

ecoscienza

Magazine of Arpaè
Regional agency
for prevention, environment and energy
of Emilia-Romagna
Supplement to No. 2 – April 2017

SUSTAINABILITY & ENVIRONMENTAL CONTROL

Special issue for
G7 Environment, Bologna, 11-12 June 2017



THE CIRCULAR ECONOMY FOR A QUALITY GROWTH

CLOSING THE LOOP:
TRANSITION PHASE AND
NEW BUSINESS MODELS,
ECOINNOVATION,
INDUSTRIAL SYMBIOSIS,
GREEN PUBLIC PROCUREMENT.

THE ROLE OF BUSINESSES
AND OF PUBLIC AUTHORITIES.
THE EVOLUTION OF CONTROL.
WASTE MANAGEMENT,
THE ITALIAN AND EUROPEAN
FRAMEWORK

Bologna, hidden gem in the heart of Italy

It is only 35 minutes from Florence, one hour from Milan, 2 from Rome and 1 hour and a half from Venice: a crossroad of Europe and Italy where everyone feels "at home". Bologna means enjoying life: let us show you how the people of Bologna have fine-tuned the art of living well.

With its 40 kilometers of arcades that embrace the medieval city center you'll feel like being inside an open air art exhibition, along a protected path of churches, historical buildings and the famous medieval towers, of course. So, why choose Bologna? Here are a few reasons to stop and experience the City of Food, the City of Culture, the City Of Music and the City of Motors.

Because it tastes good

Its food traditions have made Bologna famous throughout the world and today it is truly the capital city of culinary taste and quality. Dishes range from tortellini to tagliatelle, and local cuisine is based principally upon handmade egg pasta, rich dried and cured meats (above all the famous mortadella of Bologna), choice meats and good wines. Have a taste, you won't be disappointed.

Because it's the home of art

You may choose among Etruscan findings and Egyptian mummies, paintings by Giorgio Morandi or Guido Reni, contemporary art or medieval

swords. Or you may simply choose to visit Bologna: his heart dates back a long time, but its mind-set is open and innovative as a modern European city. Moreover, you can visit its University, the oldest in Europe and discover what have attracted so many students all over the centuries.

Because it sounds good

Music has a completely different sound in Bologna. At the beginning were the greats: from Mozart to Farinelli. For them Bologna was a much coveted training destination. Today, it is the only Italian city awarded the title of Creative Music City by UNESCO. From classical music to jazz, from dance to experimentation: in Bologna we lend our ears to excellence.

Because in Bologna it's all about the Roar of the Engine

Bologna is in the heart of the Motor Valley. Here's the top of Italian motor industries, like Lamborghini and Ducati. Moreover, it's not far from Bologna that Ferrari decided to grow their business. Fancy a high speed ride?



**BOLOGNA
WELCOME**

**Destination
is Bologna**

INDEX



ISSN 2039-0424

Magazine of Arpa
Regional agency for
prevention, environment and
energy of Emilia-Romagna

Supplement to No. 2
Year VIII
May 2017



Contacts
Ecoscienza
Via Po, 5 40139 - Bologna
Tel. +39 051 6223887
ecoscienza@arpae.it

Director
Giuseppe Bortone

Editor-in-chief
Giancarlo Naldi

EDITORIAL BOARD
Coordinator
Franco Zimoni

Raffaella Angelini
Giuseppe Battarino
Vito Belladonna
Francesco Bertolini
Gianfranco Bologna
Mauro Bompani
Giuseppe Bortone
Mario Cirillo
Roberto Coizet
Nicola Dall'Olio
Paolo Ferrecchi
Luca Marchesi
Matteo Mascia
Giancarlo Naldi
Marisa Parmigiani
Giorgio Pineschi
Attilio Raimondi
Karl Ludwig Schibel
Andrea Segré
Marco Talluri
Stefano Tibaldi
Alessandra Vaccari

Editorial coordinator of this supplement:
Stefano Folli

Translation of the articles:
Maura Radicioni
Stefano Folli (article on p. 4)

Editors
Daniela Raffaelli (coordinator)
Rita Michelon

Editorial assistant
Claudia Pizzirani

Graphic project
Miguel Sal & C.

Layout and graphics
Mauro Cremonini (Odova srl)

Cover
Cristina Lovadina

Printer
Premiato stabilimento
tipografico dei comuni
Santa Sofia (FC)

Printed on IGLOO Offset paper

Annual subscription
6 paper issues
Euro 40,00
payment to the bank account - IBAN
IT25N0200802435000003175646
headed to Arpae - Unicredit
Via Ugo Bassi, 1 - Bologna

Reg. Tribunale di Bologna
n. 7988 del 27-08-2009



All articles, unless otherwise specified,
are licensed under the Creative Commons license CC BY-NC-SA 4.0
<http://creativecommons.org/licenses/by-nc-sa/4.0/>

Closing date: 15 may 2017



- 4 **Editorial**
G7 Environment and our common future
Gian Luca Galletti
- 5 **Beyond linear economic patterns**
Gianni Silvestrini
- 8 **Circular economy for quality growth**
Danilo Bonato
- 10 **The Dame who sank the linear economy**
Interview with Ellen MacArthur
by Emanuele Bompan
- 14 **A treasure waiting to be discovered**
Emanuele Bompan
- 16 **Special waste in Europe and in Italy**
Rosanna Laraia
- 20 **Circularity and challenges for environment agencies**
Giuseppe Bortone
- 21 **The evolution of control by environment agencies**
Angelo Robotto, Renzo Barberis
- 22 **Waste recovery plants and odour control**
Luca Marchesi, Stefania Del Frate, Sara Pettrillo
- 23 **Public sector as guarantor of proper management**
Stefano Leoni
- 24 **Free market and need of guidance by public sector**
Gianluca Rusconi
- 26 **Re-use of inorganic industrial waste**
Fernanda Andreola, Luisa Barbieri,
Isabella Lancellotti, Cristina Leonelli
- 28 **A new economic and social paradigm**
Alessandra Vaccari, Mauro Bigi, Daniela Luise
- 30 **Reusable textiles seeking a new life**
Alessandra Vaccari, Patrizia Ferri
- 34 **Packaging recycling in the transition phase**
Walter Facciotto
- 36 **Paper packaging to fight waste**
Eliana Farotto
- 37 **Compost and biomethane from food waste**
Massimo Centemero
- 38 **Nature and technology for bio-composting**
Gabriele Alitto, Vincenzo Barone, Antonino Demasi,
Saverio Curcio, Orsola Reillo
- 40 **Recovery of electrical and electronic waste**
edited by Centro di coordinamento Raee
(Weee Coordination Centre)
- 42 **Efficiency and zero waste with industrial symbiosis**
Erika Mancuso, Grazia Barberio,
Silvia Sbaiffoni, Antonella Luciano, Laura Cutaia
- 44 **Industrial symbiosis in Emilia-Romagna**
Ugo Mencherini, Sara Picone, Manuela Ratta
- 46 **Rare earths, recovery is the future**
Pier Luigi Franceschini, Floriana La Marca,
Giorgio Recine
- 48 **Italy is a leader in bioeconomy**
Edoardo Croci, Denis Grasso
- 51 **Europe and Africa together for the recovery of secondary raw materials and precious metals**
Isabella Capurso
- 52 **Gpp, an incentive to eco-innovation**
Emanuela Venturini
- 54 **Emilia-Romagna promotes the circularity of resources**
Paola Gazzolo
- 56 **"Close the loop", let's open the discussion**
Cristina Govoni
- 58 **Circular economy for small and medium-sized enterprises**
Enrico Cancila, Irene Sabbadini, Federica Focaccia
- 60 **From waste to by-products, the trend of soil and stones**
Cecilia Cavazzuti, Giacomo Zaccanti, Nicola Negri
- 61 **Heavy metal mapping to support the management of soil and stones**
Nazaria Marchi, Cecilia Cavazzuti, Giacomo Zaccanti



G7 ENVIRONMENT AND OUR COMMON FUTURE

Gian Luca Galletti • Italian Minister of the Environment



The implementation of the Paris Agreement, sustainable finance, efficient use of resources, fighting waste, struggle against marine pollution, environmental policies for employment and cooperation, in particular with Africa: these are some of the main topics to be discussed at the G7 Environment's Ministers Meeting in Bologna on 11-12 June, an important event to internationally set the centrality of the environment in the world's sustainable development strategies, as indicated in Agenda 2030 signed in 2015 from 193 UN member states.

The 17 goals and 169 targets of the United Nations have never been so concrete, relevant and deeply tied to the global environmental challenge. Because it is now clear to everyone that the paradigm has come to a shift: the respect of the environment is no longer to be seen as a constraint, as a burden on governments and businesses, but it is increasingly becoming a key element for growth.

The G7 Environment is thus a key turn, another moment in which a

common consciousness can grow around great green development goals.

In recent months, the Italian Ministry of the Environment held some preparatory meetings, such as the *G7 Workshop on Marine Litter*, which took place in April in Rome. We are furthermore preparing several events, together with the City of Bologna, the University, the world of research and civic, cultural, university and environmental associations. The aim is to make Bologna not only the city of an historic event, but the capital of the environment for more than a week and potentially for a much longer time, if the city will be able to address its great expertise on research and big data towards environmental issues and opportunities.

Among the goals of the G7 Environment, there is the outline of a roadmap for a more efficient use of resources. This is a crucial point, if we aim at realising a circular economy, our future economy, whose foundations

we must lay today. Italy is doing so through three *Strategies*: the *Sustainable Development Strategy*, the *Strategy on Adaptation to Climate Change* and the *National Energy Strategy* we have presented to the Italian Parliament in recent days. Integrating these three documents consistently and with consequent actions, we will draw much more than an environmental plan: we are setting a long-lasting industrial future for our country, built on completely different foundations and premises compared to the past. The agreement we will reach at the G7, which I hope will be strong and ambitious, will not have any significance, unless a great boost will come from the civil society. We will not only do it for economic reasons, but for ethical and moral ones, today as never before. It's not a rethoric goal: choosing a new development model means making a clear choice of fairness, respect for rights, rapprochement between peoples.



BEYOND LINEAR ECONOMIC PATTERNS

Gianni Silvestrini • President, Green Building Council Italia; Scientific Director, Kyoto Club and QualEnergia



Over the next few decades, two major factors are going to change national strategies, industrial organizations, and behavioural models, i.e. the fight against climate change and the shifts in linear economic patterns.

Whereas there are strong ties among the policies designed to reduce environmental degradation, some differences should be pointed out as they may favour the commitment to abandon the use of fossil fuels, which lies at the core of the efforts against global warming.

First, let us consider risk assessment. The CO₂ produced as a result of energy metabolism is now being perceived as an irreversible threat and, for this reason, consensus was reached with the Paris Agreement to reduce it drastically.

As regards the use of other resources, e.g. land, minerals, and water, different countries are following divergent directions. Lacking in raw materials and highly anthropized, Europe and Japan have defined their own policies. Similarly, China, under the pressure of a strong environmental impact, has put forward a conversion according to the paradigms of circular economy. In other parts of the world, including the Usa, this issue is not deemed equally important.

It is worth highlighting that, contrary to the commitments on CO₂, there is no target set to limiting the use of raw materials, though in some countries, as is the case in Europe, target values have been introduced and should be reached in recycling waste along with a zero land consumption objective by 2050. Another difference concerns the available tools to reach the targets. The Earth is a kind of “closed” thermodynamic system, in which matter is not exchanged externally, but it receives a considerable and constant flow of solar radiation. Therefore, it

is possible to slow down the entropic growth process through more efficient usage of both fuels and other resources. However, as regards energy, renewable sources are a powerful weapon to go towards the decarbonization of the economy.

As concerns the other resources, the trend towards degradation cannot be avoided but only delayed.

In a circular economy, there are more or less sophisticated ways to slow down this irreversible process, from product design in order to guarantee greater durability of goods to their re-manufacturing, from the sharing economy to waste recycling.

However, there is no factor equivalent to solar energy, which is capable of reversing resource degradation, other than biomaterial production, an important albeit limited industry.

Let us now consider the results obtained in the areas of both emissions and resource usage.

The climate-related efforts have made it possible to generate a decoupling between economic growth and CO₂ production. In fact, over the last three years emissions have remained stable despite a 3% yearly growth of the world economy. In the coming decades the future scenario will see a total decarbonization, largely due to the spread of renewable sources.

As regards energy usage, the growing awareness of how irrational it is to overexploit our planet is also triggering a cultural change, and measures are being implemented to favour the progressive dematerialization of economies. Between 1990 and 2012, the world GDP more than tripled while the use of materials only increased by 66%, although between 2003 and 2013 the growth rate doubled compared to the previous two decades mostly due to the performance of the

Chinese economy. Thus, at a global level there is a relative decoupling between economic growth and the use of materials. Some areas also registered an absolute decoupling, i.e. a decrease in the materials used, which can nonetheless be explained considering the role played by importation of finished products. For instance, in 1990-2012 Germany registered a decrease of 40% in the use of materials. It is reasonable to think that the specific consumption of raw materials in various applications can be reduced, but not the absolute values of consumption on account of population growth and the fact that a considerable part of the world population has yet to reach levels of well-being.

The virtuous policies that are spreading in many countries will help reducing anthropic pressure. After a very fast growth in the course of the last century, the current stage appears to be more positively oriented towards dematerialization, and this is favoured by choices that are stimulating an increasingly circular economy.

In order to achieve a U-turn in the global use of resources it will be nonetheless necessary to question the current economic model. This shift is not to be taken for granted, but it may be necessary to meet the challenge of climate change. The commitment to reduce emissions, which has been little understood as a radical move, will inevitably lead to reflecting upon lifestyles and on the very functioning of modern societies. Its consequences may involve not only energy options but also, more generally, the use of our planet's resources.



G7 Bologna Environment Ministers' Meeting

Agenda



SUNDAY 11 JUNE

8.45
Opening of the Dialogue

9.00-13.00
Session 1: SDG and Climate Change general discussion

13.00-14.30
Working Lunch: Green Finance and Green Policies for growth and employment

14.30-18.00
Session 2: SDG and Climate Change focus on Africa and role of MDBs

18.00
G7 Environment and Invited Ministers Group Picture

20.00
Official dinner



MONDAY 12 JUNE

9.00
Reports from the side events (Universities, Firms)

9.30-11.00
Session 3: Marine Litter

11.30-13.00
Session 4: Resource Efficiency, 3Rs & Circular Economy

13.30-14.30
Working Lunch: Removing Environmentally Perverse Subsidies and Ecologic Taxation Reform

14.30-15.00
Final Session

15.00
Joint Press Conference



CIRCULAR ECONOMY IS OUR FUTURE

The paradigm shift to relaunch the economy and save the environment

“Closing the loop” has become a keyword in the construction of a resilient society which is efficient in using resources and with low carbon emissions. This is the way to go for a relaunch of the European economy while making it sustainable and competitive, and it is a challenge for the entire world, which cannot afford an inconsiderate use of resources along with an unsustainable production and consumption system. Thus the concept of “circular economy” is about to become the cornerstone of an epoch-making transition capable of breaking the linear pattern based on the take-make-dispose model: the challenge lies in thinking about how circularity, renewability and sharing can be integrated in each and every process since the very beginning.

Some concepts are not totally new: eco-design, cradle to cradle, re-use and recycling have been under the spotlight for years now. Other concepts are becoming more

established as central in the new paradigm, e.g. industrial symbiosis, remanufacturing, and sharing economy.

What is new here is rethinking (and trying to construct) the entire system on the part of all stakeholders. Businesses play a prominent role, but also institutions, associations and all the citizens with their lifestyles are called upon to play their part and be part of this change.

Europe wants to lead this revolution to regain competitiveness through innovation that may bring economic growth and increase employment while respecting environmental sustainability.

Italy, which has always been used to dealing with shortage of raw materials, can play a protagonist role and has great growth potential. The objectives are clear, it is now high time to take the correct direction and build the roads to reach them.

(SF)

CIRCULAR ECONOMY FOR QUALITY GROWTH

CIRCULAR ECONOMY REFERS TO AN ECONOMIC AND CULTURAL MODEL DESIGNED TO CREATE GROWTH AND QUALIFIED EMPLOYMENT, ALONG WITH THE PROTECTION OF NATURAL RESOURCES. RELAUNCHING THE INDUSTRIAL SYSTEM GOES HAND IN HAND WITH THE DEVELOPMENT OF EFFECTIVE STRATEGIES TO INNOVATE PROCESSES AND PRODUCTS.

A circular economy can be defined as an economy that is *“regenerative by design, and aims to keep products, components, and materials at their highest utility and value at all times. The concept distinguishes between technical and biological cycles”* (source: Ellen MacArthur Foundation).

In more advanced settings, what the states and the citizens see in a circular economy is a developmental model capable of generating wide-ranging and structural benefits, particularly in society. This economic and cultural model is designed to create growth and qualified employment, along with the protection of natural resources.

From the point of view of enterprises, the circular economy is considered a business strategy to achieve economic advantages, such as cost reduction or entering new markets that can offer appealing profit margins. An extensive application of the circular economy's principles by European businesses could lead to € 400 billion annual savings in the materials used for durable goods production; on the other hand, just in Italy the number of new jobs created as a result of the circular economy-based models and services could be 140,000 over the next five years.

However, where should one start off to achieve these objectives? It is necessary to identify the most effective strategies, capable of maximizing economic and social benefits in the short run while, at the same time, accelerating the adoption and spread of the circular economy.

The following priorities should be addressed:

- a) developing business models that are founded on the access to added value services: in the whole of Europe, consumers' preferences are undergoing a shift towards disownership with respect to service access, as an alternative to ownership of goods. This favours an increase in business productivity of the assets and their quality. In this setting, the technologies behind the Internet of things, 3D printing, and traceability are extraordinary accelerators of change
- b) producing durable goods with high and medium-high technological content through remanufacturing processes: this industrial strategy allows for high levels of remuneration to be paid to highly qualified professionals along with considerable savings in raw materials
- c) giving incentives to marketing and purchasing of products that are

manufactured and designed to provide the market with a high value of material renewability, including the recovery of post-consumer recycled matter, used within “closed” and controlled cycles. The advent of smart cities, the evolution of reverse logistics networks, modern recycling technologies and cultural change among consumers can favour the establishment of products manufactured with the use of renewable material also obtained from post-consumer recycling processes.

The identification of some broad and systemic issues can be helpful in focusing public and private investments, while it can also help avoiding micro-sectorial fragmentation of the initiatives that will be undertaken.

The broad issues indicated above are important not only in environmental terms, but they are also an effective stimulus to the creation of economic and occupational value, in that they make it possible to extend production and service supply chains, create new ones, develop ties between heterogeneous stakeholders belonging to different settings.

Business strategies for the circular economy

The main European industrial concerns have long been taking actions to improve the efficiency of the resources used in product manufacturing and production processes. While resource efficiency aims to “do the same things better” and is based on largely technological skills, the circular economy is concerned with “doing the right things” through integrated and multidisciplinary skills (*figure 1*). It is therefore necessary to start systemic eco-innovation programmes, designed to transform the enterprises’ business models from linear into circular ones.

The leading enterprises that have implemented comprehensive transition programmes towards the circular economy are working simultaneously and in a coordinated way on three areas:

1) **business model innovation.** The leading enterprises transform their value proposition from offering goods to be sold to clients into offering access to a service

2) **product innovation.** The main product innovation strategies adopted by the leading enterprises within the circular economy framework are:


- design for disassembly: optimizing products in terms of separation of their parts, therefore in terms of re-use/recycling
- eco-design: designing products free of toxic components, with optimal use of materials
- co-creation: designing products collaboratively, involving the clients and the partners in the supply chain since the very beginning
- closed loop recycling: designing products (and processes) with the aim to use materials from post-consumer recycling and recovery treatments
- biomimetics: replacing traditional materials (which potentially generate waste) with environmentally friendly organic matter

3) **process innovation.** The main actions include:

- resource efficiency: designing more efficient production processes, which optimize the use of both direct and indirect resources
- reduction/re-use: studying processes that reduce waste material, scrap, and explore the possibility of concretely reusing them in the processes themselves
- re-manufacturing: manufacturing processes performed on end-of-life parts or products in order to renovate them, with equal or higher performance

FIG. 1 RESOURCE EFFICIENCY AND CIRCULAR ECONOMY

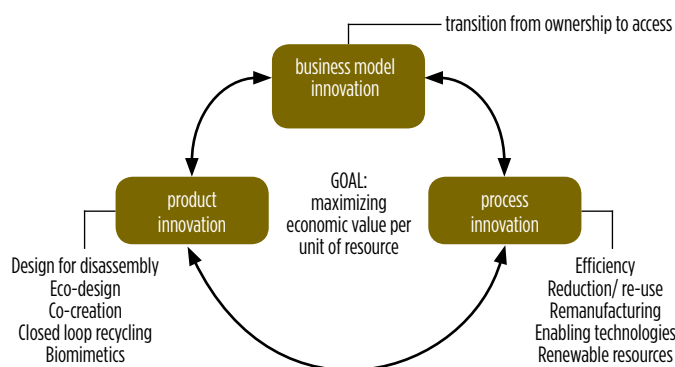
Main differences between an approach based on resource efficiency and a model based on the principles of the circular economy.



	Resource efficiency	Circular economy
Vision	Do things better	Do the right things
Skills	Technological	Multidisciplinary (social and economic science)
Decoupling goal	Relative	Absolute

FIG. 2 STRATEGIC AREAS

Strategic areas under consideration by businesses investing in the circular economy.



than the original and with a guarantee equivalent to new products

- adopting enabling technologies: using technologies, such as the Internet of things, Rfid traceability, 3D printing, in business processes
- using renewable resources as a source of energy for the production of goods.

The diagram in *figure 2* briefly illustrates the industrial strategies adopted by enterprises following circular economy models.

Italy: in search of a quality recovery

As people become increasingly aware of the fundamental role played by growth in our society, industrial policies designed to decouple economic growth from the use of resources by production systems should be favoured. From this perspective, the paradigm of a circular economy can stimulate businesses, institutions, and citizens to trigger a quality and balanced growth, with low impact on natural systems, which must be safeguarded for future generations. A “circular” view of the economy could thus contribute to focus civil society on shared ideals, in which the process of changing our economic system may be rooted. Our country’s resources, the

protection of its natural systems, the job prospects for the new generations are bold and incisive issues, which affect emotionally a large number of people and families. Creating consensus on medium to long-term targets is fundamental to move rapidly and efficiently towards the green economy and, in particular, circular economy.

Moreover, the circular economy can help enterprises improve their capacity for regenerating the resources they “borrow” from the biosphere to generate the goods and services proposed on the market. In parallel, citizens/consumers would have the opportunity to better appreciate which products do not cause hidden environmental costs that are then faced by the community. There is a need for organizations and people capable of making pervasive innovations in business models, production processes and products according to the circular economy, thus creating long-lasting value and constantly reducing the costs and consumption of natural resources.

Daniilo Bonato

General Director, Consorzio Remedia; European Commission, High Level Steering Group Raw Materials member

THE DAME WHO SANK THE LINEAR ECONOMY

HOW AND WHY AN EXPERIENCED YACHTSWOMAN HAS BECOME THE ICON OF THE CIRCULAR ECONOMY. THE STORY OF ELLEN MACARTHUR AND HER FOUNDATION, A TRUE GLOBAL FORCE TO HELP THE OLD ECONOMY'S TRANSITION. INTERVIEW BY "RENEWABLE MATTER" MAGAZINE.

Energetic, discrete, influential, outspoken, complex, Ellen MacArthur is the Dame of the circular economy. She convinced Google and the World Economic Forum that the linear model is over and that the way we produce and consume across the world can actually be changed.

Ellen MacArthur was born 40 years ago in England. At the time, she didn't know that her fate would be influenced by the most perfect geometrical shape: the circle. In the small Derbyshire village of Whatstandwell, far from the sea, she saved every penny to buy a boat. Her goal? Circle the globe, crossing the oceans as a yachtswoman. And that's exactly what she did and better than anyone else. On 7 February 2005 she broke the world record for the fastest solo circumnavigation of the globe, a feat which gained her international fame. It took 71 days, 14 hours, 18 minutes, 33 seconds to sail for the 27,354 nautical miles (50,660 km).

In 2010, she decided to focus on another circle. She retired from her sailing career on September 2nd. She had something unique in mind: creating a foundation (today globally-known as the Ellen MacArthur Foundation) to work with business and education to accelerate the transition to a new type of economy.

Designing a new model, where everything is regenerative and restorative at the very core. A system where no output is wasted, no material is worthless, where products enter a circle of reincarnation and transformation, using sustainable energy sources and impacting positively the economy. An economy shaped like a circle, a circular economy.

Ellen and her foundation worked together to give this new model prominence, involving the World Economic Forum, big corporations like Google, Ikea and Banca Intesa. She partnered with consulting firms such as McKinsey and inspired thinkers and researchers. Waves never stopped her. Once you tame the



PHOTO: BRWAN LEDGARD - CC-BY/2.0 - WIKIMEDIA

oceans, nothing can stop you. So, she decided to do something even braver, to sail the Earth-ship out of the traditional, linear, petro-capitalist, economic model. And she might set a record too.

Renewable Matter reached her in the Foundation's HQ in Cowes – Isle of Wight – to discuss the exciting future of the circular economy and her endeavor to achieve something no-one has ever been able to do and to understand how sailing solo can change the world.

Dame MacArthur, 6 years ago you started the EllenMacArthur Foundation, one of the most successful initiatives to establish a new industrial model, inspired by thinkers as Amory Lovins, Gunter Pauli and William McDonough. How has this journey been and what is the aim of the Foundation?

The aim is to extend the idea of a circular economy to the global economy. Our first step to success was to work on the circular economy and define it, trying to understand the circular economy as best as we could. It's continuously evolving and we still only understand a very small percentage of what it really is. But to understand the circular economy's systemic nature and systemic mutation,

we have to take into account raw materials, biological cycles, technology, the service industry and banking, it encompasses everything. Furthermore, it is fundamental to understand that a grasp of the circular economy is systemic. Once defined what the circular economy was we needed to take the idea out there.

So, over the years, we have introduced eight reports and three books on the circular economy. The first report, launched at the World Economic Forum in 2012, was looking at medium-complex circularity to more than one year and to less than ten. The top line figure was US\$ 600 billion dollars worth of economic opportunity in 2005. The numbers were big, even if they were only looking at recycling 25% of products' components per year. But the report was an epiphany and an eye opener, people really began to realize that it was indeed a real opportunity.

We then went on a second report, which was January 2013, looking the Fmch (Fast-Moving Consumer Goods). We discovered an economic potential of US\$700 billion in the global market, not much harder not to achieve because the Fmch is much faster. We looked at the biological elements of food waste

and plastic packaging as material with high potential. With the second report, we were invited to the World Economic Forum (Wef) in Davos. By year three, we had a partnership with the Wef. The third report, which was looking at how the global and economic value supply chains can become circular, was co-branded with the Wef. We had an impact on the global economy.

And how did you evolve from there? Revolutionizing the global economy, I must say, is no small task.

When we launched the Foundation we set out to work in three key areas. First: working directly with businesses, looking at how they could become more circular. At the beginning we knew very little about that journey, we just had a vague idea of what success looked like. Another area we wanted to work on was analysis insight: understanding the economic rationality. The third area was looking at the opportunity through education for the circular economy. I stress this aspect in particular, as we do executive education. It is beyond just publishing economic papers: we show the value of the education of the circular economy. We do this education project to create real circular business leaders but also to provide an inspirational perspective, so that people can see there is a different way in which our economy can function, especially for young people, who are still in the phase of life where ideas are being imprinted. We receive fantastic feedback from them because suddenly there's so much to be done, the more we do, the faster, the better we can get to a restorative, regenerative, powerful economy. We hope that in the future there will be a circular generation.

What direction will your work take in the future?

In the future, I see the Foundation continuing to work on education, with businesses, cities and governments, on communication and publications, accelerating ideas, and promoting systemic initiatives. Our view is that we will continue to focus on those five areas and push, as hard as we can, as we always have, as a team. Now we work in many areas: we have people in Brazil, the States, here in the UK, across Europe. We have a team in Brussels, India and China, looking at economic studies and building initiatives. Our work is expanding very quickly, it's becoming

global at a breathtaking speed I could not even imagine only three years ago. Just bringing those five things to a global level, in the way that we know it worked at the World Economic Forum, will entail a great deal of work ahead of us. It's so complex that it's impossible to say where we will be in ten years' time.

Yours is the most sophisticated and global observatory on the topic. Where is the circular economy establishing solid roots?

I would say it's definitely more advanced in Europe. There are elements that occur in many countries, but an understanding of the systemic nature of this change, I would say it is more of a European phenomenon. Overseas, the market is beginning to kick off: we have a team in the US and we have incredibly positive conversations, we have global partners in the US. Emerging markets have also a huge potential in the circular economy. In the Western World, we have built the linear system, we have a linear production, a linear thinking, a linear design, it's hard to get out of it. In emerging markets, you can escape the linear system. It would make much more sense to start from scratch and embrace the circular economy straight away.

How are you pushing circular economy's ideas in developing economies? Has the Foundation tried to lobby cooperation and development agencies, to have them bridging these models?

We had many conversations with organizations such as the World Bank, the Asian Development Bank, and of course the World Economic Forum; we organized informal gatherings with the world's economic leaders. We are targeting specifically Africa and the potential for its development, there are many conversations going on about circular economic benefits and there is a massive opportunity there. Once you realize how great an opportunity is, suddenly you are building an economic model which is restorative, which manages to keep products and materials with the highest recorded value. It's not just containing the damage on a yearly basis, it's like rebuilding a different model with massive economic potential. It's going to be challenging, there are many barriers along the way.

The EU has just approved a Circular Economy Package, with a set of policies allocating incentives to the industry in order to develop circular economy business models.

Do you think we need more ambitious policies than these?

It's part of a process. We still know so little about the circular economy. As with policies, trying to do the right thing is actually incredibly challenging because the last thing you want to do is to put something in place, with the right intentions only to find out it generates the opposite effect. The circular economy is policy-relevant not policy-prescriptive. So policies can help, but they don't necessarily have to define exactly what needs to be done. It will be trial and error, I'm sure, but what has been incredibly positive about the process with the European Commission is that it has shifted from being focused on simply waste to a real circular economy package, with systemic change and the launch of a public consultation last summer, which made a difference. I think the Package has been a very successful start. Look at the feedback from businesses, cities, regions that have worked on this for many years, going back to the Commission after the first package, saying we need the circular economy to happen, not just waste management. I think we have a real opportunity to create an innovative legislation: both parties want to create the circular economy.

Which EU country is the leader in the field?

There's a lot of work happening in Holland, for sure. Over the past 10 years they have been working with the government and the general public. In the Netherlands they have a slightly different and open attitude. Some of the challenges they had with the geography and the limited territory are indeed the reason why the circular thinking has gained momentum. There are some astonishing examples of industrial processes. But there are pockets in unlikely places. We worked for example with the city of Phoenix, or with Barcelona, places really forward-thinking.

How can a city or a region become a circular economy leader?

You need to involve all the stakeholders. When you are creating a systemic change, it's not easy because you can't do it alone, you have to do it with many other partners, you need to bring everybody to the table in order to create that systemic change.

Many fear that the circular model might impact jobs. What does your research show?

When we carried out the study on Europe, at the beginning of the public consultation [for the Circular Package], we worked specifically with the German Employment Economic Group, and we were specifically looking at what influence the circular economy would have on employment. Would employment rise or fall? Results showed that most probably it would have a positive impact. Actually there would be less employment in the raw material industry but there would be more employment in the remanufacturing and service industries. Take Airbnb as an example of the circular economy: you have huge hotels being built all over the world – it is a clear linear model and then suddenly Airbnb pops up, showing there is a lot of unused space in buildings that can be utilized otherwise. And through the IT digital revolution it unlocks spaces which were previously unavailable, almost impossible to find. Suddenly we have this visibility into spare space within the global economy. It could be spare materials, spare equipment, anything: suddenly everything has the ability to be connected. And this creates jobs. This is the time for the circular economy because we have the information technology that can help this. Five years ago we couldn't predict what the digital revolution would have done for employment, suddenly the informal economy, the sharing, the circular are showing opportunities.

How will trade change with the circular economy?

If you look at small businesses trying to become more circular, providing a product-as-a-service, they might buy the product upfront from larger manufacture company, of course, but then they need a constant relationship with the manufacturer and the customers, as they might offer life extension services, or they might be able to remanufacture those products locally. Now in the traditional enterprise you buy the product and you sell it and then re-sell it. End of story. That would change because customers will not own the materials, they will only use it for some time. For the company, that piece of equipment will be “in someone else's house” for a while. Indeed for the financial sector this will be a huge change. Financial firms are trying to understand how a business that has adopted a circular model will unlock more economic potential and will set its revenue model. Just having the banking sector understanding whether companies are trying to get to its key, you have this

huge big development of where value changes and who owns value. Having the finance sector understanding the difference between linear and circular is key.

The Foundation carries out extensive research. Does it work with specific research centres?

We have 14 university partnerships, to support teaching and research in the circular economy, from London University to Bocconi University in Milan.

We are seeing growing interests in the research partnerships. Professors want to get involved, they see the opportunity, they want to understand the circular economy more deeply. We need to fathom the consequences of the adoption of such models, take Uber or Airbnb as an example. We are going to do things differently, we are going to find spare vehicles, we are going to find spare buildings, to remanufacture everything, and we need to find a way to utilize them, to benefit from these processes. We are building a picture of what the circular economy is, and the more we have of that picture, the more straightforward it would be for new companies, cities, regions to step in the circular space.

How come that a record-breaking yachtswoman has become the icon of the circular economy?

It was very unexpected; I never thought I would do this. All I wanted to do from the age of 4 was to sail a boat, and I spent all my free time thinking about sailing. For years, I saved my school money for a boat, I left school at 17 to become a sailing instructor, at 18 I set out for my solo round-the-world tour. Everything was about sailing, everything was about being at sea, everything was about finding a sponsor, everything was about getting out there and being on the water and I absolutely loved it. I still love it as much today as I ever did, it's a massive magnet for me being on the sea. There was absolutely no reason to step out of that, I should still be doing it now. But then suddenly the penny dropped. You know, it's incredibly difficult when you go to sea. Imagine to be about to go off today from Italy to sail around the world, nonstop, you would take everything you need for your survival. Everything. You have a boat, your little world, and you put everything on that, for your survival for the next 3 months, or 4 or 5, depending on how fast your boat is.

Now when you leave, that's it. Your link with the land stop, and you prepare to be at sea for the full duration, if you run out of something, that's it, you can't stop and buy more, in the deep ocean you are 2,500 miles from the nearest town, five days away from everything, so you really are isolated and you really do develop a different way of thinking. You get used to it and you go into a different mode. And suddenly it dawned on me with the second round-the-world tour that our economy is no different than my boat. We have a world with finite resources: it's absolutely no different from the boat. When I finish my journey, I go back and I restock and I set off again. But we cannot do that, we don't have more resources, and it just suddenly hit me, and I knew nothing about the circular economy, I never heard the word, never came across the idea, I knew absolutely nothing. It's what brought me to try to understand the global economy. I started reading every book I could, I met experts, scientist, economists, educators, tried to understand. If this current model that we use doesn't work, what does? And initially you point to “we need to use less, we need to travel less”. But then you realize that all of that is essential, we absolutely need to be incredibly careful with what we use now because we have finite resources. It's not that we are going to educate every young person in the world, “we just need to use everything a little bit less”. You know it doesn't work, because we have desires. And then you start thinking “So what does work?” And suddenly you see that if we change the system, we can recover all the materials, we use biomimicry design, sharing economy models – which brings the utilization of products to the highest level – and the performance economy where they were able to do the same with bigger products. Suddenly you see that systemic thinking can change everything. And it was the personal journey I went on that made me realize that the system doesn't work, the linear economy doesn't work in the long term. That is how I started to think, alone in my boat, about a new economy, which is able to be restorative and regenerative, to rebuild natural capital, which has basically degraded since the beginning of the industrial revolution. And now the race is on!

Interview by **Emanuele Bompan**, published on *Renewable Matter*, No. 12/2016
www.renewablematter.eu

CIRCULAR ECONOMY PACKAGE

THE EUROPEAN PARLIAMENT SETS MORE AMBITIOUS TARGETS FOR WASTE MANAGEMENT AND SUSTAINABLE GROWTH

On Tuesday 14 March 2017, the European Parliament adopted the “waste package”, including a series of resolutions designed to favour recycling and re-use of waste, limit landfilling, and reduce food waste. This is a step forward in the promotion of a circular economy. It follows the adoption of the Circular Economy Action Plan by the European Commission and the relevant public consultation.

MEPs set even higher targets in comparison with the Commission’s proposal, so as to moving on more decisively towards the transition to a circular economy.

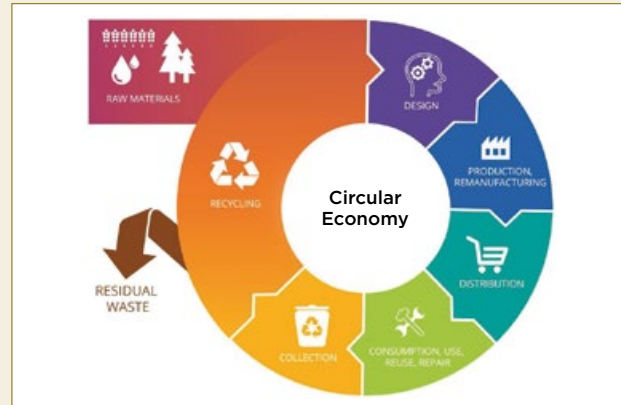
The situation of waste management in Europe has been improving over the last few years: in 2014, 44% of all municipal waste was recycled or composted. It was 31% a decade before, in 2004. Following this trend, the European Union should be able to reach its target of recycling or composting more than 50% of waste by 2020.

However, this is not considered the end: the EU bodies decided to go even further to make Europe a leader in the construction of an economic, productive, and consumption system in which waste is considered a new raw material. Improving waste management could bring benefits to the environment, climate, human health, and the economy. “The EP by a very large majority has showed that it believes in the transition towards a circular economy. We decided to restore the ambitious recycling and landfill targets in line with what the Commission had originally proposed in 2014” said lead MEP Simona Bonafè.

The Parliament will now have to negotiate the text of the approved resolutions with the Council of EU ministers. “The revised legislation sets very high targets, and we believe it cannot avoid confronting a problem we have been working on since day one at the EU Council: the harmonization of rules, which implies equal efforts by all Member States to make real performance comparisons possible. Negotiations won’t be easy, but it’s crucial to achieve the approval of a really ambitious text, if we want Europe to take a sustainable growth direction”, commented Italian Minister for the Environment Gian Luca Galletti.

As part of a change in EU policies towards a circular economy, the European Commission put forward four bills, which introduce new targets in waste management with respect to re-use, recycling and landfilling.

These proposals also strengthen EU provisions on waste prevention and extended producer responsibility, streamlining the definitions, the obligations in terms of communication, and the calculation methods for the targets.



Targets

These are the targets approved by the European Parliament in the circular economy package:

Waste and packaging

By 2030, at least 70% by weight of so-called municipal waste (from households and small businesses) should be recycled or prepared for re-use, i.e. checked, cleaned or repaired. The European Commission’s proposal was 65%. For packaging materials, such as paper and cardboard, plastics, glass, metal and wood, the proposed target for 2030 is 80%, with interim 2025 targets for each material.

Landfilling

The bill limits the share of municipal waste to be landfilled to 10% by 2030. The proposal tightens this to 5%, albeit with a possible five-year extension, under certain conditions, for member states which landfilled more than 65% of their municipal waste in 2013.

Food waste

Food waste in the EU is estimated at some 89 million tonnes, or 180 kg per capita per year. MEPs advocate an EU food waste reduction target of 30% by 2025 and 50% by 2030, compared to 2014. They also propose a similar target for marine litter. (SF)



A TREASURE WAITING TO BE DISCOVERED

THE ECONOMY NEEDS TO BE TOTALLY TRANSFORMED, FROM LINEAR TO CIRCULAR, TO RESPOND TO THE SHORTAGE OF RAW MATERIALS AND RECOVER THE HUGE CAPITALS AFFORDED BY WASTE. THIS NEW MODEL COULD HAVE A POSITIVE IMPACT ON THE GDP AND EMPLOYMENT. ITALY CAN ASPIRE TO PLAY A LEADING ROLE.

The inflow of material into the system is immense: only in 2010, more than 65 billion tonnes of new material have entered the economy. In 2020, in a business-as-usual scenario, this is estimated to peak to 82 billion. Obviously, the resources are not evenly distributed among the different countries, thus they are in contention given the growing demand for material as a result of the global demographic growth (9 billion in 2050) and the increasingly large number of people who become part of the consumer middle class (more than 5 billion by the end of the decade). Will there be enough material for all? At school, some years ago, the teachers used to illustrate the dilemma behind the shortage of material in the world by means of a classic Malthusian explanation: what would happen if all Chinese people used toilet paper? In one year's time there would be no forests left. The assumption is theoretically correct, still this is the way we are going through. Fifteen years ago a new stage of the Anthropocene epoch started, with renewed scarcity of raw materials. It is therefore necessary to address the following question: which processes should be transformed to create a world where everybody can take advantage of the well-being afforded by technology and knowledge, overcoming the limitations imposed by a linear economy?

It is calculated that every year 1.3 bn tonnes of municipal solid waste (Msw) are generated, i.e. 1.2 kg waste per capita per day on average. According to estimates by the World Bank, from the report *What a Waste*. A global review of MSW, in 2025 these figures could go up to 1.42 kg waste per capita, with more than 2.2 billion per year. Italy alone would generate more than 65 m tonnes of Msw every year. Today we are at about 55 m (of which 13 m are collected separately). But waste could be much more than this. According



to the International Solid Waste Association (Iswa), in fact, statistics are not accurate. *"We do not know exactly how much available waste exists in the world"*, an Iswa source declared. It is a sea of potential material, more than 7,000 times the volume of the Empire State Building, with inestimable and unknown monetary value. There is simply no real metric yet to estimate this immense capital. And it is not just waste.

The principles of a circular economy

A total transformation of the linear economy is thus necessary and it should comply with the following principles in order to make waste and unused material an economic, social and environmental advantage.

First, waste fields should be reconsidered as a source of material, limiting processing as much as possible: waste collection, recycling, production output management, functioning objects discarded due to bad stock management (including households).

The second principle is linked to ending the unused value of products, even before their disposal: warehouses full of machinery waiting to be discarded, boxes of clothes with low emotional value stacked in one's garage, objects bought and used just once a year. It is a useless amortization of assets whose value is not put to work. Look around with new eyes and you will see inert matter, as in the case of a teddy bear left in the armchair of one's childhood memories. The third principle is stopping the premature death of matter: although recycling and re-use are fundamental strategies of material recovery, often we sentence to death, i.e. dispose of, perfectly healthy material. It does not matter whether it will be recycled. Often just part of an object breaks down or fails while the remaining parts remain fully functioning. It would be like burying a person with a broken arm. What if the wi-fi system of a (out of warranty) mobile phone fail? Everything is thrown away, it would cost too much to fix it. Yet, the device includes a functioning processor, a touchscreen, sensors, an Led light. No

way, that is the sentence. In the best-case scenario, it will end up in an e-waste management programme (WEEE, Waste electrical and electronic equipment); in the worst-case scenario, it will be dumped in the sea (a common practice in many countries that consider oceans to be a big landfill).

These three principles lie at the basis of a new economy, i.e. the circular economy. A treasure waiting to be discovered. The rationale is as simple as this: take the straight line of capitalist economy and bend it to the point it becomes a circle. At this stage, the negative output, scrap, waste, debris, unused material become the starting point of a new, exciting world of production and economic growth.

Growth, employment and emissions reduction

According to the first studies available, this development model may have a twofold positive impact on Gdp and employment, albeit caution is in order as the economic model is still in its infancy and the relevant data are far from perfect. The latest report, drafted in collaboration with McKinsey Center for Business and Environment, is entitled *Growth Within: a circular economy vision for a competitive Europe*. It shows that moving from a linear to a circular model would lead to 11% growth of the European Gdp

by 2030 (7 percentage points more in comparison with the growth registered in the linear model), 48% reduction of emissions (which could increase to 84% by 2050) and 18% increase of household income. If it grew in a scalar way over the next five years, the circular economy could generate € 450 million savings over the cost of materials, 100,000 new jobs and prevent 100 million tonnes of waste from being landfilled at a global level, provided that within these five years businesses should focus on promoting the creation of “circular” supply chains to increase the rate of recycling, re-use, and regeneration of raw materials.

The European Commission has presented an ambitious package of measures to boost the transition of Europe towards a circular economy, with the aim of strengthening competitiveness at world level and stimulating sustainable economic growth and the creation of new jobs. “Reduce, reuse, recycle” are the keywords of a comprehensive proposal in favour of competitiveness and innovation. A lot still needs to be done to carry out this package of measures, but at least part of the Parliament seems to be willing to support this line of action.

According to Karmenu Vella, European Commissioner for the Environment, consensus around the idea of a transition towards a circular economy has overcome every political barrier: *“It is as if there were something in the air, a common idea whose*

time has come. All around the world, people are tired of the traditional ‘take, make, use, waste’ model. Yesterday’s economic model brought enormous wealth. But it also leaves a legacy we cannot ignore. Our planet is warming, species are disappearing, and the resources we depend on are becoming ever more scarce”.

The Commission’s proposals are the basics of a circular economy: maintaining the materials and the value circulating within the economic system as long as possible, so as to constantly minimizing losses. There is no specific reference to maximizing usage, renewable energies, and human resources. However, the bill is a good starting point, albeit at times not so much informed on the models of circular economy that are rising. And chances are that enlightened civil society and business people will take the steps that are so hard to be taken in the political world.

For once, we can say that Italy’s position on circular economy is more advanced than that of the Usa and Germany. We must become undisputed leaders.

Emanuele Bompan

Journalist and geographer

RESOURCE EFFICIENCY

THE ROAD MAP FOR A CIRCULAR ECONOMY AT THE BOLOGNA G7 ENVIRONMENT



The G7 Environment for sustainable development in Bologna shall launch a “road map” of energy efficiency, so as to outlining a five-year working plan on some priority issues. Italy’s Minister for the Environment Gian Luca Galletti reveals in advance one of the objectives of this international summit focusing on environmental issues to be held in Bologna on 10 and 11 June 2017. During the *International*

Workshop on Resource Efficiency, organized by Confindustria and Global Business Coalition in Rome, the minister highlighted some commonly shared points in the debate and all of them revolve around resource efficiency: indicators to measure it, the link with climate change, international recycling of resources and materials, economic analysis of an efficient use of resources, along with the social dimension,

involving citizens and raising the awareness of public opinion, food waste, plastics and green tenders, product policies for durability.

The minister restated how imperative it is to take action for greater resource efficiency, a much-needed approach to respond to the pressure put on natural resources by the world population increase and economic growth. “Resource efficiency is one of the cornerstones of the transition from a linear to a circular economy, it is essential for sustainable development and to fulfil the Paris Agreement. If the economic and the political worlds are able to work together, great results will be achieved. Today businesses are ahead of governments in some cases, as they understood long ago that the future lies in the circular economy and they are moving independently in that direction” explained the minister. Then Mr Galletti focused on the issue of process governance, giving the example of Italy. “In Italy we are working on the National Energy Strategy, a strategy for sustainable development, and the Climate Change Adaptation Strategy. These three strategies together will determine the industrial plan, not just the environmental one, of the country for the next few decades” he added.

SPECIAL WASTE IN EUROPE AND IN ITALY

SPECIAL WASTE PRODUCTION AND DISPOSAL DATA POINT TO A SCENARIO WITH MANY DIFFERENCES AMONG EUROPEAN COUNTRIES. THE ENDORSEMENT OF A CIRCULAR ECONOMY SETS RECOVERY TARGETS ONLY FOR SOME FRACTIONS. A BETTER DEFINITION OF BY-PRODUCTS AND END-OF-WASTE MATERIALS IS NEEDED.

On 2 December 2015, the European Commission presented the new package of measures to promote a circular economy. It consists of a European Action Plan including actions, strategies, and proposals for legally binding measures to be adopted according to a precise schedule, and four new proposals for directive which modify the European rules concerning waste management. The measures cover the entire cycle: from raw material extraction to product design, from production to distribution, from consumption to re-use and recycling. The proposed actions will contribute to “closing the loop” of the product life cycle through greater recycling and re-use, and will benefit both the environment and the economy.

The new proposals for directive were sent to the EU Council and Parliament for approval. They envisage amending up to six European directives, including the Waste Framework Directive (2008/98/EC), as well as those on Landfills (1999/31/EC) and on Waste electrical and electronic equipment (2012/19/EU). The main targets of the proposals for directive (the so-called “waste package”) can thus be summarized:

- a target of recycling 60% of municipal waste by 2025 and 65% by 2030
- a target of recycling 65% waste from packaging by 2025 (the minimum target for plastics is 55%) and 75% by 2030 (with distinctions depending on the materials)
- a binding target of reducing landfilled municipal waste to maximum 10% of total municipal waste production by 2030
- prohibition of landfilling waste obtained from separate waste collection
- stronger collaboration among Member States to improve waste management
- simpler and improved definitions and terminology relating to waste and harmonization of calculation methods for recycling rates
- minimum criteria of an extended producer responsibility scheme

- modifying the norms concerning by-products and end-of-waste materials
- improving prevention measures, particularly concerning food waste.

Both the EP Environment Committee and the European Council examined the new proposals for directive; the Committee completed the review on 24 January 2017 and approved the proposals with a number of amendments, which set more ambitious targets indeed. The approval by the EP Environment Committee is an important step towards an ambitious reform of the European waste policy, which is finally able to transform waste into a resource, thus creating, at the same time, both economic and occupational growth. In fact, according to estimates of the EU Commission, by reaching the targets approved by the EP Committee it would be possible to create 580,000 jobs by 2030, with € 72bn annual savings for EU businesses as a result of greater resource efficiency and a consequent reduction of imported raw material.

In particular, the EP Environment Committee set higher recycling targets, excluding product re-use, compared to those proposed by the European Commission in December 2015.

Recycled municipal waste should increase from 65% to 70% by 2030 and packaging waste from 75% to 80%. By the same deadline, landfilled waste should not be higher than 5%; food waste production and marine litter should also be reduced by 30% by 2025 and 50% by 2030 in comparison with 2014 data.

The amendments concern not only setting higher recycling targets and a drastic reduction of landfilling, but they also include economic support measures to achieve these objectives, promoting industrial symbiosis practices, prevention targets for extended producer responsibility schemes, and promoting the use of biodegradable plastics.

The proposal presented by the Environment Committee was approved at first reading on 14 March 2017. Meanwhile, the European Council is working on the joint position of the



governments of the Member States which is expected to be ready by June 2017. Subsequently, the texts by the Commission, the Council, and the Parliament will be discussed to get to the final draft of the new directives. The debate will not be easy, in that the EU Council would tend to reduce the recycling targets of both municipal and individual materials of packaging waste compared to the targets proposed by the European Commission on 2 December 2015.

In fact, the latest draft proposed at the European Council would include the following proposals of recycling targets: 55% instead of 60% by 2025 and 60% instead of 65% by 2030 for municipal waste; the final targets for packaging waste would be confirmed (80% overall recycling by 2030), but there would be reductions for wood (30% instead of 75%), plastics (50% instead of 55%), and aluminium (50% instead of 85%).

Special waste production and management in Europe

The context illustrated above and the actions being undertaken at a European level to promote a circular economy do not involve special waste, except for some specific waste flows that fall under the directives mentioned earlier and concern batteries and accumulators, Weee, end-of-life vehicles. Moreover, for these important waste flows there is no proposal to increase the recycling/re-use preparation targets, but only to harmonize definitions and calculation methods of the established targets. The same applies to construction and demolition waste, i.e. one of the major flows of special waste in quantitative terms, for which the 70% recycling target by 2020 has been confirmed.

It is worth highlighting that a better definition and identification of the criteria employed to qualify by-products and end-of-waste material as indicated in the “waste package” may actually enhance the development of a circular economy with regard to special waste too. However, the European Commission does not intend to take action on non-municipal waste, because this is strictly linked to the economy of individual Member States. These are entrusted with the task of implementing prevention policies and making sure this material is used as a resource. The end-of-waste criteria themselves must be identified and guaranteed by Member States, along with the identification of by-products.



What about the position of Italy with regard to special waste production and management? Comparisons with the rest of Europe can only be made with reference to Eurostat 2012 data, which are the more updated for the moment. The overall production of hazardous and non-hazardous waste (i.e. the sum of waste produced by all Nace activities and households) shows that in 2012 the EU-28 produced about 2.5bn tons of waste, of which 96% non-hazardous (amounting to 2.4bn tons) and 4% hazardous (amounting to 99.8m tons). The biggest waste producer was Germany, with 368m tons, followed by France (344.7m tons), Romania (267m tons) and the United Kingdom (241.1m tons). Large quantities

(greater than 100m tons) were also registered in Poland (163.4m tons), in Italy (162.8m tons), in Bulgaria (161.3m tons), in Sweden (156.3m tons), in the Netherlands (123.6m tons) and in Spain (118.6m tons).

Germany was also the biggest producer of hazardous waste with almost 22m tons, followed by Bulgaria (13.4m tons), France (11.3m tons) and Italy (9.5m tons).

As regards waste management, the 2012 data show that 42.3% of all waste managed in the 28 Member States was landfilled, 6% was destined for land treatment/disposal in water environment, and 1.6% was incinerated, whereas

45.7% and 4.4% were destined for materials recovery and energy recovery respectively. With regard to landfilling, the percentages ranged from below 10% in the Netherlands (3.3%) and in Belgium (7.6%) to 98.6% in Bulgaria. Relatively moderate percentage levels (below 20%) were registered in Slovenia (12.6%), Italy (17.7%), Germany (18%), Denmark (19%), and the Czech Republic (19.9%). A clear distinction can be made between the old Member States, where on average landfilled waste amounted to 30.8% of treated waste, and the new ones, where the average percentage of landfilling amounted to 70.9% of the total amount managed. A completely different situation was registered with regard to the more “virtuous” forms of waste management, i.e. materials recovery including backfilling. These accounted for 27.1% in the newly acceded Member States and 53.2% in the EU-15. In particular, the percentages of materials recovery (including backfilling) ranged from 1.1% in Bulgaria to 80.3% in Slovenia. It is worth highlighting that Italy registered the best performance among the EU-15 countries with 75.9% of materials recovery, followed by Belgium with 73.2%, Germany with 69.2%, and Luxemburg with 64.3%. Rate differences were much more moderate with regard to incineration. Up to 17 Member States show percentages below 0.5%, whereas in the 11 remaining States the highest percentage was registered in Belgium with 8.1%. Italy scored 4.5%, followed by the United Kingdom (3.3%), Germany (3.1%), and France (2.3%). Against this background, Italy’s special waste management system stands out as quite efficient and well in line with the best performances among the European countries, particularly with regard to recycling and materials recovery.

Special waste production and management in Italy

The brief outline presented below is based on the information gathered in the *Special Waste Report 2016* by Ispra, based on data referring to 2014. In 2014, special waste production amounted to 130.5m tons, including special waste from mechanical biological treatment of municipal waste, equal to approximately 8.3m tons. Between 2013 and 2014, a considerable increase in the total production of special waste was registered, approximately 5%, equal to

more than 6.1m tons and largely made of non-hazardous special waste. In fact, this registered an increase of more than 6.1m tons in quantitative terms (+5.3%). On the other hand, the production of hazardous special waste remained stable (+0.3%, i.e. nearly 24,000 tons). The general figures take into account both the amounts found in analyzing databases of environmental declaration forms (called Mud in Italy) and the amounts estimated by Ispra by means of specific methodologies applied to the production industries that are partially or totally exempt from the Mud declaration. The analysis of waste production data by economic activity highlights that the construction and demolition industry had the lion’s share in the overall production of non-hazardous special waste in 2014, with 42.3% which is equal to almost 51.5m tons. Waste treatment and recovery activities follow (27.2%) along with manufacturing (19.2%), accounting for almost 33.1m tons, which include the quantities resulting from mechanical biological treatment of municipal waste, and 23.4m tons respectively. Altogether, all the remaining activities accounted for 11.3% of the overall production of non-hazardous waste (more than 13.7m tons) (*figure 1*). As regards hazardous waste, the manufacturing industry accounted for the

largest amount, i.e. 39%, which is equal to almost 3.4m tons. Waste treatment and recovery activities scored 29.9% as they produced approximately 2.6m tons hazardous waste. The service, trade and transport industries scored 20.7%, with more than 1.8m tons, of which approximately 1.1m tons of end-of-life vehicles (*figure 2*). Looking at the main types of special waste produced in 2014, the data show that waste resulting from construction and demolition operations accounted for 39.1%, including land obtained from reclamation operations with approximately 51m tons. Wastes under Chapter 19 of the European list of waste accounted for approximately 31%. These include above all waste produced by waste treatment and waste water treatment plants along with water purification plants, which show a considerable increase in comparison with 2013 (+11%), amounting to almost 4m tons. Approximately 7% of wastes produced were the result of thermal processes (Chapter 10), 5.1% were wastes not otherwise specified in the list (Chapter 16), 3.7% were derived from shaping and physical and mechanical surface treatment of metals and plastics (Chapter 12), which amounted to, respectively, more than 9m tons, approximately 6.6m tons, and almost 4.9m tons. Petroleum refining processes, inorganic and organic

FIG. 1
NON-HAZARDOUS SPECIAL WASTE
Percentage of the total production of special non-hazardous waste in Italy by economic activity, year 2014.

Source: Ispra

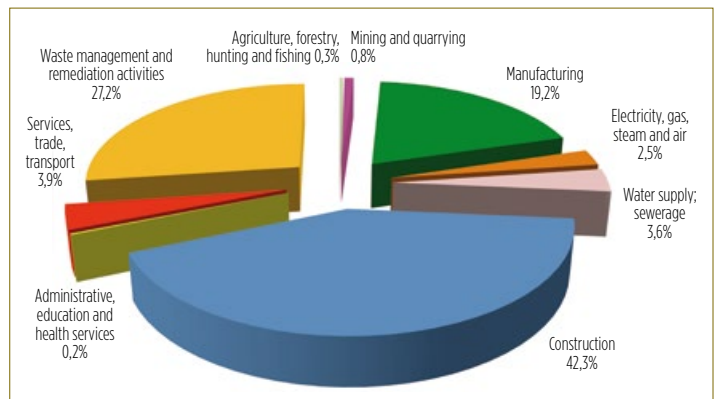
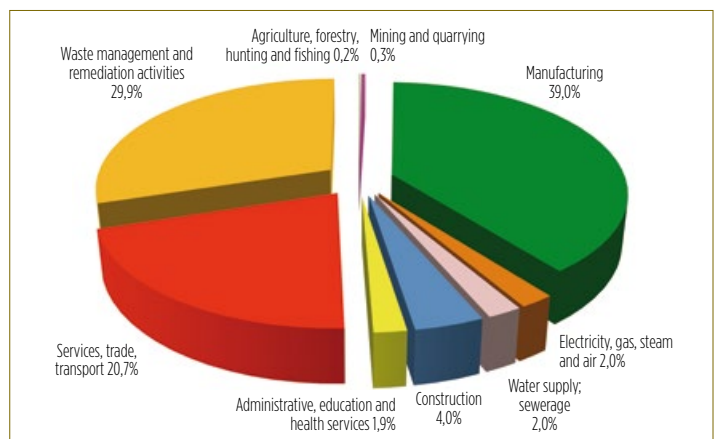


FIG. 2
HAZARDOUS SPECIAL WASTE
Percentage of the total production of special hazardous waste in Italy by economic activity, year 2014.

Source: Ispra



chemical processes (Chapters 05, 06, 07) produced 2.5m tons (2%).

With regard to hazardous waste, 26.6% waste production in 2014 resulted from waste treatment processes and 20.1% from wastes under Chapter 16, including, inter alia, end-of-life vehicles (1.1m tons), hazardous Weee, batteries and accumulators. Wastes resulting from petroleum refining, organic and inorganic chemical processes accounted for 14% altogether, amounting to more than 1.2m tons.

As for waste management, in 2014 the various forms of waste management received 133.8m tons special waste in total. Non-hazardous waste accounted for 94%, i.e. approximately 125.4m tons, and hazardous waste accounted for the remaining 6% (8.3m tons). Materials recovery was the predominant type of management, receiving 83.4m tons of waste (62.4% of the entire amount managed), 20m tons of waste (15%) were treated in physiochemical, biological and reprocessing plants, whereas approximately 11.4m tons were landfilled (8.5%). Overall, 15.4m tons were classed as “accumulation of material” (item R13 of the relevant decree) and “preliminary storage” (item D15 of the relevant decree), amounting to, respectively, 10.6% and 0.9%. The remaining minimal quantities of special waste were involved in energy recovery (1.6%) and incineration (1%).

The data also include the quantities of special wastes imported and exported to be sent to the different management forms. In 2014, 3.2m tons of waste were exported to foreign countries and mainly consisted of non-hazardous wastes, amounting to 2.3m tons, whereas the remaining 919,000 tons were hazardous wastes. On the other hand, approximately 6.2m tons were imported in our country and these almost exclusively consisted of non-hazardous wastes. In fact, imported hazardous wastes accounted for just above 166,000 tons.

Analyzing the data concerning only non-hazardous special waste management (figure 3) it is clear that materials recovery was the predominant management form, amounting to 81.6m tons (73.2% of all non-hazardous wastes managed); inorganic substance recycling/recovery was the main form of recovery, equal to 57.2% of total recovery in the form of materials, which treated approximately 46.7m tons; metal recovery accounted for approximately 16m tons, while 2m tons of non-hazardous special wastes were

FIG. 3
NON-HAZARDOUS
SPECIAL WASTE
MANAGEMENT

Special non-hazardous waste management in Italy, year 2014.

Source: Ispra

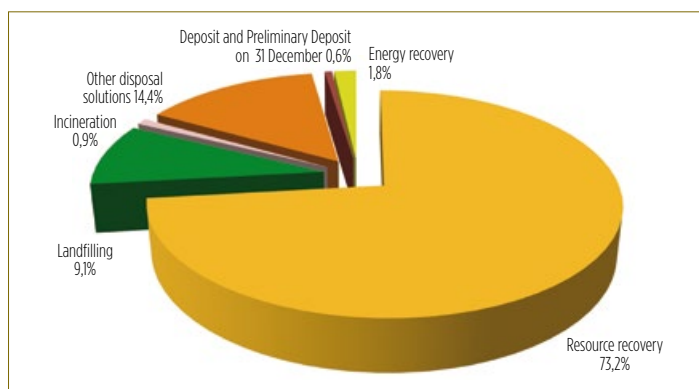
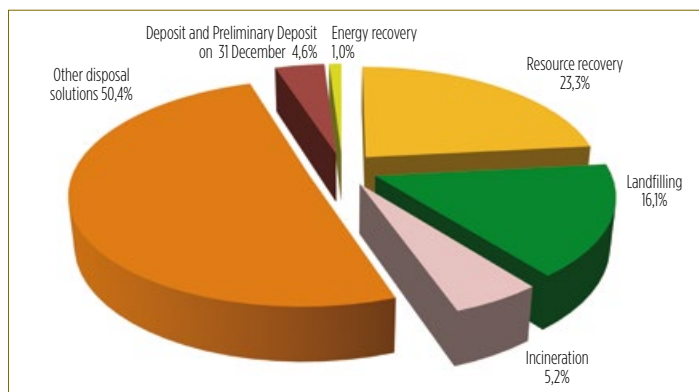


FIG. 7
HAZARDOUS
SPECIAL WASTE
MANAGEMENT

Special hazardous waste management in Italy, year 2014.

Source: Ispra



used as a source of energy in production plants (1.8%).

The quantities sent to physiochemical, biological treatment and reprocessing plants amounted to 16m tons; finally, landfilling concerned 10.1m tons of non-hazardous special wastes (9.1% of the total amount managed).

The data concerning hazardous waste management show that the largest quantities, amounting to approximately 4m tons, were sent to physiochemical, biological treatment and reprocessing plants, accounting for 50.4% of the total amount managed. The predominant management form was the physiochemical treatment, which affected approximately 3.3m tons. Considerable quantities of waste were also landfilled, amounting to approximately 1.3m tons, while 407m tons were incinerated (5.2%). 23.3% of hazardous wastes were recovered in the form of materials, amounting to 1.8m tons; the most common recovery operation was “recycling/recovery of metal or metal compounds”, approximately 535,000 tons (29.2% of the total recovered); 348,000 tons of hazardous wastes were recovered for inorganic substances; finally, energy recovery accounted for 76,000 tons (1%). For inert waste from construction and demolition, the European rules set a recycling target of 70% by 2020, to be calculated according to the methods

indicated in Decision 2011/753/EU. Italy already reached this target and went beyond it in 2014. In fact, more than 28.5m tons of construction and demolition waste were recovered in the form of materials, reaching a recycling rate of 74.3% of produced waste. The situation is different if another important flow of hazardous waste is considered, i.e. end-of-life vehicles. In 2014, the re-use and recycling rate of this kind of waste amounted to 83% of the vehicle’s average weight, above the 80% target set by Legislative Decree 209/2003 for 2016. Total recovery, including energy recovery, was nearly 85% of the vehicle’s average weight, which was in line with the 2006 target, but definitely far from the 95% target set by the norms and to be reached by 1 January 2015. This situation was due to the insignificant quantities of energy-recovered waste, i.e. only 16,000 tons in 2014.

Rosanna Laraià

Italian National Institute for Environmental Protection and Research (Ispra)

CIRCULARITY AND CHALLENGES FOR ENVIRONMENT AGENCIES

THE SHIFT TOWARDS A MORE CIRCULAR ECONOMY RELIES NOT ONLY ON THE FULL COMMITMENT OF BUSINESSES, BUT ALSO ON THE GENERAL REVIEW OF CONTROL AND SURVEILLANCE STRATEGIES. THE PRODUCTION PROCESS WILL REQUIRE MORE ATTENTION AND ALSO A CLOSER CONSTRUCTIVE COOPERATION BETWEEN PRIVATE AND PUBLIC SECTORS.

The shift towards a more circular economy unleashes unprecedented opportunities for Europe and its citizens. A successful outcome requires a deep circularity-oriented reorganization of production and consumption processes as well as the adoption of new models likely to become the new cultural heritage of future generations.

The recycling potential of a product and its components largely relies on its original design. Eco-design, for a long time focused on energy efficiency, can give a meaningful contribution to circular economy defining crucial requirements, about lifecycle, repair, update, assembly, use and recycling.

This will imply the commitment to manufacture brand new products but also in changing specific features of already existing products and will result in a general improvement of the value chain. Waste management will also have to adapt to these new principles. The EU hierarchy defining the strategy needs to be the core of both public and private waste management policies. By-products and end of waste strategies will be prevention measures; moreover this approach will contribute to the split between economic growth and waste generation reducing the recourse to virgin raw materials. This in-progress revolution implies also a general review of control and surveillance strategies in order to make the command and control model suitable for supporting this process. All the relevant stakeholders, including manufacturers, operators and control authorities will have to collaborate on that on a regular basis. Let's just think to issues like the marketing of by-products, i.e. secondary materials resulting from end of waste treatments. The scope of the Reach regulation will need to be extended also to by-products and secondary materials for industrial processes or re-use and consumption. More generally, there is the need to

improve the connection between re-use and recycle on the one hand, and design processes on the other hand. Actually the specific rules in this field are clear in terms of principles, but hard to be put into practice.

The enforcements entails the fulfilment of all the requirements set forth by articles 184a (by-products) and 184b (end of waste) of Legislative Decree 152/06, defining the fundamental principle differentiating waste from resources, in other words "the lack of a disposal willingness".

Putting this basic principle into practice in daily and management operations is rather complex, especially if controls can be performed only at end of pipe level. It is clear that the compliance with this principle can be guaranteed only through clear and transparent design ability of manufacturers together with managers/users.

Any use of by-products or secondary raw materials generated by end of waste processes will need to be clear from the very start of manufacturing processes. The many final foreseeable options will also have to be flexible enough to be modified according to the expertise resulting from environmental certifications and from the controls carried out within the context of Integrated Environmental Authorizations. Also local and specific initiatives may be helpful, such as sharing by-products lists referring to well-defined repositories.

Any list has to rely on the enforcement of general principles proving the existence of a common "use and consumption project" shared by all the relevant stakeholders. For this reason Emilia-Romagna set up a proper procedure certifying acknowledgment of good practices by companies through the creation of a Regional by-products list (Decree of the Regional Government 2260/2016).

Enrolment on the list is discretionary and does not jeopardize the chance to prove,



through the specific lawful procedures in the field, that the substances and/or objects resulting from the specific supply chains can be classified as by-products. Certainly this solution will contribute to a better organization of the control system that will be informed of the preparatory work done to fill in the fact sheets illustrating the features of the production processes and the resulting by-products to be enrolled on the list. One of the main challenges posed by the circular economy, on which Environment Agencies will certainly have to give their contribution, is the shift from an impact-assessment based system to a system assessing the features of a product and of its production process. For Agencies it will certainly be difficult to assess by themselves the proper required regulatory compliance. Therefore a whole system will be needed, the circular economy will have to integrate and enforce environmental quality oriented production processes fully complying with the specific production quality requirements and remaining in line with the latest market scenarios. Any form of circular economy getting away from the compliance with such industrial process features (economies of scale, procurement safety and multi-use products) will unlikely let Agencies play their role in an efficient and effective way.

Giuseppe Bortone

Director General, Arpa Emilia-Romagna

THE EVOLUTION OF CONTROL BY ENVIRONMENT AGENCIES

THE ACTUAL IMPLEMENTATION OF THE CIRCULAR ECONOMY PRINCIPLES MAY LEAD TO MAJOR CHANGES IN THE WORK OF ENVIRONMENT AGENCIES. THE INCREASE IN BY-PRODUCTS AND RECOVERY PLANTS WILL REQUIRE A GREATER LEVEL OF COORDINATION.

Waste management has always played a key role in the control and technical support activities carried out by Environment Agencies. The data reported on *figure 1* show meaningful figures referring to an equally meaningful quantity of people and resources needed for documentation checks, on-the-spot inspections, sampling activities, reports, sanctions.

As a matter of fact, every year, disregarding the application eligibility scope of Environmental Authorizations, more than one thousand waste recovery and treatment plants are controlled out of a total number of regional operating plants, regardless of their authorization procedure, may it be simplified or normal, varying from 1,200 to 1,400.

How would these control activities evolve in case, after an already too long phase of words and promises, a waste material circular economy was really implemented?

The European Commission in his report *“Towards a circular economy: a zero waste programme for Europe”* stated that in circular economy systems products retain their added value longer and waste is eliminated. When a product reaches its end of life, the economic system preserves the resources, which can then be re-used several times for production purposes in order to create new value.

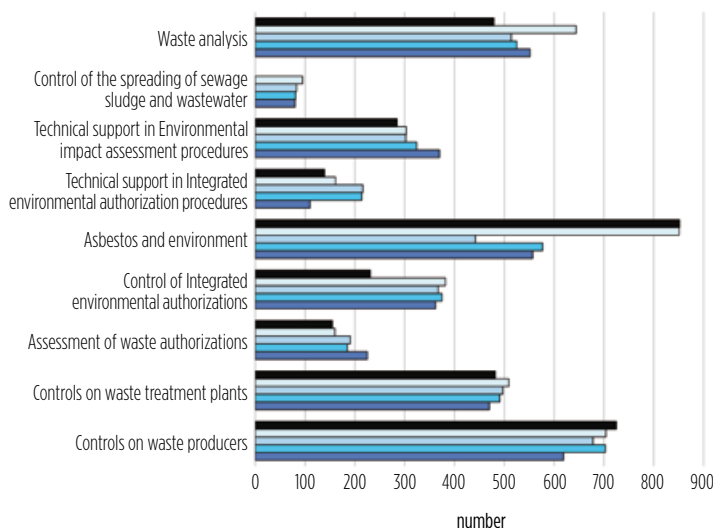
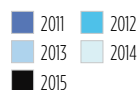
Among the many and complex scopes of action there is the re-use of by-products, not waste but real resources, as well as the proper and consistent application of European end-of-waste criteria, including their coordination with the current regulation on secondary raw materials.

That would imply the adoption of standardized, multi-sectorial and consistent technical norms regulating product quality standards, targets, contract terms and access to market, as well as striking the right balance between demanding re-use goals and the elimination of hazardous waste.

The control system will have to adapt

FIG. 1
CONTROL ON WASTE IN PIEMONTE

Control and assessment on waste by Arpa Piemonte in the last 5 years.



to a new commercial and production setting where considerable quantities of waste will be managed as by-products and considerable quantities of waste will be treated until reaching their end of waste in order to be recovered by the production cycle.

In order to get ready to tackle such a scenario, where controls not only will not certainly decrease but will also undergo major changes compared with the current situation, two key elements need to be considered:

- a major regulatory change clearly defining the features of by-products and also when and how waste stops being such and also stating clear and applicable technical norms
- an indispensable professional update

of controllers, likely to give them the required skills in order to be able to check not only traditional waste but also “products”, “by-products” or end-of-waste and check their compliance with the quality requirements that will be adopted. Provided that in the future there will be more recovery and re-use plants and also a wider application of the notion of by-products, a closer coordination between the existing control bodies will be of paramount importance, as well as a greater exchange of information, training, technical and lab skills.

Angelo Robotto¹, Renzo Barberis²

Arpa Piemonte
1. Director General
2. Waste coordination department

WASTE RECOVERY PLANTS AND ODOUR CONTROL

A CASE STUDY FROM ARPA FRIULI VENEZIA GIULIA ON THE IMPACT OF AN ORGANIC WASTE-TO-ENERGY BIOGAS PLANT: MONITORING PLAN, USE OF AN ELECTRONIC NOSE, DIFFICULTIES IN SPOTTING SOURCES OF ODOUR NUISANCES.

The term *environmental control*, in its widest definition adopted by the European Parliament and the European Council 2001/331/EC, includes both control activities on pressure sources but also the monitoring of environmental matrixes.

The crossing between environment agencies control activities and impact monitoring planning organized by companies in order to comply with authorizations, results in a virtuous circle aimed at strengthening the legal compliance with environmental rules and regulations by business operators in order to better protect communities.

Here follows what happened in Friuli Venezia Giulia region in a biogas plant located in Maniago, in the province of Pordenone.

The plant, fed with separate collected waste treated through composting, bio-stabilizing and anaerobic digestion, was considered as the cause of bad smell in the whole area. After several reports by the locals about odour nuisances, the municipality decided to check the situation and asked for the technical support of Arpa Friuli Venezia Giulia. The company had previously assessed the level of odour emissions during the environmental impact study by making estimates through odour dispersion simulation models. Environmental compatibility rules included an emission-monitoring plan through *ante operam* and *post operam* measures to be taken with the operating plant.

In particular, the concentration level of a number of compounds had to be measured with passive samplers, namely ammonia, limonene, hydrogen sulphide, mercaptans, as well as odours through an electronic nose.

The measuring points were located along the borders of the plant area and sampling was made for one week every two or three months, according to the parameter. The detected values, both for compounds and odours, seemed to indicate that the plant was not the cause of the odour nuisances.



Arpa Friuli Venezia Giulia, which has a procedure to be applied in case of odour nuisances reported by the citizens, adapted its method to this specific case that was made even more complex by the nearby presence of other similar odour-releasing sources. The Agency wanted to quantify the level of odour nuisance, compare it with the simulated impact, identify possible causes, assess possible measures and update the monitoring plan.

First of all, an impact assessment was made by giving questionnaires to the receptors, i.e. the people suffering from the impact. At the same time, the plant managers filled accurate logbooks in order to trace all the single sub-processes generating the odours reported by the receptors. The outcome of the data analysis done in order to quantify the level of perceived discomfort showed higher results compared with those calculated in the preliminary impact study. However, the presence of several similar sources did not allow a clear distinction of the specific level of contribution to the overall impact. That is why electronic noses were specifically located and set.

Further analysis showed that an update of the composting monitoring plan was needed in order to make it more accurate. Also the use of the electronic nose will

have to be modified in order to find the closest measuring point to the most affected receptors and to the plant. Moreover, measuring activities will have to consider the typical daily and weekly odour patterns highlighted by the questionnaires.

In particular, metadata monitoring (information on the specific sub-processes occurring while the odour nuisance was most perceived, weather conditions, extemporary activities in the affected area, etc.) had to be carried out in conjunction with the electronic nose sampling.

Not only the new monitoring plan will also have to include frequent and regular controls on the maintenance and cleaning of the used vehicles, because they could also be a possible cause for bad smell, but it will also need to be integrated with the monitoring plans of the other odour-generating plants located in the same area. Considering such a context, Arpa Friuli Venezia Giulia may be asked to provide technical support in setting the electronic noses with the samples coming from the other plants.

Luca Marchesi, Stefania Del Frate, Sara Petrillo

Arpa Friuli Venezia Giulia

PUBLIC SECTOR AS GUARANTOR OF PROPER MANAGEMENT

PROPER WASTE MANAGEMENT IS GUARANTEED BY THE PUBLIC SECTOR THROUGH A COMPLEX FUNCTION SYSTEM LEADING TO EFFECTIVE CONTROL ACTIVITIES AIMED AT PROTECTING COMPETITION, HEALTH AND ENVIRONMENT.

Italian laws on waste stem from the EU system. Our regulators implemented – with the necessary adaptations – the specific European directives in the field.

The Economic European Community (EEC), whose main goal was to guarantee the free circulation of people and goods within the common market area, issued the first directive in 1975. Thus, Directive 75/442/EEC was issued by an entity which was more concerned about the freedom of the market than by environmental protection.

As a consequence, it was necessary to have common rules for waste management, which, by the way, is a cost for businesses. Therefore, different rules – as it was the case – would have an impact on the final product price then leading to unfair conditions likely to affect competition. Namely, member states should not make their societies pay – at least not entirely – to create a competitive advantage for their companies.

Only at a later stage environmental protection has become one of the main pillars of the European Community, thus leading to a major development of waste management rules, until the currently discussed ideas on circular economy and the zero waste goal.

This preliminary remark makes us better understand the role and function played by public controls.

The EU architecture relies on:

- the appeal generated by the definition of “waste”: any object and/or substance left over after having been used as originally intended can be considered as waste
- the waste traceability through a code expressing their origin and grade, and reporting information about their own management
- the required compliance of facilities and operators
- the classification of treatment operations.

In other words, proper waste management is guaranteed through a series of formal steps aiming at checking



competition, health and environmental protection.

Therefore, the role of the public sector is primary and threefold: first it turns principles and criteria into planning actions and norms; secondly it issues authorization and permits; thirdly, it guarantees controls and inspections. State administrations guarantee, as third party, the consistency of the required market conditions and provide guarantees to citizens. Market conditions are also checked by European institutions. The public function system therefore is the core of the whole waste management policy.

The more the free circulation of waste is extended, including special waste, the more this function becomes unavoidable. The principle of self-sufficiency and proximity – exclusive prerogative of unsorted urban waste and of waste that are going to be disposed – is considered as a derogation to the free circulation, which can be limited only when waste import or export aims at bypassing proper waste management for the environmental reasons listed by Regulation 1013/2006 (EC).

The latter raised a question whether

environmental protection prevails on free market namely if we consider paragraph b), articles 11 and 12, allowing to reject the notification when the shipping or the treatment does not comply with the national environmental protection laws, public order, public security or public health protection as far as actions in the objection-raising country are concerned. It is therefore implied/intended, for instance, that the treatment global cost needs to be considered, including the environmental impact of shipping, therefore in order to ban shipping to faraway plants, even if commercially less expensive.

The issue, still without a commonly shared answer, does not jeopardize the importance of the public sector that has to promote as a priority the interests of the represented communities, as well as to avoid any tricky behaviour by market operators.

Stefano Leoni

Sustainable Development Foundation
www.fondazionevilupposostenibile.org

FREE MARKET AND NEED OF GUIDANCE BY PUBLIC SECTOR

THE SHIFT FROM A LINEAR TO A CIRCULAR ECONOMY POSES UNPRECEDENTED CHALLENGES. PUBLIC ADMINISTRATION ENTITIES ARE ENTRUSTED WITH MAJOR TASKS RANGING FROM GUIDELINE DEFINITION TO REGULATION AND CONTROL.

The proper definition of free market referred to special waste inevitably links up with the circular economy paradigm indicated by the European Union.

As a matter of fact, the European Commission, within the Europa 2020 strategy and the Action Programme “*Living well, within the limits of our planet*”, has set forth a package of proposals aimed at reviewing a list of European directives dealing with the opportunities generated by the shift towards a low-carbon and eco-friendlier economy, making a more efficient use of energy and resources.

The European Union raises the bar with a demanding unparalleled challenge: shifting from a linear economic system made of extraction, manufacturing, retail, use and discard to a circular model based on reproduction, reuse and recycling, industrial waste becomes a raw material for another sector, waste is no more generated, but recovered and resources are used in an efficient and sustainable way.

The proposed measures, likely to reduce both the environmental impact and warehouse gas emissions, include 70% recycling of urban waste and 80% recycling of packaging waste by 2030 and, from 2025, the ban to dispose of recyclable waste in landfills. Marine and food waste reduction is another major goal, together with the reduction of currently so-called special waste – more and more grouped with urban waste (paper, cardboard, wood, glass, plastics). Therefore, the setting of more stringent goals, in specific sector-related waste recovery rules, aims at shifting towards a more circular economy.

According to EU data, the achievement of the new waste related goals could lead to the creation of 580,000 new jobs and would make Europe more competitive, reducing the demand for primary raw materials, which keep becoming scarcer and more expensive.

The new vision outlines a new and different economic model where raw



materials are no longer extracted, used once and discarded.

In circular economy, waste disappears and recovery, reuse and recycling become the new standard to comply with.

This approach is not completely new to us: the Legislative Decree 22/1997 about waste management prioritization emphasized the key role of reducing the amount of generated waste by fostering recovery, reuse and recycling to generate new raw materials from waste.

The current challenge for businesses is even harder, because the industrial change needs to go hand in hand with a deep change of cultural mindset.

The role of businesses and the public administration

This preliminary introduction about the demanding European goals on

circular economy and the revision of waste management policies is crucial to understand how to guide corporate behaviours and public policies.

On the one hand, companies will have to face major challenges in order to radically re-design their production processes through new manufacturing layouts leading to eco-friendly products and also to comply with ISO, Emas and Epd certifications, to name but a few. On the other hand, the public sector will also have to play its part.

There can be no special waste “market” as such, excluding non-hazardous waste, without rigorous and accurate standards about the so-called end of waste, art. 184 c, Legislative Decree 152/2006, defining the features of the by-products category (see art. 184 b, Legislative Decree 152/2006).

The above mentioned demanding European goals will not be achieved, at least in Italy, without a cultural mind-set

chance about the legal acknowledgment of by-products.

The process triggered by Emilia-Romagna Region through Regional Law 16/2015 on circular economy, then through the 2016 Regional Plan on waste and then through the Regional Council Decision 2260/2016, followed by the Ministry of Environment with Ministerial Decree 264/2016, is a first important step in the right direction. There is an attempt to better define the notion of “*treatment differing from normal industrial practices*”, a key requirement to comply with the rules on by-products as set forth in Art. 184 b, in order to avoid objections from control authorities, often resulting from the subjective and discretionary assessment of industrial processes.

Even the attempt to better define the “certainty of use” is a way to try to categorize the by-products and, therefore, to provide more guarantees to both companies and control bodies, about the management of industrial waste.

It would also be advisable to guarantee essential and effective health and environmental protection during all the steps (storage, shipping, use) of industrial waste management before re-using them for a different process by the same company or by a third party; the managerial resolution on by-products issued by the Region, as well as the technical data sheet defined in Ministerial Decree 264/2017, go in this direction. Finally, the Region will have to review the limits for biomass plants, the rules on zero emissions balance and on the creation of new plants (today not authorized as recovery plants or waste disposal, according to Leg. Decree 152/2006 therefore not allowed to handle such waste) likely to reuse industrial waste – by-products – (especially those of the agri-food industry) that could lead to the increase in renewable energy production and thus to the achievement of the 2030 European goals about renewable energy sources.

However, all this is not enough.

A radical cultural change is needed also by the public administration, which should take up the challenges that industrial innovation will generate thanks to these new opportunities. In other words, an accurate assessment of the best conditions (for the environment, health, corporate economic sustainability) should be made in order to understand if given industrial waste can be re-used and not discarded.

The same applies to the activities of control bodies: the merger into a single environmental Regional Agency of inspection authorities and administrative entities, implemented in Emilia-Romagna Region through the so-called Delrio Reform – Law 56/14 and Regional Law 13/2015 Emilia-Romagna (the only case in Italy) – is a major administrative innovation that could contribute to the required paradigm change.

Only the combination of skilled, competent and qualified public bodies

and visionary and innovative corporate models leading to more resilient products, more sustainable and efficient processes likely to turn waste into resources, will guarantee the growth and competitiveness of our country.

Gianluca Rusconi

Head of Institutional Relations and Lobbying,
Confindustria Emilia-Romagna



RE-USE OF INORGANIC INDUSTRIAL WASTE

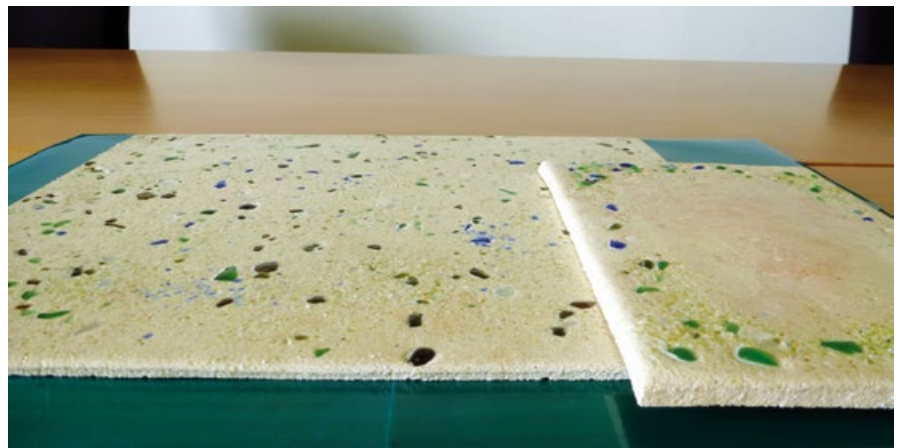
DOWNGRADING THE DANGER CLASS OF WASTE THROUGH INERTIZATION IS COST-EFFECTIVE, THE CONVERSION IN NEW RAW MATERIALS INCREASES REVENUES; THIS IS THE WAY TO ARRIVE TO A SELF-SUSTAINING SYSTEM, IMPLEMENTING THE SHIFT FROM LINEAR TO CIRCULAR GROWTH MODELS.

Sustainable waste management implies not only the quantitative prevention and reduction of hazardous waste but also a greater recourse to energy and material inertisation and re-use. Downgrading the danger class of waste (thus obtaining economic savings) or, better, converting them in proper new raw materials (obtaining more revenues), means moving from a traditional linear growth model based on “take, produce, use and discard” to a circular self-sustaining model where resources remain inside the economic system until their end-of-life in order to be reused several times for production purposes, thus generating new value.

As to material re-use, the European orientations resulting from the VI Environmental Action Programme suggest the match between sustainable use of resources and sustainable management of waste, which is key in those countries, like Italy, with few natural raw materials. Therefore, sustainable waste management needs to be implemented with the best processing and re-use technologies in full consideration of the production proximity principle.

An increase in re-use would not only reduce the demand for raw materials, but would also boost the re-use of valuable materials that are now discarded as waste and would also lead to a decrease in energy consumption and greenhouse gases emissions generated by raw materials extraction and processing. The same frame directive 2008/98/EC, implemented in Italy by Legislative Decree 205/2010, setting specific goals and criteria, also outlined a new cultural attitude affecting directly the national and local public entities as well as business and citizens, the last two being the main waste producers.

This preliminary introduction defines the context for the illustrative and certainly not thorough overview reported below,



1

whose main goal is to show how scientific applied research on technologies and materials can lead to sustainable social, economic and environmentally-friendly solutions for inorganic industrial waste management.

Heat processing

Vitrification/devitrification

Vitrification is a process based on high-temperature heating (1,200-1,700°C) of natural raw materials (carbonates, oxides, etc.) that are first liquidized then transformed into glass through water or air cooling. Vitrification turns solid waste into a highly biological and chemical resistant vitreous material. Waste organic compounds are totally destroyed, while inorganic pollutants are partially released through the gas flow as vapours or fine particulate matter (that is why special treatment lines are needed) but are mostly incorporated in the vitreous mass. Other major benefits include volume reduction and waste danger downgrading as well as the opportunity to mix solid waste of different nature and origin. The main disadvantage is that this process is very expensive and energy consuming, but it allows the transformation of

incineration residues, ceramic sludges, light carbon ashes and agri-food waste into highly value-added materials such as ceramic enamels, fibres, fertilizing glasses, vitreous granules that, previously thermally treated, generate semi-crystalline materials (glass-ceramics) with improved properties compared with the original glass, thus justifying the expensive process [1].

Sintering

Sintering is a thermal solidification process through powder compacting, removal of interstitial porosity, coalescence and development of strong bonds between adjoining particles. Usually powders are pressed into specifically sized and shaped masses, according to needs, ready to be finally processed.

The most critical factors in the process are: chemical nature and initial density of the material, particle size, pressure, time and heating cycle, atmosphere inside the furnace (reducing or oxidizing). As to waste processing the major benefits are: volume reduction, production of

1 Glass ceramic plate.

2 Geo-polymer panel.

a highly compacted material, which is extremely weather-resistant, with run-off reduction. Controlled heating leads to the final immobilization and inertisation of dangerous compounds contained in waste, namely it is largely used to incorporate heavy metals in ceramic materials. The new output materials can be used in the building sector as roof tiles, bricks, tiles, etc. Other waste categories that can be used are: packaging glass waste, Weee, ceramic sludges, steel, incineration and agri-food waste, etc. It is also possible to manufacture glass-ceramic products or porcelain tiles that due to the higher glass content have a better stabilisation of the toxic waste components. [1, 2].

Microwave thermal inertisation

Microwaves of consistent and polarized electromagnetic radiations with a frequency between 0.3 and 300 GHz can heat several materials. As many other radiation methods, microwave heating does not require the direct contact between the heating source and the heated material, therefore the furnace structure is quite simple.

There are several benefits with a suitable power level: very quick heating, very short processing times, major energy savings. The material to be heated directly and quickly absorbs energy from the microwave-transported electromagnetic field. It is also possible to apply it to gas or resistance heated furnaces for vitrification or sintering cycles leading to final products having the same features in terms of dangerous waste inertisation. Asbestos containing waste, both in compact and liquid form, absorb very well the microwave-generated energy. The fibre degradation thermal treatment (leading to inert chemical composition and microstructure) takes only a dozen of minutes and this speed, compared to the hours required by conventional treatments, brings about major energy savings. The final product, as the one obtained through conventional processing, is no longer dangerous and can be used for concrete or ceramic material production [1, 3].

Cold processing

Geopolymerization

Geopolymers refer to a technology used to get inorganic products from powders, mainly aluminosilicates ($\text{SiO}_2 + \text{Al}_2\text{O}_3 > 80$ weight %), diluted in a strongly basic solution, so that the use of ambient temperature prevents the emission of



2

greenhouse gases. These materials have been largely used over the last ten years to incorporate dangerous substances [4]. Geopolymerization is excellent to reuse and neutralise solid and liquid waste [5]. For instance, non hazardous waste can be used as a precursor of aluminosilicates to get geopolymers, namely steel or incineration waste, light ashes from power stations, etc. Also hazardous waste, like light incineration ashes, residues of ink for ceramic tile digital printing, etc. can be neutralized by this inorganic material like through vitrification. This cool process unfolds as follows: waste, in liquid or powder form, is mixed with a suitable quantity of natural or secondary aluminosilicate powders in an alkaline solution.

In spite of the use of basic solutions the process remains environmentally friendly mainly because it leads to:

- an increase in waste re-use and generation of secondary raw materials;
- the reduction of raw material extraction and CO_2 emissions
- the production of materials that can be discarded in landfills for non-hazardous waste or that can even be recycled.

Fernanda Andreola, Luisa Barbieri, Isabella Lancellotti, Cristina Leonelli

Engineering Department "Enzo Ferrari",
University of Modena and Reggio Emilia

BIBLIOGRAPHICAL REFERENCES

- [1] Fernanda Andreola, Luisa Barbieri, Isabella Lancellotti, Cristina Leonelli, "Thermal Treatments for the recovery of value added materials", in *Waste recovery, Strategies, Techniques and Applications in Europe*, Ed. FrancoAngeli, 2009, 151-164, ISBN 978-88-568-1040-0.
- [2] F. Andreola, L. Barbieri, C. Leonelli, I. Lancellotti, T. Manfredini, "Recycling of industrial wastes in ceramic manufacturing: state of art and glass case studies", *Ceram. Intern.*, 42(12), 13333-13338, 2016.
- [3] C. Leonelli, P. Veronesi, D.N. Boccaccini, M.R. Rivasi, L. Barbieri, F. Andreola, I. Lancellotti, D. Rabitti, G.C. Pellacani "Microwave thermal inertisation of asbestos containing waste and its recycling in traditional ceramics", *J. Hazard. Mater.*, B135, 149-155, 2006.
- [4] I. Lancellotti, L. Barbieri, "Geopolimeri come matrici inertizzanti", in *Geopolimeri. Polimeri inorganici chimicamente attivati*, C. Leonelli and M. Romagnoli (eds.), ISBN 978-1-4477-1913-7, 2011.
- [5] I. Lancellotti, C. Ponzoni, L. Barbieri, C. Leonelli, "Wastes materials in geopolymers" in *Wastes: Solutions, Treatments and Opportunities*, CRC Press, Taylor and Francis Group, London, 2015, pp. 115-119, ISBN 978-1-138-02882-1.

A NEW ECONOMIC AND SOCIAL PARADIGM

CIRCULAR ECONOMY REQUIRES RADICAL ECONOMIC CHANGES, STARTING FROM PRODUCT DESIGN. NEW BUSINESS MODELS ARE NEEDED, NAMELY INTEGRATING THE CIRCULAR REUSE OF RESOURCES WITH NEW SKILLS AND WITH THE FUNDAMENTAL ROLE OF THE MARKET AND OF SUITABLE POLITICAL MEASURES.

After decades of corporate sustainability focused on intangible assets as reputation, financing, community relations, today the concept of circular economy opens up a new era in which the management of material resources becomes pivotal to reach the next corporate goals on economic, social and environmental sustainability.

The current linear economic model and its production processes are based on the on-going use of massive quantities of energy and raw materials and the subsequent generation of emissions and waste. This model, that never considered the environmental aspects, has showed over time its many limits, which are mainly three: most used resources are not renewable, therefore are doomed to be depleted sooner or later; renewable resources are used at such a pace that prevents their natural regeneration; finally waste and pollutants exceed their environmental absorption¹.

Within the academic world, two English environmental economists, Turner and Pearce, were among the first², at the end of the '80s³, to talk about the need to shift from a closed and linear economic model, without any relation to the environment and with a manufacture-use-dispose process, to an open and circular system in which negative "externalities"⁴ (finite resource consumption, pollution, waste production) are part of the economic system itself according to the material balance model⁵. The concepts of "open" and "closed" systems are to be considered physically, in other words the extended economy refers to them to imagine a model based on the one hand on thermodynamics laws⁶, and on the other, likely to apply the typical economic tools to the environment.

Only over the last few years the concept of circular economy finally left mere academic debates to enter the common language. Circular economy means an economy capable of reducing to zero⁷



PHOTO: D. VILLANI, REGIONE EMILIA-ROMAGNA A.I.C.G.

its waste and pollutants production and at the same time minimizing its use of energy and raw materials through cyclical material flows similar to natural ones. This approach is also named "from cradle to cradle", using the typical life cycle assessment terms, because it underlies the need to transform post-production and post-consumption waste and residues into new resources for a new production cycle. The Ellen MacArthur Foundation, internationally well-known British non-profit organisation, defines circular economy as *"one that is restorative and regenerative by design, and which aims to keep products, components and materials at their highest utility and value at all times, distinguishing between technical and biological cycles"*. It is not simply about waste re-use optimization, but instead changing every step of the supply chain in order to preserve and regenerate the natural capital, maximize resources re-using them in biological or technical cycles and minimizing the unavoidable negative externalities. This requires

a radical change of paradigm of the whole production system, from product design and development, things need to be conceived in order to last as long as possible and to be then exchanged, recovered, repaired, reproduced and only at the very end recycled.

The vast majority of the currently marketed products is made of such a material mix that their re-use is complex and expensive and, when possible, it leads to *downcycling*⁸, in other words to a qualitative material downgrading even if the recycling is quite energy consuming. In the circular economy product design must already include end-of-life scenarios in order to facilitate the collection, recovery and re-use of materials. The shift towards a circular economy entails new business models replacing the current ones or integrating them to seize new opportunities. Large corporations may play a crucial role in terms of innovation and circular economy promotion thanks to their size, resource availability and process management

and integration. New skills and roles are needed in supply chains to guarantee circular material flows and their re-use in production or natural cycles, as well as more efficient and cost-effective systems for the collection, separation and treatment of materials.

Market mechanisms play a fundamental role in boosting and fostering such changes; nevertheless they can be supported by political measures aimed at guiding the market as well as by educational entities and opinion leaders likely to influence consumers' choices. Some crucial factors are also the European or international common rules and standards as well as incentives and other credit access tools.

In the circular economy, products and materials have a more sustainable value; waste and resource consumption are minimized and even when a product reaches its end-of-life its materials can be re-used several times to create further value. This model has a meaningful social added value: the European Commission calculates that waste prevention, eco-design, re-use and similar measures can generate for European companies net savings accounting to 600 bn euros, that is 8% of the yearly turnover, leading to the creation of 580,000 new jobs⁹. The industry will play a strategic role in promoting and accelerating such a radical change through research and innovation of product design and production processes, industrial synergies, testing of new supply chain models and reorganization of the existing ones. In order to favour the shift towards the circular economy also public entities, decision-makers and authorization and control bodies will have

to get a better knowledge of industrial processes, supply chains and reverse logistics in order to understand how to promote the creation of new cycles and to monitor their social and environmental impact.

**Alessandra Vaccari,
Mauro Bigi, Daniela Luise**

Coordinamento Agende 21 locali italiane
(Italian local Agenda 21 Association)

NOTE

¹ From the paper: "Dal Green Procurement al Circular Green Procurement. Promuovere l'economia circolare attraverso l'evoluzione degli acquisti verdi. Position Paper", Coordinamento delle Agende 21, 2016.

² This concept is not new in the academic world. See for instance, Kenneth Boulding (1966) in *The economics of the coming spaceship Earth*: "The closed economy of the future might similarly be called the 'spaceship' economy, in which the earth has become a single spaceship, without unlimited reservoirs of anything, either for extraction or for pollution, and in which, therefore, man must find his place in a cyclical ecological system which is capable of continuous reproduction of material form even though it cannot escape having inputs of energy". See also Barry Commoner (1972), *The closing circle*, here we find the first elements of this theory.

³ Pearce D.W., Turner R.K. (1989), *Economics of natural resources and the environment*, The Johns Hopkins University Press.
Turner R.K., Pearce D.W., Bateman I. (1993), *Environmental economics: an elementary introduction*, The Johns Hopkins University Press.

⁴ See the *external cost theory* introduced by Marshall (Marshall A., 1920, *Principles of economics*, London, Macmillan) then further developed by Pigou (Pigou A.C., 1920, *The economics of welfare*, Macmillan, London) and

other major authors (including, to name but a few, K. Arrow, R.H. Coase, P.M. Romer, M.E. Porter).

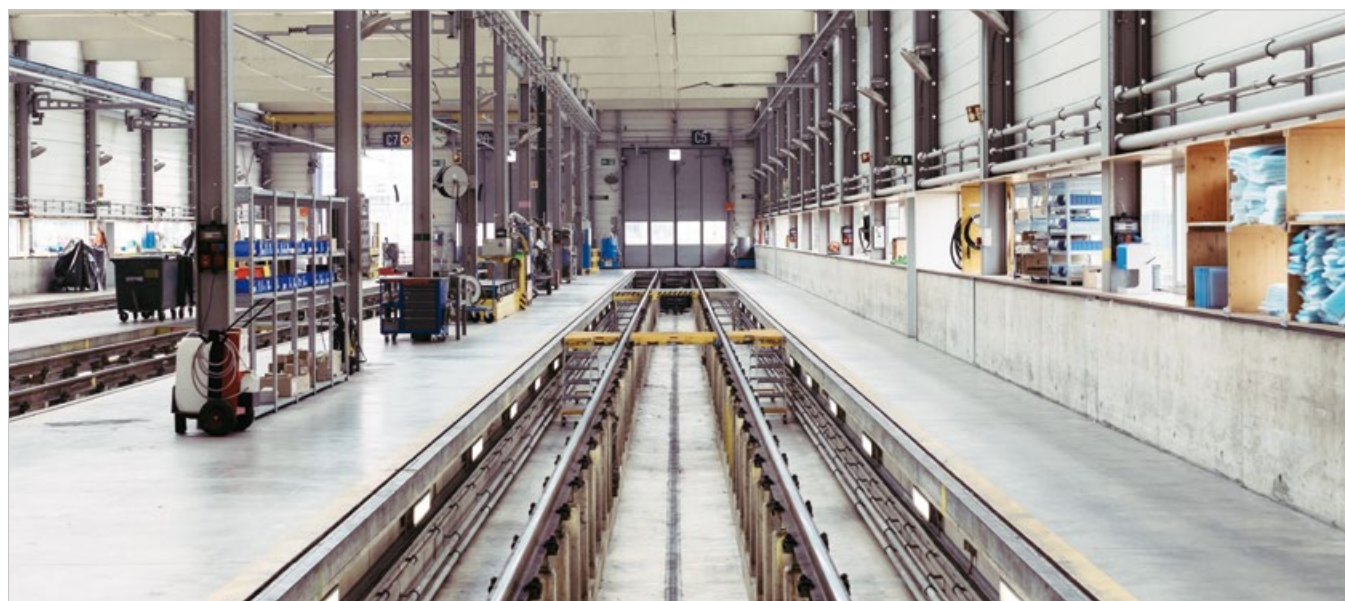
⁵ This model introduces in the economic system the contribution made by the environment in terms of natural resources and the collateral phenomenon of energy and material dispersion, generally designated as waste production. This extension lays the foundations to the integration in the analysis of the effects of some physical laws, like the mass and energy conservation laws.

⁶ The application of thermodynamic principles to economic analysis favours the comprehension of some key sustainable development concepts, which are strictly intertwined with the original meaning of the term "circular economy", the sense of this word being sometimes lost in the vulgarisation process. One of them is the impossibility to eliminate the environmental impact of man-made material and energy flows: according to the above-mentioned physical laws the waste mass equals the mass of inputs used in production and consumption cycles. Another key concept is the impossibility of a full material recovery caused by the irreversibility of the transformation processes of matter into energy and by energy degradation (also see the notions of exergy and anergy).

⁷ As explained in the previous note, a complete neutralisation of the man-made impact on the environment is impossible from a physical point of view. Here the idea is to reduce it as much as possible within the given technological, operational and physical limits.

⁸ The term *upcycling* was used for the first time in 1994 in an article by Reiner Pilz, from the German company Pilz GmbH & Co. KG, to define a form of re-use generating an added value compared to the original good or material and it is the opposite of *downcycling*, which reduces the original quality level.

⁹ European Commission, fact sheet *Circular Economy Package: Questions & Answers*, 2015, http://europa.eu/rapid/press-release_MEMO-15-6204_en.htm



REUSABLE TEXTILES SEEKING A NEW LIFE

UNDER THE LEADERSHIP OF ASSOSISTEMA, THE REUSABLE TEXTILE INDUSTRY HAS LAUNCHED AN ANALYSIS TO PROVIDE A STRATEGIC FRAMEWORK AIMED AT REDUCING DISPOSED WASTE AND PROMOTING RE-USE IN THE FRAMEWORK OF THE CIRCULAR ECONOMY.

In the transition to the circular economy, the reusable textile industry - i.e. companies dealing with the sanitization and sterilization of textile products and devices used in the healthcare, hotel and catering sectors and with the manufacturing, distribution and maintenance of personal and collective protection equipment - is assessing the sustainability of its business and services based on circular economy principles. In recent months, an analysis has been launched under the leadership of Assosistema to provide a strategic framework in this field. Every year, 1.5% of processed textiles leave the manufacturing cycle generating nearly 25,000 tons of sanitized textiles that are discarded and sent to landfill. Disposing this waste is an outlay cost for the company and an environmental cost for the society.

Textiles managed by Assosistema companies have standard technical and qualitative characteristics ensuring their durability and resistance to mechanical, thermal, chemical and biological processes during their lifecycle. Traceability is ensured by a product tag and microchip mapping each item throughout the various process steps. Reusable textiles lifespan mainly depends on two factors:

- their usage and the consequent wear level
- the impact of sanitization processes.

Both aspects are strictly connected to what textiles are used for and to the statutory physical characteristics they are required to have to be considered fit for purpose. Based on that, companies set a maximum number of washing and sanitizing cycles after which items are discarded regardless of their conditions, although they might still be fit for use. According to Assosistema, 600 industrial plants scattered throughout Italy send significant volumes of end-of-life textiles to landfill every year. Based on the sanitization procedure, items can be classified as special non-hazardous waste



and be considered as either waste from processed textile fibres (CER 040222) or waste from clothes and textiles (CER 200110 and 200111) if treated as urban waste.

The final destination of reusable textiles depends on their composition:

- if they are 100% polyester, they are disposed of as waste due to the limited quantities which cannot generate economies of scale for companies
- if they are 100% cotton, they are both disposed of as waste and used for rags manufacturing made by hand inside the companies or through industrial processes by specialized companies
- if they are mixed fabrics, they are partly disposed of as waste and partly used for

rags manufacturing (this is particularly the case for discarded overalls). However, these materials have low market value.

Textile waste in Italy

It is difficult to have a full picture of the actual production of industrial textile waste in Italy for two main reasons: on the one hand, data on special waste are not fully reliable, on the other textile waste is often considered as household waste.

National special waste production is calculated by the Italian National Institute for Environmental Protection and Research (Ispra) based on the

information provided in specific databases on the environmental declaration forms to be submitted every year under the legislation in force. The so-called “urban waste” produced by non-domestic users is not considered for this purpose. However, as outlined in the latest *Special Waste Report - 2015 Edition* by Ispra (www.isprambiente.gov.it/it/pubblicazioni/rapporti/rapporto-rifiuti-speciali), “when comparing the information provided in the database of environmental declaration forms to that taken from databases of the Italian National Institute for Statistics, less than 10% of environmental declaration forms are submitted in many manufacturing sectors (e.g. in the textile and clothing industry)”. This is due to the large presence of small businesses in the field, which are under no obligation to submit annual declaration forms. Therefore, the information inferred from the database above is supplemented with Ispra’s estimates by using specific methodologies, although Ispra believes that “supplemented data might still be partially underestimated”.

Data provided in the *Special Waste Report - 2015 Edition* focus on 2013 and estimate a total national production of 300,000 tons of textile waste, mainly in northern Italy. Very little of this waste – about 1,000 tons - is used for energy recovery or incinerated. No detailed data are available on the final use of the remainder; only aggregate data on special waste management indicate that 74.9% of the material is recovered and 9% of the waste is disposed of through the landfill. However, this total breakdown does not apply to the textile sector. Some waste produced by the textile industry is considered as household waste based on the assimilation rules defined by municipalities. This further complicates the calculation of waste produced by the textile industry, as there are no disaggregate data making the difference between real household waste and waste classified as such.

The *Urban Waste Report - 2015 Edition* by Ispra (www.isprambiente.gov.it/it/pubblicazioni/rapporti/rapporto-rifiuti-urbani-edizione-2015) provides overall data about household textile waste mainly including used clothing for which a recovery, re-use and recycling system has been set up at a national level. According to Ispra report entitled *L'Italia del riciclo 2015 (Italy recycling 2015)*, 124,300 tons of textile waste were collected in 2014 with a 12% increase compared to 2013, when 110,900 tons were collected. Some of this waste is managed by Conau,

an Italian consortium that was set up in 2008 upon the initiative of business operators consisting of bodies/companies operating in the recovery, distribution and recycling of used clothing and accessories and bodies/companies selling them. At present, the consortium manages about 50% of household textile waste (or classified as such) collected in Italy.

As to waste destination, a research on textile end-of-life management has been published by the Italian association Ambiente Italia based on the data provided by Humana, the major waste collection company. At a national level, it is estimated that 68% of waste is re-used, 29% is recycled for industrial purposes and 3% is disposed of. As already said, such data mainly refer to used clothing. As highlighted in the previous paragraph, a lot of waste is potentially being produced by the textile industry in Italy, although it is difficult to quantify it because of traceability constraints. In general terms, it can be stated that Italy produces:

- over 300,000 tons of special waste
- out of 124,300 tons of household textile waste (or classified as such), an undefined portion of sorted waste

- a portion of unsorted household waste. If, on the one hand, a lot of clothing waste is recovered or re-used due to the presence of a dedicated consortium, on the other no information exists on the management of industrial textile waste, but it might reasonably be expected that most of it is sent to landfill.

Geographical area	Waste tons
Northern Italy	213.366
Central Italy	63.178
Southern Italy	28.706
Total	305.250

TAB. 1 - TEXTILE WASTE
Textile industry special waste production by geographical area. Ispra data, 2013.

Management mode	Waste tons
Energy recovery	168
Incineration	835
Total	1.003

TAB. 2 - TEXTILE WASTE MANAGEMENT
Textile industry special waste management. Ispra data, 2013.

WHO IS ASSOSISTEMA

Assosistema represents the companies operating in the manufacturing of goods and services for the hygienic safety of textiles and surgical products used in hospitals, healthcare institutes and nursing homes, in the manufacturing, distribution and maintenance of workwear and personal or collective protection equipment, and in the reconditioning of textiles used in the hotel and catering sectors. This industry has a turnover of euro 4,200 m, employs about 35,000 workers in Italy (93% are fixed-term workers and 65% are women) with 26 employees on average, and ranks 5th among the 24 sectors identified by the latest census on Industry and Services performed by the Italian National Institute for Statistics (Assosistema data 2015).



The business focuses on 3 specific sectors: integrated healthcare services (supply, sanitization and sterilization of reusable textile devices and surgical instruments), integrated hotel services (supply, sanitization and integrated management of the store and laundry) and work safety (personal and collective protection devices, work safety systems).

Customers are large-size organizations such as hospitals, communities, hotels, restaurants, barracks, schools and chemical, textile and pharmaceutical companies outsourcing their services to pool their resources on their core business.

Member companies must provide customers with clean and stainless products that are fragrant and pleasant to the touch, with precise finishing and no unpleasant smell. Microbiological quality must be ensured both for finished products and throughout the process up to delivery. Microbiological contamination controls are in line with Assosistema guidelines complying with the UNI EN 14065:2004 standard, based on the assessment of the risk analysis and biocontamination control system.

Assosistema has set up a working group to deal with the analysis and implementation of the European novelties introduced by the new edition of the UNI EN 14065:2016 standard “Laundry Processed Textiles - Biocontamination Control System” to update the relevant association guidelines.

Circular economy scenarios in the textile industry

Assosistema has designed 3 possible scenarios to implement a circular economy model in its business. For each of them, operating models and good practices are already in place in the industry.

Scenario 1

Management and re-use of end-of-life 100% cotton textiles.

Oftentimes, end-of-life reusable textiles are transformed into rags either by hand by laundries or through industrial processes by specialized companies. That gives a longer life expectancy to items and a little higher margin of profit to companies. As explained above, rags can be used by customers of industrial laundries (hotels and restaurants), cleaning companies, car repair shops, machine shops, pizza houses and restaurants.

Longer life expectancy means that products can be re-used. This has a positive environmental impact and is in line with the strategic objectives of the European waste legislation focusing on prevention, also by re-using products or extending their life cycle (<http://ec.europa.eu/environment/waste/prevention/index.htm>).

At present, it is not possible to trace end-of-life rags, which are classified as special waste as they are drenched with biological or synthetic fats and/or other chemical products. Interviews and on-field data have shown that it is often impossible to monitor the management of their disposal, thus hampering any assessment of potential environmental impacts.

This scenario assumes that:

- 1) rags production should be maximized by extending the life cycle of all cotton garments
- 2) end-of-life textiles should be re-used and end-of-life rags should be collected and used for energy recovery.

Scenario 2

Secondary raw material production.

Cotton, polyester and mixed-fabric textiles can be recycled by specialized companies at industrial level to produce secondary raw materials and generate new products.

Textile recycling follows specific processes based on textile composition and intended purpose such as spinning, garning, melting and grinding. In Italy, there are several companies dealing with



the collection, selection, processing and packaging of textile waste.

Textile secondary raw material can be used for different purposes, e.g. the production of:

- armchair and mattress padding
- nonwoven fabrics and felts for thermal and acoustic isolation in the nautical, automotive and building sectors
- agricultural textiles to protect land and crops
- medical textiles, such as those using super-absorber polymers for nappies and incontinence products
- drawing paper from white cotton.

This scenario implements circular economy principles in the supply chain through the production of secondary

raw materials which are re-used in the production cycle, although trimming is more complex and expensive than crushing for cotton.

Scenario 3

Upgrade of textile waste, new production.

Many reusable textiles of Assosistema companies feature high quality even upon disposal. Although they no longer comply with the standards applied for the original intended purpose, they might still have better features than traditional textile waste.

This is why re-using them for the production of new products is very sustainable in economic and environmental terms.

CASE STUDIES: RESEARCH ON TEXTILE RECYCLING

Trash to cash project

This project is financed by Horizon 2020 (the European research fund) and gathers 19 international partners committed to using zero-value textile waste and cellulose fibres to create high-quality products by means of new design-driven technologies.

The team is made up of designers, researchers, technicians, raw material suppliers and manufacturing companies from all over Europe forming an interdisciplinary and intersectoral consortium.

Project website: <http://trash2cashproject.eu>



Aquafil Group

Specialized in the manufacturing of synthetic fibres (polyamide 6 in particular), this company has designed and developed an industrial system called Econyl® to produce nylon 6 from 100% regenerated waste materials out of:

- post-consumer waste, i.e. end-of-life products partly or fully made of polyamide 6 including fishing nets, fluff (the top part of carpets and rugs) and rigid textiles
- pre-consumer waste, generated from the production of nylon 6.

Interface

World leader in textile flooring, Interface has developed a system called ReEntry 2.0 collecting old carpets and rugs which are disassembled with a specific technology separating the different fibres. The whole process requires lower energy consumption compared to other methods and the company fully recycles its own waste materials.



This scenario has also been explored by the Lowaste project (financed by the EU through the Life+ instrument), which has tested the design and prototyping of products made of reusable technical fabrics used in hospital operating rooms. During the Life project, 32 projects have been identified and 24 have been prototyped with the support of 23 designers and makers.

The different types of re-products can be classified into the following categories:

- fair gadgets
- bags, sacks and cases
- furniture
- technical wear.

To conclude, not only waste but also industrial policies and corporate strategies should be considered when taking on the challenge of circular economy.

The circular economy requires reviewing strategies throughout the supply chain and should be supported by public policies, and in particular by:

- 1) *industrial policies*: a system of incentives should be in place to support research and investments in new plants and facilities promoting “return logistics”, also by means of ad hoc associations;
- 2) *green public procurement*: disposable products – often coming from Asia with no industrial traceability – are negative for the local economy and subject to fewer checks, especially in the textile sector. Public administration GPP policies should consider their impact on the environment and the labour market. Compliance with the SA8000 certification could be included in the requirements
- 3) *local development policies*: oftentimes, public administrations enabling their economic communities to

increase resource efficiency improve competitiveness at a local level (lower taxes, more connections, more trust). Local agreement models should be encouraged and supported. Last but not least, companies are knowledge repositories: they quickly learn from the surrounding environment but do not always know how and when to transfer their knowledge. Unfortunately, that also applies to the circular economy.

The bias against companies and industries is often due to the lack of communication by manufacturers. If two worlds do not speak together, they stop understanding each other

Alessandra Vaccari¹, Patrizia Ferri²

1. Indica, www.indicanet.it

2. Segretario generale Assosistema

CASE STUDY: RECOVERABLE PRODUCTS IN SCARPERIA-SAN PIERO

In 2015, the municipality of Scarperia e San Piero near Florence, decided to reward good environmental sustainability practices implemented by businesses. The local authorities introduced a 20% reduction of the waste tax for non-domestic users classified under category 22 (restaurants, small restaurants, pizza houses and taverns), 7 (hotels with restaurant) and 31 (holiday farms) proving they have fully replaced paper products with reusable textiles in running their business (for tablecloths, napkins, etc.). This initiative aims at promoting the adoption of sustainable practices by companies encouraging them to replace disposable products with recoverable ones. That has direct impacts on the environment such as lower waste production, reduction of disposal costs and better environmental sustainability. This good practice promoted by the municipality of Scarperia e Sanpiero has been replicated by the nearby village of Borgo San Lorenzo, whereas other Italian administrations are showing an interest in this initiative.

Chi-ma Florence Spa – an established local business member of Assosistema – is one of the most sustainable companies in this context. Founded in 1870 and managed by the Chiari family ever since, Chi-ma Florence Spa is a top leader in textile services for hotels, restaurants and nursing homes after 145 years of existence.

CASE STUDY: THE EXPERIENCE OF RIUP AND SERVIZI OSPEDALIERI SPA

Servizi Ospedalieri Spa is a member of Assosistema and one of the leading companies in Italy in the field of specialized services in the healthcare sector, with a focus on laundering & sterilization. Operating in the washing and rental of hospital linen for years, it has recently merged by incorporation with Omasa Spa and has become the largest Italian market player dealing with the outsourced management of sterilization units for surgical instruments.

Servizi Ospedalieri has supported the creation of Riup, a start-up re-using industrial waste to generate new products. Riup has presented its collections made by recovering reusable technical textiles used in hospitals at the event “Sharing Design - Making Makers” 2016 held at Fabbrica del Vapore, one of the most important venues at Milan’s International Furniture Fair

PACKAGING RECYCLING IN THE TRANSITION PHASE

STATE OF THE ART AND DEVELOPMENT PROSPECTS IN PACKAGING RECYCLING. 20 YEARS AGO, ONLY 1 IN 3 PACKAGING ITEMS WAS RECYCLED AND NOT LANDFILLED, WHEREAS TODAY THE RATIO IS 3 TO 4. THE ITALIAN NATIONAL PACKAGING CONSORTIUM IS MAKING EFFORTS TO FURTHER INCREASE RECYCLING.

The Italian National Packaging Consortium (Conai) was set up in 1997 following the implementation of Legislative Decree 22/1997, which transposed the European directives on waste management and focused on recycling priorities. In Italy, Conai has been promoting a real circular economy based on the enhancement and recycling of packaging waste for the past 20 years, and it continues to do so bringing important social, economic and environmental benefits to the country as a whole. The system established by Conai and sectoral consortia is based on compliance with the principle of shared responsibility between companies, municipalities and citizens, whereby separately collected packaging waste is recycled. The municipalities involved are compensated for additional costs based on the quality and quantity of their separate collection, in line with the Anci-Conai framework agreement. Compensation is financed by an environmental contribution paid by the companies producing and using steel, aluminium, paper, wood, plastic and glass packaging. In 2015, recycled packaging waste further

TABLE 1
PACKAGING

Recycled packaging waste.

Source: Conai - Sectoral consortia

Material	2014 (kton)	2015 (kton)	Annual variation
Steel	336	348	+3,5%
Aluminium	471	465	-1,3%
Paper	3.482	3.653	+4,9%
Wood	1.553	1.633	+5,1%
Plastics	790	867	+9,7%
Glass	1.615	1.661	+2,8%
Total	7.823	8.208	+4,9%

increased at a national level and reached 66.9% of the total quantity released for consumption with 8.2 m tons. 48% was managed by consortia and the remaining 52% was processed by independent operators. Current recycling rates show that the goals set by European legislation (Directive 2004/12/EC) have been exceeded, and that the 2020 goals set by Directive 98/2008 – whereby at least 50% of some types of urban waste should be recycled – have been met well in advance. When energy recovery is considered, the amount of packaging diverted from landfills rises to 78.6%, for a total of 9.6

m tons. In 2015, packaging recycling led to the generation of secondary raw materials with 3 bn of 0.75 l glass bottles, 329 m of A4 paper reams, 32 m of wood pellets, 9 bn of detergent bottles made from PET, 1 bn of 33 cl aluminium cans and 725 Frecciarossa 1000 (high-speed trains) for steel. The results achieved are extremely important but there is still much room for improvement. This holds true both for Italy, where there are still discrepancies in terms of quantity and quality of waste sorting – which is key for packaging waste recycling – between the most effective regions in the north and those



in the centre and south of Italy, and for industrial technologies that can re-use hardly recyclable waste.

In this context, the Consortium has implemented five different projects in collaboration with scientific institutes, universities and research centres.

For example, together with *Stazione sperimentale del vetro* in Venice (a glass research centre), Coreve consortium is investigating the re-use of “glass sand”.

At present, it is sent to landfill but it could increase recycling by 70,000 tons/year. Research has obtained purified glass sand that can be sent to glassmakers together with cullet ensuring manufacturing stability and quality standards. This project has also developed innovative systems for separating glass from crystal in case of mistakes during waste sorting.

But there is more to that. Similar projects are under way to increase recycling opportunities for:

- plastics, e.g. PP and PE fine films
- paper, through the creation of products generated by pulper waste from paper mills
- aluminium, for the recovery of metal layers with dry and wet processes
- steel, with the design of an electrochemical process to eliminate tin and improve recycling performance.

Conai has also been proactive in promoting the adoption and use of sustainable packaging. Most importantly, it has diversified environmental contribution for plastic packaging, which is the most complex waste in terms of waste type and selection/recycling technologies. The new environmental contribution will be defined based on three main parameters: easy selection of packaging after recycling, actual recyclability (according to industrially available technologies) and type of destination (household or trade/industry). The pilot phase started in April 2017 and

TABLE 2
PACKAGING

% recycling on total quantity released for consumption.

Source: Conai - Sectoral consortia

Material	2014	2015	Annual variation
Steel	72,5%	73,4%	+0,9%
Aluminium	74,3%	69,9%	-4,4%
Paper	78,7%	79,7%	+0,9%
Wood	59,0%	61,1%	+2,1%
Plastics	38,0%	40,7%	+2,8%
Glass	80,3%	70,9%	+0,6%
Total	65,4%	66,9%	+1,5%



the system will be fully in place on 1st January 2018.

In addition to that, Conai is boosting the design of more recyclable and sustainable packaging through a “prevention tender”, which is organized on an annual basis to give visibility and money prizes to the most effective companies.

In 2017, the jackpot will be further increased by € 400,000.

Last but not least, the Italian National Packaging Consortium is finalizing a document providing guidelines to facilitate plastic packaging recycling, in collaboration with a designer from Iuav University in Venice and Corepla.

After a public consultation with packaging producers and users, selectors, recyclers and environmental associations,

it will provide companies with an additional tool to promote the production and use of green packaging.

To conclude, 20 years ago only one in three packaging items was recycled and not landfilled, whereas today three in four items are recycled. On such an important anniversary, it is vital to start from the work done and the major objectives achieved to outline a strategy and consolidate results, so that the Italian system will still feature among the most efficient ones in Europe.

Walter Facciotto

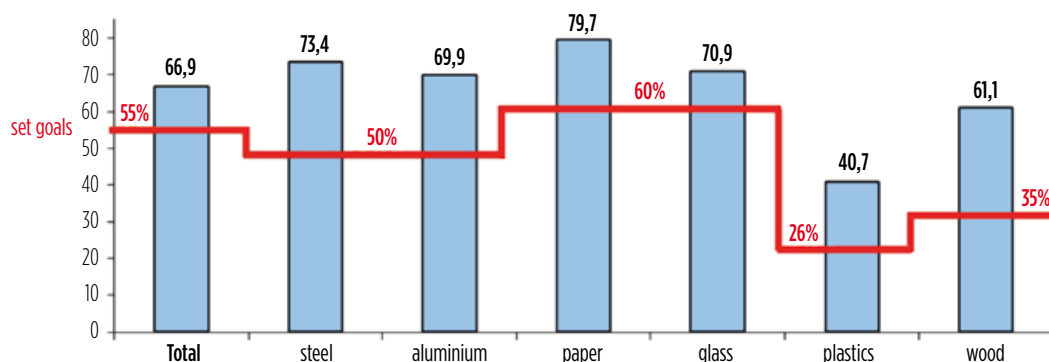
Director General of Conai,
Consorzio nazionale imballaggi
(Italian National Packaging Consortium)

FIG. 1
PACKAGING

Total recycling and recycling by material in 2015. Comparison with set goals.

Source: Conai - Sectoral consortia

■ Recycling results



PAPER PACKAGING TO FIGHT WASTE

THE ITALIAN PAPER INDUSTRY IS A POSITIVE EXAMPLE OF CIRCULAR ECONOMY. COMIECO IS A CONSORTIUM COMMITTEED TO FURTHER IMPROVING THE USE OF PACKAGING, WITH THE GOAL TO REDUCE WASTE AND LANDFILLING

The circular economy is based on the re-use and recycling of energy and materials to avoid waste and landfilling.

The Italian paper industry is a positive example of circular economy, as 55% of its raw materials consist of secondary fibres.

As for packaging, 80% of cellulose packaging used for consumption is recycled, which by far exceeds the minimum goal set by the legislation in force (60%) and the goal set for 2025 (75%).

Comieco is working in close collaboration with universities and research institutes to show the quantifiable benefits of an increasingly circular approach, with the aim to foster the involvement of packaging manufacturers, users and consumers. In one of the latest research works promoted by Comieco, Milan's Bocconi University analysed paper and organic

waste recycling and showed that the introduction of compostable cellulose packaging in the food & beverage industry to replace traditional packaging could reduce the waste of resources and waste sent to landfill.

In addition to extending product shelf life, such innovations could decrease foreign materials in the separate collection of paper and organic waste, leading to significant disposal cost savings (€ 22 m for paper and up to € 56 m for organic waste).

Through its *Paper and Paperboard Club*, Comieco will provide precious information to all the strategic players of the packaging industry, with particular reference to the companies using paper and paperboard to package and handle their products

Eliana Farotto

Head of Research & Development at Comieco



GOOD PRACTICES

RECYCLED PAPER BAGS TO BE USED FOR SEPARATE COLLECTION OF PAPER IN A PILOT PROJECT

Separate collection will be fully based on paper, starting from waste bags. From now on, all the Italian municipalities joining the new project launched by Comieco and Sumus Italia will use 100% recycled paper waste collection bags. They will replace traditional plastic bags, which are often forgotten in dustbins and become impurities, thus jeopardising paper and paperboard collection in terms of quality and quantity and frustrating waste sorting efforts. This is a new collaboration initiative between Comieco and Sumus Italia Srl, a company specialized in the production of separate collection bags made out of Italian post-consumer recycled paper.

This new agreement perfectly meets Comieco's goal to increase the quantity and quality of paper and paperboard collection in line with the guidelines provided in the Technical Annex on Paper of the Anci-Conai Agreement, whereby waste collection bags should be made of 100% paper.

The municipalities working with Comieco and joining the pilot project will receive a free test kit by Sumus with collection bags made of 100% recycled paper for the disposal of cellulose-based waste. All the instructions for proper paper and paperboard collection will be written on the dustbins to provide simple and practical information and help citizens avoid mistakes.

The first pilot phase was launched by two municipalities, Vico Equense and Meta. In southern Italy they have already set an example in the separate collection of paper and paperboard, so much so that they have become Eco-champions after the excellent results achieved in the last few years.

Overall, 750 users will be involved in the two municipalities in the province of Naples, the lead partner whose good example should be followed. Under the agreement between Comieco and Sumus Italia, free training workshops will be organized for public institutions and service companies on the operating procedures outlined in the *Green Public Procurement National Action Plan*.



COMPOST AND BIOMETHANE FROM FOOD WASTE

ORGANIC WASTE CAN PRODUCE BOTH ENERGY AND NATURAL FERTILIZERS. FOR 25 YEARS, THE ITALIAN COMPOSTING AND BIOGAS ASSOCIATION (CIC) HAS BEEN GATHERING COMPANIES AND PUBLIC AND PRIVATE ENTITIES TO SET UP A VIRTUOUS CIRCULAR ECONOMY SYSTEM TRANSFORMING AND ENHANCING ORGANIC WASTE.

New paper from paper, new glass from glass, new aluminium from aluminium and so on. But what can you get from properly sorted food waste? Organic waste is an extraordinary resource and an excellent example of circular economy, as it can generate fertilizer and even energy. Correct disposal and use of organic waste is ensured by Cic, the Italian Composting and Biogas Association, a 25-year-old non-profit organization gathering over 130 members in Italy represented by companies and public and private entities operating in the composting industry. Compost is the main product resulting from organic waste processing and can bring many benefits to agriculture as a natural fertilizer. This type of manure helps maintaining long-term land fertility, improving land structure, increasing water absorption and release and retaining nutritional elements that can easily be absorbed by plants. Compost effectiveness is best ensured by top quality waste sorting and organic waste processing. This is why in 2003 the Cic label was designed, a voluntary programme of compost quality check identifying the products complying with pre-set quality requirements.

Cic has been working for 25 years to develop a virtuous organic waste collection, processing and recycling system in Italy. It has become a model for the rest of Europe in organic waste collection, processing and enhancement. In 2015, over 6 m tons of organic waste – i.e. 100.1 kg per person every year – came from separate waste collection in Italy (Ispra data).

Cic is very satisfied with this result showing that Italy is paying increasing attention to this topic and developing a virtuous system. The next step is to accelerate and improve separate collection in southern Italy to reach 8 m



PHOTO: ARCH.CIC

tons of organic waste on an annual basis (i.e. 140 kg per person).

The Association is also promoting biomethane, which is produced by processing agro-industrial biomasses and urban organic waste coming from separate collection. Annual organic waste collection is estimated to reach about 7-8 m tons by 2020, with 5.8 m tons consisting of urban organic solid waste. If all urban organic waste was recycled in dedicated plants, over 2 m tons of organic fertilizers and nearly 300 m kg of biomethane could be generated every year, which would be more than enough to supply all vehicle fleets collecting urban solid waste.

In the field of urban waste management biomethane would play a strategic

role in line with circular economy principles, which Europe is taking as a reference in reviewing its development policies. Moreover, biomethane plants could be innovative and transform into biorefineries, where agricultural fertilizers and biomethane could be produced and research made on new industrial organic waste-based products.

Massimo Centemero

Director of the Italian Composting and Biogas Association (Consorzio italiano compostatori - Cic)

NATURE AND TECHNOLOGY FOR BIO-COMPOSTING

INNOVATIVE TECHNIQUES, PROCESSES AND METHODOLOGIES FOR ORGANIC WASTE TREATMENT IN URBAN AREAS. IN CALABRIA, A PILOT PROJECT AIMS AT TRANSFORMING ORGANIC WASTE INTO HUMUS WITH WORM FARMING: INNOVATIVE TECHNOLOGIES BASED ON NATURAL PROCESSES AND LOW CONSUMPTION OF RESOURCES.

Calabria Region is implementing a pilot project for quality bio-compost production by means of high-tech earthworm farms. They are an upgraded version of standard treatment tanks ensuring highly efficient processes.

Organic waste management

In Europe, waste is typically composed of mostly organic waste (30% of the total), paper and paperboard (30%), and other types of waste (metal 8%, glass 11%, textiles 4%, plastic 8%, other 9%). Oecd data collected in 1998 have remained almost unchanged in time, as packaging and consumption patterns for marketed products have remained the same. In 2011, urban waste management data in the EU-27 showed that 36% was landfilled, nearly 23% was incinerated, whereas 26% and 15% was

respectively recycled and composted (the later including anaerobic treatment of biodegradable waste). Between 2010 and 2011, urban waste production decreased by almost 1.1 m tons (-3.4%) at a national level. In 2012, a further decrease was recorded with a total reduction of 2.5 m tons (-7.7%) over two years. National production was below 30 m tons, with values similar to those detected in 2002/2003. The decrease in waste production went hand in hand with the drop in socio-economic indicators. As a matter of fact, between 2011 and 2012 average household consumption fell by almost 4.1% and Gdp by 2.4%. In 2012, every Italian citizen produced 504 kg of waste, i.e. 32 kg less than in 2010. The lowest production was recorded in the regions of Basilicata (below 400 kg per inhabitant per year), Molise, Calabria and Campania (all of them below 450 kg per inhabitant). In

Calabria, separate waste collection was below 20% (Ispra data, *Waste Summary Report - 2013 Edition*).

In recent years, a significant rise has been recorded in composting thanks to the increasing amount of separately collected organic waste.

The data collected in Calabria in 2015 - provided by the regional Department for Environment and Territory - indicated that urban solid waste was equal to nearly 600,000 tons produced by all the 409 municipalities in the five provinces (Catanzaro, Cosenza, Crotona, Vibo Valentia and Reggio Calabria), in an area covering 15,222 km² with a population of 1,970,521 inhabitants (source: Ancitel on Istat data referred to 1/1/2016). In 2015, separately collected organic waste amounted to almost 64,000 tons, that is a 20% average production of total urban solid waste, in fewer than half of the municipalities.



PHOTO: V. BARONE

Technological and ecological tanks

The project was designed by the working group of the Department for Environment of Calabria Regional Authority and is still in its pilot phase. The idea is to create pilot tanks servicing urban areas, such as villages or parts of cities with high quality organic waste sorting. Earthworm farming will be taken as a model. The goal is to achieve top efficiency in bio-compost production. With a view to reducing organic waste, fully natural processes requiring low energy/resource consumption will be implemented with innovative systems. Techniques and methodologies increasing volume reduction system efficiency will be validated reasonably quickly. During the pilot phase, heat and motion sensors will be installed inside tanks to monitor worm activity. Sensors will be positioned inside tanks following regular grids (observation matrices) and will be used to collect data on the life status (working worm density by area) and activity status (percentage of organic waste transformed into bio-compost). Data will be managed by a central unit monitoring a whole set of real-time data (site temperature, humidity, solar radiation) and making the necessary corrections during the pilot phase.

In its early phase, the project will involve small towns and villages in the five provinces, also in the light of earthworm farming initiatives launched by the municipalities on their own. The project will be divided into different steps:

- 1) data collection on earthworm farms currently in place in Calabria
- 2) data processing to identify consumption and size mathematical models
- 3) operating platform design with the direct involvement of municipalities and local communities
- 4) preparation of “prototype” farms with control and monitoring systems (active and passive sensors)
- 5) development of a multimedia platform providing real-time data
- 6) data post-processing and definition of mathematical models
- 7) plant validation, correction and implementation
- 8) definition of procedures for the operating management of products and household implementation

1 Worm farm in the province of Cosenza.
 2 Worm bedding.

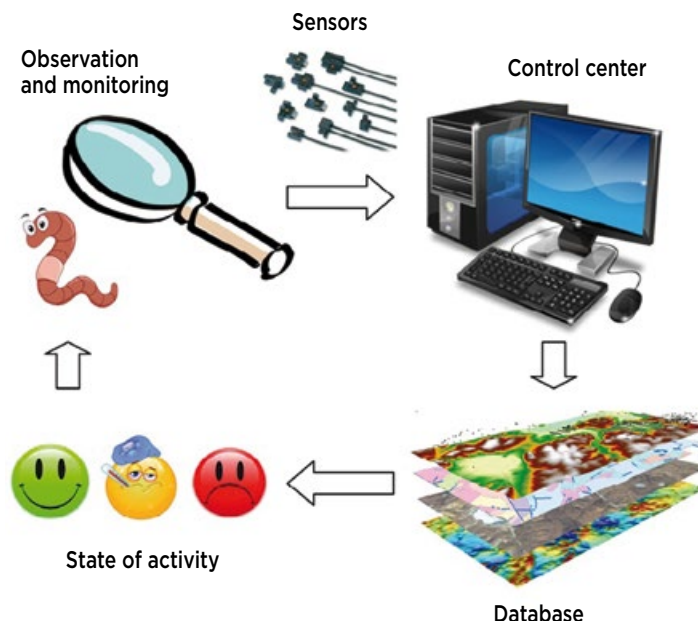


FIG. 1
 EARTHWORM
 FARMING FOR
 COMPOST
 PRODUCTION

Phases of the
 Experimental project.



2

9) GIS mapping of pilot activities with a multi-parameter assessment in the areas concerned (waste life cycle).

Conclusions

In the final step, optimal usage will be defined for each plant according to a specific timeline to ensure the best possible volume reduction performance and organic waste reduction based on different variables. Collected waste volume reduction will be implemented by sustainable and innovative technologies providing an alternative to standard waste treatment. Transforming organic

waste into humus can reduce and even eliminate the amount of landfilled waste, decrease transport costs and limit waste. Such innovative monitoring, management and control system in earthworm farming can be defined with a scientific approach to implement a low-cost and easily replicable prototype system.

**Gabriele Alitto¹, Vincenzo Barone²,
 Antonino Demasi¹, Saverio Curcio¹,
 Orsola Reillo¹**

1. Calabria Region
 2. University of Calabria

RECOVERY OF ELECTRICAL AND ELECTRONIC WASTE

IN ITALY, THE EUROPEAN WEEE DIRECTIVE HAS INVOLVED ALL STAKEHOLDERS, FROM PRODUCERS TO FINAL USERS, WITH THE GOAL TO SET UP AN EFFICIENT SYSTEM FACILITATING THE CORRECT MANAGEMENT OF THIS PARTICULAR END-OF-LIFE WASTE AND REDUCING ENVIRONMENTAL IMPACTS.

The new Circular economy Directive is focused on the *Extended producer responsibility* (Epr) approach. This principle extends producer responsibility to the whole product life cycle and has been underlying Directive 2012/19/ EU on waste electrical and electronic equipment (Weee) and its implementing legislation since 2002. In this context, the concept of electrical and electronic equipment producer responsibility has been of primary importance from the very beginning and has now been fully understood and accepted by the system.

Legislative Decree 49/2014 on waste electrical and electronic equipment has transposed the European Weee directive in Italy. Its implementation has involved all stakeholders – from producers to final users – with the goal to set up an efficient system facilitating correct Weee management and to reduce environmental impacts. This has been a major milestone in the Italian Weee system and has provided a central role to the *Centro di coordinamento Raee* (Italian Weee Coordination Centre) entrusted with new tasks.

The underlying assumption is that a system where everyone is competing provides equal status for all. In other words, competition creates efficiency which can only exist in a sound system. In this context, the Weee Coordination Centre acts as a guarantor, arbitrator and point of contact among all stakeholders involved.

The role and activities of the Weee Coordination Centre

From a legal perspective, the Weee Coordination Centre is a private consortium under collective management and governance coordinated by a Supervisory Board.



Its primary role is to ensure the correct management of separately collected Weee at a national level, so that all collective systems can work under standard operating terms and conditions. The Weee Coordination Centre decides about the distribution of collection facilities among the different collective systems and tries to increase Weee collection by the Italian municipalities to meet European goals. The Centre also enters into agreements with the municipalities, Weee collectors

and national associations of producers, distributors and treatment companies ensuring monitoring and correct Weee treatment. Acting as a central point of contact, it expresses the demands of the stakeholders involved and establishes clear and equal rules for all. Italy has more than 2,200 public and private entities managing the various types of collection points scattered throughout the country and working with the Weee Coordination Centre and collective systems to provide collection

services, in line with the legislation in force.

The latest agreements entered into by the Coordination Centre have been signed both with Weee collectors and associations representing treatment companies, with the goal to develop the sector by ensuring competition and equal rules for all. The agreements with distributors and municipalities define the main characteristics of take-back services, standard national operating rules, take-back requirements, any sanctions and the relevant remuneration.

In particular, the Programme Agreement on Weee treatment signed between the Weee Coordination Centre and AssoRae, Assorecuperi and Assofermet – the associations representing national companies managing Weee treatment plants – became fully operational on 14 November 2016.

This document aims at ensuring standard and suitable qualification and treatment levels in household Weee treatment companies, which should register with the Weee Coordination Centre based on specific audits performed by external verifiers. Collective systems can only work with accredited facilities to treat Weee.

This agreement aims both at improving the Weee system in Italy and improving environmental protection. Based on the central role played by the Weee Coordination Centre in managing

electrical and electronic waste, it is a major step forward in the relations between collective systems and companies treating properly managed Weee in Italy.

The Programme Agreement defining the terms for Weee collection and management was signed on 26 June 2015 between the Weee Coordination Centre, producers' associations, waste collection companies associations and trading and distribution associations.

This document establishes the procedures and timeframe for Weee take-back from distributors' collection points, standard collection management throughout the country and the relevant efficiency premiums. It is a final step in the inclusive process where distribution has played an increasingly proactive role in providing correct environmental management of end-of-life Weee.

The Programme Agreement defining the terms for Weee collection and management signed between accredited producers associations, national waste collection companies associations, Anci and the Weee Coordination Centre entered into force on 1 April 2015. Premiums will be given to municipalities and companies managing one or more collection facilities and other important resources to improve Weee management.

These agreements are of the utmost importance to manage this special

type of waste in Italy. In addition to clarifying stakeholders' roles and responsibilities, they have introduced many improvements and consolidated management and operations in the Weee system.

The strong point of the Italian multi-stakeholder system lies in how the legislator has implemented European regulations, i.e. by setting up a Coordination Centre entrusted with the governance of collective systems. This central entity enables the smooth running of the system as it can provide efficient management of collected waste, act as an interface for the whole system, manage Programme Agreements and ensure real competition between collective systems, where anyone can compete according to their characteristics and the best price is easier to find.

What should be improved on a continuous basis is stakeholders' control and ongoing qualification.

In Italy, all collectors (distributors and local authorities) can deliver Weee not only to collective systems but also to private operators, provided they have the necessary authorizations for treatment. It is therefore advisable that all Weee managers have the same responsibilities on proper treatment. This is the prerequisite for a circular economy worthy of its name.

Edited by Centro di coordinamento Rae (Weee Coordination Centre)



EFFICIENCY AND ZERO WASTE WITH INDUSTRIAL SYMBIOSIS

AN OVERVIEW OF THE RECENT REGULATORY TRENDS FOR THE ADOPTION OF INDUSTRIAL SYMBIOSIS POLICIES: FROM THE EUROPEAN DOCUMENTS TO THE G7 DOCUMENTS, INCREASING ATTENTION HAS BEEN DEVOTED TO THE PROMOTION OF PRODUCTION STRATEGIES ABLE TO TRANSFORM WASTE OF ONE INDUSTRY INTO USEFUL RAW MATERIALS FOR ANOTHER ONE.

The term *industrial symbiosis* first appeared in a European document dated 20 September 2011, in the European Communication “Roadmap to a resource efficient Europe”¹. In this document, industrial symbiosis is recognized as one of the useful strategies to stimulate a more efficient production through a better use of raw materials and the re-use of waste and by-products. The Commission indicated clear targets to be achieved by 2020, so that Europe may become resource efficient. The Commission also stated its commitment to increase the re-use of raw materials, also through industrial symbiosis, namely the transfer of diverse resources and residues between different industries with subsequent economic returns and benefits for the environment.

In the same year, Unep – while drawing possible pathways for sustainable growth² – pointed out the crucial role of industrial symbiosis for the green economy, namely a system of economic activities for the production, distribution, and

consumption of goods and services that increases the well-being of humans in the long term, while avoiding the exposure of future generations to significant environmental risks and natural resource scarcity. The UN document stresses the analogy between closed-cycle manufacturing and the industrial symbiosis approach, or eco-industrial parks, and wishes for a governance inspired by the principles of industrial ecology, able to invest in support infrastructures for waste treatment and the conversion of waste into resources. Such an approach is considered ideal in that it implements a production system that maximizes the useful life of products while minimizing waste, the loss of value and raw materials, in particular the so-called critical raw materials.

The following year, in December 2012, industrial symbiosis is explicitly referred to in the *Manifesto & Policy Recommendations for a resource-efficient Europe*³ by Erep; industrial symbiosis is defined as an accelerator for innovation

and the creation of green jobs. The practice of industrial symbiosis – whose effectiveness is proven – is promoted as one of the pan-European initiatives that may not only divert waste from landfills, but also upscale the value chain and contribute to the preservation of natural resources and the valorization of waste. The manifesto urges to focus on platforms for sharing knowledge, to export industrial symbiosis models outside the EU, through a match-making at cross-border level, and to create new networks, as well as scaling-up the existing ones.

A self-regenerating economy

With the new definition of circular economy – in which waste from a production and consumption process circulates as a new input in the same or in a different process – the meaning of industrial symbiosis becomes even more important. In 2014 the EU Communication⁴ embraced exactly this



concept of economy, which regenerates itself through sustainable procurement, by reproducing the natural model as much as possible. To plan and innovate while fostering a circular economy, the Commission insists on industrial symbiosis, in particular to identify the by-products markets and favour the grouping of businesses, and therefore waste streams, in order to take advantage of scaling factors and make it possible and cost-effective to recover and give value to by-products, so that they do not become waste.

In the same year, the programmes of Horizon 2020⁵ dedicated specific bids⁶ to finance projects for the implementation of industrial symbiosis. Horizon's work programme aims at systemic innovation on a large scale, able to transform the wasted resources from an industrial sector into useful raw materials for another one. The approach outlined by industrial symbiosis needs a far-reaching coordination between diverse actors, while businesses continue to play a central role, but are called upon to raise their awareness on this topic and be more accountable for the economic and social transformation underway.

Such considerations were certainly recognized in Berlin, where the G7 met in October 2015 to devise a strategy for efficiency in the use of resources. The *Alliance for Resource Efficiency*⁷ was one of the outcomes of the G7 meeting, and was designed to serve as a forum for the exchange and promotion of best practices and innovation, by the G7 partners, along with the relevant stakeholders from the business and public sectors, research communities and institutions, and civil society, on a voluntary basis. To start this process, the G7 organized some workshops, including one on industrial symbiosis covering the sharing of service, utilities and by-product resources among industries, including through eco-industrial towns. In the same year, on 2 December 2015, the European Commission adopted a new circular economy package to help European businesses and consumers to make the transition to a stronger and more circular economy, where resources are used in a more sustainable way. The proposed actions aim at "closing the loop" of product lifecycles through greater recycling and re-use, and bring benefits for both for the environment and the economy. The package envisages reviews of some Directives and an EU action plan for the circular economy⁸. The



actions to be implemented at production and consumption levels include the clarification of criteria concerning by-products in the revision of the legislation on waste, in order to facilitate industrial symbiosis. One of these actions aims to facilitate the development of new businesses, job creation, and local revitalization by accommodating and utilizing local resources, goods, and energy based on collaboration among diverse local actors (industrial and community symbiosis) in a region.

Industrial symbiosis in Italy

At national level, there are no legislative acts concerning industrial symbiosis directly. The Law Decree on the Environment, part of the Stability Act of 2016¹⁰, contains provisions that promote the green economy and curb the excessive use of natural resources, also through the strategy of industrial symbiosis. Industrial symbiosis has started to be mentioned in various planning and orientation instruments at regional and local levels. Various examples may be mentioned, including the case of the Emilia-Romagna Region: in its Regional Waste Management Plan (2014), industrial symbiosis is one strategy to adopt for the re-use and recovery of by-products, in compliance with the legislation. The 2016 Energy Plan of Lazio Region included industrial symbiosis models among the instruments for a change in the economic development model, decoupling the consumption of resources from Gdp. In addition, the guidelines for eco-industrial parks in Lazio require the

achievement of industrial symbiosis goals for such areas; the Cartesio network also mentions industrial symbiosis for eco-industrial parks. The Friuli Venezia Giulia region includes, among other topics, the promotion of industrial symbiosis in the Regional Plan for Waste Prevention (2016).

Erika Mancuso, Grazia Barberio, Silvia Sbaffoni, Antonella Luciano, Laura Cutaia

Enea, Rome

NOTES

¹ COM(2011) 571 "Roadmap to a resource efficient Europe"

² Unep (2011) "Towards a green economy: pathways to sustainable development and poverty eradication".

³ Erep (2012), European Resource Efficiency Platform, "Manifesto & Policy Recommendations".

⁴ COM(2014) 398 "Towards a circular economy: A zero waste programme for Europe".

⁵ Horizon 2020 "Work Programme 2014-2015 Climate action, environment, resource efficiency and raw materials".

⁶ Horizon 2020 Waste-1-2014 "Moving towards a circular economy through industrial symbiosis".

⁷ G7 (2015), "Alliance for resource efficiency".

⁸ COM(2015) 614 "Closing the loop - An EU action plan for the Circular Economy".

⁹ G7 (2016), Joint Communiqué of Environment Ministers.

¹⁰ Law 221/2015.

INDUSTRIAL SYMBIOSIS IN EMILIA-ROMAGNA

THE FIRST PILOT EXPERIENCE OF INDUSTRIAL SYMBIOSIS IN EMILIA-ROMAGNA HAS IDENTIFIED POSSIBLE SYNERGIES BETWEEN ENTERPRISES, AS WELL AS PROPOSING OPERATING MANUALS. THE TRIS PROJECT NETWORKED SEVERAL EU REGIONS, ANALYZING REGULATORY AND FINANCIAL ASPECTS, PROFESSIONAL NEEDS AND PROMOTING OPERATING PRACTICES.

The awareness of the “non-endless” availability of natural resources in our planet, which started at the beginning of the ‘70s, has been increasing ever since. In recent times such awareness has favoured the definition of a new economic model: circular economy, which is currently the pathway chosen by the EU in order to achieve greater overall sustainability of production processes and of the whole Industrial sector¹. One of the instruments to implement circular economy is industrial symbiosis, a methodology for the efficient re-use of waste and by-products. Such methodology is strongly related to both circular economy – as an application and policy instrument for the practical implementation of a circular model in production processes – and to industrial ecology – which defines the theoretical and scientific context for the development of symbiosis.

According to one of the most recent definitions, industrial symbiosis “engages

diverse organizations in a network that fosters eco-innovation and long-term culture change”.

Creating and sharing knowledge through the network yields mutually profitable transactions, for instance for novel sourcing of required inputs and value-added destinations for by-products. Such definition differs from the one (and probably better known) proposed by Chertow: “*The part of industrial ecology known as industrial symbiosis engages traditionally separate industries in a collective approach to competitive advantage involving physical exchange of materials, energy, water and/or by-products. The keys to industrial symbiosis are collaboration and the synergistic possibilities offered by geographical proximity*”. Note that the main differences are linked to the concept of “*geographical proximity*”, necessary to Chertow, which becomes “*economic proximity*” to Lombardi and Laybourn².

In general, however, symbiosis is an instrument based on the identification

and implementation of synergies between companies in a well-defined context.

To sum up, reference can be made to the payoff in the website of Nisp (National Industrial Symbiosis Programme, UK): “*Industrial symbiosis fosters the circulation of resources, in a continuous production cycle that prevents waste: it is circular economy in action*”³.

In Italy, the Resolution No. 60 passed on 20 December 2016 by the VIII Environment Commission of the Chamber of Deputies underlines that the circular economy model should be based on a systemic approach, aiming to promote the so-called “qualifying factors” that also include industrial symbiosis.

A pilot experience in Emilia-Romagna

Between June 2013 and December 2015, a pilot experience of industrial



symbiosis was carried out in Emilia-Romagna, within the framework of the project “Green economy and sustainable development”, promoted by Aster and by UnionCamere Emilia-Romagna – in its first phase – with the technical and scientific coordination of the Technical Unit - Environmental Technologies of Enea and with the contribution by researchers of the Rete Alta Tecnologia (High-Technology Network) Emilia-Romagna. The project aimed to develop relations between production sectors, researchers, and the territory, with the development of a circular economy model.

The project was divided in two phases and focused on the agro-industrial supply chain, with particular (but not exclusive) emphasis on solutions for the production of high added-value materials. The first phase concerned the identification of possible synergies among the participating businesses, and the second phase deepened the knowledge of paths to industrial symbiosis and their real implementation, also through the development of specific operating manuals. The project allowed to identify over 90 paths to industrial symbiosis and to draft three operating manuals, while drawing the attention of the Emilia-Romagna region towards symbiosis, included in the regional Waste Management Plan as a “useful instrument to reduce the amount and hazardousness of special waste”⁴.

The Tris project, European regions towards industrial symbiosis

The Interreg project Tris (Transition Regions for Industrial Symbiosis) originated from the experience of the project “Green economy and sustainable development” and from a focus on this topic, with the engagement of the regions participating in Climate Kic, the main public-private partnership for innovation in the fight against climate change. The Tris project started in April 2016 and aims to support partner regions in the introduction of industrial symbiosis (IS) practices as instruments for the efficient use of resources and competitiveness of SMEs.

Through the analysis and exchange of best practices and policies between the partner regions (West Midlands, Emilia-Romagna, Comunidad Valenciana, South Sweden, and Central Hungary), Tris will analyse the regulatory and financial elements, the professional and

cultural needs that hinder, or vice-versa, facilitate the widespread and lasting implementation of industrial symbiosis practices in the various regions. The outcomes of comparison and benchmark between the partner regions shall be embedded in an Action Plan to support the regional Waste Management Plan in Emilia-Romagna, and in other plans related to the efficient use of resources in the other regions.

Drafting the Action Plan is the output of the first phase of the Tris project, whose first phase will end in 2019. During the second phase, ending in 2021, the implementation of the action plan will be monitored.

The key players of the project are not only the regional partners, the General Directorate for Territory and the Environment of Emilia-Romagna and Aster, but also the stakeholders grouped in the Local IS Lab, whose major aim is to increase the awareness – at regional level – of the concept of industrial symbiosis and the ensuing economic and environmental benefits.

This working table also included the laboratories of the Rete Alta Tecnologia (High-Technology Network) Emilia-Romagna, businesses bringing innovative experiences, the professionals’ associations, Arpa (the Regional Agency for Environmental Protection), and Ervet. The first Local IS Lab was held on 23 February 2017, with an in-depth analysis of the dialogue between researchers and businesses for the implementation of symbiosis-related practices. The next meetings will focus on other topics, such as specific supply chains identified among the representatives of the Local IS Lab.



For more information on the Tris project and IS activities, send an e-mail to tris@aster.it; Url <https://www.interreurope.eu/TRIS/>

**Ugo Mencherini¹, Sara Picone¹,
Manuela Ratta²**

1. Aster
2. Emilia-Romagna Region

NOTE

¹ European Commission, Circular economy package, 2015, available at http://ec.europa.eu/environment/circular-economy/index_en.htm

² Lombardi R.D., Laybourn P., “Redefining Industrial Symbiosis. Crossing Academic-Practitioner Boundaries”, *Journal of Industrial Ecology*, 2012.

³ International Synergies, 2016, www.international-synergies.com/our-approach

⁴ Mencherini U., “Integrazione di processi industriali in una prospettiva di economia circolare” (Integration of industrial processes from the point of view of circular economy), PhD Thesis in Mechanics and Advanced Sciences of Engineering, University of Bologna, 2016.



PHOTO: ANDREA SAMARITANI - MERIDIANA IMMAGINI

RARE EARTHS, RECOVERY IS THE FUTURE

RARE EARTHS ARE KEY ELEMENTS FOR TECHNOLOGICAL DEVICES. THE WORLD DEPENDENCE ON ONE PRODUCING COUNTRY (CHINA) AND THE STEADY INCREASE IN GLOBAL DEMAND OBLIGE EUROPE TO FIND STRATEGIES THAT AIM TO INNOVATE AND CREATE NEW BUSINESS MODELS, TYPICAL OF CIRCULAR ECONOMY.

The objects we use every day are composed of very familiar elements, such as metals, ceramics and plastics. The chemical elements contained in these materials are also familiar (iron, aluminium, carbon, etc.). Other objects of everyday use, such as smartphones or fluorescent and Led lamps, contain tiny amounts of chemical elements less known to most consumers/final users. Rare earths are examples of elements contained in very limited amounts in many high-tech devices we commonly use; their properties are fundamental for the functioning of these devices.

Rare earths are a group of 17 metal elements including scandium (Sc) and yttrium (Y), plus the entire series of lanthanides, chemical elements with atomic number 57 through 71, namely: lanthanum (La), cerium (Ce), praseodymium (Pr), neodymium (Nd), promethium (Pm), samarium (Sm), europium (Eu), gadolinium (Gd), terbium (Tb), dysprosium (Dy), holmium (Ho), erbium (Er), thulium (Tm), ytterbium (Yb), lutetium (Lu) (figure 1). They are classified according to their atomic number in “light rare earth elements” (scandium and all the elements from lanthanum to samarium), and “heavy rare earth elements” (from europium to lutetium). Despite the adjective “rare”, these metals are quite plentiful in the Earth’s crust (with the exception of radioactive promethium, very scarce in nature): the two rarest elements of the series (thulium and lutetium) are 200 times more abundant than gold. However, mineral deposits contain many of these elements at the same time, and in very low concentrations (a few percentage points), making very complex separation processes necessary¹. In such conditions, economic exploitation of deposits is cost-effective only in a few areas of our planet. China currently has the majority of rare earths deposits (figure 2): the United

CIRCULAR ECONOMY

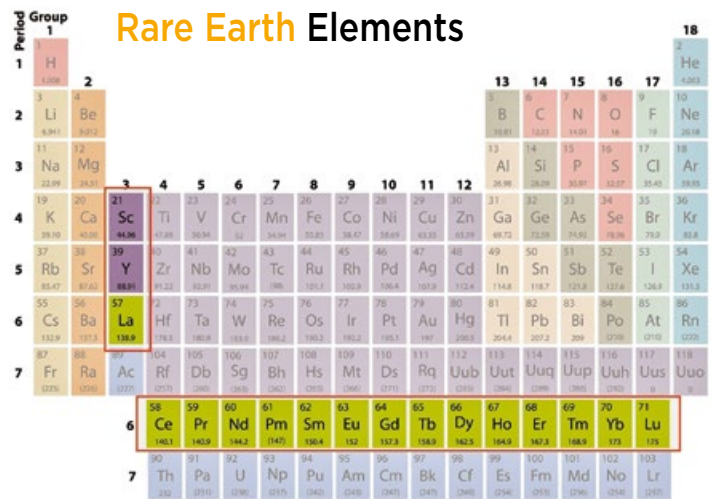


FIG. 1 RARE EARTHS

Periodic table of elements highlighting the position of rare earth elements.

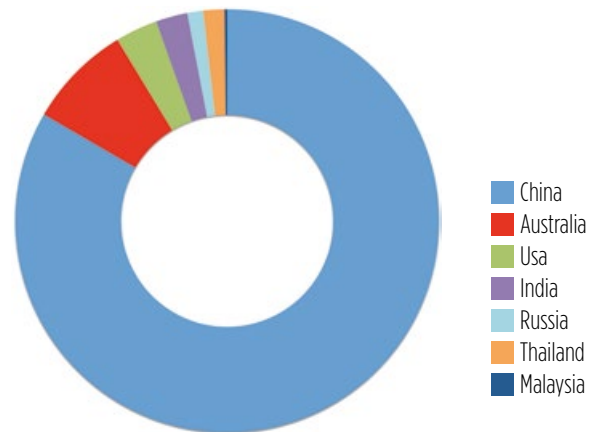


FIG. 2 RARE EARTHS PRODUCTION

World production of rare earth elements.

Source: USGS, 2016.

States Geological Survey in 2016 estimated that over 80% of the world’s rare earths come from China, with very few countries competing for only some percentage points of production². The United States were the largest producer of rare earth oxides until mid-1980’s, when the primary production started to decline and the US and the rest of the world became dependent on exports from China. In 2002, the closure of the Mountain Pass mine (in the US) marked the beginning of China’s monopoly in the world, and this happened when the industrial applications of such elements started to increase remarkably.

The world dependence on one single producing country and the constant increase of global demand for rare earths triggered the “perfect storm” of the 8th of July 2010, when China announced a substantial cut in export quotas. As a consequence, the price of rare earths recorded a huge hike. This scenario of dependence on China and the related “crisis of rare earths” – largely predictable and anticipated by some experts at the beginning of the 2000s – still continues, although with much lower price levels. Today, rare earths are contained in smartphones, in Tv displays, in the lamps we use at home and in our offices, in

batteries, in cars and in some substances used for medical diagnostics. Rare earths have such electrical, magnetic and optic properties, that substituting them with other substances is very difficult or unattractive from an economic point of view. The wide range of technological applications makes these elements strategically important for advanced economies. In addition, the recycling rate of rare earths is currently lower than 1%, due to the difficulty in separating such elements, their presence in complex products such as electrical and electronic appliances, and the lack of suitable infrastructure to collect and process them.

In this scenario of uncertainty and instability, Europe in recent years has launched diplomatic initiatives with the aim to reach agreements to reduce the dependence of European industries on imports, while stressing the importance to invest in research and innovation to fill the technological gap with China. Rare earths are still in the list of “critical raw materials” prepared by the European Commission in 2014³. The criticality index of these raw materials is measured in relation to the procurement risk and the economic importance of raw materials. In 2013, the Erecon (European Rare Earths Competency Network) was established to take a snapshot of scientific, technological, and market-related aspects of rare earths⁴.

One key aspect underlined by the Erecon report concerns the forecasts on market demand for rare earths in the next few years. The increase in the sales of electrical cars might drive the demand for rare earths, with an expected double-digit growth. This radical change would entail, for instance, an increase in demand for magnetic materials containing neodymium for permanent magnets based on NdFeB. Demand for rare earths is steadily increasing also due to the continuous developments in low-carbon emission technologies to produce energy from renewable sources (e.g. photovoltaic panels, magnets for wind turbines). In the aftermath of the crisis of 2011, a change was recorded in the use of rare earths in various applications, thanks to the increasing efficiency in the use of such elements and the effort for substitution, where possible, with a significant contribution to demand restraint.

The large-scale application of basic concepts of circular economy, though not being significantly widespread yet, might further optimize the use of rare



earths. Shifting from a linear model to the circular model entails an increase not only in the recycling rate of materials, but also a radical restructuring of the value chain and the way products are conceived when it comes to their design, use, and end-of-life.

To tackle these challenges and boost innovation in circular economy, another initiative was the setting up of KICs (Knowledge Innovation Communities) for raw materials promoted by Eit, the European Institute of Innovation and Technology. The KIC for Raw Materials⁵ is the world's largest network in the field of raw materials. It groups together over 120 partners, including leading businesses, research institutes, and universities, which collaborate to foster the introduction of innovative products and services. As for rare earths, this means, for instance, new processes with low environmental impact for the recycling of rare earths from electronic goods, new processes for the re-use or processing of materials for permanent magnets containing rare earths, substitution with innovative materials, business models allowing an efficient use of resources, new technologies for the exploration and exploitation of primary resources in Europe. This initiative has different goals, including the support to the creation of start-ups in the sector, and paves the way for the mitigation of Europe's dependence on rare earths imports by taking advantage of young

people's creativity, innovation and new business models typical of circular economy.

**Pier Luigi Franceschini,
Floriana La Marca, Giorgio Recine**

Eit Raw Materials

NOTE

¹ Haxel G., Hedrick J., Orris J., 2006, *Rare earth elements critical resources for high technology*, Reston (VA), United States Geological Survey, Usgs Fact Sheet: 087-02 (pdf), access on 6 April 2016.

² United States Geological Survey, 2016, *Mineral commodity summaries 2015*, access on 10 April 2016, <http://minerals.usgs.gov/minerals/pubs/mcs/2015/mcs2015.pdf>

³ Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, COM(2014) 297, <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014DC0297&from=EN>, access on 10 April 2016.

⁴ Erecon, 2014, *Strengthening the European rare earths supply chain: Challenges and policy options*, J. Kooroshy, G. Tiess, A. Tukker, A. Walton (eds.).

⁵ Website of Eit Raw Materials: www.eitrawmaterials.eu

ITALY IS A LEADER IN BIOECONOMY

THE ECONOMY UTILIZING BIORESOURCES AS INPUTS PLAYS A KEY ROLE IN THE TRANSITION TOWARDS A MORE SUSTAINABLE SYSTEM. BIO-BASED INDUSTRY IS A SOLID REALITY IN ITALY, A COUNTRY WITH FAVOURABLE CONDITIONS FOR FURTHER GROWTH, WHICH IN TURN MAY MOBILIZE CAPITALS, PROMOTE RESEARCH AND DEVELOPMENT, AND CREATE JOBS.

Bioeconomy is an economy that uses renewable bioresources, such as waste, as inputs to produce food, products and energy (European Commission, 2016). The bioeconomy thus intends to promote the transition towards a more sustainable socio-economic system, based on a more rational use of bioresources. Advancements in bioeconomy can result in several benefits, including the reduction of fossil fuel dependence, the reduction of the environmental impact of primary production and along the production chains, the increase of competitiveness at international level, the creation of new jobs and new business opportunities. According to the European Commission, the sectors and sub-sectors (based on the Nace classification) that relate directly to the bioeconomy are agriculture, forestry, fisheries, food and beverages, wood processing, pulp and paper production, biofuel production, as well as parts of the chemical industry that use renewable resources (European Commission, 2012).

This statistical definition, however, runs the risk of simply labelling – with the term ‘bioeconomy’ – mostly mature businesses, while failing to grasp their innovative potentials. The bioeconomy, instead, entails a transition of huge parts of the production system towards new production methods, both in terms of processes and products.

Bioeconomy and bio-based industry in the EU

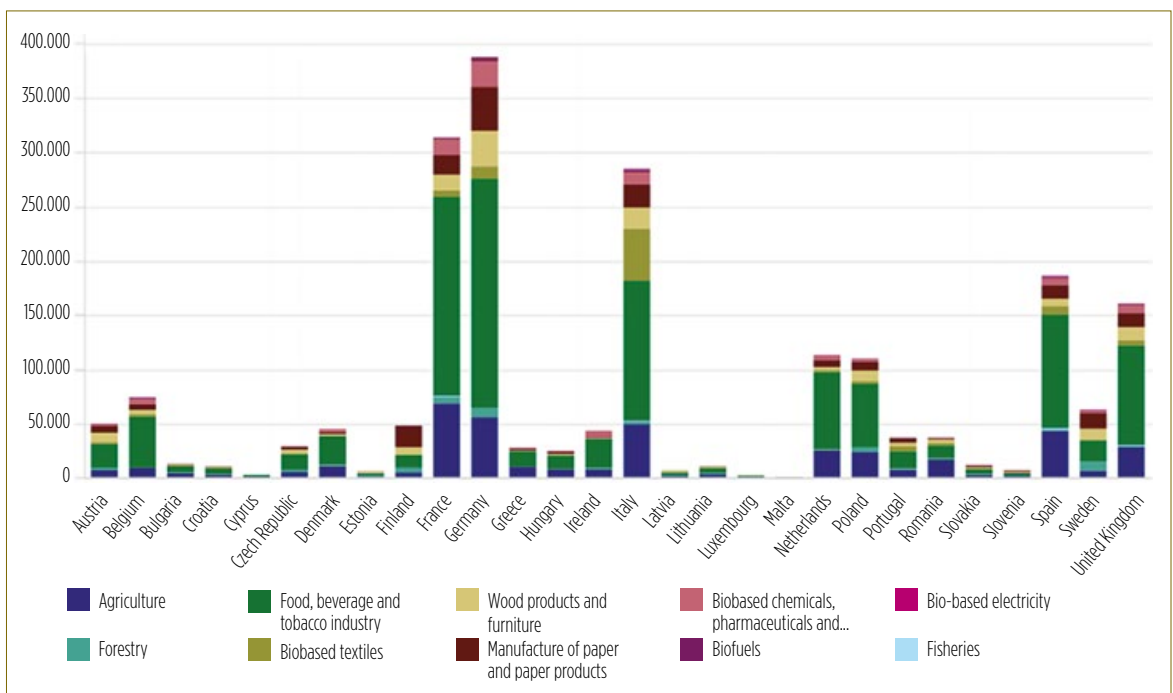
The EU’s bioeconomy sectors are worth € 2 trillion in annual turnover and account for more than 22 million jobs and approximately 9% of the workforce (European Commission, 2013). As highlighted in *figure 1*, however, big differences between European countries still exist, and the leaders are Germany, France and Italy. Each euro invested in EU-funded bioeconomy research and development

is estimated to trigger € 10 of value added in bioeconomy sectors by 2015 (European Commission, 2013). In order to promote and support the growth of bioeconomy in the EU, the European Commission (2012) adopted the strategy “*Innovating for sustainable growth: a bioeconomy for Europe*”. The strategy has three pillars: promoting investments in research, innovation and skills through EU funding, promoting a greater interaction between policies and the stakeholders involved by means of an ad-hoc EU platform and observatory, promoting markets and competitiveness of sectors linked with the bioeconomy. The strategy also encourages the development of biorefineries, above all as substitutes for traditional chemical industries, based on supply chains as local as possible, as well as “*the development of standards and standardized sustainability assessment methodologies for bio-based products*” in order to improve information for final consumers and support the green public procurement.

FIG. 1
BIOECONOMY

European bio-economy turnover in 2013 (in millions of euros) per country and per production sector.

Source: DataM-Bioeconomics, European Commission, Jrc, 2015.



The key role of the bioeconomy for industrial growth in the EU was stressed in the package on circular economy “Closing the loop. An EU action plan for the circular economy” adopted by the European Commission in 2015. Biomass and bio-based products are among the five priority areas of intervention to increase the efficiency in the use of raw materials and reduce waste, according to the principles of circularity, whereby waste of one industry becomes inputs for another. In particular, the EU acknowledges that *“the bio-based sector has shown its potential for innovation in new materials, chemical and processes, which can be an integral part of the circular economy”*. However, it underlines that *“realising this potential depends in particular on investments in integrated bio-refineries, capable of processing biomass and bio-waste for different end-uses”*.

The situation in Italy

In Italy, the bioeconomy is a solid reality. Indeed, its production potential amounts to € 244 billion, 7.9% of the total value of national production (data from Intesa San Paolo, Assobiotec, 2015). As highlighted in *figure 1*, Italy is one of the leaders in the EU in terms of value of the production coming from bio-based sectors, above all food and agriculture, while biochemistry is constantly growing. At present, the bioeconomy sector in Italy accounts for almost 1.5 million jobs (Eurostat, 2015) and represents 13% of total Italian exports. Italy therefore ranks 10th in the world as for exports of bio-based products, with a share of around 3%. If we analyse in detail the biochemistry supply chain in Italy, it is worth mentioning projects for reconverting industrial sites in crisis into biorefineries for the production of bio-products and biochemicals from renewable sources (such as, for instance, in Porto Torres and in Porto Marghera). Italy today has 5 pilot installations in this sector, 2 demonstrative installations and 3 industrial sites with cutting-edge industrial productions. This sector engages 1,600 researchers, working in dedicated research centres in 9 Italian regions (Intesa San Paolo, Assobiotec, 2015).

Italy seems to have all the favourable conditions for a further growth of bio-based industry: highly-skilled human capital and leading industries at world level in terms of developed and patented technologies. In addition, concerning public policies, many



advances were recorded to support bioeconomy. Consultation is underway for the national strategy on bioeconomy *“La bioeconomia in Italia: un’opportunità unica per connettere ambiente, economia e società”* (“Bioeconomy in Italy: a unique opportunity to connect the environment, economy and society”) promoted by the Presidency of the Council of Ministers. The strategy aims to increase the current turnover and employment of the Italian bioeconomy by 2030, by € 50 billion and 350,000 jobs, respectively.

In general, the strategic importance of bioeconomy is mentioned in several guidelines and legislative acts for the transition towards a sustainable economy. Bioeconomy is strongly supported by the Law Decree on the Environment, part of the Stability Act, which contains the obligation to include minimum environmental criteria (Mec) in purchasing procedures for some types of goods and in the assignment of certain services. This measure has encouraged the use of recycled materials after consumption, the management of specific waste fractions (both biological and non-biological) and products with environmental labels and certifications (Emas, Ecolabel, Environmental Footprint, etc.). Another policy instrument that supported growth was the *Strategic Plan for innovation and research in the agricultural, food and forestry sectors*. The plan fosters the sustainable use of bioresources for energy and industrial production purposes, through the development and rationalisation of biofuels and biomass supply chains, with suitable environmental and economic sustainability requirements, and the development of biorefineries for the production of industrial materials and

technical means from residues and agricultural waste. The final aim is to achieve proper remuneration of the agricultural sector.

The Italian Ministry for Education, University and Research also promoted the creation of national technological clusters capable of identifying drivers for a sustainable growth of territories and the whole Italian economic system. Eight clusters were identified, two of them related to bioeconomy. These are Spring (*National Technological Cluster of Green Chemistry*) and Clan (*Cluster agrifood nazionale - National Agri-food Cluster*). The aim of technological clusters is to promote a close link between industries, research institutions and national and regional institutions in order to trigger Italian top research and innovation entities. The ultimate goal is to achieve smart specialization of Italy as a country, in order to be competitive in the EU and the rest of world.

A new way to organize industrial production

Bioeconomy and bio-based industry represent both in the EU and in Italy, a solid industrial reality, capable of mobilizing capitals and research and development activities in many mature and innovative industrial sectors. However, social and environmental benefits of bioeconomy still need to be assessed, above all from the point of view of the reduction of negative externalities generated by industrial activities. Only after an objective assessment of such aspects will it be possible to consider giving incentives to bio-based activities.

An objective approach will also have to be adopted for the development of standards and standardized methods for assessing and communicating the sustainability of bioproducts. The bioeconomy, indeed, is not a new economic sector, but rather a new way to organize industrial production. A more sustainable and accountable way, that is relatively new and therefore in need of adequate safeguards for consumers and suitable policies.

Edoardo Croci, Denis Grasso

Iefe, Bocconi University, Milan

BIBLIOGRAPHIC REFERENCES

- European Commission, 2012, *Innovating for sustainable growth: a bioeconomy for Europe*.
- European Commission, 2013, *Innovating for sustainable growth. A bioeconomy for Europe*.
- European Commission, 2015, *Circular economy strategy. Closing the loop - An EU action plan for the circular economy*.
- Intesa San Paolo, Assobiotech, 2015, *La bioeconomia in Europa, 2° report*.
- Jrc, 2013, *Bio-economy and sustainability: a potential contribution to the Bio-economy Observatory*.
- Jrc, 2016, *The EU bio-based industry: Results from a survey*.
- Ronzon T., Santini F., M'Barek R., 2015, *The bioeconomy in the European Union in numbers. Facts and figures on biomass, turnover and employment*, European Commission, Joint Research Centre, Institute for Prospective Technological Studies, Spain, 4 pp.

BEST PRACTICES

EURVEN REWARDS CITIZENS AND RETAILERS WITH RECYCLING INCENTIVE SCHEMES

Fostering the circular economy and achieving a virtuous waste chain, by giving incentives to citizens who do the separate collection correctly; fostering the recovery and re-use of materials: this is Eurven's philosophy. Eurven, based in the Veneto region, is a leading company in Italy in the field of research, design and production of systems to improve waste collection, also featuring incentive schemes.

Recycle machines that provide incentives

The Italian territory counts 1,800 innovative recycling points created by Eurven, with 450 recycle machines that reward virtuous citizens by supplying Eco-bonuses, coupons, discounts, and money. The collection systems - some supplying incentives and some not - are located in schools, factories, hospitals, supermarkets, airports, parks, shopping malls, markets, city halls and squares all over Italy. They can collect an average of 500 plastic bottles per day, therefore 15,000 per month, for a total of around 27 million bottles. In this way, around 810 tons of plastic per month are diverted from landfills. Recycled plastic bottles also bring benefits to the environment, in that they prevent the emission into the atmosphere of around 1,215,000 kg of CO₂ equivalent - 1 kg of recycled plastic corresponds on average to 1.5 kg of non-emitted CO₂.

How do these recycle machines work? The system is very simple: citizens only have to place recyclable waste into the machines and are rewarded in the form of discount vouchers to spend in affiliated shops. Alternatively, they can collect real money in their e-purse thanks to the partnership *Cash for Trash* with 2Pay, an app for smartphones that allows simplifying the payment process by cutting transaction costs considerably.

Projects in Italy

In Italy, numerous projects are taking advantage of Eurven recycle machines that provide incentives: the company holds 4 international patents registered in the compaction system, and custom-made machines according to specific needs, such as the type of material to treat (plastic, aluminium, oil, Weee), the treatment system required and the amount of collection



desired. A classic example can be found in the municipality of Gambatesa, in Molise, where incentives for recycling also reward retailers: thanks to the *Mon€y4Trash* project, residents receive discounts and eco-bonuses in exchange for waste sent to the Erven eco-compactors, and retailers can deduct from the tax for municipal waste management a part of the discounts they grant with this initiative.

With the project *Equaazione* implemented by Evergreen Recycle, residents of the municipalities of Conegliano, Vittorio Veneto and Oderzo who place waste into the recycling bins that supply incentives can save money on their tax for municipal waste management: the company Savno s.r.l. pays 1 eurocent for each bottle inserted into eco-compactors, and each month, the annual tax for municipal waste management is paid to the citizen who recycles the most in the three participating municipalities.

Schools are also being engaged: young students of Assisi, for instance, are participating in projects that teach environmental education in classes, with particular emphasis on the recycling incentive scheme by Eurven. This is a convenient and amusing way to teach children of all ages how to do separate collection correctly. In the two complexes of kindergarten, primary and middle schools of Assisi, Weee boxes were installed, and residents can leave their old electronic devices there, in return for discounts and other bonuses.

THE EWIT PROJECT

EUROPE AND AFRICA TOGETHER FOR THE RECOVERY OF SECONDARY RAW MATERIALS AND PRECIOUS METALS

Procurement of raw materials is raising concerns in many countries all over the world, and is particularly topical in the EU. According to the European Environmental Agency (Eea), the EU depends on imports from other continents for over 80% of raw materials used. This rate has urged policy-makers to define new strategies for resources procurement, including recovery of secondary raw materials through an alternative management of products end-of-life. This idea is at the basis of the large-scale reflection on the circular economy, and today it is possible to identify great potentials for innovation and investments in the EU.

Following such reflections, the European Commission has launched several initiatives with the aim to deepen the knowledge of such an important topic - the recovery of secondary raw materials - through waste valorisation, with a particular emphasis on waste electrical and electronic equipment (Weee). As a matter of fact, because of their content of highly-recyclable secondary raw materials and precious metals (such as gold, silver and platinum), Weee are now the focus of EU management strategies that aim to optimize recovery and re-use in production processes.

The project called Ewit (*E-waste Implementation Toolkit*) is integrated in this strategic field. Ewit started in 2014 as a European innovation partnership on raw materials, and in 2015 it became a project for coordination and support, funded by the European Commission within the framework of the Horizon 2020 programme. As a matter of fact, Ewit is an initiative based on cooperation between Europe and Africa, with the aim to develop best practices in Weee management in some African target areas. Africa was chosen as a target area for an initiative related to technological waste because of major changes that have been recorded in this continent in the last few years. Africa, as other developing areas, is indeed experiencing a process of increasing demographic growth and urbanization, set to increase even more in the future. At the same time, the number of consumers of technological devices in Africa is constantly growing, and this fact generates unprecedented volumes of Weee.

In addition to locally generated Weee, another phenomenon is being recorded in Africa and in other developing areas of the world, namely e-waste dumping. Every year tons of Weee is shipped illegally from industrialised to developing countries, in order to curb the costs related to proper treatment, with severe effects on the local environment and populations,



which are not in the condition to safely manage the toxic components of Weee.

The management of Weee has thus become an urgent issue in Africa as well; this continent has a growing amount of Weee volumes available, but has not developed a suitable management system, in terms of waste collection policies and infrastructures for waste treatment and recovery.

Ewit therefore grasps this double opportunity: on the one hand by developing policies for Weee management, on the other hand by fostering the recovery of secondary raw materials. The project supports the establishment of a network, with 11 African partners and 13 European partners, collaborating to meet the three project goals:

1) mapping the status in the Weee management system in four target areas of Africa, twinned - within the framework of the project - with four European areas: Choma (Zambia) with Vienna (Austria), Kisii (Kenya) with Porto (Portugal), Johannesburg (South Africa) with Florence (Italy) and Abidjan (Côte d'Ivoire) with Antwerp (Belgium).

The twinning scheme has two purposes: sharing of experience and best practices between the twinned towns, and encouraging Europe-Africa bilateral relations in the field of Weee

2) studying guidelines to develop and improve the respective systems in the four African target areas, with particular attention to issues such as waste collection, treatment technologies, as well as aspects related to the law and the funding of the system. The guidelines generated within the project were inspired by the principle of the circular economy (closing the loop). In this respect, the destination and treatment of recovered fractions and the market-related aspects are important causes for reflection, even among EU countries

3) systematization of the project know-how and guidelines in a toolkit available on an online portal, which is dedicated mainly, but not exclusively, to policy-makers working in Africa and in other developing areas of the world, who may be interested in developing policies for the management of Weee at local level.

The Ewit project lasts for two years, but it paves the way for medium to long-term cooperation between the partners, with the double aim to disseminate best practices in Weee management in Africa, for the environmental, economic and social benefits of local populations, and also to recover secondary raw materials and sign trade agreements with the EU, so that the continent becomes less vulnerable in procurement on a global scale.

PHOTO: REMEDIA/EWIT



Isabella Capurso

Remedia Consortium, www.consorzioremedia.it

GPP, AN INCENTIVE TO ECO-INNOVATION

GREEN PUBLIC PROCUREMENT CAN BE AN IMPORTANT DRIVER FOR THE CIRCULAR ECONOMY. A FUNDAMENTAL STEP WAS TAKEN IN ITALY WITH THE COMPULSORY ADOPTION OF MINIMUM ENVIRONMENTAL CRITERIA. OTHER MEASURES ARE NEEDED IN ORDER TO SHORTEN THE SUPPLY CHAIN.

The *EU Action plan for the circular economy* (COM (2015) 614) identifies several initiatives and instruments to be implemented so that the value of products, materials and resources is maintained for as long as possible, and waste production is minimized. Such Plan also envisages an essential role for public administrations in promoting eco-innovation of products and services and increasing the re-use of materials, a role which is not limited to awareness-raising campaigns, but also includes a concrete implementation of *green public procurement* (Gpp). As a matter of fact, the package of measures on the circular economy defines a set of fundamental actions, such as the inclusion – in public procurement contracts – of durability, reparability and recyclability requirements. Another objective pointed out in the package is the drafting of targeted training programmes.

In Italy, a fundamental step was taken to promote the circular economy with Law 221/2015, which made the adoption of *minimum environmental criteria* (Mec)¹ compulsory in public procurement contracts; the compulsory nature of such criteria was confirmed in the new code for public procurement contracts (Legislative Decree 50/2016). As a matter of fact, the minimum environmental criteria affect several objectives of the *EU Action plan for the circular economy*, and are important instruments of the plan. Depending on the case, minimum environmental criteria provide for lower contents of hazardous substances, quantified percentages of recycled materials, minimization and recyclability of packaging, technical requirements that have beneficial effects on the useful life of goods, and other eco-design elements that foster the recovery or re-use of products.

Such aspects have been emphasized in the recent Ministerial Decree of the



11th January 2017², which updates the minimum environmental criteria in “construction industry”, “furnishings” and “textiles”. Common elements are: the definition of technical specifications that valorise the recycled material content (plastic, concrete, brickwork, wood, iron, steel, etc.), durability and the ability to be disassembled. According to the minimum environmental criteria in the construction industry, 5% of the technical score is assigned to projects that provide for the use of materials or artefacts with a minimum content of post-consumer material, obtained from the recovery of discarded material or from the disassembling of complex products in a greater amount than the one envisaged in technical specifications. These provisions are consistent with the incentive-based rules introduced by the Law Decree on the environment.

In the light of such aspects, the minimum environmental criteria also play a role in supporting the industrial symbiosis, to give value to eco-efficient supply chains.

They provide a contribution so that pre-consumer or post-consumer waste may become – in a structural way – real resources to re-use in other production processes. Along this line we find, for instance, the minimum environmental criteria for entrusting municipal waste management services³, which valorise waste management that fosters the preparation for re-use and recycling, and in this way they try to have positive repercussions in the creation of demand for secondary raw materials by producers. The result is a concurrence of interests between producers, users and consortia for recovery and recycling. The minimum environmental criteria in some cases – electrical and electronic equipment, photocopy and graphic paper, furnishings, cleaning services and detergents, transports, design and works for the new construction, refurbishment and maintenance of buildings – also provide indications for the analysis and assessment of needs, with positive effects in the reduction of natural resources and energy consumption.

Finally, the key actions identified at EU level include the reduction of food waste, and the minimum environmental criteria for catering services⁴ go in this direction, and specifically mention that *“the portions provided must be adequate and calculated according to the nutritional needs of users to whom they are supplied, so as to minimize food surpluses and waste”*. The criteria also envisage the possibility to give scores – within the most economically advantageous tender – to the tenderer who engages to recover the food not distributed and to give it to public benefit organizations that distribute food to the indigent for free.

By way of conclusion, the need for a transition towards a circular economy is a fact, acknowledged both by many policy-makers and by important industrial sectors. For this transition to occur, however, instruments are required to support, guide and foster such a change. The Gpp, thanks to the volumes involved in economic terms and to the numerous stakeholders involved – who are encouraged to invest in R&D – is one of the most promising instruments, being capable of orienting production choices towards eco-innovative solutions,

as well as fostering smarter consumption. At national level, a fundamental measure for the promotion of circular economy models is put into practice with the compulsory implementation of the minimum environmental criteria. Yet, because of restrictions contained in the laws on public contracts, the Gpp, though compulsory, cannot affect all the complex aspects related to the circular economy. They need to be complemented by other initiatives, including incentives to virtuous companies (such as priority in allocating contributions), facilitations and public financing in the environmental sector to enterprises that possess environmental certifications and adopt measures to encourage re-use. Such measures, some of which are better described in the other articles of this issue, have been introduced or recalled by the Law Decree on the environment. Other measures should be added, for instance those aimed at shortening the supply chains and favouring the proximity between production facilities and places of consumption

Emanuela Venturini

Arpa Emilia-Romagna

NOTE

¹ The Minimum environmental criteria – adopted with a Decree by the Ministry for the Environment and Protection of Land and Sea – contain general indications to guide the entity towards achieving rationalization of consumption and purchases, and provide “environmental considerations” and social considerations, linked to the various phases of bid procedures (object of the contract, technical specifications, bonus technical characteristics, conditions for the performance of the contract). The aim is to achieve environmental qualifications for supplies and allocations along the entire lifecycle of the service/product.

² Published in the Official Gazette No 23 of 28/01/2017.

³ M.D. of the 13th February 2014, O.G. No 58 of 11/03/2014.

⁴ M.D. of the 25th July 2011, O.G. No 220 of 21/09/2011.

GREEN PUBLIC PROCUREMENT

GPP IN PUBLIC ADMINISTRATIONS, EMILIA-ROMAGNA AIMS TO ACHIEVE 50% BY 2018

Goal: 50% of “green public procurement” by 2018 for the public administrations of Emilia-Romagna. A percentage that reaches 100% in the cases envisaged in the Code of public contracts, including those for electricity, the construction industry, and means of transport.

This is contained in the new plan for green public procurement, launched in November 2016 by the Regional Council of Emilia-Romagna and approved permanently on the 7th February 2017 by the Regional Legislative Assembly. The measure focuses on the activities to inform, train and raise the awareness of civil servants, so that the supplies of goods, services and works become increasingly “green”. It is also worth mentioning the promotion of green procurement in the use of Community resources of the Regional Operational Plan and Regional Development Plan, technical assistance to clients in drafting and adopting environmental and social criteria in their calls for bids, and the involvement of professionals associations (economic operators).

“The approval of the Plan – as stated by the Regional Councillor for the Environment Paola Gazzolo – is a further step forward of Emilia-Romagna towards an increasingly circular economy: introducing green purchasing procedures in a public entity means rethinking about the needs of an administration and re-orienting consumption processes, with the final aim to reduce waste and optimize the use of resources. The keyword here is innovation: only by innovating we will be able to support effective and far-sighted industrial policies, capable of making the new green approach we propose economically advantageous. Public demand should represent an incentive, so that the competitiveness of



enterprises is more and more linked to product or process innovations, in order to achieve growing sustainability. A far-reaching cultural action is required so that the social, ethical and environmental values of purchasing choices are transmitted to the employees of public administrations. The same awareness should also be achieved by producers”.

The Emilia-Romagna region ranks first in Italy by number of EPDs (Environmental Product Declaration), and it ranks second considering the Emas (Eco-Management and Audit Scheme) and Ecolabel. This vitality is clearly visible in some driving sectors of the regional economy, such as ceramic manufacturing for Ecolabel, food and agriculture for experiments in the implementation of Emas in cheese and ham factories.

The achievement of the aims contained in the Plan shall be constantly monitored; the monitoring activity aims to involve both the regional directorates and IntercentER, and the local administrations, thanks to the collaboration with the regional Observatory of public procurement.

EMILIA-ROMAGNA PROMOTES THE CIRCULARITY OF RESOURCES

APPROVED AT THE END OF 2015, THE LAW OF THE EMILIA-ROMAGNA REGION ON WASTE MANAGEMENT ANTICIPATED THE CONTENTS OF THE EUROPEAN PACKAGE ON CIRCULAR ECONOMY. A NEW VISION IS REQUIRED TO TURN WASTE INTO A RESOURCE. COMMITMENTS AND TANGIBLE ACTIONS TO PROMOTE A SUSTAINABILITY CULTURE.



Today a number of facts are becoming increasingly patent: resources are limited and depleted; climate change phenomena have a growing impact on communities' everyday life and the countries' ecological footprint has already exceeded the planet's bio-capacity for decades. Owing to these facts, the Emilia-Romagna Region thought that it could not wait any longer. Quick signals of change were required and the Regional Law 16/2015, which was approved just over one year ago, is a case in point. The first in Italy, even before the Circular Economy Package of the European Commission, Emilia-Romagna Region enacted a law conceived with the active contribution of the whole regional community, as well as the municipal and provincial councils, that sets ambitious goals to be reached by 2020: cutting per capita urban waste production by 20-25%; increasing separate collection to 73% and recycling to 70%; reducing landfills and making regions self-sufficient in terms of waste disposal.

We started from a precise assumption: focusing on the end-of-life phase of goods is not enough. A new vision of

waste management is necessary so that waste is intended not as mere scraps but rather as an actual resource.

The value of products and materials should be maintained as long as possible, the use of raw materials and waste production must be minimized and, whenever a good reaches the end of its life cycle, actions should be undertaken to re-introduce its components into the system to make up a new resource.

Important opportunities for growth should be based on this assumption by developing new technical and technological solutions and by creating green jobs.

This is also the foundation for a development model in which all activities – starting from production – are organized to turn waste into a resource and to ensure that raw materials are reused.

Law 16/2015 points in this direction. Once approved, we immediately took action to prevent its contents from remaining just on paper: this was clearly shown by the actions we carried out in 2016.

Of course, considerable work still needs to be done and transition towards a

more circular economy remains a real priority for the actions of the regional government chaired by president Stefano Bonaccini.

I should point out the progress that has been achieved so far, resulting from the efforts made and the human and financial resources provided.

The first, important result was the approval of the Regional Waste Management Plan that includes useful tools to reach our goals: from the extension of punctual pricing to fully express the Community "polluter pays" principle up to the incentive fund that, with an overall allocation of € 11 million, aims at rewarding the best performing towns – which received 5.5 million in discounted bills for citizens and enterprises – and to support those willing to improve their performance in terms of waste production reduction. Let's not forget the support to re-use centres, for which we have recently approved specific guidelines that have become a basis for dialogue and discussion.

Moreover, we signed 4 supply chain agreements on a voluntary basis and we are committed to sign others with different stakeholders, first of all

companies, because our circular economy model should be necessarily based on industrial logics; we started a Permanent Circular Economy Forum that, within the participatory initiative known as “Close the loop”, provides an opportunity for active participation and dialogue with the regional community on such an important topic. It gathers local institutions, civil society representatives, the economic organization of enterprises and environmentalist associations: all together for the same purpose, towards the adoption of a new economic development model.

The latest strategic tool, presented in mid-November, is the Green Public Procurement Plan that aims at making Emilia-Romagna public governments greener and greener.

The reform of the Public Contracts Code introduced the adoption of minimum environmental criteria in the contract procedures for purchasing goods, services and works, making them 100% binding for products with energy-intensive components (e.g. lighting, construction, vehicles) and 50% binding for other types of goods such as office furnishings, stationery, urban waste management and street furniture.

Through the regional plan, the minimum share of 50% is extended to all the remaining categories and it is expected that it will be reached by 2018. But how can this be achieved? Thanks to the many measures made available through the Plan: strengthening training and information activities; providing technical support to help contracting authorities developing and adopting environmental and social criteria in contract procedures; promoting green procurement by using European funds; raising awareness and involving trade associations; spreading environmental quality certificates across the production world.

A monitoring activity, to be started by the Region's public authorities, will ensure that the results achieved are constantly checked.

If the whole public machine turns to green procurement, a small revolution would follow: lower energy consumption and a reduced environmental footprint; less emissions, included those responsible for climate change; starting an innovative and virtuous production and distribution supply chain within the boundaries of the green and circular economy, especially in sectors such as construction, health, transport and computer equipment. It is not only a matter of rules and regulations. First of all, it is a cultural issue.



A radical change is required to fully implement the shift towards a more circular economy, for a truly smart, sustainable and inclusive growth. In order to achieve this, the collective work of the communities should play a central role. Only together we can achieve better and better results. I feel very strongly that it is essential to share an idea, a model, a goal to be reached.

The cultural issue is decisive: we should create a veritable environmental sustainability culture, it is necessary to

raise awareness, inform and train citizens so that they become more aware of how much everyday living patterns affect the future of the planet. Resources should be used more efficiently, while respecting the environment. Today we are determined to accept and meet this challenge

Paola Gazzolo

Councillor for territorial security, soil and coast protection, environmental and mountain policies, Emilia-Romagna Region

BY-PRODUCTS

A REGIONAL BY-PRODUCT LIST DRAWN UP IN EMILIA-ROMAGNA

By Decision of the regional government No. 2260 of 2016, the Emilia-Romagna Region launched the *Permanent coordination for by-products* and drew up the *Regional by-product list*, that can be joined on a voluntary basis by all regional enterprises complying with the relevant legal requirements. By-products are materials derived from production processes that, provided they comply with the conditions required by legislation (in particular by Art. 184 of Legislative Decree 152/2006), should not be considered as waste, but rather as by-products to be employed in other production processes or for other uses.



The list is a public recognition system aimed at enhancing the use of by-products in line with the circular economy principles laid down in the regional Law 16/2015 and in the context of a constructive public-private collaboration. The regional government outlined a system that, through official determinations, identifies the types of production processes entitling enterprises to apply for registration into the regional list. The technical sheets that have been approved so far are those relating to apricot and peach stones.

“CLOSE THE LOOP”, LET’S OPEN THE DISCUSSION

THROUGH ITS LAW ON CIRCULAR ECONOMY, EMILIA-ROMAGNA REGION STARTED SEVERAL FORMS OF INVOLVEMENT TO ENCOURAGE PARTICIPATION BY ALL STAKEHOLDERS. A PERMANENT FORUM WAS SET UP AND THE SHARING ACTIVITIES WERE CARRIED OUT THROUGH A VIRTUAL SQUARE CALLED “CLOSE THE LOOP”.

With the regional Law on circular economy, Emilia-Romagna Region was the first regional government to enact a specific Law resulting from a bottom-up process that involved citizens and different city councils that had already submitted their own draft laws. The regional government promoted a shift towards a new waste management model, in which waste is regarded as a resource for a sustainable economic growth as it helps moving from a linear to a more circular economy model. The focus is no longer limited to waste management, but it has now been extended to the whole life cycle of goods, starting from the design phase. This change involves regulatory, production, organizational and distribution issues, it requires innovation and a new cultural approach with significant effects on citizens’ everyday life and on consumers’ habits.

The goals of the regional Law 16/2015 were included in the Regional waste management plan to further specify them. They are very ambitious, more stringent than those proposed by the European Union in the so-called *Circular economy package*: this is a crucial challenge to guarantee the competitiveness of the regional economic system.

In order to support this process and pursue the goals that we have set ourselves, it is important to ensure an ongoing exchange of information with those who play different roles in the economic system, dealing with products’ design, manufacturing, use and end-of-life phase. The regional Law 16/2015 established the setting up of a *Permanent circular economy forum*, which helps the Region promoting its own strategies and actions on circular economy and allows various stakeholders to give their contribution to public decisions. The Forum gathers local institutions, civil society representatives, the business



1 intermediary organizations and environmentalist associations. Its purpose is to define participation modes, also using specific IT tools.

In particular, this tool is intended to keep the dialogue alive with those who promoted the circular economy law and with other people dealing with the waste cycle in different capacities such as citizens, enterprises, public service managers, bodies in charge of service planning and regulation, and the research community.

The regional government set up the Forum with its Resolution 1442/2016 and established that, in the first phase, activities should be carried out through the participatory process called “*Chiudi il cerchio*” (“Close the loop”), which was conceived in collaboration with the regional department of the environment and the statistics, communication, Gis and participation regional office.

The communication project features various and complementary activities, including attendance of events (conferences and workshops) and on-line participation tools published on the ioPartecipo+ platform.

A first cycle of meetings took place in December 2016: in particular, a number of events and working groups were held for different target groups (citizens, associations, enterprises, research world) depending on the covered topics and goals to be reached. As a whole, the events involved more than 350 participants.

The ioPartecipo+ platform and, in particular, the so-called “Close the loop” virtual square, are boosting the

- 1 Workshop 6 Dicembre 2016, “Innovation experiences on circular economy”, Bologna. Activities of Lego Serious Play.
- 2 Workshop in the participation process “Close the loop”.

participation process through forums, surveys, questionnaires. The virtual square also aims at disseminating and making the process more transparent thanks to the document sections and multimedia galleries, where all the process-related materials are published. The on-line platform contains and makes available information, actions and documents concerning the circular economy with the additional purpose of registering and integrating all activities dealing with the topic at regional level, making them visible and accessible within just one venue: the “Close the loop” virtual square.

The Permanent circular economy forum and “Close the loop” virtual square were presented on 16th September 2016 by the regional councillor Paola Gazzolo on the occasion of “*The circular economy model in Emilia-Romagna*” conference. During the event, the regional and European contexts were analysed and the experience of some local enterprises that succeeded in turning waste into a resource was described, showing that environmentally-friendly good practices can be adopted and transformed into successful ideas from a market perspective.

On 20th October, during the second “Close the loop” event, the Region met those who promoted Law 16/2015, one year after its approval, to take stock of the implementation of the policies that have been launched in the field of waste production prevention and punctual pricing: the circular economy law and the Regional plan are working well and are beginning to yield tangible results. For the first time, citizens and enterprises in the municipalities with the best waste management were rewarded through the “incentive fund”. The second part of the conference addressed the topic of punctual pricing that is already in place in a few municipalities that took part into the event to share their experience.

On the same day, the first “Close the loop” workshop about waste reduction, re-use and punctual pricing was held, gathering more than 30 representatives of environmentalist associations and municipalities.

At first participants worked on a few proposals to encourage implementation of the prevention actions envisaged by the regional Waste management plan and the improvement of guidelines for municipal re-use centres. Later on, they developed a few proposal prototypes for the Permanent forum and explained their



2

own idea creating images with the “idea boxes” method.

On 10th November, on the occasion of Ecomondo trade show in Rimini, a second workshop about “Circular economy and resilient city”, open to the educators of the sustainability education centres (Ceas - Centri di educazione alla sostenibilità), was held. It allowed to start a shared educational project in support of Law 16/2015 as provided by the same law. As a matter of fact, the circular economy requires not only new enterprise strategies and a new management, but also training for new consumers and the adoption of sustainable ways of living, that means investing in the education of all citizens.

The last workshop, entitled “Innovation experiences on circular economy”, was organized on 6th December 2016, with the purposes of highlighting the needs of enterprises and the research world and of identifying conditions that favour the implementation of circular models with a special focus on industrial symbiosis. Participants were involved into the prototyping activities by using Lego® Serious Play® to build the industrial symbiosis process stressing the elements that stimulate innovation and create greater added value.

The work done so far allowed us to

share knowledge and points of view with different stakeholders, favouring the implementation and achievement of actions and goals laid down by Law 16/2015 and by the regional Waste management plan.

In the next months, the participation process will continue with an educational project based on Law 16/2015 that will be shared with the “sustainability education” group. This action includes training activities as well as specific initiatives to be carried out across the Region through Ceas, in particular during the European Waste Prevention Week. The “Close the loop” virtual square will be continuously updated by posting notices, surveys and forums. Public meetings will also take place to illustrate the results of the first phase of the participatory process.

We conceived the “Close the loop” initiative not just as a regional square, but also as a square belonging to all those who care about the principles of circular economy and are willing to meet challenges and work together to find the best solutions for its full implementation.

Cristina Govoni

Emilia-Romagna Region

CIRCULAR ECONOMY FOR SMALL AND MEDIUM-SIZED ENTERPRISES

THE SPREADING OF CIRCULARITY IN SMALL AND MEDIUM-SIZED ENTERPRISES, ACCOUNTING FOR 98% OF THE EUROPEAN ECONOMIC SYSTEM, IS STILL HINDERED BY OBSTACLES. THE CESME INTERNATIONAL PROJECT AIMS AT PROVIDING USEFUL TOOLS TO ENCOURAGE THE SHIFT TOWARDS A GREENER PRODUCTION AND CONSUMPTION MODEL.

Today all sectors of society are relatively aware of the urgent need to move towards a circular model, since the current production and consumption model is neither environmentally nor economically sustainable. Citizens seem to be willing to adopt new consumption models, the currently available technologies are rather mature, institutions are introducing the circular economy in their agendas as well as in their planning or regulatory tools and, finally, enterprises are very interested in this topic.

Therefore, what is missing to fully accomplish the shift towards circularity and an extensive application of this new thinking and business model to the whole economic system?

Spreading circularity among small and medium-sized enterprises (SMEs) faces several specific problems. Some of the best known ones are the following:

- the lack of economic resources needed for research, the industrial scale-up of technologies and, more in general, for process or product innovation
- the necessary know-how to access technology and to keep high technical and quality levels
- an often unclear regulatory structure, which may be hard to interpret and apply, leading to a discouraging red tape burden for companies.

Therefore, in-depth analyses are extremely useful to fully understand the economic advantages for companies that become more environmentally friendly, along with tangible tools aimed at supporting entrepreneurs in their decision-making process and at orienting them towards the best choices for their business (and for the environment as well).

How can they evaluate the viability of making a green investment in the company? Which resources can be tapped for such investment?

To that purpose, Ervet takes part into an international project called Cesme



(Circular economy for SMEs) that provides the venue for testing and discussing different ways in which SMEs can move towards the circular economy. The project aims at offering tangible tools to streamline the longed-for transition of SMEs that find many difficulties in facing large-scale changes while accounting for 98% of the whole European economic system.

The Cesme project

The Cesme project aims at promoting access of SMEs to circular economy, working on 2 types of activities.

Activities for institutions

Local and regional institutions as well as development agencies joining the partnership are required to improve their local policies to support SMEs and their transition towards circularity. Each partner has to consider a well-defined policy instrument: some of them will work on the operating programmes resulting from their own *Smart Specialization Strategies* (in the case of the Italian partners, the *Regional operational programme - European regional development fund* of the Emilia-Romagna Region); other partners, for example, will work on the regional Waste management plan. The common goal is understanding how institutions can actively support

SMEs to introduce circularity elements within the company context, using already existing tools (plans and programmes) and giving them a greener dimension, if necessary.

Activities for enterprises

SME supporting tools will be developed, such as a tool to evaluate the company’s environmental profile (*green profile assessment*) and a calculation model for Roi (*return on investments*). The first tool provides a kind of gap analysis suggesting actions to be taken to enhance the green side of the company; the second one, Roi, evaluates the economic sustainability of specific interventions. Both tools aim at providing a qualitative and quantitative support for companies’ decision-making process.

Other project outputs will contribute to gain a better insight of this topic and will generate operational ideas. Like all Interreg projects, Cesme is also based on an exchange of existing good practices that will be collected in a document addressed to the public at large. A white book containing “lessons learnt” and “recommendations for policy makers” will be also drafted along with 6 local action plans (one for each partner region) to ensure operating benefits in the involved areas.

The project involves 10 partners from 6 different European regions: the Northern Denmark region, the South Ostrobothnia (Finland), the Emilia-Romagna Region, the Central Macedonia region (Greece), Wales and Bulgaria. The Emilia-Romagna area is represented by Ervet (Regional development agency) and the Metropolitan City of Bologna.

The Local Support Group

In the first six months of the project, each partner country set up a local working group, known as *Local Support Group* (Lsg), consisting of different circular economy stakeholders: companies having an interest in the topic, local authorities, institutions and research bodies. Each Lsg will have to test the tools that will be developed by the project and will act in synergy with the *Circular Economy Forum* of the Emilia-Romagna Region suggesting contents and actions. Moreover, it will be offered to possibility to learn about local and foreign good practices and evaluate their repeatability inside its own country, it can get in touch with possible national and foreign partners and increase the visibility of its good practices at international level.

TABLE 1
SMEs AND CIRCULAR ECONOMY

Areas of intervention identified during the Cesme project to overcome obstacles to the application of circular economy models in small and medium-sized enterprises.

Areas of intervention to overcome obstacles
Business tools to assess investments in the circular economy
Green procurement, incentives and market actions
New business models, Regenerate, Virtualize, and Share: new ways to realise circular economy
Strategic planning, S3, structural funds and financing sources
Dialogue, mutual knowledge and creation of public-private partnerships and business networks
Ecodesign, process optimization, closing cycles and industrial symbiosis
Communication/training/education towards citizens
Development research, dialogue between university and businesses
End-of-waste, by-products, punctual pricing and other forms of taxation, bureaucratic simplification



The first Lsg operating meeting was held on 16th September 2016 after the regional conference entitled “*The circular economy model in Emilia-Romagna*” and registered the participation of 40 representatives of companies and institutional bodies. The two groups discussed about how each different entity can contribute to the shift towards circularity, identified possible obstacles and the most suitable tools to overcome them.

The discussion led to identify a few areas that need action to overcome these obstacles (*table 1*). These areas will be further studied during Lsg future meetings aimed at providing tangible solutions: the tools that will be developed

within the project and will be tested by the Lsg members provide an operating support to actively improve some of the identified areas.

For further information about the past and future meetings of the *Local Support Group*, apply to Ervet writing to the following e-mail: Cesme@ervet.it. Information about Cesme project activities and good practices reported by partners are available on the official page of the project: www.interregeurope.eu/cesme/

Enrico Cancila, Irene Sabbadini, Federica Focaccia

Ervet Emilia-Romagna

FROM WASTE TO BY-PRODUCTS, THE TREND OF SOIL AND STONES

THE MANAGEMENT OF SOIL AND STONES WASTE IN EMILIA-ROMAGNA CALLS FOR A GROWING REDUCTION OF THE QUANTITIES TREATED AS WASTE AND FOR AN INCREASE OF THOSE USED AS BY-PRODUCTS. ARPAE COLLECTS KNOWLEDGE ABOUT FLOWS AND CARRIES OUT SURVEILLANCE AND CONTROL ACTIVITIES ON THE PLACES OF PRODUCTION AND DESTINATION.

Materials from excavation activities (classified as soil and stones) have always been something between “waste” and “non waste”. Now they can be managed as by-products by way of derogation from the waste regime in compliance with Law 98 Art. 41bis or with the Ministerial Decree 161/2012 or they can be managed as waste within the meaning of Article 183, part IV of Legislative Decree 152/06. The Ministerial Decree 161/2012 applies to excavated materials from works subjected to Environmental impact assessment (Eia) or to Integrated environmental authorization (Iea) coming from “major works” for volumes above 6,000 cubic meter, while Art. 41 bis applies in all other cases.

In order to be considered by-products and to comply with provisions under Art. 41bis, the applicant or producer shall certify that a suitable place of destination for the produced materials has been identified, that these materials can be used without undergoing any prior treatment, that their use does not pose any health-related risks and is not a source of contamination. The applicant or producer of excavated soil and stones shall demonstrate compliance with these rules by submitting a “self-certification” (statutory declaration in lieu of an affidavit within the meaning of the Presidential Decree 445/2000) to the environmental agency having local competence.

In order to carry out its functions, Arpa Emilia-Romagna relies on a specific database that contains information about earth-handling under Art. 41bis, aimed at cataloguing and geo-referencing the site-specific data relating to the places of production and destination of the soil and stones handled at regional level.

More than 2,600,000 m³ of soil and stones have been handled as by-products

Year	Province									Total
	Piacenza	Parma	Reggio Emilia	Modena	Bologna	Ferrara	Ravenna	Forli-Cesena	Rimini	
2013	226.444	102.885	48.961	64.504	82.756	31.121	78.908	61.710	41.948	739.237
2014	191.596	21.622	60.940	103.941	94.123	9.262	57.414	15.782	16.934	571.615
2015	142.960	46.434	80.929	90.661	137.675	20.334	46.621	16.536	14.511	596.662
Total	561.000	170.941	190.831	259.106	314.554	60.717	182.944	94.029	73.393	1.907.513

TABLE 1 - SOIL AND STONES WASTE IN EMILIA-ROMAGNA

Soil and stones production (Ewc 170504) in Emilia-Romagna, years 2013-2015, tons.

in Emilia-Romagna from 2013 up to date. This way of managing excavated ground and rocks is not evenly spread across the Region. Arpae received 680 self-certifications in total, 29% of them came from Reggio-Emilia province, 25% from Bologna, 12% from Ferrara, 10% from Modena, 9% from Forli-Cesena, 8% from Rimini and the remaining 8% from Parma, Piacenza and Ravenna provinces.

Soil and stones are mainly produced in urban areas, since the work sites they come from are construction sites dealing with the enlargement or construction of buildings or the establishment of infrastructural networks. Once produced, soil and stones are mainly used to carry out land improvement works or to recover abandoned mining sites. By analysing the location of production and destination sites, it was possible to estimate that the average distance between the site in which soil and stones are produced and the site in which they are used is of 40 km.

Soil and stons can be managed not only as by-products, but also as waste; this onerous management is governed by Article 183, part IV of the Legislative Decree 152/06 and covers all waste falling within the Ewc (European waste catalogue) code 170504 “Other soil and stones”.

In Emilia-Romagna, the amounts of soil and stones produced and classified as

waste reached 1,907,513 tons (amounting to a total of 3,400,000 m³ of materials) in the 2013-2015 period.

Arpae carries out a surveillance and control function for the management of these materials, making sure that information reported in the self-certifications are complete and carrying out specific on-site inspections in places of production and destination.

As a conclusion for this analysis, it has been noticed that the amounts of soil and stones managed as waste tended to drop from 2013 to 2015, presumably due to the coming into force of specific legislation allowing these materials to be managed as by-products. The possibility to manage soil and stones as by-products takes on a remarkable environmental meaning, as it contributes to the protection of natural resources and, at the same time, allows to achieve the system's competitiveness goals: cutting the costs related to raw materials procurement, reducing the use of quarry materials, lowering the use of landfills for disposal, predicting clear and rapid times for starting works in construction sites.

Cecilia Cavazzuti¹, Giacomo Zaccanti¹, Nicola Negri²

1. Arpae Emilia-Romagna

2. Free-lance geologist

HEAVY METAL MAPPING TO SUPPORT THE MANAGEMENT OF SOIL AND STONES

One of the features of heavy metals is that they are always present in the soil in variable quantities depending on the sediments that gave origin to them, on their texture and soil-forming processes that over time altered chemical characteristics, increasing or lowering the content of some elements (natural background content); at the same time, they result from several human activities and show a tendency to accumulate in the most superficial layer of the soil through the atmospheric fall out or the widespread supply of solids or liquids that is mainly linked to agronomic practices. As a result, the natural content plus the enrichment resulting from anthropic activities (natural-anthropic background content) will be found in the most superficial layer. Despite the availability of extensive literature, identifying any natural geochemical anomalies and defining the widespread contamination effects in the soil is a rather complex and controversial issue.

Since 2005, the Geological, Seismic and Soil Service of the Emilia-Romagna Region started a knowledge process within the collaboration with the University of Bologna, Arpae and the National Research Centre of Florence, drafting the following maps in line with ISO/DIS 19258:2005 standard: "Soil quality - Guidance on the determination of background values":

1) chrome, copper, nickel, lead, vanadium and zinc natural background map in a 1:250,000 scale representing the local distribution of metal concentration at a depth of about one metre (90-130 cm): the map representation is based on polygons and the basic information layers are the map of soils and that of reservoirs

2) arsenic, chrome, copper, nickel, lead, tin, vanadium and zinc natural-anthropic background map in a 1:250,000 scale representing the local distribution of metal concentration in the most superficial 30 cm, which can be regarded as representative of the topsoil in farming land. The map is based on geostatistics using finite square elements with 1 km long sides and proxies that include agronomic management.

Both maps are available on the following web sites of the Geological Services: <http://bit.ly/suoli-ER> and <http://bit.ly/cartografia-suoli-ER> under the item "Suoli" and can be downloaded from the Regional Geocatalogue.

Maps can be consulted on-line, sending queries to the polygon/EQF for which 50th, 90th, 95th percentile values in mg/kg are provided. In this way, users receive additional information as well as the natural or natural-anthropic background value corresponding to 95th percentile (figure 1).

The maps produced by the soil division of the Geological Service aim at helping technical officers in charge of evaluating the soil parameters laid down in the different environmental procedures, introducing them in the regional/local context as per 2006 Ispra (former Apat) guidelines for the determination of the background value. In practical terms, geological, soil and geochemical information are available in just one on-line map that provides either the natural or anthropic background value of the area at issue whenever a query is sent.

The Italian legislation regulates the metal concentration in the soil in mainly three cases: Legislative Decree 99/92 on the use of waste sludge from urban water treatment in agriculture, Legislative Decree 152/2006 (Part IV Title V) for the reclamation of contaminated sites, the Ministerial Decree 161/2012 or Art. 41bis of Law 98/2013 on the re-use of soil and stones.

Excavated ground and rocks can be managed as by-products by way of derogation from the waste regime in compliance with Law 98 Art. 41 bis or Ministerial Decree 161/2012.

The management of soil and stones under a simplified regime (Art. 41) establishes that the applicant or producer shall certify that the contamination threshold concentration values as per columns A and B of table 1 of annex 5 to part IV of the Legislative Decree 152/2006, with reference to the characteristics of the environmental matrices and to the urban use of the place of destination are not exceeded and that the

materials are not a source of direct or indirect contamination for underground waters, except for the natural background values. The Ministerial Decree 161/2012 provides that materials intended for reuse have to comply with threshold concentration of contamination (col. A or B with reference to the specific use) "except if the applicant can demonstrate, by relying on past analyses and studies that have been already assessed by the relevant bodies, that the values have been exceeded due to the soil natural characteristics or to natural phenomena and that, as a result, the measured concentrations refer to the natural background values" (Ministerial Decree 161/2012, annex 4). If the materials are used in a place that is different from the production one, this should happen in an area with a natural background having similar and comparable characteristics for all parameters being exceeded.

In 2014 a collaboration was started between Arpae and the Geological, Seismic and Soil Service for using background content maps. Arpae is in charge of a number of functions: it carries out surveillance and control activities and runs a specific database that allows to catalogue and geo-reference the site-specific data relating to the places of production and destination of soil and stones that are handled at regional level. A comparative analysis of the physical-chemical characteristics of the handled material declared by the producer, with respect to the analytical screening provided by the maps developed by the Regional Geological Service provide guidance for carrying out *in situ* document control and inspection on the received files.

The main problem when applying the current legislation is relating the sample concentration value ranging from 0 to 1 m to the natural background value, because this range of depth refers to both the natural and anthropic content for soils.

Therefore, the screening data were firstly compared with the map of the anthropic natural content, defining an experimental procedure suitable to evaluate the cases in which the applicant/producer declares that the contamination threshold values taken as background values have been exceeded. In 2017 the comparison will be carried out using the map of the natural background content too.

As a whole, the experimental procedure allowed to use maps "on site", further validating them and, at the same time, it will ensure that more reliable analytical data are selected for the new 2017 edition, with the purpose of achieving different goals: an optimum management of environmental data, database integration and the collaboration between bodies having different competences.

Nazaria Marchi¹, Cecilia Cavazzuti², Giacomo Zaccanti²

1. Geological, Seismic and Soil Service, Emilia-Romagna Region
2. Arpae Emilia-Romagna



FIG. 1 - SOIL MAPPING
Example of Gis map output.

PROGRAM

- 8.30 *Welcome*
- 9.30 INTRODUCTION SPEECH AND GREETINGS
Virginio Merola, Mayor of Bologna
Stefano Bonaccini, President of Emilia-Romagna Region
-
- 10.00 KEYNOTE SPEECH
Kate Raworth, economist, Senior Visiting Research Associate at Oxford University, Senior Associate at Cambridge Institute for Sustainability Leadership
-
- 10.30 *Discussion panel*
FROM WASTE TO MATTER, FROM PRODUCTS TO SERVICE
 Chairman: **Fabio Iraldo**, Scuola Superiore Sant'Anna Pisa and IEFE Bocconi
Giancarlo Morandi, President of Cobat
Giovanni Corbetta, Director general of Ecopneus
Alessandro Massalin, CEO of Officina dell'ambiente
Tommaso Campanile, President of Conoe
-
- 11.30 *Discussion panel*
NEW EMPLOYMENT: ROLES AND JOBS
 Chairman: **Marco Gisotti**, journalist
Fabio Fava, University of Bologna
Franco Fassio, University of Gastronomic Science of Pollenzo
Stefano Mazzetti, President of SprecoZero.net
Giuseppe D'Ercole, Cisl Ambiente
-
- 12.30 CLOSING SPEECH OF THE MORNING SESSION
Gian Luca Galletti, Minister of Environment
-
- 14.30 KEYNOTE SPEECH
Luca Mercalli
-
- 15.00 *Discussion panel*
SMART DEVELOPMENT: FROM VERTICAL ECONOMY TO NETWORK ECONOMY
 Chairman: **Emanuele Bompan**, journalist
Catia Bastioli, CEO of Novamont
Andrea Segrè, Vice-president of FICO project
Alessandro Russo, President of Cap Holding
Marco Palmieri, CEO of Piquadro
Lucio Cavazzoni, President of Alce NEro
-
- 16.00 *Discussion panel*
COMMUNICATING INNOVATION, CREATING INTEGRATION
 Chairman: **Pierluigi Masini**, Director of editorial projects at QN
Paola Gazzolo, Councillor for Environment of Emilia-Romagna Region
Rossella Muroli, President of Legambiente
Antonio Cianciullo, Director of Renewable Matter magazine
Daniele Manca, Vice-President of Bologna Metropolitan City
-
- 17.00 CLOSING SPEECH
Alessandro Bratti, Member of Parliament, President of the Parliament Commission on the cycle of waste and environmental crimes

**FIRST NATIONAL
 FORUM ON
 CIRCULAR
 ECONOMY
 BOLOGNA
 PALAZZO MALVEZZI
 7 JUNE 2017**

**ENVIRONMENT,
 ECONOMY
 AND TERRITORIES
 CREATING
 NETWORKS
 AT THE TIME
 OF CIRCULAR
 ECONOMY**

CIRCULAR ECONOMY is a new and multifaceted concept.

It is primarily referred to matter and energy flows coming from productive waste. But it also includes the dematerialisation process of whole productive cycles, with the substitution of products with equivalent services. These structural aspects are supported by fastly evolving innovation and technologies, which create new opportunities of qualified employment.

Thus the change affects not only productive processes, but also operative networks, infrastructures, training requirements, communication and life styles.

Promoters



In collaboration with



Under the patronage of



Technical sponsors



GREEN ECONOMY

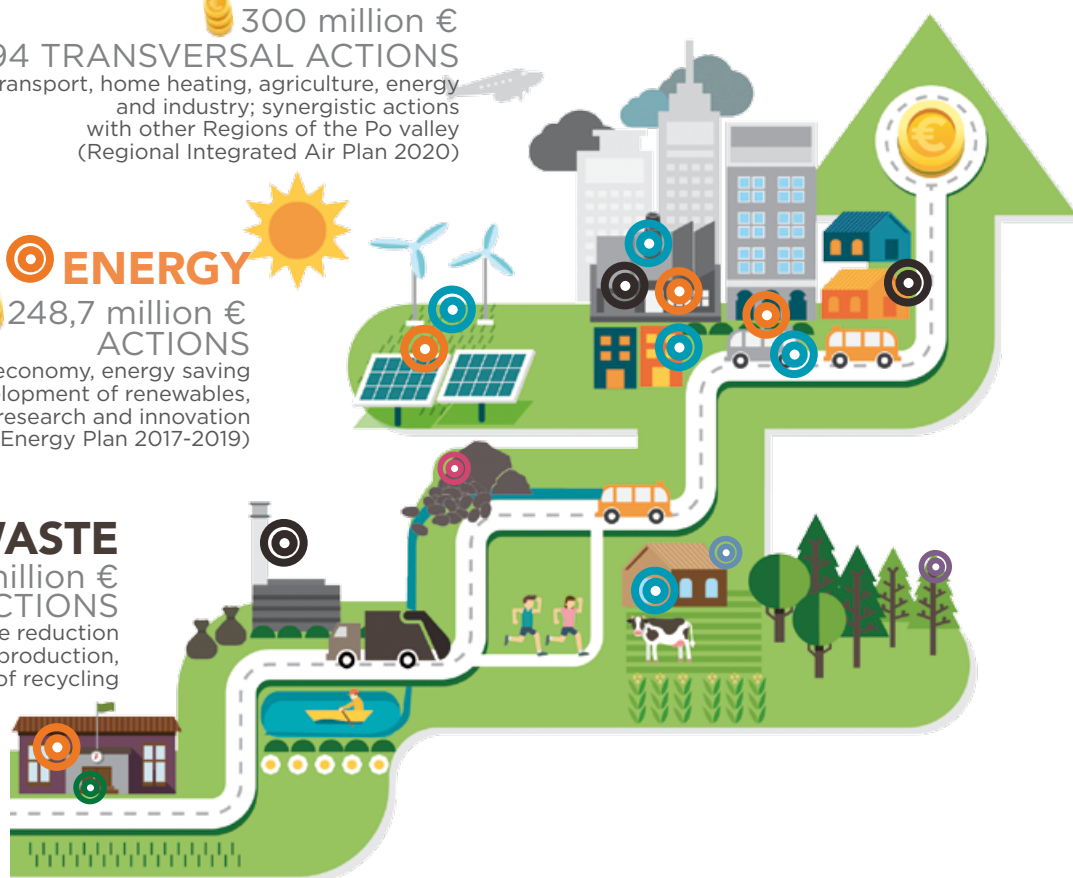
Emilia-Romagna Region supports the green evolution of the territory, in order to achieve a resilient, sustainable and competitive society with the involvement of all actors – enterprises, institutions, associations and individual citizens – through integrated and targeted actions for environmental enhancement: reduction of greenhouse gas emissions, energy saving, use of renewable sources, waste recycling.

🎯 AIR AND SUSTAINABLE MOBILITY

📈 300 million €
94 TRANSVERSAL ACTIONS
 transport, home heating, agriculture, energy and industry; synergistic actions with other Regions of the Po valley (Regional Integrated Air Plan 2020)

📈 **ENERGY**
 248,7 million €
ACTIONS
 green economy, energy saving and efficiency, development of renewables, research and innovation (Regional Energy Plan 2017-2019)

📈 **WASTE**
 4 million €
ACTIONS
 progressive reduction in production, industrialization of recycling



🎯 **GPP**
 50% of green public procurement by 2018 for sectors not covered by current public procurement legislation

🎯 **AGRICULTURE**
 125,6 million € for integrated production
 117,8 million € for organic production by 2020

🎯 **FORESTRY**
 80 million € for afforestation by 2020

🎯 **LAND SAFETY**
 75 million € for 310 mitigation measures for hydrogeological risk in 2017

greenER Information taken from the infographics of the Green Economy Observatory of Emilia-Romagna at the States general of green economy, 2nd edition (2017)

GOVERNMENT POLICIES ON AIR QUALITY AND CLIMATE CHANGE

LIFE15 IPE IT 013 PREPAIR - Launch CONFERENCE

Bologna, 8-9 June 2017

Emilia-Romagna Region Headquarters - Room "20 Maggio", Viale della Fiera 8

The densely-populated, intensively-farmed and heavily-industrialized Po Valley in northern Italy fails to meet air quality limit values for particulate matter, ozone and nitrous oxides. Meteorological conditions and the transport and dispersion of pollutants are strongly influenced by the morphological characteristics of the Po Valley and the northern Adriatic Basin. The transport of pollutants is limited by the Alps, the Apennines and the Dinaric Alps.

To comply with the Air Quality Directive, National Emissions Ceiling Reduction Commitments and the EU's Clean Air for Europe strategy, **LIFE-IP PREPAIR** sees the collaboration of 18 partners made of Regional Authorities, Municipalities, Regional environmental agencies and development agencies that will build capacity and strengthen coordination among public authorities and private operators. It will carry out pilot actions to improve air quality and assess the effectiveness and transferability of those measures in the project area and other EU regions. The project will establish a near-real time web-based system for sharing air quality and emissions data and air quality models. Measures will focus on four main sectors: **biomass burning, energy efficiency, transport and agriculture.**

Agenda

8 June 2017

- 9.30 Registration of participants
- 10.00 Opening session
- 10.30 PREPAIR in action
- 12.15 The Stakeholders point of view
- 14.30 Monitoring and evaluation of air quality
- 16.00 PREPAIR in network

9 June 2017

- 9.30 Registration of participants
- 10.00 Interventions by institutional representatives of European Commission, Italian Government and partner Regions
- 11.40 Signatory ceremony of Air Quality Protocol with Italian Environmental Minister and Governors of Piedmont, Lombardy, Veneto and Emilia-Romagna Regions
- 12.15 Press conference



Simultaneous Translation Service from Italian to English and from English to Italian will be available.

REGIONAL INTEGRATED AIR PLAN

The Regional Integrated Air Plan (PAIR2020) sets measures to improve air quality, aiming at reducing pollutant levels, respecting EU limit values and safeguarding the health of the population.

PAIR2020 keyword is "integration": it is necessary to act in all the areas contributing to atmospheric pollution and climate change, developing coordinated policies and measures for the Po valley at local, regional and national level.



PAIR2020 FUNDING
300 million €



GOALS

- safeguarding the health of the population
- reducing particulate, nitrogen oxides ammonia, sulfide bioxide and COV emissions in the air
- overcoming emergency measures

⊙ PUBLIC TRANSPORT

renewal of the bus fleet, 10% enhancement of local public transport and 20% of rail service



160 million €
replacing at least 600 buses with new low impact vehicles by 2020

⊙ SUSTAINABLE MOBILITY

achieving 20% urban bicycle mobility, 10% of electric or hybrid vehicles and 20% of green urban areas
increase in pedestrian areas, restricted traffic zones, "zone 30"



14 million €
bicycle mobility, pedestrian areas, restricted traffic zones, "zone 30" and infomobility



6,7 million €
electric mobility and enhancement of public recharge network



2 million €
scrapping of more polluting diesel commercial vehicles for enterprises

⊙ TRAFFIC

20% reduction of traffic in urban areas, restrictions on the circulation of most polluting vehicles (from October to March) in the cities with more than 30.000 inhabitants and in the metropolitan area of Bologna

⊙ ENERGY AND HEATING

reduction of emissions from energy production and consumption



67 million €
energy efficiency of buildings and productive activities
ban on the use of open and low-efficiency fireplaces powered by wood under 300 meters of altitude (from October to March)
obligation to close the doors of buildings with public access to avoid thermal dispersion
ban on the installation and use of winter and summer air conditioning systems in common spaces of buildings (garages, stairs, etc.)

⊙ AGRICULTURE

reduction of ammonia emissions from agriculture and livestock



53 million €
coverage of manure storage tanks, upgrading of animal shelters, efficient effluent distribution practices, change to the diet of animals

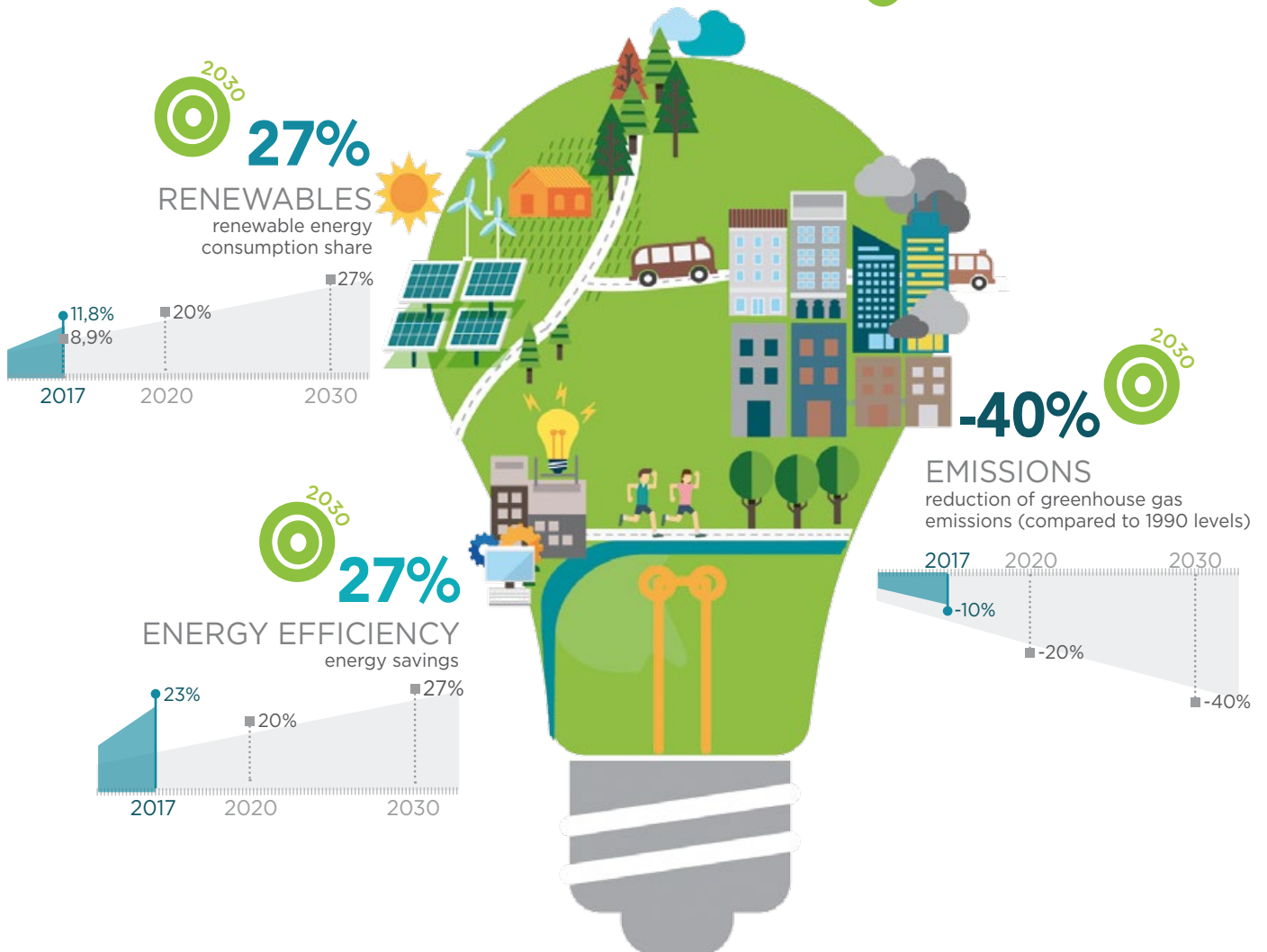
REGIONAL ENERGY PLAN

The Regional Energy Plan sets the strategy and targets of Emilia-Romagna Region for energy and climate up to 2030, dealing with the enhancing of green economy, energy saving and efficiency, renewable energy development, transport, research, innovation and training.



IMPLEMENTATION PLAN 2017-2019 FUNDING

248,7 million €

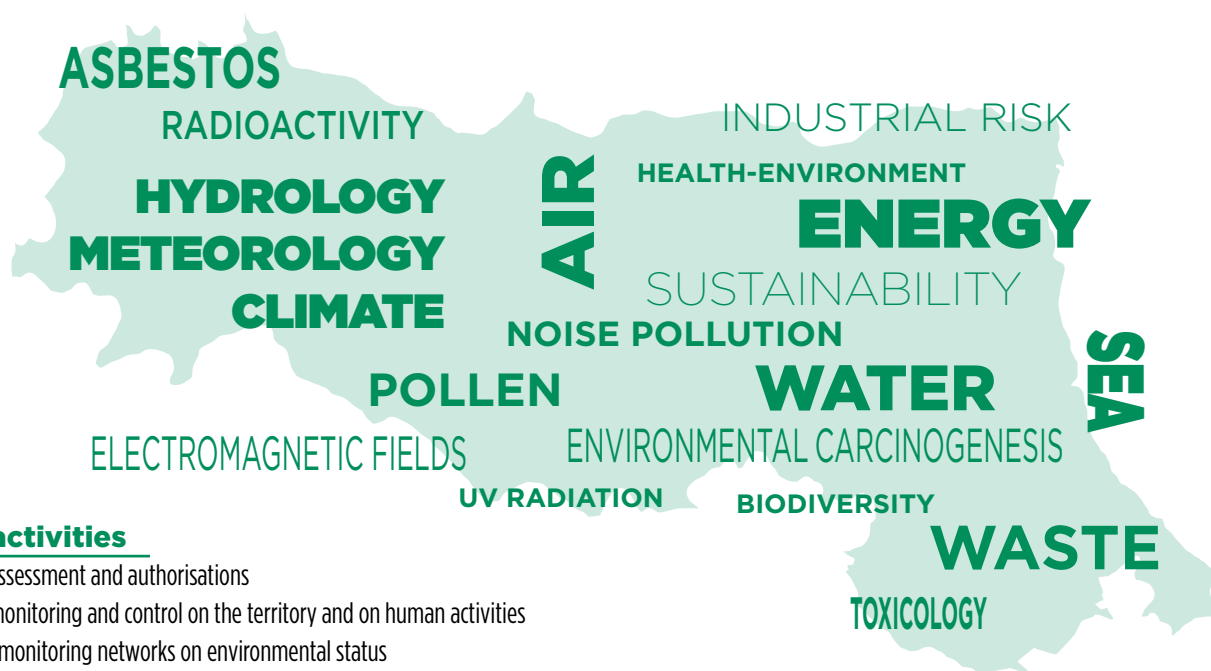


Arpae Emilia-Romagna is the Agency of Emilia-Romagna Region dealing with environment and energy.

The goal of the Agency is to promote the sustainability of human activities that affect the environment, health, and territorial security, both through controls, assessments and regulatory approvals, and through projects, prevention activities, environmental communication and education to sustainability. Arpae also develops forecasting systems and models to improve the quality of environmental systems, facing climate change and new forms of pollution and degradation of ecosystems.


The Agency operates through a network organization. Nine Provincial departments grant widespread monitoring and control. Nine Authorization and concession structures deal with environmental authorisations and water use concessions. Thematic centers and laboratories carry out operational activities and research projects. Two special structures deal with sea environment and with meteorology and climate.

The web site www.arpae.it is the main information and data dissemination tool.



Our main activities

- › Environmental assessment and authorisations
- › Environmental monitoring and control on the territory and on human activities
- › Management of monitoring networks on environmental status
- › Study, research and control on the environment
- › Water use concessions and public concessions
- › Hydrological, meteorological and climatic forecast and studies
- › Environmental emergency management
- › Civil protection functional centre
- › Sampling and lab analysis
- › Environmental information
- › Environmental management systems



Sustainable development
is development that
meets the needs of
the present without
compromising the ability
of future generations to
meet their own needs.

Gro Harlem Brundtland

