



COMPETITIVE MARKETS AND CONSUMER WELFARE

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DANISH WATER SECTOR ECONOMICS 2010 - 2019

In this article, we describe recent years' economic and efficiency trends in the Danish water sector.

The general trend indicates that efficiency improvements have been realised in the sector, and that the water and wastewater companies are concurrently performing more and more tasks within, for example, groundwater protection and climate adaptation. Overall, the price of water has increased.

For example, the figures indicate that the costs of environmental projects will continue to increase in the coming years, and that further efficiency requirements will not prevent this development. With rising costs, it is essential to maintain a focus on cost effective investments, so that the nation gets as much clean water for its money as possible, especially when taken into account that consumer water bills are not dependent on their means in terms of income.

After a decade of efficiency requirements, there is still considerable potential for efficiency improvements in the water sector. A realisation of this potential will benefit the Danish households' water affordability and also both the export and competitiveness of firms heavily relying on water in their production.

A sustained focus on efficiency also supports the development of innovative Danish water technology solutions that must not only be economically efficient but also sustainable, for example, by using less energy.

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The Danish water and wastewater companies are so-called natural monopolies. At the same time, a substantial efficiency potential of the sector remains.

Since 2009, a broad political majority have therefore agreed on imposing regulatory requirements for the sector's efficiency. The aim is continuously ensure productivity and cost effectiveness in the sector so as to accommodate sustained high security of supply, environmental protection and natural resources conservation, high service standards, health and technology development.

Economic regulation consists of imposing constraints (caps) on the companies' revenues collected as water tariffs from household and non-household consumers. In 2019, the Danish water sector revenue cap totals around DKK 15bn. The revenue caps are reduced annually by means of efficiency requirements designed to induce the companies to keep pace with productivity improvements in competitive sectors. The some 330 largest Danish water and wastewater companies are subject to economic regulation.¹

Since the regulation was introduced, the value of efficiency requirements set by regulators amounts to DKK 1.9bn. Thus, national aggregated household and non-household water bills would have been DKK 1.9bn higher in 2019 all things equal in the absence of economic regulation of these monopolistic markets. The prices have not fallen. This is due to the fact that companies are performing more and more tasks relating to security of supply and groundwater protection for example. The water companies gain remuneration for these additional tasks by their revenue cap being raised by corresponding amounts ('additions').

Performing more tasks costs money. Therefore, it is essential to maintain a focus on cost effectiveness, so that the nation gets as much clean water for its money as possible. Greater cost effectiveness also benefits water affordability for household consumers, the competitiveness of Danish business water consumers and exports of Danish water technology solutions.

This article shows the development in water prices, costs, and revenue caps along with the factors that have contributed to these developments. However, in spite of increased investment and expenditure on new tasks, prices of water and wastewater have overall been kept fairly stable since 2015, while prices had been rising in the years before that when taking into account the general price trends of the economy.

The consumer price of water has risen

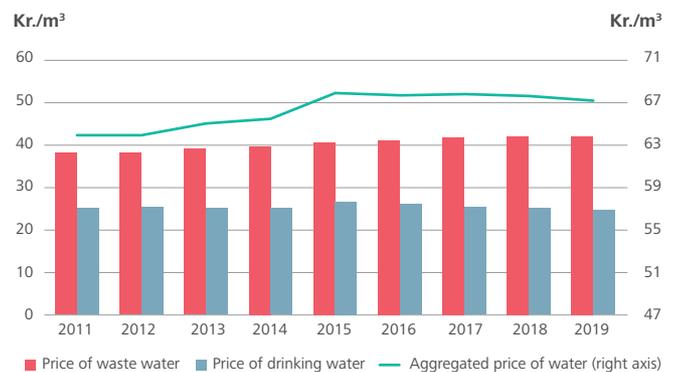
The average annual household water bill amounts to approximately DKK 5,450, around two-thirds of which is for

¹ Today, 224 of the largest water companies are subject to economic regulation. The water companies supply approximately 90 per cent of total Danish water consumption, and the wastewater companies manage approximately 97 per cent of the country's total wastewater. The smallest water utilities are subject only to a self-sustaining break-even principle, meaning that they only have to balance their expenditures and revenues.

wastewater services.

Since 2011, the average consumer price has increased by about DKK 3.0 per cubic metre, which corresponds to a real increase of about 5 per cent; see Figure 1. This reflects an increase up to 2015, after which the real price has been quite stable.

Figure 1
Consumer price of an average household (avg) by water and wastewater, 2011-2019 (2019 level)



Note.: The prices are VAT inclusive. The prices are linked to the Danish consumer price index, taking 2019 as index 100.

Source: Price data from the water and wastewater companies' tariff spreadsheets and reporting to the Danish Water Regulatory Authority.

The DKK 3.0 kroner per cubic metre price increase since 2011 is largely attributable to increases in wastewater prices, while the price of potable water has largely remained unchanged in the same period.²

The significance of the water prices for business and industry

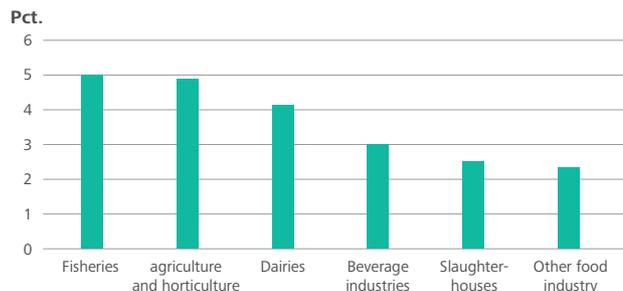
About a third of the water and wastewater companies' charged water volume is used by business clients in various sectors. The water prices of large business clients are higher than the consumer price because a consumption-dependent rebate is granted to large business clients.

For the most water consuming industries, their total water and wastewater spend corresponds to as much as five per cent of the industry's gross value added (GVA); see Figure 2, which shows the six industries with the highest expenditure on water. On average the expenditure corresponds to 0.2 pct. of the value added in the private sector.³

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³ For price data by company, municipality and region, please visit our website: <https://www.kfst.dk/vandtilsyn/analyser> In the calculation of the share of expenditure for the private sector, the share of expenditure is weighted by the gross value added of the sector.

Figure 2
Water expenditure at industry level (as a percentage of GVA)



Note: The total includes expenditure on both effluent disposal and water consumption. The percentages are calculated as the average percentage share in the period 2010-2015.

Source: Statistics Denmark

Food industry operators especially report high expenditures on water and wastewater. Other industries with high water and wastewater costs are the hotel and catering industry and amusement parks industry. The price of water is important for the competitiveness of Danish companies if expenditure of water and wastewater is a component of their production costs.

Regulation places a cap on revenue

Economic regulation of the water sector entails that an overall cap is placed on each company's revenue. The revenue is collected as tariffs from household consumers and business clients.

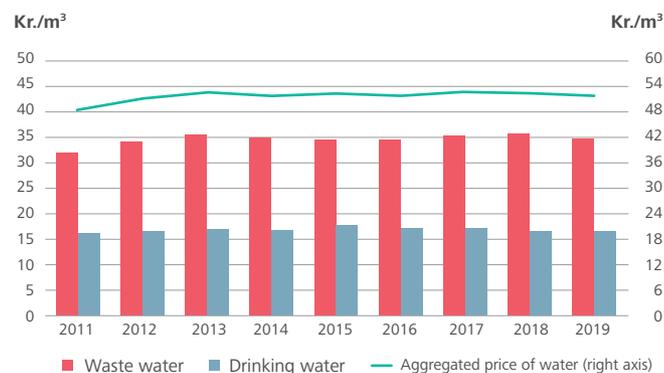
A water or wastewater company's revenue cap has to cover operating, investment and financial costs and non-impactable costs; see Box 1.

Slight increase in revenue caps since 2011

In 2019, the DKK 15bn total revenue cap for the water sector as a whole breaks down into approximately DKK 5bn for water companies and DKK 10bn for wastewater companies.

In 2019, the revenue cap is DKK 52 kroner per cubic metre of water, which is DKK 3.0 per cubic metre higher than in 2011; see Figure 3. This increase is attributable, among other things, to an increase from 2011 to 2013 in the wastewater companies' investment costs.

Figure 3
Trend in revenue caps, 2011-2019, by cubic metre of debited water



Note: The revenue cap totals expressed in cubic metres are weighted by the debited volume of water.

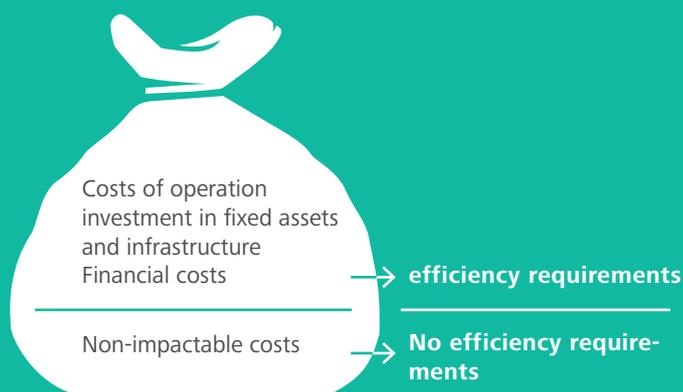
Box 1: What does a revenue cap consist of?

Revenue caps impose an upper limit on company revenues. For each water and wastewater company, a revenue cap is based on the costs of operation, maintenance, investment in fixed assets and infrastructure, financial costs, and a number of non-impactable costs such as taxes.

The water companies' revenue caps are subject to annual efficiency requirements. However, some costs are not subject to these requirements. These are the so-called non-impactable costs. They differ from the other (impactable) costs in the revenue cap in that they are not subject to efficiency requirements, cf. Figure.

The fraction of the revenue cap pertaining to operating, investment and financial costs was in 2016 set on the basis of financial statements from 2013-2015. This base value is then adjusted annually in line with efficiency requirements, price trends and by 'additions' if the companies are to perform new tasks.

Wastewater companies incur costs associated with diverting wastewater from customers to a wastewater treatment plant, purifying it and discharging the water back into the natural environment in the quality required by environmental regulation. Wastewater companies also deal with the increasing volume of precipitation that lands on roofs and surfaces that drain into sewers.



The trend in revenue caps expressed per cubic metre of debited water is broadly similar to the consumer price trend expressed in cubic metres of water in Figure 1. However, the revenue caps trend and the consumer price trend are not directly comparable because the consumer price includes VAT, and the revenue caps also include revenue from business clients. Moreover, water and wastewater company revenues also derive from a number of fixed, non-consumption-dependent inputs.

In addition, some companies do not collect revenue corresponding to their full allowable revenue cap. If revenue caps are higher than accounting costs but the tariffs charged are higher than those costs, the water and wastewater companies have the option of accumulating savings.

Today, the total sum of savings held by the companies amounts to DKK 2.3bn, which corresponds to approximately 15 per cent of the revenue caps.⁴ This statement disregards the share of savings that is used for debt payments on existing facilities.

What drives increases in the revenue caps?

Overall, the efficiency requirements are instrumental in bringing the revenue caps down annually towards the effective cost level. But other factors have the opposite effect:

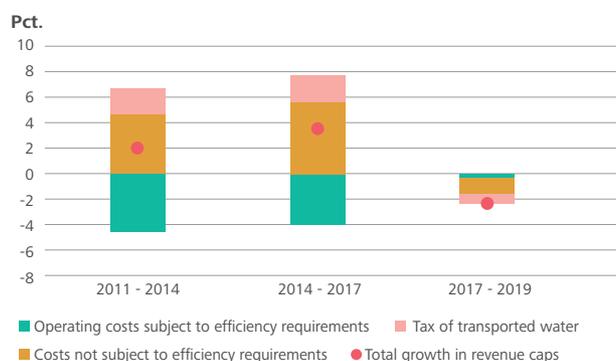
Thus, a revenue cap may be raised, for example, if a company is required to undertake new tasks. In this case, the revenue cap will be raised by an addition. Subsequently, the company is allowed to collect an increased tariff from its customers corresponding to the addition by which the revenue cap was increased. The most cost-driving additions require municipal approval. A revenue cap might also be increased in the event of a company merger.

The changes in revenue caps can also be expressed in terms of the influencing factors of different cost types determined for the following three periods: 2011-2014, 2014-2017 and 2017-2019. The cost types are 1) operating costs subject to efficiency requirements⁵, and 2) costs not subject to efficiency requirements, and 3) water companies' tax for transported water (this tax is included in the revenue caps, even though it is passed on to the state).

The results for the water companies show that both tax for transported water and – especially – costs not subject to efficiency requirements were the main drivers behind the increase in the revenue cap from 2011 to 2017. On the

contrary, operating costs subject to efficiency requirements were a driving factor behind the reduction in the revenue caps; see Figure 4.

Figure 4
Factors influencing the water company revenue cap trends



Note: Each bar shows the influencing factor within the given period.

Within the period 2017-2019, the revenue caps of the water companies were lowered slightly. This was partly due to amended regulatory adjustments in 2016, which meant that increases in the revenue cap were "deferred" to a subsequent year; see below. The fact that the operating costs not subject to efficiency requirements did not lead to a decrease in the revenue caps might be attributable to new cost-driving tasks "counteracting" the revenue cap efficiency requirements.

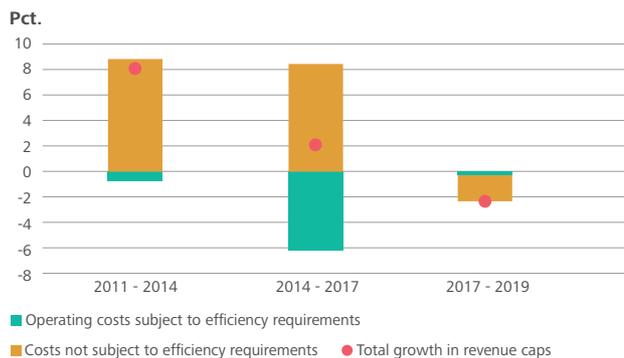
The tax on transported water accounts for one third of the water price. This is a statutory tax, which the water and wastewater companies are required to charge to their customers and pass on to the state. Until 2017, this tax led to an increase in the revenue caps after which the tax decrease due to a tax reduction.

For the wastewater companies, the influencing factor was determined for operating costs subject to efficiency requirements and costs not subject to efficiency requirements. Until 2017, cost types not subject to efficiency requirements were an influencing factor for an increase in the revenue caps, while operating costs subject to efficiency requirements were a negative factor in the period 2014-2017; see Figure 5.

⁴ Savings is calculated from the companies' accounts for 2018 as current assets less current liabilities.

⁵ Includes all costs that were not subject to efficiency requirements until 2017, including operating costs for environmental and service targets, additions for co-financing of climate projects, investment costs, net financial costs and taxes, etc. Financial costs are included in this calculation from 2017 onwards, although they were subject to efficiency requirements from 2017. All years also include corrections as a result of the companies charging more/less than they were permitted to (from 2017, only more) as well as a correction for past over/under-charging. The corrections account for only a small proportion of the influencing factor in all periods.

Figure 5
Factors influencing wastewater company revenue cap trends



Note: See Figure 4.

Wastewater companies' costs not subject to efficiency requirements contributed to an increase in revenue caps until the end of 2017. Increased investment was a notable influencing factor in the period 2013-2017 during which time investments were not yet subject to efficiency requirements. From then on, these costs led to a decrease in the revenue caps, presumably as a result of investments also being subject to efficiency requirements post-2016.

The fact that operating costs subject to efficiency requirements scarcely contributed to a lowering of the wastewater companies' revenue caps in the period 2011-2014 is primarily due to the temporary revenue cap additions that the companies were granted. They were a result of the original revenue caps being set too low due to outdated baseline values that, therefore, resulted in a correction. The fact that the efficiency requirements did not lower the revenue caps in 2017-2019 is attributable to new addition-triggering projects, as in the case of the water companies.

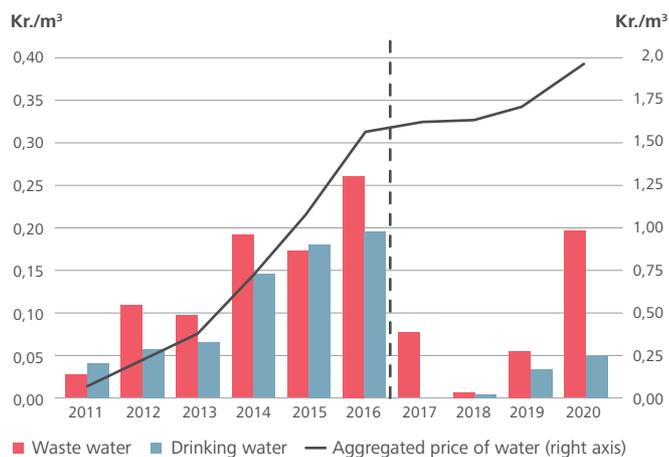
Revenue caps raised as a result of new tasks

Since economic regulation was introduced in Denmark in 2009, it has been possible for the water and wastewater companies to permanently increase their revenue caps by means of an 'addition', i.e. an increase in the upper limit to their revenue to finance the new tasks.

Examples of new, addition-triggering tasks are climate adaptation projects, intensified environmental interventions, raised service level, enhanced security of supply, relocation of water pipes to make way for new roads, extended geographical supply areas etc.

During the period, the aggregate revenue caps were raised by just under DKK 1bn for these purposes. This corresponds to an increase in water prices of just under DKK 2.00 per cubic metre of water; see Figure 6.

Figure 6
Revenue cap additions, 2011-2020



Note: The figure illustrates increases in the revenue caps as a result of permanent additions for new tasks. The black line shows the accumulated cost of additions (right axis). The vertical dashed line indicates changes to the addition-eligibility rules. Additions for 2020 are provisional figures from company reporting in 2019.

are provisional figures from company reporting in 2019. The bars (left axis) show new permanent additions per annum. The additions increased until 2016. Amendments to the addition-eligibility rules came into force in 2017, which meant that additions were granted based on actual expenditure incurred as opposed to budgeted costs. As a result, new additions in 2017 and 2018 are very low while the additions increase as costs are incurred and incorporated in the revenue caps. The cost of total additions (black line, right axis) will therefore continue to increase in the years to come.

Given that revenue caps are being raised on an ongoing basis to accommodate new tasks, this makes it more important to maintain a keen focus on cost effectiveness to ensure that the nation gets as much clean water as possible for its money.

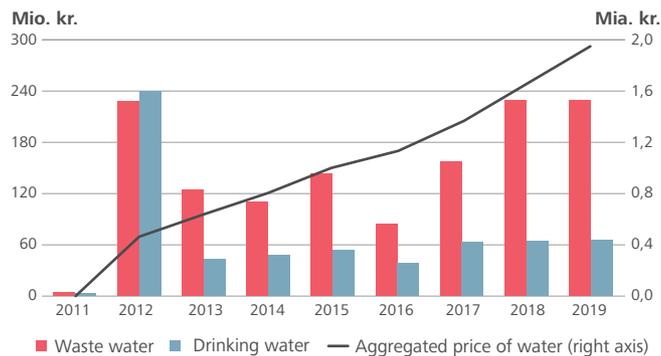
Efficiency requirements lower the revenue caps

Economic regulation is intended to encourage efficient operation for the benefit of household consumers and businesses alike. This is effected primarily by means of efficiency requirements – both a general requirement, so that the water sector as a monopoly sector keeps up with productivity trends in the rest of society and an individual, benchmarking-based requirement.

The individual efficiency requirement is calculated on the basis of a benchmarking model that compares the efficiency of all companies with the most efficient among them and from that determines an efficient cost level and an efficiency potential for each company. From a regulatory perspective, revenue cap reductions ensue from the efficiency require-

ments.⁶

Figure 7
Efficiency requirements in the water sector, 2011-2019



Note: The annual efficiency requirements comprise both requirements from the benchmarking model and the general efficiency requirements. The curve (black) indicates the accumulated efficiency requirements, with the values indicated on the right axis.

Source: Own calculations.

In the first two years (2011 and 2012), the efficiency requirements were not commensurate with the other years because they were made during the transition phase to economic regulation. The high requirements in 2012 were due to an extraordinary correction of the level of operating costs in the revenue caps as part of the implementation of benchmarking in the sector.⁷

The cost types that are subject to efficiency requirements were extended in 2016 with effect from the 2017 revenue caps. In the revenue caps predating 2017, the efficiency requirements were only applicable to water and wastewater companies' operating costs, which represent about a quarter of their total costs. From 2017, the efficiency requirements were applied to both operating and investment costs as well as financial costs. In addition, the definition of which operating costs are to be subject to efficiency requirements was expanded.

Consequently, the efficiency requirements show an increase from 2016 to 2017. The increase from 2017 to 2018 was mainly due to technical improvements in the benchmarking model, which resulted in a more accurate model.

With the amendments made to the rules in 2016, the smaller water and wastewater companies with an annual debited water volume of less than 800,000 cubic metres were

⁶ When setting individual efficiency requirements, a number of precautionary principles are applied, the most important of which are that 1) the individual benchmarking-based efficiency requirements should not be obtained immediately but in 8-year cycles; b) a so-called best-of-two approach is applied in the benchmarking, (c) a cap is set on how high a single requirement may be in any one year, and (d) four-year regulatory

⁷ This extraordinary correction is described in more detail in a supplementary paper on performance-oriented benchmarking "Nyt tillæg til resultatorienteret benchmarking 2012", available here: <https://www.kfst.dk/vandtilsyn/benchmarking/okonomiske-rammer-modelbeskrivelse-og-resultater/benchmarking-2012/>

exempted from the benchmarking and from 2017 they were no longer subject to an individual benchmarking-based requirement.

Water and wastewater companies' accounting costs have decreased

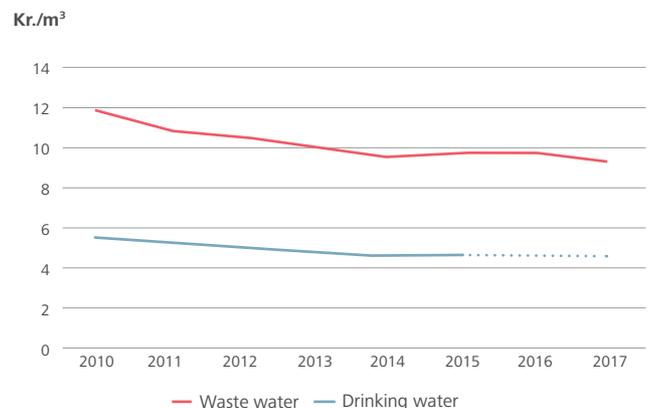
As stated, the requirements for efficiency improvements lower the cap on water and wastewater company revenues. This means that companies must reduce their costs in order to comply with their revenue cap. This makes it useful to examine the trends in the water and wastewater companies' accounting costs.

Since the regulation up to 2016 only required efficiency improvements for operation, the following only examines the trends in these particular operating costs.

From 2010 to 2015, accounting operating costs decreased by DKK 895m for the 289 companies included in this analysis.⁸

Denmark's water and wastewater companies' accounting operating costs decreased by DKK 1.00 and DKK 2.00 per cubic metre, respectively, in the period from 2010 to 2014, after which they remained relatively unchanged until 2017; see Figure 8.

Figure 8
Accounting operating costs for water and wastewater companies, 2010-2017



Note: The costs are shown in DKK per cubic metre and in current prices. Due to new rules in 2016 there is a gap in the data for 2015 because the definition of operating costs was amended. The trend is presented without the new costs that were included as operating costs under the new rules. Another gap in the data occurs for 2016, as the operating costs of the water companies were not reported to the Danish Water Regulatory Authority.

Source: Danish Water Regulatory Authority.

Overall, the water and wastewater companies' accounting operating costs decreased by DKK 3.0 per cubic metre from 2010 to 2017. This is roughly in line with the requirements

⁸ In the same period, these companies were subject to requirements for efficiency improvements worth DKK 945m. Since the revenue caps may be higher than the costs, the difference is due to the fact that the requirements apply to the caps, and not to the costs.

for efficiency improvements to which the companies were subject during this period.

The cost reductions were greatest up until 2014, after which they slowed up until 2017.

Potential efficiency improvements remain in the water sector

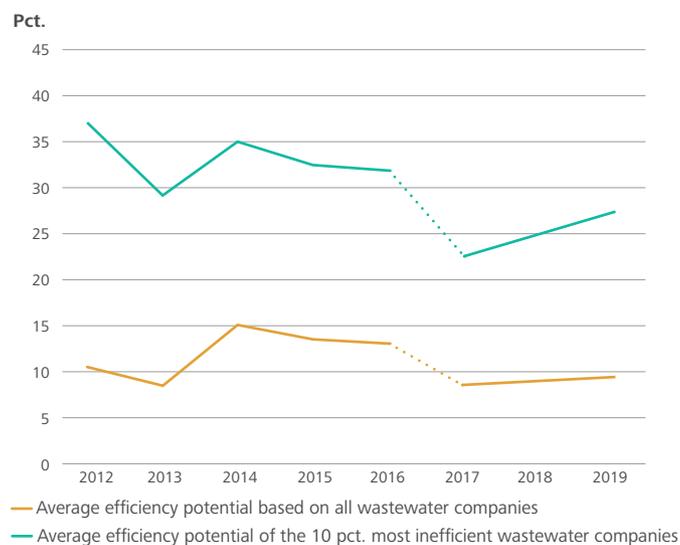
Another way of assessing the efficiency of the water sector is to look at the trend in potentials for efficiency, as projected in the benchmarking model.

The latest projection shows efficiency potentials of DKK 771m, breaking down into DKK 187m for water companies and DKK 584m for wastewater companies.

This type of projection of potential is intrinsically a 'snapshot'. A comparison of 'snapshot' potentials over time indicate that, in percentage terms, they are lower today than in 2010 – possibly as the least efficient become more efficient. Conversely, it might be an indication that the most efficient become less efficient.⁹

For the water companies, the average potential was about 10 per cent in 2019, which is roughly the same level as in the first benchmarking in 2012; see Figure 9.

Figure 9
Water company potentials from the benchmarking model, 2012-2019



Note: Due to the transition in 2016 to benchmarking every two years, water companies were not benchmarked for the purposes of the 2018 revenue caps, so the data point for this year is an average between 2017 and 2019.

Source: Own calculations based on the companies' reported data.

⁹ Changes in the benchmarking model also affect the scale of the potentials. Changes have been made to the benchmarking model on an ongoing basis. The biggest methodology shift occurred in 2016-2017 with the introduction of TOTEX benchmarking and a new method for implementing requirements. This makes it expedient to examine the trend in two periods: 2010-2016 and 2017 onwards. Learn more about the benchmarking model here: <https://www.kfst.dk/vandtilsyn/benchmarking/>

The 10 per cent most inefficient companies' potentials are generally higher than 25 per cent. This means that these companies' costs are 25 per cent higher than they might have been when benchmarked against the (comparatively) most efficient ones.

For the wastewater companies, the average potential in 2018 was approximately 7 per cent, which is three percentage points lower than in the first benchmarking; see Figure 10.

Figure 10
Wastewater companies' potentials from the benchmarking model, 2012-2019



Source: Own calculations based on the companies' reported data.

Up until 2016, the potentials of the 10 per cent most inefficient companies were more than 30 per cent, and in 2018 were calculated as more than 25 per cent.

Changes in potential from one year to the next can be a result of the efficiency initiatives but in some cases, they might be due to changes in the benchmarking model.

The general steep fall in the potentials from 2016 to 2017 is primarily due to the introduction of a new and very substantial technical precautionary approach in the benchmarking model¹⁰. In addition, investment costs are included in the benchmarking post-2016, which also contributes to reducing the potential.¹¹

¹⁰ Due to uncertainty in the benchmarking models calculation of the average operating costs for wastewater treatment plants in the OPEX-model, a precaution was temporarily introduced to the benchmarking model. The objective was to remove a systematic favouring of small wastewater companies over larger wastewater companies. Therefore, the return to scale in the benchmarking model was changed from constant to decreasing in 2017. From 2018, the return to scale is again assumed to be constant.

¹¹ This is due firstly to there being less variation in the input and output ratio in the benchmarking model for capital expenditure than for operating costs because a proportion of the cost data derives from POLKA (the official spreadsheets on which companies report prices and useful life of assets). Second, capital expenditures prevail over operating costs, which is why differences in operating costs are accorded less significance.

From 2017 to 2018, the potentials increased slightly. This is due to an enhanced benchmarking model including a change in the method for assessing outliers in the benchmarking model: companies are not automatically excluded on the basis of estimated threshold values. Instead, a company's representativity overall is evaluated qualitatively.

The significance of economic regulation for prices

The significance for consumer prices of the efficiency requirements and increases in the revenue caps in 2019 is shown in Figure 11. The figure solely illustrates the average consumer price of water and wastewater – and not the price of business customers.

Figure 11
Actual consumer price and estimated consumer price in the absence of efficiency requirements and revenue cap additions



Note: Price trends are shown for the same companies featuring in Figure 1.

In 2019, the consumer price is approximately DKK 67.1 per cubic metre of water. If the water and wastewater companies had not been subject to efficiency requirements during the period of economic regulation, the consumer price today would have been DKK 71.3 per cubic metre, or DKK 4.2 per cubic metre higher than at present.

If the water and wastewater companies had not been entrusted with the new tasks that have led to increases in the revenue caps since 2011, the consumer price today would be DKK 65.0 per cubic metre.

Conclusion

Since 2010, increased investment and additional new tasks, notably within domains such as security of supply and climate adaptation have driven up costs in the water sector. However, efficiency requirements have kept the real price of water stable since 2015. In the light of a projected sustained increase in the level of investment, it is consequently important to continue to focus on cost effectiveness by means of a regulation that ensures the realisation of this monopolistic market's efficiency potential and keeps pace with productivity improvements in the economy generally, for the benefit of Danish household and business consumers alike.