May 2019

Briefing note

Reducing the Energy Footprint of the Water Sector

Possibilities, Success Stories and Bottlenecks

Summary

In the past, the water services sector was seen as energy intensive. However, for a number of years now, water operators in many countries are firmly engaged on a pathway towards optimised energy use through various measures in both drinking water and waste water services. With the commitment of the EU to reducing greenhouse gas emissions and to contribute to the UN Sustainable Development Goals, efforts have been stepped up.

The water sector has made great strides in becoming more energy-friendly. Among the implemented solutions are reducing the energy consumption for heating, treatment, distribution and collecting of water, improving energy efficiency and the generation of energy through waste water components.

There are, nevertheless, limits to these improvements. Principle factors include local configurations and finding the right balance between environmental objectives, economical feasibility and water services affordability.

National regulatory frameworks, investment cycles and some technical aspects may still slow down the movement towards a low energy sector. Efforts must be supported by policymakers to better address future challenges through an enabling regulatory framework, support for the establishment of financial instruments alongside the unambiguous implementation of the Control at Source Principle to avoid new treatment requirements that consume energy.

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1. Introduction

For many years, the water sector has been engaged in ambitious measures to reduce its energy consumption. However, with the effects of climate change affecting all our activities, a new sense of urgency has been added to our efforts.

The EU engaged in reducing greenhouse gas (GHG) emissions to mitigate the effects of climate change through the 2020 Climate and Energy Package and the 2030 Climate and Energy Framework.

Three targets are defined:

~ Progressively reducing GHG emissions by:
  - 20% in 2020
  - 40% in 2030
  - 60% in 2040 and
  - 80% in 2050, compared to 1990 emissions

~ Increasing the use of renewable energy by 20% by 2020 and 27% by 2030

~ Improving energy efficiency by 20% in 2020 and 27% in 2030.

In the long-term strategy 'A clean planet for all' (November 2018) the EU called for a climate-neutral Europe by 2050, in line with the United Nation's Paris Agreement objective to keep the global temperature increase to below 2°C and, if possible, 1.5°C. Member States will have to arrange their own engagements in relation to these European targets.

Water utilities are a source of GHG emissions, indirectly through energy use and chemicals, and directly through gases that have a high global warming potential such as nitrous oxide and methane (around 1% of the total industrial air emissions for Europe[1]). In reducing our energy use we would significantly cut our overall carbon footprint.

Moreover, the UN's Sustainable Development Goals promote access to safe drinking water and sanitation but they also call for improved resource-efficiency.

In our Briefing Note on Water and the Circular Economy[2], we addressed energy use by outlining the general vision for a resource-efficient water sector. This paper will explore in more detail how water service providers are engaged in reducing their carbon footprint and GHG emissions through efficient energy use, by analysing their energy performance, as well as the lessons we can learn from the sector's leaders.

Saving energy and producing renewable energy are major tools to improve the efficiency of our sector. It is complemented by a mind-set change towards a circular economy. This can become a strong incentive to reduce GHG emissions through the

[1] Eurostat, 2017.
[2] http://www.eureau.org/topics/waste-water/waste-water-briefing-note/3010-briefing-note-on-water-and-the-circular-economy-package/file.

better recycling of some water components, such as treated waste water, organic matter, nutrients or heat in water. It will lead our sector in becoming more resilient in addition to increasing the value of the services for our customers.

This environmentally friendly management of water services is illustrated by inspiring cases from the field, in real life conditions, or by the results of recent science-based studies exploring new ways of thinking and operating.

2. Where do we come from?

Meeting society's demand for safe drinking water and waste water services may involve energy intensive processes. It is estimated that the net annual electricity consumption for urban water management accounts for about 5.5% of the electricity consumed by households in one year in Europe[3]. Depending on water sources, topography, waste water treatment efficiency and other aspects, this percentage can differ substantially between regions.

Traditionally, the largest energy use for drinking water suppliers is the electricity used for pumping (approximately 80%). Where water scarcity, exuberated by climate change, and/or increased water demand requires it, desalination may be used for drinking water production. This process usually consumes additional energy related to reverse osmosis processes and high pressure pumping.

Waste water treatment plants (WWTP), on the other hand, also utilise mechanisms necessitating heavy energy consumption. They make use of blowers to provide oxygen in activated sludge reactors with fine bubble aeration, especially for nitrogen removal purposes, for instance. Other aeration systems, pumping, propellers and mixers, as well as solids processing, usually account for most of the electricity use.

Apart from electricity, water operators use various other energy sources, including fossil fuels, such as oil and gas.

It is also worth noting that, for many water operators, energy consumption is one of the highest operational cost factors. With power prices set to increase over the next years, water and waste water operators have a very practical reason to optimise their energy use in addition to more general sustainability goals.

Against this background, the water services sector is committed to continuously improving its energy balance. Progress can be measured in kilowatt hour (kWh) per m^3 of drinking or waste water (focus on cost reduction), in CO_2 emissions per m^3 (focus on mitigation, decrease of fossil fuel consumption), or kWh per person equivalent (energy used is proportional to the load removed). One could also take the degree of energy self-sufficiency as key indicator (focus on energy neutrality or being energy positive). Irrespective of the measurement unit used, it is important that we work with long-term visions and goals supported by an enabling regulatory framework.

[3] EEA Technical report No 5/2014: Performance of water utilities beyond compliance.

3. What are the potential improvements?

In the short and medium terms, the water services sector has the great potential to improve its energy balance along the whole water cycle by increasing our energy-efficiency and producing renewable energy. A complete reorganisation of the systems complemented by new approaches might be more appropriate in the long term.

Energy Saving

Reducing energy consumption in drinking water plants

Energy savings in drinking water treatment processes are feasible by improving the operation and optimisation of the supporting facilities. There is potential to save energy by reducing the need to treat water treatment residues.

Some water treatment processes can be optimised by replacing inefficient and over-dimensioned components, or by deactivating parts which are no longer required.

Energy savings can also be obtained through the choice of water resources. If several water resources are available the resource that requires less treatment, with respect to raw water quality and less pumping energy, must be used.

Reducing energy consumption in drinking water networks

<u>Pressure and leakage management</u>

Energy savings in drinking water networks can be optimised through pressure management and reducing leakages. Less pressure will use less electricity and less water volume will be lost. However, the pressure of the network is highly dependent on the infrastructure and the services to be provided (e.g. fire-fighting requirements).

<u>Pumping Stations</u>

The design and operation of water pumping stations must contribute to saving energy by a needs-based, efficiency-optimised design of the system and its components (pumps, motors, valves, pipes, etc.), while operating the plant at its best efficiency point.

Correct operation and good maintenance of pumping equipment is also necessary. This is particularly the case for boreholes which provide more than 40% of drinking water in Europe. Due to their huge number and rather small size, they are not always equipped to be the most energy-efficient, something which could be resolved through quick corrective actions. In addition, technical optimisation can improve efficiency by way of avoiding unnecessary pump head and pressure losses, and optimising pump operation. The energy requirement of pumps behind storage tanks can be minimised by keeping the level in the storage tank as high as possible.

Reducing the amount of water collected by sewer systems

Most of the European sewer networks are combined systems that collect waste water and storm water from roofs, streets, parking lots, etc. Storm water mixed with waste water must be collected, often pumped and sometimes treated several times in a WWTP. The less water collected means the less energy is consumed. Reducing impervious surfaces, enhancing the infiltration of storm water in soils (i.e. shortening the storm water cycle in cities); promoting natural water retention systems; proper disconnection of 'flu clean water' from sewers (groundwater, drainage, sources, brooks, water from heat pump systems, cooling water, etc.); and promoting separate sewer systems when appropriate, are all measures that can save energy through reducing the volume of water entering our waste water network and treatment plants.

Likewise groundwater must be prevented from entering the sewer systems, as this substantially increases energy use from pumping. Denmark is currently determining the related costs and energy consumption.

Maximising gravity to collect (waste) water

Depending on the local topography, making use of the natural landscape to take advantage of gravity for collection processes must be preferred to a pumping station that requires electricity to transport water.

Reducing the energy consumption in waste water treatment plants

It is possible to reduce energy consumption through various actions, including:

~ Regular energy audits (both electricity and heat), possibly accompanied by internal energy saving targets

~ Improving the operation management (best practices and modelling + Scada system improvements + energy efficiency features)

~ New and more energy efficient equipment

~ Preventive maintenance – good quality of data comes from maintained online meters and instruments. Well maintained devices keep their energy-efficiency.

Reducing water consumption per capita

Reducing water consumption in the home leads to energy savings in the production, supply, collection and treatment of water. Here are some ways that consumers can cut their domestic consumption:

~ Improving the efficiency of household devices (dishwashers, washing machines, etc.)

~ Reducing leakages inside buildings (immediately repairing dripping taps or faulty toilet flushes, etc.)

~ Promoting toilet cisterns instead of flush valves

~ Harvesting rain water

- Reducing the stored rinse quantities in toilet cisterns (from 15L to 7.5 or 6L per flush)
- Avoiding multiple flushes to clear toilets by using the appropriate materials. Soft multilayer toilet paper or wet wipes are not flush-friendly. Changes in their component materials and manufacturing could make them easier to flush and therefore we could save up to 800,000 m^3 of water every day by flushing only once[4]
- Promoting consumer education through communication campaigns on energy and the carbon footprint of water consumed
- Regular energy audits (both electricity and heat)
- Improving the operation management (best practices and modelling + Scada system improvements + energy efficiency features)
- New and more energy-efficient equipment
- Preventive maintenance – good quality of data comes from maintained online meters and instruments. Well maintained devices keep their energy-efficiency.

Reducing Hot Water Use

Heating water for baths, showers, cleaning clothes, dishes, etc., is the most energy consuming step in the urban water cycle accounting for approximately 80% of the overall energy use. The remaining 20% is consumed by water service provisions[5]. Simple measures like optimising home water heating systems, insulating hot water pipes in households, taking showers instead of baths and promoting the use of renewable energy or heat recovery to heat water would help reduce energy consumption without compromising human health and well-being.

Energy efficiency

One of the key aspects of the Energy Union is the "Energy Efficiency First" Principle. With this in mind, water service providers strive to reduce the amount of energy needed for their services by increasing the energy-efficiency of the networks and treatment processes. Many promising technologies are already available.

When selecting the treatment methods, the energy efficiency of the various methods should enter in the decision-making process. On the other hand, if an energy-intensive treatment step is technically necessary, it must prevail despite its high power consumption.

Higher pump efficiency in the drinking water and waste water networks has top priority in many areas. Using high-performance pumps fitting the demand associated to the

[4] Assuming that one third of consumers in Europe flush twice per visit, two times a day.
5 J.A. Elías-Maxil, J.P. van der Hoek, J. Hofman and L. Rietveld (2014) Energy in the urban water cycle: Actions to reduce the total expenditure of fossil fuels with emphasis on heat reclamation from urban water, Renewable and Sustainable Energy Reviews, 30, pp 808-820.

appropriate pressure control strategy can realise around 20% savings compared to more traditional approaches or older types of pumps.

WWTPs offer significant potential for efficiency improvement. Optimal pump and pumping station design with appropriate maintenance strategies to avoid clogging could save between 5-25% of energy use in the sewer system.

Optimisation and/or replacement of the aeration infrastructure, combined with online measurement and control of the aeration process may also lead to a reduction in energy consumption of 25-60%.

Using instruments at their optimum performance level; applying intermittent versus continuous operations where possible (e.g. mixing, pumping); implementing more energy efficient equipment (screw blowers, high speed turbos, air header valves) and more efficient processes (anammox, other new technologies) can improve the energy efficiency of WWTPs.

All of these measures will not only save energy but also maintain, in some cases even increase, the level of service performance. They are independent from the size of the infrastructure and should be an objective for all operators. However, the priorities may vary depending on the specific situation of each water service provider.

The world's first energy-neutral catchment area: Marselisborg, Aarhus Water, Denmark.

- Energy neutrality for the whole cycle (water supply + waste water)
- Catchment area for 200,000 people.
- Energy production based only on municipal wastewater
- Total investment cost for upgrading infrastructure was around €3 million with a payback timeframe for most of the installation of less than 5 years.

Marselisborg catchment area	**Status 2014**	**Status 2018**
Energy consumption		
Water treatment, distribution [kWh] (avg. 0,59 kW/m^3, high)	3,1 mill	3,6 mill
Wastewater transport [kWh]	0,7 mill	0,8 mill
Marselisborg WWTP	3,4 mill	3,1 mill
Total energy consumption [kWh]	***7,2 mill***	***7,5 mill***
Energy production		
Electricity production [kWh]	4,4 mill	4,8 mill
Heat production [kWh]	2,1 mill	2,6 mill
Total energy production [kWh]	***6,5 mill***	***7,4 mill***
Own energy supply degree		
Wastewater treatment process, electricity and heat [kWh]	192%	234%
Wastewater treatment process, electricity [%]	131%	153%
Total Marselisborg catchment area [%)	***90%***	***99%***

Renewable energy production

The water sector has significant potential to produce renewable energy, which can replace fossil fuels and help the European Union and Member States to meet their renewable energy targets.

Power production from turbines

Depending on the topography, raw water or drinking water may flow down a slope before reaching the treatment plant or the end user. This mechanical energy can be transformed into power by installing turbines along the way.

> The Greek city of Athens produces electricity by diverting aqueduct water to power plants before sending it back to the network for drinking water distribution. It generates 5MW (megawatts) per year. Iraklion in Crete is planning to build a similar facility.
>
> Thanks to a favourable topography, the drinking water supply of the city of Vienna, Austria generates 5 times the electricity needed for its water production and distribution. On the waste water side, the WWTP generates electricity by using the height difference between the water-level of the plant and the receiving water.
>
> Helsinki Metropolitan Area, Finland uses Lake Päijänne as a raw water reservoir. There is more than a 100km long rock tunnel between Lake Päijänne and the Helsinki water treatment plant, which is equipped with a power plant for energy production. Heat recovery is integrated into the system.
>
> The WWTP in Brussels-North, Belgium generates 18% of its energy requirements through a turbine, which recuperates the energy released by the effluent after the final settlement tanks.

Biogas production from sewage sludge

Sewage sludge is an organic material which can generate biogas by anaerobic digestion, which is on average 65% methane and 35% carbon dioxide. The total chemical energy potential is estimated at 87,500GWh (gigawatt hour) per year, or the output of 12 large power stations[6]. The technology is mature and widely used, and the sector already produces over 6,381 GWh/year[7] from biogas production in nine European countries.

The performance of digesters and associated biogas production can be increased by pre-treatment of the sludge with advanced processes such as Cambi thermal hydrolysis, ultrasonic disintegration or electroporation, or by applying co-digestion with organic waste if allowed. The sludge waters coming from digested sludge dewatering represent an additional (nutrient) load for the WWTP, which might hinder the optimal use of available capacity. Separate treatment of these sludge waters, in this case, might be necessary.

Excess heat from the power plant can also be used, and it can even be upgraded by the

[6] Powerstep policy brief (POWERSTEP.EU/SYSTEM/FILES/GENERATED/FILES/RESOURCE/POLICY-BRIEF.PDF).
[7] Sustainable biogas production in municipal WWTP, IEA Bioenergy (http://www.iea-biogas.net/files/daten-redaktion/download/Technical%20Brochures/Wastewater_biogas_grey_web-1.pdf).

ORC-process to a more valuable electrical energy. The biogas produced can be used directly for heating or in gas turbines (combined heat and power, CHP) to generate heat and electricity. Alternatively, it can be fed into the municipal gas grid or used by gas powered vehicles after upgrading to more than 95% of methane. In this case biogas must be cleaned and compromised to a similar quality as natural gas.

As biogas is a storable resource, it can be injected into smart grids and used during peak demand or low solar and wind energy production.

In Oslo, Norway, the Bekkelaget WWTP produces biogas out of sewage sludge, which is refined and used as biofuel for waste trucks and buses*. The WWTP produced 1.76 million Nm³ of biogas fuel in 2018, which reduced Oslo's climate emissions to an equivalent of 1.7 million litres of diesel. It contributes to the reduction of Oslo's carbon footprint of 5,000 tonnes of CO_2 eq. in 2018. Switching over from fossil-diesel to sludge-derived biomethane has also helped reduce emissions of other pollutant gases generated by diesel vehicles.

Finally, it is worth noting that the carbon dioxide emitted by the combustion of biomethane is biogenic and not fossil fuel.

The Viikinmäki, Finland, WWTP maximises and prioritises electrical energy production, recovering wasted heat from several points. The plant has ran an ORC-process for electrical energy production from exhaust gas heat since 2014.

In Strasbourg, France's fourth biggest sewage plant, the Biovalsan project, supported by the LIFE+ programme of the European Commission allowed for the injection of 1.6 Mm³ of biomethane into the gas grid (equivalent of the gas consumption of 5,000 households) in 2015.

Thermal energy recovery from the whole water cycle

Sewage is an important source of heat as it is usually not significantly affected by outside air temperatures. Its temperature remains relatively stable throughout the year[8]. This heat can therefore be recovered in the sewer networks or at the WWTPs by heat pumps providing renewable heating to buildings, swimming pools or feeding cities' heating systems. While first pilot projects have proven the feasibility of this concept, technologies need to be further enhanced before envisaging a large-scale roll-out. Economic viability is still largely uncertain and implementing it would require rather large sewers and flows.

In WWTPs, heat can be recovered from effluent (aquathermia), or from the sewers (riothermia). Heat recovery from effluent has the advantage that it has little impact on the optimal treatment process temperature, but projects may be distant from where the heat is needed. Heat recovery from sewers is more suited to urban areas.

* Oslo Kommune – the sewage adventure (http://bit.ly/1y4NaPz).
[8] AgentschapNL & UVW - Wastewater management roadmap towards 2030 (http://bit.ly/1tfHLrY).

Depending on the process and climate conditions, heat embedded in waste water may be necessary to maintain the efficiency of the process, especially for nitrogen removal. In those conditions, the heat recovery should be favoured after the biological treatment.

On the drinking water side, heat exchange with the drinking water network may allow for heat or cold recovery. Tests carried out in The Netherlands show no impact on the drinking water quality[9].

Bucharest, Romania and Brussels, Belgium recover heat from waste water in the sewers, while the Katri Vala heating and cooling plant in Finland uses the effluent of the WWTP as a heat source for heat production of 100MW annually. In Gothenburg, Sweden, the effluent waste water is used by the local energy company to produce 350GWh per year, which are being fed into the district heating system.

The Nosedo WWTP in Milan, Italy, is heating and cooling its offices through heat exchangers in waste water. They have a project to heat and cool a residential area in the neighbourhood.

In France, more than 15 cities use the heat from waste water in sewers to provide heat to swimming pools, administrative buildings and even the Elysée Palace – residence of the President of the French Republic.

Heat recovery from sewage sludge incineration

The high potential of energy recovery from sludge can be accessed by way of its dewatering and drying. Dried sludge has an energy content of about 3.5MWh/TDS, which may give about 2.5MWh/TDS with efficient new-generation mono-incineration (70%). However, about the same amount of energy - most of it thermal - is needed to dry the sludge. Hence, the concept might become energy sustainable if the sludge is dried with low value waste heat from other sources.

An additional advantage of mono-incineration is that it can be combined with Phosphorus recovery from the ashes. Yet, processes must be controlled to avoid the emission of nitrous oxide, which is a very high GHG.

[9] J.P. van der Hoek, S. Mol, S. Giorgi, J. I. Ahmad, G. Liu and G. Medema (2018) Energy recovery from the water cycle: Thermal energy from drinking water, Energy, 162, pp 977-987.

Solar and wind energy

Water and waste water treatment plants are usually big, with a large ground footprint. Solar and wind energy production can be developed as alternative energy sources if the environment of the site allows it. Solar energy production is a good solution for the electrical source since the price of the solar panels is already competitive and payback times are reasonable.

> The WWTP Harelbeke Aquafin (Flanders, Belgium) installed 6,500m³ of solar panels with a capacity of 1MW, producing around 820,000kWh/year, representing about 20% of the energy needs of the plant.
>
> In Gothenburg, Sweden, solar panels with a capacity of 40kW were installed and expected production is 35,000kWh/year. Also, more space is being made available for the local energy company to install many more solar panels.

Reducing the energy footprint in corporate management

EurEau's 32 member associations together represent more than 70,000 companies, which together employ almost 500,000 people. Regardless of size, they take action to reduce energy consumption not only in their operational business, but also in ancillary activities. Offices and buildings are managed in an increasingly efficient way. More and more of them are undergoing energetic renovation consuming less energy (e.g. modern lighting, appliances, smart heating and air conditioning, reduced water consumption in toilets, lunchrooms etc.). The employees are aware of the need to reduce the energy consumption at their workplace and feel responsible for taking small but effective initiatives (e.g. no single use plastic, ecological use of dishwashers, etc).

Regulations and procedures applied by water utilities are based on energy savings. Many companies introduce energy management systems such as ISO 50001, which aim to manage energy efficiently while taking into account the company's specific situation. Operators increasingly use electric vehicles and machines and are mindful of the energy footprint of business trips.

Water utilities often use green procurement tools, where energy efficiency can be one of the selection criteria.

While implementing the Corporate Social Responsibility policy, enterprises also influence their stakeholders and social environment. Thanks to public campaigns they encourage consumers to drink tap water and to serve it in restaurants reducing the use of disposable packaging, in turn creating savings of energy in production, transport, waste management.

4. What are the limits?

Local conditions determine the possible reduction of the energy footprint, such as the type of drinking water source, the level of required treatment, population density, the size of the plant, topography and others. Furthermore, water service providers must always try to find the right balance between environmental goals and economic feasibility.

Drinking water and waste water operators increasingly use computer-aided modelling to test different optimisation options for their processes. In some countries, this is becoming a part of the performance evaluation of WWTPs and will sooner or later become the norm for optimising energy demand.

The net energy consumption of a WWTP may also be affected by efforts to recover resources and provide water for reuse in the framework of the circular economy.

In specific cases, waste water operators may achieve energy neutrality or even become energy positive by combining energy efficiency measures with the production of renewable energy. Even if this energy neutrality is then applied only to the treatment plant itself, we see projects including the whole catchment area.

Measures to achieve this would require significant investment and implementation would be gradual. Differences in regional development levels need to be considered and solutions applied in large WWTP are not always adaptable to smaller plants. Water operators can always opt to buy green electricity if their aim is to reduce the carbon footprint as much as possible.

To achieve better efficiency of the sector, considerations must go beyond the part of the supply-chain controlled by water operators. In regions with hard drinking water, the use of individual softening devices in households can reduce GHG emissions from domestic water usage - for instance bottled water consumption - as much as the total GHG emissions of the water and waste water services.

In conclusion, achieving energy neutrality and energy positive plant operations should not become the general objective. However, optimising the energy consumption of our infrastructure must be a common thread for the sector.

Following energy audits, the WWTPs of Aarhus, Denmark, and those of Kakolanmäki and Viikinmaki in Finland succeeded in becoming energy positive by combining the highest energy-efficiency of processes; upgrading and optimising components; introducing innovative and less energy demanding processes (anammox) and improving the energy recovery by optimising the anaerobic digestion process and the heat exchange systems, respectively.

5. What are the bottlenecks?

The narrative is very appealing. Although we see progress across Europe, one could ask why the transition is not advancing faster. A number of reasons can explain this situation:

Regulatory framework

With a view to minimising the energy footprint of water services, Europe and national/regional governments must develop a supportive and enabling regulatory framework. Unfortunately, regulations may still act as a powerful obstacle. The EU's Renewable Energy Directive is seen as supporting the production of biogas from sewage sludge rather than hampering it. The issues are mainly linked to the national level. For example, in a number of Member States, WWTPs are not considered as energy producers and, hence, are not authorised to produce power in excess of their own needs and feed it into the grids.

Meanwhile, many water operators are already generating energy from sources not directly linked to water-related processes, such as solar and wind energy.

Member States must include all of these alternative sources in their national lists of renewable energy sources and authorise the feeding of renewable energy generated by WWTPs in municipal grids.

Financing and cost effectiveness

Big energy savings might require big capital-intensive investments and, therefore, exceed the financial capacity of water service providers. Operators in countries where full cost recovery is not guaranteed are particularly likely to postpone such investments. Also, high depreciation costs for existing infrastructures may be an obstacle.

The pay-back periods for investment decisions may be very long for certain investments - 8-10 years, or two thirds of the expected life time - or they may not pay back at all. Although a change of procedures for energy-related investments towards a procedure based on total cost of ownership instead of capital costs might increase confidence in long-term investments.

The European Union should authorise national financial incentives for energy-related investments of water service providers. Member States should set up such support schemes in order to overcome financial bottlenecks. EU research and development programmes should strengthen their support for innovative solutions for the water sector, and cohesion funds should support investments on the ground.

Investment cycles

Water infrastructure has an investment cycle of 40-50 years. In some cases, it might be more. While newer infrastructure will be more efficient, it is also more unlikely to undergo major modifications. This is especially the case when there are no financial incentives from public authorities.

Maturity of technologies

A number of new technologies have gained maturity over the past years. Others are still in the development phase and evidence of feasibility on the ground is pending. Installing these new technologies today therefore comes with a higher risk.

Technical compatibility

For specific solutions, technical issues may be put forward when water service providers want to export energy to the grid. This is particularly the case for biogas which may be considered incompatible with the gas in the existing gas distribution system and needs to be upgraded before added to the distribution system.

Adequate resources

Water utilities are key players in the introduction of energy-efficient solutions. Energy consumption needs to be considered already at the planning stage and should take into account the whole lifetime of the system. Knowledgeable and adequate human resources are a prerequisite to being able to consider energy issues. Water utilities should not be pushed to solely aim at producing cheap services, but good quality and sustainability should be valued as well.

6. What about new challenges?

Our societies produce more and more products and substances that may end up in our drinking water resources or in waste water. If there is a need to remove those substances, it will have a significant impact on the energy and chemical footprint of water service providers.

For instance, possible regulation of perfluorinated compounds in the future Drinking Water Directive may lead to implementation of sophisticated and energy intensive treatment. Treatments such as reverse osmosis which would generally double the energy consumption of water production and distribution, depending on the molecules and concentrations targeted.

Energy needs and related costs for additional technologies in both drinking water and waste water treatment are largely unknown and very much site-specific. According to the EU FP7 project Neptune, the average additional electricity consumption for ozonation and sand filtration is 0.1-0.2kWh/m^3. Much research and innovation is necessary to allow water utilities to cope with new challenges sustainably. Additional energy consumption and the Life Cycle Analysis of possible solutions should be taken into account for such projects. Evaluation of the environmental benefits of removing emerging pollutants from waste water should be put in balance with investment and operational costs.

Policy makers must respect the EU Treaties and implement control at source measures. If control at source measures cannot or only partially address the emission of pollutants, producers must contribute to the financing of remedial actions elsewhere in the supply chain, so as to implement the Polluter Pays Principle through extended producer responsibility.

About EurEau

EurEau is the voice of Europe's water sector. We represent 32 drinking and waste water service providers from 29 countries in Europe, from both the private and the public sectors.

Our members are the national associations of water services in Europe. At EurEau, we bring national water professionals together to agree European water industry positions regarding the management of water quality, resource efficiency and access to water for Europe's citizens and businesses. The EurEau secretariat is based in Brussels, from where we coordinate the work of around 150 experts from member organisations and utilities and advocate common positions with EU decision makers.

Our members are fully committed to the continuous supply of clean water and its safe return into the water cycle. We have a role in raising awareness of threats to the water environment. With a direct employment of around 470,000 people, the European water sector makes a significant contribution to the European economy.

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