Ref. Ares(2019)3540191 - 31/05/2019

EMBRACED

Establishing a Multi-purpose Biorefinery for the Recycling of the organic content of AHP waste in Circular Economy Domain

Grant Agreement No.: 745746

Call (part) identifier: H2020-BBI-JTI-2016

Topic: BBI-2016-D06 – Valorisation of the organic content of Municipal Solid Waste and contributing to the renewable circular economy

Starting date of project: June 1st, 2017

Duration: 60 months

WP 6 – Legislative framework, standardization and social acceptance
Deliverable 6.1 – Policy recommendation to overcome legislative barriers for the recovery of AHP waste as secondary raw material

Due date of deliverable: **31st May 2019**
Actual submission date: **31st May 2019**

Lead beneficiary: Legambiente

Dissemination Level (Specify with "X" the appropriate level)		
PU	Public	X
CO	Confidential, only for members of the consortium (including the Commission Services)	

This project has received funding from the Bio Based Industries Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement No. 745746

TABLE OF CONTENTS

Special thanks to Ms Marzia Mattioli for the production of this report

LIST OF ABBREVIATIONS

Abbreviation	Definition
AHP	Absorbent Hygiene Products
APA	Portuguese Environment Agency
DMC	Domestic Material Consumption
EC	European Commission
ECESP	European Circular Economy Stakeholder Platform
ENEA	Agenzia Nazionale per le Nuove Tecnologie, l'Energia e lo Sviluppo Economico Sostenibile/The Italian National Agency for New Technologies, Energy and Sustainable Economic Development
EPR	Extended Producer Responsibility
EoW	End of Waste
EU	European Union
GDP	Gross Domestic Product
ICESP	Italian Circular Economy Stakeholder Platform
ISPRA	Istituto Superiore per la Protezione e la Ricerca Ambientale/The Advanced Institute for Environmental Protection and Research
ISS	Istituto Superiore di Sanità/The Advanced Health Institute
MATTM	Italian Ministry of the Environment
OVAM	Public Waste Agency of Flanders
PAYT System	Pay-As-You-Throw System
RIVM	Dutch National Institute for Public Health and the Environment
SAP	Super Absorbent Polymers
SEPA	Scottish Environmental Protection Agency
WDF	Waste Derived Fuel
WEEE	Electrical and electronic waste

INTRODUCTION

The present report constitutes deliverable D6.1 “Policy recommendation to overcome legislative barriers for the recovery of AHP waste as secondary raw material” within the framework of the EMBRACED project. The following activities refer to WP6 and specifically to Task 6.1.

1.1 Executive Summary

The circular economy is a new economic paradigm characterising recent productive and economic approaches. This new approach has begun to shape the choices made by industrialised countries and companies whose annual turnover may exceed 3 trillion dollars worldwide. Absorbent hygiene products (AHP) have become essential items in contemporary society and their use has greatly increased. AHP accounts for approximately 2% to 4% of total municipal solid waste and is currently considered a non-recyclable component, which is usually incinerated or disposed of in landfills. However, an innovative recycling solution exists which involves using post-consumer AHP waste to create secondary raw materials with high-value applications. The EU-funded EMBRACED project aims to close the AHP waste cycle. The objective is to obtain commercial end products which have value in terms of price, quality, reducing greenhouse gas emissions and enhancing sustainability in Europe. The project is guided by a circular economy approach which closes the raw material cycle. As such, it minimises the use of primary resources while generating a positive cooperative model among the actors involved.

This study proposes regulatory recommendations regarding AHP that are based on best evidence from diverse countries and the most advanced processes. It adopts both a national and European focus. The main recommendations made foster the consolidation of “circular” policies and take as a model existing EoW criteria related to Absorbent hygiene products (AHP) which are currently under approval or formalisation in Italy or other EU states. Once the bureaucratic regulatory process has followed its course, it may be necessary to make these criteria generalizable to other countries that seek to promote circular resource processes based on secondary raw materials. In Italy, after a normative, technical and institutional process lasted four years, the EoW legislative Decree for the AHP has been signed on 15th May 2019 by the Ministry of the Environment, Mr. Sergio Costa.

A unified recognition of EoW concepts at the European level would generate numerous benefits. It would allow levelling the playing field for recycling businesses in terms of market conditions, provide greater security of investment and help eliminate unnecessary controls on the use of materials to which EoW criteria may apply.

1.2 Introduction to the Circular Economy

The European Circular Economy Package was approved in 2018. However, 2019 will be the key year for its implementation and to begin working towards the new objectives it sets out. For this to happen, the non-technological obstacles that still exist, at least in Italy, need to be eliminated.

The circular economy represents an opportunity for revolutionising the use of natural resources and waste management, leaving landfill and the energy recovery as last options. However, the current level of innovation and development does not allow for the adequate recovery of secondary raw materials.
The innovatory aspect of this new circular economy development paradigm resides in transforming the economic functionality of resources. This means, among other things, fighting food waste, isolating organic components for use in energy generation via anaerobic digestion, lengthening the life of consumer products, making items more recyclable and reusable in terms of design and ending programmed obsolescence.
Reducing “waste” production, recovery and reuse all become an integral part of processes, together with other measures aimed at reducing production costs, lowering dependence on primary raw materials and increasing job opportunities. This approach also allows for reducing climate emissions within supply chains, limiting the pollution producing effects of new goods and services and lowering production process waste and emissions.

If properly implemented, circular economy effects on production systems in this century will rival the major technical and economic changes seen in the 20th century. These historical changes generated advantages for the companies and countries that primarily engineered them, including the Ford and General Motors companies in the United States, pioneers in mass production, and Toyota in Japan, which introduced just-in-time and flexible production strategies.
Moreover, ’it has been demonstrated that once the benefits of a new approach are evident, systemic changes in the economy can happen much faster than expected, taking into account the continuing influence of factors like available technology, resource prices, rules and regulations. But unlike economies of scale and flexible production strategies of the past, the circular economy is a completely new and revolutionary production approach. One factor necessitating such innovation has been the constantly growing rates of resource extraction which have tripled since 1970. Another is increased greenhouse gas emissions, 62% of which may be linked to the extraction and processing of raw materials. According to the “2019 Circularity Gap Report”, the world economy extracts 92.8 billion tons of raw materials annually, including minerals, fossil fuels, metals and biomass, and only 9% of these materials are reused.
This demonstrates that circular economy strategies have ample room for development worldwide. Europe is playing a central role in this evolutionary process, at the institutional, regulatory and production level. In fact, there are many pioneering companies currently involved in activities for the recovery and use of secondary raw materials. For example, there is now an active service network, created by the European Commission, European Economic and Social Committee and European Circular Economy Stakeholder Platform (ECESP), which is already bringing together many best practices, strategies, contacts and related news. The new national economic powers which have already become aware of the potential benefits of the Circular Economy should not be underestimated. At the World Cities Summit Forum in Singapore last July, the State Council of the Republic of China kicked off the “Zero Waste Cities” project. This project aims to support the circular economy process through plant upgrades, reducing basic waste generation and promoting worldwide replication of the project’s activities. This sudden change of course in China is not only due to the waste problems affecting the entire country, but also to the value the circular economy can offer. Turnover associated with it may be worth approximately $3 trillion according to estimates presented at the Annual World Economic Forum in Davos.

The potential of the circular economy also encompasses savings in terms of waste sector economic and environmental costs. These savings derive from reducing use of landfills and incinerators, which have high environmental impacts and are becoming increasingly obsolete. There are also advantages in terms of extending the useful life of products. One of the main objectives is to increase the recyclability and reparability of goods by putting an end to dependence on primary materials and programmed obsolescence, a pillar of consumption-driven societies. This does not necessarily mean halting world economic growth and productivity, but a shift of importance towards recovery, repair and research. Following the ECESP example mentioned above, Legambiente has produced the first "Atlas of Champions of the Circular Economy in Italy" (2017), which brings together positive experiences in optimising resource use. These examples address bioeconomics, waste management and reuse for production, while paying much care and attention to the design and disposal phases. It includes 107 entries comprised of small and medium-sized enterprises, cooperatives, innovative start-ups, municipalities, associations and other territorial entities. 65% of them contribute to the circular economy by reducing use of raw materials, 53% through waste reduction and 48% by saving resources (water, energy and raw materials). 43% produce secondary raw materials and 34% use them. 38% recycle waste through other production cycles and 26% within a single cycle. 36% carry out reuse activities, 14% are reducing food waste, 13% produce biomethane from agricultural/livestock waste or FORSU and 8% see sharing as a priority. This reflects a great overall achievement for Italy given that it was internationally known in the 1990s for its waste-related emergencies.

The trend is in the right direction. Addressing waste issues is now necessary, fundamental and indispensable to creating a more stable world for future generations. As a result, there has been a continual growth in conferences and trade fairs addressing the issue. These have included: Ecomondo 2018: Green & Circular Economy in Rimini; the EU Circular Business Conference 2018: Sustainable Products in a Circular Economy in Brussels; the Amsterdam Circular Expo 2017; the upcoming World Resources Forum 2019 in Antwerp; and Pollutec 2020 in Lyon. The circular economy is a common thread running through all these events. In addition, university faculties have started to offer degree courses dedicated to the subject (for example, the University of Tuscia in Viterbo). There are also an increasing number of prizes and competitions fostering start-up development and sustainable innovation centring on the environment and the protection of natural ecosystems.

2 CORE OF THE DELIVERABLE

2.1 The importance of End-of-Waste criteria

A fundamental pillar of the circular economy is the recovery and reintroduction of waste into the production circuit, transforming it into what is known as secondary raw material. This process is defined as End-of-Waste (EoW). In this regard, EoW criteria are key since they lay out a clear path ahead for the recycling and recovery sector involved in this process. At the EU level, Directive 2008/98/EC addresses waste, by-products and secondary raw materials. This European legislation has been integrated into Italian law through the Legislative Decree No. 205/2010, and specifically Art. 184-ter, which

corresponds to Article 6 of the EU Directive. The Italian legislation indicates that, under certain conditions, a substance initially defined as waste may be recovered and change its status. It becomes secondary raw material rather than waste and is thus, no longer subject to waste-related regulations.
2018 was a decisive year in regulatory terms due to the approval of the Circular Economy Package in Strasbourg. As a result, four “Circular Economy Package” directives have been in effect since 4 July 2018 (No. 849/2018/EU, No. 850/2018/EU, No. 851/2018/EU, and No. 852/2018/EU). These directives affect and amend six existing EU ones on waste (2008/98/EC), packaging, landfills, electrical and electronic waste (WEEE), end-of-life vehicles and batteries. Although the original 2008 EU directives were innovative, they did not consider circularity thus, requiring their subsequent amendment.
The recent package also sets new and ambitious common objectives for the European Union. With regard to municipal waste, 55% recycling needs to be achieved by 2025, 60% by 2030 and 65% by 2035. Meeting these objectives will require the ability to recover secondary raw materials, optimise waste quality collection and rationalise recovery.
The package’s goals are ambitious but also completely achievable, as Eurostat statistics show (Figure 1). Slovenia, Austria, Belgium, and the Netherlands have already exceeded targets set for 2020 and Germany has surpassed those for 2035.

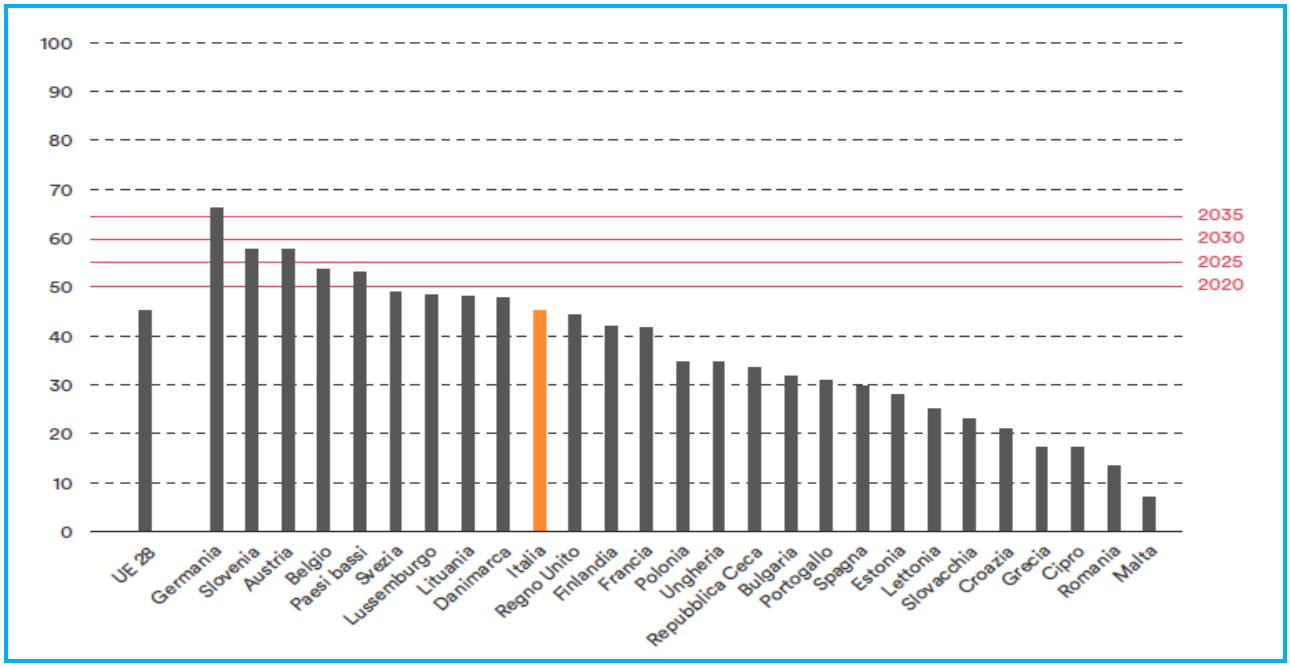

Figure 1: The municipal waste recycling rate for municipal waste in EU 28 countries, 2016 (%)
Source EUROSTAT
(from the report on Circular Economy in Italy 2019-Circular Economy Network)

Another objective set out in the European package is the recycling of 65% of packaging waste by 2025 (70% by 2030) with material-diversified targets. The 70% by 2020 recovery target remains to be achieved for C&D (construction and demolition) waste, which is a separate category. In this regard, a selective demolition requirement has also been introduced to facilitate the safe treatment of hazardous substances, high-quality material reuse and recycling by selective removal of materials. These measures also ensure sorting systems at least for wood, mineral components (cement, brick, tile and ceramic,

stone), metals, glass, plastic and plaster. In addition, the package also puts a cap on municipal waste in landfills, setting a maximum of 10% by 2035.
Member States will have to integrate these changes by 5 July 2020 and this is essential to better define and regulate secondary raw materials and End-of-Waste criteria.

Secondary raw materials, however, have immediately presented some problems in terms of the application of Article No. 6 of Directive 2008/98/EC on End-of-Waste.
There are a number of reasons for this. First, there are technical difficulties linked to the diversity of recovery and treatment technologies waste may undergo in producing different end materials. Secondly, it is difficult to mark the final stage in these different treatment processes which transform waste into another type of end product. Last but not least, there are issues linked to the variety and range of legal studies and experiences emerging in this area over the last twenty years at the internal and Community level.
Also, Community legislation does not yet set down specific and unitary provisions for all waste at the EU level. To date, there are only three European rules specifying criteria for glass, scrap metal and copper scrap recovery. They include EU Regulations No. 1179/2012, No. 333/201 and No. 715/2013, respectively. There are also some current national level regulations in Italy, such as DM No. 22/13, concerning certain types of secondary solid fuels (CSS).
However, these measures have not been sufficient given the numerous categories of waste and treatment types that exist.
The document entitled “Guidance on the interpretation of key provisions of Directive 2008/98/EC on Waste” is relevant in the regard as it notes Member States can “decide case-by-case” or by type of refuse type in the absence of European level rules. As the document states:
“*Member States may determine EoW criteria in two different ways: (1) by waste class through ministerial decrees or (2) case-by-case through the competent authority as part of the authorisation process*”.
Regarding the last possibility, the Directive also adds that “*there is no obligation to provide the notification foreseen in Article 6 of Directive 98/2008/EC*”.
The European Commission document cited above, however, is not binding because, “*The binding interpretation of EU legislation is the exclusive competence of the Court of Justice of the European Union (CJEU))*”. It can, however, still be considered an important guideline for Member States to follow.

These difficulties in interpreting and applying European legislation at the national level have an impact primarily on the productive sector with regard to getting authorisations and permits necessary for plant start-up, operation and the EPR (Extended Producer Responsibility) schemes recognised by the Circular Economy Package. The latter consist of Member States’ measures ensuring that producers bear financial and/or organisational responsibility for managing the production phase in which a product becomes waste.
Simplifying regulatory, bureaucratic and application procedures related to EoW criteria is the first step in the circular reuse of previously unusable raw materials. Assuming the political responsibility to define clear and sustainable procedures is necessary to make environmentally sensitive development, economic prosperity, green innovation and accounting for the common good fully feasible.

2.2 The EoW situation in Italy

The circular economy constitutes a new and emerging economic paradigm capable of replacing linear growth models. It aims at reducing waste and a radical rethinking of products and their use over time.
This is an important systemic and societal challenge because it requires adopting activities as well as consumption and production processes that are all more sustainable. It also means managing the planet's resources in a conscious and efficient way.
Italy can take the lead here and is already part of this new industrial revolution and way of thinking. Many Italian companies have long believed in sustainability and this has made the country a leader in this area. Italy has also become a pioneer by making administrative changes that have led to more positive waste management, undertaking preventative measures, recycling and building material recovery plants. Citizens dedicated to circular approaches have also played a role by being more responsible and aware of their daily actions.
There is a need, however, to establish strong national level coordination and direction capable of implementing standards and economic measures and removing non-technological barriers. These efforts may facilitate the emergence of a genuine circular revolution in Italy and, above all, in Europe.
In the transition to a circular economy, the manufacturing sector plays an important role since it can use innovative processes to transform inputs into outputs and has direct impacts on patterns of resource use. Through the adoption of strategies and business models oriented toward a circular economy, manufacturing companies can play a decisive and active role by redesigning internal processes and production line relationships, promoting innovative eco-designed products with new materials and influencing consumer use (of products and services).
Furthermore, the circular economy, as described above, is able to generate new employment and economic growth. With regard to this innovation, the number of patents or employment can be used as indicators of the performance of the Italian economy with respect to circularity.
Overall, the benefits related to investment and employment linked to the circular economy in Italy are second in Europe only to Germany. Italy ranks first in terms of circular economy employment which stands at 2.05% of total employment.
Legambiente, in collaboration with the Department of Economics and Business Sciences “Marco Fanno” of the University of Padua, has recently carried out research on the *“Economics of Italian companies and the contribution of Industry 4.0*". This study indicates that 55.8% of companies studied said that employment increased after adopting a circular economy model. Only 3.8% indicated a decrease and among the rest jobs remained stable.
In order to implement change, companies had to undertake a double investment. On one hand, they needed to train new specialised professionals and, on the other, update employee skills. For most companies (81.5%), the investments noted came mainly out of their own capital resources.
There were fewer positive indications regarding innovation in Italy. In 2014, 338 patents were filed in the European Union, of which almost 50% were registered by France (83 or 25%) and Germany (75 or 22%).

Italy has filed only 15 patents relating to waste recycling, putting it in last place within the top 5 European economies. Another weak point for Italy was the Eco-Innovation Index. Eco-innovation is any innovation that results in significant progress toward the goals of sustainable development, reducing the impact of production processes on the environment, strengthening natural resilience to environmental pressures or promoting more efficient and responsible use of natural resources.
The 2019 report on the circular economy in Italy considered two main factors of innovation or eco innovation input and output indices. The eco-innovation input index level for Italy indicated underperformance with regard to three main factors: (1) government appropriations and expenditure on environment and energy research and development; (2) staff and total researchers employed in research and development; and (3) the total value of green investments. Taking an index of 100 (the European average) as a basis, Italy has a comparative index of 66 and ranked 17th or somewhat behind the rest of the EU. According to the European Commission, countries that are leaders in investment input for eco-innovation are Finland (index = 200), Germany, Denmark (178), Sweden (166), Slovenia (141) and France (118). Italy had more satisfactory levels with respect to the eco-innovation output index (112) which considered patents, academic publications and media coverage. In this regard, Italy's position is second only to Germany and was in line with the European average. The research carried out by Legambiente in *"The Circular Economy in Italian Enterprises and the Contribution of Industry 4.0"* highlighted that marketing was the area in which the most substantial investments in the "circular" business model occurred. 64.7% of Italian companies involved in the research reported that they had changed their marketing and business processes and had invested in new product development. This seems to be a winning strategy given that Italy's circular economy performance in this category was the best among the five most important European economies, surpassing the United Kingdom, France, Germany and Spain, respectively. In the productive sector, Italy ranks first in circularity compared to the same top five.

Italy also has a high rank in terms of resource productivity, which can be considered in terms of the Eurostat indicator which compares Gross Domestic Product (GDP) to Domestic Material Consumption (DMC) or the total amount of material directly consumed at the national level. The latter also considers the amount of nationally produced raw materials adjusted for imports (plus) and exports (minus).

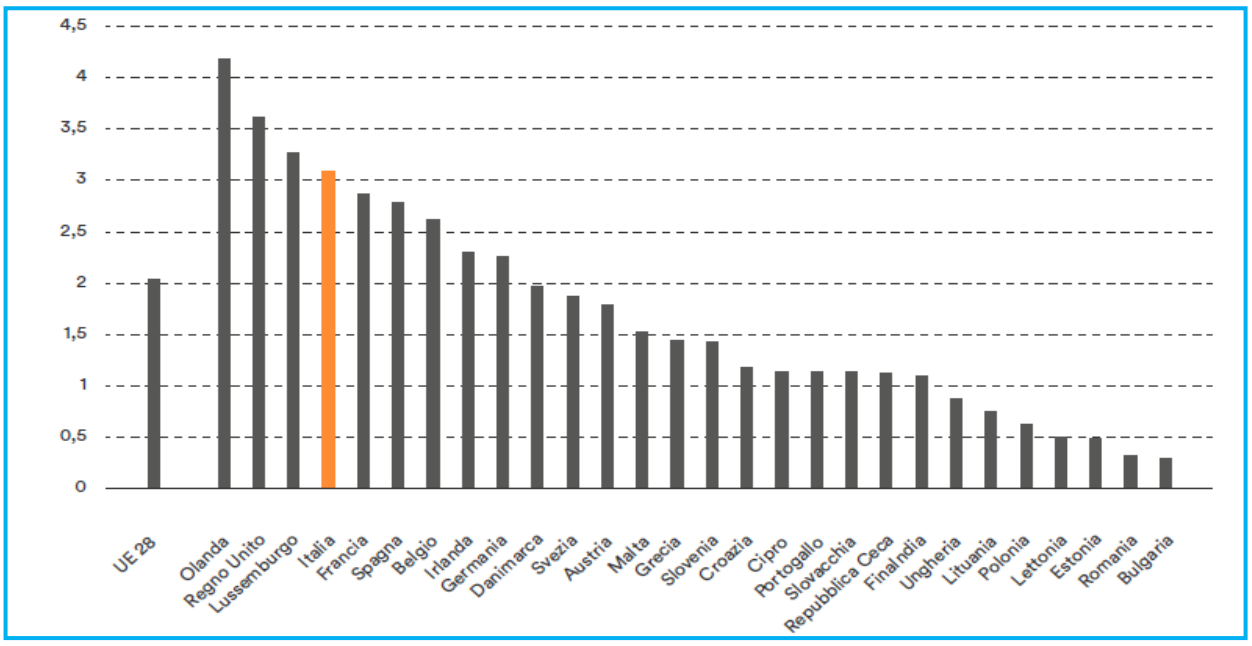

Figure 2: Natural resource productivity in the EU 28, 2017 (€/ kg) - Source EUROSTAT (Report on Circular Economy in Italy 2019-Circular Economy Network)

Italy's productivity performance then reflects a better level when considered in terms of overall natural resource productivity (Figure 2), again measured as the ratio of Gross Domestic Product (GDP) to Domestic Material Consumption (DMC), which accounts for the quantity of nationally extracted raw materials adjusted by imports (plus) and exports (minus). Data for the Total Resource Productivity index for 2017 shows Italy comes second only to Luxembourg (Figure 3).

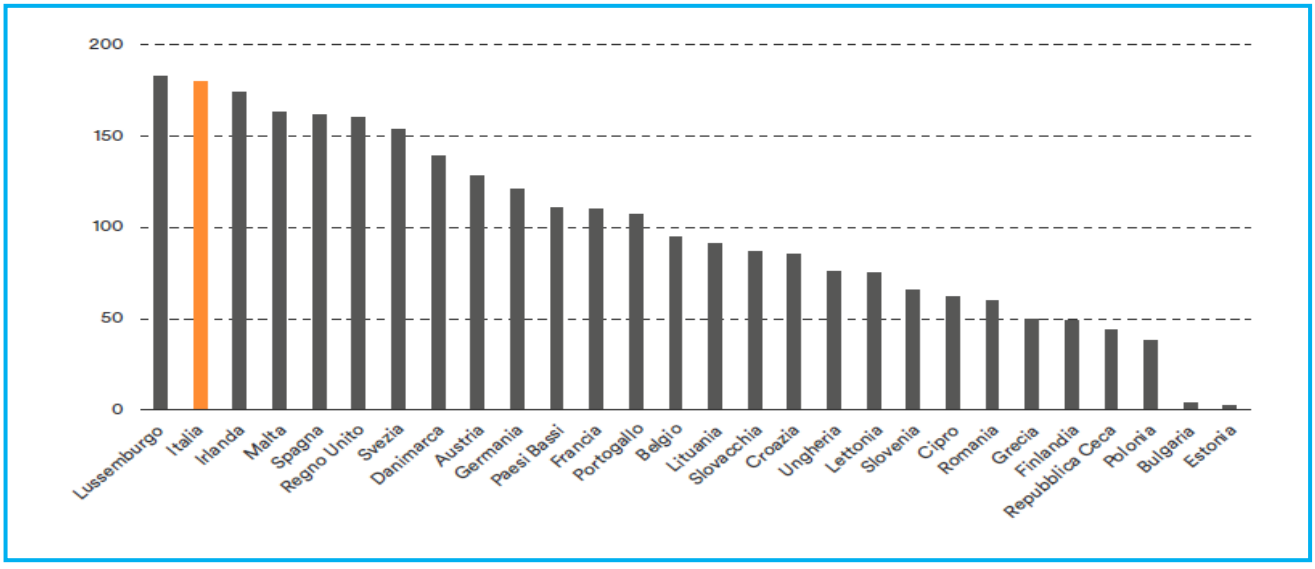

Figure 3: Total Resource Productivity Index (materials, water, energy, CO2 emission intensity) in the EU 28, 2017 (EU average = 100) - EC source (from Circular Economy Report in Italy 2019 – Circular Economy Network)

Data on the propensity for enterprise investment (in production, products, ISO 14001 registration), however, tell a different story. Italy ranks ninth suggesting that, although it may be doing well, it could do better.

In any case, Italy is the only country in which the circular economy is worth just as much as the energy and textile sectors in terms of turnover (88 billion overall and 22 billion in added value or 1.5% of the national amounts) and employment (575,000 employees in the sector).
In addition, the use of secondary raw materials is crucial especially in the steel and metallurgical sector. Aluminium production serves as an example. In 2017, 900,000 tons of aluminium were produced nationwide, of which 100% came from recycled material.
The recycling of municipal waste in Italy in 2016 amounted to 45.1% and was in line with the European average. So was the percentage of recycling for all waste, in which Italy was second after Germany. The percentage of recycling of all waste in Italy is 67%, well above the European average (55%), making Italy first among the other main European economies. Landfill disposal in Italy has fallen to 25%. This is also in line with the European average, but high compared to Germany, France and the United Kingdom. Another point in favour of Italy is undoubtedly the data on repairs and the extension of product life cycles, a central aspect of the circular economy. According to Eurostat data, there are almost 25,000 companies in Italy specialising in repair activities across different sectors, including electronic and personal goods (clothing, footwear, watches, jewellery, furniture, etc.). Italy was third in this regard after France (more than 40,000 companies) and Spain (about 30,000).

The data on Italy presents a paradox. On one hand, it reflects excellent and above-the-European-average performance in terms of efficient use of resources and recycling indices for most types of waste. On the other hand, Italy still lacks clear End-of-Waste Criteria legislation which would help establish a market for a wide range of secondary raw materials. The country also lacks assured uniform application of national by-product regulations which would encourage symbiotic industrial practices, better management and waste reduction. These turn out to be major obstacles to truly affirming the circular economy in Italy.
For years, Italian companies have been waiting for sectorial End-of-Waste criteria and are meanwhile using ad hoc standards. In addition to the European directives for glass and metal waste, only solid fuel, milled asphalt waste and AHP has been regulated to date in Italy. This means that, according to national laws, any other recycled material remains waste and cannot be sold after any treatments. In practice, however, plants have sought authorisations for this at the regional or provincial level on a case-by-case basis.
Relevant to this is the Ministry of the Environment Circular No. 10045 of 1 July 2016, *"Rules on End-of-Waste criteria — Application of Art. 184-ter of the related Legislative Decree 152/2006*" which establishes that Regions or Entities, if delegated to do so, may also determine relevant criteria on a case-by-case basis.
It should be noted that this statement, criticised by some and supported by others, is in line with the European framework.
However, a decision was taken by the Italian Council of State in February 2017 which definitively blocked all authorisations, stating that it was not possible for Regions to provide them. Rather, only the state was enabled to do this, considering requests on a case-by-case basis. For this reason, interested parties paid great attention to the Italian Tax

Simplification Law which should have encompassed rules for End-of-Waste policies as well as address the problem of recycling plant authorisations. The Ministry of the Environment stated that these rules were not included in the law in the end because parliament needed more information. However, they were to be included in an amendment when the national budget came before the Senate.

2.3 The specific case of absorbent products in Italy

As noted above, the integration of EU Directive 98/2008/EC on the EoW criteria into Italian law took place with the creation of Article 184b paragraph 2, which was added to Legislative Decree No 152 of 3 April/2006 (essentially following Article 6 of Directive 2008/98/EC) while by-products were addressed through the creation of Article 184-bis. The criteria and characteristics that define when an item or substance stops being waste and can be re-introduced into the economic cycle as a product varies by material type.
Absorbent products have special features in this regard and this recognition is at the heart of our project goals. Fater is an Italian company and an equal joint venture with Procter & Gamble and the Angelini Group (Gruppo Angelini). It presently produces and markets Absorbent Hygiene Products (AHP) including baby diapers (Pampers), female pads (LINES), tampons (Tampax) and incontinence briefs (LINES Specialist). Fater also manufactures and distributes ACE brand home care products in more than 39 countries. It is the coordinator of the Embraced project and one of the first Italian companies to become aware of technological processes for recycling post-use AHP and recovering valuable secondary raw materials from this waste which was until very recently considered as "non-recyclable". By recycling AHP, in fact, it is now possible to recover 3 high-performance and low-environmental impact materials: (1) polyolefin plastics, (2) superabsorbent polymers (SAP) and (3) cellulose with low SAP or other content. In terms of magnitude, 150 kilograms of cellulose and 75 kg of plastic and superabsorbent polymer each can be extracted from 1 ton of AHP net of waste.
In Italy, about 900,000 tons of AHP end up in landfills and/or incineration plants every year. The first system in Italy with an industrial capacity for processing AHP waste is currently in operation at the Contarina SpA recycling centre in Lovadina di Spresiano, Treviso. The plant is processing up to 10,000 tons annually of AHP waste. The plant will continue to recycle the same amount of AHP. This will avoid taking up more than 13,000 cubic meters of landfill while reducing carbon dioxide emissions by 3,000 tons a year.
The Italian Ministry of the Environment (MATTM) recognised the strategic value of Fater's activity for the circular economy. In response, they set up a working group to define specific End-of-Waste criteria for AHP materials in April 2017. The group was attended by two of the main environmental and health institutions in the country, ISPRA (l'Istituto Superiore per la Protezione e la Ricerca Ambientale/The Advanced Institute for Environmental Protection and Research) and ISS (l'Istituto Superiore di Sanità/The Advanced Health Institute). The main results of the roundtable were organised by MATTM into a draft law which was issued in March 2018 and defined the criteria for AHP recoverable materials and their re-qualification as non-waste products.
To date the Endof-Waste Decree is close to be fully operative (it will become law, when it is published on the Italian Official Journal) thanks to the recent signature of the Ministry of the Environment, Mr. Sergio Costa (on 15th May 2019).

The draft law, based on Article 184 ter, paragraph 2, No.152, indicates criteria for recycling post-consumption AHP to recover secondary raw materials. These recovered secondary materials can then compete with primary raw materials, thus reducing consumption of the latter and natural resource use. There are not only environmental, but also economic advantages to this process since waste becomes a new product with monetary value. Not only that, there is added advantages in that an effective market for these materials already exists in Italy, making them immediately commercially viable. The law specifies in detail how the resulting secondary raw materials can be employed. Cellulose can be used to make absorbent products, paper, chemical building blocks, gardening products, textiles, building materials, materials for the iron and steel industry, additives, chemical-industrial products and syngas (non-combustion applications). SAP polymer can be used to produce absorbent products, polyolefin-based heterogeneous plastics for manufacturing (making plastics), automotive materials and syngas (non-combustion applications).
As required by the European Directive, the materials recovered from AHP must meet highly stringent environmental and health criteria to be re-qualified as non-waste. Also, it must be ensured that their use in new production processes does not have any negative effects on the environment and human health.

2.4 What is the situation in Europe?

Legambiente has been active in collecting information to get a complete and detailed overview of the circular economy and, in particular, End-of-Waste criteria and the recovery of Absorbent Hygiene Products (AHP). To gain some numerical insight, it fielded a survey of companies, institutions and organisations active in AHP activity across Europe. 38 surveys in total were completed from 10 countries: Italy, Belgium, Spain, Portugal, France, Scotland, Poland, Finland, the Netherlands and Montenegro. The largest number of participants were from Italy, the Netherlands and Scotland. It is important to underline that the survey has been given and filled out some months before the signature of the EoW Decree for AHP products in Italy. The survey had two sections: (1) general questions on the circular economy and End-of-Waste criteria and (2) specific questions on AHP recovery.
The main purpose of many of the questions was to identify the major obstacles to circular economy efforts and the development of specific End-of-Waste criteria. The survey also aimed to identify existing AHP recovery and recycling activity in Europe.

The results showed that only 12.5% of respondents saw a lack of adequate and targeted scientific research as an obstacle. Most emphasised that ground-breaking and efficient technical knowledge on material recovery was already available.
The main obstacle to the development of the circular economy identified was instead associated with problems in current national legislation. This was seen as unfortunately out of step with technological and scientific development in the field of material recovery (62.5% of respondents indicated this). Moreover, 50% reported a lack of economic resources and sufficient investment.
The lack of adequate separate waste collection systems (37.5%) and difficulties in correctly pricing secondary raw materials and by-products (31.3%) were also notably mentioned. Other less frequently mentioned issues included lack of awareness and approval of processes (25%), lack of technology and innovation (25%), and difficulties

related to plant construction and authorisations (18.8%). These factors, however, may not be considered true and proper obstacles to the circular economy.

Looking more specifically at the problems related to current laws, particularly in Italy, the survey also asked about existing EU Member State regulations. In Italy, the authorities indicated as responsible for authorising procedures for recycling plant start-up have so far been the Ministry of the Environment, Regions and Provinces. In Poland, only the Ministry of Environment is involved. In other countries, alternative public authorities were noted as able to issue permits for plant operation.
In Finland these include centres for economic development, transport and the environment, in Scotland the Scottish Environmental Protection Agency (SEPA) and in Portugal the Portuguese Environment Agency (APA). Local or regional authorities, depending on the raw material and plant size, are responsible in the Netherlands. In Belgium, provincial authorities in Flanders or regional ones together with OVAM, which has a consultative role, are in charge. Montenegro relies on the Ministry of Tourism and Sustainable Development, France on its prefectures and Spain on local authorities or the Basque government.
The survey also asked, "*With regard to waste legislation in your country, does it include a specific aspect regulating end-of-waste criteria and is it based on the EU Directive Framework 98/2008/EC?*". 62.5% surveyed confirmed their country had legislation on End-of-Waste criteria which was directly derived from the EU Directive.

However, as the results in Figure 4 show, 33.3% noted difficulties in integrating the directive for the following reasons:

- The Italian respondents noted the lack of a precise definition of End-of-Waste and by-products in the relevant Italian laws. They also signalled the slowness in legislative processes due to a lack of decision-making capacity and the unclear division of responsibility between central and regional administrations.
- Waste legislation in Belgium is regional and the integration of the EU directive needs to be done by region, which may lead to some differences. Standards are also stricter in Flanders than in the EU legislation, which may result in higher recycling targets and a greater circular economy transition there.
- In Montenegro, there is a large negative gap between the EU directive and national legislation.

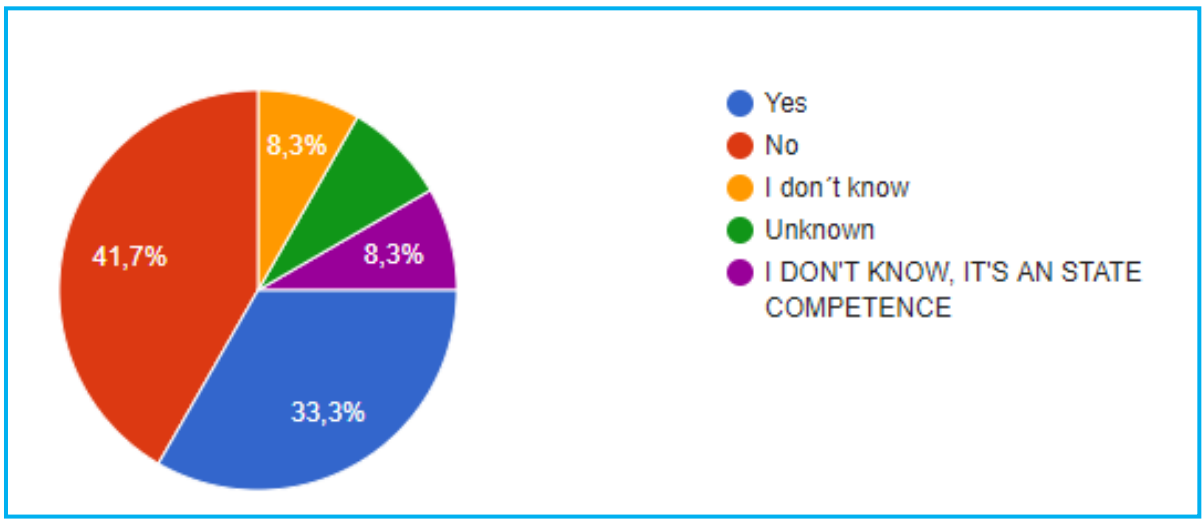

Figure 4: Obstacles to integrating European legislation into national legislation (%).

Answers to the question on the existence of already identified and regulated materials at the European level varied (Figure 5).

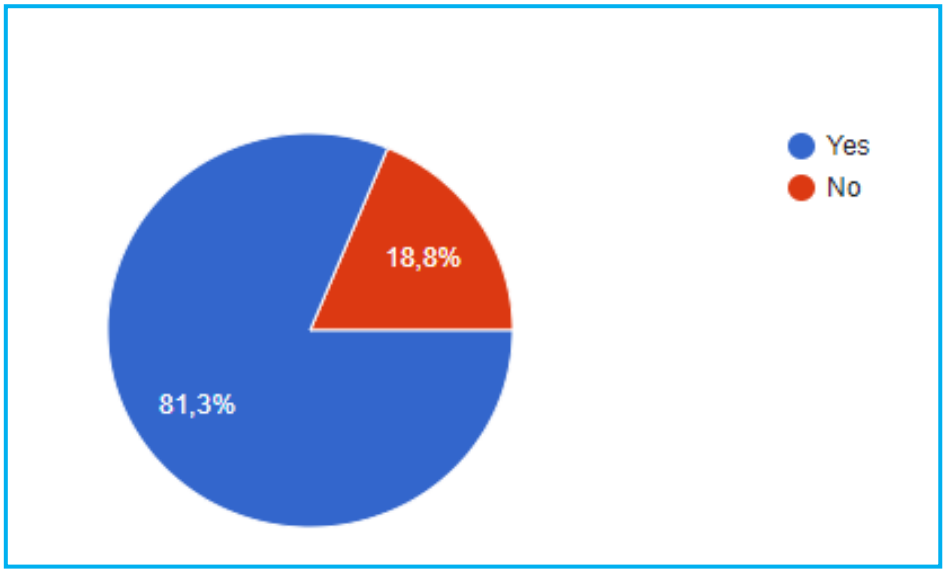

Figure 5: Implementation of EoW regulations for glass, metal and copper (%)

81.3% surveyed said that EoW regulations for glass, metal and copper had been integrated according to the waste materials identified by the European Commission. The applicable regulations are: for iron, steel and aluminium, Council Regulation EU No. 333/2011; for glass residues Commission Regulation EU No. 1179/2012; and for copper scrap, Commission Regulation EU No. 715/2013. Only France and Montenegro indicated having no regulations. 81.3% also noted that other materials are also subject to control including: paper, cardboard, plastic, organic waste, construction and demolition waste, sludge used as soil, WDF (Waste Derived Fuel), stone gravel, fuel oils, ship fuel recovered from MARPOL type waste, compost, processed fuel oil, biodiesel, aggregates, reusable chemical products or items, industrial cloths and wood packaging.

One Italian respondent noted the ongoing existence of a process for identifying and regulating new materials which may be transformed into sub-products. One of the first materials to be included in this procedure will be Absorbent Hygiene Products (AHP). Montenegro, on the other hand, is currently drawing up a new comprehensive waste management law, but it has still not been finalised.

The second section of the survey collected key and, from our perspective, compelling information on existing AHP or similar recycling facilities, the authorisation procedures involved and the overcoming of potential difficulties.
The countries most frequently confirming the existence of AHP facilities were Italy and The Netherlands (accounted for 31.3% of positive responses). However, these two countries also had the largest number of survey respondents. They were also the only countries that had AHP pilot recycling plants involved in the Embraced project. The survey results thus indicate that, although limited, attempts to establish AHP recovery have been made at the European level. However, these efforts are hampered by difficulties, which have prevented wider operationalisation of AHP recycling.
Survey participants were also asked to rank on a scale from 1 to 5 (1 = *"not at all"* and 5 = *"very much"*) how specific problems may have adversely affected implementation of Absorbent Hygiene Product (AHP) recovery.

Below is a summary of the results.

Problems adversely affecting AHP recycling	**1**	**2**	**3**	**4**	**5**
Lack of the End-of-Waste criteria	25%	12.5%	18.8%	31.3%	18.8%
Lack of National Legislation	12.5%	25%	25%	12.5%	25%
Lack of adequate plants and infrastructure	6.3%	6.3%	12.5%	18.8%	56.3%
Lack of adequate technology	18.8%	31.3%	18.8%	-	31.3%
Absence of the separate waste collection services	31.3%	-	-	31.3%	37.5%
Absence of economic resources and adequate investments	18.8%	12.5%	25%	18.8%	25%
Lack of social acceptance	37.5%	25%	18.8%	6.3%	12.5%

Table 1: Ranking of problems in the implementation of AHP recycling.

The survey indicated that the lack of adequate plants and infrastructure were the main difficulties in operationalising AHP recycling. These factors were ranked highest among the largest percentage of respondents (Table 1).
There were different opinions regarding the absence of a separate waste collection system. 31.3% gave this a low rank while the remaining 31.3% and 37.5% ranked it 4 or 5, respectively.
There was a more even distribution of ranking regarding a lack of End-of-Waste criteria in national legislation. Italy, the Netherlands and Portugal gave this a higher ranking.

Portugal, Spain, France and Poland ranked the absence of adequate technology highest, while insufficient economic resources and investment represented a serious problem as well for Portugal and Spain as well as Scotland. Finally, a lack of social acceptance had the lowest overall ranking. Only Spain and Portugal noted this was a significant obstacle, particularly in opening plants in western areas.
A Spanish respondent also noted that in the municipalities of Usurbil and Hernani separate AHP waste collection existed, but this was still not common across the country. Belgium noted that it was important to establish a more socially and economically acceptable separate AHP waste collection system and more detailed EoW criteria were needed to develop a market for recycled materials. Belgium now has established technological competence, but the lack of EoW criteria for recycled materials currently limits recycling companies from starting up plants.
Only Montenegro specified that AHP is not yet considered a real problem. Scotland noted that there are no separate collection systems or treatment facilities for AHP and more interest is needed to start discussions on EoW criteria there.
Another Scottish respondent indicated that some municipalities are certainly trying to recycle AHP, but it does not seem to be of great concern in most areas. Kindergartens are not really involved either. Consequently, there has been little attention paid to the topic. Incinerating diapers or landfill disposal of them does not seem to have become an issue yet.

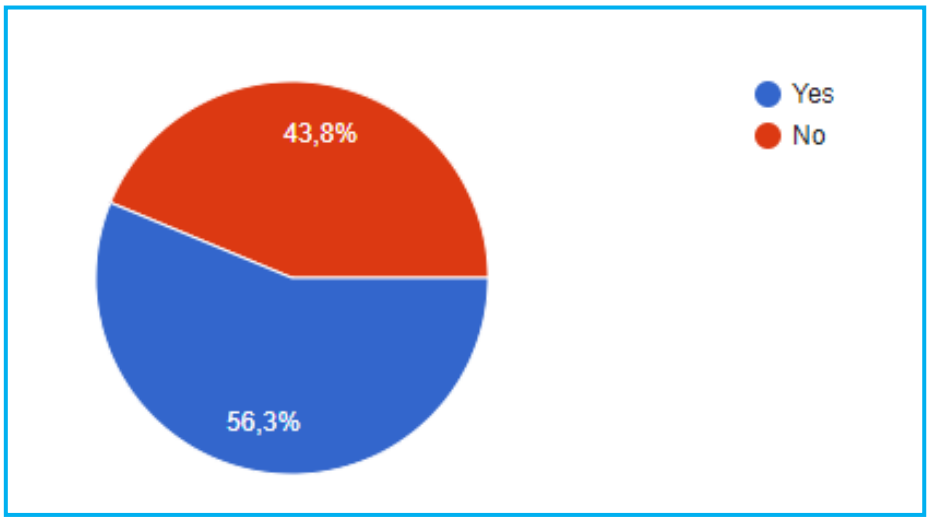

Figure 6: Existence of separate waste collection for AHP (%)

Figure 6 shows the percentage of respondents indicating the existence of separate waste collection systems for AHP. 56.3% said there were different types of separate collection systems for diapers, tampons, etc.
One respondent from Belgium indicated that some communities provide separate collection (not door-to-door), but that the separated AHP is then incinerated.
In Italy, the separate collection of AHP is becoming widespread, especially where a PAYT scheme is in operation. Under this scheme, users are charged for municipal solid waste disposal based on the amount they leave for collection by local authorities.
Reducing the number of collection rounds and the amount of waste residues requires a dedicated AHP collection system.
In Poland, AHP is collected together with other waste, while in Scotland probably only 1% of households have access to separate AHP collection and there is no recycling. In

France, there is a type of separate collection for diapers since kindergartens usually accumulate them, but they are then incinerated. In this case, diapers are separated “at source” due to smell, etc., but this separation is not done for recycling purposes. It is just a way of collecting them until they can be disposed of. Only one municipality in the south of France seems to have explored the possibility of testing separate collection. Respondents were not able to answer the question on the separation of AHP from residual waste. However, they did confirm that the prevalence of this is very low, e.g. for Scotland about 1% of communities may be doing it.

2.5 What is the situation in the Netherlands?

The issue of End-of-Waste criteria in the Netherlands is handled differently than in Italy. The survey confirmed that in the Netherlands local authorities may decide on a case-by-case basis for authorising plants and determining End-of-Waste criteria. In fact, when authorisation is granted, it needs to be shown that a material meets the following conditions set out in the EU Directive (EU Directive 2008/98/EC):

a) The substance or item is commonly used for specific purposes;
b) There is a market or demand for that substance or item;
c) The substance or item meets the technical requirements for the specific purposes it is to be used for and complies with the legislation and standards applicable to the intended products;
d) The use of the substance or item will not lead to overall negative impacts on the environment and human health.

In addition, the Dutch National Institute for Public Health and the Environment (RIVM) is required to assess whether a recycling process and/or a recycled material can be considered safe.
In the specific case of AHP, RIVM established a protocol in 2018 addressing technologies aimed at recovering secondary raw materials from AHP, including those developed by Fater.
RIVM has, in particular, created a special challenge test which consists of loading an AHP with a known amount of medications often used by consumers and which, therefore, might be traceable in this refuse. If the level of these medical substances at the end of the processing treatment applied to this AHP turns out to be less than a predefined limit, then the processing procedure can be considered safe. Otherwise, a *risk assessment* is conducted to evaluate whether the process can be considered safe. This assessment is based on the specific applications for which the material is intended to be used.
The recycling technology developed by Fater, which will be implemented in Amsterdam as part of the Embraced project, has already begun to be evaluated under the RIVM protocol. This evaluation is expected to be completed by the start of the second half of 2019.

3 CONCLUSION

3.1 Regulatory recommendations

Regulatory factors present obstacles to the comprehensive and effective development of the marketing of secondary raw materials and the circular economy in Italy and Europe. There have been a number of useful recommendations made for overcoming current bottlenecks in this regard. A number of these were presented to local authorities at Legambiente's 2019 conference on "*Obstacles to the circular economy in Italy*", which was held on 6 February 2019 in Rome. The aim was to provide a stimulus and vision for developing circular systems in the country. These suggestions are also a starting point for other European countries to reflect upon, given the EU's shared development goals and aim of protecting natural resources.

We highlight some of the broader suggestions made in this context.

1. The simple and effective approval of regulations for increasing municipal and special waste recycling is necessary. This requires a clear path forward, defining a timeframe for setting End-of-Waste (EoW) criteria and working with central state and delegated regional authorities.

2. There is a need to move away from seeing landfills and incinerators as the go-to waste disposal solution. Rather, national and European networks of waste recycling and reuse plants and facilities should be consolidated. Other options need to be adopted that promote development and innovation and see landfill and energy recovery as part of wider system and not the only solution. This requires state and regional independence in the management of waste generated at different levels.

3. It is necessary to encourage public debate in order to increase consensus and facilitate the construction of industrial plants that will enhance the Italian and European circular economy (this has already been done to some extent within the new Procurement Code for certain public works and is also evident in France).

4. The possibility of applying a compulsory and targeted tariff to reduce and prevent waste production should be explored. As indicated in the European guidelines and dictated by sustainability principles, *Whoever pollutes pays*. For example, statistics on the waste cycle in Italy have long confirmed the validity of municipal pricing systems that charge users lower waste disposal fees if they produce less waste. We suggest the possibility of approving a regulation that makes this mandatory.

5. Landfill waste disposal should be obligatorily and economically penalised. Concurrently, innovative actions and processes and product development which counter landfill use should be encouraged and stimulated. In addition, increasing the cost of landfill disposal will provide support for the circular economy.

6. Green Public Procurement is certainly a useful and indispensable tool to promote and encourage the circular economy. This also involves the development of sustainable

products for use by public entities. Italy plays a central role from this point of view, given its legal obligations at the national level. It can thus be a key actor and serve as a model for the rest of Europe. A task force may need to be established to control and compel contracting companies to comply with Minimum Environmental Criteria in public procurement tenders. This will promote Green Public Procurement and create an internal market for waste recycling products. It will also help address the emergency caused by China's banning of recyclable waste imports in January 2018 (including recyclable plastic, textile residues and lower quality waste paper). The European market demand for recycled products is small compared to the large supply of recycled materials available. For this reason, the process has been slow in Italy and across Europe. Warehouses are overflowing with potentially recyclable materials that cannot find any market outlets.

8. It is necessary to ensure an effective system of controls throughout the urban and special waste chain and to combat illicit waste-related activity and trafficking. More controls are also needed to combat unfair competition.

9. There is a need to promote product and process innovation and make new technologies for recycling materials more affordable and convenient. Product innovation can strongly reduce the sale of high-performance products that rely on energy recovery and landfills.

10. It is also important to rigorously simplify the waste recycling system and make the use of secondary raw materials subject to official review by state environmental and health authorities (e.g. ISPRA and ISS in Italy). This will assure that products made from waste resources are treated in the same way as primary raw materials whenever possible. Creating incentives or bonuses for the use of secondary materials might be considered to this end as well.

In particular, Legambiente advises to facilitate the consolidation of the “circular” policy process of the AHP, adopting the EoW criteria existing in Italy as valid model for processes and formalisation of similar procedures in other EU states.

Once the bureaucratic regulatory process has followed its course, it may be necessary to make criteria applicable in other countries, which may want to promote circular resource processes based on secondary raw materials.

It is also important to establish minimum European EoW criteria which Member States would adhere to and which would form the basis for the development and use of secondary raw materials across Europe.

The work of the Italian National Agency for New Technologies, Energy and Sustainable Economic Development (l'Agenzia Nazionale per le Nuove Tecnologie, l’Energia e lo Sviluppo Economico Sostenibile) (ENEA) may serve as a reference point in this regard. This agency provides a national level link to the research activity of the Coordinating Group of the European Circular Economy Stakeholder Platform (ECESP). To promote the Italian model for a circular economy, the Agency has proposed the creation of the Italian Circular Economy Stakeholder Platform (ICESP). Like the ECESP, it will be a group of networks that come together to create a national focal point for initiatives, experiences and identifying critical issues. This platform will bring into focus development prospects in Italy

while also representing circular economy issues at the European level. It can also be a tool for coordinating the various Italian initiatives currently underway and making them more visible and viable.

3.2 Final conclusions

The End-of-Waste (EoW) concept can play an important role in giving refuse a new function and allowing it to be re-introduced and marketed in the same way as primary raw materials. This can help reduce consumption of the latter and overall natural resource use. It also offers both environmental and economic advantages due to the existing market for secondary raw materials. In this way, refuse will become a new resource, which can benefit society as a whole by reducing primary resource use and waste quantities. As such, EoW can help solve some of the main environmental problems currently affecting our society.
For this reason, updating existing legislation linked to EoW is in order. It is also important to establish new criteria and regulations that specify the treatments, reuses and secondary materials recoverable from different types of waste.

In this context, post-consumption Absorbent Hygiene Products (AHP), and secondary raw materials derived from it, are examples par excellence in terms of the need for this regulatory change, now achieved after the signature of the EoW legislative Decree (15th May 2019). The AHP products, in a couple of months, can be transformed and used for several specific purposes. The above discussion has also shown that there is an existing market in Italy for the AHP components: secondary primary materials (including cellulose, SAP and polyolefin-based heterogeneous plastics), which can be derived from Absorbent Hygiene Products (AHP). These secondary materials are commonly marketed in Italy and elsewhere and may have significant economic value as a result.

With regard to the assessment of impacts on the environment and human health, two Italian institutions, ISPRA (Istituto Superiore per la Protection and Environmental Research) and ISS (Istituto Superiore Sanità) have issued a qualified favourable opinion regarding AHP and confirmed an absence of negative impacts. The first AHP recovery plant in Italy has been purposefully developed using now proven cutting-edge and high-performance technology.
Increasing current demand for raw materials necessitates developing the use of secondary ones. This can improve the certainty of Europe's raw material supply, reduce extraction pressure on resources and environmental impacts and contribute to the development of a consolidated circular economy at the sub-national, national and European level.

From a circular economy perspective, it is essential to monitor the impacts which the availability of secondary raw material may have on reducing demand for primary resources. The EU Circular Economy Action Plan states that materials which can be reasonably recycled should be re-introduced into the economy as new raw materials, thereby increasing certainty of supply. Secondary raw materials can be generated within a national economy and, as with primary ones, they can also be exchanged, imported or exported.

Out of the 165 million total tons of urban, toxic or special waste produced in Italy, 55 million tons or 33% are comprised of construction and demolition refuse, mixed plastics, waste paper and cooking oils. All the aforementioned waste items could be subject to and are awaiting End-of-Waste criteria that would simplify their recycling and recovery. This, in turn, would reduce landfills, incinerator use and the prevalence of illegal waste disposal.

The EoW Decree for Absorbent Hygiene Products (AHP), signed on 15th May 2019 by Italian Ministry of Environment, Mr Sergio Costa, marks the beginning of the transition to a circular economy.
It will allow an Italian industry to take off, able to create job vacancies as well as recovering 900 thousand tons of waste per year (rather than sending those wastes to incineration or landfill). The EoW Decree represents the green light for the operating of plants and technology already performing on the territory. It can finally contribute to increase the excellence in the recovery and recycling field in both Italy and Europe.

REFERENCES

BIBLIOGRAPHY

- Legambiente, 2017 – #circulareconomy Made in Italy, Atlante dei Campioni dell'Economia Circolare.
- Legambiente & Dipartimento di Scienze Economiche e Aziendali "Marco Fanno" Università di Padova, 2018 - *L'economia circolare nelle imprese italiane e il contributo di industria 4.0*
- Analisi ambientale della raccolta e del riciclo di prodotti sanitari assorbenti – Ambiente Italia
- Ambiente Italia - "*L'economia Circolare in Italia – La filiera del riciclo asse portante di un'economia senza rifiuti*" di Duccio Bianchi
- Sentenza consiglio di stato - N. 01229/2018 REG.PROV.COLL.N. 01976/2017 REG.RIC.

SITOGRAPHY

- https://www.chathamhouse.org/publications/AHPers/view/182376
- http://www.rinnovabili.it/riciclo/economia-circolare-risorse/
- https://www.circularity-gap.world/
- https://www.greenstyle.it/città-a-zero-rifiuti-ecco-come-la-cina-abbraccia-leconomia-circolare-287577.html
- https://it.euronews.com/2019/01/23/davos-l-economia-circolare-un-affare-da-3-mils-miliardi-di-dollari
- https://www.legambiente.it/sites/default/files/docs/circulareconomy_madeinitaly.pdf
- http://www.reteambiente.it/news/14331/recepimento-direttiva-2008-98-ce-novita-in-vigore/
- http://www.reteambiente.it/news/32130/pacchetto-economia-circolare-dal-4-luglio-2018-in/
- http://www.lexambiente.it/materie/rifiuti/179-dottrina179/13722-rifiuti-senza-eow-non-c
- https://circulareconomynetwork.it/wp-content/uploads/2019/02/Rapporto-sulleconomia-circolare-in-Italia-2019.pdf
- http://www.europarl.europa.eu/news/it/headlines/society/20170120STO59356/pacchetto-sull-economia-circolare-nuovi-obiettivi-di-riciclaggio-dell-ue
- https://www.ambientediritto.it/dottrina/Dottrina_2010/end_of_waste_giampietro.htm
- http://ec.europa.eu/environment/waste/framework/end_of_waste.htm
- http://ec.europa.eu/environment/waste/framework/pdf/guidance_doc.pdf
- https://lexambiente.it/materie/rifiuti/179-dottrina179/13676-rifiuti-end-of-waste-chi-decide-i-%E2%80%9Ccriteri-specifici%E2%80%9D-utili-a-stabilire-quando-un-rifiuto-cessa-di-essere-tale.html
- http://ec.europa.eu/environment/pubs/pdf/factsheets/ecoinnovation/it.pdf
- https://circulareconomynetwork.it/wp-content/uploads/2019/02/Rapporto-sulleconomia-circolare-in-Italia-2019.pdf
- http://www.riciclanews.it/rifiuti/economia-circolare-italia-prima-in-ue-ma-serve-end-of-waste-caso-per-caso_9408.html
- http://www.arpat.toscana.it/notizie-brevi/2019/prima-conferenza-annuale-sulla-piattaforma-italiana-per-leconomia-circolare
- Https://ilfattoquotidiano.it/2018/12/14/dl-semplificazioni-stralciata-la-norma-che-trasforma-i-rifiuti-in-prodotti-il-ministro-costa-insertita-nella-manovra-al-senato/4834579/
- https://www.minambiente.it/sites/default/files/dlgs_03_12_2010_205.pdf

- https://www.repubblica.it/economia/2018/12/06/news/in_italia_il_primo_impianto_che_ricicla_pannolini_la_tecnologia_c_e_ora_manca_una_legge_-213498456/
- https://fatergroup.com/it/news/comunicati-stampa/progetto-riciclo
- https://www.legambiente.it/la-corsa-ad-ostacoli-delleconomia-circolare-in-italia/
- https://www.ilsole24ore.com/art/impresa-e-territori/2018-01-12/la-cina-blocca-l-import-rifiuti-caos-riciclo-europa-160732.shtml?uuid=AELQpUhD&refresh_ce=1
- http://www.enea.it/it/seguici/events/icesp_31mag2018/presentazione-e-lancio-icesp-italian-circular-economy-stakeholder-platform
- https://www.italiaambiente.it/2019/02/06/end-of-waste-i-decreti-che-tutti-aspettano-dal-recupero-rifiuti-allo-sblocco-del-biometano/