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# Biogas production and nutrient recycling in the EU: the role of manure and agricultural residues

SCALE UP Training Session, 24/04/2024

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# EBA members operate across the whole biogases value chain

+240 companies

51 National Associations

Research Centres

# Europe produced 21 bcm of biogases in 2022

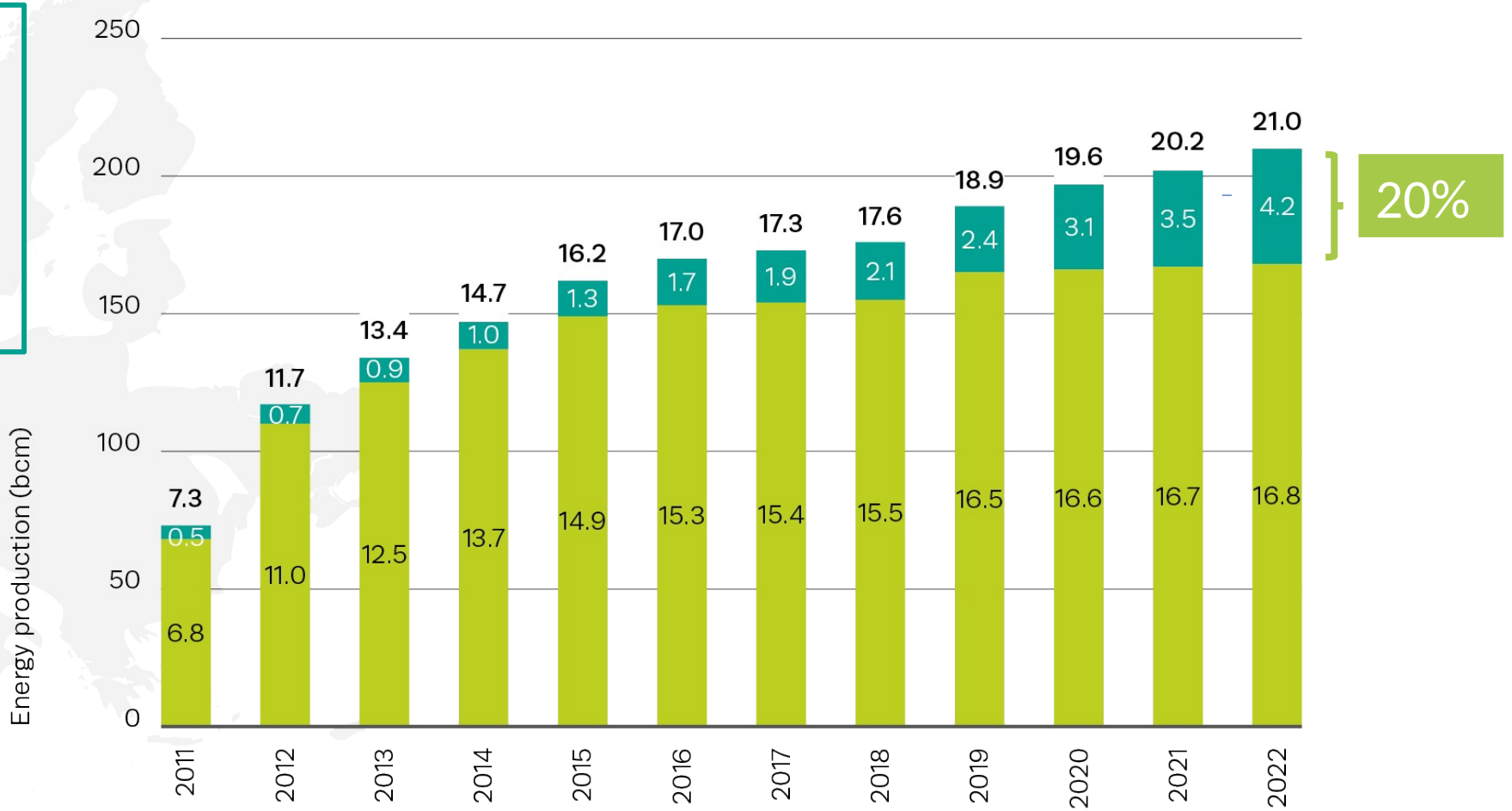
**> gas demand of Poland**

= 6% EU gas consumption

**20% biogases upgraded**

18 bcm produced in EU-27

## Combined biomethane and biogas production in Europe

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# Agricultural plants rank first for the biogas and biomethane production

**67%** of the biogas and **64%** biomethane is produced from agricultural plants in Europe

**Figure 2.8**

Percentage of European biogas production per plant type in 2022

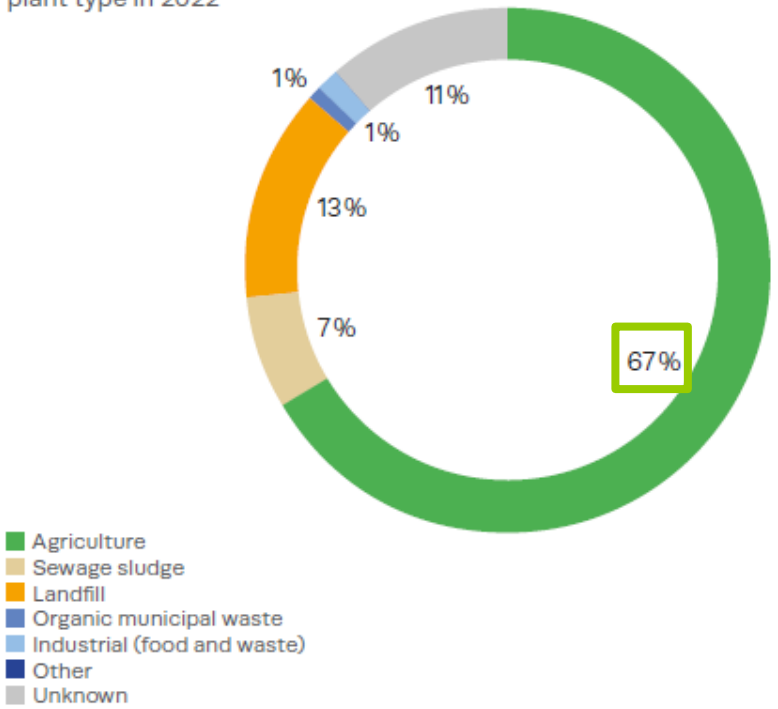
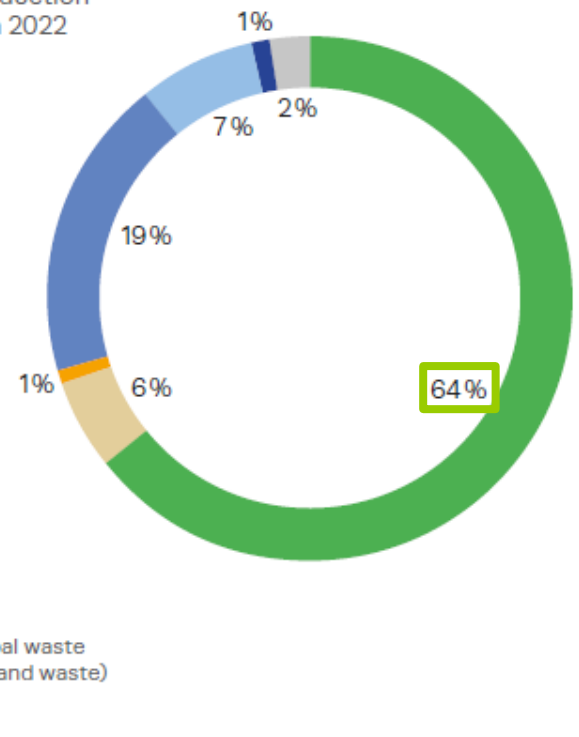



**Figure 2.9**

Percentage of European biomethane production per plant type in 2022

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Source: EBA Statistical Report 2023

# Biomethane in Europe is produced from sustainable feedstocks

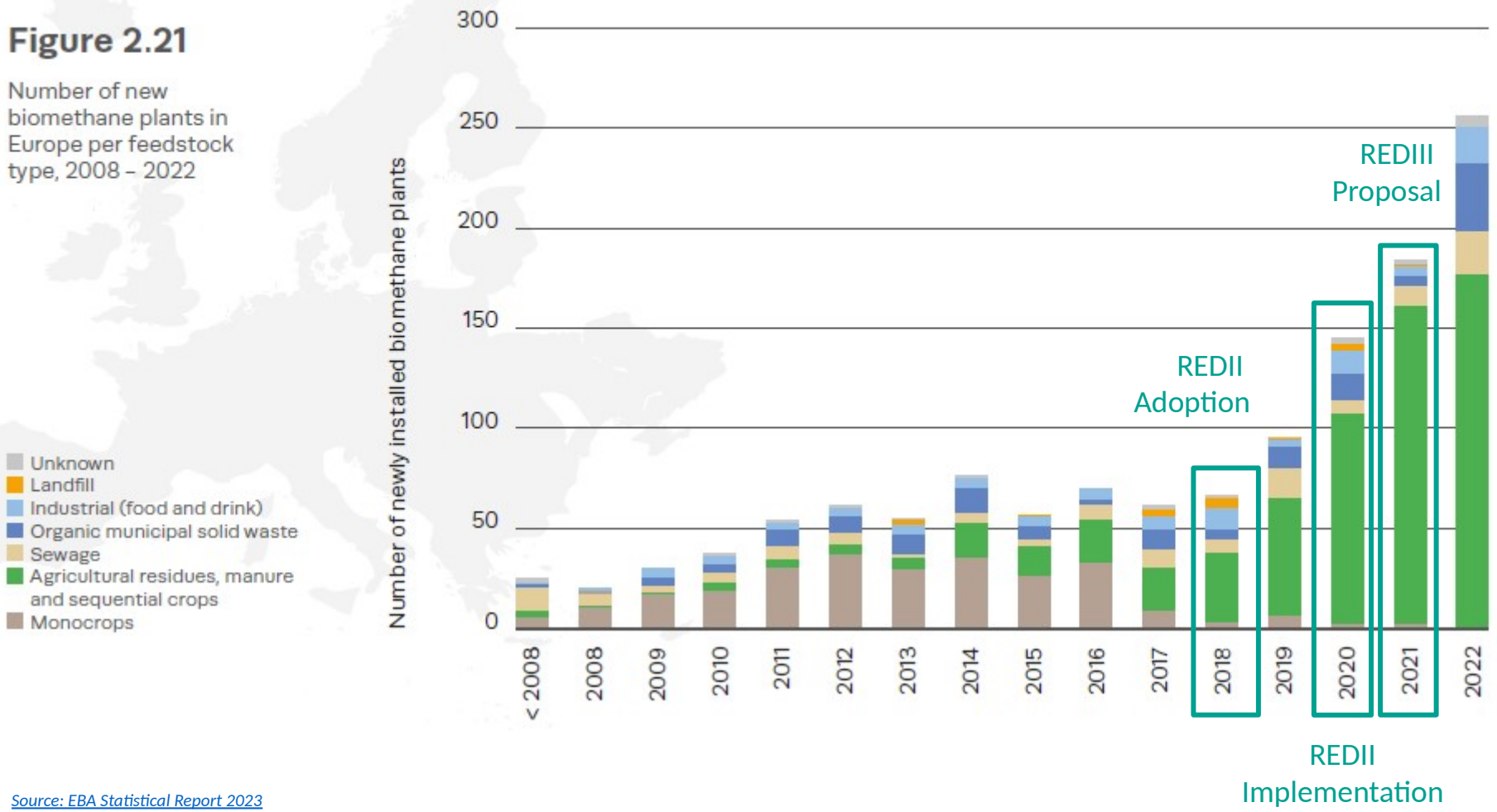
Evolution of feedstock use

Driver #1: GHG emissions savings

Enabler #1: Tech development

**Figure 2.21**

Number of new biomethane plants in Europe per feedstock type, 2008 – 2022




Source: EBA Statistical Report 2023

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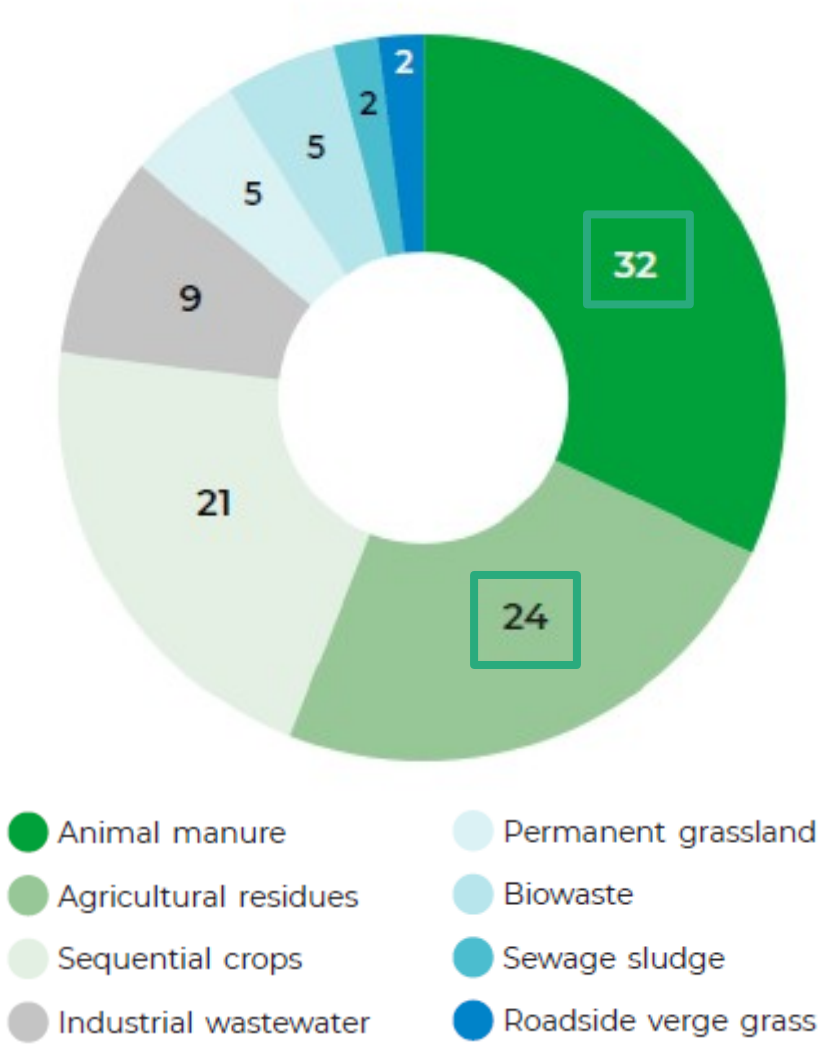
# Manure will be the most used feedstock for biomethane in 2030

In 2030, **32%** of EU biomethane will be produced from **manure** and **24%** from **agricultural residues.**

**EU anaerobic digestion potential in 2030 per feedstock**

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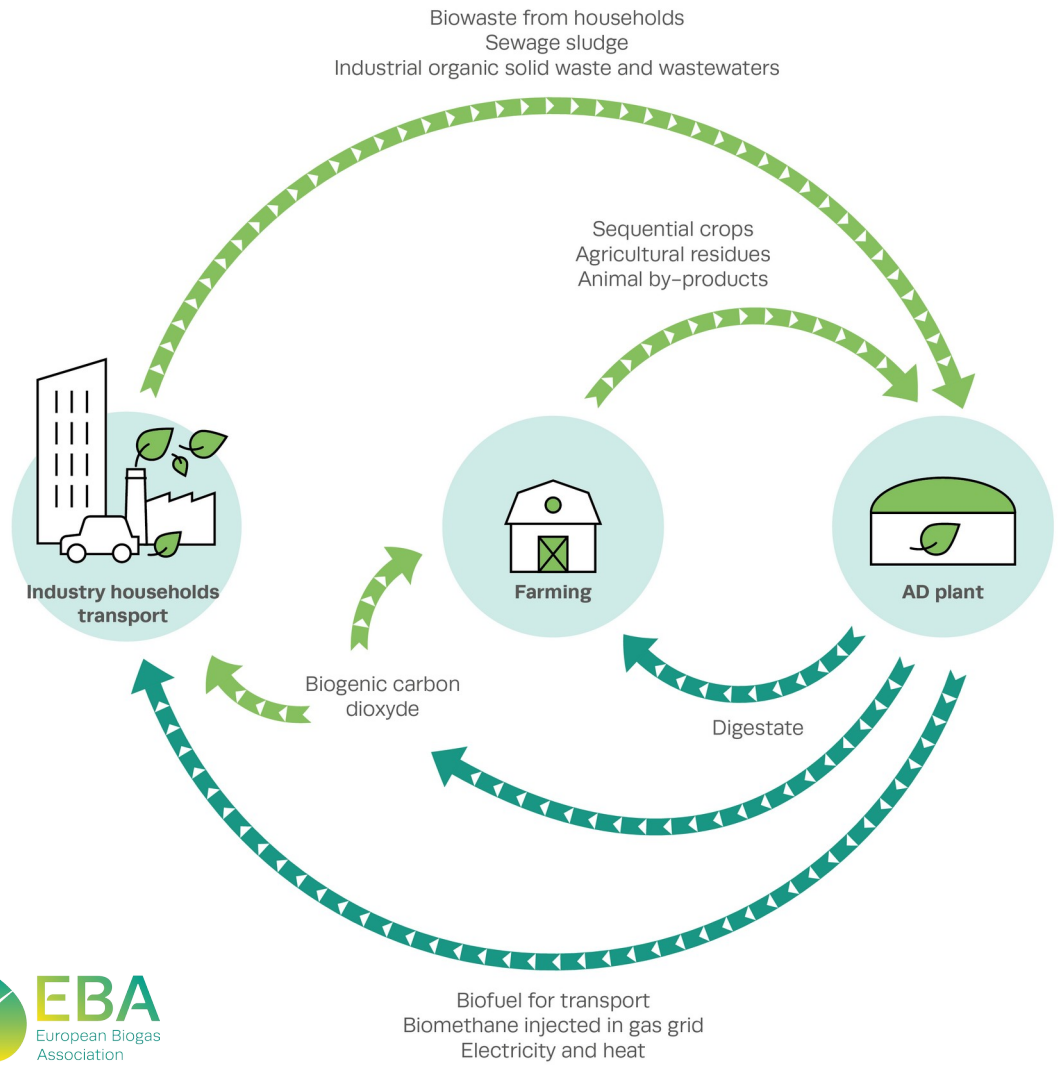
# What is digestate?

**Schematic overview of the inputs and outputs of the bio–gases production process**




During anaerobic digestion, **biogas is produced** along with digestate.

Digestate contains a higher proportion of **readily available nutrients** than in the raw feedstock.

The same amount of **stabilised organic matter** is present in the digestate than in the raw feedstock.

➔ **Digestate is a valuable organic fertiliser and soil improver.**

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# Digestate offers an alternative to synthetic fertilisers

**31 Mt (DM)**
digestate produced
Europe, **2022**

Digestate can already displace:

**15%**
**Nitrogen-based fertilisers**
(N applied in EU-27: 11.1 Mt/year)

**11%**
**Phosphorus fertilisers**
(P applied in EU-27: 2.8 Mt/year)

**6%**
**Potassium fertilisers**
(K applied in EU-27: 3.1 Mt/year)

GHG reduction potential when displacing synthetic N-fertilizers with digestate

**10 Mt**
**of $CO_2$ equivalent**
**in 2022**

**Natural gas** is the main feedstock and energy source to produce **synthetic fertilisers**

The replacement of 15% of **synthetic nitrogen fertilisers** with digestate could save today around **2 bcm of natural gas**


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# Digestate is an enabler of carbon sequestration

**9,3 Mt** of Total Organic Carbon, **2022**

More **stable organic carbon**, particularly **recalcitrant to biodegradation**

- High potential for **carbon sequestration**
- Leads to **humus** and **structure formation** in the soil and increases its **fertility, functionality, microbial activity, aeration, and water storage capacity**

**Carbon sequestration potential of digestate**

| | % of remaining TOC after 92 days |
|---|---|
| Solid fraction of digestate | 86% |
| Digestate 1 | 73% |
| Digestate 2 | 56% |
| Cattle manure | 58% |
| Maize straw | 43% |

*Reuland, G.; Sleutel, S.; Li, H.; Dekker, H.; Sigurnjak, I.; Meers, E. Quantifying $CO_2$ Emissions and Carbon Sequestration from Digestate-Amended Soil Using Natural $^{13}C$ Abundance as a Tracer. Agronomy 2023, 13, 2501.*

➔ The application of (solid fraction) digestate on soil is both a **sustainable soil management** and a **carbon farming practice**

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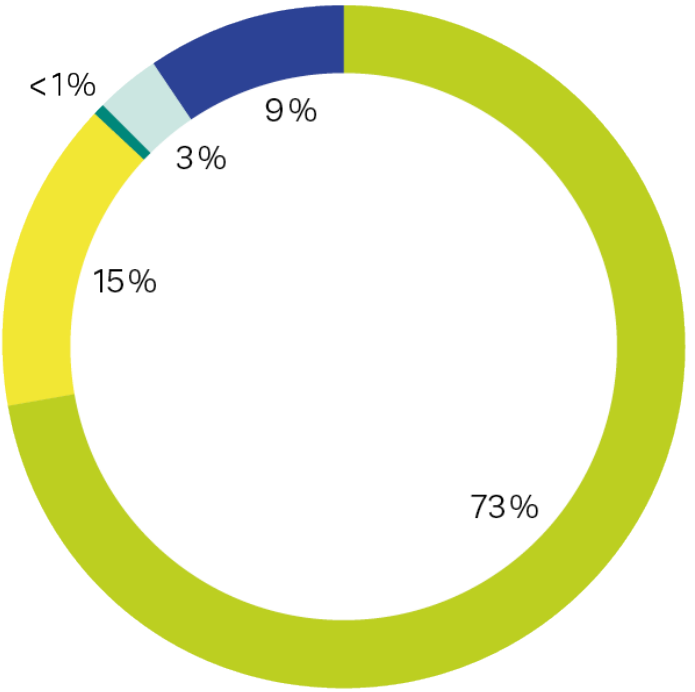
# European digestate production

**Most common end-use:**
directly applied biofertilizer

**Mostly non-separated digestate**
Austria, Denmark, Germany, Poland, Slovakia, Sweden, and Ukraine

**Mostly liquid digestate**
Serbia, Croatia, Slovenia, UK, Switzerland and Belgium

## Digestate end-uses in Europe



# Digestate valorization routes

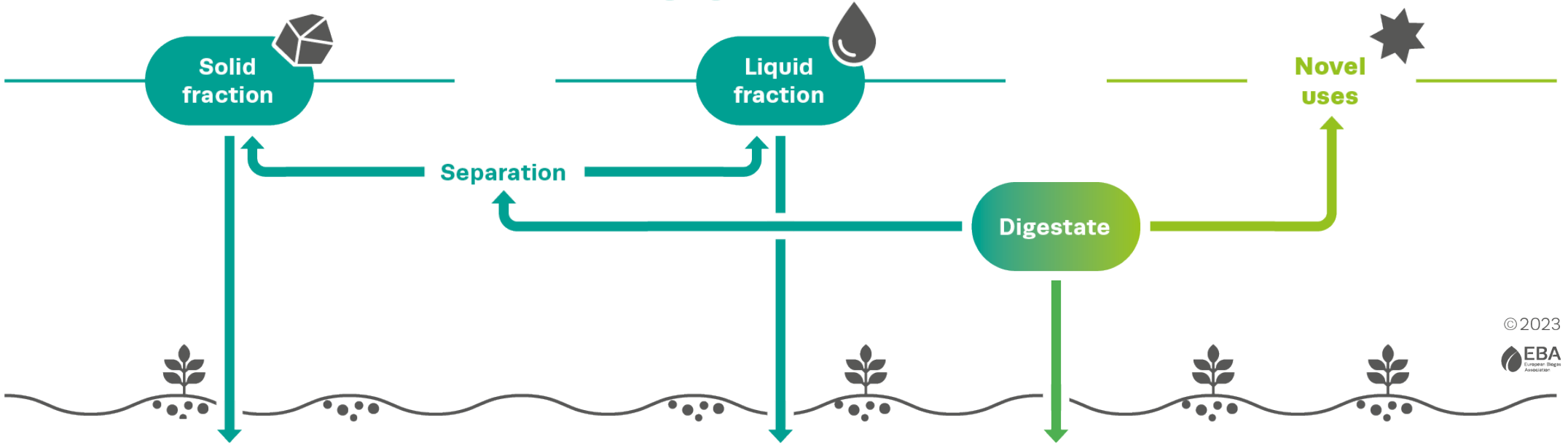
**Nutrient recovery**
**char, hydrochar, biofuels**

- Pyrolisis
- Gasification
- Hydrothermal carbonization
- Compost

- Membrane filtration
- Reverse osmosis
- Evaporation
- Ammonia stripping and scrubbing
- Struvite precipitation
- Microalgae growth

**Range of different**
**value added products**

- Insects cultivation
- Pretreatment agent
- Substrate for microbial fuel cells
- Medium for hydroponics
- Production of volatile fatty acids (VFAs)
- Bio stimulants



# Regulatory challenges and opportunities for digestate

## Challenges

- **Fertilising Products Regulation** (EU 2019/1009): setting heavy requirements for digestate to be CE-marketed as organic fertiliser or soil improver.
- **Animal By-Products Regulation** (EC 1069/2009 & EU 142/2011, EU 2023/1605): setting additional requirements for certain *animal by-products* to be placed on the market.
- **Nitrates Directive** (91/676/EEC): restricting the application of digestate from *manure*.
- **Sewage Sludge Directive** (86/278/EEC): restricting the application of digestate from *sewage sludge* in agriculture.

## Opportunities

- **Soil Monitoring Law:** promoting the application of circular fertilisers as a sustainable soil management/regeneration practice.
- **Common Agricultural Policy:** incentivizing the use of organic fertilisers through eco-schemes.
- **Carbon Removal Certification Framework:** setting a voluntary framework for carbon removal activities including carbon farming.
- **Waste Framework Directive:** encouraging the recycling of *bio-waste* through anaerobic digestion with use of digestate.
- **Urban Wastewater Treatment Directive:** stimulating the recovery of nutrients from *sewage sludge*.

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# Thank you for your attention!

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