FERTITEC

INNOVATIVE RECOVERY TECHNIQUES FOR ALTERNATIVE FERTILISERS

European Innovations in Circular Fertiliser Systems and Livestock Manure Utilisation

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Third Conference on Green, Low-Carbon, High-Quality Development of Animal Husbandry
Changsha, China • October 18, 2025

PARTNERS

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Aligning with China's Green Development Goals

Conference Focus

- Dual-carbon strategies
- Manure resource utilisation
- Green low-carbon development
- Model innovation in livestock

Our Contribution

- Proven European technologies
- Cross-sector cooperation models
- Emissions reduction pathways
- Circular economy implementation

Shared Challenge: Transform livestock waste from environmental burden to valuable resource

FERTITEC Project Overview

EU Horizon Europe Project (Grant Agreement 101181513)

Promoting circular economy through alternative fertilising products from secondary raw materials

Project Objectives

- Reduce reliance on conventional mineral fertilisers
- Address resource depletion and environmental pollution
- Lower energy consumption in fertiliser production
- Map and assess 184 technologies, techniques, and practices (TTPs)
- Identify 12 Best Available Technologies (BATs) for wider adoption

184	18	12
Technologies Mapped	EU & AU Projects	BATs to Identify

CiNURGi Project Overview

Interreg Baltic Sea Region

Co-funded by the European Union

CIRCULAR ECONOMY CiNURGi

EU Interreg Baltic Sea Region Programme

Regional roadmaps and standards for manure and nutrient recycling

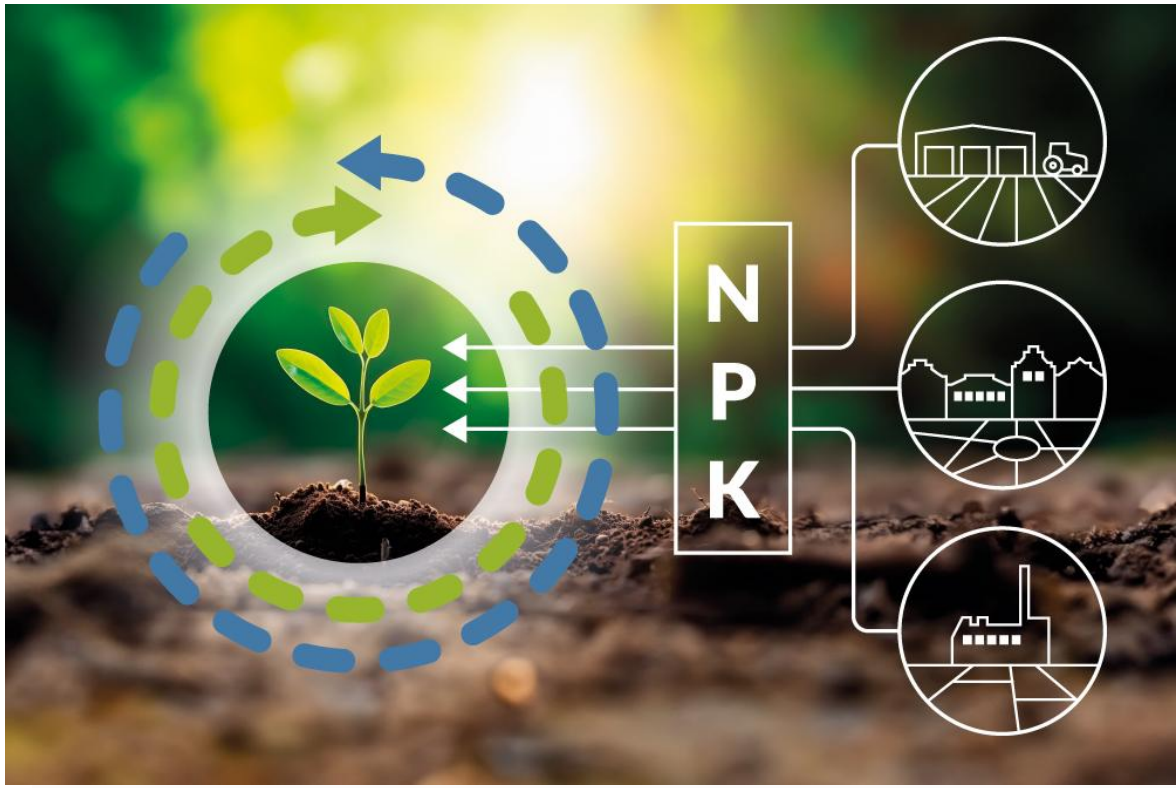
Key Focus Areas

Cross-Sector Integration

Agriculture, municipal, and industrial sectors working together for nutrient recycling

Regional Implementation

Developing practical roadmaps adapted to local conditions and regulations



Complementary Approach

- FERTITEC: Technology and innovation focus
- CiNURGi: Regional implementation and standards
- Combined: Complete solution from technology to market

Secondary Raw Materials for Circular Fertilisers

Resource Stream	Main Materials	% of Database
Agricultural Biomass	Livestock manure, slurry, crop residues, digestate	>50%
Urban Wastewater	Sewage sludge, wastewater	~20%
Municipal Biowaste	Food waste, restaurant waste, green waste	~15%
Industrial Side-Streams	Food, wood, chemical industry by-products	~10%
Blue Biomass	Fish by-products, seaweed, aquaculture sludge	<5%

Agricultural manure dominates but co-processing with other streams enhances value

Core Technologies for Manure Valorisation

1. Anaerobic Digestion (AD)

Function: Converts manure to biogas + nutrient-rich digestate

Advantage: Energy generation + fertiliser production

Scale: Farm to industrial; most mature technology (TRL 8-9)

2. Composting

Function: Aerobic decomposition for stable organic fertiliser

Advantage: Low-cost, improves soil structure

Scale: All scales; widely adopted (TRL 9)

3. Nutrient Separation & Concentration

Function: Extract phosphorus (struvite) and nitrogen compounds

Advantage: High-value mineral fertilisers

Scale: Medium to large operations (TRL 7-9)

Advanced Processing Technologies

Thermal Treatments

- Pyrolysis → Biochar
- Incineration → Ash
- HTC → Carbon concentrate

Benefits: Pathogen destruction, carbon sequestration, P recovery

Chemical Recovery

- Struvite precipitation
- Ammonia stripping
- Membrane filtration

Benefits: High-purity products, market-ready fertilisers

Emerging Technologies

- **Biostimulants:** Microalgae, protein hydrolysates from manure
- **Insect Frass:** Using insects to convert manure to high-value fertiliser
- **Bio-Based Innovations:** Enhancing fertiliser efficiency with biologicals

Technology Readiness Levels (TRL)

~65%	~20%	<20%
TRL 8-9 Operational Systems	TRL 6-7 Demonstration	TRL 3-5 Development

Market-Ready Technologies

- Anaerobic digestion systems (TRL 9) - thousands of installations
- Composting facilities (TRL 9) - proven worldwide
- Solid-liquid separation (TRL 8-9) - standard practice
- Struvite recovery (TRL 8) - commercial plants operating
- Ammonia recovery (TRL 7-8) - multiple vendors available

Key Message: Most technologies are mature and ready for deployment - the challenge is implementation, not invention

European Implementation Examples

Case 1: Denmark - National Biogas Strategy

- 50+ large-scale biogas plants processing agricultural manure
- Integrated energy and nutrient recovery
- Policy support: mandatory manure coverage, biogas subsidies
- **Result:** 30% reduction in agricultural GHG emissions

Case 2: Netherlands - Nutrient Separation

- Manure processing cooperatives handling excess manure
- Membrane filtration + struvite recovery
- Produces mineral concentrate fertiliser for export
- **Result:** Solved regional nutrient surplus problem

Groot Zevert, The Netherlands – demonstration plant

https://systemicproject.eu/plants/demonstration-plants/groot-zevert-the-netherlands/

Case 3: Sweden - Biochar from Manure

- Pyrolysis of chicken manure and deep litter
- Carbon-negative fertiliser production
- **Result:** Premium product for organic farming + carbon credits

Digestion of poultry manure, deep litter manure, horse manure

Solid manure is a poorly used resource in Sweden but by anaerobic digestion this can be change. It has the potential to contribute with 1 TWh biogas/year. Furthermore, nitrogen is largely in organically bound form but by digestion it´s directly plant available nitrogen form, ammonia, will be multiplied.

RISE: https://www.ri.se/en/expertise-areas/projects/digestion-of-poultry-manure-deep-litter-manure-horse-manure

CiNURGi Model: Cross-Sector Nutrient Networks

Interreg Baltic Sea Region

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CIRCULAR ECONOMY CiNURGi

Nutrient Flow Integration

Farms (Manure) →

+ Municipalities (Wastewater) →

+ Food Industry (Waste) →

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Central Processing Facility

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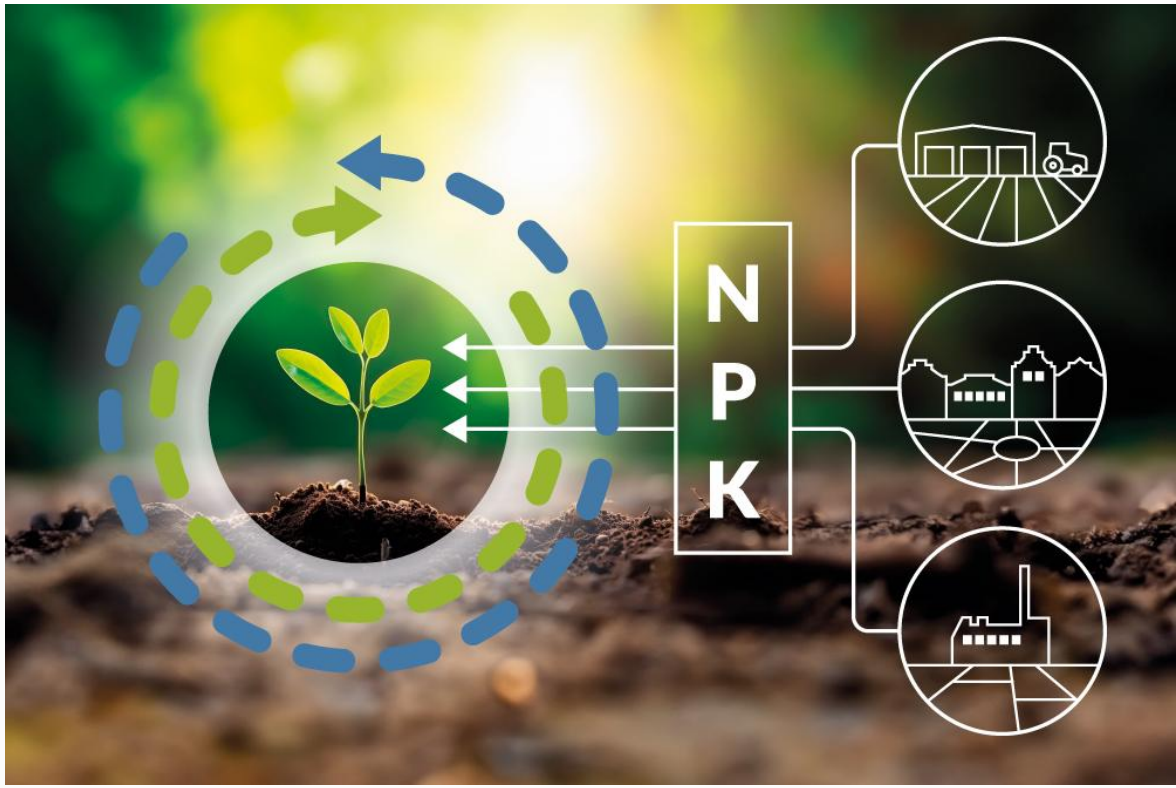
Quality Fertiliser Products → Back to Farms



Success Factors

- **Regional coordination:** Municipality or cooperative leadership
- **Shared infrastructure:** Reduces individual farm investment
- **Quality standards:** Certified products build farmer trust
- **Multiple revenue streams:** Energy, fertiliser, carbon credits
- **Policy alignment:** Coordinated regulations across sectors

Environmental & Climate Benefits

50-70%
GHG Reduction vs. Mineral Fertiliser

80-90%
Energy Savings

100%
Nutrient Recycling

Specific Benefits by Technology

- **Anaerobic Digestion:** Captures methane (25x GHG impact of CO_2); produces renewable energy
- **Nutrient Recovery:** Reduces nitrogen runoff by 40-60%; prevents eutrophication
- **Biochar Production:** Sequesters carbon for centuries; improves soil water retention
- **Composting:** Reduces pathogens; stabilizes nutrients; builds soil organic matter

Dual-Carbon Alignment: These technologies simultaneously reduce emissions AND enhance carbon sequestration in soils

Key Challenges and Barriers

Regulatory

- Fragmented regulations across regions
- Lengthy permitting processes
- Unclear certification requirements
- Limited policy incentives

Technical/Economic

- High upfront investment costs
- Variable raw material quality
- Transport/logistics expenses
- Competition with cheap imports

Market Barriers

- **Farmer skepticism:** Lack of trust in organic fertiliser performance
- **Information gap:** Insufficient demonstration and education
- **Quality variability:** Inconsistent products damage market confidence
- **Price sensitivity:** Competing with subsidized mineral fertilisers

Most barriers are institutional and market-based, not technical

EU Policy Framework & Lessons

EU Fertilising Products Regulation (2019/1009)

Harmonized framework for circular fertilisers across EU market

- Defines product categories for recycled nutrients
- Sets quality and safety standards
- Enables cross-border trade
- Supports circular economy goals

Complementary Policies

- **EU Green Deal:** Carbon neutrality by 2050
- **Farm to Fork Strategy:** Reduce nutrient losses by 50% by 2030
- **Renewable Energy Directive:** Biogas from manure qualifies for incentives
- **National programs:** Investment subsidies, R&D funding, demonstration projects

Key Lesson: Successful deployment requires integrated policy framework combining regulation, incentives, and market support

Recommendations for Implementation

1. Technology Deployment

- Focus on proven technologies (TRL 8-9) for immediate impact
- Adapt European BATs to local conditions
- Pilot cross-sector cooperation models

2. Policy & Standards

- Develop harmonized quality standards for circular fertilisers
- Create certification system building farmer trust
- Align manure management with renewable energy and climate policy

3. Market Development

- Establish demonstration farms showing performance
- Support farmer cooperatives for shared infrastructure
- Consider carbon credit mechanisms for climate-positive practices

4. Knowledge Exchange

- Continue EU-China technical cooperation
- Share databases and best practices
- Joint research on adaptation to Chinese conditions

EU-China Collaboration Opportunities

European Strengths

- Technology database & BATs
- Policy frameworks
- Certification systems
- 25+ years implementation

China Strengths

- Scale of implementation
- Manufacturing capacity
- Policy coordination
- Rapid deployment ability

Potential Joint Activities

- **Pilot Projects:** Demonstrate European technologies in Chinese conditions
- **Technology Transfer:** Adapt and localize proven solutions
- **Standard Development:** Harmonize quality standards for mutual recognition
- **Research Cooperation:** Joint development for Asian agricultural systems
- **Training Programs:** Technical capacity building and knowledge exchange

Key Takeaways

1. Technologies are mature and ready - 65% at TRL 8-9
2. Agricultural manure is the primary resource with proven valorisation pathways
3. Cross-sector cooperation multiplies benefits and reduces costs
4. Environmental benefits are substantial: 50-70% GHG reduction
5. Success requires integrated policy + technology + market development

The Path Forward

Transform livestock manure from waste to resource through proven circular economy technologies, supporting China's dual-carbon goals while enhancing farmer prosperity and environmental quality.

Thank you! Tack! 谢谢!

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