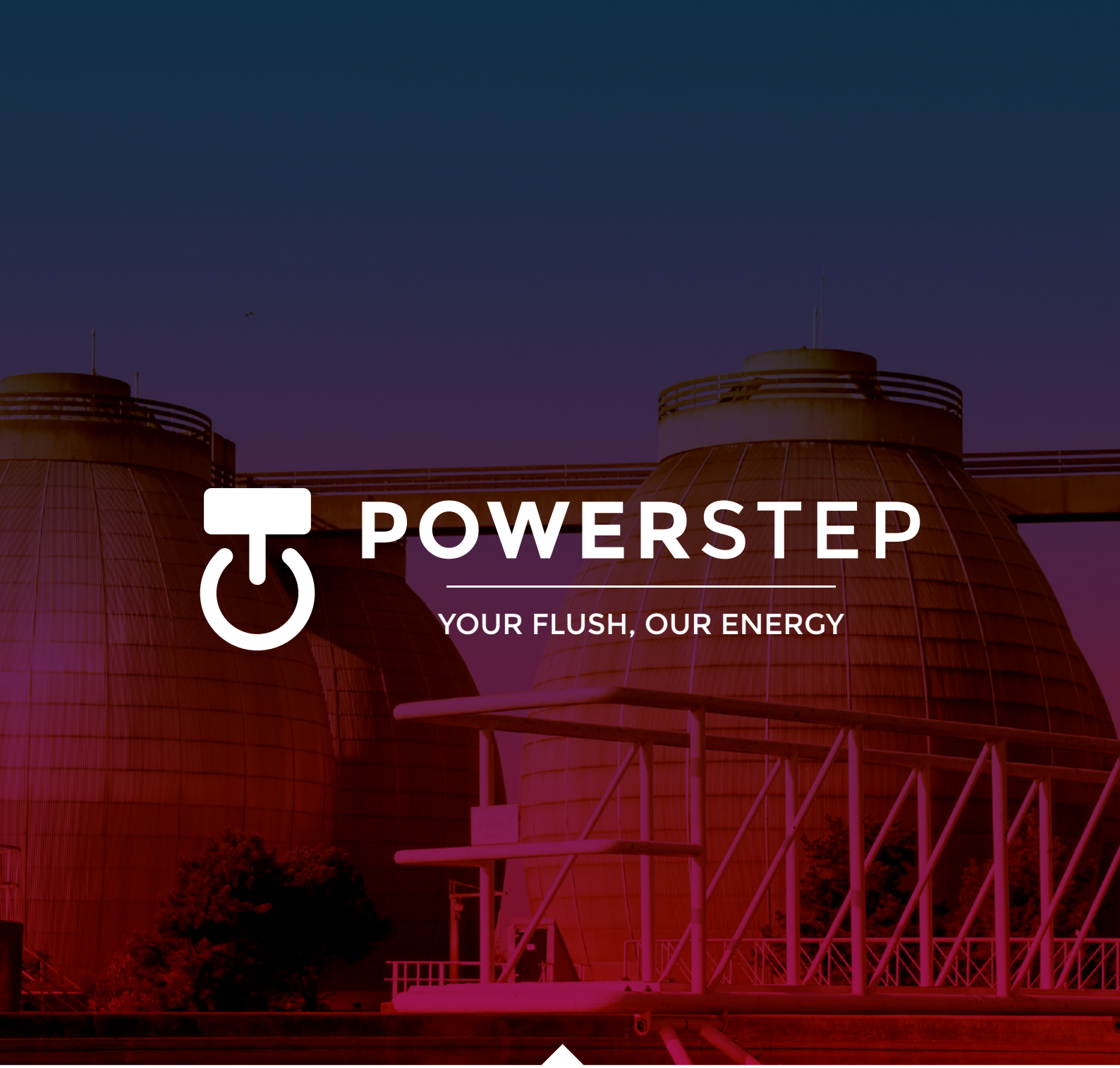

POWERSTEP

YOUR FLUSH, OUR ENERGY

POLICY BRIEF

THE POTENTIAL OF THE WASTEWATER SECTOR IN THE ENERGY TRANSITION

#POWERSTEP_EU

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IMPRINT
PowerStep H2020 Project
Policy Brief - The potential of the wastewater sector in the energy transition

#POWERSTEP_EU

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EXECUTIVE SUMMARY

The EU H2020 project PowerStep transforms existing municipal wastewater treatment plants from net power consumers into energy neutral or even energy positive service providers, exploiting the chemical energy bound in the organic matter. Decreasing energy consumption and raising energy production at the same time, PowerStep converts wastewater treatment plants into real power producers.

These new treatment plants can be a source of flexibility in the energy system, empower cities and regions, and facilitate the decarbonisation of the heating-cooling, and transport sectors.

With the PowerStep concept, the quality of the treated wastewater is maintained or even improved, compared to today's standards. PowerStep's goal is the full-scale demonstration of lab-tested innovations for energy-positive wastewater treatment, to kick-start their market deployment.

Turning wastewater treatment plants into efficient renewable energy generators is a good fit with the current goals of strengthening the European economy and its energy system.

PowerStep plants consume less and produce more energy than state-of-the-art wastewater treatment plants today (see Figures 2 and 3). They can even become energy positive in the net energy balance. At its heart, the PowerStep concept is based on the extraction of more organic matter from wastewater to turn into biogas. It can be applied to new or existing plants at a similar cost to conventional treatment, resulting in a reasonable payback time.

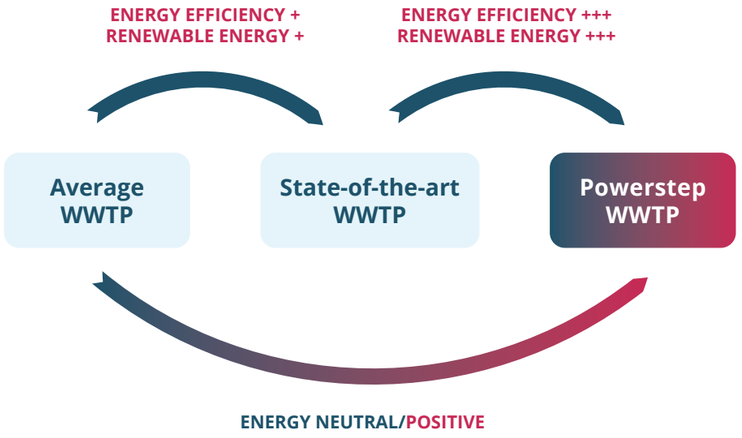

Figure 1: The PowerStep concept

MAKING RENEWABLE ENERGY FROM SEWAGE IS:

#01 A natural fit with the **Juncker Plan's** growing emphasis on climate, energy and circular economy investments.

#02 A contributor to the **Energy Union** and its five pillars: climate action, energy efficiency, an internal energy market, innovation and energy security.

#03 Fully in line with the EU's **Energy Efficiency First** principle.

#04 A way of helping the EU meet its goal of being a **world leader in renewables.**

#05 A source of **flexibility in the energy system** (crucial to help integrate renewables) and a means of extending the energy transition from the power sector to heating and cooling, and transport (essential if Europe is to meet its Paris climate commitment).

#06 Capable of making a big contribution to a **climate neutral water sector.** Renewable energy from sewage can be a contributor to Europe's international climate and sustainable development commitments, in the form of the Paris Climate Agreement and Sustainable Development Goals (SDGs) respectively.

#07 In line with Europe's efforts to **improve its energy security.**

#08 An opportunity for Europe to **eco-innovate and export new technologies and processes.**

#09 The realisation of the **circular economy.**

#10 Empowerment for **cities and regions on climate, energy and sustainable development.**

POLICY RECOMMENDATIONS

To enable the full potential of energy neutral or even energy positive wastewater treatment plants using the PowerStep concept, the consortium recommends that EU policymakers:

#01 **Recognise biogas from sewage as a renewable energy with a lower environmental footprint than other forms of biogas and biofuels.** Biogas from municipal sewage is already recognised as renewable in the European Commission's (EC) proposal for a new EU renewable energy directive for 2030. However, Member States and Members of the European Parliament need to confirm this and ensure its implementation in all renewables support schemes. Member States should favour the use of biogas from sewage in their energy tax regulations.

#02 **Prioritise renewable energy from sewage for public support.** Given its dispatchability and low environmental footprint, biogas from sewage should get the highest possible levels of public support and financing. Europe should consistently favour second generation biogas and biofuels (produced from wastewater and organic wastes) over first generation biogas and biofuels (produced from land-based crops).

#03 **Extend green public procurement (GPP) criteria for wastewater treatment plants so that they promote energy neutral or energy positive plants as well as energy efficiency.** GPP criteria already exist for wastewater treatment plants but so far they only encourage energy efficiency.[1]

#04 **Grant access to cohesion/structural funds contingent on energy efficiency investments, including in wastewater treatment plants.** As the EU debates new energy efficiency legislation and begins planning its post-2020 budget, there is a golden opportunity to use regional development funds to promote efficiency improvements in those countries with the highest untapped potential.

#05 **Make public subsidies for energy production at wastewater treatment plants contingent on the application of energy management systems** that render these plants state-of-the-art. In line with the EU's Energy Efficiency First principle, wastewater treatment plants should be made as efficient as possible before they are upgraded to become energy positive.

1 http://ec.europa.eu/environment/gpp/eu_gpp_criteria_en.html

#06 **Define power-to-gas (P2G) as a form of energy storage.** Like other forms of P2G, the production of biogas from wastewater treatment is a potentially valuable store of energy that can support the further deployment of variable renewables like wind and sun power. EU lawmakers need to define P2G as energy storage - and remunerate it accordingly - in the market redesign proposals of the Clean Energy Package.

IN A NUTSHELL

European wastewater treatment plants today consume more than two power plants' worth of energy every year and eat up the biggest part (a fifth) of municipalities' electricity bills. They cost society about €2 billion a year. Instead, they could be producing up to twelve power plants' worth of efficient, renewable, flexible energy that contributes to the low-carbon, circular development of the European economy.

CONVENTIONAL WASTEWATER TREATMENT PLANT

ENERGY POSITIVE WASTEWATER TREATMENT PLANT

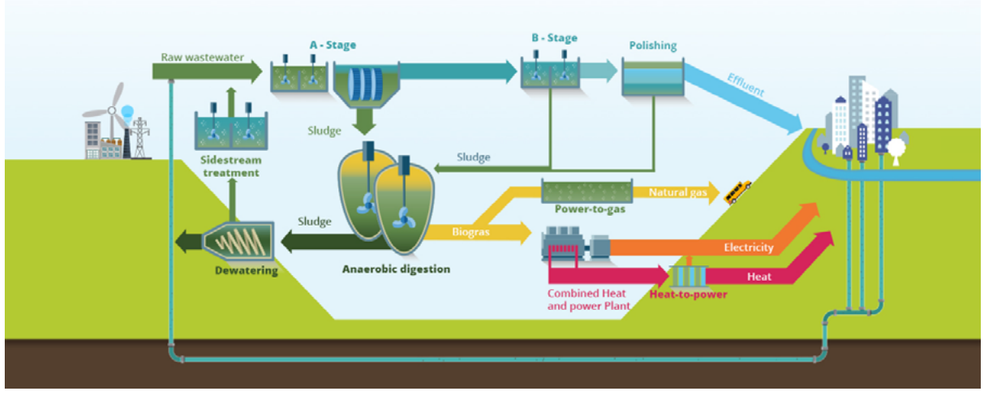

Figure 2: Conventional vs PowerStep wastewater treatment plants

DISCLAIMER:

- The PowerStep project only focused on the overall energy management concepts for the wastewater treatment plant without considering the other water and wastewater relevant infrastructures (e.g. sewer systems; pumping stations or drinking water systems).

- The energy efficient treatment schemes considered within PowerStep are primarily relevant for large or very large wastewater treatment plants (>100,000 p.e.). The potential of these schemes is less in the case of small and medium-sized infrastructures.

INTRODUCTION - POWERSTEP: ENERGY PRODUCTION FROM WASTEWATER TREATMENT PLANTS

The PowerStep concept turns ordinary municipal wastewater treatment plants into energy neutral or even energy positive service providers. These plants produce more energy on an annual basis than they require for wastewater treatment, leaving the surplus energy to be valorised by other consumers. At its heart, the PowerStep concept is based on the extraction of more organic matter from wastewater to turn into biogas. It can be applied to new or existing plants with similar cost to conventional treatment, resulting in a reasonable payback time.

A conventional municipal wastewater treatment plant typically produces several kinds of energy:

- **Biogas** (typically 60% methane and 40% CO2);
- **Electricity and/or heat** (through biogas combustion).

Despite this, conventional wastewater treatment plants still consume a lot of energy from the grid. The PowerStep concept can transform these plants into energy neutral or even energy positive operations. This can be realised in four steps:

#01 **Reduce energy demand by efficient operation** - decrease internal energy consumption by introducing state-of-the-art concepts for plant operation and control.

#02 **Increase biogas production from sewage sludge** - more efficient 'primary treatment' to transfer a maximum amount of organic matter into anaerobic digestion to produce biogas.

#03 **Innovative nitrogen removal** - an essential corollary because the usual biological denitrifying process depends on the presence of organic matter as an easily accessible source of carbon.

#04 **Biogas valorisation** - efficient conversion of the energy potential of biogas into useable (and marketable) forms of energy.

With these steps, PowerStep can significantly decrease the energy consumption of wastewater treatment, and increase energy production at the same time. By improving the energy profile well beyond the current benchmark, PowerStep plants will produce surplus energy that can be exploited for other purposes (e.g. biogas for transport or heating).

To get an idea of the real potential of PowerStep within the EU:
Overall, the municipal wastewater sector in Europe is estimated to consume the equivalent of more than two large power plants' annual production. Yet organic matter in its wastewater equates to a chemical energy potential of 87,500GWh per year, or the output of 12 large power stations. That's quite a few power stations worth of energy going unused!

Potential of the PowerStep concept for German wastewater treatment plants (WWTPs):

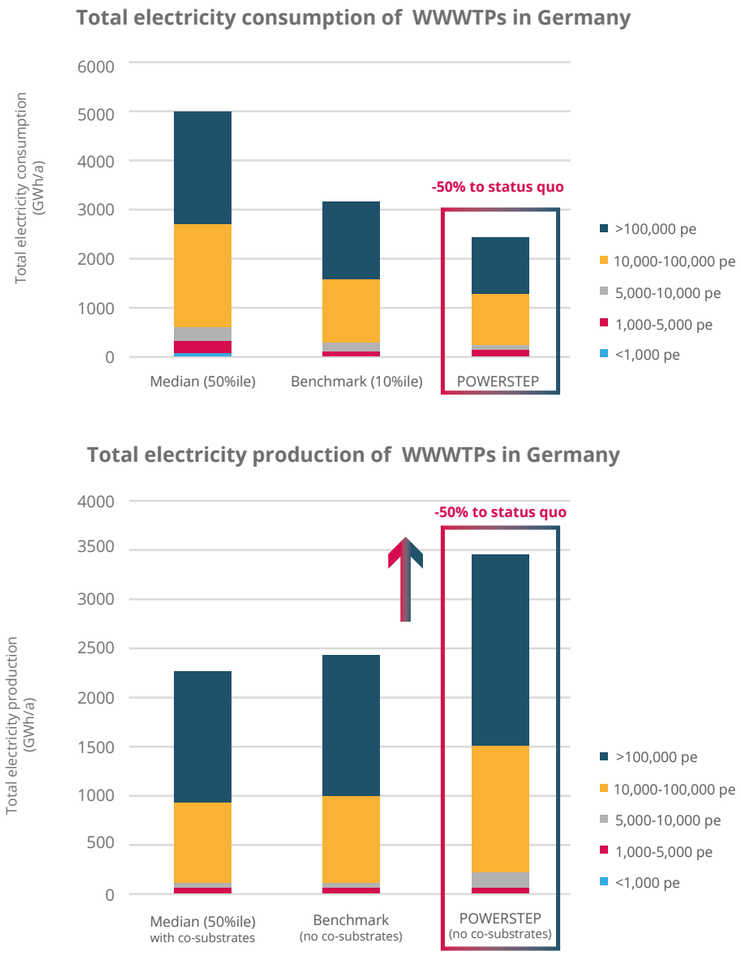

Figure 3: Electricity consumption and production of German WWTPs: Comparing the status quo (Median), "state-of-the art" (Benchmark) and innovative PowerStep concept (GWh/year)

THE POWERSTEP PROJECT'S OBJECTIVES

- ⇨ Demonstrate the concept of **energy-producing wastewater treatment plants based on full-scale demonstrators**. Assessing **energy balance and operation costs.**
- ⇨ Define full design schemes of **cost-competitive energy positive and carbon neutral wastewater treatment plants.**
- ⇨ Ensure confidence in the design and operation of the overall treatment schemes **to enable replication of solutions and rapid deployment.**
- ⇨ **Raise awareness and knowledge** about the potential of wastewater at **local and regional level.**
- ⇨ **Guarantee** a significant contribution from the water sector to the green energy sector **for securing worldwide market shares and job growth in Europe.**

MARKET RELEVANCE

Due to the rapidly decreasing production costs of renewable electricity from wind and PV technologies, electricity from wastewater treatment plants may not be fully competitive in the electricity market. Nevertheless, PowerStep technologies can pay for themselves by covering the electricity demand of their hosts.
In addition, renewable feedstocks for biogas and biomethane are limited and can fuel conflicts (energy-food nexus, intensive agriculture). Biogas and biomethane from wastewater therefore represent a good alternative to decarbonise the transport sector, especially for long-haul and heavy-duty vehicles.
In addition, a wastewater treatment plant may help stabilise a regional energy network. Indeed, wastewater treatment plants can store, produce or use large amounts of electricity or heat on demand, and can therefore play a significant role in a region's sector coupling strategy.

1. PRESIDENT JUNCKER'S PRIORITIES

The EU PowerStep project needs to be understood in the context of the EU's political priorities. European Commission President Jean-Claude Juncker has identified ten priorities for his mandate from 2015 to 2019. Two of these are: 1) jobs, growth and investment, and 2) energy and climate.

This is about keeping Europe on track to economic recovery after the global financial crisis of 2007-8. An Investment Plan for Europe (the 'Juncker Plan') offers investment stimuli and assistance, while a package of circular economy proposals pushes for more efficient use of resources.

The latest figures show that the Juncker Plan is expected to trigger over €230 billion in investments across the EU-28.[2] The EC and European Investment Bank estimate that it has already supported 300,000 jobs. In mid-September 2017, Member States and the European Parliament came to an agreement on how to extend and reinforce the Plan so that it delivers more than twice this number by 2020.

The upgraded Plan has an even greater focus on investments that will help the EU meet its commitments under the Paris Climate Agreement and aid the transition to a circular economy. Energy projects already accounted for a third of all infrastructure and innovation projects approved by June 2016.[3] From now on, at least 40% of infrastructure and innovation projects have to contribute to climate action.[4]

Building up an energy efficient sewage infrastructure for Europe is a "no regret" investment measure matching the criteria of the Juncker Plan. The construction or maintenance of municipal wastewater treatment plants supports the creation of green jobs. PowerStep is a natural fit with the Juncker Plan's growing emphasis on climate, energy and circular economy investments.

2 http://europa.eu/rapid/midday-express-21-09-2017.htm

3 http://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1473853487429&uri=SWD:2016:297:FIN

4 http://europa.eu/rapid/press-rele ase_MEMO-17-3224_en.htm

2. ENERGY UNION

President Juncker's goals on energy and climate are framed by the Energy Union. The Commission wants to create a more secure, affordable and sustainable energy supply through the establishment of a European Energy Union.

"This is undoubtedly the most ambitious European project since the formation of the coal and steel community [which created the EU]."

– EC Vice President Maroš Šefčovič, presenting the Energy Union proposals in Brussels on 25 February 2015

The energy union rests on five pillars:

#01 **Security, solidarity and trust** - diversification and cooperation for energy security;

#02 **A fully integrated internal energy market** - enabling the free flow of energy to match supply with demand;

#03 **Energy efficiency** - the first priority;

#04 **Climate action** - an ambitious climate policy for all sectors of the economy;

#05 **Research, innovation and competitiveness** - supporting breakthroughs in clean energy technologies.

The energy neutral or energy positive wastewater treatment plants proposed by the PowerStep project can contribute to each of the Energy Union's five pillars.

State-of-play:
A 'Clean Energy Package' of eight legislative proposals on power market design, renewables and energy efficiency is currently under negotiation by Member States and the European Parliament. This is the core of the Energy Union project, with a deadline for completion of early 2019. In parallel, EU lawmakers are finalising new climate legislation and tackling low-emissions mobility. They have already finished a fresh revision of Europe's energy security framework. Together, these initiatives are creating the EU's climate and energy policy for 2030. Making renewable energy from sewage should be incentivised by this framework.

3. ENERGY EFFICIENCY FIRST

The EU is committed to “Energy Efficiency First”. This means prioritising investments in energy efficiency whenever they would cost less or deliver more than investing in energy production or transportation. The logic behind this is that energy is a valuable resource and should be treated as such.
The International Energy Agency (IEA) estimates that two-thirds of the EU’s low-carbon investments from now to 2040 need to be in energy efficiency to keep alive the goal of limiting global warming to 2ºC.
Prioritising efficiency makes sense for many reasons. It can help lower the costs of the energy transition, restore Europe to growth and create jobs, reduce reliance on energy imports, cut greenhouse gas emissions and improve air quality.

To this end, the EU is committed to an energy efficiency target of at least 30% by 2030, with MEPs pushing to raise that to 35%.

The PowerStep concept fully aligns with the EU’s Energy Efficiency First commitment. Many wastewater treatment plants today are not operating as efficiently as they could be (see Figure 3).
Energy neutrality can and should be the benchmark for large wastewater treatment plants. Multiple existing plants in Europe show that this is possible. These plants often rely on external fuels such as organic co-substrates or sludge from other plants to reach high biogas production however, or they use on-site renewable energy production (wind and/or PV).
Upgrading wastewater treatment plants to “state-of-the-art" typically means more efficient aerators and pumps, or more efficient digester operations. These steps are necessary to improve the energy balance, but they will not bring about energy positive operations. That is where PowerStep comes in.
PowerStep goes beyond pure efficiency targets: on top of equipping wastewater treatment plants with state-of-the-art technologies, the PowerStep concept aims to deliver additional energy savings above and beyond this benchmark. **By decreasing energy consumption and raising energy production at the same time, PowerStep transforms the wastewater treatment plants into real power producers.**
Greater energy savings appeal to plant operators because energy typically accounts for about a third of their operating costs. It is also often the biggest electricity expense for municipalities, accounting for more than a fifth of a city’s electricity bill.

4. MAKING EUROPE A WORLD LEADER IN RENEWABLES

One of Juncker’s explicit aims in energy policy is to make the EU a world leader in renewables. To this end, European heads of state and government have committed to a renewable energy target of at least 27% by 2030. MEPS are pushing to raise that to 35%.

Wastewater treatment plants can contribute to the EU’s renewable energy targets.

Biogas from wastewater treatment is a clean energy source that has several advantages:

- ⇨ it is dispatchable and, once upgraded, can be stored and distributed using the existing gas infrastructure network;
- ⇨ it does not rely on critical raw materials;
- ⇨ it does not disrupt wildlife;
- ⇨ it does not compete for agricultural land or put pressure on water bodies.

Biogas from wastewater treatment should be considered as a source of renewable energy with a **low environmental impact.** It can either be used to power the plant itself, or upgraded and fed into the grid as biomethane for use in heating and cooling and/or transport.

There is a lot of untapped potential to use wastewater as an energy source. Sewage sludge accounted for just under a tenth (9%) of the 15 Mtoe of biogas produced from waste in Europe in 2014.[5] Most of the biogas is used for electricity production (62%), followed by heat (27%). About a tenth of it is upgraded into biomethane for direct use in transport or injection into the gas grid.

5 https://ec.europa.eu/energy/sites/ener/files/documents/ce_delft_3g84_biogas_beyond_2020_final_report.pdf

The Ryaverket Wastewater Treatment Plant in Sweden has the highest inflow of any Nordic plant, handling over 4000 litres of sewage per second. It produces about 60GWh of biogas a year from its sludge treatment. This is sold on to Gothenburg Energy, which cleans it, compresses it and sells it on as motor fuel. To increase biogas production, Ryaverket also accepts fat and food waste from restaurants, schools and food producers in the region. Most of the leftover sludge is composted and used as a surfacing and landscaping soil.

Biogas gives gas a future in a decarbonised energy sector, and the European Commission is ready to incentivise this type of renewable gas. In its proposal for a power market redesign as part of the Clean Energy Package, the Commission proposes a definition for electricity storage that includes "converted to another energy carrier" and therefore opens the door to power-to-gas (P2G) - using electricity from the grid to upgrade the CO2 in biogas to pure biomethane. The Commission has identified the upgrading of biogas into bio-methane for further distribution and use – just as the PowerStep project foresees – as the best way of increasing the energy efficiency of anaerobic digestion.[6]

"We must develop a path to decarbonise gas. Otherwise it will probably be the end of the gas sector."

– Eva Hennig, Head of Policy at Thüga AG, Germany's biggest network of local utilities

PowerStep is a useful project because biogas is one of the ways to decarbonise transport. This is real-life sector coupling: wastewater treatment plants can produce biogas as an alternative fuel to petrol, diesel, and even natural gas. In this scenario, wastewater treatment plants could fully cover their own energy demand and inject excess biogas into the grid.

Danish company Nature Energy has teamed up with car manufacturer Audi to make 10,000 of its cars run on biogas. Nature Energy operates four large biogas plants and plans to build three more. The biogas comes from waste and sludge. It is classified as a 'second generation' biofuel because it does not use food as a raw material. More than two million cars across Europe already run on biogas as a way of reducing greenhouse gas emissions.

6 http://ec.europa.eu/environment/waste/waste-to-energy.pdf

5. MARKET DESIGN: FLEXIBILITY AND SECTOR COUPLING

The biggest advantage of biogas compared to other renewables, notably solar and wind power, is that it is dispatchable. In other words, it can be used to provide power at times of low wind and solar intensity.[7]

Wastewater treatment plants can be a source of flexibility in the energy system. They can store energy in the form of biogas in existing gas storage tanks. Moreover, like decentralised renewables, they are widely distributed across regions and municipalities so they can step in where flexibility is needed (and thus save on energy grids).

This is significant because the next big challenge for EU energy policymakers is not how to produce more renewable energy but how to better integrate renewables into the energy system. To this end, the Clean Energy Package's market design proposals are centered on how to remunerate flexibility and storage.

Energy stored in gas is part of the palette of flexibility options that is needed for the energy system to cope with an ever-increasing share of renewables. Gas storage offers large-scale seasonal storage to complement smaller, shorter term storage in electric batteries. Wastewater treatment plants are part of an existing gas production and storage infrastructure whose use allows policymakers to tackle the next big challenges of the energy transition in the most cost-effective way.

In addition, wastewater treatment plants can implement power-to-gas (P2G), by using electricity from the grid to upgrade the CO^2 in their biogas to pure biomethane. This means that wastewater treatment plants can implement sector coupling and extend the energy transition from the power sector into the heating and cooling, and transport sectors.

7 https://ec.europa.eu/energy/sites/ener/files/documents/ce_delft_3g84_biogas_beyond_2020_final_report.pdf

6. CREATING A CLIMATE NEUTRAL WATER SECTOR

The Paris Climate Agreement requires every sector to do its utmost to decarbonise.

The PowerStep concept can deliver a big step forward to making the water sector climate neutral. It can help the EU deliver simultaneously on all three of its climate-led 20-20-20 targets: a 20% cut in greenhouse gas emissions (below 1990 levels), a 20% share of renewable energies and a 20% improvement in energy efficiency (compared to business-as-usual) by 2020. Providing wastewater treatment without the need for external energy sources makes this public service carbon neutral and cuts greenhouse gas emissions from the water sector.

Looking ahead, the EU is already tightening up its climate policies in line with its Paris climate commitment and a global aspiration to limit global warming to 1.5 not 2°C degrees. The International Panel on Climate Change (IPCC) is due to publish a report on the feasibility of 1.5°C and what it would require in 2018. On the back of this, the Commission will draw up a new EU 2050 low-carbon roadmap in early 2019. This will underpin any renegotiation of the EU's 2030 climate target. MEPs are pushing the EU to adopt a net zero greenhouse gas emissions goal for 2050.

For now, the EU has committed to a 40% greenhouse gas emission reduction by 2030, compared to 1990 levels. To see this through, it finalised a reform of its EU Emission Trading Scheme (ETS) in autumn 2017 and a new "effort-sharing regulation" (ESR) just before Christmas. The latter sets national emission caps for the non-ETS part of the economy (transport, buildings, waste and agriculture). It is to these targets that PowerStep can also contribute.

It remains important to avoid the risk of emissions of greenhouse gases other than CO^2, such as CH^4 and N^2O. Methane can leak from biogas plants due to poor design or maintenance[8], and N^2O can be emitted in biological processes for nitrogen removal. Both gases should be carefully managed to minimise overall greenhouse gas emissions.

8 http://ec.europa.eu/environment/waste/waste-to-energy.pdf

7. IMPROVING ENERGY SECURITY

By cutting energy consumption and boosting (green) energy production, the PowerStep concept ensures that wastewater treatment plants contribute their share to European energy security.

The biggest challenge to energy security comes from gas, for which Europe depends on a growing share of imports. Most of these come from Russia. **Energy efficiency and "home-grown" renewables such as biogas from wastewater can help diminish this dependence.**

"When it comes to energy security in the long term, there is no better antidote than focusing on sustainable energy."

– EU Climate and Energy Commissioner Miguel Arias Cañete, at the launch of a new EU energy security master plan in Brussels on 16 February 2016

Renewables also bolster European energy independence. Increased production of biogas from sewage is particularly relevant because it offers a way for Europe to continue to use gas, but without increasing its dependence on Russia. The Commission believes gas can play an important bridging function between coal and renewables, and will still be an important part of the European energy system in 2030 and beyond, especially for transport and heating purposes.

8. ECO-INNOVATION POTENTIAL

The PowerStep project uses concepts and technologies that have been tested in laboratories and pilot scale plants. At stake now, is their full-scale commercial operation with a reliable assessment of process efficiencies under realistic conditions. **Thus, the PowerStep approach fosters eco-innovation, improves the competitiveness of the EU water sector, and introduces new export opportunities for European companies.**

The environmental benefits of selected PowerStep technologies will be independently verified and validated through the EU's Environmental Technology Verification (ETV) programme.[9] This is an official stamp of approval of their good environmental performance.

Wastewater treatment is a critical – and growing – global market, expanding in parallel to population growth. Still, over 80% of the world's wastewater – and over 95% in some least developed countries – is released to the environment without appropriate treatment.[10] This is an opportunity for Europe: it is looking for new value-added export opportunities and it has strong corporate players in the water sector. These can sell the innovative and environmentally-friendly water technologies linked to the PowerStep concept.

The PowerStep project fits with the new EU industrial policy strategy presented by President Juncker in his annual State of the Union address on 13 September 2017, to make European companies "world leaders in innovation, digitisation and decarbonisation".[11]

"Europe is at the forefront of the global transition towards a low-carbon and circular economy. It must now capitalise on this leadership in all sectors and tackle increasing global competition in green production and clean energy technologies."

– EU industrial policy strategy

9 https://ec.europa.eu/environment/ecoap/etv_en

10 http://www.unesco.org/new/en/natural-sciences/environment/water/wwap/wwdr/2017-wastewater-the-untapped-resource

11 http://ec.europa.eu/docsroom/documents/25384

The European Commission has pledged to promote EU leadership in clean energy technologies, including through a "Clean Energy Industrial Competitiveness Forum".[12] Energy neutral or energy positive wastewater treatment plants are such an industry.

Clean energy and "market-creating innovation" are also two focus areas for the EU's flagship research programme, Horizon 2020. The Commission has created a "European Innovation Council pilot" with €2.7 billion to better support projects focused on market-creating innovation.[13] In addition, it has set aside €2.2 billion to accelerate clean energy innovation.

12 https://ec.europa.eu/research/eic/index.cfm

13 https://ec.europa.eu/info/news/launch-eu-clean-energy-industrial-competitiveness-and-innovation-forum-renewables-2018-jan-08_en

9. CIRCULAR ECONOMY IN ACTION

The circular economy is part of president Juncker's jobs, growth and investment strategy. Previously an environmental initiative, it is today an economic imperative. It means thinking about all waste as a resource. In practice, the EU's circular economy proposals – still making their way through the European Parliament and Council of Ministers – entirely rethink production and consumption.

Four legislative proposals on waste plus 54 initiatives in an accompanying action plan are supposed to save EU businesses €600 billion or 8% of their annual turnover, create over half a million jobs and cut greenhouse gas emissions by 2-4%.

"If we can be more resource efficient and reduce our dependency on scarce raw materials, we can develop a competitive edge."

– EC Vice-President Jyrki Katainen on the day the Commission launched its circular economy proposals, 2 December 2015

MEPs and Member States reached a provisional agreement on the four waste proposals in December 2017. This should be formally confirmed under the Bulgarian EU Presidency in the first half of 2018. Bulgaria's main environmental focus is on the circular economy and eco-innovation.

Europe's international commitments on climate change (the Paris Climate Agreement) and sustainable development (the UN Sustainable Development Goals or SDGs for 2030) depend on its realisation of a circular economy.

The PowerStep approach is a prime example of the circular economy in action. Wastewater treatment plants can be recovery points for energy and nutrients as well as clean water, exploiting the resources that are wasted today and bringing them into a circular economy as valuable products.

The production of biogas by anaerobic digestion is seen as recycling in EU waste legislation (unlike waste incineration with energy recovery). The PowerStep project therefore also fits well with the development of a sustainable bio-economy in Europe.

"A stronger development of the bioeconomy can also help the EU to accelerate progress towards a circular and low-carbon economy."

– EU industrial strategy, September 2017

In its industrial policy strategy in September 2017, the European Commission announced a fresh series of actions on the circular economy, including "measures to improve the production of renewable biological resources and their conversion into bio-based products and bioenergy".

10. RESILIENT CITIES AND PUBLIC SECTOR LEADERSHIP

Wastewater treatment plants can empower cities and regions on climate, energy and sustainable development goals. They can be absorbed into the development plans and programmes of initiatives such as the Covenant of Mayors. Sub-national actors such as cities and municipalities are increasingly taking on a leadership role in climate mitigation and adaptation.

Next-generation wastewater treatment plants are key service providers at the heart of a municipality. They are a source of essential resources for the inhabitants: waste disposal, clean water, energy and even fertiliser. They are part of a local, decentralised infrastructure that contributes to a city's resilience, for example by helping build energy autonomy. By integrating the provision and management of many different products, they are part of the shift to a service economy.

Optimised wastewater treatment plants can enable public sector leadership on the energy transition. Eurostat has made it easier for municipalities to invest in energy efficiency by clarifying that energy performance contracts can be recorded "off balance sheet" in national accounts.[14] Municipalities should investigate this opportunity for upgrading their wastewater treatment plants.

In a new EU industrial policy strategy in September 2017, the European Commission announced an initiative "to improve the functioning of public procurement in the EU, including a voluntary mechanism to provide clarity and guidance to authorities planning large infrastructure projects". This could be an opportunity to introduce incentives to turn wastewater treatment plants into energy neutral or energy positive service providers.

A brochure on circular procurement from the Commission includes several best practice case studies where municipalities have supported sewage sludge treatment and valorisation, for example by turning it into biogas to power buses in the city of Vaasa, Finland.[15]

14 http://europa.eu/rapid/press-release_IP-17-3268_en.htm

15 http://ec.europa.eu/environment/gpp/pdf/Public_procurement_circular_economy_brochure.pdf

Existing green public procurement criteria for wastewater treatment plants already encourage energy efficiency, but they could be developed further to promote energy neutral or energy positive plants.[16]

Upgrading wastewater treatment plants makes economic sense for municipalities. Today, they typically make up the biggest part - a full fifth - of a municipality's electricity bill. If they were energy neutral or energy positive, that money could be spent on other priorities. It makes even more sense to save on operational costs when new wastewater treatment plants are built with EU regional development (structural and cohesion) funds, to avoid burdening the community with future costs.

16 http://ec.europa.eu/environment/gpp/eu_gpp_criteria_en.htm

11. THE SKEPTICS' CORNER

⇨ ***Energy neutral or energy positive wastewater treatment plants are expensive:***

No, they are affordable and come at the same total cost as conventional treatment plants.

⇨ ***The innovative technologies are not mature:***

State-of-the-art technologies are commercially available, and new PowerStep processes have been demonstrated at large industrial scale.

⇨ ***Most wastewater treatment plants are already built, and it is difficult to implement new concepts:***

The PowerStep concept can also be used to upgrade existing plants, working with existing infrastructure to reorganise or retrofit assets to improve the energy balance.

In Eastern Europe, much of the wastewater infrastructure still needs to be built, and should be designed with modern energy efficient concepts.

⇨ ***Wastewater treatment is too small a sector to make a difference to the energy system:***

Wastewater treatment plants may account for just 1% of Europe's electricity demand but they make up the biggest part (20%) of a municipality's electricity bill. Hence, they are relevant on a municipal level and represent a "win-win" situation for cities to improve their environmental footprint.

⇨ ***The cost of electricity from wastewater will not be competitive versus ever cheaper wind and solar power:***

Biogas from wastewater should be used for its biomethane content to decarbonise the transport, and heating and cooling sectors. The production of biogas from wastewater is an environmentally-friendly solution to green gas.

⇨ ***Energy is a distraction; the focus should be on water quality:***

Energy neutral wastewater treatment plants produce effluent water of the same or even better quality as conventional plants. Moreover, more efficient plants can reduce the cost of water quality improvements or compensate for the additional energy demand of more advanced future treatments.

⇨ ***The decrease in CO2 emissions from energy production may be offset by the rising emissions of other, more powerful greenhouse gases (N2O and CH4):***

The PowerStep concept has been shown to decrease the total climate footprint of wastewater treatment plants. If properly operated, the emissions of N2O and CH4 can be minimised and will not diminish the climate positive effect of the concept.

⇨ ***There are limited supplies of wastewater:***

There is no shortage of wastewater nor competition for other uses (unlike for other forms of waste-based bioenergy), as we all produce wastewater every single day.

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