D2.4.1: 5 REPORTS ON THE LEGISLATIVE/ADMINISTRATIVE REGIONAL FRAMEWORKS

ITALY

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1. Introduction

Innovation in the water sector is stifled by multiple barriers, keeping innovation outcomes lower than in other sectors. Factors commonly include risk aversion of water and wastewater utilities, lack of public or commercial funding or, too stringent and conflicting regulations (Kiparksy et al., 2013, Ajami et a. 2014, Speight, 2015). A growing body of studies is investigating the barriers that particularly apply to nascent wastewater-to-energy systems. Dierich et al. (2017) for example mentions an unsuitable legal framework, low political priorisation of inter-sectoral action, and insufficient experience in utilities as main barriers. In another study (WERF, 2012), the authors find that "inadequate payback/economies" feature as the most dominant among 10 barriers impeding the implementation of biogas usage in the US wastewater treatment plants (WTPs). Financial hurdles also rank high up in a global study focusing on energy efficiency in US water and wastewater utilities, alongside governance issues and knowledge gaps (ESAMAP, 2012).

These studies indicate that the dissemination of wastewater-to-energy systems is generally confined by a large range of different barriers, rather than a few single ones. Some of the barriers are applicable to all water-related innovation. Others are unique to wastewater-to-energy systems, their specific type of technological or managerial solution, and the local or regional context the utility is situated in. This becomes obvious in studies that examine specific aspects of wastewater-to-energy systems, for example the "flexibilisation" of energy production and consumption in waste water treatments plants (WWTPs) for optimized energy supply (Dierich et al., 2017). Barriers concern cultural or behavioural aspects within the utility itself (e.g. low commitment of top management) as much as external conditions, for example low regulatory pressure to reduce energy consumption (ESAMAP, 2012). Identifying these barriers is a critical step in order to form measures for setting up framework conditions conducive to the uptake of innovate wastewater-to-energy systems.

As with any other environmental reform, improving the energy performance of wastewater utilities (WWUs) requires strong backing through legislation and policy at various political levels. In this report, we understand legislation and policy and the framework they form to include all laws, policies, regulations, strategies, rules and other instruments used to improve energy outcomes of WWUs. These affect a large host of disciplinary fields, like economics, spatial planning, finance, or utility governance and management relevant to wasterwater-to-energy systems. In implementing the framework, national and sub-national governments play a key role. They need to grant high-level political support for establishing national legislation and policies, take up the role of the regulator and financier, and initiate other important steps, such as creating a well-engaged and connected agency that provides leadership and coordinates efforts nation-wide (e.g. to produce necessary information like energy maps) (Vogt et al., 2010).

In overcoming key barriers, there are different types of legal and policy measures. With respect to heat generation in WWTPs, Kretschmer (2017) distinguishes between regulatory, incentive-oriented and actor-supportive measures. Necessary regulations, for example, require utilities to reduce CO2 emissions, to track and improve energy performance through energy audits, or to prescribe phasing out energy-inefficient

technologies. Incentives, in contrast, may link government funding or tariff reforms to the utility's energy performance. Or they remove subsidies for electricity that discourage utilities from taking steps towards more energy-efficient operations. Typical actor-supportive measures help utilities to gain access to information about new innovations, their costs, benefits, and available funding opportunities, or offer educational programs for and advice to utility staff. Governments can further establish policies to shore up financing, such as specific financial vehicles for investments in energy efficiency and renewable production in WWTPs or by facilitating access to cross-sector financing programs (e.g. climate funds).

2. Scope of the Study

The objective of deliverable 2.4.1 is to

I) examine the **legal and policy situation** with respect to energy efficiency (EE) and renewable energy (RE) production outcomes of WTPs in the five countries participating in the project REEF2Water;
II) identify the main **legal and policy barriers;**
III) and discern **drivers and existing approaches** to overcome them.

The analysis is based on **desktop research**, information compiled in D1.1.1 on the legal situation and experience of the authors themselves.

The aim of deliverable D2.4.1 is to contribute **to improving the legal and policy framework conditions** that are central for the uptake of wastewater-to-energy systems in each of the five countries. The resultant outcomes form the basis for D2.4.2, in which concrete recommendations for improving laws and regulations are provided. These will subsequently be shared and discussed with policy makers from the participating countries. Furthermore, D2.4.1 will form the basis of a position paper (D5.2.3), which identifies local legislation and regulatory barriers hindering REEF2Water regional implementation strategies, as well as measures to dismantle them.

The nature of the Reef2Water solutions implies that their implementation is affected by a **complex legal and policy framework**. Given that the solutions are part of the wastewater, energy, and solid waste system, a **cross-sectorial perspective** that relates to legal and policy aspects of each of these three systems was taken. This ensures that necessary **sector linking** is achieved in practice.

The analysis considers the **different ways to exploit energy** from wastewater, including energy from biogas production, on-site renewable generation and operational energy efficiency. Here, it is being distinguished between **thermal and electrical energy.** Given the project's particular ambition to enrich sludge through **organic substrates** in the treatment process, the analysis considers applicable legislation and policies of the solid waste system. Furthermore, as the project aims at exploring the potential for WWTPs to become local providers of energy, legislation and policies regulating **temporary energy storage** (such as power-to-gas solutions) and **feed-in into the grid** (including relevant market-based mechanisms) are considered. All of these aspects are examined for

different political-administrative levels, at which policy and legislation are given effect at (international/EU, national, federal, and municipal). This helps to locate barriers more precisely, as well as to find scale-sensitive measures to overcome them.

3. The EU-Legal and Policy Framework

3.1. Environmental policy and law making in the EU

This chapter summarizes the most relevant EU Directives affecting the implementation of measures to increase EE and RE production in WWTPs. It then analyses a range of legal and policy barriers that are central in doing so.

Directives form the most common regulation in the EU legislative framework. They set the standard conditions and rules. According to the Subsidiarity Principle, member states have to transpose these into national legislative systems, following a clearly defined timetable and a way that best suits national circumstances (LeBlanc et al. 2008).

While member states are aiming at the same goals, the means they use to achieve them can be quite distinct, the heterogeneous development of EU energy markets serving as a very good example.

3.2. Key drivers of wastewater-to-energy solutions and resulting trends across EU member states

The share of renewables in the EU energy mix reached 17 % in 2016. It increased twofold since 2004, being mainly driven by legally binding energy saving and decarbonisation targets (Edwards et al., 2016).

- Renewable energy markets have distinctly developed across member states in what regards their scale and composition of different renewable energy forms. For example, biogas is predominantly used to produce electricity while much of the heat potential remains unexploited (Kampman et al., 2016). Also, only some frontrunners such as Sweden actively pursue producing biomethane for the transport sector.

- Only a few countries, such as Spain, use sewage sludge as a main feedstock for biogas production, making it the feedstock being used the least overall (Scarlat et al., 2018). In most member states, such as Germany and Italy, crops dominate as a feedstock while the potential to use sewage remains largely untapped (Figure 1.).

- The EU has began to embrace a circular economy approach. Its stringent regulatory regime is changing waste streams and disposal options. Importantly, while bio-waste and sludge production increase (Zsirai, 2011), limits are put on landfilling, and particularly of biodegradable material. Applying sludge as a fertiliser and soil conditioner is still the preferred options in most member states, more stringent rules confine this end-use form (Spinosa 2010). Together these developments have driven wastewater-to-energy solutions.

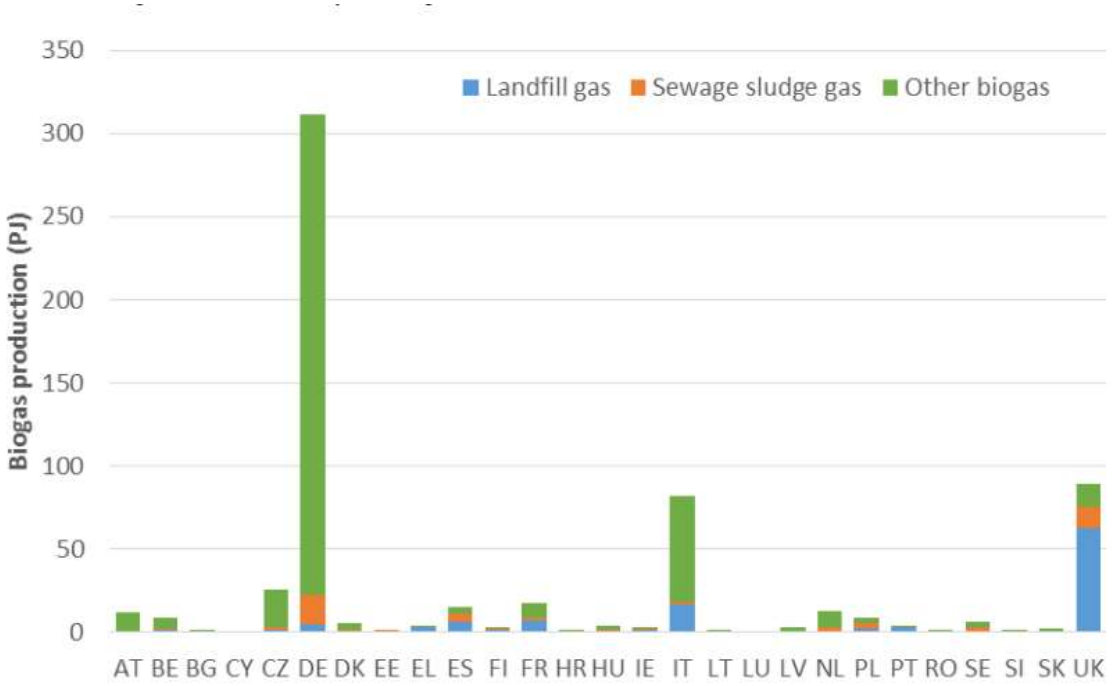

Figure 1: Biogas production per Member State in 2014, differentiated by source (Kampman et al., 2016)

3.3. Overview of key EU legislation and policies

3.3.1. Water & Wastewater

The Water Framework Directive (2000/60/EC)

This directive (here referred to as the WFD) requires that rivers, lakes, transitional waters, coastal waters, and groundwater obtain "good status" by 2027. To achieve this goal, the EU has determined a clear timeline and three six-year management cycles for the member states. One of its main elements is the introduction of River Basin Districts, which form the management units for managing water resources. Importantly, the WFD pertains to services of both water and waste water.

The Urban Waste Water Treatment Directive (91/271/EEC)

The main objective of the Urban Waste Water Treatment Directive (UWWTD) is to protect the environment from negative effects of urban wastewater discharges. It comprises the collection, treatment, and discharge of domestic wastewater, mixture of wastewater, and wastewater from certain industrial sectors. It stipulates the level of treatment and the removal of nutrients and basic sanitary parameters, as well as conditions for sludge disposal and reuse.

The Sewage Sludge Directive (86/278/ EEC)

The Sewage Sludge Directive (SSD) is concerned with the management of sewage sludge. It particularly seeks to encourage the use of sewage sludge as a soil conditioner and fertiliser in agriculture. It bans applying untreated sludge on

agricultural land. Also, it sets all the requirements and provisions to prevent potential harmful effects on humans, animals, soil and vegetation as well as surface and groundwater. The Directive lays down the basic limits for potentially toxic elements (PTEs, which are HMs) in SS and soil.

3.3.2. Climate change mitigation

2020 Climate and energy package ("20-20-20 targets")

This package was established in 2007. Its goal is to ensure that the EU meets its climate and energy targets. In consequence, the legislation encompassed three main targets for the year 2020:

- 20% increase in energy produced from renewables
- 20% enhancement in energy efficiency
- 20% cut in greenhouse gas emissions (compared to 1990 level)

Emissions Trading System (ETS)

The ETS is a central element in the EU's policy to tackle climate change and a key tool for reducing greenhouse gas emissions in a cost-effective manner. It is based on a "cap and trade" system. The cab limits the amount of greenhouse gas emissions a certain user or industry is allowed to emit. As the cap is gradually lowered over time, emissions are expected to fall. Within the cap, companies receive or buy emission allowances that cover their emissions. These can be traded.

Effort sharing agreement for the non-ETS sectors

The Effort Sharing Decision establishes binding annual greenhouse gas emission targets for Member States for the period 2013–2020. These targets concern emissions from most sectors not included in the EU Emissions Trading System (EU ETS), such as transport, buildings, agriculture and also waste. The regulation aims to ensure that the non-ETS sectors emissions reduction target of 30% by 2030 compared to 2005 levels.

3.3.3. Renewable energy production and energy efficiency

Renewable Energy Directive (2009/28/EC)

The Renewable Energy Directive (RED),which is currently being revised, establishes a policy framework for producing and encouraging renewable energy in the EU, including biogas. The directive requires that 20 % of the EU's energy mix in 2020 must be renewable. It translates this general goal into individual targets for each of the member states. In a recent proposal to revise the directive the Commission elevated that goal to 27 % by 2030. The RED also defines sustainability criteria for biofuels and bioliquids in the transport sector.

Directive to reduce indirect land use change for biofuels and bioliquids ((EU/2015/1513)

The ILUC was established as response to sustainability challenges concerning bio-energy made out of food-based crops, most importantly indirect land-use change. It amends current legislation on biofuels, including the Renewable Energy Directive (2009/28/EC) and Fuel Quality Directive (2009/30/EC). For example, it limits the share of biofuels produced from crops in the transport sector (7% in overall fuel mix). It also requires that biofuels produced in new installations emit at least 60% fewer greenhouse gases than fossil fuels.

Energy Efficiency Directive (2012/27/EC)

The Energy Efficiency Directive (EED) mandates energy efficiency improvements. It establishes a common framework for the promotion of EE within the EU to meet its EE headline target of 20% by 2020, in all stages and sectors of the supply chain. EU member states have to prepare a National Energy Efficiency Action Plan every three years and report on their progress in the different sectors (i.e. industry, residential, services, public, transportation, electricity and heat generation).

Directive for combined heat and power generation (2004/8/EC)

This directive promotes the use of combined heat and power (CHP) units to improve the efficiency of electricity and heat production. It sets rules on guarantees of origin, efficiency criteria, administrative procedures, and other issues. Member states are encouraged to provide support schemes for CHP units to enable their widespread implementation (including specific support for WTTPs).

3.3.4. Natural Gas

Directive on services in the internal gas market (2009/73/EC)

This 'Gas Directive' establishes common rules for the transmission, distribution, supply and storage of natural gas. It stipulates rules relating to the organisation and functioning of the natural gas sector, access to the market, the criteria and procedures applicable to the granting of authorisations for transmission, distribution, supply and storage of natural gas and the operation of systems. The rules also apply in a non-discriminatory way to biogas and gas from biomass, i.e. sewage gas from WWTPs.

Directive for internal electricity market (2009/72/EC)

This directive establishes common rules for the generation, transmission, distribution and supply of electricity, together with consumer protection provisions, with a view to improving and integrating competitive electricity markets in the EC. It lays down the rules relating to the organisation and functioning of the electricity sector, open access to the market, the criteria and procedures applicable to calls for tenders and the granting of authorisations and the operation of systems such as transmission or distribution systems, including the request for unbundling of electricity production and

Directive for taxation of electricity and other energy products 2003/96/EC (EU 2003a) sets a framework for taxation of electricity and other energy products, e.g. gas or other fuels. It defines the energy products to be taxed and the minimum amount. The project "Full scale demonstration of energy positive sewage treatment

plant concepts towards market penetration" (POWERSTEP) has received funding under the European Union HORIZON 2020 –

3.4. Solid waste management

The Waste ´Framework Directive (2008/98/EC)

This directive defines basic concepts such as the "waste hierarchy" (a priority order set among waste prevention and management options), and stipulates requirements for waste management, such as to up a separate collection of waste, waste management plans, and waste prevention programmes. It also establishes legally binding targets such as for household waste streams including biodegradable materials).

The Landfill Directive (1999/31/EC)

This directive aims at preventing or reducing adverse environmental impacts from landfilling of waste through stringent technical requirements for waste and landfills. It obliges Member States to reduce the amount of biodegradable municipal waste that they landfill to 35% of 1995 levels by 2016 (for some countries by 2020) while current legislative of the proposal of it consider a complete ban of landfilling.

3.5. Legal drivers and barriers

Paucity of energy aspects and targets in water legislation

Energy-related issues remain vastly absent from the EU's legal and policy framework of the water sector. The key water-related directives, the WFD and the UWWTD, make no provisions that specifically focus on targets, measures or incentives to improve EE or renewable production measures in WWTPs, whether motivated by ambitions of cost-efficiency or decarbonisation. Also, more recent water policy documents such as the "Blueprint to Safeguard Europe's Water Resources" (2012) poorly make that linkage. A legislative proposal of the Drinking Water Directive adopted this year comprises one of the first attempts to embrace the water energy-water nexus by encouraging member states to increase energy efficiency.

Lack of overall cross-sectoral and coherent legal framework

The absence of a cross-sectoral approach spanning across various relevant EU energy, waste, water, agricultural and other concerned directives stifles legal backing needed to more systematically support wastewater-to-energy solutions. Energy-related issues are missing in EU water sector policy and law, which predominantly focus on water quality and quantity goals. The RED, on the other side, fails to articulate specific provisions on how, for example, the waste water sector can contribute to achieving targets concerning carbon reduction and renewable production. Incoherence of the overall legal and policy framework has been ranked as the top barrier for biogas production (Kampmann et al., 2016).

Inadequate priorisation of second generation bio-energy

Member states have been free to opt through which form of renewable energy they accomplish these targets. This flexibility has given rise to divergent developments of

the biogas market across the member states (Torrijos, 2016), with in part undesirable outcomes. A prominent example applies to the rise of crop-based biogas, which ranks as the EU's main type of bio-energy and dominant renewable energy form (Kampman et al., 2016). As a feedstock, however, crops have proven adverse environmental impacts (e.g. land use change). The environmental footprint of biogas produced from waste streams, in contrast, is significantly better, but their share in the biogas market lag behind that of crop-based biomass (see. Figure 1). This is because the EU legal and policy does not systematically support renewable energies according to their sustainability performance. Sustainability criteria, which form one central pre-condition towards doing so, exist only for the transport sector while they lack cross-national harmonisation (Kampman et al., 2016).

An improving yet unreliable base of bio-waste feedstock

The EU's stringent regulatory regime for waste functions as a strong driver for wastewater-to-energy systems. The Landfill Directive is viewed as the most important factor propelling the growth of anaerobic digestion (AD) (including on-farm applications) in treating biowaste and industrial feedstock (Edwards et al., 2015). This is because the ban on landfilling and tightening quota for reducing landfilled biodegradable organics increase the need to find solutions for disposing growing amounts of bio-waste (Torrijos, 2016). However, many member states do not have a reliable bio-waste feedstock base (Edwards et al., 2016). Only 25 % of the total bio-waste in the EU is recycled while recycling rates are considerably lower in many member states (Mateescu et al., 2008). In some countries like the UK, access to adequate organic feedstock is already a barrier (Kampman et al., 2016). Additionally, current regulations do not promote AD as a preferable disposal option for biowaste. Legal loopholes still allow member states incinerate or landfill biowaste (Iacovidou et al., 2012). The European Biogas Association (2016) remarks that incineration may become the main disposal option for biowaste as the as the landfilling ban takes effect.

Under-development of heat usage due to weak incentives

Whether WWTPs achieve high potential of energy and carbon emissions savings depends on exploiting both heat and electricity generated during the combustion of biogas. Biogas markets have expanded in several EU member states. However, despite some positive development, often only the electricity generated from biogas is used while the heat potential remains untapped. Currently, only 25 % of the heat is used in Europe's WWTPs (Scarlat et al., 2018). While plant operators face pressure to improve the economics of biogas plants (ibid), weak incentives at the EU-level comprise one key factor responsible for the slow development of heat usage from biogas (Kampman et al., 2016).

Lacking revenue streams for sewage-based co-digestate

Using co-digestate of sewage sludge and bio-waste as soil conditioner or fertiliser (for example in agriculture) can spur the uptake of wastewater-to-energy solutions (Edwards et al., 2015). Such "end-use" applications guarantee that sewage sludge, whose production in Europe will rise over the next years (Werle, 2015), will be harnessed in the spirit of a circular economy. Currently, however, sludge-based co-

digestates are subject to an incoherent and partially conflicting legal and regulatory regime (Iacavidou et al., 2012), which compounds the dissemination of AD technologies. One main barrier is that co-digestate containing sewage sludge is currently classified as waste and not a valuable product. This legal definition only allows WWTP operators to market the biogas, but not its by-products, undermining additional revenue streams (Kampmann et al., 2016).

Ambiguous financial mechanisms for wastewater-to-energy solutions

Access to inexpensive renewable energy will become increasingly important because the cost of sewage sludge treatment is bound to rise due to higher treatment standards and rising energy costs, among others (Zsirai, 2011). Cost pressures, which the imposed by the cost-recovery principle in the WFD, theoretically attractive for WWUs to deploy RE production. However, new technologies such as AD are capital-intensive, generally requiring subsidisation (Edwards et al., 2015). National support schemes (e.g. feed-in tariffs) form the key financial mechanism to drive renewable energy developments in the EU. However, these are still ineffective in many member states, for example due to low or reduced subsidies (Kampman et al., 2016). At the same time, the EU legislation and policies upon which the support schems are based are yet not sufficiently linked to sustainability criteria, as argued above. Furthermore, Green Public Procurement (GPP) for WWTPs currently apply only to EE, but not to producing RE (Loderer and Hananel, 2018).

Grid injection of bio-energy

If not used for self-supply in on-site CHP plants, WWUs have several options to bring bioenergy to the market: As biogas or biomethane via the gas network; as heat via the district heating network; or as electric power via the electric grid. Arguably, a range of barriers apply to each of these options. Generally, decentralized energy forms – such as wastewater-to-energy solutions – lack a common EU framework that explicitly supports them. Across member states + small market entrants providing distributed energy (DE) still face various challenges, including a lack of explicit incentives in planning and operations of networks, high connection charges, or high trading fees (Ropenus and Skytte, 2005). Another specific example concerns cross-border trade of biomethane, which is hindered substantially by national quality standards, which lack harmonisation (Kampan et al., 2016).

4. Overview on legal and policy situation in Italy

The Italian regulatory framework for renewable energy that is produced from waste and wastewater is very complex and in continuous evolution, with more than 1700 acts at national and regional level. Renewable energies have been receiving financial support since the early 2000's when the EU Directive 2001/77/EC concerned with the promotion of the use of electric energy produced by renewable sources was transposed into national law (Decree 29 December 2003, n. 387)

4.1. National Level:

Decreto Legislativo n.28/2011 stipulates provisions made in the EU Directive 2009/28/EC, which promotes renewable energy production. Legislation regarding waste and wastewater treatment and management is regulated by the legislative decree 152/2006 (GU, D.Lgs. 3 April 2006) and its subsequent modifications. This decree relates to and reorganises all legislation on environmental issues and, as a consequence, also on waste and wastewater management established by EU law. For this reason the laws mentioned above, which were introduced before the 2006, have been repealed and renewed through this decree while it implements all European directives.

The decree describes procedures and limits for the use of waste and waste water and requirements for disposal and recycling. The decree does not address to the energetic aspects, but only the protection of the environment. The energy production processes are affected by this decree, and in particular anaerobic digestion process and wastewater management and sludge treatment and disposal, relating at their effects on the environment.

Only the use of specific wastes that possibly cause negative environmental effects is specifically and strictly regulated. This is of particular relevance in the case of sewage sludge. The organic components of sludge enable application, as organic fertilizer, in agriculture (Maglia e Balossi 2017). The potential health risk from this has led to the development of specific regulations. In this case sludge or the final products it is a part of (such as co-digestate with food waste) must respect stipulated concentration limits in order to qualify as a fertilizer or compost.

Legislation requires to examine values for pollutants of sludge that is going to be used as fertiliser regularly: Plants larger than 100.000 PE have to conduct an assessment every three months and plants with PE smaller than 5.000 every year.

In several cases this strict legislation suggests local wastewater utilities to identify other solutions for the sludge management instead of the biogas digestion or co-digestion. These can include incineration or other stabilization technologies.

Renewable energy production is regulated by the Decree 23 June 2016 that takes into account all renewable energy forms.

An important new decree published on 2nd March 2018 named “Promozione dell'uso del biometano e degli altri biocarburanti avanzati nel settore dei trasporti” (Promotion of the use of biomethane and other advanced biofuels in the transport sector”) determines the rules for biogas upgrading, grid injection, and for the use as biofuel.

This decree is of particular relevance. According to the 2020 climate & energy package Italy has already reached its renewable energy targets. However, it has not yet reached the objectives for increasing the fraction of biofuels used in the transport sector. This was particularly because legislation failed to define rules and procedures for grid injection and for the use of upgraded biogas as biofuel.

Decree 2 March 2018 overcame this “legal gap” and it can be expected that amendments relating to biogas upgrading will come into force within the next months.

In particular, the new Decree has the following objectives:

• to further promote the use of biomethane for transportation and for achieving the objectives set for Italy by the European directives in terms of the use of renewable fuels in transport. The incentive charge is distributed to the parties who are obliged to release biofuels for consumption (Obligated Subjects);

• promote retrofitting of existing plants, actually producing electricity, to bio-methane plants distributing methane for the grid or as biofuel with the aim to reduce the operational costs for the electricity consumption;

• promote production facilities for advanced biofuels other than biomethane.

The decree will establish a transparent and reliable scheme for the production of biomethane and the subsidies that energy producers can apply for.

It is based on an instrument called Cetificato di Immissione al Consumo (CIC Consume Admission Certificate). This certificate has a value of 10 Gcal for biofuels and five Gcal for advanced biofuels as biomethane produced with a list of biomasses listed in the annex 3 part A of the of the Decree 2 March 2018. It is possible to use also other biomasses, but it is forbidden to exceed the limit of 30% of the weight of the total feeding.

The value of each CIC is 375€. In addition to this amount, each producer will receive a subsidy if the feedstock used is renewable and is by definition no food. An additional subsidy is also available if the biomethane technology used to produce it is listed in the annex of the decree.

4.2. Regional Level:

In Italy each region is legitimised to modify national legislation only in the sense of an higher environment protection. Most of the regions take this opportunity to develop their own legislation for several reasons.

As the Italian Reef 2W pilot site is located in the Emilia Romagna Region below is a short list of the legislation developed in this region that is more or less closely related to the production of biogas:

- ✓ Legislative Assembly Resolution no. 51 of 26 July 2011 "Identification areas and sites for the installation of electricity production facilities through the use of renewable wind energy sources, from biogas, from biomass and hydroelectric ";
- ✓ Resolution of the Regional Council n. 1495/2011 "Technical criteria for mitigation environmental impacts in the design and management of biogas plants ";
- ✓ Resolution of the Regional Council n. 1496/2011 "General authorization for energy production plants with engines with rated thermal power less than 10 MWt powered by biogas ": establishes limits on emissions into the atmosphere for biogas combustion engines;

- ✓ Resolution of the Regional Council n. 362/2012 "Implementation of the D.A.L[1]. 51 of the 26 July 2011 ": approval of the criteria for the calculation of the emission calculation for biomass energy production plants (for checking the balance of emissions of PM10 and NO2).
- ✓ Regional regulation 4 Janury 2016 that define the use of sludge in agriculture that results from wastewater treatment

Moreover the Agenzia Regionale per l'Ambiente Emilia Romagna (ARPAE Regional Envioromental Agency Emilia Romagna) has the obligation to provide its opinion on each energy facility with respect to the biomass uses and the effects on the environment as well as on human health. This opinion must be taken into account while considering legislation in force, as well as the local environmental situation.

All the above mentioned laws/decrees addresses the use of the final products resulting from the anaerobic digestion process in agriculture. It specifically provides more strict rules for its application in agriculture and emission of air pollution.

5. Main legal and policy barriers in Italy

In Italy, the share of biogas produced from sewage sludge is low compared with crop-based biogas. Landfilling and incineration of sludge have been the preferred disposal options for sludge historically. Their dominance has impeded the development of biogas produced from waste streams including wastewater. Legislation in Italy focuses mainly on the environment and human health protection and it has been developed mainly looking at the agricultural sector rather than the increase of efficiency of urban waste and wastewater treatment plants. For this reason it is probable that a specific legislation developed for the sludge and waste conversion to biogas has not evolved to date. Previous legislation does not make specific provisions for biogas production and fails to define preferences or requirements for which feedstocks to used. Additionally, there were several levels of subsidies for electricity generated from renewable energy sources according to the year of installation of the anaerobic digestor. This is a consequence of the development of legislation in different years. The problem with the different levels of subsidies was that during the last years the number of plants constructed decreased considerably, and "new" biomasses available were not used for energy production because it was not economically convenient.

As aforementioned, the 2020 objective for the electricity from renewable energy in Italy is already reached. For this reason two main strategies for new plants have been developed: The first seeks to decrease the subsidy for electricity production; the second aims at promoting the increase of the heat use. Unfortunately most of the plants are far away from easy utilisation and for this reasons it is difficult to use this energy.

[1] D.A.L.: Deacreto Assemblea Legislativa, Decree of the Legislative Assemblee regional legislative body

Thanks to the decree of March 2018 the last barrier for the biogas upgrading has fallen and shortly the biomethane production for vehicles or grid injection could start. (GSE, Biometano s.d.)

The first national legislation for biomethane production was introduced in 2016, the application rules of the legislation has been published in 2018 and after another four month the procedures will be published.

The extensive processes to develop and implement legislation in Italy is likely the main barrier for the development of the RES in Italy. Additional barriers are the unpredictable development of the energy market and legislation and the competition with fossil energies. According to European policy Italy has developed its own energy plan in 2017. Therein no specific provisions are made relating to the production of energy from solid waste or wastewater. Yet it contains objectives to reduce the use of biogas for the energy production. All large and medium-sized plants built in the future should transform the biomass in biomethane or other biofuels. This is due to the still unreached objective for the biofuel production in Italy and in the meantime for the strong request that most the population ask for a better quality of the air in the urban areas.

6. Drivers and existing approaches to overcome barriers in Italy

The new Italian National Energy Strategy (SEN2017), adopted in November 2017 by a Joint Decree of the Ministry of Economic Development and the Ministry of the Environment, assigns to the RES a central role for the sustainable development of the country. It sets, among other things, targets for the development of renewable energies until 2030, which are more ambitious than those currently proposed at European level. The strategy aims to make the national energy system more:

- Competitive, continuing to reduce the sales price gap and the cost of energy compared to Europe, in a context of increasing international prices.
- Sustainable, achieving environmental and de-carbonisation objectives defined at European level in an ecological way.
- Safe, continuing to improve the security of supply and the flexibility of energy systems and infrastructures, strengthening Italy's energy independence.

Among the quantitative targets envisaged by SEN2017, it is necessary to mention (MiSE 2017):

- Energy efficiency: reduction of final consumption from 118 to 108 Mtep with a saving of about 10 Mtep to 2030.
- Renewable sources: 28% of renewables on total consumption in 2030; in sector terms, the objective is divided into a share of renewables on electricity consumption of 55% to 2030, on thermal uses of 30% and in transport to 21%.

- Cessation of the production of electricity from coal with an acceleration target of 2025, to be achieved through a precise plan of infrastructural interventions.
- Decarbonisation in 2050: compared to 1990, a decrease in emissions of 39% in 2030 and of 63% in 2050.
- Redouble research and technological development investments in clean energy.

Another driver is the national target to reduce Italy's dependence on foreign energy from 76% (2015) to 64% by 2030 (the ratio between the import / export balance of primary energy needed to cover the needs and gross domestic consumption), thanks to the strong growth of renewables and 'energy efficiency.

At the moment, this is the only existing strategy. Other technological approaches like Power-to-Gas are not considered in the current legislation. It is thus unlikely that these technologies will gain traction in the next few years. A more holistic legal approach could be useful because biomethane generates a surplus of pure carbon dioxide that could be utilized for the production of other biomethane using the excess of electricity deriving from the photovoltaic plants.

7. Appendix I: Questionnaire for Legal and Policy Barrier Analysis

This questionnaire is intended for gathering primary and secondary data needed to accomplish D2.4.1. There is no obligation to use it, but you may find it useful drawing on all or several of the proposed guiding questions.

- Conduct 5-10 interviews with experts such as utility staff or policy makers and other experts, separately or in focus groups;
- Adjust questions according to the type of interviewed respondent, characteristics of the treatment facility and utility and country context.

Legal and Policy Barriers in Country X

1. How conducive is the legal and policy framework in supporting the implementation of EE and RE measures in the WWTP(s) of your country?

2. Can you outline and describe in detail the most significant legal and policy barriers, differentiating between the main ways for exploiting energy from wastewater where relevant (such as improving operational energy efficiency or generating electricity and heat from biogas)?

3. Can you identify the political level(s) at which legal and policy barriers may be most severe (EU/International, national, federal and local)?

4. Does the legal and policy situation support or impair interventions for exploiting waste heat more than electricity or vice versa? If so, what barriers apply?

5. Which legal and policy barriers constrain WWUs from using surplus heat and electricity for self-supply?

6. What legal and policy barriers impede supplying waste heat or electricity to the market in your country? For example, regulations may prohibit WWUs from entering business other than managing wastewater while low subsidies for RE might constrain them to gain financial sustainability.

7. What legal and policy barriers particularly apply for integrating systems of solid waste and wastewater to use organic substrates for enrichment of sludge in the co-fermentation process?

Policy and legal drivers and approaches to overcome barriers in Country X

8. Can you outline and describe the most significant legal and policy drivers, differentiating between the main ways for exploiting energy from wastewater where relevant?

9. What governmental or private sector actors do you consider most critical for improving the legal and policy framework for wastewater-to-energy systems?

10. What actor-based instruments (such as a central agency to coordinate interventions with respect to energy-related matters or specific funding or educational programmes) have been established to promote wastewater-to-energy systems?

11. Are you aware of legal and policy interventions that are currently being planned or already under way to overcome the main barriers you mentioned above (e.g a revision of the sludge ordinance or law with respect to CHP?)

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