentally, a decline in the population always entails the risk of an increase in fees, as the infrastructure costs have to be borne by fewer customers.

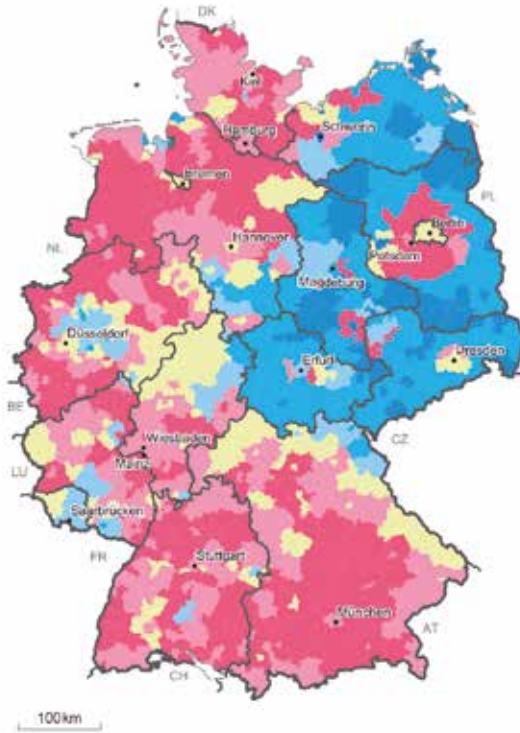
Due to the high fixed costs for water supply facilities, the base price should also be weighted more realistically in relation to the volume price.

## Small-scale population dynamics in the past and the future

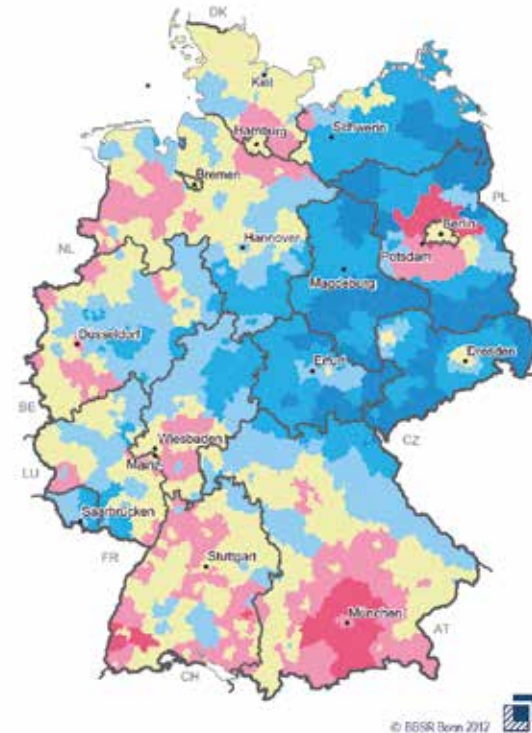
18

Changes in population development from 2010 to 2030 as a percentage

1990 to 2010



1990 to 2010



Changes in population development from 1990 to 2010 as a %



Data basis: running spatial observation by the BBSR, BBSR population forecast 2009-2030/ROP

Changes in population development from 1990 to 2010 as a %



Geometric foundation: BKG forecast areas 2010

Source: Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR) 2012

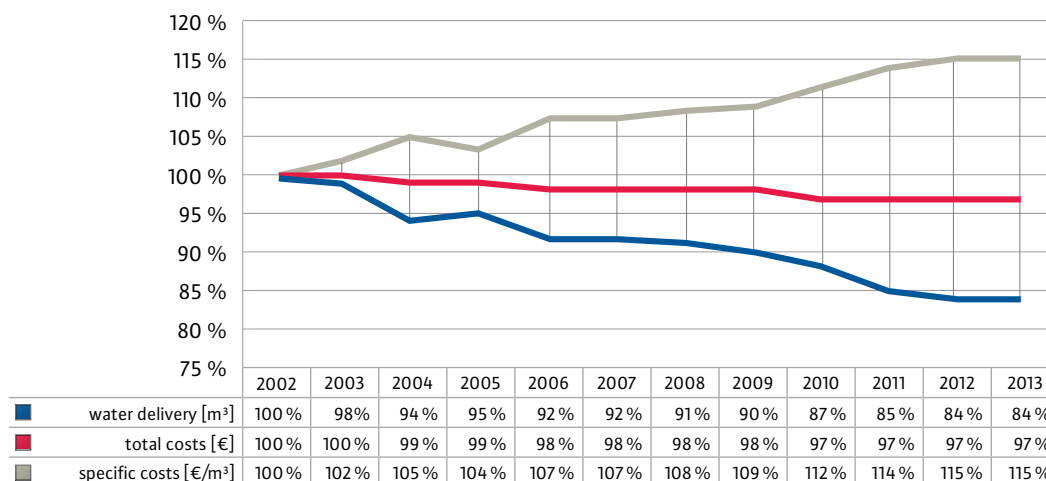
Therefore, water supply and wastewater utilities need to be included early on in urban development

planning processes and concepts for the development of rural areas.

## Effects of decreasing water deliveries on total and specific costs

19

Relative evolution over time



Source: VKU 2014, based on Holländer et al., 2009

### 5.4 Climate change

The current Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) reinforces existing forecasts on the impact of climate change in Germany. In the course of the 21st century, temperatures will rise on an annual average, summers will get hotter and drier and winters milder and wetter. The regional differences will be large and partly contrary to general trends. Fundamentally, the probability of extreme events will increase.

For the water sector, this means an intensification and increase in the frequency of existing and known phenomena and problems: more intense rainfall, longer heat waves and droughts, increased flooding events, new precipitation patterns, changing groundwater recharge. Thus, the amount of water in lakes and reservoirs which is usable for water supply may be reduced. Seasonal availability

of water may decrease, which may also result in an increase in concentrations of nutrients and pollutants in water bodies. In addition, the competition with other users for the water resources is growing. More frequent and prolonged droughts and heat waves may lead to a higher peak demand. Local heavy rainfall and floods may affect the supply and disposal infrastructure to such an extent in individual cases that they even result in complete failure.

The water sector is developing responses to these challenges, e.g. in research projects, such as in the framework of the funding programme “KLIMZUG” of the Federal Ministry of Education and Research concluded in 2014. In regional projects, concrete possibilities have been developed for adapting to changed water availability and water demand, and adjusting the network operation to the higher water temperatures during more frequent and longer heat waves.



Adaptation needs and possibilities for action always result from the respective natural conditions, the technical structure of the supply and disposal system, the interactions with other factors such as population and economic development, industrial and agricultural water use.

Numerous examples of dealing with extreme events have shown in the past that the central water supply and wastewater disposal have worked without major problems (e.g. the drought year 1976, the extreme summer 2003) and faults and failures could be compensated relatively quickly (e.g. Elbe flooding in 2002 and 2013).

Also the possibilities of adjustment being examined by the utilities and the sector as a whole are many and varied. When it comes to trend analyses and long-term water availability and demand forecasts, the utilities take increasing account of the regional impact of climate change. More and more water supply and wastewater disposal utilities are establishing safety, risk and crisis management instruments in their company organisation and thus systematically review their adaptation requirements to the effects of climate change.

At the same time, however, politics, administration and legislation also need to involve themselves. Water supply and wastewater disposal as tasks of general interest should take priority in sovereign decisions on the use of water resources or the protection of critical infrastructures.

## 5.5 Micro pollutants

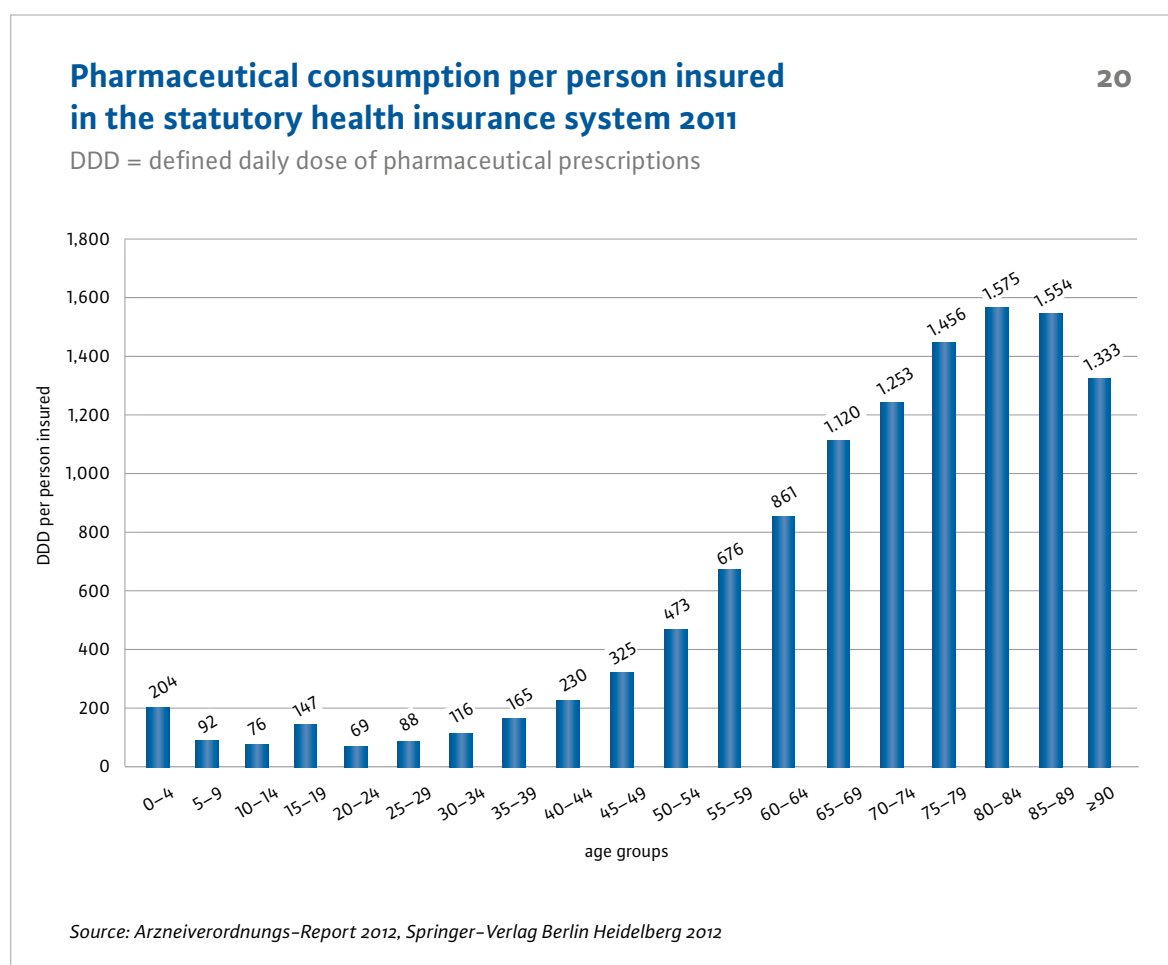
In a highly industrialised, intensively farmed and densely populated country such as Germany, water resources are exposed to various influences. Anthropogenic micro pollutants such as pharmaceuticals, cosmetics and industrial chemicals and their impact on water bodies have attracted growing attention over the past few years. Weighing up the avoidability and non-avoidability of these pollutions is a socio-political task.

Refined analytical technologies permit the detection of micro pollutants in extremely low concentrations that previously remained undetected. For new pollutants, comprehensive hazard analysis and risk assessment is still not possible in many cases due to insufficient knowledge of interactions and inadequacy of data. The concept of health guidance values (GOW) developed by the Federal Environmental Agency for new substances and substances which do not yet have limit values takes this into account and requires stringent implementation in all states.

To ensure precautionary water protection, it is essential that all stakeholders make corresponding efforts. In this context, it is necessary to weigh the benefit associated with a substance according to its intended use (e.g. pharmaceuticals, per- and polyfluorinated chemicals (PFC), such as PFT in extinguishing agents, textiles or coatings) against the damage caused by the occurrence of this substance in the aquatic environment and in the human organism (e.g. carcinogenic effect of PFC). The prevention principle is also taken into account by the legal maxim that the quality of raw water used for the production of drinking water should allow for near-natural treatment processes. As a precaution, non-natural, amphibious substances

that are not easily biodegradable should be kept away from water bodies and the environment. As a matter of principle, the focus should be on measures for minimising input at the immediate source, e.g. by separate treatment of hospital sewage and circulation systems for pharmaceuticals, but also

by already taking the concerns of water protection into account in the licencing of pharmaceuticals. Whether and to what extent additional measures are effective and necessary for wastewater disposal and water supply is something that has to be considered on a case-by-case basis.



Currently, it can be said that legal regulations and the implementation of existing provisions are not sufficient to sustainably protect water bodies from unwanted pollution. The protected assets (water resources for drinking water supply, aquatic eco-systems, fishing, sports and recreation areas,

foodstuffs) require close cooperation among all stakeholders. In other words, manufacturers, users, consumers, politicians, administrative bodies, suppliers and disposal utilities must work together to find solutions with a view to minimising or preventing the pollution of protected assets.

The current situation is unsatisfactory for operators of drinking water processing and sewage treatment plants, with politicians and the general public creating huge pressure for action in the case of identified or assumed pollution, although scientific findings are not available to serve as a basis for investment decisions. Furthermore, the lacking legal certainty makes it more difficult to assert the associated costs by means of prices and charges. It is therefore essential to establish a legally secure framework for systematic, scientifically and technically oriented action on a national and European level.

## 5.6 Changed conflicts of use

In the context of the current discussions on the energy revolution, the use of renewable and thus climate-friendly energy sources is rightly supported by the European Union, but also by federal and state governments, in order to ensure a sustainable energy supply, taking into account ecological, economic and socio-political aspects. However, this can also lead to conflicts of use. In this respect, the energy revolution needs to take all protected resources into account so that it can actually do justice to the concept of integral sustainability.

Against this background, the claims of possible uses for above-ground areas and the underground area of drinking water catchments have been increasing of late. The water sector has been following this with concern, since possible threats to the groundwater are often not considered. In the use of the land and subsoil, the drinking water abstraction should be given priority over other commercial interests because the associated protection of water bodies and water resources is of fundamental importance for the people.

In the interest of climate protection and the conservation of fossil fuels, renewable energies such as wind turbines, geothermal energy or biomass

use are becoming increasingly important. Furthermore, the underground area in processes such as fracking to utilise unconventional gas resources for energy supply or as potential storage sites, as is clear in the example of CCS (= carbon capture and storage) under discussion. Underground uses can pose a threat to drinking water resources in the catchment areas of drinking water abstraction plants. Specialist clarification is needed with regard to the long-term safety, and the issues of technical and legal liability in dealing with possible damage cases. The principles of the Water Resources Act apply, according to which waters are to be protected from adverse effects. Concomitant conflicts of use should be solved through social consensus.

Due to the agricultural policy framework – also in conjunction with the increasing use of renewable energy sources – the intensity of cultivation in the area is also continuing to increase. This leads to high nitrogen release, which conflicts with the achievement of quality standards for water protection set by the EU. An increasing trend in nitrate concentrations in groundwater can be observed regionally. The diffuse input from agriculture pollutes the water resources primarily through fertilisers, but also pesticides and their metabolites.

The significantly worse conditions for the preventive protection of water bodies require considerably higher costs even within the drinking water protection areas. In particular, the cultivation of energy crops and the increasing biomass production – especially in areas that already have very high numbers of livestock – lead to significant conflicts with the objectives of water protection. Permanent safeguarding of the drinking water resources for future generations remains of central importance for the water sector.

Precautionary water protection as a socio-political task is therefore to be recognised as the ultimate goal in all economic activities and decisions.

# PART B – Performance of the German Water Sector

Performance characteristics of the German water sector are long-term safety of supply and disposal, high drinking water quality, high wastewater disposal standards, high customer satisfaction and sustainable utilisation of water resources while paying attention to economic efficiency (5-pillar benchmarking model).



This performance is illustrated by the analyses represented in the following chapters. These figures are based on surveys carried out by the Statistical Offices of the EU, Germany and the federal states, on surveys carried out by the German and European sector associations and on the results of performance indicator comparisons and benchmarking projects with the participation of water supply and wastewater disposal utilities. Many practical examples emphasise the importance of benchmarking

for continuously enhancing the sector's performance and efficiency.

Benchmarking regularly enables the participating utilities to identify potential for efficiency increases and to develop and implement concrete measures for their realisation, by comparing processes in a way that goes beyond the comparison of performance indicators and analyses the causes of differences.

## 1 Benchmarking

**Future generations should benefit to the same degree from a high quality and sustainable drinking water supply and wastewater disposal. One of the central questions of the German water sector is therefore how this high-quality public service can also be guaranteed in the future.**

To remain competitive, the water sector needs to be efficient, economically viable and transparent to the customer. Benchmarking projects are a key tool here, so that the sector continues to develop steadily and dynamically. Therefore, the associations of the water sector have supported the various benchmarking projects commissioned by the economics, interior and environment ministries of the federal states or by the utilities themselves for more than a decade.

The utilities use the project results to determine their performance and improvement potential. The main results are made public, partly through extensive project reports.

The maps provide an overview of which federal states already have public project reports, and indicate the extent of the area the projects now cover (see Figure 21).



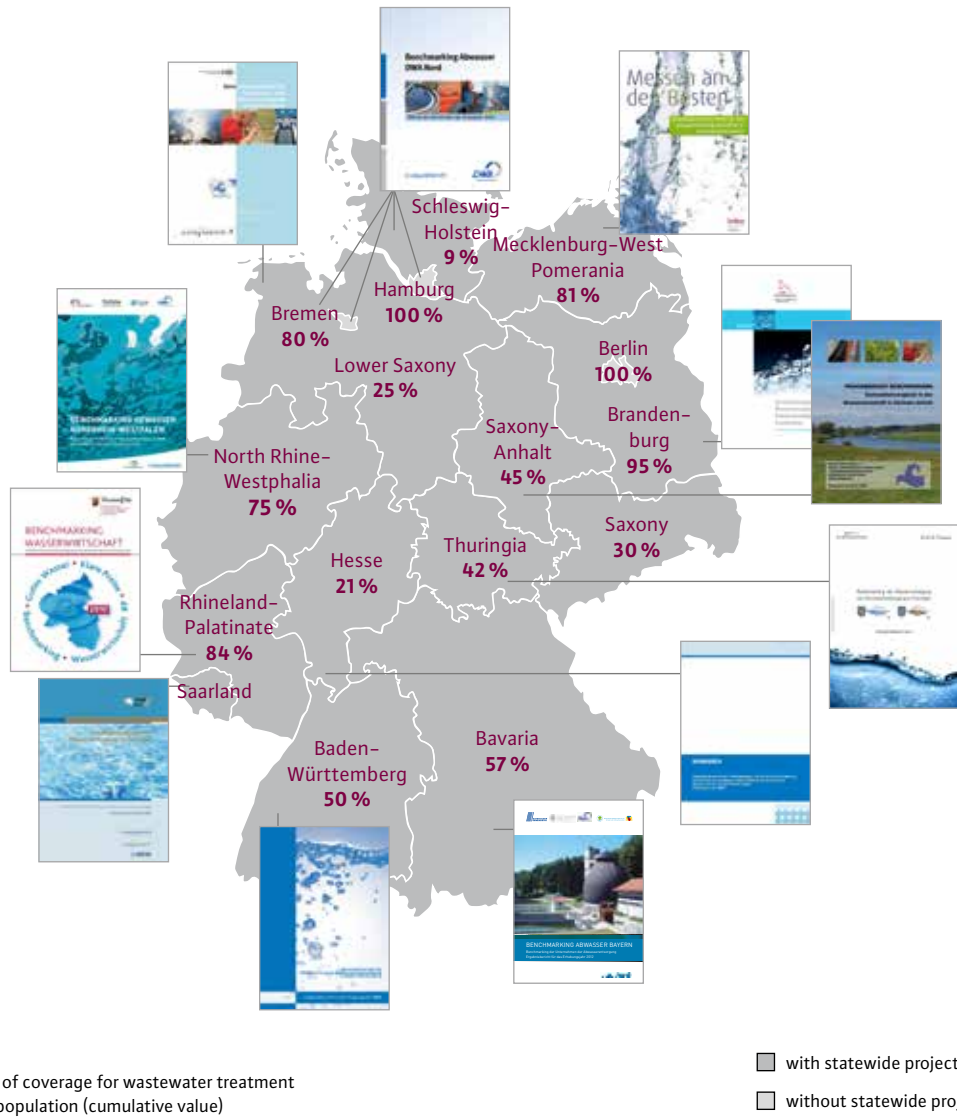
## Distribution of statewide water supply benchmarking projects

21



Source: Public project reports and BDEW 2014

### Distribution of statewide wastewater disposal benchmarking projects

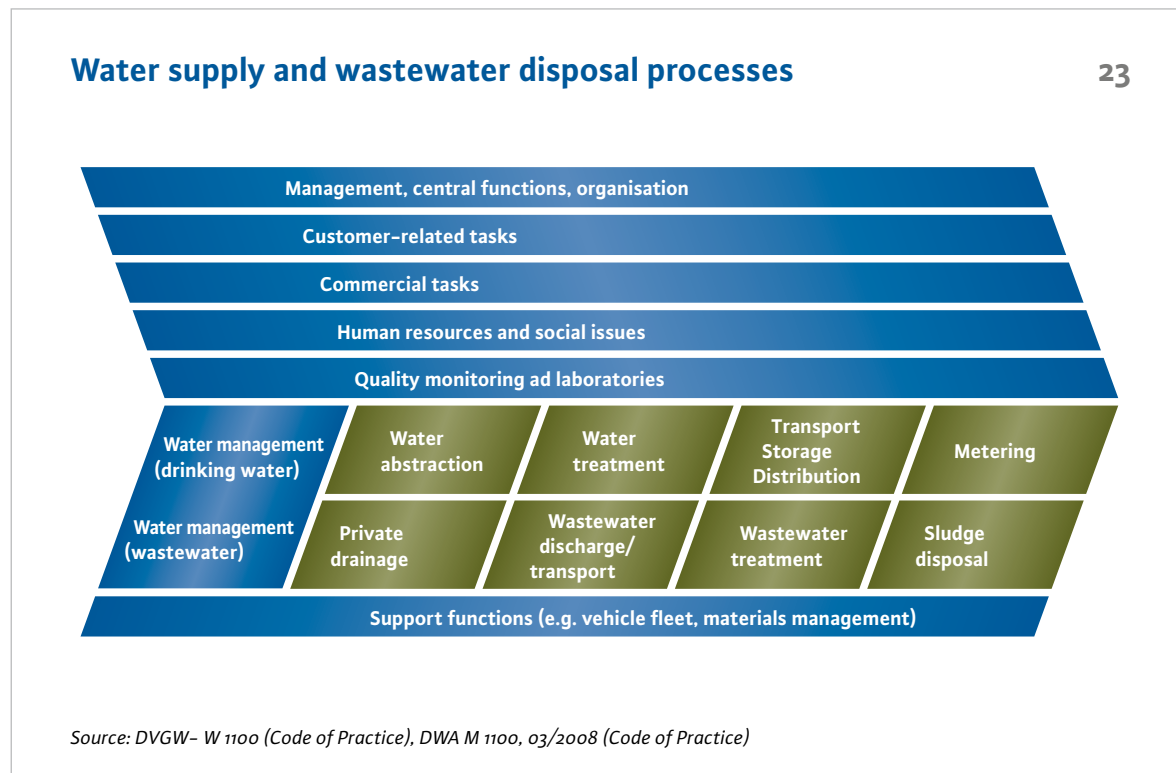


Source: Public project reports and DWA 2014



In addition to the benchmarking projects by the states, water supply and wastewater disposal utilities use process benchmarking for the specific optimisation of all relevant processes of water supply

and wastewater disposal. More information on benchmarking and the statewide projects are available from the publishers.



The main prerequisites for the success of the benchmarking and performance measurement projects are confidentiality and voluntariness, but also the consistency and compatibility of the data collected. To ensure this, the sector continues to develop the performance indicator systems.

There is evidence that a number of utilities have improved in all five performance pillars after benchmarking was performed in their company.

This is shown by a current BDEW special survey on benchmarking statistics 2013:

- Safety: 13 percent
- Quality: 18 percent
- Sustainability: 23 percent
- Efficiency: 41 percent
- Customer service: 22 percent (multiple answers possible).

## 2 Safety

Long, frequent service interruptions of water supply are unknown in Germany. This is due to the high technical standards and the excellent condition of plants and networks in comparison with other European countries. The German water supply utilities have very low water losses in European comparison. Usually, wastewater treatment plants are well utilised and there are sufficient reserves available.



## 2.1 Safety of water supply and disposal

According to the international standard of the International Water Association, interruptions of supply are deemed negative for the safety of supply if at least 0.1 percent of the population supplied is cut off from the water supply for more than 12 hours. The results of the benchmarking projects show that this situation does not occur in Germany.

Practical experience shows that a household is affected by an interruption of water supply caused by operational disruptions for a maximum of 10 to 15 minutes per year.

These results are attributable to the high technical standards for distribution and discharge as well as the excellent condition of the networks and plants. Supply and disposal utilities often keep additional capacities available for use in outage and emergency situations to ensure supply and disposal without any interruptions.

In Germany, it is taken for granted that such interruptions do not occur. However, this does not apply to the same extent on an international scale.

Nationwide, sufficient capacities are available for wastewater treatment. This is regularly confirmed by the benchmarking projects carried out in different federal states.

The increasing automation improves the safe control and monitoring of water management plants. With the dependence on information technology

systems, however, the susceptibility to cyber attacks grows. The IT security of the critical infrastructures water/wastewater is therefore a central task for the sector. The decentralised structure of the water sector and the generally closed distribution networks present effective protection against large-scale supply disruptions as a result of cyber attacks.

## 2.2 Organisational safety within the utilities

Apart from high-capacity facilities and qualified personnel, a well-functioning organisation is a mainstay for safe operation of the plants. Numerous management systems are used today to support the organisational processes within the utilities. The best known scheme is the certification according to the requirements of ISO 9001 and 14001. One management system adjusted to the needs of water supply and wastewater disposal is the Technical Safety Management (TSM) developed by DVGW and DWA for the operational practice.

Alongside benchmarking, the TSM is further important element for ensuring safety of supply through a well-established organisational and operational structure.

The Rhineland-Palatinate, for example, recommends that utilities use these instruments and supports them financially in the introduction of a technical safety management system (Source: Funding Guidelines for Water Management Administration of the Rhineland-Palatinate 2014).

### 2.3 Advanced training

Qualified personnel who undertake continuous advanced training are a fundamental prerequisite for safe water supply and wastewater disposal. The sector is aware of this responsibility: 86.5 percent of the energy and water supply utilities provide for their staff's advanced training. Compared to the German average of 72.8 percent, the sector thus holds a top-level position. Based on the number of employees, at 53.5 percent the participation rate in training courses is considerably higher than the German average of approximately 39.5 percent (Source: German Federal Statistical Office 2010).

However, the sector's benchmarking projects show that there is definitely potential for improvement in the area of advanced staff training. The evaluation of the projects in ten federal states shows that the participating utilities, representing almost half of nationwide water deliveries, offer an average of two days per year for advanced training per person employed. The number of advanced training days shows a distinct increase where time sequences are available (e.g. in Bavaria from 2 to 3, on average, in Baden-Württemberg from 2.3 to 2.8 and in Lower Saxony from 1.5 to 2 days). The median value of advanced training in wastewater disposal on the basis of statewide benchmarking projects lies at between two and three days per full-time equivalent.



### 3 Quality

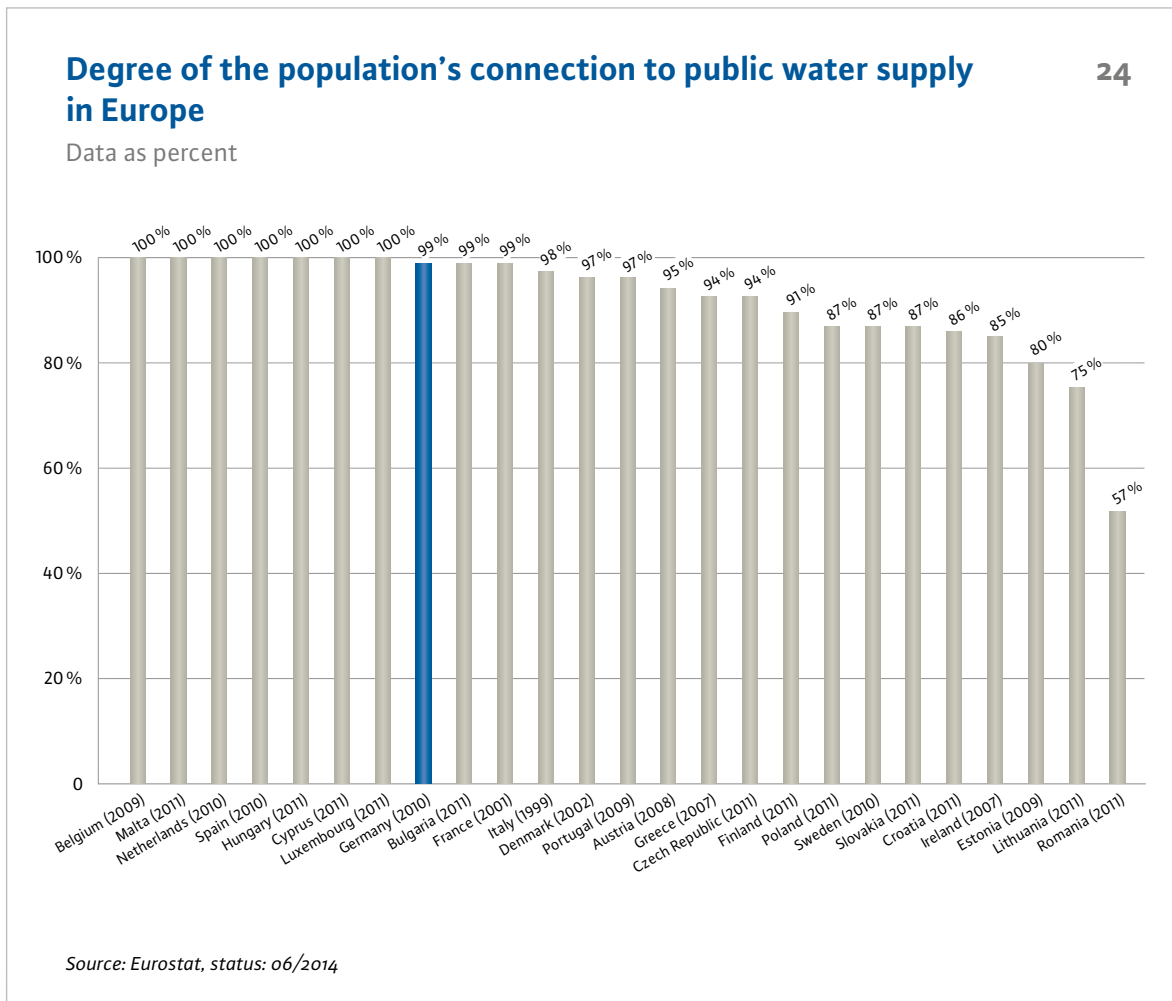
The statutory requirements for drinking water quality are observed throughout the country. Drinking water of an excellent quality is available to the population at all times in sufficient quantities. In contrast to many other EU Member States, wastewater is treated in Germany almost nationwide according to the highest EU purification standards.



### 3.1 Connection degree and network length

In Germany, the degree of connection to the public water supply is above 99 percent and thus on a very high level compared to other European countries (see Figure 24).

No exact data are available regarding the length of the drinking water network, but the total length of the drinking water network in Germany is likely to be 530,000 km (without house connections).



The German public sewage network is approximately 562,000 km in length, with combined sewers prevailing. In addition, there are about 70,000 storm water drainage systems.

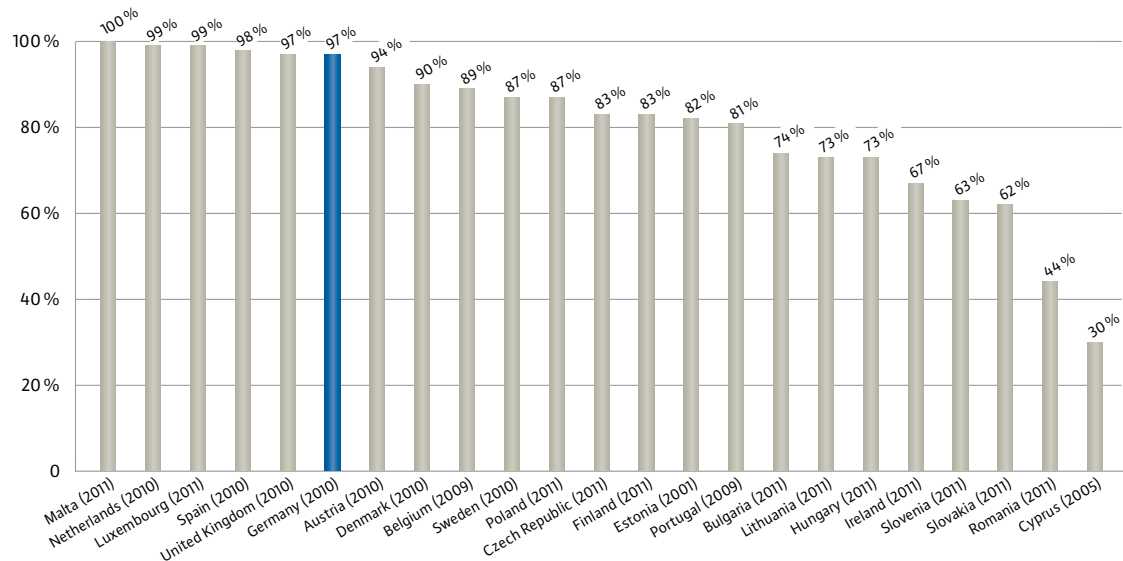
With a connection degree of 97 percent, Germany holds a top position in comparison with other European countries. The degree of connection to sewage networks and wastewater treatment plants has increased slightly since 2001.



## Degree of the population's connection to the sewage network

25

regardless of the availability of sewage purification plants, data as percent



Source: Eurostat, status: 06/2014; German Federal Statistical Office

The share of the population whose wastewater is treated according to the highest EU standard (i.e. biological wastewater treatment plants with nutrient elimination, called “tertiary treatment”) has again increased considerably from 88 percent (2001) and 90 percent (2004) to 95 percent at the present time.

It is interesting to note that even countries resembling Germany in terms of their structure and economic power are still very slow to catch up – such as Belgium from 82 percent (1998) to 89 percent (2009).

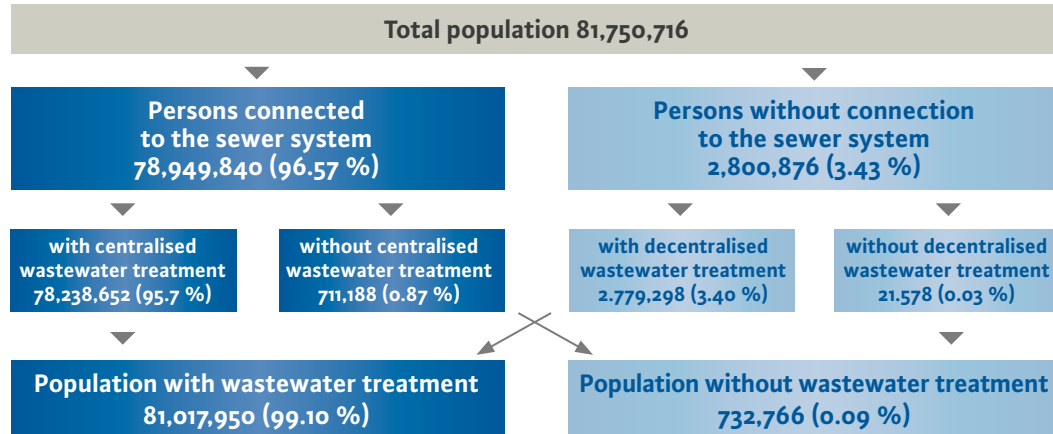
The total number of plants is declining, as some small plants have been taken out of service and wastewater is diverted to existing plants which are larger and more powerful.

The wastewater of households which are not connected to central wastewater systems is treated by small, decentralised sewage works, so it can be said that the degree of connection to wastewater treatment plants is almost 100 percent (99 percent in 2010; source: German Federal Statistical Office 2013).

### Wastewater disposal in Germany in 2010

26

Degree of connection



Source: German Federal Statistical Office, Fachserie 19, Reihe 2.1.3, 2010, published in 10/2013

### 3.2 Quality of the mains

56

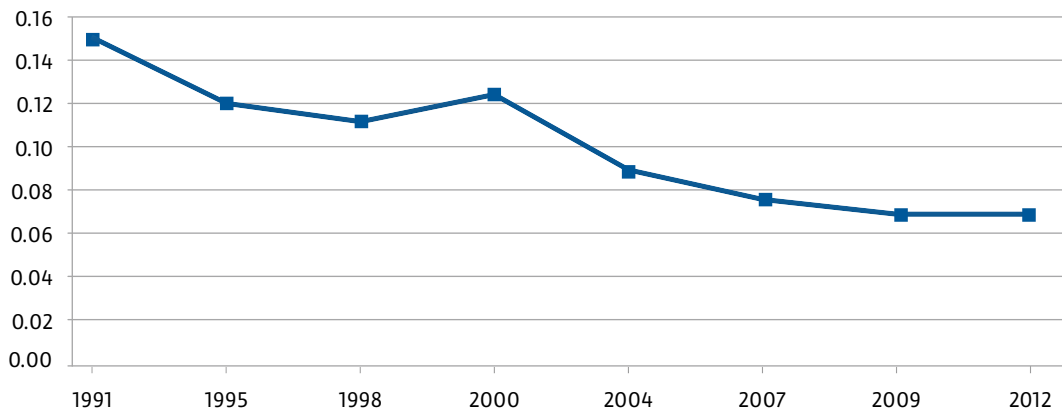
Low water losses in the public drinking water network are an important indicator for the state of the mains and the safety of supply. The water supply utilities have continuously reduced the water

losses in their mains for decades (see Figure 27). Thus the water losses in the German water supply network are also very low in international comparison. A further reduction of the water losses would involve an unreasonably high technical effort and disproportionate increases in costs.

### Real water losses in relation to network lengths

27

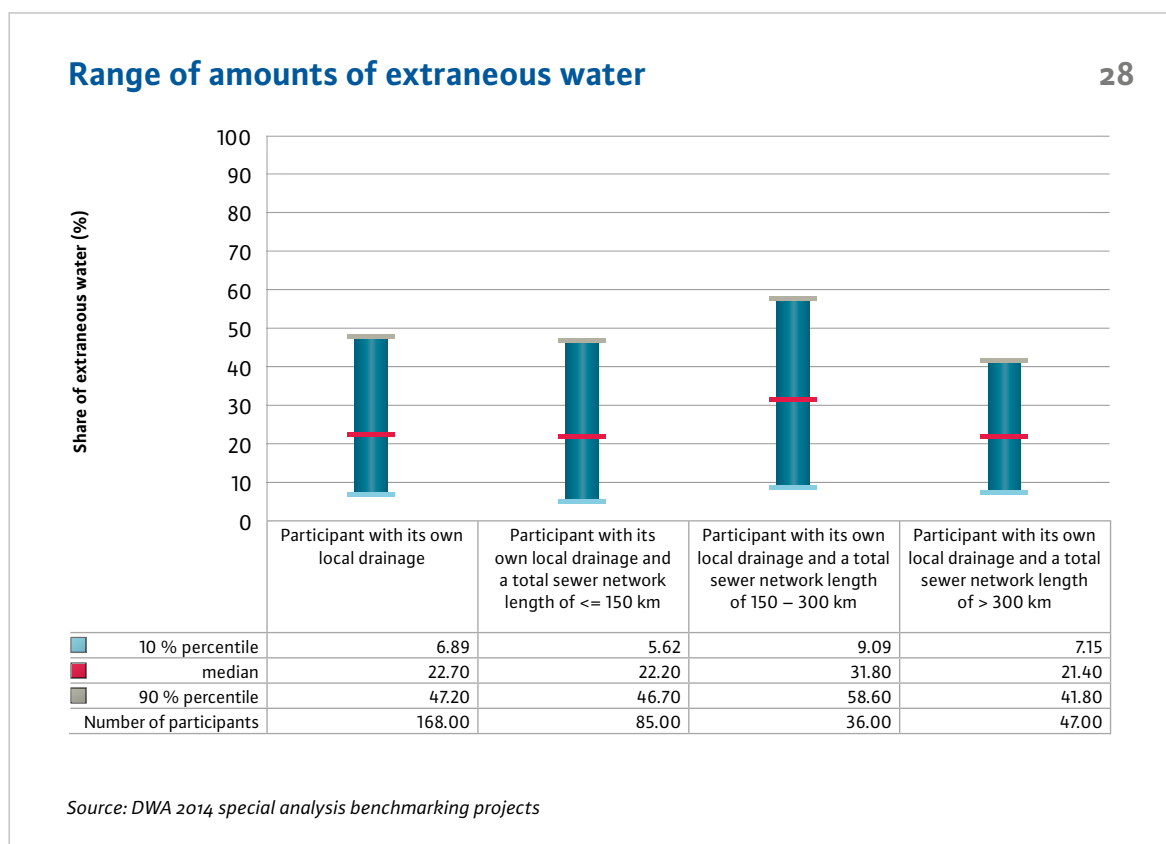
in m<sup>3</sup>/(km x h) 1991 – 2012



Source: BDEW water statistics 2014

While the tightness of supply mains can be measured through water losses, a high share of extraneous water is frequently an indicator of leaking sewers. In many cases, extraneous water is groundwater penetrating into the sewer through leakages. Furthermore, the share of extraneous

water can be increased by water introduced without permission via faulty connections or by surface water flowing into the sewer. Median values are generally inconspicuous. The large range of results underlines the need for action on a case-by-case basis (see Figure 28).



On a national average, the rates of damage to supply mains, house connections and mains fittings in recent years have been on a constantly low level in Germany. This not only documents a high quality of supply but also illustrates that the German water sector's maintenance and investment strategies are sustainable and effective.

In 2001, 90 percent of the sewage network operators had checked their entire network in the wastewater area through inspection. In 2004, this already amounted to 95 percent. Benchmarking projects carried out in the different federal states (see Chapter B1) show that sewers needing rehabilitation in the short term have a share of between 4 and 9 percent (median values).

### 3.3 Drinking water quality

The latest report (2011) of the Federal Republic of Germany to the EU Commission on the implementation of the EC Drinking Water Directive (see Chapter A 3.3) shows the enormous density and intensity of monitoring for the consumer good no. 1. Utilities carry out considerably more than the minimum number of investigations required by law. In addition, the Public Health Authorities also carry out investigations at the consumers' water taps. The requirements of the Drinking Water Ordinance are met in more than 99 percent of the analyses. This is proven by the continuously high drinking water quality in Germany. More than 99 percent of the analyses carried out during the previous periods under review (2002 to 2004 and 2005 to 2007) also met the requirements of the Drinking Water Ordinance.

The mostly minor violations of limit or indicator values are caused primarily by pesticides, nitrate and coliform bacteria. The occurrence of coliform bacteria often refers to sporadic cases where limits were exceeded, but which were not confirmed by further analyses. Except for 2006, violations of limit values continued to decrease according to a trend observed in recent years for nitrate: from 1.1 percent in 1999 and 0.13 percent in 2004 to practically 0 percent in 2010. In view of the fact that in particular nitrate pollution in groundwater diminishes only very slowly (cf. Chapter A 1) or increases again in regions with intensive agricultural use, these improvements are mainly attributable to operational measures implemented by the water supply utilities.

In many places, the use of disinfectants in water treatment can be omitted without reducing the high hygienic drinking water standard in Germany.

The current report of the European Commission on compliance with the EC Drinking Water Directive from June 2014 shows that, also in European comparison, Germany has a very good drinking water quality.

### 3.4 Performance of wastewater disposal

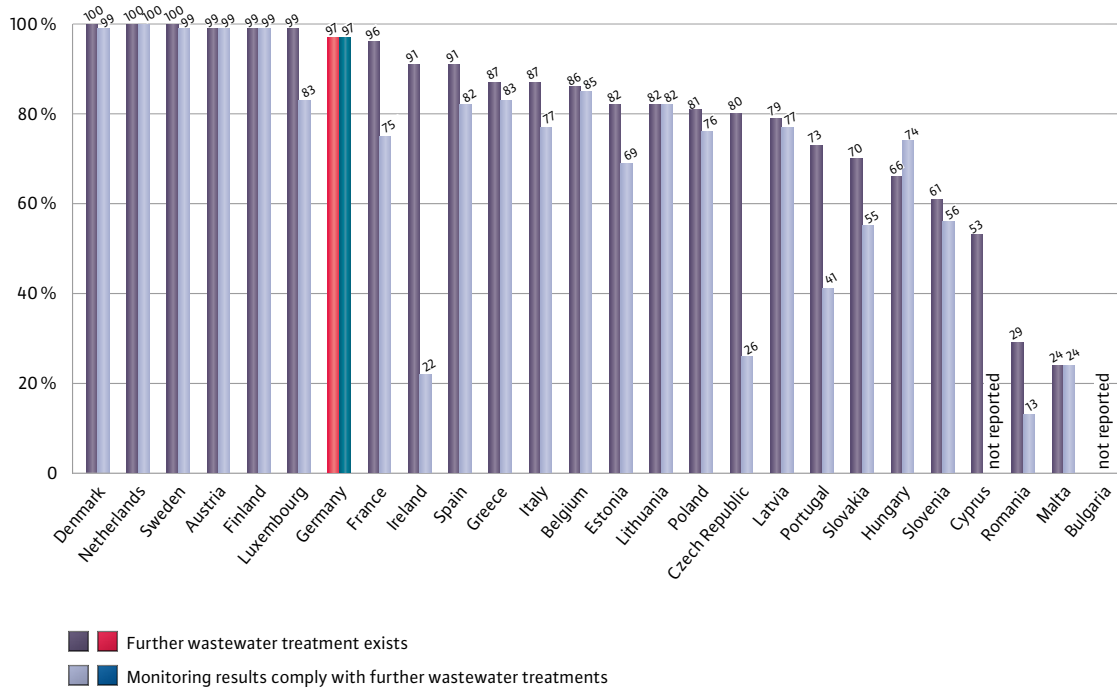
In Germany, 97 percent of the municipal wastewater is treated at the highest EU standard, that is biological treatment with nutrient elimination, i.e. tertiary treatment pursuant to the EC Directive on Urban Wastewater Treatment (source: EU Commission 2011). In Germany, in 2013 the municipal sewage treatment plants achieved an average degradation degree of 81 percent for nitrogen and 91 percent for phosphorus (Source: 26th DWA performance comparison 2014). Smaller sewage plants which do not have to meet certain requirements in terms of nutrient elimination also showed good degradation values.

According to EU legislation, it is left to the discretion of the Member States to specify "sensitive areas". For the most part, Germany already carried out this specification in the early 1990s, whereas other EU Member States have only increasingly specified certain areas as sensitive in recent years. Implementation deficits in the Member States rank among the largest problems in terms of compliance with EU environmental standards. The data from 27 EU Member States show that Germany fully complies with the requirements of the EU and performs very well in comparison with other EU countries (source: EU Commission 2013).

### Status of further wastewater treatment based on a comparison of EU countries

29

Share of wastewater quantities (total number of inhabitants and population equivalents – PT) subject to further treatment (%)

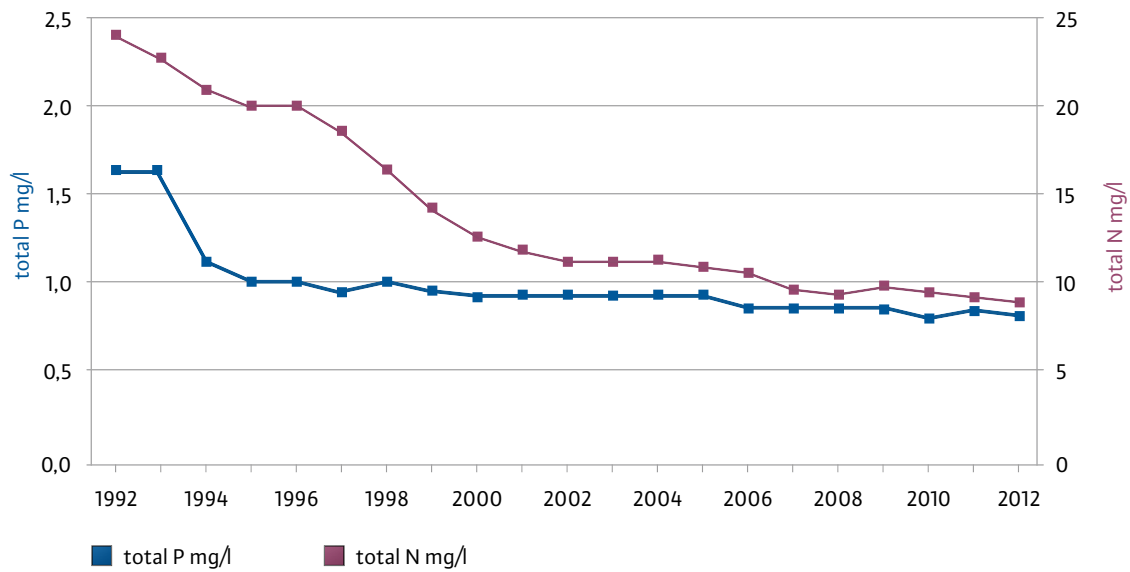
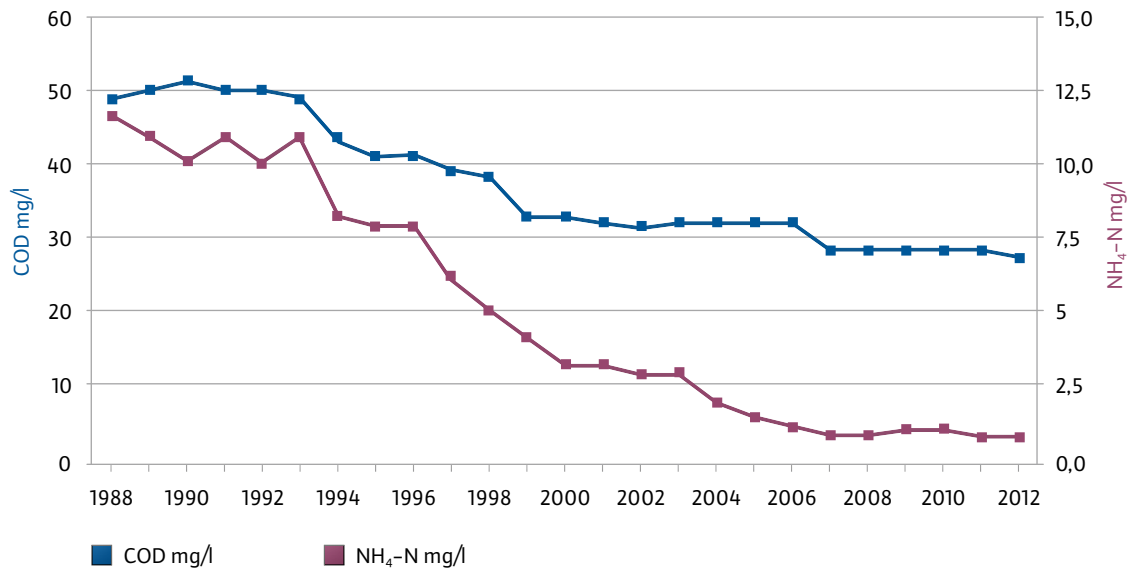


Source: 6th Commission Summary on the implementation of the Urban Waste Water Treatment Directive, EU-Commission 2011

The good treatment performance of wastewater treatment plants in Germany is also reflected in the development of the outlet values (see Figure 30).

**Development over time of the mean values of the parameters chemical oxygen demand (COD), ammonium (NH<sub>4</sub>-N), total nitrogen (total N) and total phosphate (total P) in the effluent of municipal wastewater treatment plants**

30



Source: 25th DWA performance comparison of municipal wastewater treatment plants, 2013



## 4 Customer satisfaction and customer service

The German water sector aspires to provide high safety and quality of supply at reasonable prices.

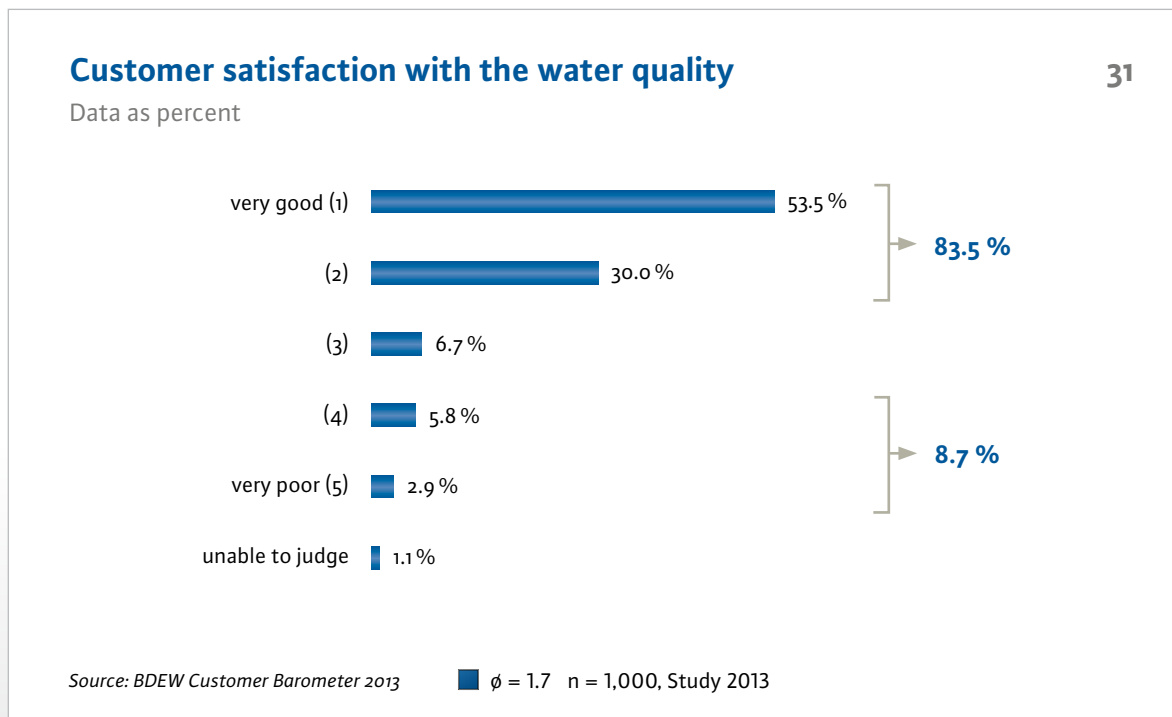


Whether the water supply and wastewater disposal utilities are able to fulfil this aspiration for their customers is investigated by the associations of the water sector and the local utilities in regular surveys on quality, prices and charges, safety, sustainability and service. The BDEW customer barometer surveyed customers in 2013 for the sixth time on the water supply and for the fifth time on the wastewater disposal. The study “Quality and image of drinking water in Germany” by the VKU – in short TWIS (drinking water study) has continuously compiled representative monthly statements on price perception, quality perception and use of drinking water in Germany since 2007 by means of continuous online surveying of customers. The results show that the water sector meets the high expectations of the consumers.

#### 4.1 Drinking water supply

The consumers in Germany trust the performance of their drinking water supply. For many years, the drinking water quality has received consistently good to very good marks (See Figures 31 and 32). Customer satisfaction has stabilised at a very high level. More than 80 percent are extremely satisfied or satisfied. Two thirds of the customers even consider that drinking water in Germany ranks among the best in comparison with other countries.

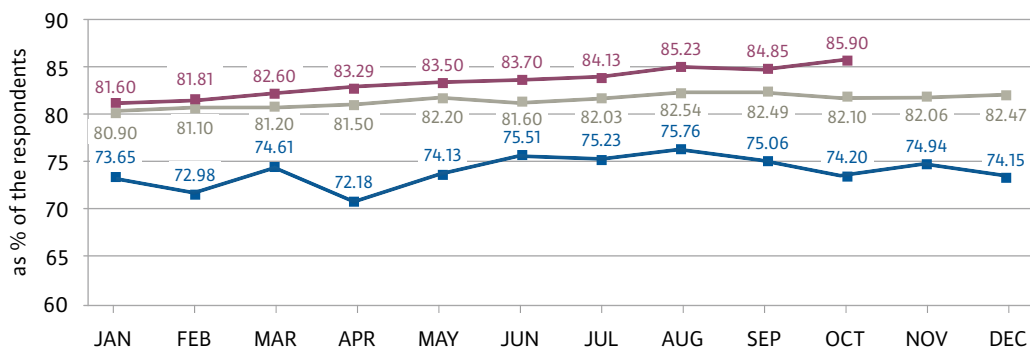
Also the customer satisfaction with the service provided by the water supplier is on a constantly high level – more than two thirds rate this as very good or good (See Figures 33 and 34).



### Customer satisfaction with the water quality over the year

32

Answer “very good” and “good”



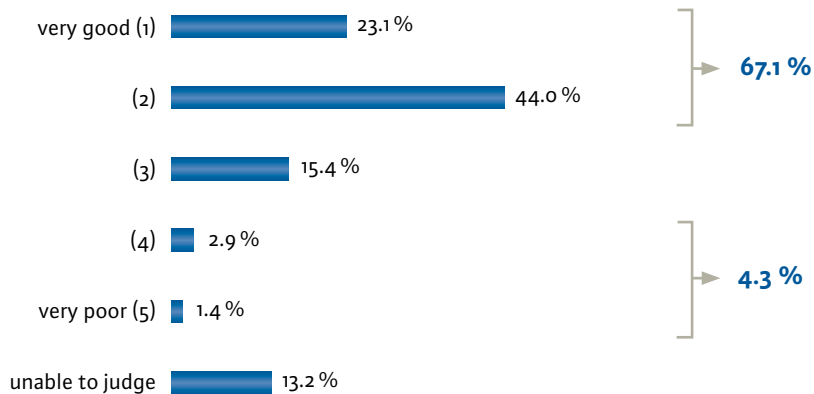
■ 2011 = 10,119 respondents   ■ 2013 = 9,899 respondents   ■ 2014 = 8,242 respondents

Source: study: quality and image of drinking water in Germany (TWIS), data report 2013/2014, I.E.S.K./VKU

### Customer satisfaction with the service of their water supplier

33

Data as percent

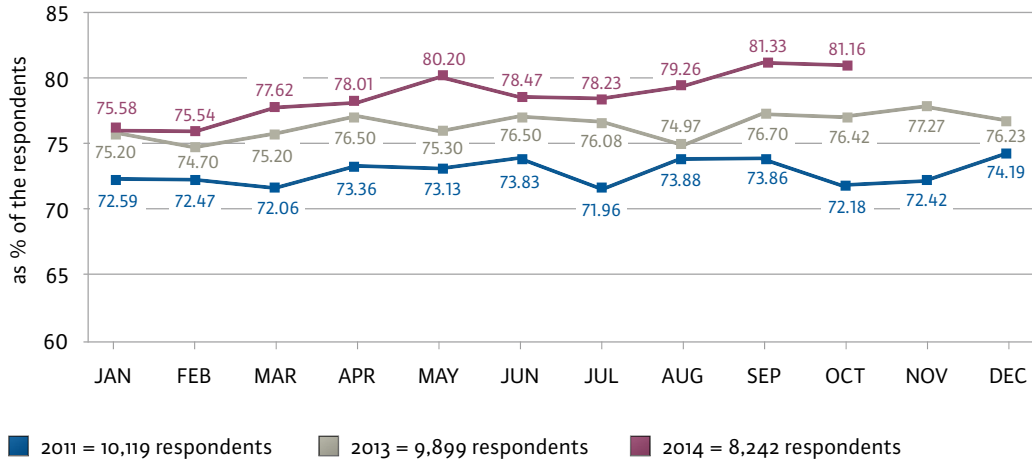


Source: BDEW Customer Barometer 2013   ■  $\phi = 2.0$  n = 1,000, Study 2013

### Customer satisfaction with the service of their water supplier over the year

34

Answer “very satisfied” and “satisfied”



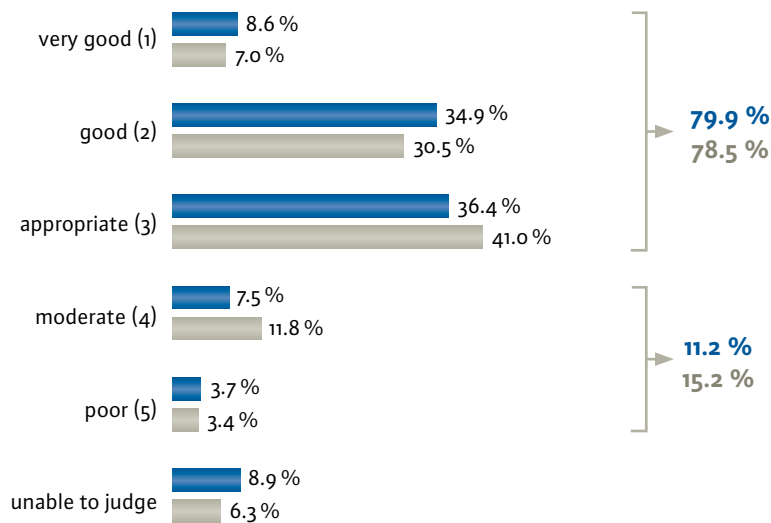
Source: study: quality and image of drinking water in Germany (TWIS), data report 2013/2014, I.E.S.K./VKU

64

### Price performance ratio in the water supply

35

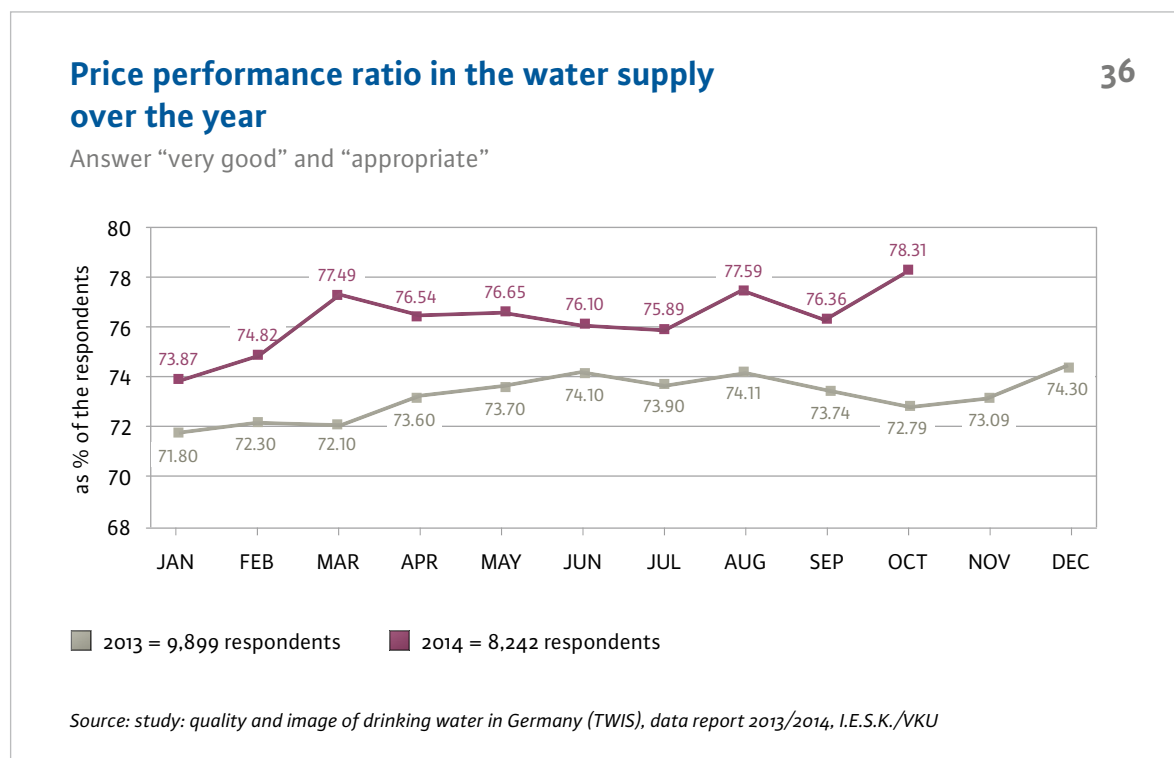
Data as percent



Source: BDEW Customer Barometer 2013   ■  $\phi = 2.6$  n = 1,000, Study 2013   ■  $\phi = 2.7$  n = 1,000, Study 2011

Reliability of 24/7 water supply is the most important performance indicator for customers, followed by speedy troubleshooting. 91.4 percent are satisfied or very satisfied with the reliability of the

water supply (24/7). More than three quarters of the customers consider the fees to be appropriate (see Figures 35 and 36).



## 4.2 Wastewater disposal

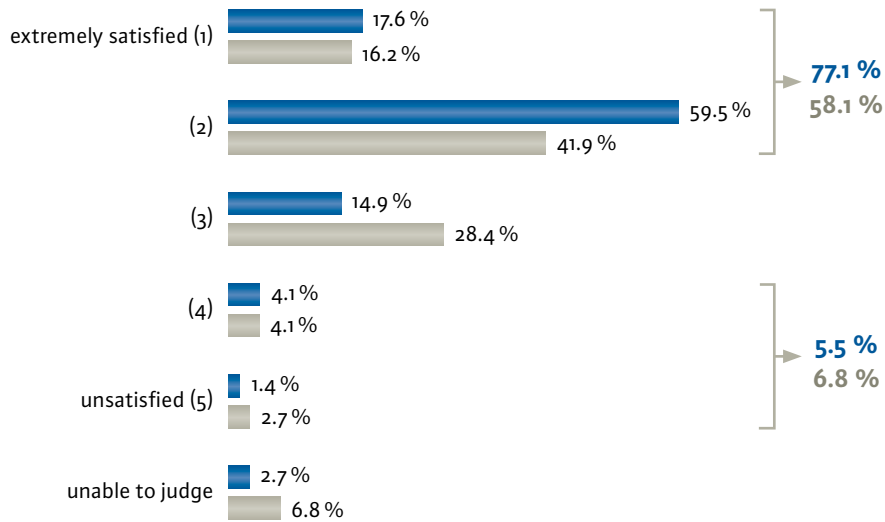
With regard to the wastewater disposal, the expectations of the population are also met to a high degree. With a level of connection to the public sewer network of 97 percent, Germany is in a top position here in comparison with the rest of Europe.

The consumers are extremely satisfied or satisfied with the service of their wastewater disposal utility (see Figure 37). 77 percent of customers who have been in contact with their wastewater disposal utility are extremely satisfied or satisfied with the quality of the contact. The level of complaints has been extremely low for years. Of the less than 3 percent of respondents who had contacted their wastewater disposal utility at all, only a fifth of them did so in order to complain.

### Satisfaction with the wastewater disposal utility

37

Data as percent

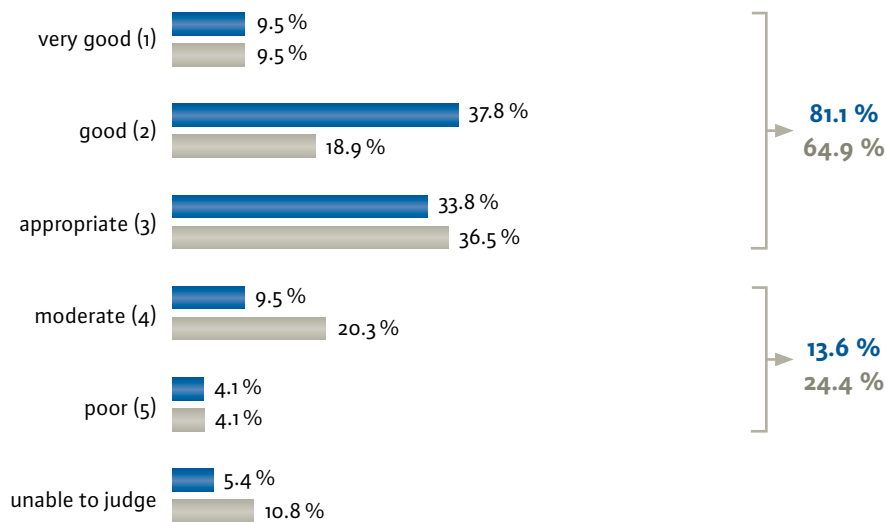


Source: BDEW Customer Barometer Water 2013 ■  $\phi = 2.1$  n = 1,000, Study 2013 ■  $\phi = 2.3$  n = 1,000, Study 2011

### Price performance ratio in wastewater disposal

38

Data as percent

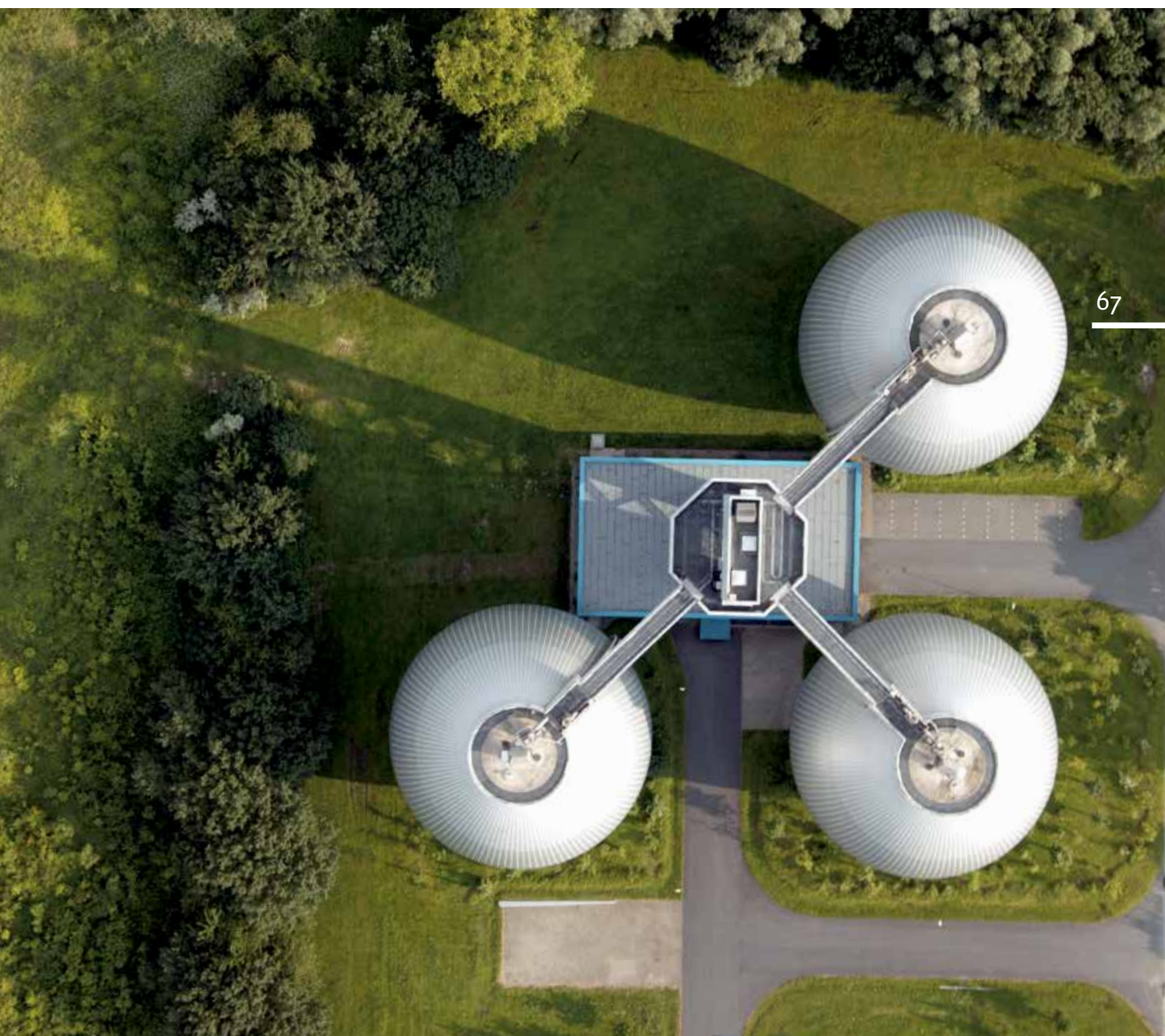


Source: BDEW Customer Barometer 2013 ■  $\phi = 2.6$  n = 74, Study 2013 ■  $\phi = 2.9$  n = 74, Study 2011



## 5 Sustainability

The features of the German water sector are long-term safety of supply and disposal, high quality drinking water, high standards in wastewater disposal, high customer satisfaction and careful management of water resources with economic efficiency (5-pillar concept of benchmarking).



## 5.1 Availability of resources and their utilisation

The Federal Republic of Germany is a water-rich country (see Chapter A 1). Its total annually renewed water resources amount to 188 billion cubic metres. Only around 18 percent of these resources are utilised per year by different users. Public water supply uses approximately 5.1 billion cubic metres per year; this corresponds to only

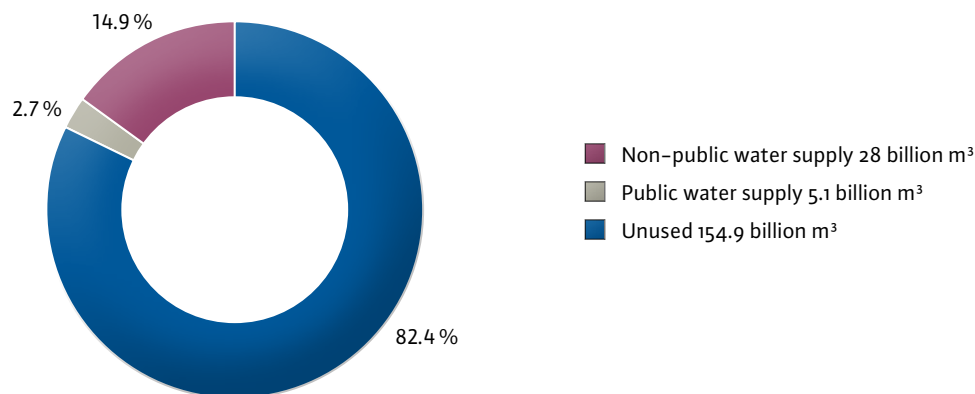
2.7 percent of the available resources. The water use of the public water supply decreased from 2.9 percent in 2004 to 2.7 percent in 2010 (see Chapter A 5.1). The volume of unused water increased in this period from 81.0 percent to 82.4 percent (see Figure 39).

In the light of such a comfortable situation and the careful use of water resources available, water supply is secured in Germany in the long term.

### Water utilisation in Germany in 2010

Total available water resources: 188 billion cubic metres

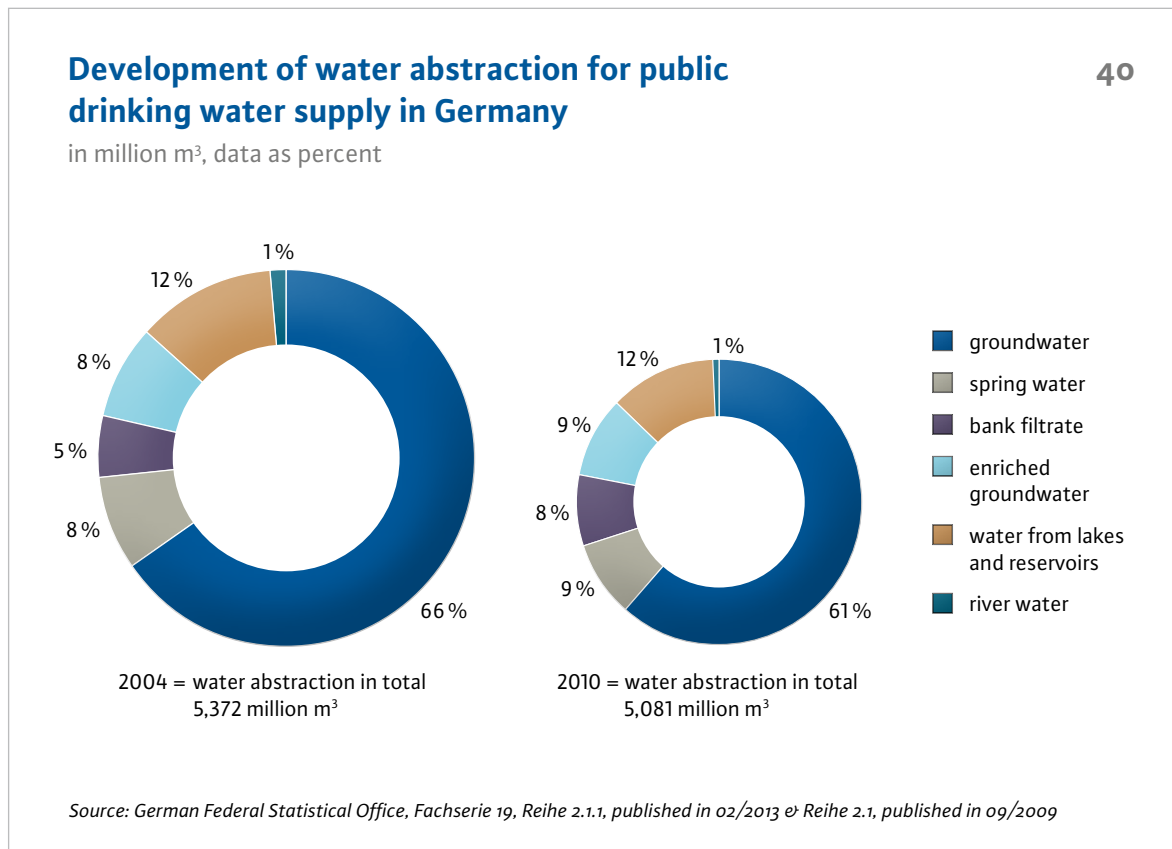
Data as percent



Source: German Federal Statistical Office, Fachserie 19, Reihe 2.1.1, published in 02/2013; German Federal Institute of Hydrology

With a share of approximately 61.8 percent, groundwater (including 69.9 percent spring water) is still the most important resource for drinking water abstraction. The share of utilised surface water resources (reservoirs, bank filtrate, enriched

groundwater, direct extractions from rivers and lakes) amounts to 30.1 percent. Since 1990, annual abstraction volumes have decreased continuously by about 25 percent.



## 5.2 Network renewal

The network renewal rate depends on the state of the networks. Here, material and maintenance play an essential role. A technically and economically reasonable rate of network renewal must be determined by every utility on the basis of local conditions, such as mains material, network age, damage rates, leakages.

The benchmarking projects (drinking water) carried out in Baden-Württemberg, Bavaria, Hesse, North Rhine-Westphalia, Rhineland Palatinate and Saarland published the values of network renewals averaged over the past ten years. Accordingly, the average annual rates of renewal for the participating utilities are between 0.4 and 1.2 percent of the

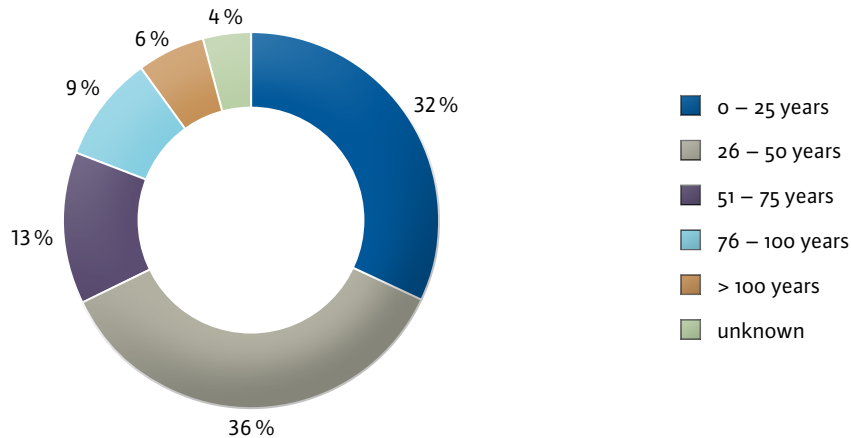
mains network. However, it should be noted that the renewal strategies take many aspects into account. For instance, a lower rate of renewal can initially be reasonable for a younger network, as also revealed by the permanently low water losses and damage rates (see Chapter B 3.2) and by the extremely low number of interruptions of supply (see Chapter B 2.1). Total annual capital expenditure in drinking water supply amounts to 2 billion Euros (see Chapter B 6.2).

In the wastewater sector, about 32 percent of the existing sewers were constructed over the last 25 years. 36 percent of the existing sewers are between 25 and 50 years of age. Consequently, approximately 70 percent of sewers are less than 50 years old (see Figure 41).

## Age pattern in the sewer network

41

Data as percent



Source: DWA, State of Germany's sewers, 2009

70

From 2004 to 2008, the mean costs for sewer rehabilitation, based on the costs for repair, renovation and renewal measures, amounted to approx. €908 per metre of overhauled sewer.

On average, operators plan capital expenditure of about €8,000 per year and sewer kilometre (Source: DWA survey 2009). According to a recent survey, in 2012 investments of 46.41 €/E\*a were made (Source: DWA Economic Data 2014).

### 5.3 Sewage sludge

In Germany, the volume of sewage sludge in 2008 amounted to about 2 million tons, using different disposal methods (Source: DESTATIS 2013). Recent years have seen thermal procedures gaining in significance. Thus, in 2012, more than half of the sewage sludge from municipal wastewater treatment plants in Germany was disposed of in this way. Due

to the ban (since 2005) on landfilling waste with higher contents of organic substances, landfill disposal of sewage sludge is no longer of any significance in Germany.

Overall, 42.3 percent of sewage sludge was recycled in 2012, approximately 30 percent going to agriculture.

The data on the quality of recycled sewage sludge used in agriculture (Source: DESTATIS 2013; sewage sludge reports by the states) show that the municipal sewage sludge is far below the limit values of the German Sewage Sludge Ordinance and the EC Sewage Sludge Directive (86/278/EEC). The German reports to the European Commission show that the long-term trend of decreasing levels of



the most important parameters of lead, cadmium, chromium and mercury as well as zinc has continued (Source: Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, 2012).

Municipal wastewater disposal has taken comprehensive measures to improve the environmental compatibility of sewage sludge. In particular quality assurance systems have been established for agricultural use. The use of preferably quality-assured sewage sludge as fertiliser enables the direct use of the phosphates contained in sewage sludge.

In order to be able to take advantage of the phosphorus from sludge not used in agriculture or landscaping in future, as agreed in the coalition agreement of 2013, intensive work is being applied to the large-scale application of technologies for nutrient recovery from wastewater, sewage sludge or sewage sludge ashes.

#### 5.4 Energy consumption and efficiency

Drinking water supply and wastewater disposal accounts for merely half a percent of the entire primary energy consumption in Germany (Source: German Federal Statistical Office 2011). This takes account of the energy required for the abstraction, treatment and distribution of drinking water and the collection, discharge and purification of wastewater. Added to this is the energy consumption for commercial and domestic hot water production, which is energetically much more

relevant. This alone made up about 5 percent of energy consumption in Germany in 2012 (Source: Federal Ministry of Economy and Energy based on data from the “Arbeitsgemeinschaft Energiebilanzen” and the BDEW). It takes on average 0.51 kWh to provide 1,000 litres of drinking water. There is a large fluctuation range. The amount of energy required depends, for instance, on whether spring water is available or deep-seated groundwater needs to be abstracted, and on the differences in altitude to be overcome for water transport and distribution. Taking the average per capita water consumption as a basis, the water sector uses 29 kWh per year for the drinking water supply of one person. The cost for wastewater treatment is similar and is on average 34 kWh per capita per year (Source: DWA performance comparison 2012).

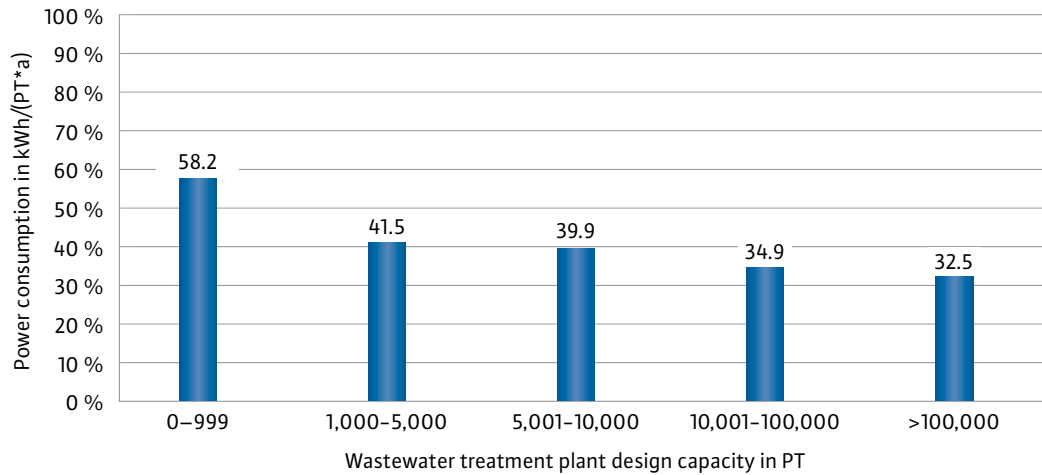
By way of comparison, in the same period a person uses an average of about 100 kWh just to cool their food, provided they have a modern fridge/freezer combination of the energy efficiency class A+++.

Wastewater disposal plants are among the largest infrastructural energy consumers in municipalities and have higher power requirements than, e.g. schools or street lighting. (Source: Haberkern et al, 2006). Operators make great efforts to treat wastewater with a minimum expenditure of energy. Of the 10,000 sewage treatment plants, currently about 1,000 plants that are equipped with sludge digestion, produce around 1.1 TWh of electricity from biogas. The total power consumption of wastewater treatment plants is 4.2 TWh per year.

### Electric power consumption in wastewater treatment

42

based on total number of inhabitants and population equivalents (PT)



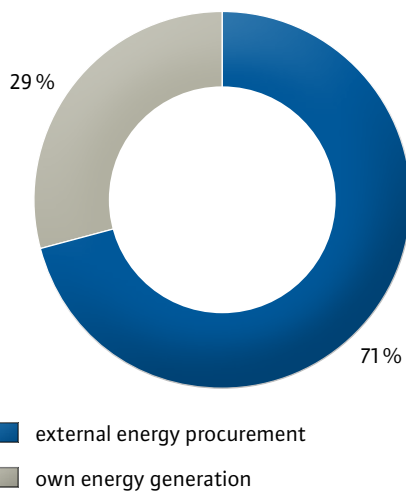
Source: DWA, Performance comparison of municipal sewage treatment plants 2011

72

### Share of the plants' own energy generation

43

as percent



Source: VKU, Energie im Fokus, 2012

In addition to these well-proven procedures, utilities are developing and testing new technologies for saving or generating energy, such as the use of energy-efficient pumping technologies or heat recovery from wastewater.

Increasing requirements made on water or wastewater treatment e. g. through the mandatory introduction of further processing and treatment stages or phosphorus recovery are expected to significantly increase the energy requirements of the water management facilities and reduce the efficiency gains achieved so far.



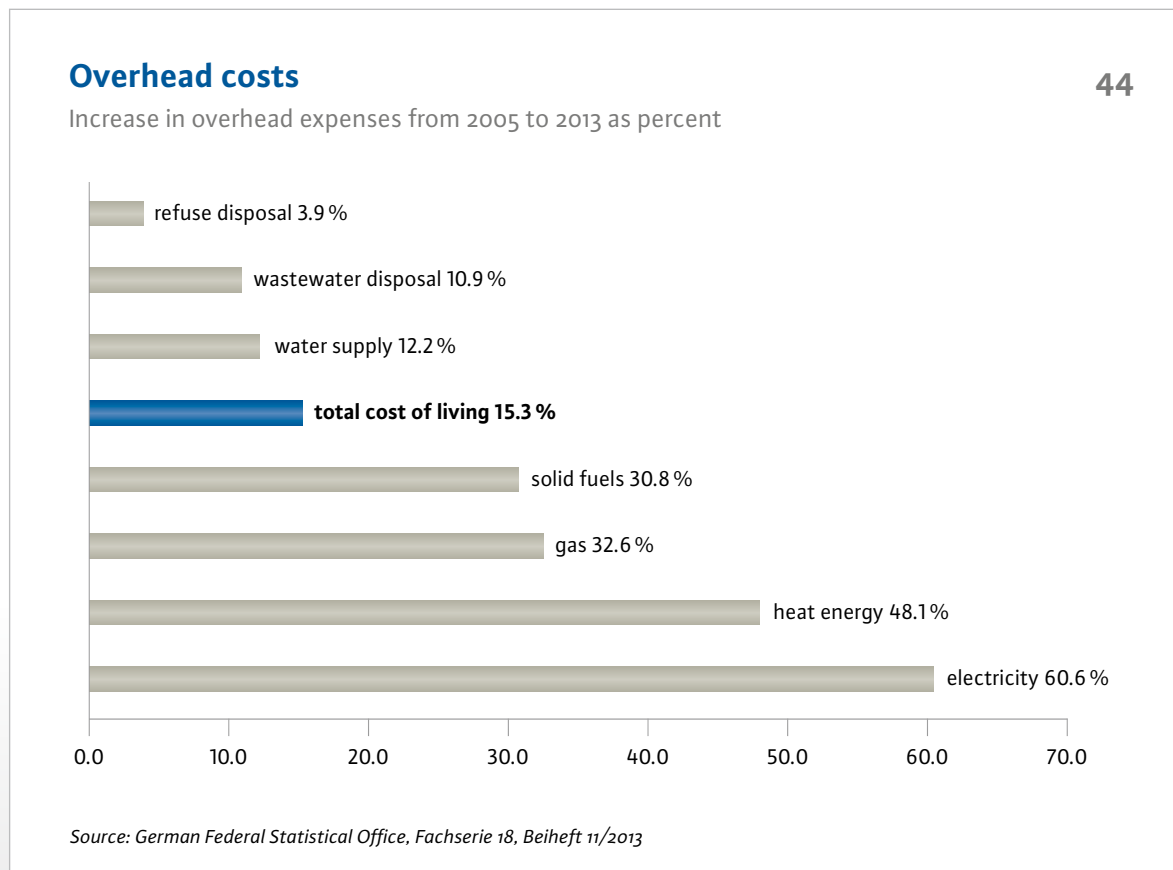
## 6 Economic efficiency

The increases in fees for drinking water and wastewater have mostly remained below the inflation index for many years.

### 6.1 Water fees and wastewater charges

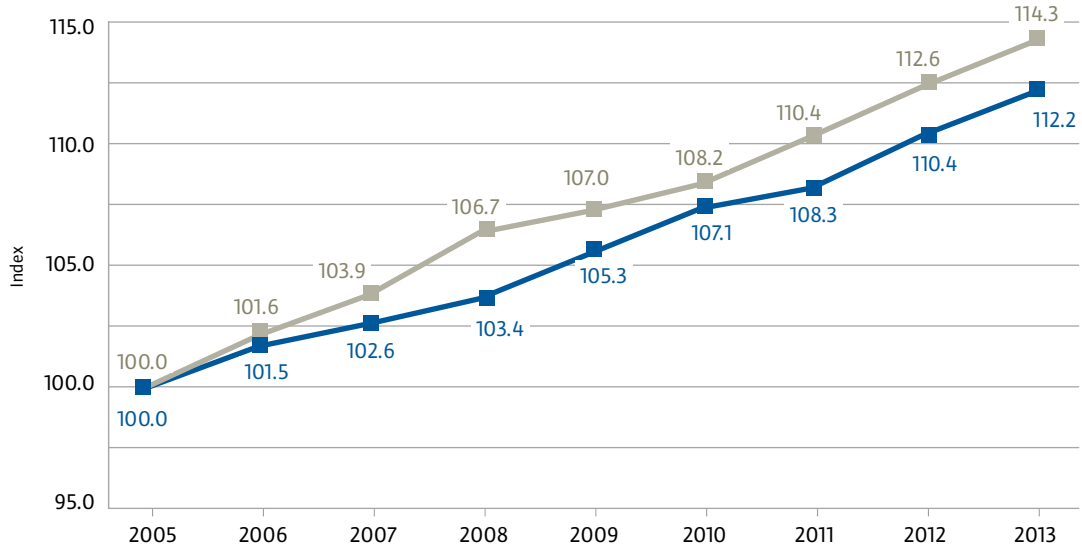
Since 2005, the prices and charges for drinking water have only increased by 12.2 percent, for wastewater disposal by a mere 10.9 percent, whereas inflation increased by 14.3 percent and the cost of living rose by a total of 15.3 percent.

Thus, the development of fees, both for wastewater and drinking water, is below the rate of inflation and the water supply and wastewater disposal remain at a constant low (see Figure 44).



### Development of the prices and charges for the water supply and the inflation rate 2005 to 2013

45



Source: BDEW, German Federal Statistical Office

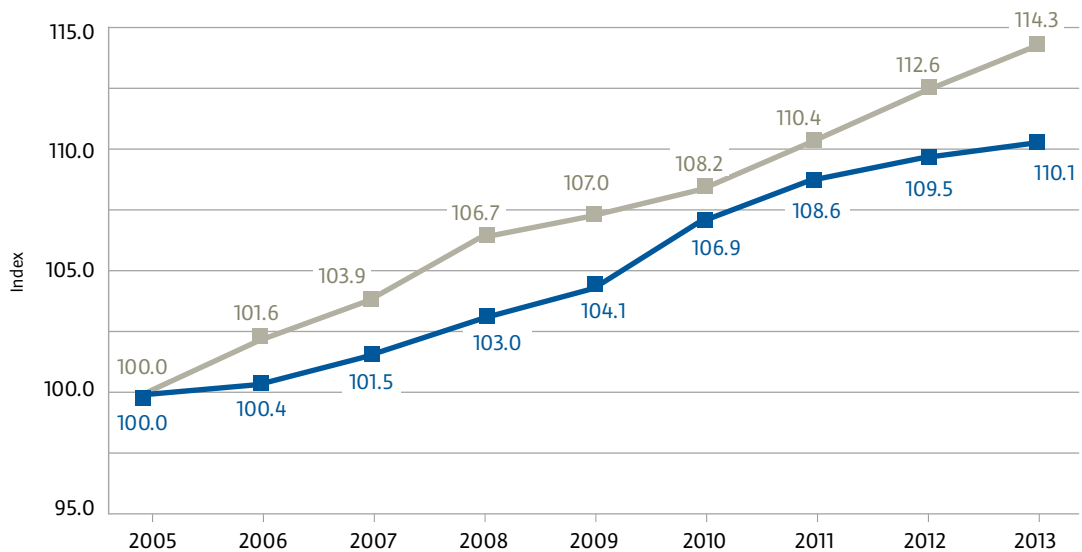
■ Index of inflation ■ Index of water supply

74

### Development of the wastewater charges and the inflation rate 2005 to 2013

46

Year 2005 = 100



Source: German Federal Statistical Office, Fachserie 17, Reihe 7

■ Index of inflation ■ Index of wastewater charges

In 2013, wastewater charges as a whole increased slightly compared to the preceding year. Where the freshwater standard was applied, the charges fell by 2.88 percent. Based on split wastewater charges, the increase amounted to 0.47 percent for sewage water and 1.18 percent for precipitation water. The increase in the period 2005 to 2013 is below the inflation rate.

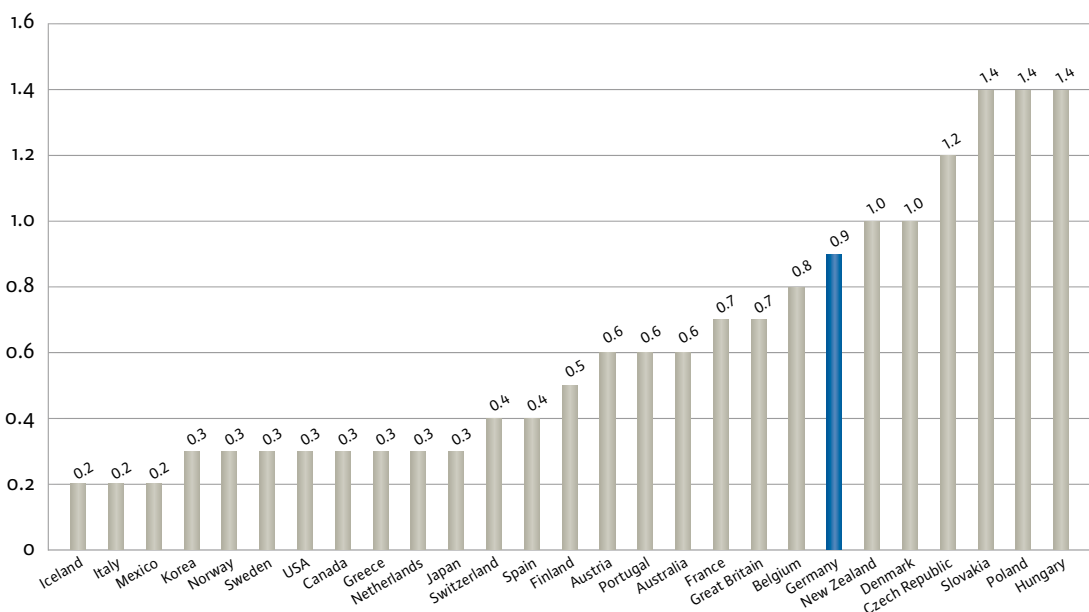
In a global comparison of selected industrial nations, in 2009 the OECD made a comparison of the

per capita expenditure on water supply and wastewater disposal with disposable income. According to this, German households spend an average of 0.9 percent of their per capita disposable household income on their water supply and wastewater disposal (see Figure 47). However, the study assumes an average per capita water use of 166 litres per day, whereas, in fact this lies at 121 litres per day in Germany. The financial burden is therefore actually significantly lower than calculated by the OECD.

## Average share of household expenses for drinking water supply and wastewater disposal

47

as part of average net disposable income



Source: OECD, 2009 *Managing Water for All: An OECD Perspective on Pricing and Financing*, Page 87–88

## 6.2 Capital expenditure

Continuous maintenance of the plants and renewal of the infrastructure are crucial factors for the long-term safety of supply and disposal.

The water sector therefore invests an above-average share of its sales revenues in plants and networks, making it a driving force for small and medium-sized businesses in terms of employment and environmental policy. In 2008, the share of capital expenditure invested by the water supply sector amounted

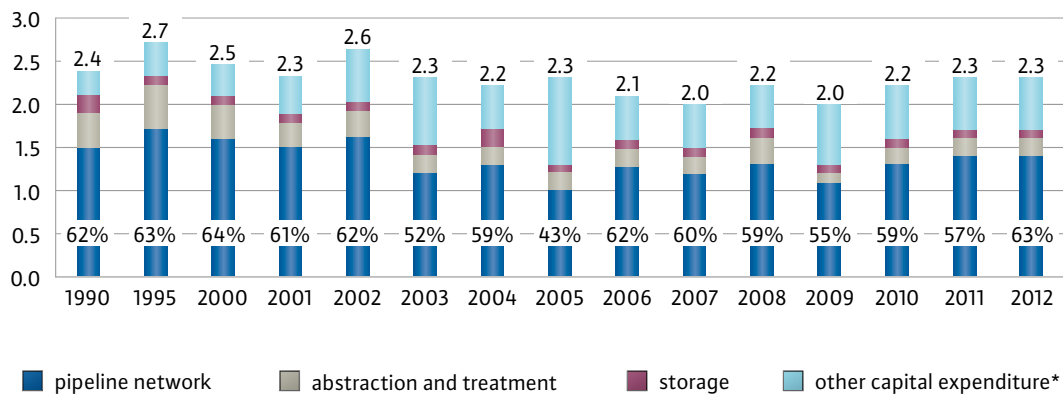
to 18 percent of overall sales revenues and was thus far above the average achieved by other sectors of economy (e.g. manufacturing sector 3.3 percent in 2007, utility industry as a whole 3.1 percent in 2008; German Federal Statistical Office 2009).

In 2012 alone, water and wastewater utilities invested 6 billion Euros, with another 7 billion Euros forecast each year for 2013 and 2014. Most capital expenditure is spent on networks.

### Development of capital expenditure in public water supply from 1990 to 2012

48

according to plant areas, in billion Euro



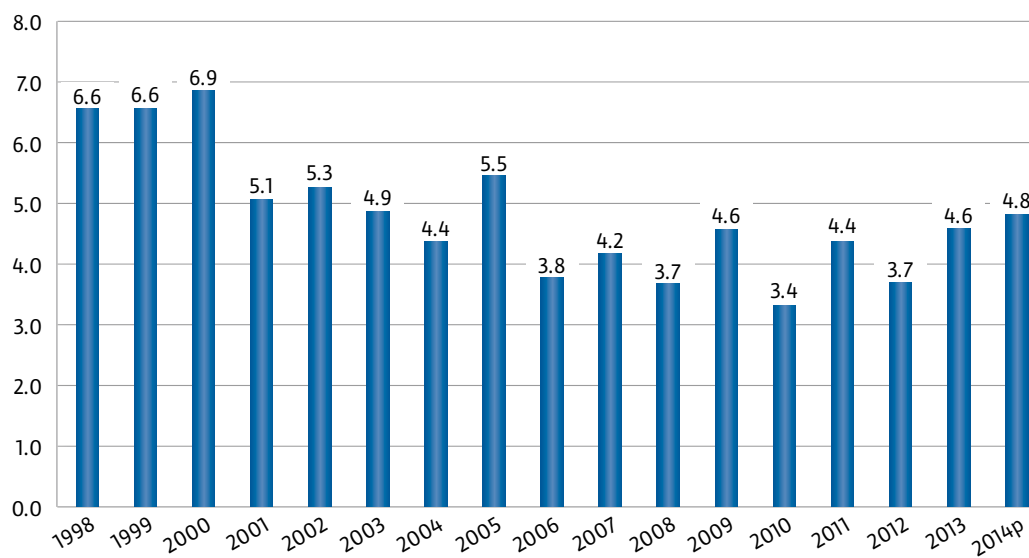
\* other capital expenditure = meters and measuring devices, and capital expenditure which cannot be broken down into asset areas.

Source: BDEW Water Statistics

## Development of capital expenditure in public wastewater supply from 1998 to 2014

49

in billion Euro



Source: BDEW/DWA/Deutscher Städtetag – wastewater survey, p = provisional

The decrease in investments in public wastewater disposal compared to the years before 2000 is attributable to the phasing-out of capital invest-

ment as part of implementing the EC Directive on Urban Wastewater Treatment.

## Statewide benchmarking projects in water supply and wastewater disposal

<b>Baden-Wuerttemberg</b>	<a href="http://www.abwasserbenchmarking-bw.de">www.abwasserbenchmarking-bw.de</a> <a href="http://www.benchmarking-bw.de">www.benchmarking-bw.de</a>
<b>Bavaria</b>	<a href="http://www.abwasserbenchmarking-bayern.de">www.abwasserbenchmarking-bayern.de</a> <a href="http://www.effwb.de">www.effwb.de</a>
<b>Brandenburg</b>	<a href="http://www.kennzahlen-bb.de">www.kennzahlen-bb.de</a>
<b>Bremen</b>	<a href="http://www.abwasserbenchmarking-nord.de">www.abwasserbenchmarking-nord.de</a>
<b>Hamburg</b>	<a href="http://www.abwasserbenchmarking-nord.de">www.abwasserbenchmarking-nord.de</a>
<b>Hesse</b>	<a href="http://www.abwasserbenchmarking-hessen.de">www.abwasserbenchmarking-hessen.de</a> <a href="http://www.bkwasser.de">www.bkwasser.de</a> <a href="http://www.benchmarking-he.de">www.benchmarking-he.de</a>
<b>Mecklenburg-West Pomerania</b>	<a href="http://www.kennzahlen-mv.de">www.kennzahlen-mv.de</a>
<b>Lower Saxony</b>	<a href="http://www.abwasserbenchmarking-nord.de">www.abwasserbenchmarking-nord.de</a> <a href="http://www.kennzahlen-h2o.de">www.kennzahlen-h2o.de</a> <a href="http://www.wasserverbandstag.de/main/siwa_informationen.php?navid=8">www.wasserverbandstag.de/main/siwa_informationen.php?navid=8</a>
<b>North Rhine-Westphalia</b>	<a href="http://www.abwasserbenchmarking-nrw.de">www.abwasserbenchmarking-nrw.de</a> <a href="http://www.wasserbenchmarking-nrw.de">www.wasserbenchmarking-nrw.de</a> <a href="http://www.benchmarking-nrw.de">www.benchmarking-nrw.de</a>
<b>Rhineland-Palatinate</b>	<a href="http://www.wasserbenchmarking-rp.de">www.wasserbenchmarking-rp.de</a>
<b>Saarland</b>	<a href="http://www.wasserbenchmarking-saarland.de">www.wasserbenchmarking-saarland.de</a>
<b>Saxony</b>	<a href="http://www.abwasserbenchmarking-sachsen.de">www.abwasserbenchmarking-sachsen.de</a>
<b>Saxony-Anhalt</b>	<a href="http://www.kennzahlen-lsa.de">www.kennzahlen-lsa.de</a>
<b>Schleswig-Holstein</b>	<a href="http://www.abwasserbenchmarking-nord.de">www.abwasserbenchmarking-nord.de</a>
<b>Thuringia</b>	<a href="http://www.abwasserbenchmarking-thueringen.de">www.abwasserbenchmarking-thueringen.de</a> <a href="http://www.benchmarking-th.de">www.benchmarking-th.de</a>



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## Presentation of the Associations

This Profile of the German Water Sector was drawn up by the following Associations:

### **Association of Drinking Water from Reservoirs (Arbeitsgemeinschaft Trinkwassertalsperren – ATT)**

The ATT is a non-profit association consisting of about 40 water supply utilities, water associations, reservoir undertakings and administrative bodies, as well as university, testing and research institutes in the Federal Republic of Germany and the Grand Duchy of Luxembourg concerned with the production, treatment and distribution of drinking water from reservoirs.



### **Association of Energy and Water Industries (Bundesverband der Energie- und Wasserwirtschaft – BDEW)**

The German Association of Energy and Water Industries (Bundesverband der Energie- und Wasserwirtschaft – BDEW), Berlin, represents the interests of more than 1,800 companies. The spectrum of its members ranges from local and municipal to regional and interregional companies. They represent about 90 percent of electricity sales, more than 60 percent of local and district heat supply, 90 percent of natural gas sales as well as 80 percent of drinking water abstraction and about one third of wastewater disposal in Germany.



### **German Alliance of Water Management Associations (Deutscher Bund verbandlicher Wasserwirtschaft – DBVW)**

The DBVW is a union of eight regional associations. It represents the interests of water sector associations responsible for the maintenance of water bodies, coastal protection and flood control, drinking water supply, wastewater disposal, etc. Approximately 2,000 associations of the water sector (public-law corporations with self-administration) are represented within the DBVW. The DBVW unites all areas of the water sector and has gained comprehensive experience in terms of integrative water management.



**German Technical and Scientific Association for Gas and Water  
(Deutscher Verein des Gas- und Wasserfaches –  
Technisch-wissenschaftlicher Verein – DVGW)**



The DVGW promotes the gas and water supply sector, taking particular account of technical and hygienic safety and environmental protection. With its approximately 12,000 members, the DVGW elaborates generally accepted technical rules for gas and water. Furthermore, its tasks include the control and certification of products, persons and companies, the initiation and promotion of research projects and training for the whole spectrum of issues relating to the gas and water sector. The non-profit organisation is independent and neutral in economic and political terms.

81

**German Association for Water, Wastewater and Waste  
(Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall – DWA)**



The DWA intensively supports the development of secure and sustainable water resources management. As an independent organisation in political and economic terms, the DWA works in the fields of water resources management, wastewater, waste and soil protection. Its membership of approximately 14,000 makes it the largest association in this field within Europe and provides it with special professional competence in terms of rule-setting, education and information of the public.

**German Association of Local Utilities  
(Verband kommunaler Unternehmen – VKU)**



The VKU represents the interests of 1,400 municipal utilities in the sectors of energy, water/wastewater and waste management. Within the VKU, the municipal water industry has its own independent representation of interests which stands for the priority given to the responsibility of municipalities for water supply and wastewater disposal. The VKU represents the interests of its members in terms of regulatory, environmental and economic issues within the different federal states and at national and European level.



# Statement of the Associations of the Water Industry on Benchmarking in the Water Sector<sup>1)</sup>

June 2005

On 22 March 2002, the German Bundestag passed the resolution on a „Sustainable Water Industry in Germany“, striving for a modernisation of supply and treatment. For this purpose, the resolution, amongst other things, called for a procedure for performance comparisons among the enterprises (benchmarking). The associations of the water industry,

ATT – Association of Drinking Water from Reservoirs  
 BGW – Federal Association of the German Gas and Water Industries  
 DBVW – German Alliance of Watermanagement Association  
 DVGW – German Technical and Scientific Association for Gas and Water  
 DWA – German Association for Water, Wastewater and Waste  
 VKU – Association of Local Utilities

agree with the German Government and Bundestag that performance comparisons serve the purpose of modernisation, and are prepared to jointly draw up and develop further the required conceptual framework for benchmarking in the water industry in terms of a self-administration. The outline concept will ensure that performance and process comparisons of different contents are possible, thus taking account of Germany's long-standing experience. The associations of the water industry assume the following principles in the implementation of their joint benchmarking approach:

- ▶ Voluntary benchmarking is a well-proven instrument for the **optimisation of the technical and economic performance and efficiency** of enterprises.
- ▶ Optimisation objectives include, besides the **increase of economic efficiency and customer satisfaction, the security of supply and treatment, quality and sustainability** of the water industry.
- ▶ The associations of the water industry recommend their members a **voluntary participation** in benchmarking projects, and support their **broadly effective implementation**.
- ▶ The associations assist the enterprises by issuing joint and coordinated notes, reports and supplementary information on the benchmarking issue.
- ▶ The dissemination of the benchmarking is backed by a guideline jointly set up by DVGW and DWA in coordination with and with the textual support of the other associations.

- ▶ DVGW and DWA formulate principles for benchmarking requirements for drinking water supply and wastewater disposal in a joint paper in cooperation with the other associations.
- ▶ Within the framework of a uniform concept, the associations consider it helpful to maintain the present **flexibility and diversity of the benchmarking systems** in the water industry. In this context, on the one hand the existing, successfully practised models and concepts are to be continuously developed further, and on the other hand, developments are to be supported which provide for international, European and national comparisons and positions.

The factors for the successful application and broad acceptance of benchmarking include:

- ▶ Continuous adaptation to the optimisation objectives
- ▶ Confidentiality of company data, since these have to be disclosed in the project in order to identify innovative approaches
- ▶ Comparison and analysis of indicators in order to provide for an increase in performance.

To achieve these objectives, compatible structures are required within which benchmarking systems can be applied which are tailored to the respective question. Benchmarking on this basis will lead to a further high-level development of the water industry.

The associations generally welcome the need for information on the part of politics, the public and enterprises. Accordingly, the associations will regularly report on the state and development of the water industry in the form of an aggregated, anonymised „Water Industry Profile“.

The following information is provided as core parts of the Water Industry Profile:

- ▶ Results of nationwide data collections by the associations, data of institutions and authorities
- ▶ Results of a nationwide survey on customer satisfaction levels within the population
- ▶ Information on voluntary benchmarking projects.

The Water Industry Profile will have to be continuously developed further against the background of new findings and requirements.








ATT-Vorsitzender Gummertsbach, 30.06.2005   
 BGW-Vizepräsident Berlin, 30.06.2005   
 DBVW-Präsident Hannover, 30.06.2005   
 DVGW-Präsident Bonn, 30.06.2005   
 DWA-Präsident Hennef, 30.06.2005   
 VKU-Präsident Köln, 30.06.2005

<sup>1)</sup> Translation of the German original version



## Contact addresses and contact persons:

### Association of Drinking Water from Reservoirs (ATT)

#### Prof. Dr. Lothar Scheuer

c/o Aggerverband  
Sonnenstraße 40  
51645 Gummersbach  
phone: +49 2261 36-1000  
fax: +49 2261 36-81000  
lothar.scheuer@aggerverband.de  
www.trinkwassertalsperren.de

### German Association of Energy and Water Industries (BDEW)

#### Astrid Groth

Reinhardtstr. 32  
10117 Berlin  
phone: +49 30 300199-1213  
fax: +49 30 300199-3213  
astrid.groth@bdew.de  
www.bdew.de

### German Alliance of Water Management Associations (DBVW)

#### Dipl.-Ing. Dörte Burg

Am Mittelfelde 169  
30519 Hannover  
phone: +49 511 87966-0  
fax: +49 511 87966-19  
doerte.burg@wasserverbandstag.de  
www.dbvw.de

### German Technical and Scientific Association for Gas and Water (DVGW)

#### Dipl.-Ing. Kirsten Wagner

Josef-Wirmer-Str. 1-3  
53123 Bonn  
phone: +49 228 9188-868  
fax: +49 228 9188-988  
wagner@dvwg.de  
www.dvgw.de

### German Association for Water, Wastewater and Waste (DWA)

#### Dr. Stefanie Budewig

Theodor-Heuss-Allee 17  
53773 Hennef  
phone: +49 2242 872-144  
fax: +49 2242 872-184  
budewig@dwa.de  
www.dwa.de

### German Association of Local Utilities (VKU)

#### Dirk Seifert M. A.

Invalidenstr. 91  
10115 Berlin  
phone: +49 30 58580-155  
fax: +49 30 58580-105  
d.seifert@vku.de  
www.vku.de

