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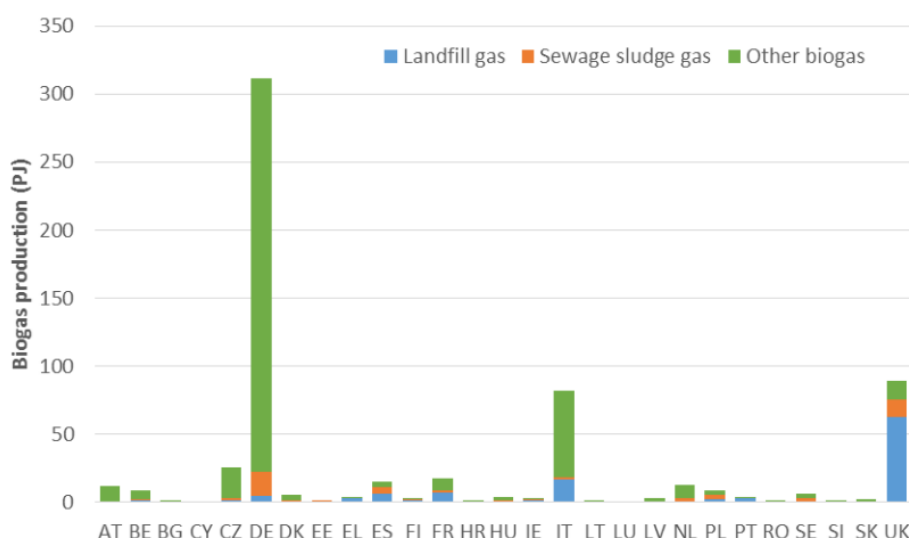
Towards a systematic legal-policy approach for unlocking the energy potentials of wastewater treatment plants

Tapping into the energy potential of the wastewater and solid waste sector is imperative for realising Europe's energy transition. However wastewater utilities face many obstacles to become more energy-efficient and net producers of renewable energy. Analyses within the project REEF 2W showed that typical barriers do not only concern legal aspects (fragmented policies and laws, conflicting and overly restrictive regulations) but also include economic (low subsidies, low prices for fossil energy source) and social issues (need for a multi-sectoral approach, lack of awareness). This policy brief provides recommendations for decision-makers at both EU and national levels to overcome these barriers. It highlights the need for policies and legislation to be better integrated across sectors, to better prioritise energy generated from wastewater, to increase targeted financial support while strengthening utilities' economic self-sufficiency.

Background

Context

Solid waste and wastewater utilities have different options at hand to optimise their energy performance. Alongside energy efficiency measures operators can increase biogas yields, most effectively through co-digestion with organic waste. Moreover technologies such as biogas upgrading or power-to-gas can further improve the rates at which biogas is exploited energetically. The degree to which these optimisation forms are implemented varies greatly across EU member states. For example, using sewage sludge to produce biogas has been practiced for several decades in countries like Germany. Waste heat capture through heat pumps in sewer networks, in contrast, has only gained currency in recent years (Steinmetz 2012). In Germany and Denmark, the potential to exploit biogas in WWTPs has almost peaked, whereas France, Italy, and Spain have realised relatively little of their actual potential (Bodík et al. 2011). Especially rather new technologies like biogas upgrading and power-to-gas are yet not very common.



- Figure 1: Biogas production per Member State in 2014, differentiated by source (Kampman et al., 2016).

The current problem

Multiple interconnected barriers usually cause the slow uptake of innovation in the water sector (Kiparksy et al., 2013, Ajami et a. 2014). This also applies to “waste-to-energy” solutions in Europe. The barriers are technical, cultural, legal, financial, political and institutional. The research within the REEF 2W project shows that legislation, policy and regulation impair utility operators in many countries to venture outside their core business of treating solid waste and wastewater. Those that want to pioneer them generally confront high upfront costs and additional work that often outweigh economic benefits, especially when co-digestion with biowaste is part of the technological upgrade. Moreover, rarely is there regulatory pressure to save energy or low incentives to produce and sell energy to the grid. This is because a policy and legislation framework for solid waste and wastewater-to-energy solutions at both EU and national is only in the making.

A particular challenge for policy-making

Its design, too, is a challenging task. The waste-to-energy solutions do not only involve a variety of different technologies harnessing different kinds of energy, all of which demand specific legal and regulatory provisions. These solutions also need to align different objectives stretching beyond treating solid waste and wastewater, including energy security and flexibilisation of the energy system, reducing carbon emissions, costs savings and the management of other resources (such as phosphorous). Moreover given the solutions touch across the water, energy, and solid waste system, a multi-sector approach is of utmost importance. This necessarily involves also a broad range of stakeholders from these different sectors, whose participation is crucial for implementing new innovations. It is also important to consider the spatial spatial connections and dependencies of waste-to-energy solutions involving co-digestion with organic waste. To implement them, there



need to be sufficient availability of organic waste streams in the region. So are selling surplus energy to the grid, as well as disposing co-digestate in economically and environmentally viable ways, dependent on nearby demand for these products.

Outline of the brief

This policy brief is based on a legal and policy barrier analysis, which has been conducted within the Interreg project Reef2W. It draws on interviews with utility operators, scientists and policy-makers from five European countries, who have been asked to report on the most critical obstacles impeding Reef2W solutions at the pilots in their countries. The findings have been consolidated through a literature review. Five main issues emerged from the analysis, for which key barriers and policy recommendations to overcome them have been outlined.

Challenges and Opportunities

A systematic and cross-sectoral legal and institutional approach

Energy-related concerns and goals are almost non-existent in the EU's legal and policy framework of the solid waste and wastewater sector. Key sectoral laws such as the Water Framework Directive make no provisions for water or wastewater utilities to increase energy efficiency or renewable energy generation. Simultaneously energy directives do not formulate specific CO₂ emission targets for the wastewater sector. To scale solutions developed in REEF 2W, however, requires a legal framework that anchors water-energy linkages in all concerned sectoral laws and policies. On the long-term policies and laws need to provide targeted support for the whole range of wastewater-to-energy solutions, from waste heat capture in sewers over improving energy outputs through co-digestion to biogas upgrading and power-to-gas. Following the Energy Efficiency First Principle, wastewater utilities must maximise energy efficiency before starting to generate renewable energy. At national level establishing a coordinating agency that raises awareness across government levels and institutions and provides knowledge and capacity building (e.g. on how to conduct energy audits) is critical.

Prioritisation of biogas produced from waste feedstocks in energy law and policies

A requirement for elevating biogas production in wastewater treatment plants remains vastly absent in EU and national energy legislation. EU countries are free to opt through which forms of renewable energy they meet decarbonisation targets. This flexibility has given rise to divergent developments of national biogas markets (See figure 1), in which energy crops dominate as a feedstock. Emerging evidence about their adverse environmental effects has led the EU to introduce legislative measures that cap the production of energy crops. Yet governments and environmental agencies have placed only low priority on promoting biogas produced from wastewater in a targeted way. Sustainable feedstocks should receive more support to scale their market shares. Extending sustainability criteria beyond biofuels in the transport sector, in addition to

harmonizing them across member states, is a central element in doing so. The uptake of wastewater-to-energy solutions will further profit from specific renewable energy targets for sustainable feedstocks like wastewater and for biomethane production.

Increasing production of biowaste stimulates co-digestion in wastewater treatment plants as a preferred disposal pathway

A strict regulatory waste regime incentivises utilities to adopt co-digestion technology that use organic waste. Utilities can charge gate fees for organic waste they accept from municipalities while enhancing energy performance through a more productive feedstock mix, both of which improves their business case. Studies show that an increased production of biowaste as a result of a ban on landfilling and policies requiring solid waste separation has encouraged projects using co-digestion with biowaste. However, in EU countries like Croatia waste separation is still poorly established, leading to supply shortages as different sectors compete for scarce resources. To further unlock biowaste feedstock from residential, commercial and industrial streams, it is necessary to enforce the municipal separate collection of solid waste while phasing out the option to landfill biowaste (e.g. through complete bans, diversion targets, or taxing of landfilled wastes). Gate fees reflecting the external costs for landfilling and other less preferred disposal options need to be raised and introduced where yet non-existent. This will be crucial to make gate fees charged by waste utilities using co-digestion more competitive and helps them to secure a reliable biowaste feedstock.

Providing appropriate subsidies through national support schemes

Waste-to-energy solutions have high upfront costs, which increase if co-digestion is introduced additionally (e.g. for special permits). Utility operators therefore depend on subsidies (or potential CO₂ taxes) to be more competitive given that prices for fossil energy are rather moderate. In many EU countries subsidies for renewable energies are non-existent, insufficient and, usually guaranteed over short periods while market energy prices have remained too low. For example, in some countries utility operators producing biomethane can barely compete with “Russian” natural gas prices. This undermines the economic viability of wastewater-to-energy solutions and discourages new investments into them. National governments and energy agencies therefore need to increase support schemes for renewables and introduce specific support for biogas produced from wastewater. Germany, for example, established bonuses of up to €0.13/kWh of electricity on top of the Feed-in Tariffs to promote demand for certain feedstocks. National support schemes, however, should not only promote “green electricity” production, but the full spectrum waste-to-energy solutions (including heat capture, biogas upgrading, sale-to-grid, and power-to-gas). And the rates and duration of subsidies must be predictable, transparent, and relatively stable to motivate investments. Additionally grants and loans become necessary to mitigate high financial risks due to long payback periods.



Unlocking multiple revenue streams to achieve self-sufficiency

For waste-to-energy solutions to be economically viable utilities need to tap into multiple revenue streams. Converting biogas into electricity and heat in Combined Heat and Power systems or upgrading it to biomethane for sale to the grid, charging gate fees for processing organic waste, selling co-digestate as bio-fertiliser or soil conditioner, or using power-to-gas are all options to minimize payback time and attract investments. To overcome the wide range of barriers ranging from poor grid accessibility for small energy provider to restrictive quality standards biomethane, a holistic regulatory approach is needed. Given the increasing amounts of sludge resulting from co-digestion, it is especially urgent to develop a coherent strategy for the disposal (and ideally) marketization of co-digestate (e.g. including quality criteria).

Increase cross sectoral awareness and establish a national platform for promoting energetic use of wastewater

Today, the energetic use of wastewater outside the premises of a wastewater utility is still not widespread. Wastewater-based external energy supply involves multiple stakeholders or stakeholder groups which implies more complex planning approaches compared to a sole internal use in the wastewater infrastructure. Furthermore, the awareness and the knowledge concerning energy generation from wastewater differs widely between the different stakeholders. To deal with these challenges, in other countries a central agency like a non-profit organization, functioning as a knowledge broker and support provider has been proven beneficial. It would coordinate educational and financial interventions regarding energy optimisation of waste utilities across different governmental levels and institutions, but also to integrate policies. Further effective measures emerging from other studies also included a “buddy system” which matches experienced utilities with technologies with those being interested to adopt new innovations. This provides for exchange about the short-term and long-term benefits and costs of investing in the process or permitting and regulatory requirements and advice on how to overcome these challenges.

Recommendations

Wastewater-to-energy solutions, specifically when including co-digestion with organic waste, touch upon policies and legislation of the water, energy and solid waste sector. To scale them up and unleash their potential for enhancing energy security and grid flexibilisation, mitigating climate change and improving municipal budgets, the future legal and policy framework at both EU and national level should:

- Establish cross-sectoral policies and legislation that integrate critical interlinkages between the energy, water and solid waste systems innate to wastewater-to-energy solutions so as to maximise their synergies and avoid overlaps and conflicts;
- Recognize the superior environmental performance of bioenergy produced from solid waste and wastewater compared to forms using unsustainable

feedstocks and prop up targeted support through legal and regulatory instruments;

- Foster a waste regime that drives up the production of organic waste and consequently stimulates co-digestion in wastewater treatment plants as an economically attractive disposal pathway;
- Set up National Support Schemes that offer sufficient, predictable and long-term subsidies for renewables and specifically promote electricity, gas and heat produced from wastewater;
- Enable utilities to exploit multiple revenue streams around treating wastewater to improve their business case and become independent of subsidies in the long-term with a focus of developing a profitable way of disposing co-digestate;
- Increase multi-sectoral information transfer, education as well as targeted knowledge building and establish a national platform in charge of promoting energetic use of wastewater beyond the premises of wastewater utilities.