CIC - Italian Composting and Biogas Association

Annual Report

2016

State of Art of Composting and Anaerobic Digestion in Italy

CIC's contact details

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Index

Key data about biowaste management

The term "Organic waste" or "Biowaste" in this document includes the following waste types: food-waste, green-waste, sludge, waste from agro-industries and other non-municipal organic waste.

5.721.000 tons	*Total food- and green-waste collected in 2014 in Italy*
94 kg/pers/yr	*Separate collection of food- and green-waste (Italy's average per person per and year)*
+9,5% annual increase	*More than 500.000 tons collected in 2014 compared with the previous year*
252 & 46 plants	*About 300 composting & anaerobic digestion facilities operating in Italy*
32% CIC Quality Compost	*Amount of compost produced in Italy with CIC's Quality Label*

Who we are

The **Italian Composting and Biogas Association** (**CIC**) unites public and private compost producers, local authorities and others involved in compost production, like machinery and equipment constructors, growing media producers, research bodies, etc...

Since the very beginning CIC's mission has been to enhance recycling and prevention of biowaste, share knowledge and know-how between CIC's associates, enhance compost quality and market, perform technical training for the composting sector, assist government bodies in improving biowaste recovery.

In 2016 the Italian Composting and Biogas Association celebrate its 24th anniversary.

CIC members are:

- **Ordinary members** representing biological treatment facilities such as composting and/or anaerobic digestion plants treating mainly organic waste from separate collection;
- **Associate Members** representing companies that are not directly managing waste treatment plants;
- **General Association Members** from the public and private sector involved in MSW management and recycling.

Between 2014 and 2015 the Ordinary Members rose from 73 to 79, Associate Members from 43 to 45 and General Association Members are currently 2.

Membership last updated: October 2015.

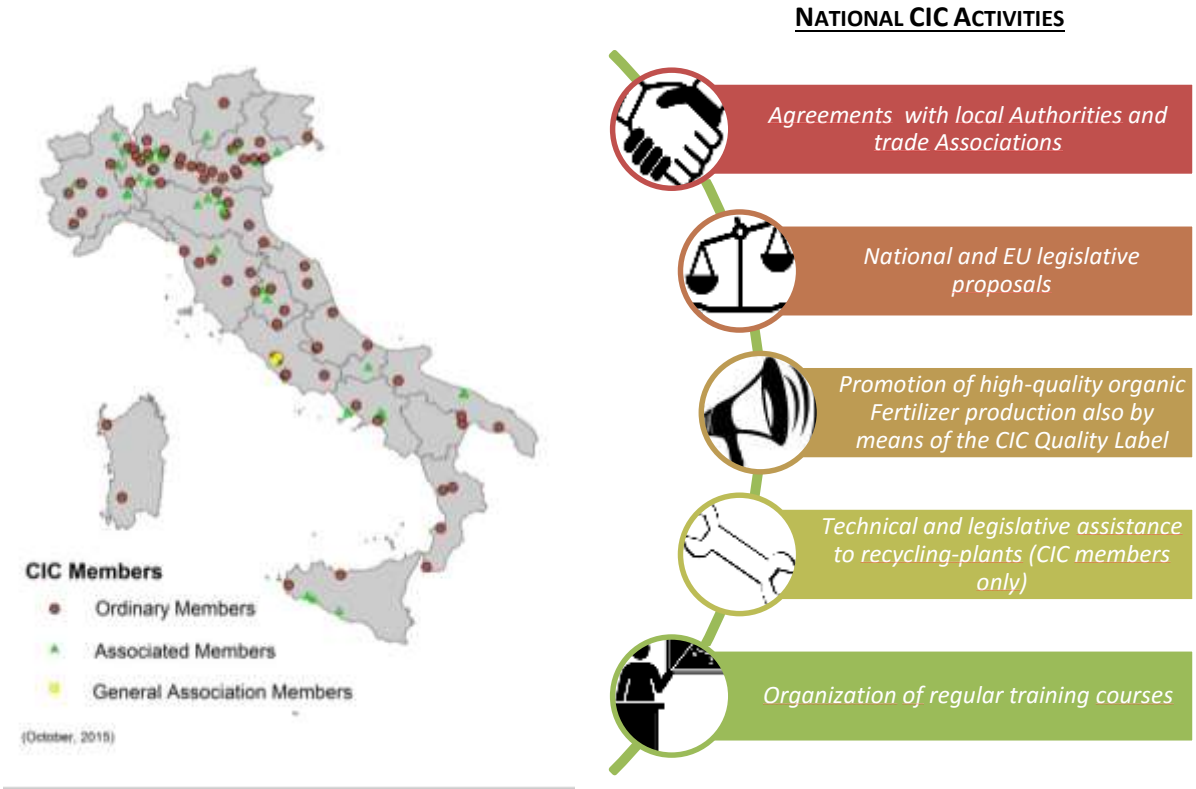


Figure 1: CIC Members updated on October 2015.

International activities and memberships

CIC is a founding member of the **European Composting Network** (**ECN**). ECN is the leading European membership organization promoting sustainable recycling practices in composting, anaerobic digestion and other biological treatment processes of organic resources.

www.compostnetwork.info

CIC strongly supports the activities of **ISWA** – the **International Solid Waste Association**, a global, independent and non-profit association, working in the public interest to promote and develop sustainable and professional waste management worldwide.

www.iswa.org/en/169/working_groups.html

Ecomondo is the leading Exposition on Green Economy, Waste Management and Recycling technologies in the Mediterranean Area.
CIC is Worldwide Ecomondo Ambassador promoting new business opportunities, participating in roadshows, training sessions and specific events organized by Ecomondo both in Italy and abroad.

www.ecomondo.com

CIC is a founding member of the **Mediterranean Compost Network**. The Association, involving companies, experts and local authorities, promotes initiatives for recycling of biowaste by means of separate collection, quality compost production and its use in the soils of Mediterranean countries.

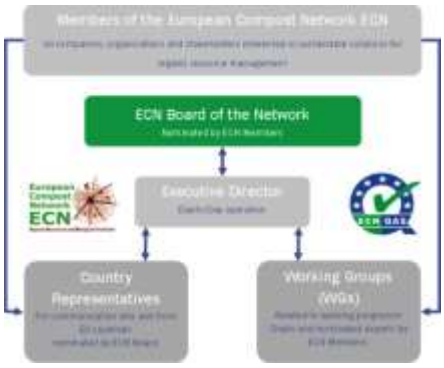
www.medcompost.net

CIC has recently started lobbying activities in **Brussels** (Belgium) in cooperation with ECN - European Composting Network, so to steer EU politics towards effective scheme for biowaste collection and push for **clear targets, obligation and incentives** for member-states to recycle biowaste into quality compost and biogas as fundamental bricks of the Circular Economy approach in MSW management. CIC is supported by Hanover (www.hanovercomms.com) which offers to CIC and ECN high level advisory and logistics support in its premises.

ECN - European Compost Network

The European Compost Network (ECN) is a European non-profit membership organization promoting sustainable recycling practices in composting, anaerobic digestion and other biological treatment processes of organic resources. The Italian Composting and Biogas Association (CIC) is one of the founding members of ECN and CIC's managing director is one of the Vice-Chairs of the European organization.

Representing Europe's biowaste recycling sector: ECN is a membership organization with 71 members from 27 European Countries. Members include all European biowaste organizations and their operating plants, research, policy making, consultants and authorities. ECN represents 21 biowaste organizations (compost and digestate quality assurance organizations) from 14 European Countries and two from abroad, 23 companies producing bio-based products (organic fertilizers, soil improvers, growing media and biodegradable plastics), 11 NGO of environmental protection organizations, 11 academic (research) institutes in environmental, agricultural and natural sciences and 3 environmental agencies. Via the member organizations, ECN represents more than 2000 experts and plant operators with more than 25 million tons of biological waste treatment capacity.



ECN Objectives: ECN supports the policy objectives of the European Union through its activities and with its network of knowledgeable experts. ECN directly assists Member States in developing waste management plans and policies that drive them away from large scale landfilling and into the recycling of organic resources. ECN also serves as focal point for developing EU quality standards for biowaste treatment and compost production; it is a network for the organic waste recycling sector in Europe, as well as the emerging bio-based economy.

ECN Board Members 2015-2016

Board Members	Organization/Company/Institution	Country
Henrik Lystad (Chair of ECN)	Avfall Norge, Waste Management Association of Norway	Norway
Massimo Centemero (Vice-Chair of ECN)	CIC Consorzio Italiano Compostatori	Italy
Mait Kriipsalu (Vice-Chair of ECN)	Estonian University of Life Science	Estonia
Kristel Vandenbroek	VLACO – Flemish Compost and Digestate Quality Association	Belgium
Florian Amlinger	ARGE Kompost & Biogas Austria	Austria
Grigor Stoyanov	100 - First Zero Waste and Organic Cycle Organization	Bulgaria
Irmgard Leifert	RETERRA Service GmbH	Germany
Percy Foster	CRÉ Composting and Biogas Association of Ireland	Ireland
Arjen Brinkmann	BVOR Dutch Composting Association	Netherlands

ECN's vision is a Europe in which all organic resources are recycled and recovered in a sustainable way. From this vision, ECN's primary goal is to support the implementation of EU waste policies and thereby contributing to the development of a recycling society, to sustainable agriculture and energy recovery, to improve human health and to create overall added value within the European market. To achieve this, we believe that effective recycling in all Member States should be built on appropriate collection systems for organic waste to promote high quality products derived from biological treatment.

Quality Assurance Scheme for Compost and Digestate: ECN published in October 2014 the Quality Manual 'ECN-QAS, European Quality Assurance Scheme for Compost and Digestate', defining harmonized requirements for national certification bodies and quality criteria for recycled materials from organic resources. The aim is to facilitate the free cross-border movement of composts and digestate made out of recycled biowaste within the EU. The ECN-QAS is registered as Trade Mark ('OHIM 2012/210: TM No 011007168') for certified quality assurance organizations, compost and digestate products.

Separate collection of biowaste in Italy

Intensive Source Separation of biowaste: the Italian approach

Recycling of municipal waste has always been suggested by the European waste management hierarchy, and consequently by the Italian legislation, as the most favorable option, compared to incineration and landfilling of mixed waste. In Italy, national legislation has foreseen ambitious targets, namely a 65% Source Separation and Recycling Level (SSL) for each municipality.

Today, biowaste, and particularly food-waste from residential source separation, is clearly addressed as the first waste fraction to tackle for municipalities planning to reach the very high SSL targets set by the National law. These high SSL levels have been easily achieved by hundreds of municipalities in Italy through the so-called "*kerbside collection programs*", focusing on food waste collection with the typical Italian scheme. This approach is based on small volume kitchen caddies fitted with biodegradable bags, collection at the kerbside (or door-to-door collection) and adopting small vehicles without compacting and frequencies aimed at enhancing citizen's participation.

Figure 2: Scheme for the collection of food waste at the kerbside.

Door-to-door collection program requests that households and commercial activities are responsible for the maintenance and cleaning of the receptacles (buckets, bins, etc.) assigned to them.

The economical sustainability of intensive sorting schemes

Many concerns have been raised about both the economic feasibility of such intensive schemes and the possibility of implementation in peculiar contexts such as very rural areas or densely populated cities.

An important evaluation was completed by the regional Authority of Lombardy, a Region of about 10 million inhabitants located in Northern Italy with 1546 municipalities, including Milan as the largest of all. The evaluation is focused on the economical aspects of collection schemes and introduces a new indicator (**NOC**, **Normalized Overall Costs**), developed to better compare municipalities with a very different population size, density and collection scheme.
The new NOC indicator evaluates the overall MSW management costs, including both collection and treatment, normalized by equivalent inhabitant. This parameter allows to keep into proper account waste generated by non-resident households, such as tourism or commercial activities generating waste collected in the same municipal stream. Moreover, it keeps out of the calculation costs related to street sweeping.

The main result of the evaluation is shown in **Figure 2**. The chart represents seven subsets of municipalities, ranging from the low performing in terms of source separation level, to the "near zero waste" ones. It can be outlined that increasing source separation leads to a strong reduction in disposal and treatment costs, which compensates the increase of "general costs" (typically infrastructures and amortization, such as civic amenity sites, bins and caddies delivered for free to citizens, awareness campaigns etc...).

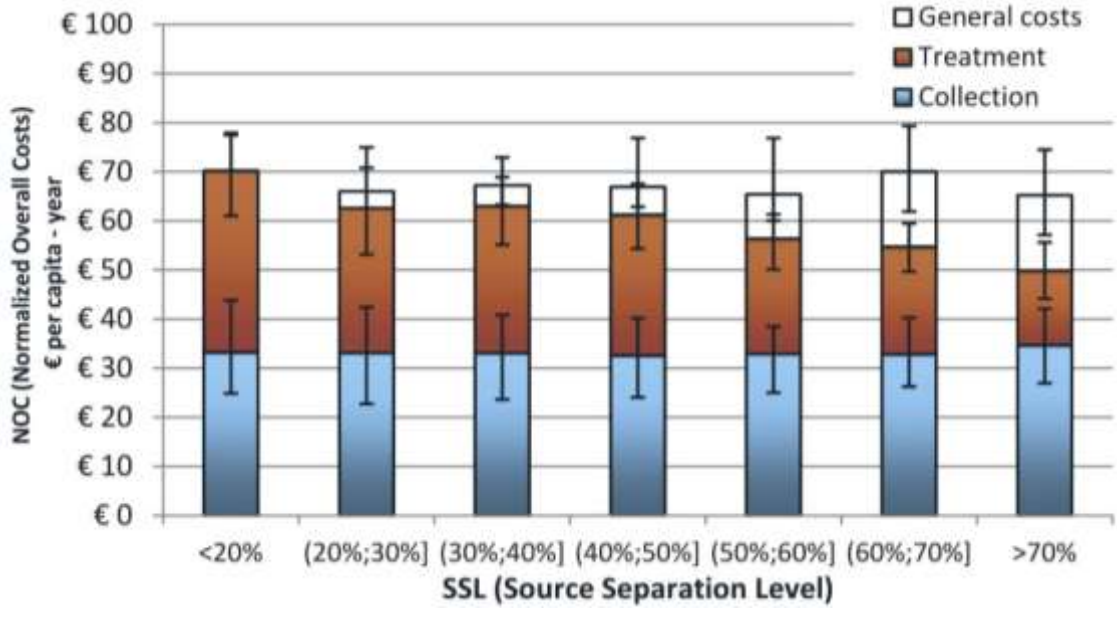


Figure 3: Cost composition for different subsets of municipalities in Lombardy, according to the source Separation Level.

In conclusion, Normalized Overall Costs shows that the total costs for MSW management per equivalent inhabitant remain constant also for municipalities with intensive source separation levels and schemes.

The National trend in separate collection of biowaste

The separate collection of recyclables waste in Italian municipalities (including biowaste, packaging waste, WEEEs and others) has reached a quota of 45,2% of all MSW managed in Italy in 2014 (29,66Mtons/yr), with a rather stable total production of waste.

The separate collection of food-waste and green-waste accounts for 5,72 Mtons in 2014 with an increase of 9,5% compared to the previous year. CIC estimates that, in 2014, the amounts of food-waste reached 3,7Mt or 60 kg/pers/yr and 2,0 Mt of green-waste or 34 kg/pers/yr. In Italy, the separate collection of food- and green-waste currently represents about 43% of all MSW separately collected and sent to recycling.

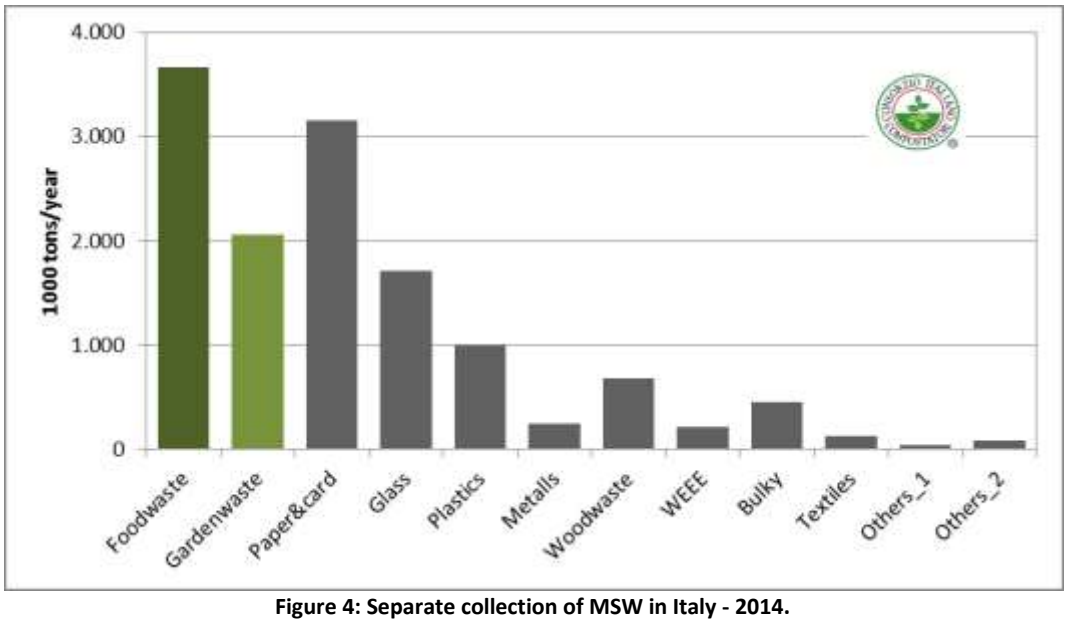


Figure 4: Separate collection of MSW in Italy - 2014.

According to CIC surveys in different Italian Region, about 40 million inhabitants are currently sorting food- and green waste.

The trend of separate collection of food- and green-waste in Italy's Regions

The trends of separate collection of food and garden waste and quantities collected at regional level are shown in **Figure 5**.The Region of Lombardy (Lombardia) contributes with the largest absolute amounts of more than 1,1Mtons of biowaste (i.e. food and green-waste) annually; smaller Italian regions such as Veneto, Emilia Romagna and Campania collect up to 700.000 tons each.

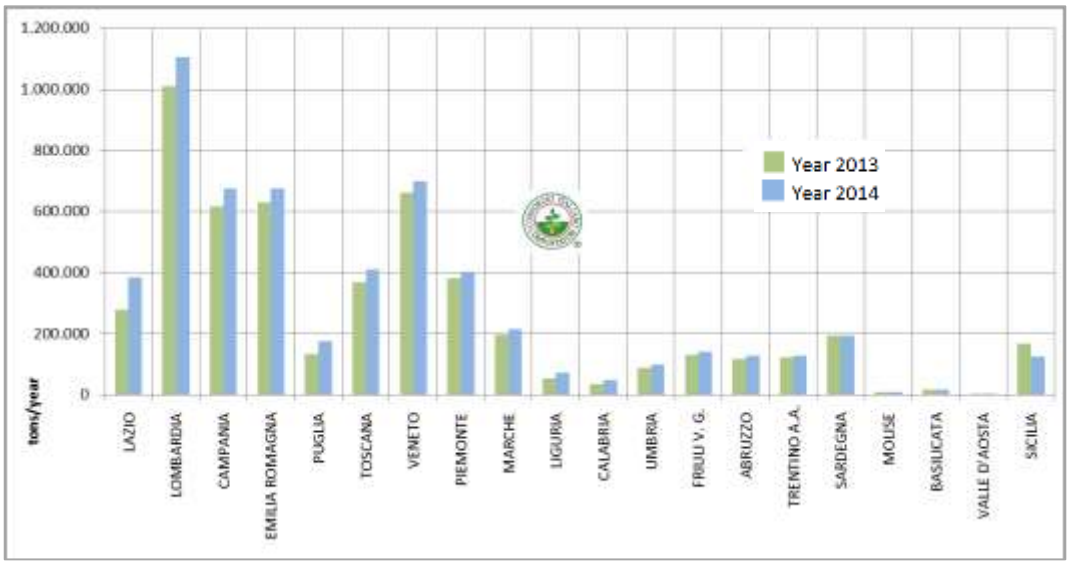


Figure 5: Separate collection of biowaste (food- and green-waste) for Italy's Regions in year 2013 and 2014.

Between years 2013/2014 the separate collection of biowaste increased by 0,5Mtons, an amount corresponding to about 10 medium-size composting plants. Data surveys show an increase and adoption of separate collection in Regions such as Lazio, Lombardia (mainly due to the separate collection of food-waste applied in the City of Milan) and in other Italian Regions (see **Fig. 6**), while a sharp reduction is registered in only Sicily, where the implementation of waste management systems complying to European and National policies has always been problematic.

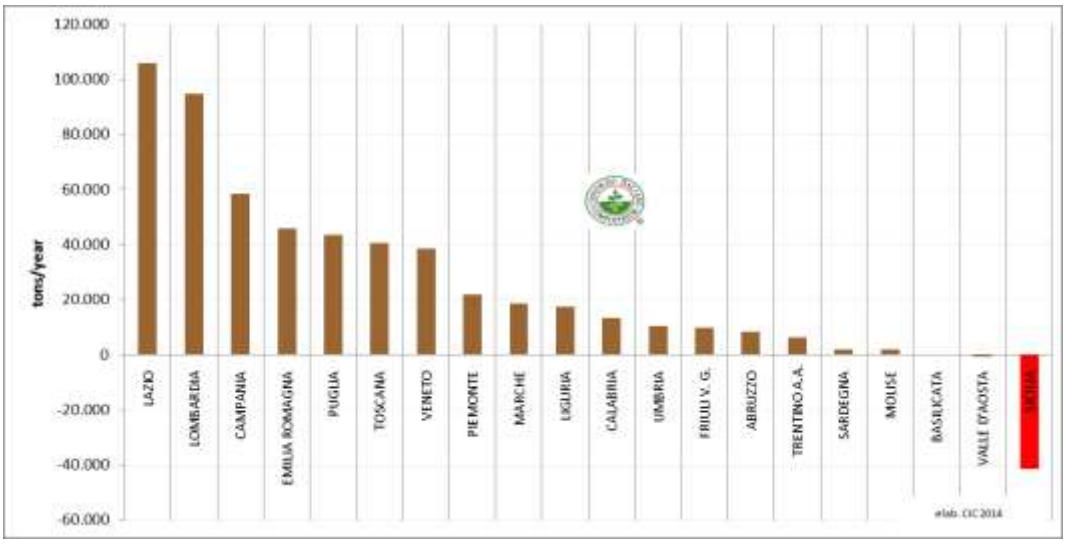


Figure 6: Change between 2013/2014 in separate collection of biowaste for each Region.

On average, Italy collects 94,1 kg-per-capita per year of biowaste. The largest amounts are collected in Emilia Romagna, followed by the Regions Veneto, Marche, Trentino AA and Sardegna (see **Fig. 7**).

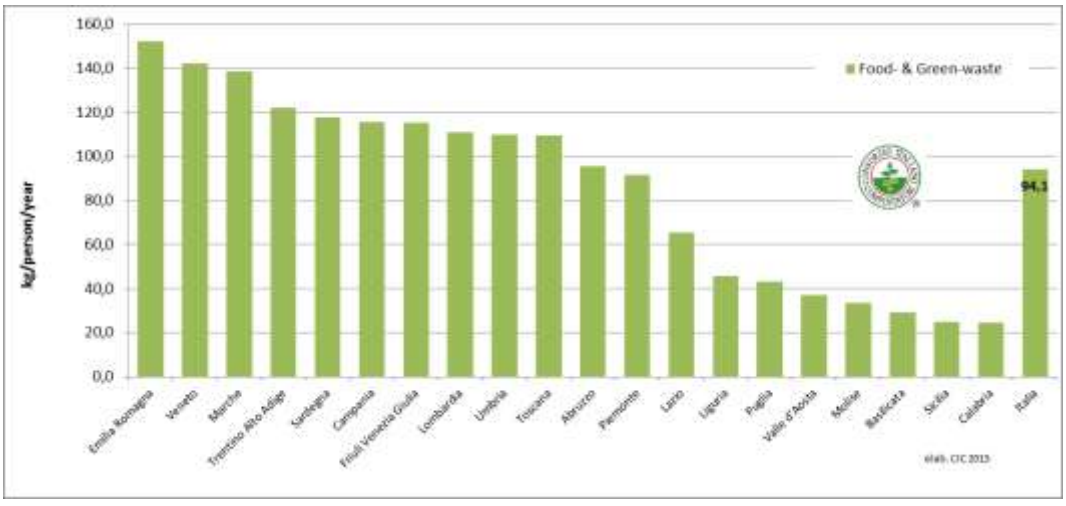


Figure 7: Per-capita collection of biowaste (food- and green-waste) per Region, 2014.

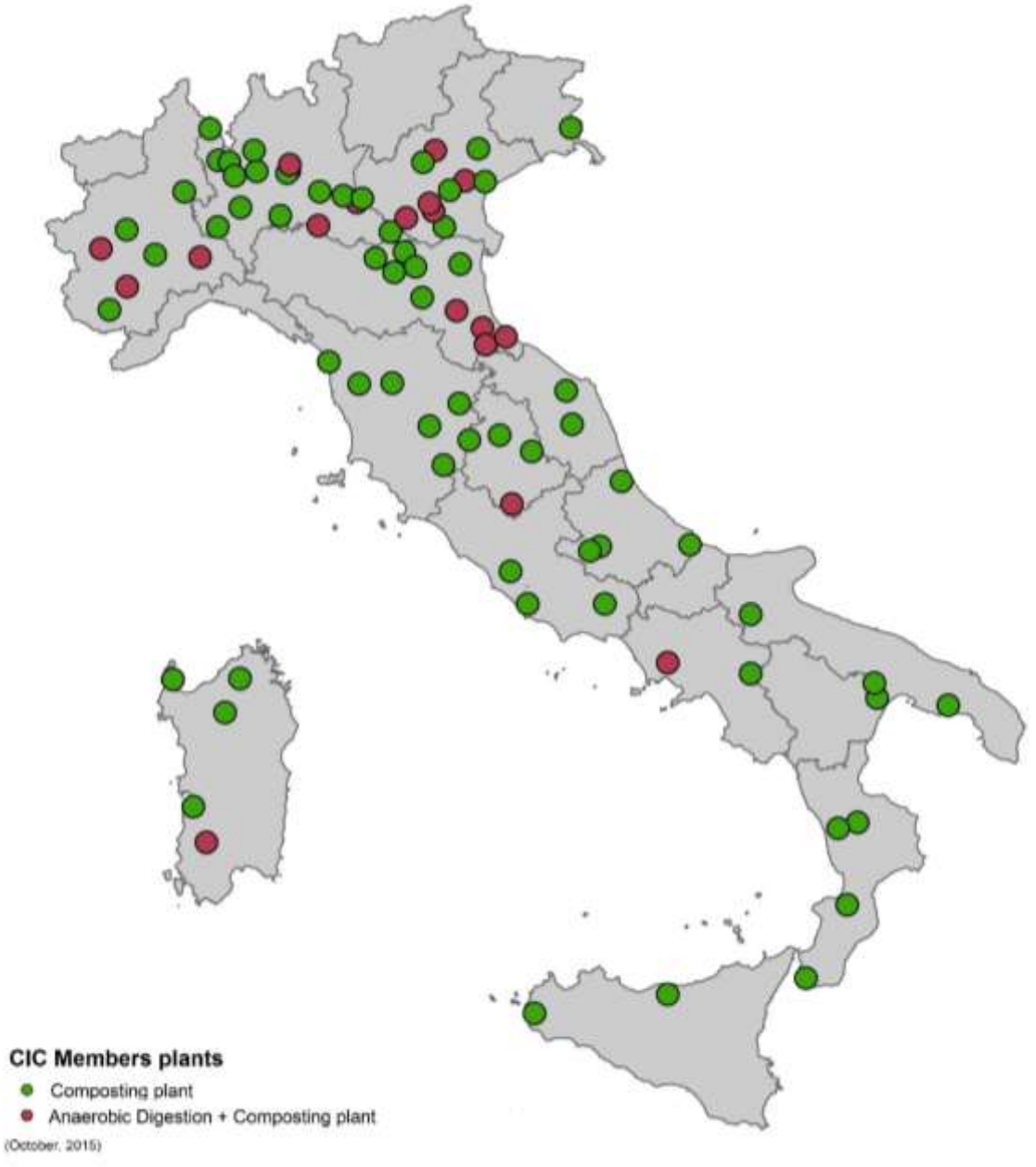
The outlook for year 2020

The figures for 2014 and preliminary data for 2015 reconfirm the increase in the separate collection of biowaste waste with a rate of growth equal to 4-6% per annum. This result derives from the progressive expansion of the separate collection services of food and garden waste in different municipalities.
Using the trend recorded in the last 10 years, CIC estimates that by 2020 between 7-8 million tons of organic waste, equivalent to 140kg-per-capita, will be collected.

Recycling of organic waste in Italy

Composting and AD- plants

In the last few years the number of recycling facilities is basically constant (see **Fig. 8**): in Italy organic waste is recycled in 252 composting plants and 46 facilities combining Anaerobic Digestion (AD) and (post)composting.



In 2014 the sector of composting and AD has reached an installed treatment capacity of about 7,3 Mtons, sufficient to recycle all organic waste separately collected in Italy.

Despite an overall treatment capacity already able to face the future growth of separate collection, an unbalanced distribution of the facilities is observed, with a growing demand of new installation above all in southern regions

The number of AD plants is constantly increasing in the last decade. By 2015, 46 AD-plants have been realized with a total authorized capacity of 2 million tons; most plants integrate AD with (post) composting of Digestate.

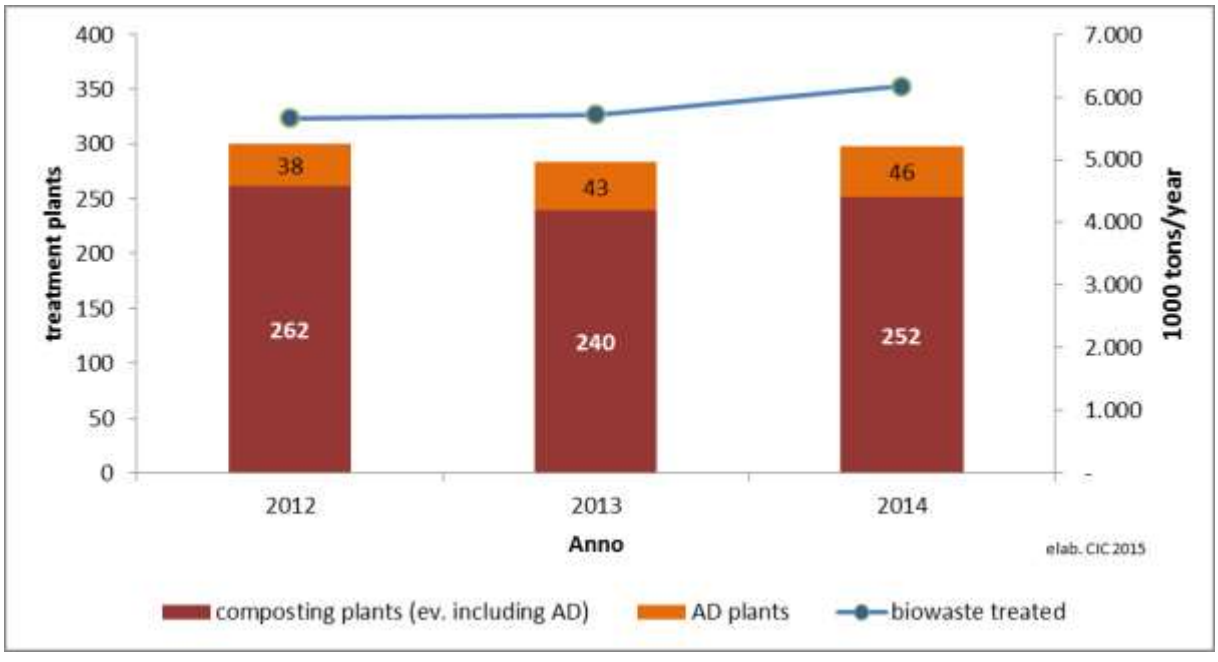


Figure 8: Number of composting and anaerobic digestion plants in Italy and amounts of biowaste recycled (in 1000 tons/year) – data for years 2012 to 2014

The different feedstock treated at composting and AD-plants

Italy's recycling facilities (including composting and AD-plants) mainly treat food- and green-waste, but do accept regularly other organic waste fraction such as sludge from waste-water treatment and other organic waste from agro-industries.

According to Italy's Environmental Protection Agency's data (itl. ISPRA), in 2014 the amount of food-waste recycled in composting facilities represents about 45% of all organic waste treated, while in AD (and composting) plants the rate of food-waste exceeds 68%.

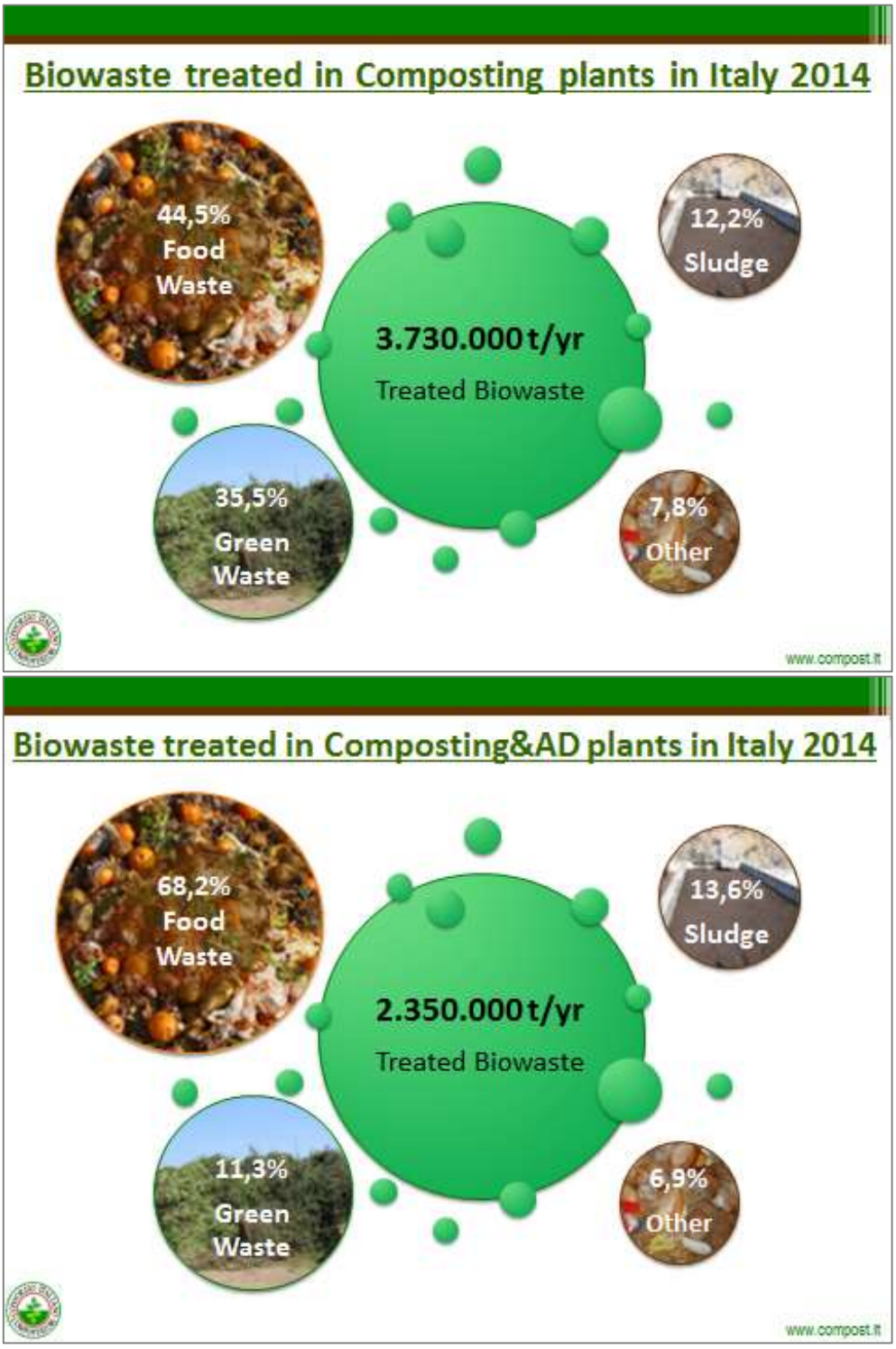


Figure 9: Recycling of different feedstock at composting plants and anaerobic digestion facilities.

Quality of biowaste

One of the goals of biowaste collection (mainly food-waste) is the reduction of the amount of non-compostable materials (contamination) for maximizing the recovery through composting and/or Anaerobic Digestion (AD). Initially, a high citizens participation rates was facilitated providing users with kitchen caddies and plastic bags. However, over the years, this practice has evolved, switching to compostable bags, which have brought a reduction of contamination, and vented caddies that allow the material to "breathe" and thus reduce odors and mould.

Compost quality is based on feedstock composition and purity. Hence CIC conducts hundreds of waste-audits each year at its members' facilities, for monitoring the quality of organic waste collection. These analyses can be divided into three main groups.

TYPES OF WASTE-AUDITS ON BIOWASTE PERFORMED BY CIC	
1	Composition of incoming food waste, so to determine the percentage of non-compostable materials not suitable for composting
2	Micro analysis which consist product waste composition analysis of the contents of a single bag, for groups of bags of different types of material
3	Analysis on the type of bags used for the separate collection of biowaste, to distinguish the origin and type of material bags are made of

Waste-Audits on food-waste

CIC is monitoring continuously since 2006 the quality of source-separated biowaste and performed about 4500 waste-composition analyses up to year 2015. Currently, CIC is carrying out its analyses in 15 Italian regions each year.

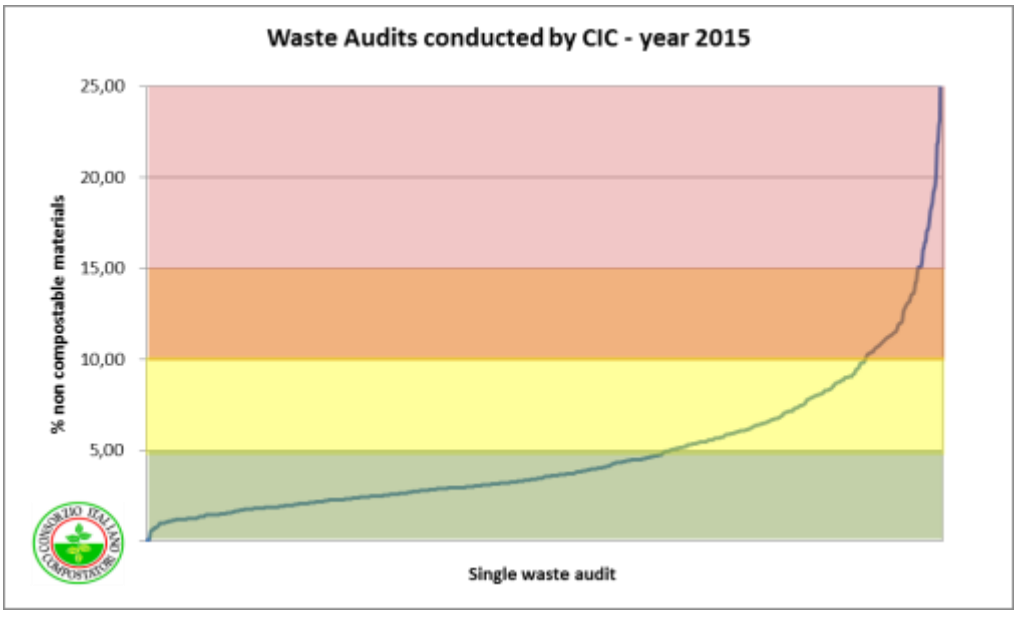


Figure 10: Non Compostable quota of food-waste (as % on f.m.) resulting from waste composition audits performer by CIC on samples of food-waste - 2015

CIC classifies the quality of separately collected biowaste according to four quality groups (classes) depending of the percentage (w/w f.m.) of non-compostable fractions present in the incoming waste. The **Non-Compostable-Material** quota **(NCM**) consists of different plastic items (i.e. bags, cups, etc.) and other non-compostable materials (i.e. glass, stones, metals, etc.).

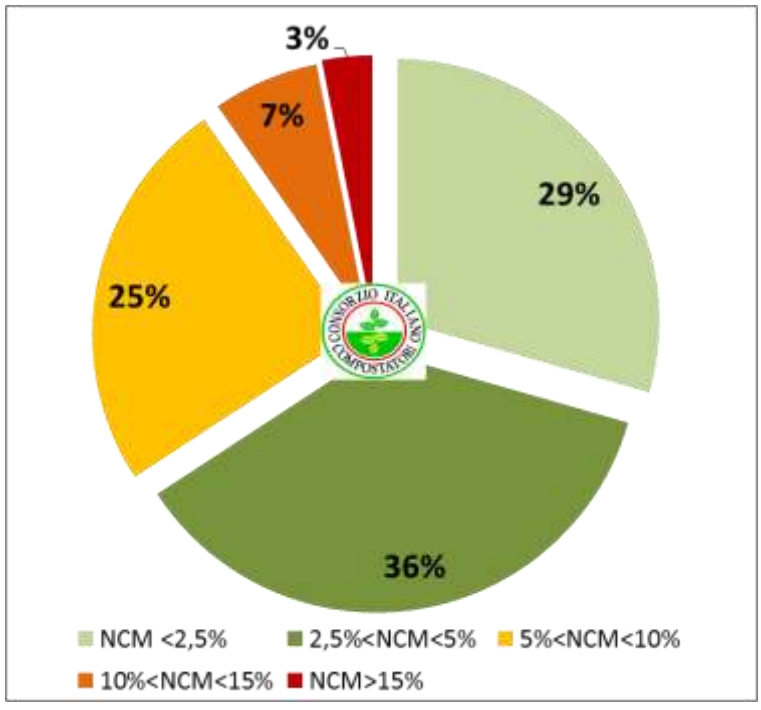


Figure 11: Percent frequency of quality classes determined by waste- analyses performed in year 2015

In 2015, CIC performed about 850 waste audits on food-waste; the **average non-compostable** quota of biowaste delivered to Italian composting plants is **4,8% in weight**, with best-practice cases[1] showing less than 2,0% impurities.

CIC's waste-audits also allow to **compare the effectiveness of bring schemes and kerbside schemes** in terms of keeping NCM sufficiently low to enhance recycling activities at composting and AD plants. The assessment conducted in year 2015 clearly shows how kerbside schemes significantly reduce the need for pre-sorting of delivered biowaste before recycling the waste by means of biological treatments.
Hence kerbside collection also reduces significantly the amounts of residues from the recycling process that need to be disposed off.

[1]Mostly door-to-door collection with compostable bags distributed to households and other biowaste producers.

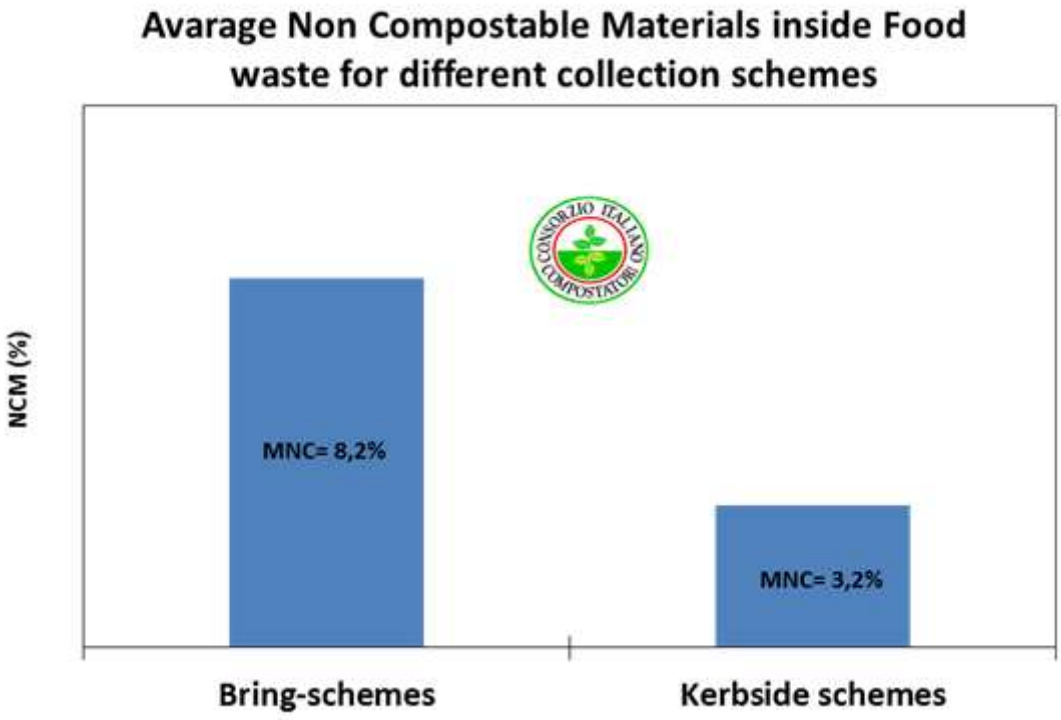


Figure 12: Impurities inside food waste delivered to CIC's composting and AD plants - year 2015

CIC Waste-Audits on bags used by citizens for biowaste collection

Plastic bags are a contamination factor in the composting process. The Italian National Law on waste-management (Decree 152/2006 article 182ter) states that "*the separate collection of organic waste must be carried out either with reusable containers, or with compostable bags certified according to UNI EN 13432-2002 standard on biodegradable packaging materials*".

The demand for bioplastic-bags in Italy increased in recent years due to specific regulatory prescriptions aiming to reduce the environmental burden of plastic packaging. A ban on the use of plastic-bags by retailers and supermarkets was issued in December 2006 and enforced from January 2011. This ban caused a significant reduction of throw away bags being sold in supermarkets (less 50%) as well as the growing use of compostable shopping bags for biowaste collection.

Additionally in recent years products labeled as "degradable", "biodegradable", "oxo-degradable" and "oxo-biodegradable" are proposed to customers and used to promote products made from conventional plastics with additives, thus causing an increase of non-compostable items that are placed on the market claiming to be compostable. Therefore, CIC started in 2011 to survey nationwide the type of bags used for biowaste collection. Specifically, the analysis conducted by CIC identifies up to 11 types of bags, as detailed in the following list.

TYPE OF BAGS FOR BIOWASTE COLLECTION TRACED BY CIC	
Bags made of polyethylene plastic (PE)	subdivided into shopping bags, transparent bags (usually used for carrying fruit and vegetable), sacks and bags (wrongly) provided by municipalities for biowaste collection
Bags with oxo-degradable plastic additives (PA-OXO)	subdivided into bags and sacks specifically (wrongly) supplied by municipalities for biowaste collection
Bags made of compostable materials (BIO)	subdivided into bags and liners supplied (properly) by municipalities for biowaste collection
Bags made of paper (PAPER)	all types of bags and liners
Bags made of other materials (Other)	bags not fitting the previous types of classification

Going into detail, in year 2015 the technical department of CIC classified nearly 45.000 bags during its waste audits. Of about 100 analyzed bags (see **Fig. 13**), 53 are proper bags for biowaste collection, most of which are certified, but 46 are shopping bags made of traditional plastic- or oxo-degradable bags; paper-bags are only 1% of the bags used for separate collection of food waste.

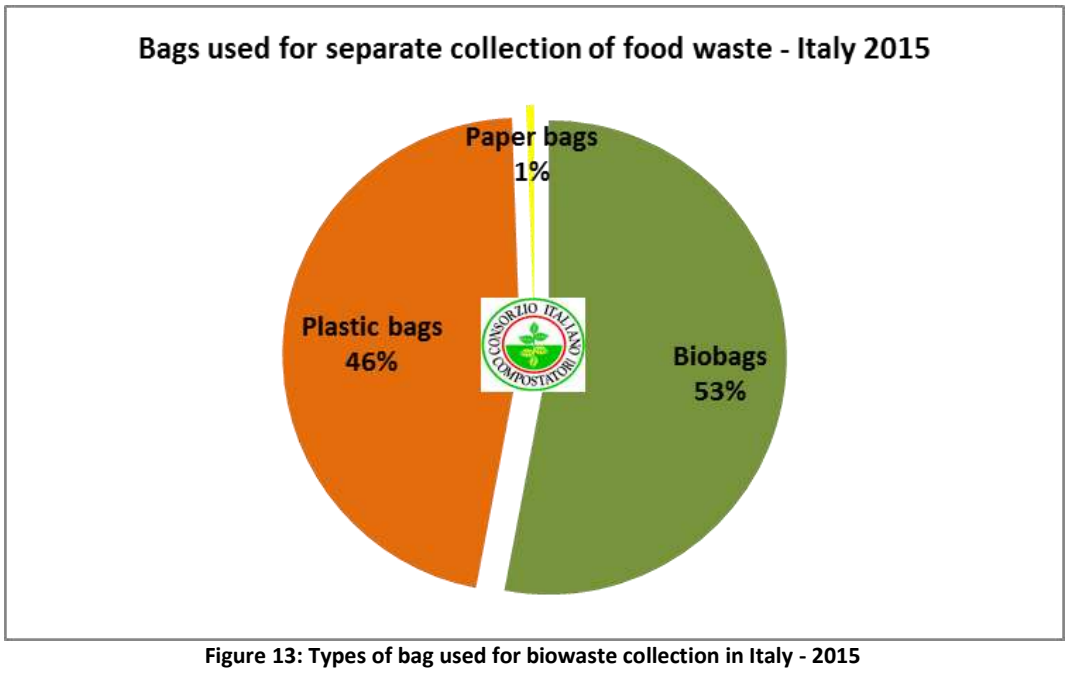


Figure 13: Types of bag used for biowaste collection in Italy - 2015

CIC Waste-Audits on cellulosic items on behalf of COMIECO

COMIECO (the Italian National Consortium for Recovery and Recycling of Cellulose Packaging) represents the Italian compulsory EPR scheme for recycling packaging waste and graphic paper collected separately by Italian Municipalities.

The largest packaging fraction collected separately in Italy is paper and cardboard; cellulosic Items and food-waste represent together about 51% of all MSW separately collected and send to recycling in Italy.

Source segregated food-waste always contains limited amounts of paper and other cellulose items, which may be assimilated to organic material considering the possibility to be degraded in industrial

composting processes. CIC estimated that annually about 100'000 tons of cellulose items are collected together with food-waste.

YEAR	TOTAL FOOD-WASTE RECYCLED	TOTAL PAPER AND CARD COLLECTED IN MUNICIPALITIES	CELLULOSIC ITEMS INSIDE FOOD-WASTE	AMOUNTS OF CELLULOSIC ITEMS INSIDE FOOD-WASTE COMPARED TO SEPARATE COLLECTION
2015	3,6 million t	3,2 million t	2,9%	3,2%

Key data about separate collection of food-waste and Paper&Card in Italy

Hence CIC started in 2013 a technical cooperation with COMIECO for investigating the different kinds of paper and cellulosic items that can be found inside food-waste from separate collection; more than 1000 waste composition analyses were performed by CIC between 2013 and 2015. The investigation allows to classify cellulosic items into six different categories: four types of packaging including multi-layer packaging for beverages, graphic paper and mixed paper (which mainly consist of napkins, tissues, etc.).

According to CIC's data, cellulosic items account on average for 2,4% to 3,4% in weight f.m. of food-waste and about 25% of these items are packaging, 7% graphic paper and the remaining amounts are the so-called mixed paper. CIC's survey and the large number of data available allowed to detail the result for different Italian Regions, from higher-income to lower-income areas (data are not shown).

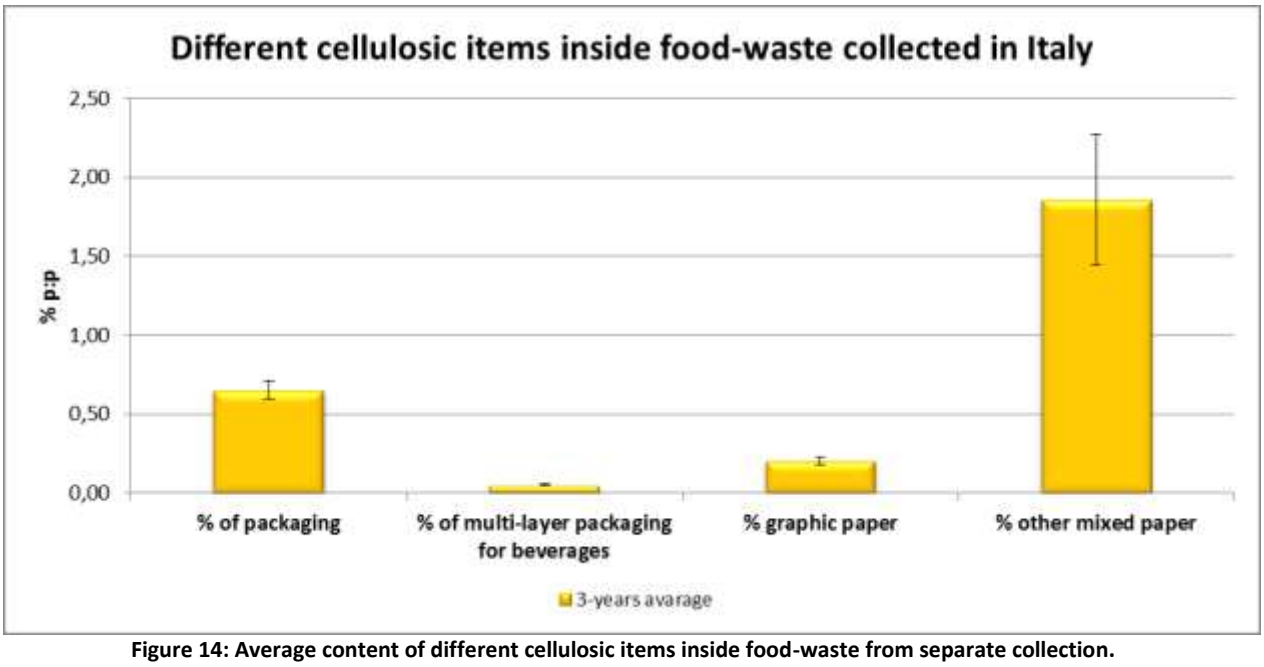


Figure 14: Average content of different cellulosic items inside food-waste from separate collection.

The large set of data allows to establish the expected amounts of cellulosic items collected with food-waste from source separation. Current data show that composting facilities can effectively recycle these items, without harming the treatment process.

As an additional result of the cooperation, CIC and COMIECO have prepared a joint vademecum for the correct management of cellulosic items that can be collected together with food-waste, thus to be recycled at industrial biogas and composting plants.

Production of quality compost

The production of Compost in Italy

According to the Italian Legislation, compost is defined as a soil-amendment. On the amounts of waste delivered to Italy's composting- and AD-plants, CIC has estimated that the total production of compost reached 1,55 Mtons in year 2014.

Compost in Italy is divided into three categories, recognized as "End-of-Waste" for biowaste, as shown in **Fig. 15**, according to the input feedstock:

- ***Mixed Compost (MC):*** 64% of the compost was produced from biowaste (i.e. 992.000 tons) including both food- and green-waste,
- ***Green Compost (GC):*** 25% was produced from green-waste only(387.000 tons) and
- ***Compost from sludge:*** 11% was produced including also sludge inside the mixture of different feedstock (i.e. 171.000 tons).

The production of compost in North-, Central- and Southern-Italy depends on the treatment capacities of the different composting plants.

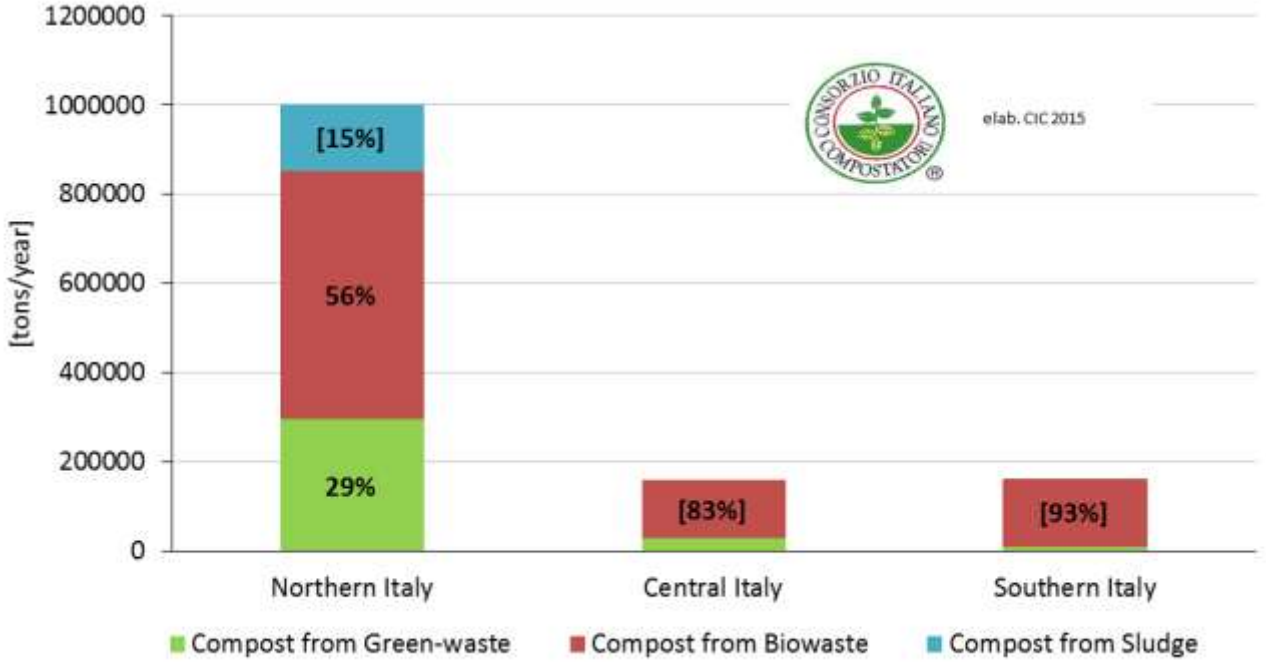


Figure 15: Production of compost (according to input feedstock) in Italian Composting plants - 2014

CIC's QAS for compost

In order to support the development of biowaste management sector, CIC has introduced in Italy in 2003 the first voluntary program for quality compost addressed to its associated companies, "**CIC Quality Compost Label**" (**CQL**), so to assess the quality of Compost produced by its members.

The standards applied in the rules of CIC's compost label are a useful instrument both for the producer of compost products, as a way of monitoring the quality standards achieved, and for the consumer, who can verify the quality of the compost used.

Since 2003, there has been a growing interest in quality Compost and a consequent significant increase of products labelled with the CQL (see **Fig. 16**). Between 2013 and 2015 the number of labeled composting-facilities increased by 34%.The reasons for this increase can be explained as follows:

- Substantial communication and marketing investments as well as public awareness activities and sharing of information;
- Convenient price of compost compared to the mineral fertilizers one;
- Incentives for compost use in organic depleted soils, including the use of Compost in Rural Development Plans so to restore organic matter content;
- Extensive availability of the product.

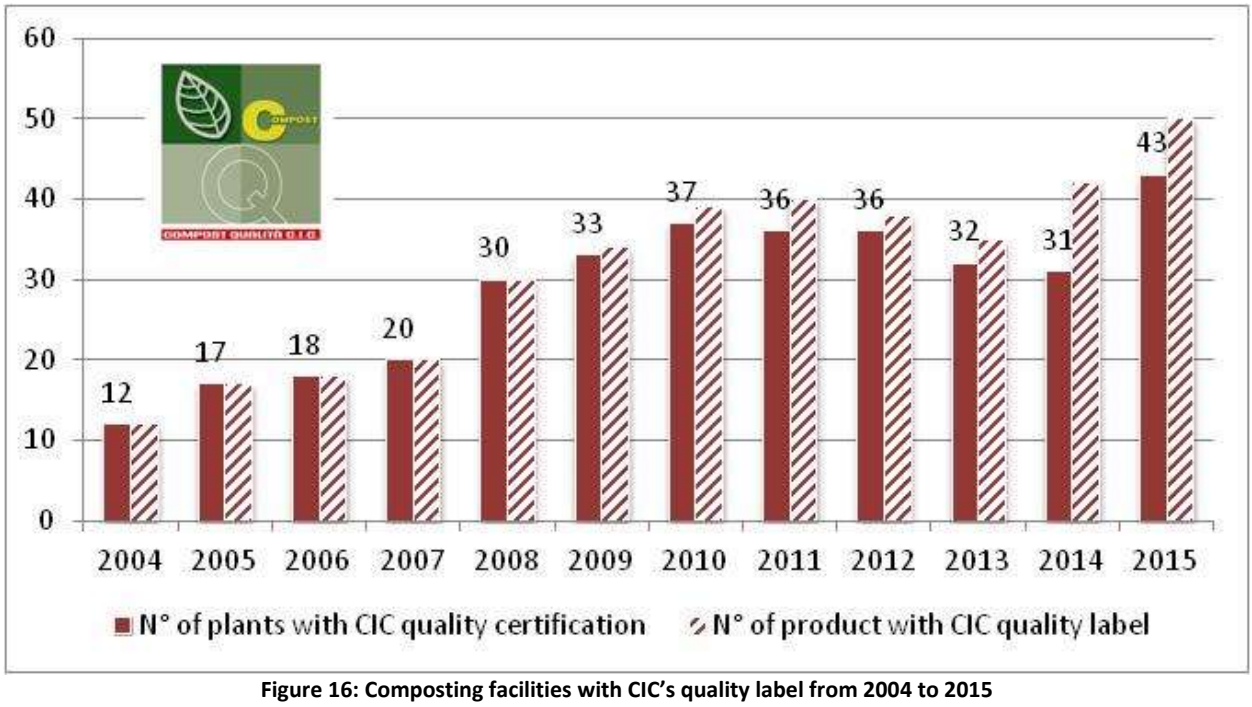


Figure 16: Composting facilities with CIC's quality label from 2004 to 2015

In year 2015, there were 43 composting-facilities complying with CIC's QAS scheme, producing 47different products (i.e. soil amendments or compost).

Hence, by end of 2015, the amount of compost labelled represents about **490.000 tons, equal to 32% of Italy's total compost production**.

Most of the products awarded with CIC's Quality Label are referred to mixed compost (34 products, around 420.000 tons of compost produced), against 11 green compost products, with some 70.000 tons of compost produced.

Since 2003, over 2.500 samples of compost were taken and analyzed within the CIC QAS system. The Compost samples are taken by qualified operators, trained and authorized by CIC and independent from the composting plant.

The samples are analyzed by Laboratories accredited by the Italian Ministry of Agriculture (MIPAAF) for analysis of soil improvers and growing media and for the European Ecolabel.

The Italian standards for End of Waste compost are set by the national Law on Fertilizers (D.Lgs 75/2010 and subsequent amendments), and can be divided into agronomical parameters (pH, moisture content, Carbon and organic Nitrogen, etc...), environmental parameters (heavy metals, physical impurities) and sanitization parameters (*Salmonella* spp., *E.coli*).

PARAMETER	M.U.	GREEN COMPOST (GC)	MIXED COMPOST (MC)	COMPOST FROM SLUDGE
Moisture content	% f.m.	≤50	≤50	≤50
pH	-	6-8,5	6-8,8	6-8,8
Organic C	% d.m.	≥20	≥20	≥20
Humic and fulvic acids	% d.m.	≥2,5	≥7	≥7
Organic N	%Ntot (d.m.)	≥80	≥80	≥80
C/N	-	≤50	≤25	≤25
Cu	mg/kg d.m.	≤230	≤230	≤230
Zn	mg/kg d.m.	≤500	≤500	≤500
Pb	mg/kg d.m.	≤140	≤140	≤140
Cd	mg/kg d.m.	≤1,5	≤1,5	≤1,5
Ni	mg/kg d.m.	≤100	≤100	≤100
Hg	mg/kg d.m.	≤1,5	≤1,5	≤1,5
CrVI	mg/kg d.m.	≤0,5	≤0,5	≤0,5
Tl	mg/kg d.m.	≤2*	≤2*	≤2*
Impurities (Plastic, glass and metals ≥ 2 mm)	% d.m.	≤0,5	≤0,5	≤0,5
Stones ≥ 5 mm	% d.m.	≤5	≤5	≤5
Salmonellae	MPN/25g	Absent	Absent	Absent
E.coli	CFU/g	≤1.000	≤1.000	≤1.000
Germination index (30% dilution)	%	≥ 60	≥ 60	≥ 60
PCB**	mg/kg d.m.	-	-	0,8

*For algae containing compost

** Up to 30% of sewage sludge into feedstock (d.m. basis)

Quality standard for Green Compost (GC) and Mixed Compost (MC) according to the Italian National legislation (source: D.Lgs n°75/2010)

The development of the CIC label among compost producers over the last 12 years not only has brought the market to increase its confidence on the compliance of compost to the national standards, but even makes it possible to consolidate the knowledge on the features of different types of compost. This kind of information can be used to address the product to specific fields of application, ranging from professional applications in pots, to horticulture, to agricultural sectors.

Comparison among different types of compost

Since 2003, over 2.500 samples of compost were taken and analyzed within the CIC QAS system. A focus was made on the quality of compost between 2013 and 2015; this period was chosen since the consolidation, over the last years, of the rate of CIC labeled compost generated by anaerobic digestion processes followed by composting, making it interesting to point out potential peculiarities of this "new" type of compost. For this reason, Mixed Compost was divided into two categories, depending on its being generated from composting processes (MC-C) only or integrated anaerobic-aerobic processes (MC-AD). The analyses involved 557 compost samples, distinguishing samples of Green Compost (94 samples), MC-C (324 samples) and MC-AD (139 samples).

PARAMETER	M.U.	GC	MC-C	MC-AD
Moisture content	% f.m.	35,3	26,4	28,5
pH	-	7,9	7,8	8,1
Organic C	% d.m.	24,7	26,0	23,3
Humic and fulvic acids	% d.m.	9,2	9,7	8,5
Organic N	%Ntot (d.m.)	96,1	92,1	89,4
Total N	% d.m.	1,8	2,3	2,3
Conductivity	dS/m	1,3	3,5	3,1
Germination index (dil. 30%)	%	93,9	84,4	86,3
P	% d.m.	0,7	1,6	1,5
K	% d.m.	1,3	1,5	1,5

Average features of Green Compost, Mixed Compost from composting process and Mixed Compost from integrated anaerobic-aerobic process, over 2013-2015

As far as nutrients content is concerned, MC-C has the highest organic carbon content, followed by GC and MC-AD. Total Nitrogen is present in comparable concentrations in MC-C and MC-AD, while GC has a poorer N content; on the other hand, Green Compost has the highest relative content of organic N, followed by MC-C and MC-AD. While no clear differences can be observed in K content, a poorer P content characterizes Green Compost, compared to Mixed Compost. These features can be due by several reasons:

- the characteristics in the composition of the starting mixture undergoing the biological transformation (poorer in P and higher in C/N ratio for vegetable waste originating GC) account for the lower P and total N content in GC;

- the fact that anaerobic digestion is in general more effective in transforming putrescible organic matter than composting processes only accounts explains for the lower organic C and higher rate of mineralized nitrogen observed in MC-AD compost.

Market share

Around 70% of compost produced by the Italian composting plants is used in agriculture, while the remaining 30% is sold to make gardening or landscaping products. Thanks to the last update of the Italian law on fertilizers, compost can be used in other organic fertilizers as basic growing substrate, mixed growing substrate or organic-mineral fertilizers.

Together with a considerable increase in the use of Compost, everyone became accustomed to this product. This is probably due to:

- **Information** campaigns put in place by Compost producers;
- **Higher price of mineral fertilizers** than the one of Compost;
- **Economic incentives** for reintegrating the organic matter in poor soils (only in some Italian Regions);
- **Easy availability of a large amount of Compost** almost everywhere in the Italy.

It has to be noted that CIC's Compost Quality Label represents an added value to Compost marketing. Indeed, Compost plants which obtained the CIC's Label constantly increase the product quality and, as a consequence, the final user is more satisfied by Compost.

As according to CIC information, the whole compost produced in Italy is used within the national border.

A recent market investigation performed by CIC shows that the price of the quality Compost depends on the "final product packaging".

The mean price for Compost sold in bulk, which is the more common form of the sold Compost, is around 10 €/t and the price fluctuates between 5 and 15 €/t.

Price fluctuation is probably related to the transport service cost which is often paid by the Composting plants.
On average, the price of a packed material in bags, that is Compost mixed with peat or other kinds of fertilizers, is remarkably higher than the bulk material and reaches prices of 120 €/t and above.

Biomethane and Circular Economy

In 2013, the Italian Ministry for Economic Development promoted an important decree on incentives for producing Biomethane. This legislation opens new development perspectives for renewable energies from biowaste, as this biofuel could be used for vehicles as substitute of fossil fuel and to replace the natural gas in domestic, commercial and industrial consumption.
Biomethane from biowaste could strongly transform the Organic Waste Recycling sector, as anaerobic digestion plants would transform the organic waste into both compost and Biomethane.

If the separate collection of biowaste were evenly widespread across the Italy, it would be possible to recycle 8-9 million tons of biowaste per year. From this amount, a Biomethane production exceeding 500 Gm^3 of could be a realistic evaluation.

CIC estimates that, considering the current biowaste production, if this CIC estimates that, considering the current biowaste production, if this amount were recycled through Anaerobic Digestion, the Biomethane produced could be used as fuel for 80% of the waste collection vehicles and could reach the 100% if the per-capita biowaste production increases.

CIC has developed and is now implementing a Biomethane Label "**Biometano Fertile**" to assess the quality of Biomethane produced in composting and anaerobic digestion plants.

Biomethane production from Biowaste is also an important contribute to reach the objectives established by the EU Directive 2009/28 on renewable energies, with the aim to reduce green-house-gases emissions and promote a "green" transportation system.

The Italian biowaste collection and recycling sector is now considering Biomethane as a good opportunity both for green incentives and a new challenge for CIC's composting and AD plants. According to Circular Economy principles, CIC is developing two complementary Circular Economy scenarios, as in figures below.

CIC's label for compostability

The development of products that have features of biodegradability and compostability is one the most innovative progress of the last decade. Italy is proudly to be a world leader of a new "Green Chemistry" which produces bioplastics materials and products, which decompose during composting process. Nowadays, it is necessary to classify these products once they become waste, to be properly processed and recycled. In particular, while the bioplastics market is constantly evolving, the EU legislation regulating its production is limited to the Packaging Directive and the standards of certification of 2002, e.g. the EN 13432:2002 standard.

Items made of degradable materials which decompose during industrial composting process, can be defined as "compostable" if they meet the requirements provided by the EN 13432:2002. According to this standard, a product can be defined as biodegradable and compostable if it disintegrates within 84 days and biodegrades within 180 days. As a result, under micro-organism activities, the compostable item would transform into water, carbon dioxide and compost. At the same time, the compostable items need to be compatible with the composting process without affecting the quality of the obtained compost.

Figure 17: Compostability Logo by CIC

ACCORDING TO THE EN:13432 STANDARD A COMPOSTABLE MATERIAL MUST COMPLY WITH FOLLOWING FEATURES:
Biodegradability: the capability to be converted into CO_2 by micro-organisms processes.
Disintegrability: the fragmentation and loss of the material inside the final compost.
Absence of **negative effects** on the composting process and on the quality of compost

The EN 13432 basic requirements for compostability

CIC started in 2006 a certification scheme on biodegradable materials and - in particular - on compostable products. The certification scheme ensures the material's ability to turn into Compost during the industrial composting process. Particularly, CIC assesses the compostability by testing materials on a full scale industrial composting facilities. CIC's compostable certification program meets the European regulation EN:13432 on compostable packaging. The reasons that led CIC to establish the certification program on compostable products are briefly listed below:

- The bioplastics world market is evolving rapidly;
- The quality of incoming biowaste into composting facilities strictly depends upon Non-Compostable Materials (MNC) content;
- Impurity content of biowaste increases treatment costs;
- Biowaste can became an organic fertilizer only if impurities are really low;
- Promote only authentic compostable bioplastics that meet the European standards.

The "**Compostable CIC**" labelling program requires a third party certification body, to perform audits and sampling of tested products. Therefore, CIC has partnered with Certiquality, a market leader in certification standards.
Companies that successfully achieve the compostable certification would be allowed to print the "Compostable CIC" logo on the certified product, and being recognized all across the Europe. This logo helps the final customers to visually identify truly biodegradable and compostable products making a consciousness choice.

Figure 18: Examples of compostable products (reference figures)

Nowadays, more than 50 products are certified with CIC's compostability scheme and 25 companies are licensed to use the Compostable CIC logo.

The detailed list of compostable products certified according to the "Compostable CIC" scheme can be found at: http://compostabile.com/prodotti_certificati.html

CIC Staff – November 2015

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