SI Baltic Sea Neighbourhood Programme

WORKSHOP 4

Policy and practice of digestate valorization in Sweden, Poland and Ukraine

SEPTEMBER 29, 2025

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Definition of the term “digestate"

Digestate
- “is the residual semisolid or liquid material of anaerobic digestion of biodegradable materials” (Regulations (EC) No 1069/2009 and (EC) No 1107/2009)
- “a residual semisolid or liquid material that has been sanitised and stabilised by a biological treatment process, of which the last step is an anaerobic digestion step, and where the inputs used in that process are biodegradable materials originating only from non-hazardous source segregated materials, such as food waste, manure and energy crops” (Commission Regulation (EU) 2019/1691 (amending REACH)

Digestate produced in biogas plants is the remains of raw materials, household products and waste of animal or vegetable origin, whether mixed or not, resulting from a controlled process of anaerobic fermentation with the release of biogas, which meets the requirements established by Regulation (EU) 2019/1009 of the European Parliament and the Council of June 5, 2019 on establishing rules for the placement of EU fertilizers and amending Regulations (EC) 1069/2009 and (EC) 1107/2009 and repealing Regulation (EC) 2003/2003 (defined in the Law of Ukraine "On Pesticides and Agrochemicals”)

Sources: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52022SC0656; https://zakon.rada.gov.ua/laws/show/86/95-%D0%B2%D1%80#Text

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Key values of digestate

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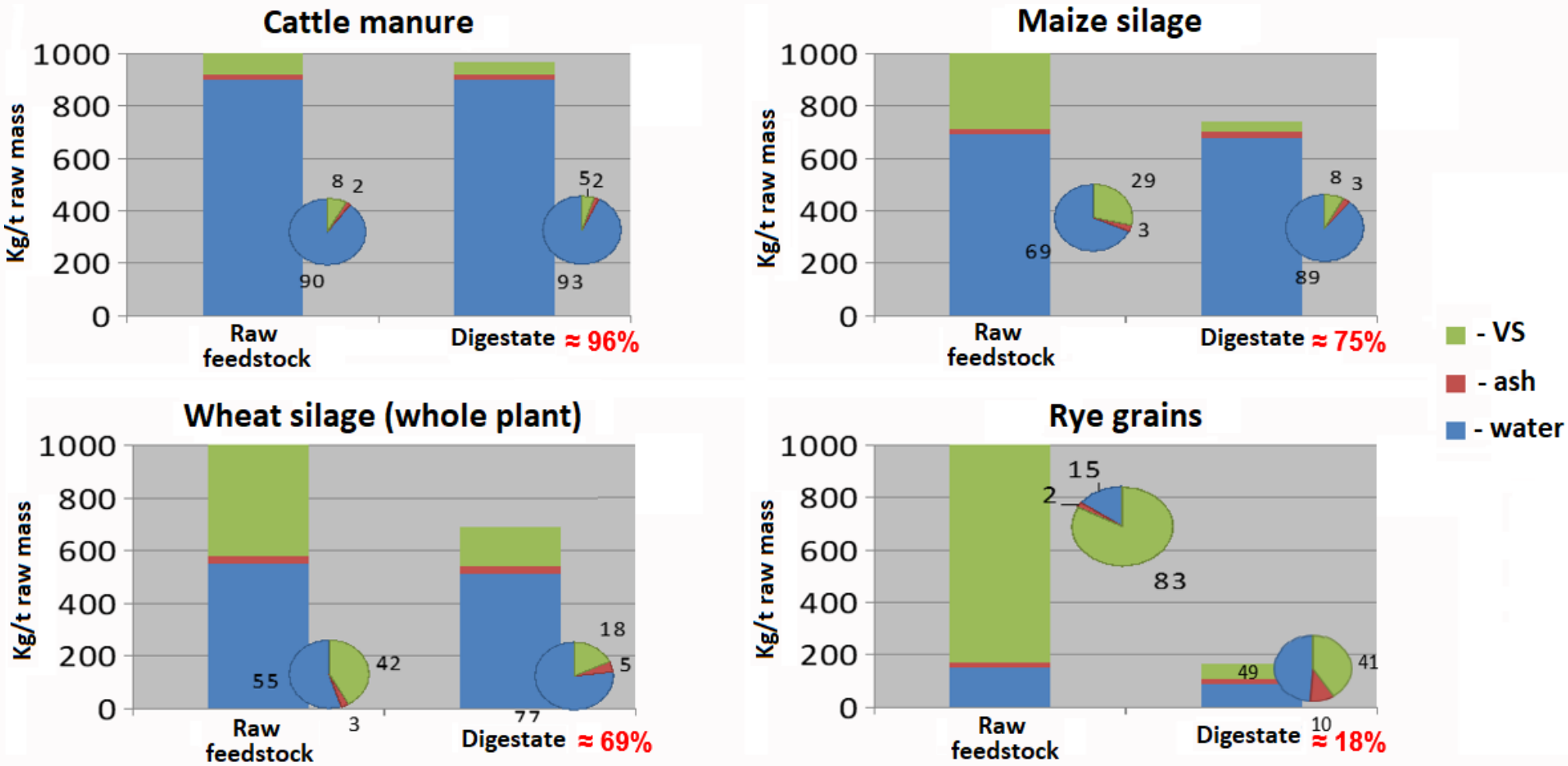
Examples of the mass balance of "raw material-digestate"



Source: USAID ENERGY SECURITY PROJECT. Digestate management (use of digestate, spreading technology, nutrient recovery from digestate. Case studies. Petro kucheruk, expert UABIO, january 2025

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Typical composition of digestate

Average (typical) composition of raw digestate and its fractions

Digestate form	TS [%]	N_{total} [kg/m³]	NH_4 [kg/m³]	NH_4 [% of N_{total}]	P_2O_5 [kg/m³]	K_2O[kg/m³]
Raw digestate	6.5	5.1	3.2	62.7	2.3	5.5
Liquid fraction	5.7	4.9	3.1	63.3	2.0	5.4
Solid fraction	24.3	5.8	2.7	46.5	5.0	5.8

Bayerische Landesanstalt für Landwirtschaft

The digestate composition from the MHP's biogas plants (UA)

Parameter	Liquid fraction	Solid fraction
Phosphorus	1.9 kg/m3	3.1 kg/ton
Potassium	6.2 kg/m3	2.7 kg/ton
Manganese	21 mg/kg	47.65 mg/kg
Zinc	8.2 mg/kg	12.5 mg/kg
Copper	14.1 mg/kg	34.5 mg/kg
Cobalt	7.2 mg/kg	18.1 mg/kg
Sulfur in liquid	0.27%	1.56%

While digestate is a rich source of essential macro and micronutrients required for promoting plants growth, its application risks leading to nutrient overload, contamination from heavy metals, pathogens, antibiotics, microplastics, and emerging contaminants.

Source: https://www.biogas.org/edcom/webfvb.nsf/id/BJHCPA-DE-Digestate-as-Fertilizer/$file/Digestate_as_Fertilizer.pdf, https://propozitsiya.com/articles/ahrokhimiya-dobryva/yak-u-biohazovykh-ustanovkakh-dobryvo-vyroblyayut

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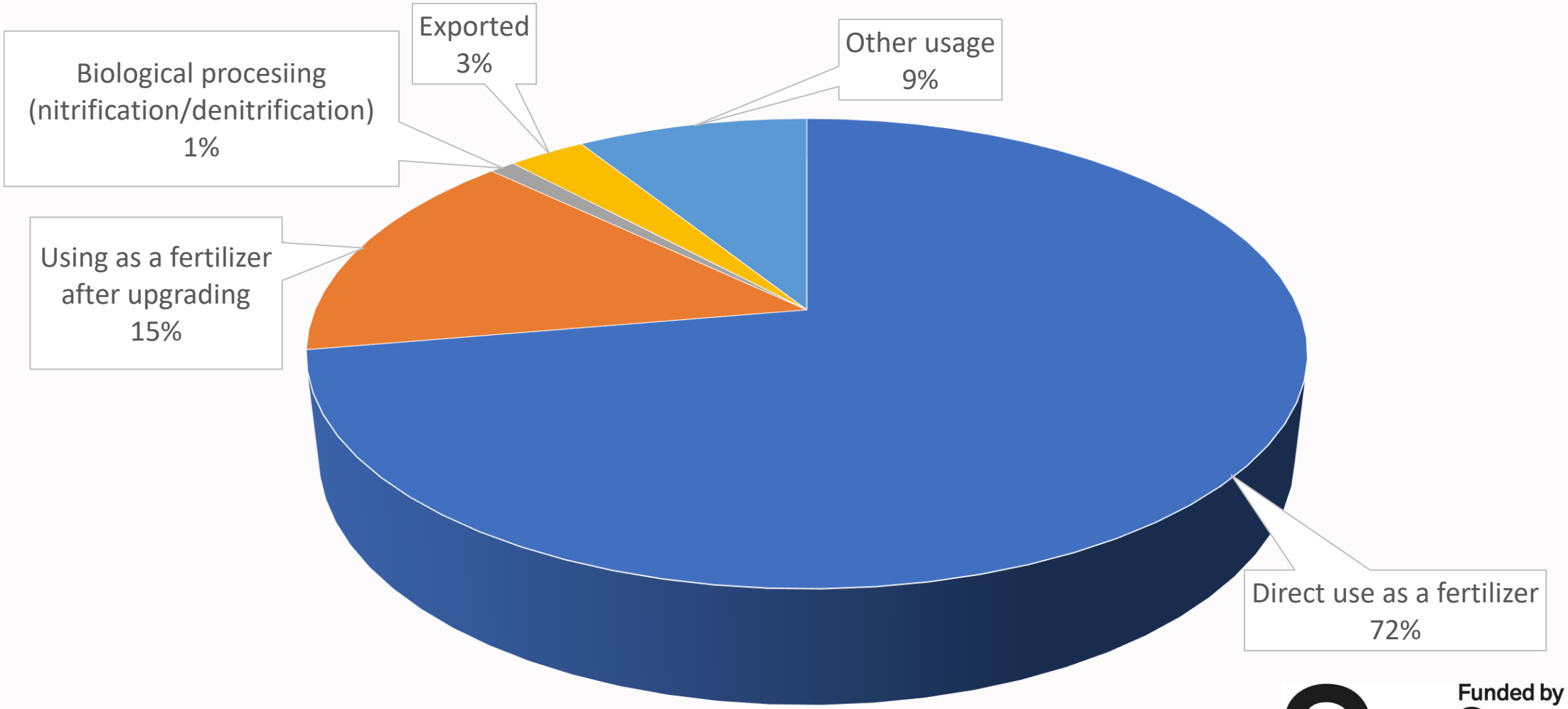
Digestate end usage in EU



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Digestate's contribution to healthy soils: fact sheet

The total amount of non-separated digestate produced in 2022 was **263,283 tonnes DM:**

- over 50% - from sewage treatment plants
- nearly 30% from agricultural substrates (mainly manure)
- 20% is derived from co-digestion plants.
- Little separation of digestate into liquid and solid fractions takes place in Sweden and digestate upgrading (except for the dewatering of sewage digestate) is not common in the country.
- The vast majority (90%) of digestate is used in agriculture.

In 2022, Poland produced nearly **4.4 Mt** of whole digestate (fresh matter).

- The digestate is applied directly to neighbouring agricultural land, without separation taking place.
- In 2023 new legislation introduced easier way to spread agricultural digestate as fertiliser (before it was treated as waste).

Ukraine produced **119,167 tonnes** DM of non-separated digestate:

- 76% - from agricultural feedstocks.
- The majority of digestate is directly used as a biofertiliser on neighbouring agricultural land.

Source: EBA Report, 2024. https://www.europeanbiogas.eu/wp-content/uploads/2024/12/EBA_stats_report_complete_241204_preview.pdf

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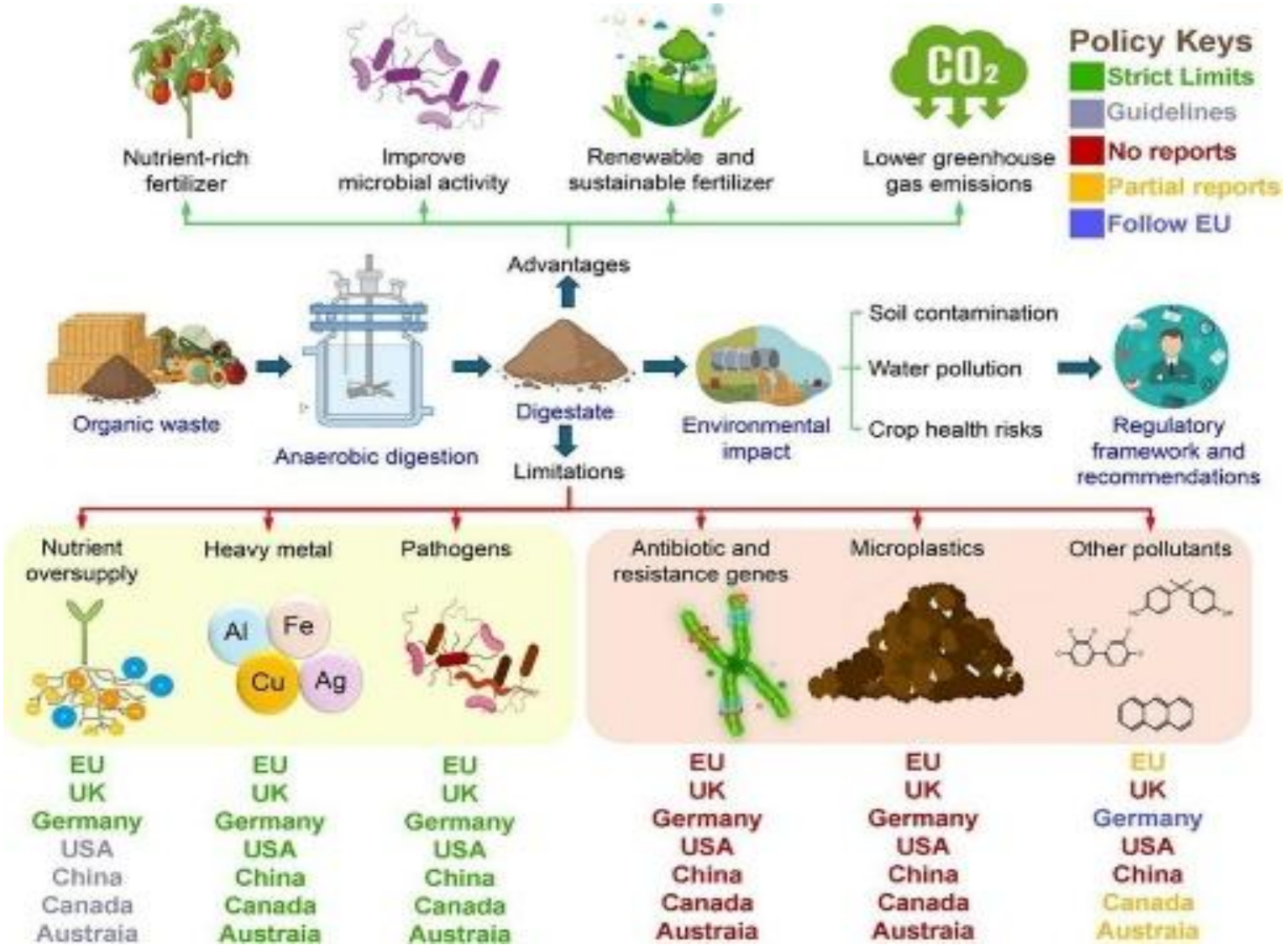
Limitations and global regulations in the use of biogas digestate as fertilizer



Source: https://doi.org/10.1016/j.scitotenv.2024.177855

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Regulatory Framework

- **Waste Framework Directive:** Classifies digestate as a potential residue or waste, leading to bureaucratic permitting challenges in some Member States.
- **Regulation (EU) 142/2011:** Implements and complements the ABPR by setting detailed rules for the use of Category 2 and 3 by-products in fertiliser production and linking them to the Fertilising Products Regulation (FPR).
- **Fertilising Products Regulation (FPR) & Delegated Regulation (EU) 2023/1605:** Defines the "end point" at which digestate from animal by-products, once compliant with ABPR standards, becomes a recognised fertilising product and is no longer subject to ABPR.
- **EU Fertilizers Regulation:** Sets standards for fertilizers, including digestate, to be placed on the EU market, focusing on nutrient content, heavy metals, pathogens, and overall product quality.
- **Animal By-Products Regulation (EC) 1069/2009 (ABPR):** Regulates the safe handling, processing, and disposal of animal by-products, defining three risk categories and strict requirements for traceability, storage, and processing (e.g., 1h at 70 °C, ≤12 mm).
- **Nitrates Directive:** Restricts the amount of nitrogen (e.g., 170 kg N/ha/year for manure digestate) application limit from manure and digestate, restrict the use of organic fertilizers and often compel farmers to supplement with synthetic alternatives.
- The **Sewage Sludge Directive (86/278/EEC)** sets heavy metal limits, requires prior treatment, mandates alignment with plant nutrient needs, and restricts use on grassland and food crops, while allowing Member States to define end-of-waste criteria for digestate from sludge.

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Regulatory framework at national level

	Inclusion of digestate in a legislation on fertilisers	End-of-waste for digestate	Quality assurance scheme/certification for digestate	Additional rule for digestate
	No, but no need because certification possible	No	Yes, SPCR 120 for biofertilisers and REVAQ certification for digestate from sewage sludge	Digestate from sewage sludge must comply with the **REVAQ certification system**
	Yes, in the Regulation on the implementation of certain provisions of the Act on fertilisers and fertilisation (currently being updated)	Yes, when compliant with the Regulation on the implementation of certain provisions of the Act on fertilisers and Fertilisation	No	Digestate use is subject to **quality and sanitary standards**, **170 kg N/ha/year limits** under the Nitrates Directive, and rules on storage, timing, and nutrient management; legislation is being updated to align with EU FPR.
	The term **"digestate"** is legally defined under a law (Amendment to "On Pesticides and Agrochemicals", 2022). Draft Laws propose clearer legal definitions and aligning with EU Regulation 2019/1009.	Abolition of state registration required for digestate as agrochemical, when it meets certain criteria and use as fertilizer or soil improver. End-of-waste explicitly mentioned by proposing abolition of registration and acceptance of digestate as fertilizer under certain conditions. But full legal implementation and formal EU-level equivalence are still in progress.	No mandatory national certification; proposals for voluntary certification adopting features similar to EU ECN-QAS.	Proposed quality-standardization measures: setting requirements for input feedstocks; categorization by purpose (fertilizer, soil improver, growing medium); limits for heavy metals, pathogens etc.; control of process parameters and storage. Voluntary schemes discussed. Additional rules proposed include harmonization with EU fertilizer laws, clarity on safety/sanitary norms, ensuring feedstock quality, consistency of process, stability of product, limits on contaminants.

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Basic principles of digestate quality management

- The basic rule is that if the effective removal of pollutants cannot be guaranteed either by pre-treatment or in the fermentation process, the relevant material should not be used as feedstock in biogas plants where the digestate is used as fertilizer or for other agricultural purposes.
- There are two main approaches for digestate quality management, namely: **avoiding and treatment.**
- Main focuse on:
  - Minimization of volumes of digestate at the stage of technological design of a biogas plant
  - Reducing logistic costs
  - Ennsuring the standardized quality of the digestate
  - Implementing of the voluntary certification scheme
  - Involvement of specialized fertilizer production companies

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Scheme of voluntary certification of digestate in the EU

The pan-European quality assurance scheme (ECN-QAS) was developed by the European Society of Compost Producers (ECN) and was implemented in 2010 (quality criteria for digestate were implemented in 2014)

- Applies to composting and anaerobic digestion plants.
- Covers input material control, process monitoring, product quality (nutrients, stability, contaminants, hygiene), and environmental performance.
- **Certification proces** includes regular assessment of digestate production at factories by the national quality assurance organization, regular sampling and analysis of the final product for relevant quality parameters by independent, recognized laboratories, as well as evaluation of these results by a national quality assurance organization
- Certified digestate can be placed on the market as a **safe, reliable biofertiliser or soil improver** instead of being treated as waste.
- ECN-QAS is designed to support EU member states and national schemes, ensuring alignment with EU Fertilising Products Regulation (2019/1009).

The sign for certified digestate

Source: https://www.compostnetwork.info/ecn-qas/

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- Depending on the origin, digestate residue is usually given different names: **biofertilizer** (from co-digestion plants and farm facilities) and **digestate sludge** (from sewage treatment plants).
- **Primary use:** land-applied as a fertiliser and soil conditioner (whole digestate or fractionated liquid/solid), returning nutrients (N, P, K) and organic matter to agricultural soils.
- Sweden applies both non-separated and separated digestates depending on plant type and local logistics.
- **Sources:** digestate comes from co-digestion of manure, food/urban biowaste and sewage sludge (sewage-derived digestate is a large share in Sweden).
- **Markets & users:** farmers (crop and grassland), some organic farms (when quality criteria are met), and local/regional reuse schemes (e.g., island/municipal projects). There are also examples of digestate used in horticulture and as a feedstock for processed fertilizer products.

Plant type	Production of digestate, kton wet weight	Use of digestate as fertilizer, kton wet weight	Use of digestate as fertilizer, %	Certified according to Revaq or SPCR 120, number
Wastewater treatment plants	596	242	41	37
Co-digestion plants	1 864	1 848	99	28
Farm plants	773	772	100	0
Industrial plants	23	22	96	0
Total	3 256	2 885	89	65

Table: Amount of digestate produced (ktonnes wet weight), use of this as fertilizer in agriculture and number of facilities within each facility type that have certified digestate in 2023

Source: Energigas Sverige (The Swedish Gas Association) – the industry association for players in biogas, vehicle gas, LPG, natural gas and hydrogen

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Exiting Legislation: plants producing biofertilizers

- **Hygenisation:** *Animal by product ordinance* (ABPO) EG nr 1069/2009; EU nr 142/2011
  - -70°C in 60 minutes (also for food waste)
  - -Exception: farm plants digesting manure from < 3 farms
- Plants where ABPO is relevant must obtain an approval by the **Board of Agriculture**
- **Plants recycling or managing** >75 ton/day (18 750 ton/yr), with digestion/composting applied to some part must follow the revised *Industrial Emissions Directive*
  - -Best Available Technology; annual reports; documented inspections; status reports
- ***Waste Act*:** Municipal organic waste is segregated by waste ”owners” – municipality is collection responsible
- Define when the digestate is not classified as a waste product (***End of Waste criteria***)
  - -Quality assessment
  - -Usefulness as a product with no health or environmental risks
  - -Specific content standards when relevant
  - -Reduced environmental and health risks
- Reporting according to ***Corporate Sustainability Reporting Directive***, CSRD, starting for 2025 – e.g. Municipal Waste companies

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Exiting Legislation: use of biofertilizer as a product

- **Certification.** Voluntary, SPCR 120 owned by ”Swedish Waste”.
  - Allowed feedstocks, chemical/process additions
  - Declare nutrients+organic matter content
  - Controlled function of hygienisation
  - Metal content below limits
  - Limits for ”visible pollutants”
- Limits on **total applied dose** of heavy metals (not only concentrations in product) as well
- Same **fertilization rules** regarding storage, application and spreading as for **slurry & solid manure** (Board of Agriculture):
  - Max 22 kg/ha of P, mean of 5 years
  - No spreading Nov 1st – Feb 28th in nitrate-sensitive areas
  - Work into soil within 4 hours/12 hours (to reduce ammonia loss)
  - Autumn spreading on oil seed crops allowed, 60 kg/ha available N, 30 kg/ha for other autumn sown crops
- Rules on **required storage capacity**, 8 – 10 months in nitrate sensitive areas

Metal	Max, mg/kg DW
Lead, Pb	100[2]
Cadmium, Cd	1
Cupper, Cu	600[2]
Cromium, Cr	100[2]
Mercury, Hg	1
Nickel, Ni	50[2]
Zink, Zn	800[2]

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In Sweden, biofertilizers are products – but a net cost for the co-digestion plant producers

Increased demand for biofertilizer

- Energy prices
- Commercial/synthetic fertilizers prices
- Increased food-security with local fertilizers
- Substitute fossil fertilizers with circular

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Challenges and Barriers:

1. **Regulatory uncertainty & long permitting processes** — evolving EU/Swedish rules on sewage sludge, waste vs product status, and fertilising product rules create administrative and market risk for digestate producers and buyers. This slows investment and market development.
2. **Quality variability and contaminants** — digestate nutrient concentrations and pathogens/pharmaceutical residues, microplastics and heavy metals (especially from sewage line inputs) are variable; that undermines farmer confidence and can trigger restrictions.
3. **Logistics & transport economics** — digestate is bulky and water-rich; transport costs limit use to nearby fields unless dewatering/fractionation is performed. This constrains market scale and spatial nutrient matching.
4. **Market competition & acceptance** — digestate competes with established mineral and organic fertilisers; retailers/processors of commercial fertilisers can out-compete small scale digestate suppliers. Farmer concerns about odour, application timing, and nutrient predictability lower acceptance.

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Opportunities & Recommendations

1. **Circular nutrient policy alignment:** Sweden's bans on landfilling organic waste and strong food-waste/biowaste streams mean large volumes of digestate are available for nutrient recycling — opportunity to close nutrient loops regionally.
2. **Regional valorisation models:** islands/municipal clusters show co-development of local markets for biofertiliser — reducing transport, creating traceable supply chains and farmer buy-in.
3. **Technology upscaling:** investment in mechanical separation, nutrient recovery (P-concentration), hygienisation and drying can convert low-value whole digestate into higher-value, transport-efficient fertiliser products.
4. **Certification & quality schemes:** certified, tested digestate products (clear origin/analysis & contaminant limits) can access organic/retail markets and command better prices.

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Poland

- Digestate is already used as a fertilizer substitute in many agricultural biogas plants.
- Research on farms near biogas plants shows digestate has economic value. Estimated values are in the range of ~6 to ~15 EUR per megagram (fresh digestate) depending on quality and nutrient content.
- According to current legislation and the status of the market in Poland, digestate is usually treated as a by-product requiring disposal and causing additional outlays for a company.
- Under current legislation, digestate is generally considered waste, with the exception of **biogas plants using only typical agricultural substrates**, where the digestate can be easily used as a fertilizer in the fields ("**Kowalski low**" from 2023). Because of that, its use for fertilization must comply with regulations for waste management.
- There is a possibility to change the status from waste to a fertilizer product or soil improver. This requires obtaining a permit from the Minister of Agriculture and Rural Development, after **long procedure** (1-2 years).
- To get that status change, digestate producers must conduct tests (e.g. for heavy metals), get scientific opinions, and prepare necessary documentation.

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Challenges and Barriers:

Regulatory status and burocracy:

- Digestate being classified as waste places regulatory burdens: obtaining R10 permits, frequent testing, documentation.
- Changing status to fertilizer product is complex, very long and not yet widespread.

Cost of management:

- Testing (metals, pathogens), transport and storage costs can be high.

Quality variability:

- Nutrient content of digestate varies greatly with substrate mix. This affects its fertilizer value.

Logistics:

- Need for proximity to land usable for application, or else transport becomes expensive and inefficient. Issues with odor, handling, storage.

Environmental and health safety concerns:

- Risks of heavy metals or pathogens if digestate is not properly treated.

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Opportunities & Recommendations

1. End-of-Waste (EoW) status or regulatory clarity: Harmonizing definitions and statuses so digestate can more easily become a product rather than waste.
2. Standardization of quality: Clear thresholds for nutrients, contaminants, moisture etc., to help producers and users evaluate digestate.
3. Support for biogas plants (including digestate use) in rural/agricultural policies and subsidies. For example, Poland's "Energy for the Countryside" program supports agricultural biogas investments.
4. Awareness & capacity building: Educating farmers on digestate's benefits, best practices for application, managing safety risks.
5. Improved logistics: Closer matching of sites producing digestate with farms able to use it, storage infrastructure.

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Ukraine

- The bulk of digestate is used directly on fields owned by the biogas plant operators (solid or liquid forms). This is mostly non-commercialized use; i.e. applying to own fields rather than selling it.
- Digestate is often separated into solid and liquid fractions to help with handling. The liquid fraction may be applied more directly; solids sometimes handled differently.
- In 2022, Ukraine passed Bill 4558 ("On Amendments to Certain Laws Regarding Handling Pesticides and Agrochemicals") which *introduced* the term "digestate formed in biogas plants" into legislation. Under this law:
    1. Digestate is defined as "residues of raw materials, by-products and waste of animal or vegetable origin, mixed or not, resulting from a controlled process of anaerobic digestion with the release of biogas."
    2. Digestate when used as an organic fertilizer or soil improver is not subject to the state registration requirements for pesticides and agrochemicals.

Soil fertility context: Many studies point out that Ukraine has soil fertility challenges, and organic fertilizers (such as digestate) are seen as one path to reduce dependence on mineral fertilizers and to improve soil organic carbon. The rising cost of mineral fertilizers strengthens the incentive.

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Requirements for digestate as a fertilising product in the EU (Ukraine)

- For market access, any type of fertilizer in the EU must meet the requirements of Regulation (EU) 2019/1009 on rules for access to the EU market for fertilizer products dated June 5, 2019.
- The main feature of this Regulation is the clear categorization of products by functional purpose and material composition
- Requirements are set both separately for product categories by functional purpose and for product categories by material component
- The requirements for the digestate relate to:
  - origin of raw materials (applies to almost all types, except sewage sludge, the organic fraction of solid waste from a mixed flow, some categories of livestock by-products)
  - the content of impurities necessary for the regulation of the biochemical process,
  - clear separation of raw material and digestate processing lines (including digestate storage areas) within the biogas station,
  - control of the decay of organic material (with a combination of thermophilic mode of fermentation at 55^0C, pasteurization and/or composting), the content of macroscopic impurities (glass, metal or plastic),
  - residual biochemical activity (expressed through oxygen consumption or residual biogas generation potential)
- Subject to compliance with the Regulation, the digestate or its product can be classified according t and receive the CE marking in order to have free access to the EU markets.

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Challenges and Barriers:

1. **Registration & administrative burden:** digestate might require “state registration” as an agrochemical/fertilizer, which is costly, time-consuming, and sometimes impractical given high variation of digestate composition.
2. **Lack of quality standards / standardization:** there are no general national standards defining types, quality thresholds, permitted inputs, limits on contaminants that makes commercialization difficult, and buyers are uncertain.
3. **Variability in digestate composition:** types of feedstock (manure, crop residues, co-substrates, etc.), operational conditions, seasonality, influence nutrient content, pathogens, moisture etc. That leads to unpredictability in fertilizing effect and possibly risk.
4. **Logistics / transport & handling issues:** transport costs and storage are high. Untreated digestate can have odors, issues in spreading, risks of nutrient losses.
5. **Limited market / commercial sales:** because of the legal and standardization issues, most digestate remains used by the producer on their land rather than being marketed widely. That limits scale and the ability to realize value.
6. **Environmental / health risks:** without standard control, there’s risk of heavy metals, pathogens, possibly unwanted residues. Also storage and application practices (e.g. surface spreading) can lead to emissions.

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Opportunities & Recommendations

1. **Harmonization with EU standards:** since Ukraine is aligning legislation with EU norms, there's a chance to adopt EU-standard definitions, quality thresholds, and certification schemes (e.g. similar to EU Regulation 2019/1009).
2. Remove or **simplify state registration** for digestate: instead rely on quality standards / voluntary or mandatory certification.
3. **Develop national standards** / technical regulations for digestate quality: support voluntary certification/labeling schemes: encourage operators to certify their digestate through recognized schemes (or Ukraine-developed).
4. **Financial and technical support for post-treatment & processing**: subsidies, loans or grants for facilities to implement separation, drying, stabilization, etc., to reduce transport costs, improve storage, reduce emissions, increase usability.
5. **Infrastructure planning & logistics support**: facilitate local/regional hubs for digestate processing, common storage, shared transport facilities to reduce cost and distance.
6. **Monitoring and environmental protection**: develop monitoring requirements for contaminants, pathogens, residuals; enforce best practices in storage to prevent leaching, odours, GHG emissions.

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Legislative and Policy Frameworks – main insights

- Digestate as a product vs. waste (Regulations under SEPA, Naturvårdsverket).
- Quality certification (SPCR 120 for biofertilizer).
- End-of-waste criteria.
- Incentives for circular economy and biogas valorization.
- Restrictions on heavy metals, pathogens, P leaching.

- Digestate under Waste Act and Fertilizers and Fertilization Act.
- Need for registration with the Ministry of Agriculture for use as fertilizer.
- Simple usage on field only for limited biogas plants.
- Limited harmonization with EU end-of-waste policies.
- Regional programs (e.g., Polish Green Deal) and biogas incentives.

- Digestate still often considered waste (lack of end-of-waste legislation).
- Absence of official standards for digestate reuse.
- Influence of EU Association Agreement and alignment with EU Waste Framework Directive.
- Prospective reforms under the new bioeconomy and decarbonization strategies.

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Common Issues Across Partner Countries

variability in feedstock quality & digestate composition

transport, storage & logistics costs

contaminants / environmental risk concerns

lack of trust & awareness

insufficient incentives / supportive policy frameworks

competition with established mineral fertilizers

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Thank you for your attention!

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