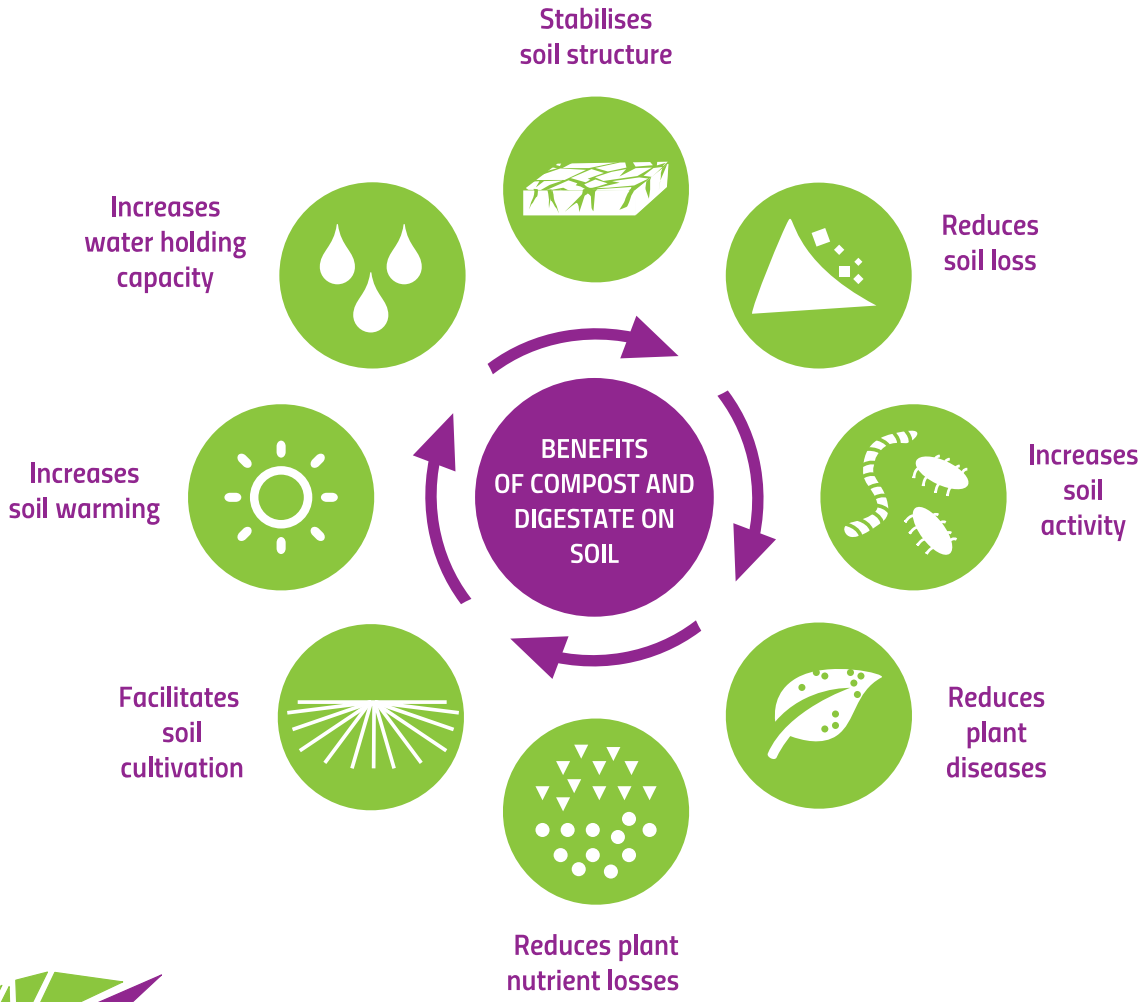
ECN DATA REPORT 2022

COMPOST AND DIGESTATE FOR A CIRCULAR BIOECONOMY

Overview of Bio-Waste Collection, Treatment & Markets Across Europe



ECN
Compost and Digestate for a Circular Bioeconomy

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ECN
Compost and Digestate
for a Circular Bioeconomy

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ECN
Compost and Digestate
for a Circular Bioeconomy

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CHAIR'S FOREWORD

Dear Reader,

Welcome to the new edition of the ECN Data Report on European Bio-Waste Management. The new report is focussing on the role bio-waste recycling plays for making the circular bioeconomy in Europe happen, by saving greenhouse gases from keeping bio-waste away from landfills and by providing compost and digestate, as high-quality organic soil improvers and fertilisers for keeping our soils healthy and fertile.

Twenty years after the European Compost Network was founded, ECN is recognised as an authoritative voice for Europe's biological waste management sector through supporting separate collection and high-quality recycling of organic resources. Today, ECN represents more than 4.500 biological waste treatments plants (composting and anaerobic digestion) with a treatment capacity of over 48 million tonnes of bio-waste per year.

Over this time and with the support of our members, we have followed several initiatives of the European Commission with the objective to introduce separate collection of bio-waste across Europe and to recycle bio-waste into high-quality compost and digestate. Separate collection is a prerequisite for high-quality recycling, for turning waste into products. Today, the demand for quality compost and digestate is high and still increasing, as these recycled products provide locally produced organic matter and nutrients.

With the adoption of Europe's Circular Economy Package, including the revisions to the waste directives and the new European Fertilising Product Regulation, the framework for a viable circular bioeconomy has been set. By 31 December 2023, EU member states are obliged to collect bio-waste separately (or recycle it at source) and from 16 July 2022 compost and digestate can be placed as CE marked fertilising products on the European market.

But there is still a long-way to go. The ECN data report verifies that less than 40 million tonnes of municipal bio-waste is separately collected and are processed into high-quality compost and digestate in Europe. This means that only 17 % of municipal solid waste is organically recycled through composting and anaerobic digestion. For reaching the overall recycling target of municipal waste of 65 % by 2035, there is a need to set further incentives to improve the separate collection and the biological management of bio-waste at European level.

ECN looks forward to supporting the new initiatives within the EU Green Deal addressing climate change, restoring Europe's natural capital and biodiversity, supporting carbon farming practices and more resilient agricultural practices and finally keeping our soils healthy.

With our S.O.S. Soil initiative 'Save Organics in Soil', initiated by ECN's Vice-Chair Massimo Centermero in 2019, we raised awareness for soil health and we are happy that the Commission has introduced a Soil Health Mission for Europe and we will support the Commission in implementing a Soil health Law by 2023.

I fully believe in ECN, and together with Massimo Centemero as Vice-Chair, and with the other Board members, we will further strengthen the position of ECN.
For realising this report I would like to thank all members who provided data from their countries and as well Dr Stefanie Siebert, as Executive Director of ECN, for setting up the report. The data were compared and supplemented with the data published in the EEA report No 04/2020 'Bio-waste in Europe - turning challenges into opportunities' published in 2019. Therefore, I would like to thank Ms Almut Reichel of the European Environment Agency for her cooperation.

I would also like to take the opportunity to thank Dr Jane Gilbert, representing Carbon Clarity in ECN, for her hard work, compiling, comparing and analysing the bio-waste data and information and for editing this report.
I would like to say a very special thank you to those companies and organisations who made this publication possible by placing advertisements.

Above all, I want to take the opportunity to thank you, our Members, for your support and trust in our Network. I wish you a successful bio-waste future within a circular Europe; please share this report within your organisations, networks and all interested parties.

If you aren't yet on board, please join us to make Europe's Circular Bioeconomy happen and please support as well our S.O.S. soil initiative 'Save Organics in Soil'. I believe ECN has an important role to play in the future management of Europe's bio-waste and to develop a European market for compost and digestate.

Enjoy the report.

Kristel Vandenbroek
Chair of ECN

ABOUT ECN

ECN is the leading European membership organisation promoting sustainable recycling practices in composting, anaerobic digestion and other biological treatment processes of organic resources. Its purpose is to work with practitioners, researchers, technicians and policy makers to deliver integrated organic waste recycling solutions that generate high quality products for the benefit of the environment and the users of the recycled products. It serves as central resource and network for the organic waste recycling sector in Europe, as well as the emerging bio-based economy.

ECN'S VISION

ECN's vision is living well within the limited resources of the planet respecting the organic cycle.

ECN'S OBJECTIVE

The objective and the main focus of ECN is to promote knowledge about best practices throughout Europe for the establishment of sustainable systems for organic waste management through integration of policies and strategies, technological development and improvement of operations.

WWW.COMPOSTNETWORK.INFO

ABOUT THE ECN-QAS

ECN's QUALITY ASSURANCE SCHEME (ECN-QAS) sets out requirements for national quality assurance organisations, covering process management, compost and digestate quality criteria. Its aim is to establish a common platform for existing national quality assurance schemes for composts and digestate in Europe, as well as to support member states develop their own standards and quality assurance schemes. At present, four national quality assurance organisations (in Austria - KBVÖ, Belgium - Vlaco, Germany - BGK and Italy - CIC) have been approved.

AIMS

The ECN-QAS has supported European policy initiatives setting end-of-waste criteria for compost and digestate within the Waste Framework Directive and was cited in the JRC-IPTS report on end-of-waste criteria for compost and digestate. The ECN-QAS provides a European-wide independent quality assurance scheme for national quality assurance organisations. It operates in accordance with the ISO/IEC standard "Conformity assessment for bodies certifying products, processes and services" (ISO/IEC 1 7065) and has been based on knowledge of, and experience in, existing quality assurance organisations.

WWW.ECN-QAS.EU

ABOUT THE S.O.S. SOIL INITIATIVE

This international initiative S.O.S. SOIL - Save Organics in Soil, led by ECN and the Italian Composting and Biogas Association (CIC), aims to highlight the importance of soil organic matter to encourage policy makers to develop instruments to move Europe towards implementing sustainable, climate proof soil management practices.

The Main Priority Goals of the S.O.S. SOIL Initiative is to:

- Increase Soil organic matter in arable soils
- Encourage a more efficient management of nutrients on agricultural land
- Protect the existing stock of carbon in soils
- Minimize further losses of carbon from cultivated carbon rich soils

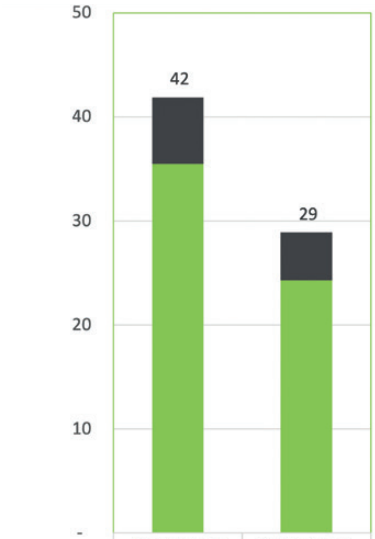
WWW.SAVEORGANICSINSOIL.ORG

Soil is a vital, non-renewable resource for ecosystems, playing an essential role in services such as water purification and food production. It is also a major global carbon sink, with significant potential to remove climate-changing gases from the atmosphere. However, the ability of soil to deliver ecosystem services - in terms of food production, as a biodiversity pool and as a regulator of gasses, water and nutrients - is under severe pressure.

At the global level, the notion of preserving soil functionality has been embedded in the land-degradation-neutrality concept as part of the Sustainable Development Goals (SDGs), agreed by the United Nations General Assembly in 2015. The SDGs also include targets on soil quality, soil contamination, the management of chemicals and waste. Implementation of the SDGs can provide an important vehicle for soil protection measures in Europe.

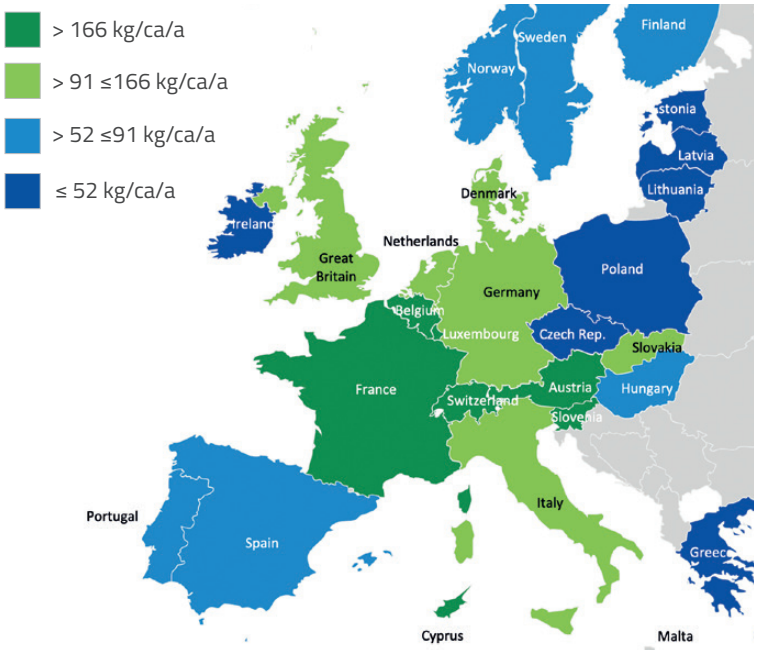
KEY MESSAGES

QUANTITIES OF BIO-WASTE SENT TO COMPOSTING & AD
(tonnes per annum)



	Biowaste to composting	Biowaste to AD
TOTAL	42	29
CH, NO & UK	6	5
EU27	36	24

BIO-WASTE COLLECTED PER CAPITA IN SELECTED COUNTRIES GROUPED INTO QUARTILES
(kg/capita/annum)

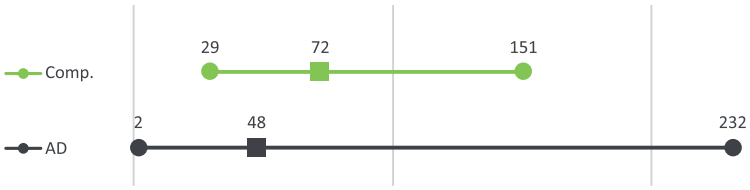


Sources: ECN & EEA data. Excludes derived estimates

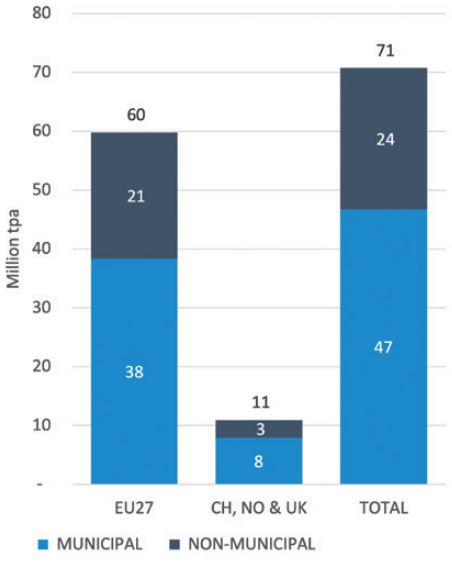
76 %
COMPOSTING
- Green waste
- Garden & food waste

73 %
ANAEROBIC DIGESTION
- Food waste
- 'Other'

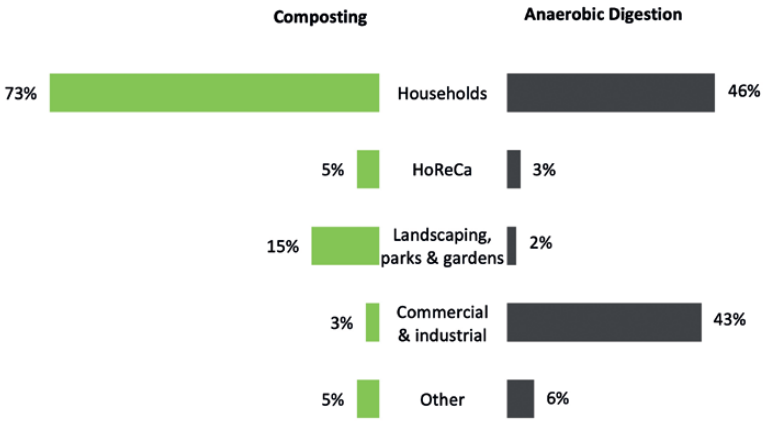
BIO-WASTE COLLECTED PER CAPITA
Minimum, median and maximum kg/capita/annum



QUANTITIES OF MUNICIPAL AND NON-MUNICIPAL BIO-WASTES COLLECTED AND TREATED

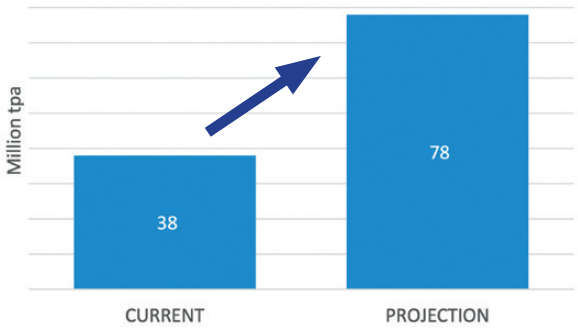


SOURCES OF BIO-WASTE TREATED IN COMPOSTING AND AD PLANTS
(percentage based on mass)



KEY MESSAGES

PROJECTIONS TO REACH THE EU's 65% MSW RECYCLING TARGET INCREASE IN SEPARATELY COLLECTED & TREATED BIO-WASTE (EU27)



PROPORTION OF FACILITIES TREATING BIO-WASTE

66 % COMPOSTING

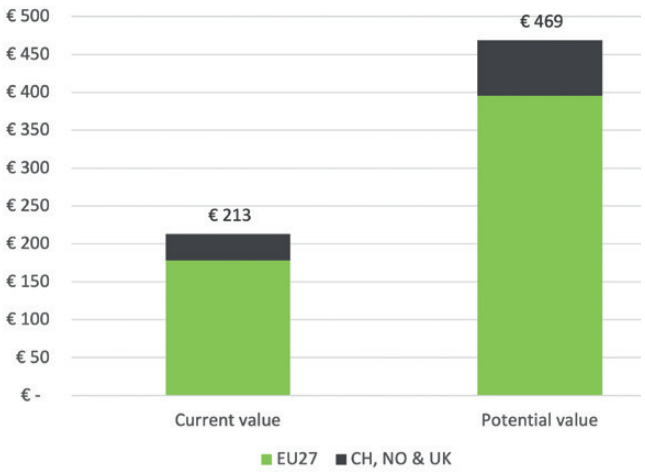
34 % ANAEROBIC DIGESTION

TREATMENT PLANTS

	COMPOST	ANAEROBIC DIGESTION	TOTAL
CURRENT	3,800	2,000	5,800
PROJECTED	7,600	4,000	11,600

PROJECTED VALUE OF COMPOST SALES BY 2035 (MUNICIPAL & NON-MUNICIPAL) ASSUMING DOUBLING OF INPUT FEEDSTOCKS

(Price per tonne of compost in millions EUROS)



CURRENT AND PROJECTED GDP CONTRIBUTIONS THROUGH BIO-WASTE PROCESSING OF MUNICIPAL & NON-MUNICIPAL BIO-WASTE in the EU27, CH, NO & UK

(Values shown in millions of Euros)

Inner circle represents the lower estimate; outer circle represents the upper estimate.

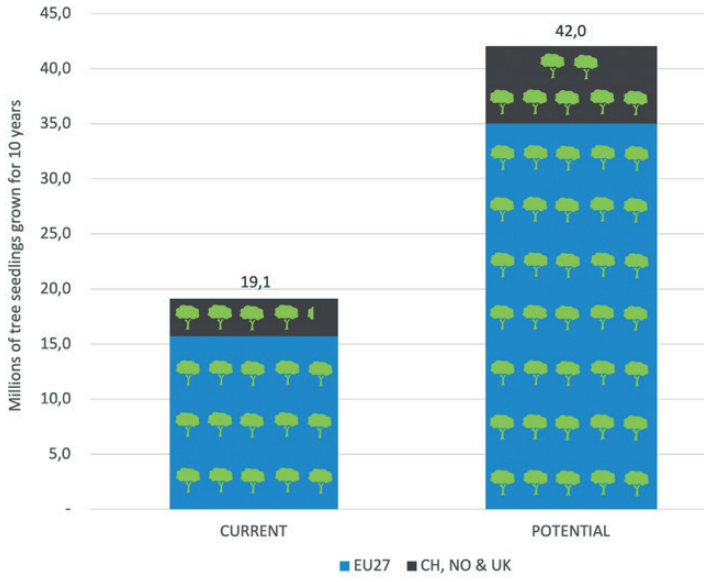
ESTIMATED RANGE IN NUMBER OF CURRENT FULL TIME EQUIVALENT EMPLOYEES AT BIO-WASTE TREATMENT FACILITIES (MUNICIPAL & NON-MUNICIPAL BIO-WASTES)

11,000 - 18,000 FTEs
COMPOSTING

2,000 - 5,500 FTEs
ANAEROBIC DIGESTION

SOIL ORGANIC CARBON SEQUESTRATION EQUIVALENTS EXPRESSED AS THE NUMBER OF URBAN TREE SEEDLINGS GROWN FOR 10 YEARS

(estimates for current and potential bio-waste treatment shown)



SUMMARY

Compost and Digestate for a Circular Bioeconomy

CURRENT STATUS

The transformation of biologically derived waste streams into compost and anaerobic digestate is one of the key pillars of the nascent bioeconomy[1], and one that if often side-lined in European policy making due to its cross-cutting impact. The results of the European Compost Network's recent survey highlighted in this report cast new light on the significant contribution the bio-waste processing sector makes to Europe's bioeconomy, as well as the environmental and social benefits that arise. For the first time, it has placed a value on the sector's contribution to the European economy, not only from the sale of recycled products, but also from the generation of new employment opportunities.

The survey included the 27 countries that are currently members of the European Union (the EU27) and Norway (NO), Switzerland (CH) and the United Kingdom (UK). Data relate to the years 2019-2020, unless otherwise stated.

ECONOMIC SIGNIFICANCE

The survey identified that, on average, every tonne of compost manufactured in Europe contained EUR 41 worth of NPK[2] fertilisers, and EUR 4 worth of carbon sequestered in agricultural soils: a value four and a half times greater than the average current sale price of compost (EUR 10 per tonne). Collectively, these suggest that the carbon and fertiliser value of compost in the EU27 amounted to some EUR 800 million per annum, whilst in NO, CH and UK compost is valued at EUR 157 million per annum. Increasing the use of compost in agriculture will increase carbon sequestration further.

The composting sector was found to employ between 11,000 and 18,000 full time equivalents (FTEs) across the EU27, CH, NO and UK, whilst the anaerobic digestion sector employs between 2,000 and 5,500 FTEs: this equates to 1 FTE per 4,200 tonnes of bio-waste composted, and 1 FTE per 5,300 tonnes of bio-waste digested. Employment in the sector contributes an estimated EUR 76 per tonne to gross domestic product (GDP), whilst the overall contribution to GDP was around EUR 1.3 billion in the EU27and EUR 300 million a year in CH, NO and UK.

BIO-WASTE TREATMENT

In terms of separately collected bio-waste, an estimated 71 million tonnes per annum (tpa) were treated through composting and anaerobic digestion (60 million tpa in the EU27 and 11 million in CH, NO and UK). These estimates included both municipal and commercial/industrial bio-wastes. Composting accounted for 42 million tpa (59%), whilst anaerobic digestion (AD) accounted for 29 million tpa (41%). These data refer to bio-waste as defined in the European Union Waste Framework Directive (EU 2018/851) and therefore exclude mechanical biological treatment processes, agricultural wastes/products, and sewage sludges.

Looking at individual countries, there was a large variation in the amount of separately collected bio-waste treated per person, ranging from a minimum of 28 kg/capita/annum to a maximum of 328 kg/capita/annum. Overall, composting treated on average 72 kg/capita/annum and AD 48 kg/capita/annum. Green, garden and food, and food waste were the dominant feedstocks at composting sites, whilst food waste and 'other' non-specified wastes dominated at AD sites.

Waste from municipal sources has been targeted by European policy makers with minimum recycling and re-use targets having been set for certain material streams, including bio-waste. A total of 47 million tonnes of municipal bio-waste was found to have been composted and anaerobically digested in the EU27, CH, NO & UK. Of this, 38 million tpa was in the EU27, with 70% sent for composting and 30% sent for anaerobic digestion; an amount equivalent to 17% of the total municipal solid waste fraction.

INFRASTRUCTURE

There were an estimated 5,800 bio-waste treatment facilities in the EU27, CH, NO & UK, with 3,800 (66%) being composting and 2,000 (34%) being anaerobic digestion plants. On average, each composting facility treated 8,000 tpa of bio-waste, whilst each AD facility treated 13,000 tpa. Similarly, each composting facility was found to serve approximately 120,000 people, whilst every AD facility serves 225,000 people. These differences probably reflect the differing levels of automation and economies of scale for the two different treatment types.

In terms of bio-waste, 88% of composting facilities treated solely bio-waste, whilst 48% of AD facilities treated only bio-waste and no other feedstocks. Although the integration of AD and composting treatments is now being recognised as an environmentally beneficial means of processing food waste, the survey only found that 5% of composting facilities treated anaerobic digestate at co-located facilities. This fraction is anticipated to increase in future years.

MARKETS

An estimated 21.1 million tpa of compost was produced, with 17.6 M tpa of this being in the EU27. Agriculture was found to be the dominant market segment for both compost and anaerobic digestate, although sale prices were far below their theoretical potential, with digestate commanding either a zero or negative price (EUR 0 to minus 10 per tonne) and compost

having a weighted average price of only EUR 10.1/ tonne (fresh mass) across all market sectors.

All European agricultural soils suffer from erosion, a situation that is partly due to the loss of organic matter over time as a result of unsustainable agricultural practices. Quality compost is recognised as an important soil improver, adding organic matter and helping to restore productivity. Overall, an estimated 2% of arable land and 16% of moderately/severely eroded agricultural land could benefit from compost application at 10 tonnes per hectare per annum. Presently, nine countries currently manufacture sufficient compost to apply to their moderately/severely water eroded agricultural soils; a finding that has important climate change and food security implications.

CARBON SEQUESTRATION IN SOIL

Countries located between 45-55° latitude were calculated to sequester more carbon in soil per capita than those located above 55° latitude, despite having lower potential SOC sequestration rates. Conversely, countries located below 45° latitude sequester the lowest rates of SOC per capita, despite their soils having the greatest need for organic matter due to desertification.

The EU27, CH, NO and UK currently sequester in the region of 1.2 million tonnes of carbon dioxide equivalents a year on agricultural soils, a value equivalent to just over 19 million urban tree seedlings grown for 10 years. When valued at a carbon dioxide trading value of EUR 80 per tonne of carbon dioxide equivalents, this was valued at 92 million EUR.

Twenty-five percent of all compost produced in the EU27, CH, NO and UK was certified to the ECN's Quality Assurance Scheme (5.3 million tpa out of a total of 21.7 million tpa). The total nutrient value (NPK) of ECN quality assured compost almost quadrupled over 15 months due to increases in inorganic fertiliser prices on the international markets. On average, one tonne of ECN certified quality compost contained nutrients valued at 63 EUR per tonne (fresh matter).

PROJECTED INCREASES IN BIO-WASTE TREATMENT

The European Union's target to recycle or prepare for re-use 65% of municipal waste by 2035 can only realistically be met by increasing bio-waste recycling through both composting and anaerobic digestion. In practice, that would mean increasing the current rate of recycling from 17% of separately collected municipal waste to 35%, a rise that translates into an additional 40 million tpa (i.e., an increase from 38 to 78 million tpa of bio-waste) in the EU27 and 6 million tpa in CH, NO and UK (an increase from 8 to 14 million tpa). These calculated increases exclude non-municipal commercial and industrial bio-wastes.

To treat this additional bio-waste, 3,900 new AD and composting facilities would be needed, of which 3,000 would be in the EU27. Overall, employment is projected to rise to between 17,000 to 31,000 FTEs (from 11,000 - 18,000 FTEs across the EU27, CH, NO and UK), contributing between 1-2 billion EUROS to the European economy every year.

An estimated 46 million tpa of compost would be produced from municipal and non-municipal bio-waste by 2035 should input bio-wastes from both sources double, resulting in products with an estimated total market value of EUR 470 million (up from EUR 210 million) across the EU27, CH, NO and UK. Despite these projected increases, compost would only cover less than 10% of Europe's arable land when applied at 10 tonnes per hectare per annum, however, annual carbon sequestration in agricultural soil was estimated to be equivalent to growing 42 million seedlings for 10 years every year.

POLICY IMPLICATIONS

Realising the significant potential of Europe's bio-waste can only be realised through consistent and co-ordinated policy actions aimed at the agricultural, energy, environmental, resource and waste sectors.

The EU's emerging Farm to Fork strategy, the Soil strategy for 2030 and the Green Deal all need to recognise the role compost and anaerobic digest make in the recycling of major plant nutrients, the improvement of soils through increasing organic matter levels, and the reduction of greenhouse gas emissions through carbon sequestration in soils, offsetting inorganic nitrogen fertilisers and the manufacture of biogas. Moreover, aims of the EU's Biodiversity strategy for 2030 can also be addressed through improvement in soil productivity and ecosystem services, and the use of speciality compost and digestate products to replace horticultural peat use.

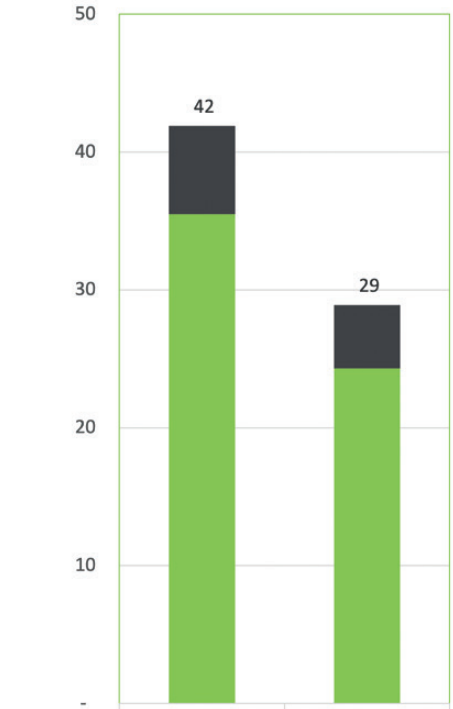
Development of Europe's nascent bioeconomy will necessitate the emergence of cross-cutting policy mechanisms to create new value chains, realise synergies between sectors and maximise environmental, economic and social gains. ECN's survey has highlighted the important role bio-waste treatment currently plays and its potential to assist Europe in its quest to decarbonise the economy and reach net zero carbon by 2050. The main challenge now is to gather together the differing policy threads and weave a new policy paradigm for bio-waste.

[1] Europe's bioeconomy is composed of economic activities that use renewable biological resources to produce food, materials and energy.
[2] Nitrogen, Phosphorus and Potassium.

KEY MESSAGES

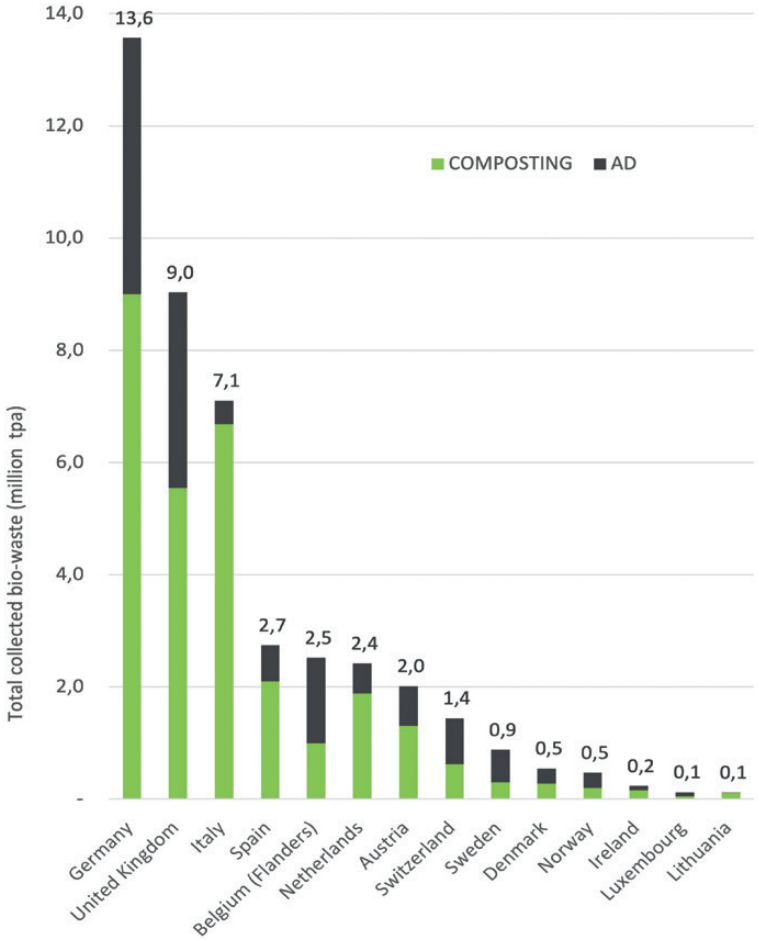
- 71 million tonnes per annum of separately collected bio-waste were treated through composting and anaerobic digestion
- 60 million tpa in the EU27
- 11 million in Norway (NO), Switzerland (CH) and the United Kingdom (UK)
- Italy, Germany and the UK treat just under 30 million tpa collectively
- Composting accounts for 42 million tpa (59%)
- Anaerobic digestion accounts for 29 million tpa (41%)

QUANTITIES OF BIO-WASTE SENT TO COMPOSTING & ANAEROBIC DIGESTION
(tonnes per annum)



	Biowaste to composting	Biowaste to AD
TOTAL	42	29
CH, NO & UK	6	5
EU27	36	24

QUANTITIES OF TREATED BIO-WASTE IN SELECTED SURVEY COUNTRIES
(tonnes per annum)



Germany, the United Kingdom and Italy compost the most bio-waste, amounting to just under 30 million tpa between them.

SOURCES OF BIO-WASTE IN THIS REPORT

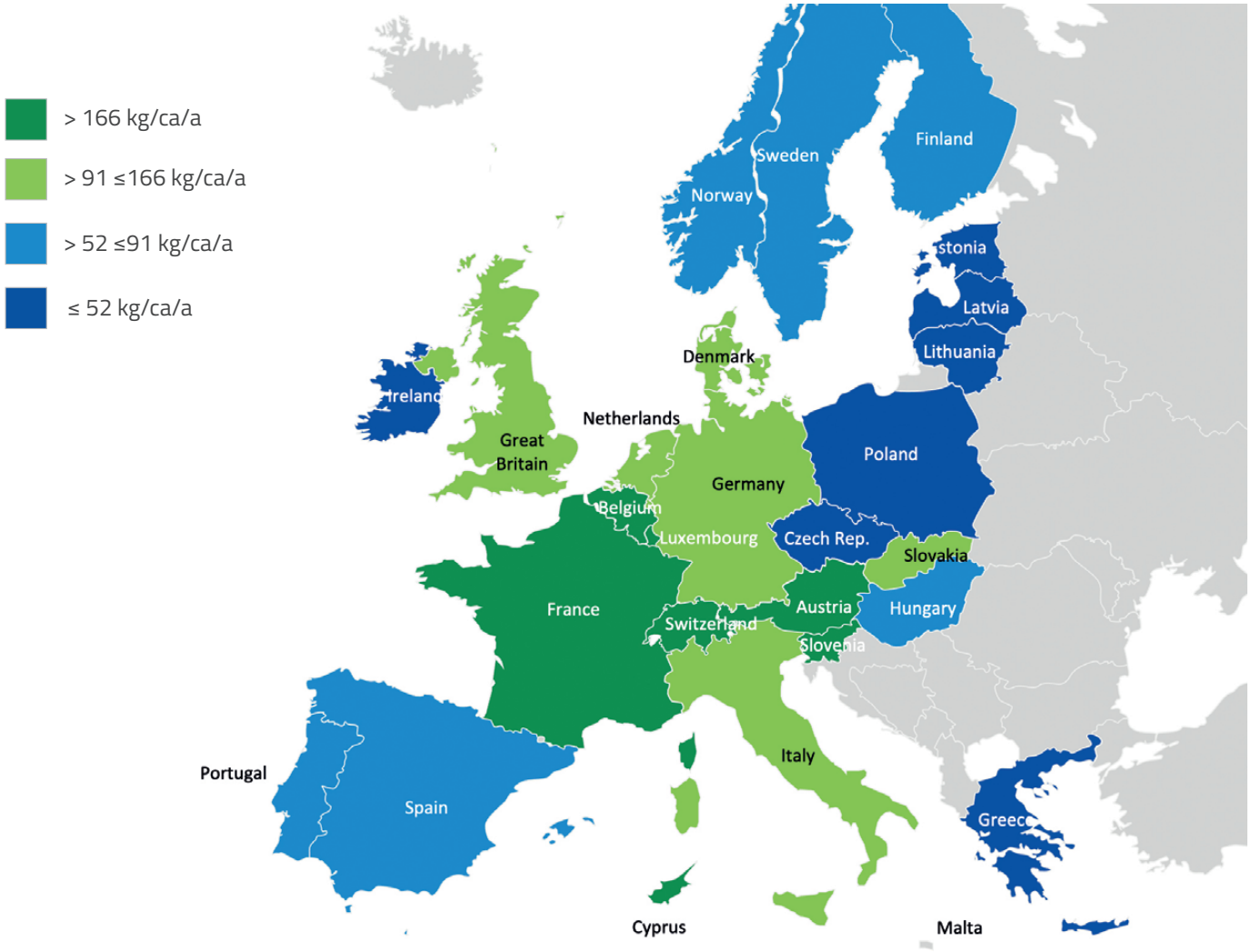
Households, hotels, restaurants, catering (HoReCa), landscaping, parks and gardens (non-household), and commercial and industrial.

THE DEFINITION OF BIO-WASTE

Biodegradable garden and park waste, food and kitchen waste from households, offices, restaurants, wholesale, canteens, caterers and retail premises and comparable waste from food processing plants. It does not include forestry or agricultural residues, manure, sewage sludge, or other biodegradable waste such as natural textiles, paper or processed wood.

SEPARATELY COLLECTED BIO-WASTE TREATMENT IN EUROPE

BIO-WASTE COLLECTED PER CAPITA IN SELECTED COUNTRIES GROUPED INTO QUARTILES
(kg/capita/annum)



Sources: ECN & EEA data. Excludes derived estimates

DATA SOURCES AND ASSUMPTIONS USED THROUGHOUT THIS REPORT

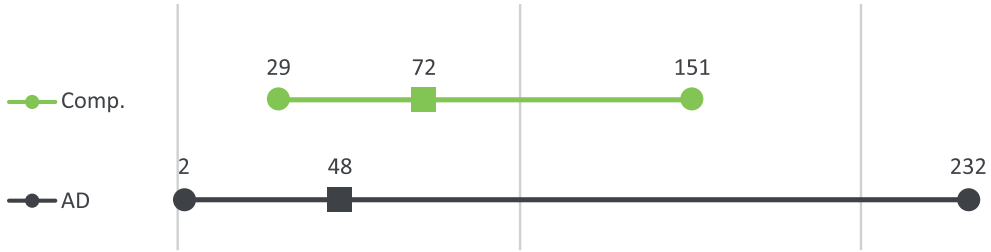
- Data refer to separately collected bio-waste, and exclude mixed waste treatment, sewage sludges and agricultural wastes unless specifically stated
- ECN survey data relate to 2019/2020
- European Environment Agency data were used to supplement ECN data gaps (2019)
- Country data were estimated using the 25 percentile of calculated per capita bio-waste collection where both ECN and EEA data were absent
- Population data were obtained from EUROSTAT (2019 estimates)
- The population of Flanders (BE) was used instead of Belgium, as bio-waste data relate solely to Flanders
- Where bio-waste was pre-treated through AD prior to composting, data were accounted for as being composted in order to prevent double counting
- Estimates relate to bio-waste treated at waste permitted/licensed facilities only. They exclude smaller scale on-farm or community operated facilities that do not require an environmental/waste permit/licence

KEY MESSAGES

- There is a large variation in the amount of separately collected bio-waste treated per person living in each country
  - Maximum = 328 kg/capita/annum
  - Minimum = 28 kg/capita/annum
- More bio-waste is sent for composting compared with anaerobic digestion
  - Composting 72 kg/capita/annum (median)
  - Anaerobic digestion 48 kg/capita/annum (median)
- Data refer to separately collected bio-waste from municipal, commercial and industrial sources

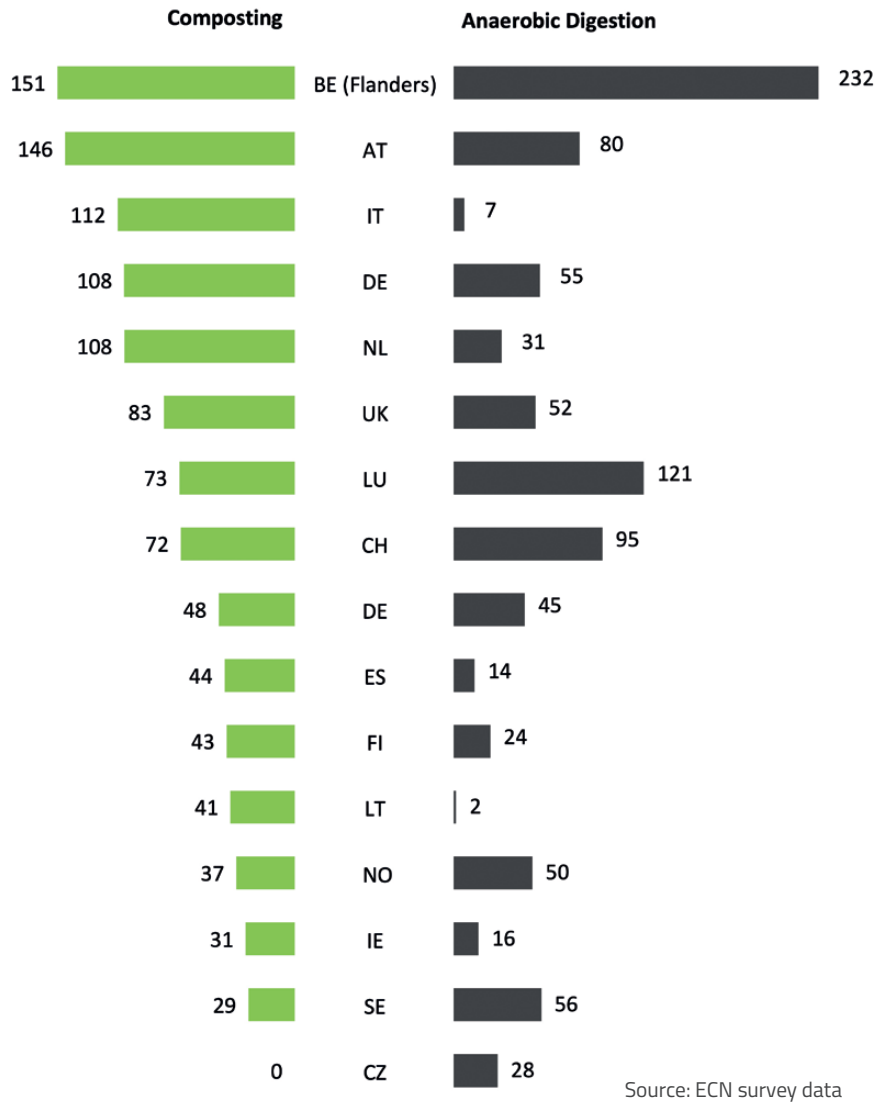
BIO-WASTE COLLECTED PER CAPITA

Minimum, median and maximum kg/capita/annum



SEPARATELY COLLECTED BIO-WASTE TREATMENT IN EUROPE

SEPARATELY BIO-WASTE (MUNICIPAL & COMMERCIAL/INDUSTRIAL) COLLECTED PER CAPITA
kg/capita/annum



Source: ECN survey data

Flanders in Belgium collects significant amounts of bio-waste from the food/drink industry per capita population.

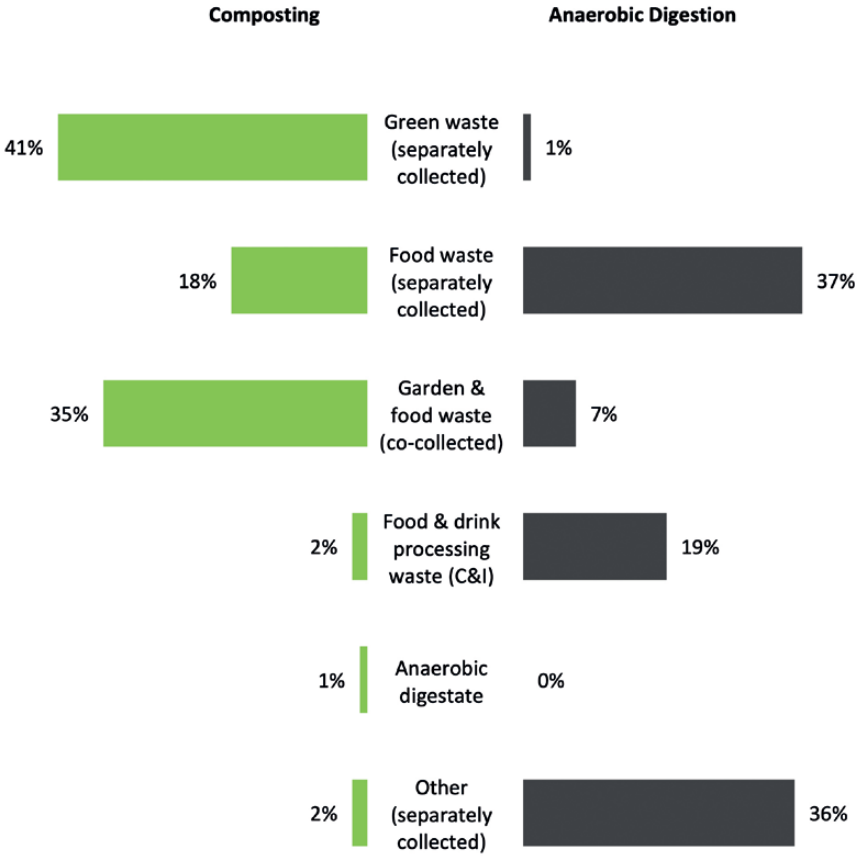
Flanders processes the most separately collected bio-waste per capita, with over 14-times more than the Czech Republic.

- AD = Anaerobic digestion
- CH = Switzerland
- NO = Norway
- UK = UK = United Kingdom
- tpa = tonnes per annum (tonnes a year)
- Metric units have been used throughout this report

KEY MESSAGES

- Green, garden & food, and food waste dominate at composting sites
- Food waste and 'other' non-specified wastes dominate at AD sites
- Composting facilities process mainly household waste
- Anaerobic digestion facilities process household and commercial and industrial waste in similar amounts
- 78% of bio-waste at composting facilities is municipal
- 49% of bio-waste at AD facilities is municipal

TYPES OF BIO-WASTES COLLECTED FOR BIOLOGICAL TREATMENT (MUNICIPAL, COMMERCIAL & INDUSTRIAL SOURCES)
(percentages based on mass)



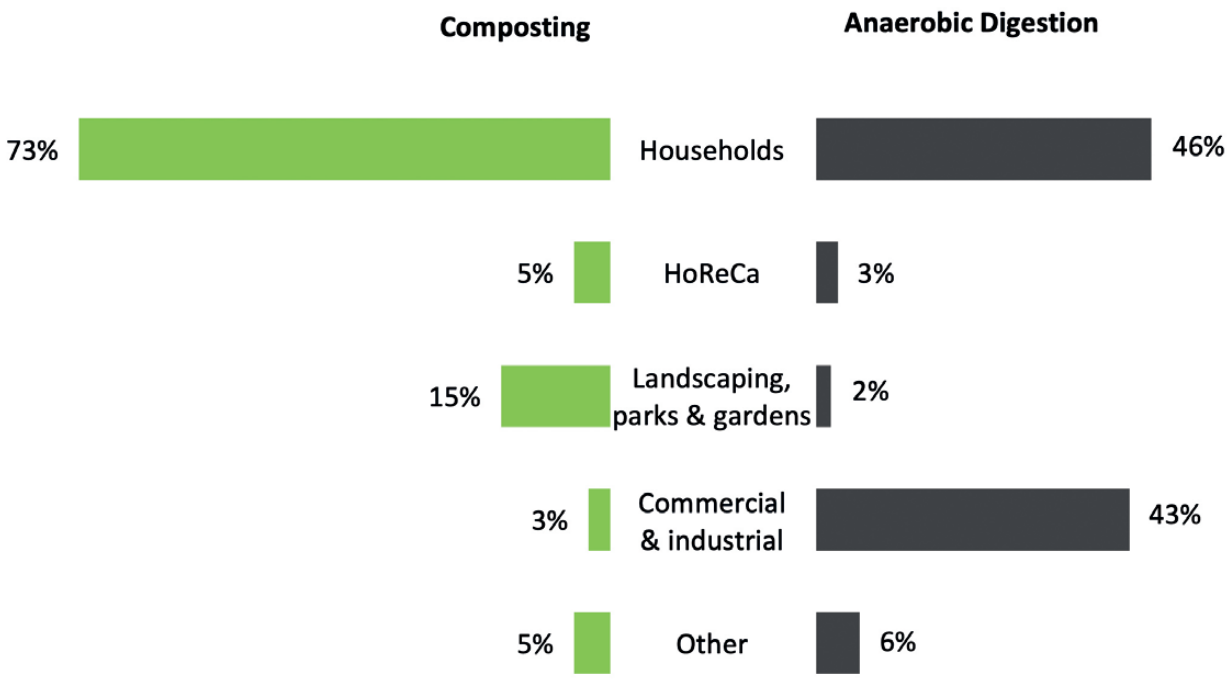
76 %
COMPOSTING
- Green waste
- Garden & food waste

73 %
ANAEROBIC DIGESTION
- Food waste
- 'Other'

MUNICIPAL WASTE DEFINITION
Municipal waste consists of waste collected by or on behalf of municipal authorities and disposed of through waste management systems. Municipal waste consists mainly of waste generated by households, although it also includes similar waste from sources such as shops, offices and public institutions.
It include bio-wastes from households and the HoReCa sector.

TYPES & SOURCES OF BIO-WASTE

SOURCES OF BIO-WASTE TREATED IN COMPOSTING AND ANAEROBIC DIGESTION PLANTS
(percentage based on mass)



78 %
COMPOSTING
Municipal waste

49 %
ANAEROBIC DIGESTION
Municipal waste

HoReCa = Wastes from HOtels, REstaurants and CAtering establishments
C&I = Commercial and industrial
EU27 = The 27 European Union countries after the UK left the EU (1 February 2020 onwards)

KEY MESSAGES

- 38 million tpa of municipal bio-waste composted & digested in the EU27
- 47 million tonnes of municipal bio-waste composted & digested in the EU27, CH, NO & UK
- 70 % of separately collected municipal bio-waste is sent for composting in the EU27
- 30 % of separately collected municipal bio-waste is sent for anaerobic digestion in the EU27
- 78 million tpa of bio-waste in the EU27 needs to be collected and treated by 2035 (additional 40 million tpa)
- Current recycling rate is 17% of MSW (EU27) through bio-waste collection and treatment

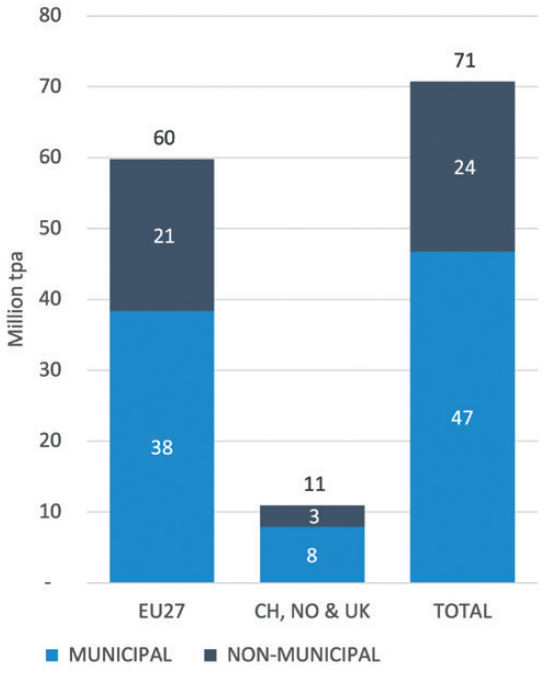
MUNICIPAL BIO-WASTE AS A FRACTION OF TOTAL BIO-WASTE COLLECTED FOR COMPOSTING & ANAEROBIC DIGESTION

64 % EU27

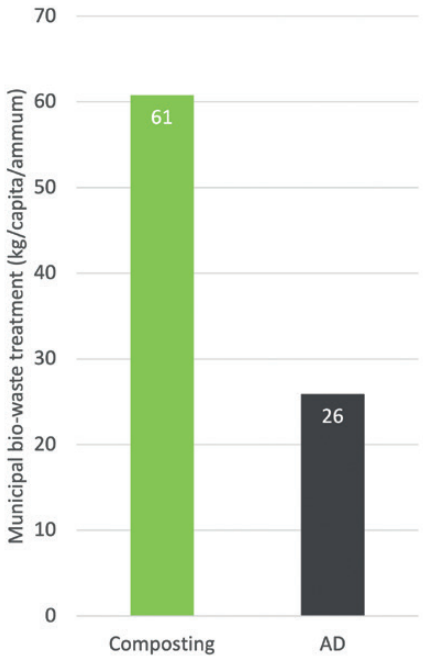
72 % CH, NO & UK

66 % TOTAL

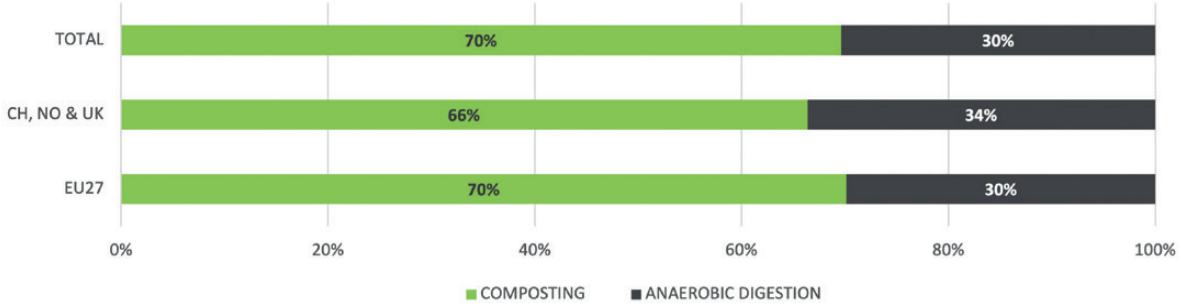
QUANTITIES OF MUNICIPAL AND NON-MUNICIPAL BIO-WASTES COLLECTED AND TREATED



AMOUNT OF MUNICIPAL BIO-WASTE TREATED PER PERSON IN THE EU27



FRACTION OF COLLECTED MUNICIPAL BIO-WASTE SENT FOR COMPOSTING & ANAEROBIC DIGESTION

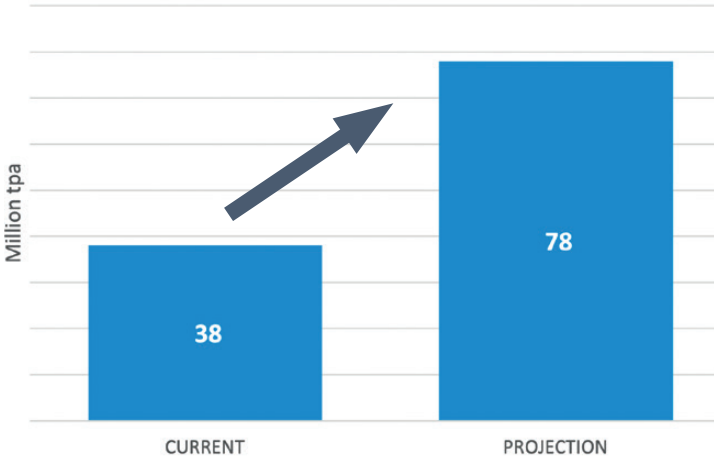


MUNICIPAL BIO-WASTE

WASTE FRAMEWORK DIRECTIVE RECYCLING TARGETS
By 2025, the preparing for re-use and the recycling of municipal waste shall be increased to a minimum of 55%, 60% and 65% by weight by 2025, 2030 and 2035, respectively.

35% OF MUNICIPAL WASTE NEEDS TO BE COLLECTED AND TREATED BY 2035
As the proportion of bio-waste in high and upper-middle income countries ranges between 34% and 46% of total municipal waste, ECN estimates that 35% of the EU's municipal solid waste would need to be separately collected as bio-waste to meet the 2035 65% recycling target.

PROJECTIONS TO REACH THE EU's 65% MSW RECYCLING TARGET INCREASE IN SEPARATELY COLLECTED & TREATED BIO-WASTE (EU27)



17 % RECYCLING OF MSW → **35 %** RECYCLING OF MSW

An additional 40 million tonnes per annum of bio-waste needs to be separately collected and treated in composting and anaerobic digestion plants by 2035 to meet the 65% MSW recycling/re-use target.

COMPARISON OF ECN DATA WITH EUROSTAT DATA FOR MUNICIPAL BIO-WASTE ESTIMATES

ECN's estimates for separately collected and treated bio-waste from municipal sources are similar to those estimated by EUROSTAT, differing by only 4%.

MUNICIPAL BIO-WASTE	Tonnes	kg/capita/annum
ECN Data EU27	38,3370,00	87
Eurostat Data EU27	39,898,000	89
% Difference	**4%**	**2%**

MSW = Municipal solid waste
EUROSTAT data for year 2019. Data from the sum of the EU27 member states used in the calculations.

CIC Members

- Ordinary Members
- Associated Members
- General Association Members

SCAN ME

CIC KEY DATA

140 Members of the CIC	**8,1 tons** Of organics waste treated yearly
1.8 billion euro the turnover of the biowaste recycling sector	**80%** Of Italian people covered by source separation of organic waste
2.2 million tons of compost every year	**60 – 65 million €** as carbon and nutrient values of compost
4.3 million tons of CO_2 equivalent saved as avoided disposal in landfill	**37%** of the Italian total compost production awarded the CIC quality compost label
75% of Italian biowaste are treated in CIC's plant	More than **1400** number of annual surveys on the quality of organic waste from separated collection
102 products certified and labelled with the CIC's compostability scheme	**80 million tons** recycled and 100 m^3 avoided in landfill in 30 years
120 million m^3 Of Biomethane from anaerobic digestion of biowaste	**698 GWh** eletrical energy from biogas produced by anaerobic digestion plants

WHO WE ARE

The Italian Composting and Biogas Association is the unique association in Italy for recovery and recycling of the organic waste and, since 30 years, CIC's mission is to promote recycling and prevention of biowaste, enhance compost quality and market, organise technical training for the composting sector and assist government bodies in improving biowaste recycling.

Among 140 Members of CIC there are public and private compost producers, local authorities and others involved in compost productions, such as machinery and equipment constructors, growing media producers, research institutes, and much more.

Via Boncompagni, 93 Roma | Tel. +39 06.68584295 | cic@compost.it
www.compost.it | www.compostabile.com | @ConsorzioCIC

CONSORZIO ITALIANO COMPOSTATORI

DALLA TERRA ALLA TERRA

the circular economy of biowaste

CIC's label

54 AWARDED PRODUCTS

PLANTS IN THE QAS **48**

104 CERTIFIED PRODUCTS

LICENSED COMPANIES **40**

1992 – 2022

The CIC is turning 30!

Giovedì 23 Giugno 2022
ore 10:00 – 17:00

c/o Nazionale Spazio Eventi
Via Palermo 10 - ROMA

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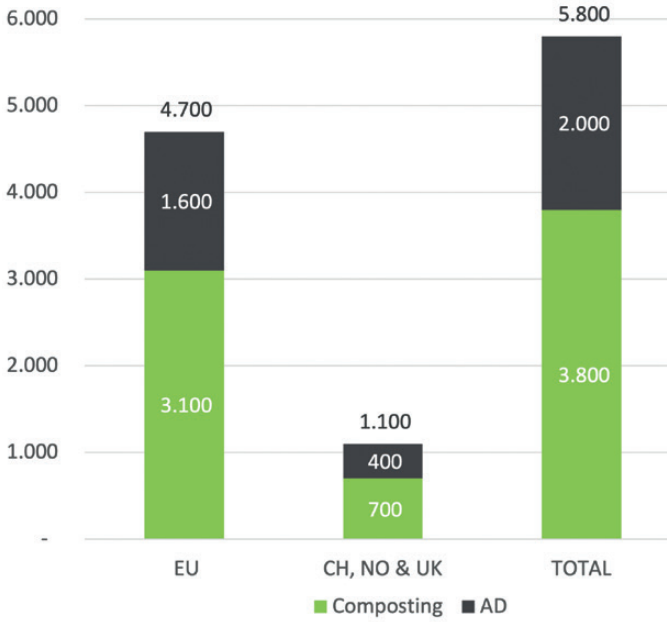
www.compost.it | www.compostabile.com | @ConsorzioCIC

KEY MESSAGES

- There are 5,800 bio-waste treatment facilities in the EU27, CH, NO & UK
- 66% are composting facilities (3,800)
- 34% are anaerobic digestion facilities (2,000)
- 8,000 tpa is the median amount treated at a composting facility
- 13,000 tpa is the median amount treated at an AD facility
- Every composting facility serves 120,000 people
- Every AD facility serves 225,000 people
- 88% of composting facilities treat bio-waste only
- 48% of AD facilities treat bio-waste only
- Only 5% of composting facilities treat anaerobic digestate at co-located facilities
- 6,000 AD and composting facilities will be needed to treat the projected increases in municipal bio-waste to meet 35% recycling of MSW (municipal sources only)

ESTIMATED NUMBER OF COMPOSTING & AD FACILITIES TREATING SEPARATELY COLLECTED BIO-WASTE
(municipal & non-municipal sources)



66 %
COMPOSTING

34 %
ANAEROBIC DIGESTION

There are an estimated 3,800 composting facilities and 2,000 anaerobic digestion plants processing bio-waste (municipal and non-municipal sources) across the EU27 plus NO, CH and UK.
On average, each AD facility processes more waste and serves a greater population than a composting facility.

THOUSAND TONNES PER FACILITY
(minimum ●, 25 percentile ✶, median ■, 75 percentile ✶ & maximum ●)

THOUSAND CAPITA PER FACILITY
(minimum ●, 25 percentile ✶, median ■, 75 percentile ✶ & maximum ●)

COMPOSTING & ANAEROBIC DIGESTION FACILITIES

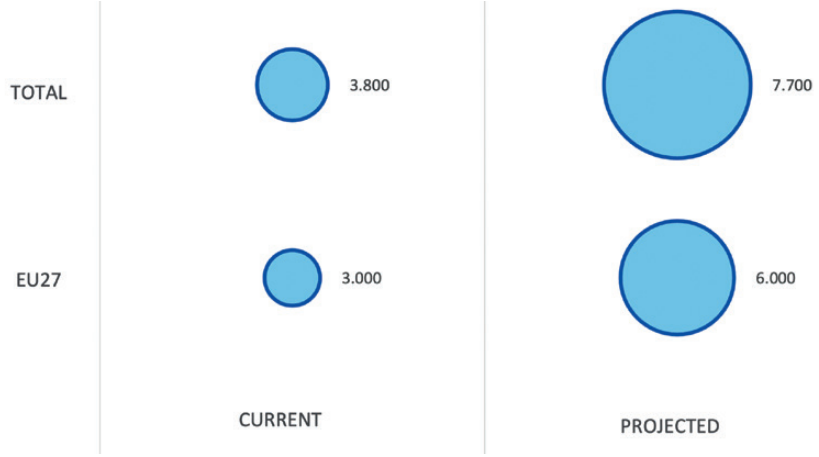
COMPOSTING FACILITIES

- Bio-waste only (88%)
- Co-composting bio-waste & anaerobic digestate (5%)
- Co-composting bio-waste & sewage sludge (7%)

ANEROBIC DIGESTION FACILITIES

- Bio-waste only (48%)
- Co-composting bio-waste & agricultural crops/ manures (25%)
- Co-composting bio-waste & sewage sludge (28%)

ESTIMATED INCREASES TO RECYCLE 35% OF MUNICIPAL WASTE
(facilities to treat municipal bio-waste only)



If the total estimated amount of bio-waste (municipal and non-municipal sources) were to double, then a total of 11,600 composting and AD facilities would be needed.

INFRASTRUCTURE DEVELOPMENT

	COMPOST	ANAEROBIC DIGESTION	TOTAL
CURRENT	3,800	2,000	5,800
PROJECTED	7,600	4,000	11,600

- At integrated facilities, each composting and AD plant has been counted separately even though they are located at the same site.
- Estimates relate to permitted facilities only.
- They exclude small scale on-farm or community operated facilities that do not require an environmental/waste permit/licence.
- They also exclude facilities treating solely agricultural feedstocks (e.g. crops and manures), sewage treatment plants and mixed waste facilities, such as mechanical biological treatment.
- Scaled up estimates assume that the average size of each facility remains the same.

KEY MESSAGES

- The composting sector employs between 11,000 and 18,000 FTEs (all bio-wastes; EU27, CH, NO & UK)
- The AD sector employs between 2,000 and 5,500 FTEs (all bio-wastes; EU27, CH, NO & UK)
- Composting employs 1 FTE per 4,200 tonnes of bio-waste
- Anaerobic digestion employs 1 FTE per 5,300 tonnes of bio-waste
- Projected employment increases to meet the EU's 2035 recycling target are in the region of 17,000 to 31,000 FTEs (EU27, CH, NO & UK)
- Bio-waste processing contributes between 1-2 billion EUROS to the European economy every year

ESTIMATED RANGE IN NUMBER OF CURRENT FULL TIME EQUIVALENT EMPLOYEES AT BIO-WASTE TREATMENT FACILITIES (MUNICIPAL & NON-MUNICIPAL BIO-WASTES)

11,000 - 18,000 FTEs
COMPOSTING

2,000 - 5,500 FTEs
ANAEROBIC DIGESTION

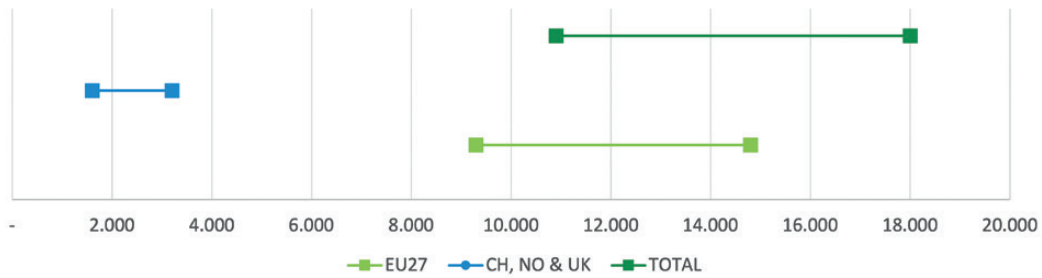
	FTEs PER FACILITY	TONNES PER FTE
COMPOSTING	4.7	4200
ANAEROBIC DIGESTION	4.9	5300

There are more people employed on average at each AD facility compared to composting. This reflects the differences in the calculated average throughput at each type of facility (8 k tpa for composting versus 13 k tpa for AD).

Anaerobic digestion plants are less labour intensive compared to composting, reflecting the differences in technologies and processing.

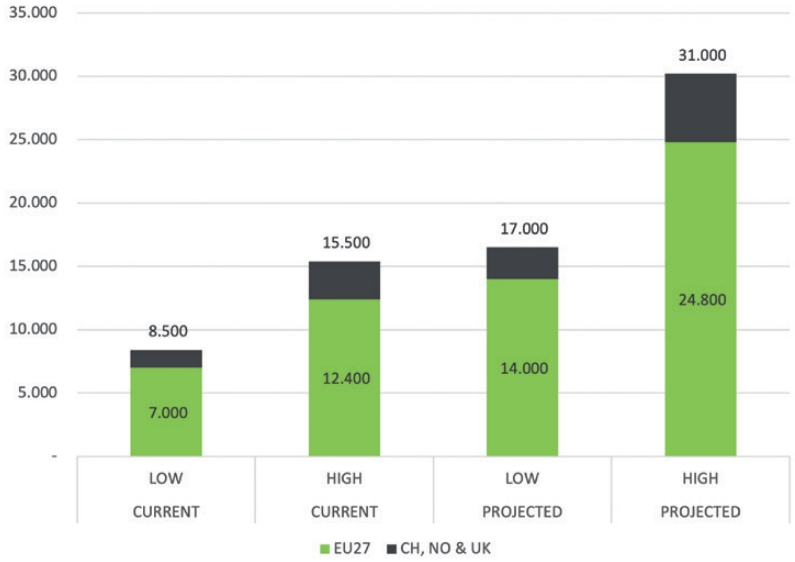
COMPOSTING ESTIMATED RANGE IN NUMBER OF CURRENT FTEs

ANAEROBIC DIGESTION ESTIMATED RANGE IN NUMBER OF CURRENT FTEs



EMPLOYMENT

ESTIMATED INCREASE IN NUMBER OF CURRENT FTEs TO MEET 35% BIO-WASTE RECYCLING (MUNICIPAL BIO-WASTE)



Looking at municipal bio-waste, the number of FTE employees would need to increase from between 8.5 k - 15.5 k to 17 k – 31 k to achieve 35% MSW recycling (EU27, CH, NO and UK).

CURRENT AND PROJECTED GDP CONTRIBUTIONS THROUGH BIO-WASTE PROCESSING OF MUNICIPAL & NON-MUNICIPAL BIO-WASTE in the EU27, CH, NO & UK (Values shown in millions of Euros)

Using OECD data for the contribution to gross domestic product per FTE employee across the EU27, CH, NO and UK, it was estimated that the bio-waste processing sector contributes between 1-2 billion EUROS to the European economy every year. This has potential to rise to 2-4 billion Euros should the projected increase in bio-waste processing be realised.

- FTE = Full time equivalent
- GDP = Gross domestic product
- The range in estimated FTEs is due to scaling up of estimates based on both tonnes of bio-waste processed and the number of employees per facility.
- Estimates exclude back-office staff and employees in ancillary sectors, such as agronomic advisers, spreading services, energy advisers etc.
- Growth in the number of employees at bio-waste treatment sites may displace some employees involved in waste disposal activities, such as landfilling; however, it is unclear to what extent this will occur.
- Data on GDP per person employed were obtained from OECD.Stat and converted from US Dollars to EURO at an exchange rate of 0.9. A weighted average (based on population) was calculated for CH, NO and UK.

Quanturi

Automated Compost Temperature Monitoring

The wireless Quanturi system provides real-time and continuous temperature monitoring to optimize the transformation process of fermentable materials, as biowaste or green waste, into compost. The Quanturi temperature probes are yellow, easy to spot, extremely robust and compatible with all types of composting platforms.

Safety and compliance

- Continuous wireless measurement with minimal manual effort and reduced risks of work accidents
- Real-time visualization with any computer, tablet, or smartphone
- Instant temperature visualization and conformity reports in accordance with the relevant sanitary regulations
- Reduction of labor costs

Proven quality

- Robust temperature probes developed for extreme conditions
- Compatible with all types of composting platforms
- In operation worldwide

Individualized quality control

- Simple online application with individual process controlling
- Automated monitoring of definable temperatures from fermentation to maturation
- Hourly measurements, process data available up to one year
- Virtual map to visualize probe locations

Fire prevention

- Individually adjustable temperature levels for alert messages to up to 3 mobile phone numbers
- Overview about temperature data outside of business hours

Further information on our homepage:
www.quanturi.com/pages/compost

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Our soils are sick. Quality composts can regenerate them.

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Regeneration for a clean and healthy soil

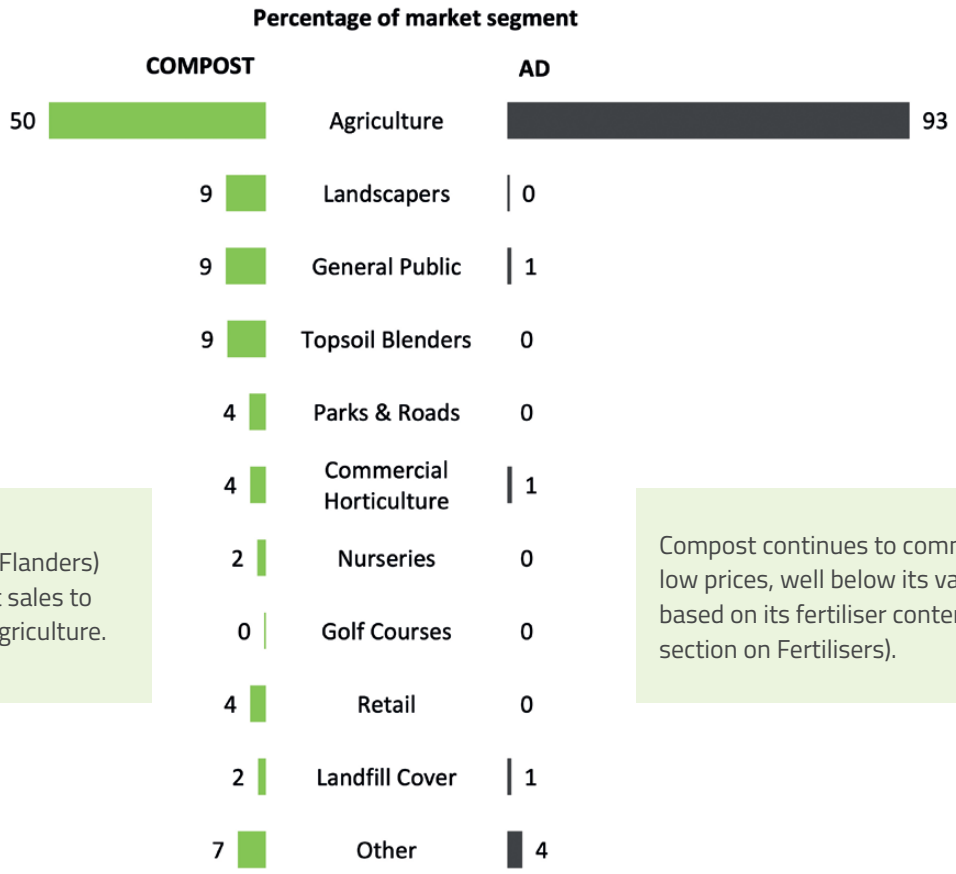
Promoted by University of Bologna, Coldiretti, Novamont and Turin Polytechnic, **Re Soil Foundation** aims to protect one of our planet's most important and neglected natural resources: soil. To combat soil degradation Re Soil plans to foster activities in the sectors of scientific research, technology, education and information to grow the understanding of soil health, quality of life and system decarbonization.

resoilfoundation.org | **Re Soil Foundation**

KEY MESSAGES

- Agriculture was the dominant market sector for both compost and anaerobic digestate
- Digestate was valued at between EUR 0 to minus 10 per tonne
- Compost was valued at a weighted average price of EUR 10.1 / tonne (fresh mass) across all market sectors
- 46 million tpa of compost would be produced from municipal & non-municipal bio-waste by 2035 should input feedstocks double
- The total market value of compost in the EU27, CH, NO & UK would increase from approximately EUR 210 million to EUR 470 million should input feedstocks double

MARKET SECTORS FOR COMPOST & DIGESTATE (%)



Denmark and Belgium (Flanders) relied more on compost sales to the public rather than agriculture.

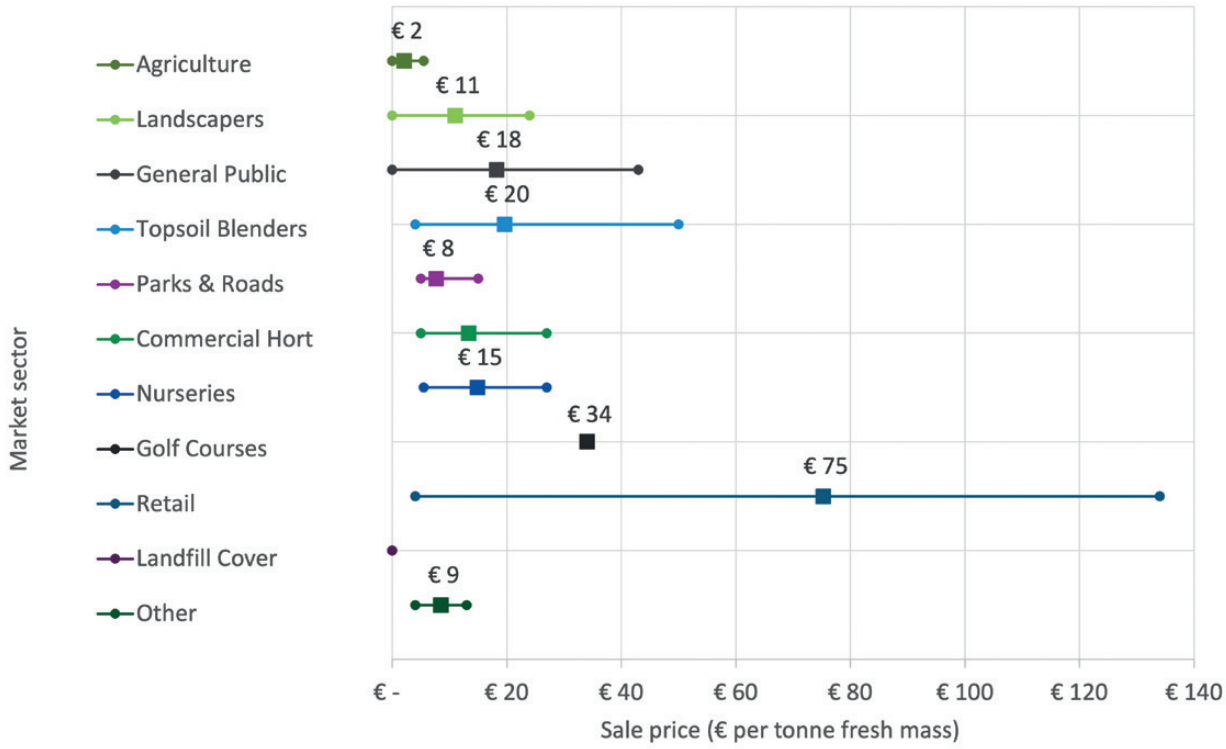
Compost continues to command low prices, well below its value based on its fertiliser content (see section on Fertilisers).

ESTIMATED INCREASES IN COMPOST PRODUCTION FROM BIO-WASTE (MUNICIPAL & NON-MUNICIPAL) BY 2035 ASSUMING DOUBLING OF INPUT FEEDSTOCKS

	COMPOST CURRENT (tpa)	COMPOST POTENTIAL (tpa)
EU27	17.6	39.2
CH, NO & UK	3.4	7.2
TOTAL	21.1	46.4

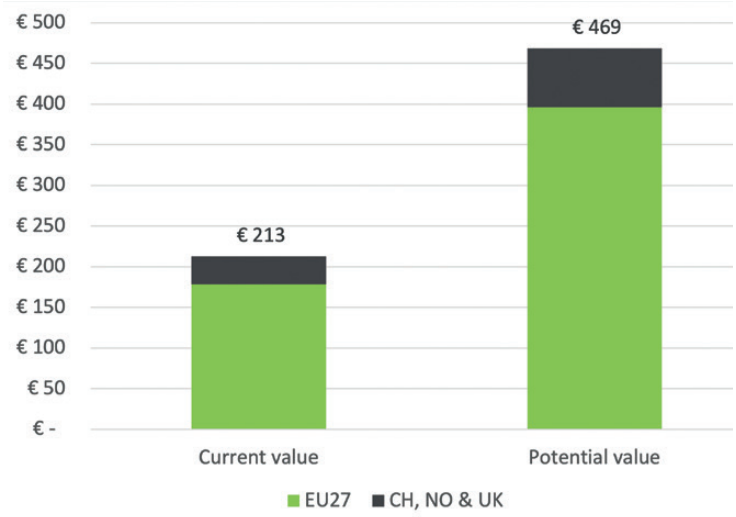
COMPOST MARKETS

MINIMUM, MEAN AND MAXIMUM COMPOST PRICES (EUROS PER TONNE; FRESH MASS)



PROJECTED VALUE OF COMPOST SALES BY 2035 (MUNICIPAL & NON-MUNICIPAL) ASSUMING DOUBLING OF INPUT FEEDSTOCKS

(Price per tonne of compost in millions EUROS)



- Data on compost markets relate to fresh matter
- Conversion of bio-waste to compost was assumed to be 50% for EU27 and 54% for CH, NO & UK
- Projected increases in market value assumed that the average price of compost remained static at EUR 10.1/tonne
- Limited data were available on the markets for anaerobic digestate, precluding any in-depth analysis and projected increases
- The type of anaerobic digestate (whole liquid or solid), fibre or liquor was not specified

KEY MESSAGES

- All European soils suffer from erosion
- 2% of arable land and 16% of moderately/severely eroded agricultural land could benefit from compost application at 10 tonnes per hectare
- The potential area that could benefit from compost application could double by 2035 if recycling targets are met
- Nine countries currently manufacture sufficient compost to apply to their moderately/severely water eroded agricultural soil
- Compost production in all countries would cover less than 10% of arable land when applied at 10 tonnes per hectare

CURRENT AND POTENTIAL FRACTION OF ARABLE LAND AND ERODED AGRICULTURAL SOILS THAT COULD BENEFIT FROM COMPOST APPLICATION

(Compost spread at 10 tonnes per hectare per annum)

	COMPOST (million tonnes)	FRACTION OF ARABLE LAND	FRACTION OF MODERATE/ SEVERELY WATER ERODED LAND
CURRENT	2.1	2%	16%
POTENTIAL	4.6	4%	34%

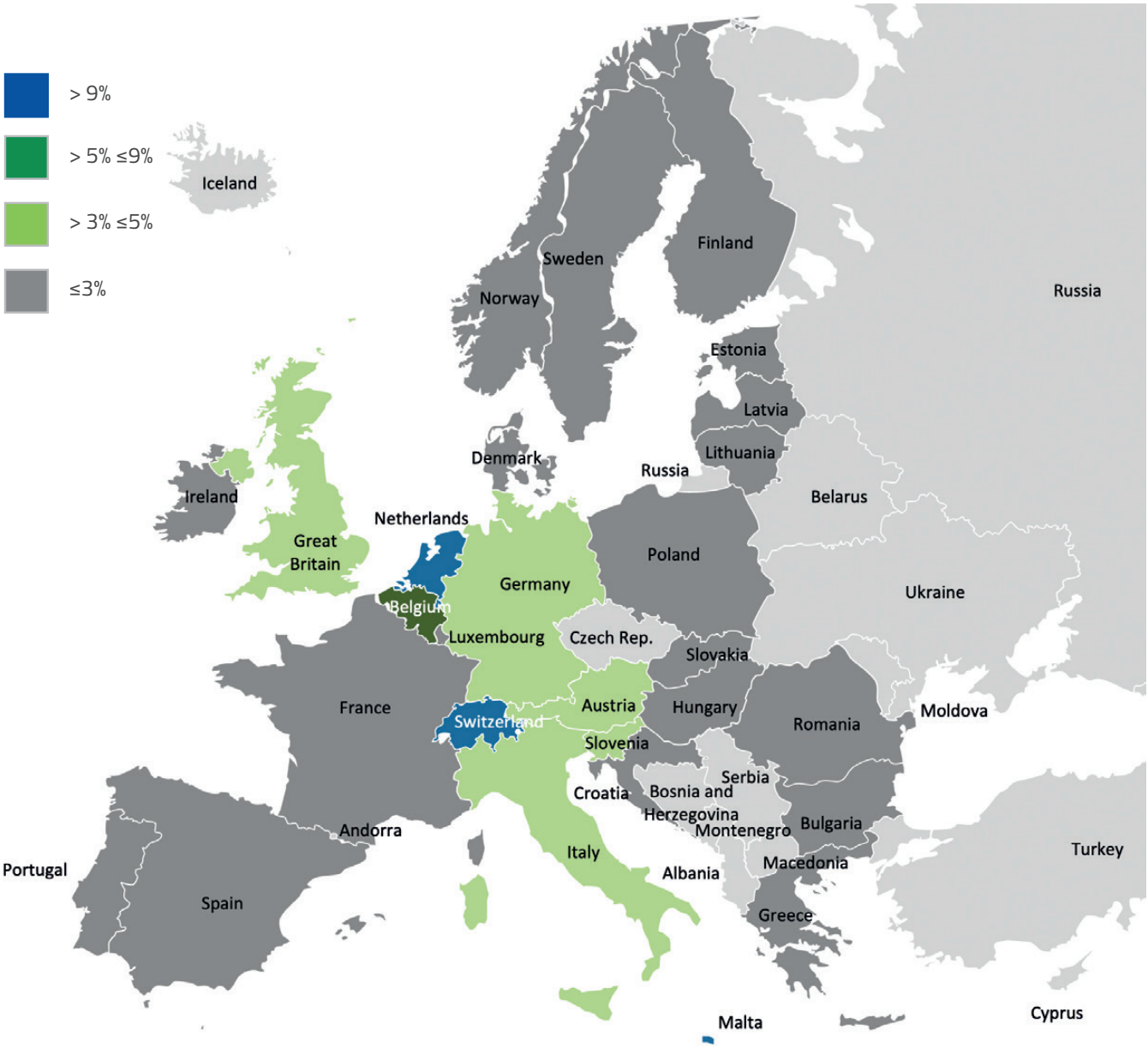
COUNTRIES THAT CURRENTLY MANUFACTURE MORE THAN ENOUGH COMPOST TO APPLY TO ALL OF THEIR MODERATELY/SEVERELY WATER ERODED AGRICULTURAL SOIL

(Compost spread at 10 tonnes per hectare per annum)

Most European countries don't manufacture enough compost to apply to their eroded soils

CARBON RECYCLING & SOIL IMPROVEMENT

FRACTION OF ARABLE LAND IN EACH COUNTRY THAT COULD BENEFIT FROM COMPOST PRODUCED AT CURRENTLY ESTIMATED AMOUNTS
(applied at 10 tonnes / hectare / annum)



- Data on compost markets relate to fresh matter
- Area of total agricultural land suffering from moderate or severe water erosion (EUROSTAT)
- Area of arable land (EUROSTAT)

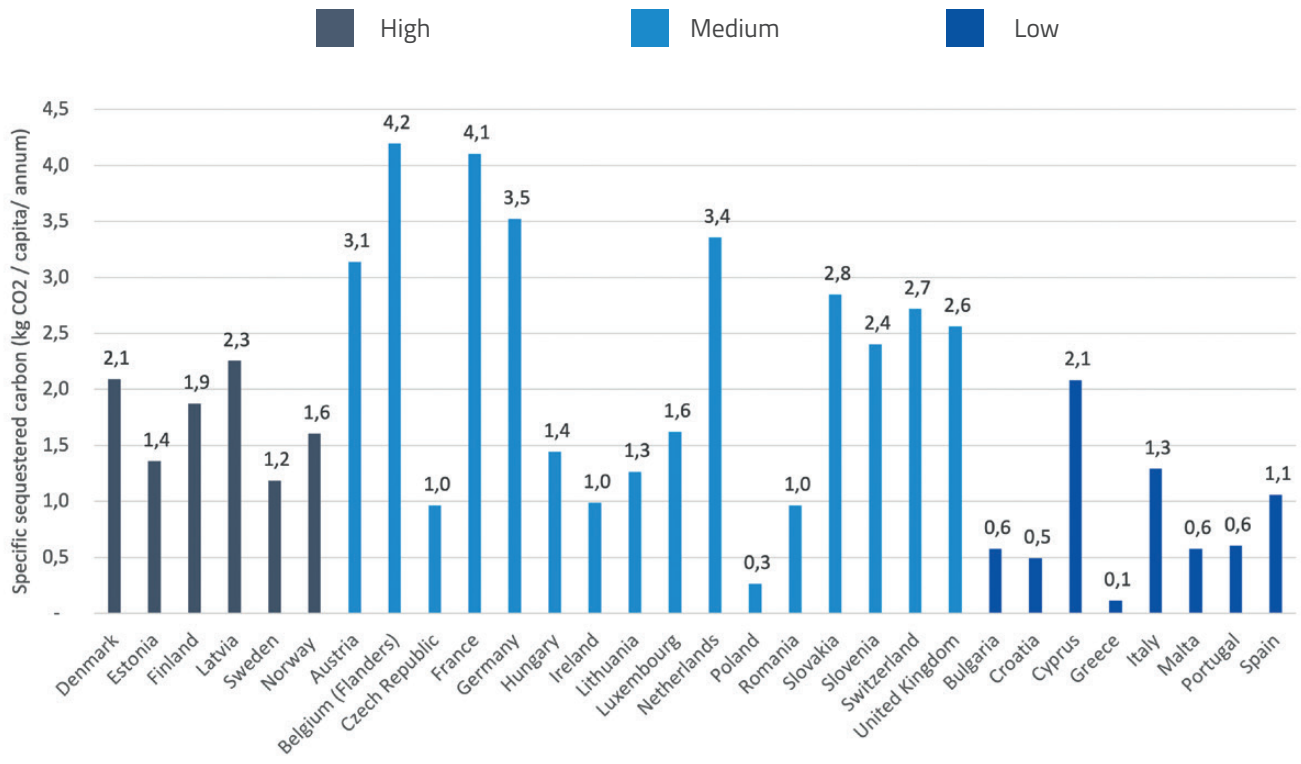
KEY MESSAGES

- Countries located between 45-55° latitude sequester more carbon in soil per capita than those located above 55° latitude, despite having lower potential SOC sequestration rates
- Countries located below 45° latitude sequester the lowest rates of SOC per capita, despite their soils having the greatest need of organic matter due to desertification
- The EU27, CH, NO and UK currently sequester in the region of 1.2 million tonnes of carbon dioxide equivalents a year on agricultural soils. This is valued at about 92 million EUR based on the current carbon dioxide trading value
- These annual sequestration values are equivalent to just over 19 million urban tree seedlings grown for 10 years; a figure that could rise to 42 million seedlings a year

MEDIAN QUANTITIES OF CARBON SEQUESTERED IN SOIL PER CAPITA THROUGH COMPOST APPLICATION IN EUROPEAN COUNTRIES, GROUPED ACCORDING TO ASSUMED SEQUESTRATION RATES

GROUPING	MEDIAN SEQUESTRATION RATE ($kg\ CO_2$-eq / capita / annum)
All countries	1.5
Countries above 55° lattitude	1.7
Countries between 45-55° latti-tude	2.5
Countries below 45° lattitude	0.6

CALCULATED QUANTITIES OF CARBON SEQUESTERED IN SOIL PER CAPITA THROUGH COMPOST APPLICATION IN EUROPEAN COUNTRIES, GROUPED ACCORDING TO ASSUMED SEQUESTRATION RATES



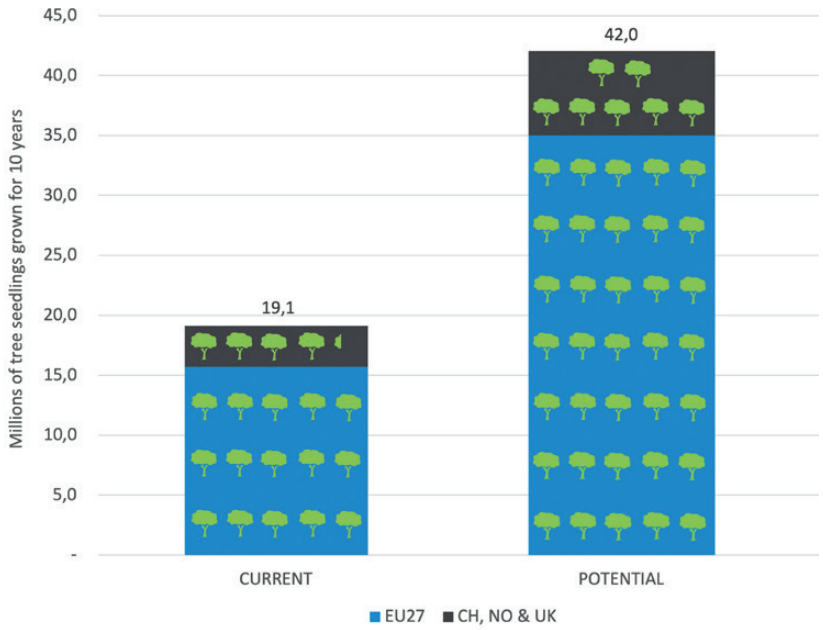
CARBON SEQUESTRATION IN SOIL

ESTIMATED VALUE OF COMPOST APPLIED TO SOIL IN TERMS OF INCREASES IN SOIL ORGANIC CARBON AND CARBON DIOXIDE EQUIVALENTS

	CURRENT COMPOST PRODUCTION (milion tonnes)	ESTIMATED CONTRIBUTION TO SOIL ORGANIC CARBON (thousand tonnes)	CARBON DIOXIDE EQUIVALENTS (thousand tonnes)	TRADING VALUE OF CARBON DIOXIDE (million EUR)
EU27	18	258	950	€ 76
CH, NO & UK	3	55	203	€ 16
TOTAL	21	314	1,153	€ 92

SOIL ORGANIC CARBON SEQUESTRATION EQUIVALENTS EXPRESSED AS THE NUMBER OF URBAN TREE SEEDLINGS GROWN FOR 10 YEARS

(estimates for current and potential bio-waste treatment shown)



- SOC = soil organic carbon
- Estimates for the potential amounts of carbon that could be locked up (sequestered) in soil were based on research published by the International Solid Waste Association (ISWA): Gilbert, J., Ricci M. & Ramola, A. (2020) Quantifying the Benefits of Applying Quality Compost to Soil. ISWA, Rotterdam
- Countries were classified as having either low, medium or high carbon sequestration potential (30, 50 and 70 kg soil organic carbon per tonne of compost [dry matter] per hectare per year, respectively) based on the latitude into which the majority of their land mass falls, namely: below 45°= low sequestration rate; between 45-55°, medium sequestration rate; and above 55° = high sequestration rate
- It was assumed that 49% of each country's manufactured compost would be applied to agricultural soils at typical application rates and that the soils had not reached their maximum levels of organic carbon. All other market sectors were disregarded
- Carbon dioxide equivalents were priced at EUR 80 per tonne (the average trading price in 2022)
- Sequestration equivalents were calculated using the following online calculator: www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

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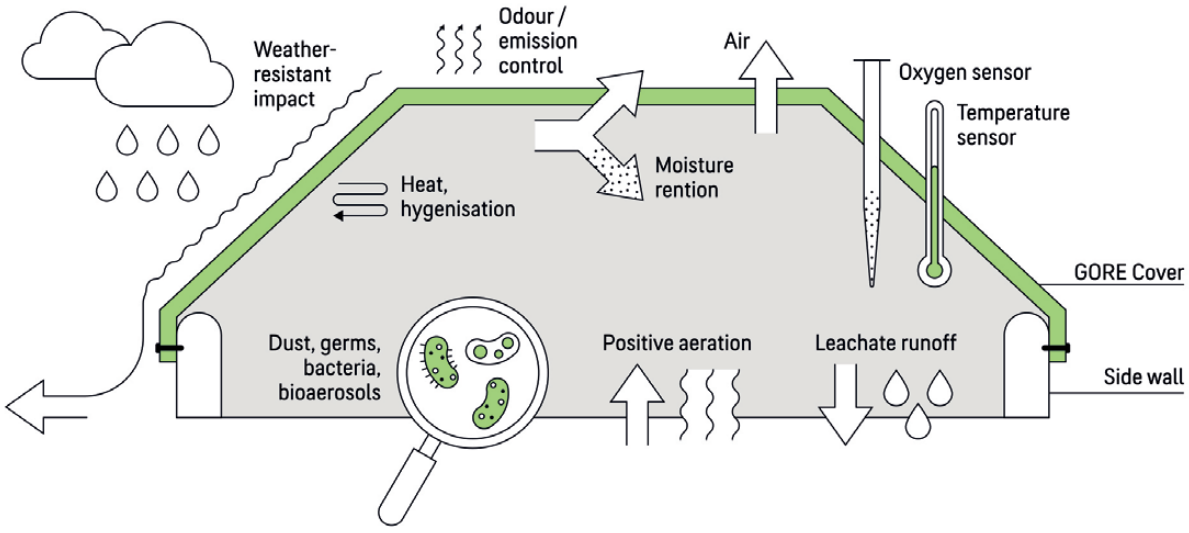
* Best Available Technique acc. to the Best Available Techniques Reference Document (BREF) for Waste Treatment 2018 under the Industrial Emissions Directive 2010/75/EU (IPPC)

◇ ADDRESSING THE NEEDS FOR THE PRODUCTION OF HIGH-QUALITY COMPOST THROUGH GORE® COVER SYSTEM



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KEY MESSAGES

- 25% of all compost produced in the EU27, CH, NO and UK was certified to the ECN's Quality Assurance Scheme (5.3 million tpa out of a total of 21.7 million tpa)
- The total nutrient value (NPK) of ECN quality assured compost almost quadrupled over 15 months
- On average, one tonne of certified compost contained nutrients valued at 41 EUR per tonne (FM)
- The recent rise in global fertiliser prices means that compost and digestate are a cost-effective source of NPK plant nutrients

ECN QUALITY ASSURANCE SCHEME CERTIFIED COMPOST

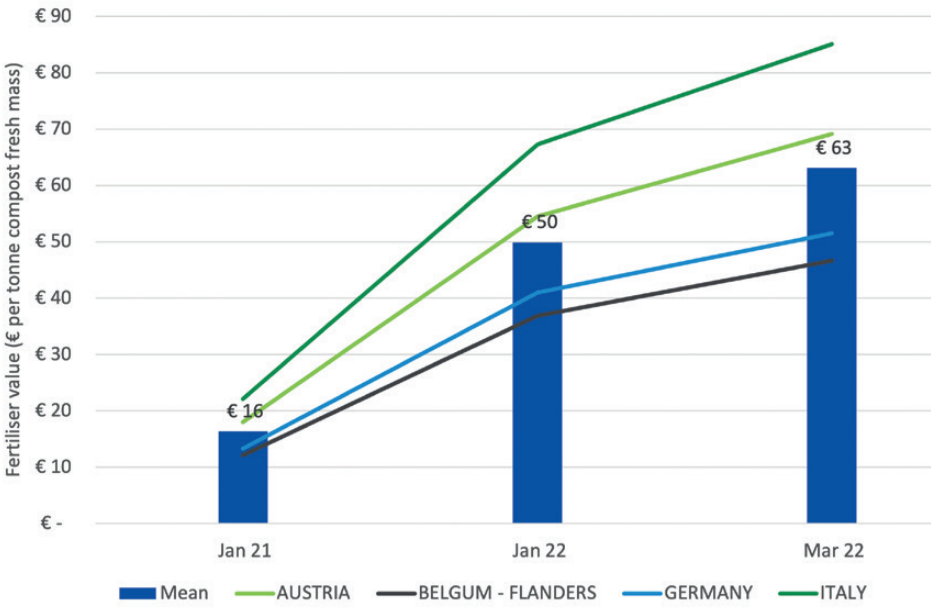
	CERTIFIED COMPOST PRODUCED (thousand tpa)
AUSTRIA	393
BELGUM - FLANDERS	472
GERMANY	3,750
ITALY	722
TOTAL	5,337

N = 1.2% FM

P = 0.5% FM as P_2O_5

K = 0.7% FM as K_2O

INCREASE IN VALUE OF TOTAL NPK CONTENT OF ECN-QAS CERTIFIED COMPOST FROM JANUARY 2021 TO MARCH 2022

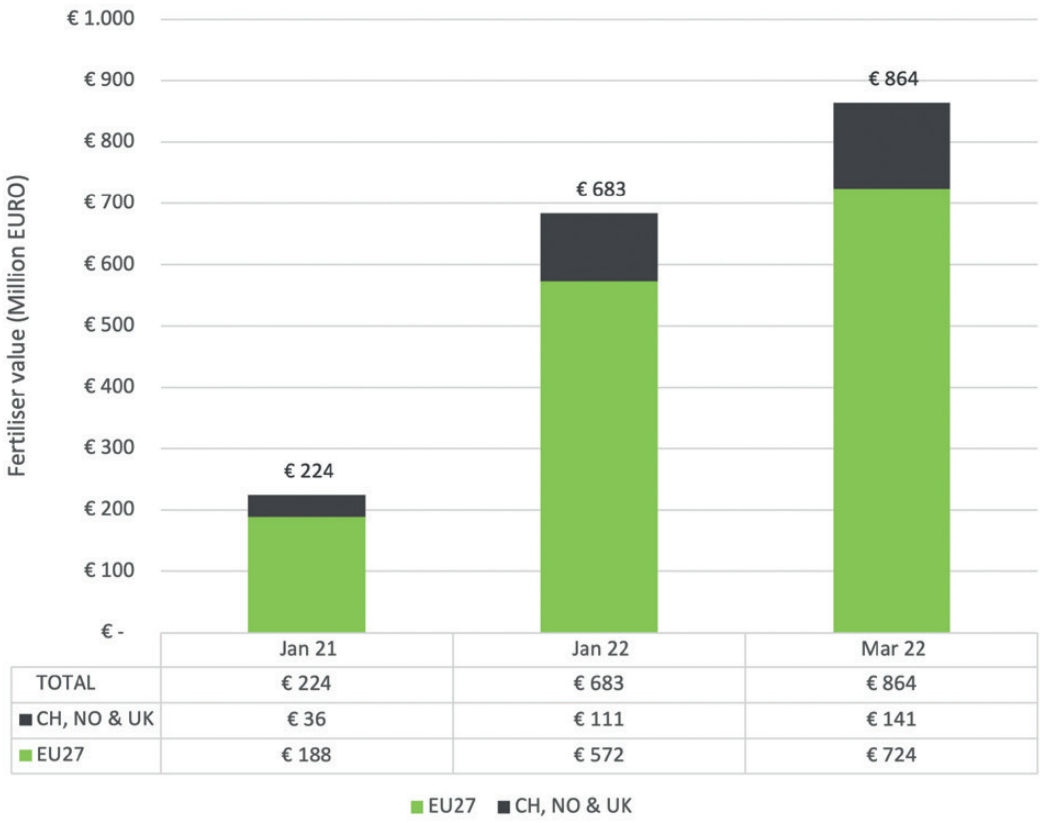


FERTILISER VALUE

ESTIMATED QUANTITIES OF NPK FERTILISERS IN EUROPEAN COMPOST
(total nutrients, not readily available)

	N	P as P_2O_5	K as K_2O
	(thousand tonnes)		
EU27	142	53	84
CH, NO & UK	28	10	16
TOTAL	170	63	100

INCREASES IN NUTRIENT VALUE IN COMPOST (Jan 21 to March 22)



One tonne of digestate contains NPK valued at EUR 26

- FM = Fresh matter
- N = nitrogen, P = phosphorus, K = potassium
- ECN-QAS = ECN's Quality Assurance Scheme
- Calculations for anaerobic digestate need to be treated with caution due to limited data and the large variability in water content due to differing AD processes
- NPK prices were obtained from https://ahdb.org.uk/GB-fertiliser-prices and converted from GBP to EURO

METHODOLOGY, DATA SOURCES & ABBREVIATIONS

ASSUMPTIONS

Metric units have been used throughout the report.

Data refer to separately collected bio-waste, and exclude mixed waste treatment, sewage sludges and agricultural wastes unless specifically stated.

Where bio-waste was pre-treated through anaerobic digestion prior to composting, data were accounted for as being composted in order to prevent double counting.

At integrated facilities, each composting and AD plant was counted separately even if they were located at the same site.

Estimates of the number of facilities related to permitted facilities only and excluded small scale on-farm or community operated facilities that did not require an environmental/waste permit/licence. Estimates also excluded facilities treating solely agricultural feedstocks (e.g. crops and manures), sewage treatment plants and mixed waste facilities, such as mechanical biological treatment.

Scaled up estimates assumed that the average size of each facility would remain the same.

The range in estimated full-time equivalents was due to scaling up of estimates based on both tonnes of bio-waste processed and the number of employees per facility. Estimates excluded back-office staff and employees in ancillary sectors, such as agronomic advisers, spreading services, energy advisers etc. It is recognised that growth in the number of employees at bio-waste treatment sites may displace some employees involved in waste disposal activities, such as landfilling; however, it is unclear to what extent this will occur and is not thought to materially affect the conclusions made in this report.

Detailed calculations for anaerobic digestate were not possible due to limited data and the large variability in water content of digestate due to differing AD processes. Moreover, the type of anaerobic digestate (whole liquid or solid), fibre or liquor was not specified. Collectively they precluded any in-depth analysis and estimated projected increases in quantities and nutrient content.

Data on compost markets relate to fresh matter.

Conversion of bio-waste to compost was assumed to be 50% for EU27 and 54% for CH, NO & UK (based on ECN survey data).

Projected increases in market value assumed that the average price of compost remained static at EUR 10.1/tonne.

Estimates for the potential amounts of carbon that could be locked up (sequestered) in soil were based on research published by the International Solid Waste Association (ISWA): Gilbert, J., Ricci M. & Ramola, A. (2020) Quantifying the Benefits of Applying Quality Compost to Soil. ISWA, Rotterdam.

Countries were classified as having either low, medium or high carbon sequestration potential (30, 50 and 70 kg soil organic carbon per tonne of compost [dry matter] per hectare per year, respectively) based on the latitude into which the majority of their land mass falls, namely: below 45°= low sequestration rate; between 45-55°, medium sequestration rate; and above 55° = high sequestration rate.

It was assumed that 49% of each country's manufactured compost would be applied to agricultural soils at typical application rates and that the soils had not reached their maximum levels of organic carbon. All other market sectors were disregarded.

Carbon dioxide equivalents were priced at EUR 80 per tonne (the average trading price in 2022).

Sequestration equivalents were calculated using the following online calculator:
www.epa.gov/energy/greenhouse-gas-equivalencies-calculator

DATA SOURCES

Data on bio-waste processing, the number of composting/anaerobic digestion facilities, employment, nutritional content and markets were obtained from a survey of ECN members during the second half of 2021 and relate to the years 2019/2020 (n=17).

European Environment Agency (EEA) data (covering the year 2019) were used to supplement ECN survey data where gaps existed (n=9).

Country data were estimated using the 25 percentile of the calculated amount of bio-waste collected per capita where both ECN and EEA data were absent (n=4).

Population data were obtained from EUROSTAT (2019).

The population of Flanders (BE) was used instead of Belgium (as bio-waste data related solely to the region of Flanders). Data were sourced from Statistics Flanders.

Municipal solid waste arisings were obtained from EUROSTAT data for the year 2019. Data from the sum of the EU27 member states were used in the calculations.

Data on gross domestic product per person employed were obtained from OECD.Stat and converted from US Dollars to EURO at an exchange rate of 0.9. A weighted average (based on population) was calculated for CH, NO and UK.

Fertiliser prices were obtained from https://ahdb.org.uk/GB-fertiliser-prices and converted from GBP to EURO.

Area of total agricultural land suffering from moderate or severe water erosion (EUROSTAT).

Area of arable land (EUROSTAT).

ABBREVIATIONS

AD	Anaerobic digestion
C&I	Commercial and industrial
CH	Switzerland
ECN	European Compost Network
ECN-QAS	European Compost Network's Quality Assurance Scheme
EU27	The 27 European Union countries after the UK left the EU (1 February 2020 onwards)
EUR	EURO (currency)
FM	Fresh matter
FTE	Full time equivalent
GDP	Gross Domestic Product
HoReCa	HOtels, REstaurants and CAtering establishments
K	Potassium
MSW	Municipal solid waste
N	Nitrogen
NO	Norway
P	Phosphorus
SOC	Soil organic carbon
tpa	tonnes per annum (tonnes a year)
UK	United Kingdom

DEFINITIONS

Bio-waste

Biodegradable garden and park waste, food and kitchen waste from households, offices, restaurants, wholesale, canteens, caterers and retail premises and comparable waste from food processing plants.

It does not include forestry or agricultural residues, manure, sewage sludge, or other biodegradable waste such as natural textiles, paper or processed wood.

Municipal waste

Municipal waste consists of waste collected by or on behalf of municipal authorities and disposed of through waste management systems. It consists mainly of waste generated by households, although it also includes similar waste from sources such as shops, offices and public institutions. It includes bio-wastes from households and the HoReCa sector.

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ECN
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