National infrastructure, synchrotron related research in academy and industry of relevance for Bio4Energy

Bio4Energy Autumn Researchers' Meeting 2023

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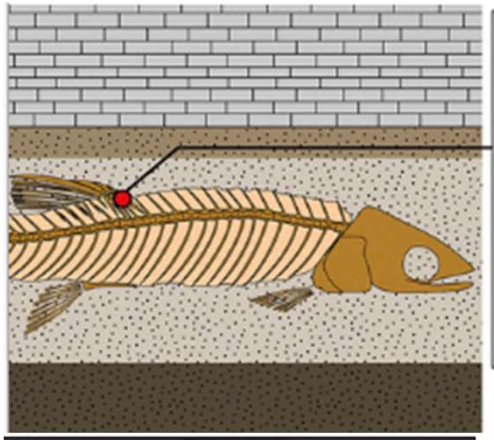
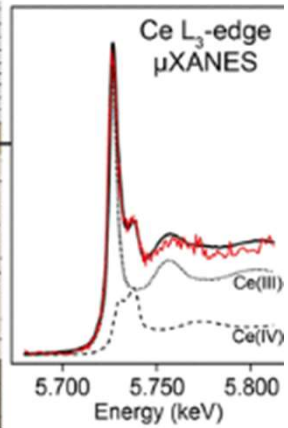
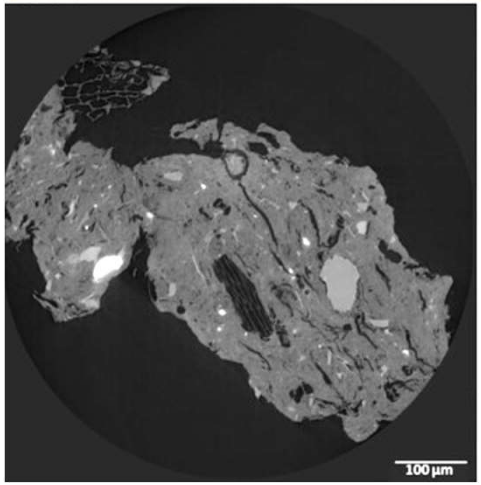
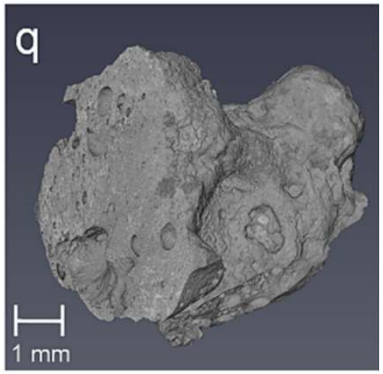
International infrastructure enabling excellent science – synchrotrons and neutron sources

- Enables experiments near impossible in laboratory settings today
- Versatile in terms of techniques and combinations
- Time-resolved studies at femtosecond possible
- X-rays or neutrons depending on research question
- Useful for any aggregation state
- Oxidation state measurements









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Light sources of the world

There are more than 50 light sources in the world (operational, or under construction). This page lists all the members of the lightsources.org collaboration.

- Application season – typically twice per year at each synchrotron and beamline
- You apply for a beamline and technique(s)
- Contact beamline scientist well in advance about your experiment
- Do your homework with in-house techniques to motivate why beamtime is necessary
- Beamtime is free if data is for publications – rarely, travel costs are also covered
- 1 shift is normally between 4 hours – 8 hours; usually at least 1 day total
- Example from Balder at MAX IV – 30 samples w/ triplicate EXAFS in 4 hours

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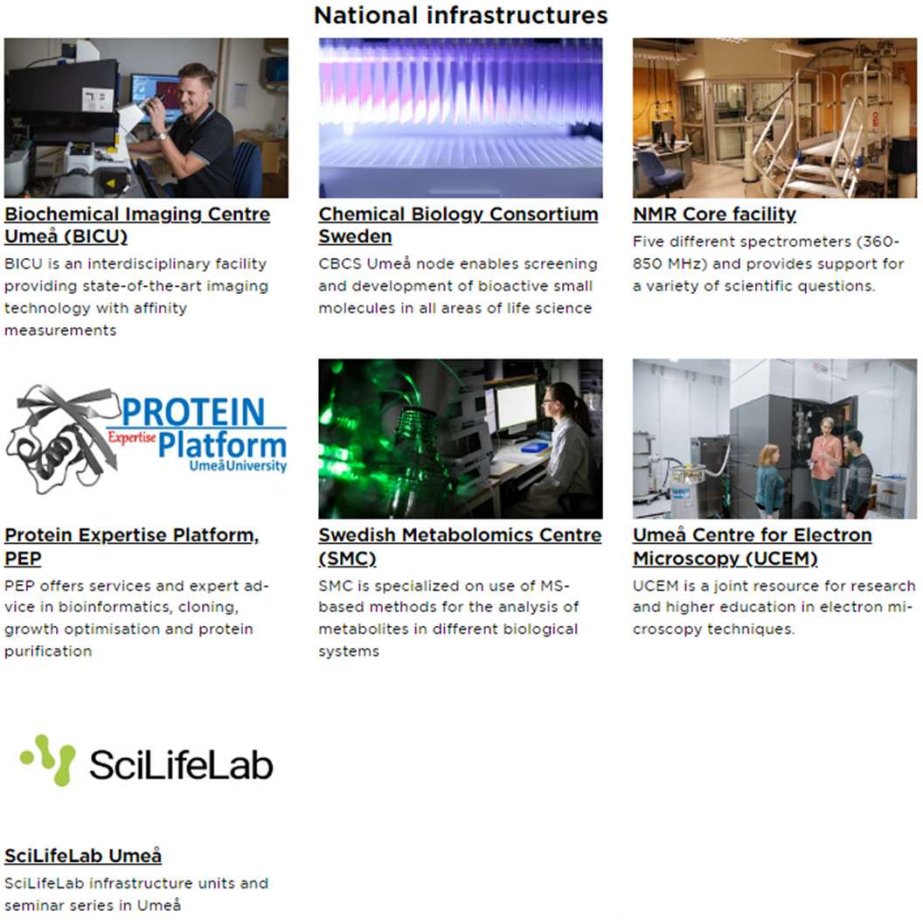
Homework – complementary analysis

- Complementary to X-ray or neutron techniques
- National analytical infrastructures
- KBC research infrastructures
- Many techniques available through Bio4Energy collaborations



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Homework – initial analysis

LUMIA - Luleå Material Imaging and Analysis

LUMIA is a merger of four laboratories that perform micro-analysis of various solid materials in 2D/3D/4D.

Within LUMIA, analytical research expertise and advanced analytical equipment have been brought together to create a forum for groundbreaking research and analysis of various materials. LUMIA acts as a hub for the technical analytical capacity at the university and this experimental environment for advanced materials analysis is a creative meeting place for researchers, students, and companies.

Director

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MAX

UMEÅ UNIVERSITY

MULTI-PURPOSE ADAPTIVE X-RAY SCATTERING PLATFORM

- 2x Bruker D8 Advance
- Eiger2 500K
- Lynxeye XE-T
- Powder X-ray diffraction (WAXS/SAXS)
- Total X-ray scattering
- X-ray reflectometry
- Multiple X-ray anodes
- Sample environments

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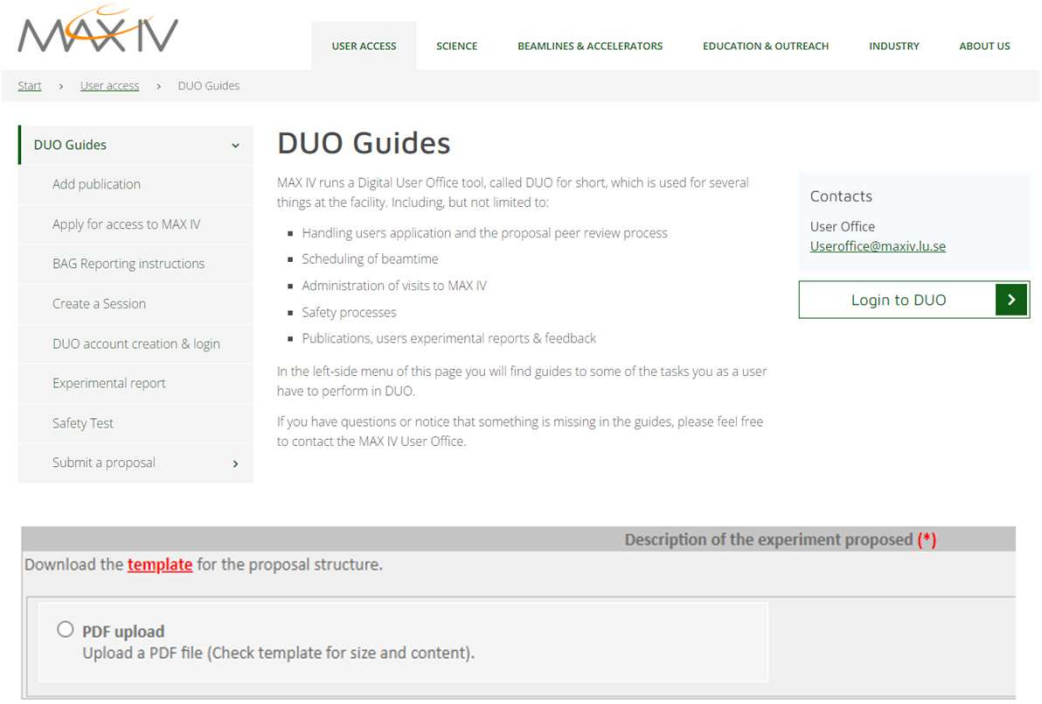
Application procedure

- Find user portal for the synchrotron with beamline identified as relevant
- Check for similar capabilities at other synchrotrons or beamlines
- Prepare the idea – in dialogue with beamline staff
- Discuss with experienced colleagues
- Typically 2-page template



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Experiment time!

- First visit is a learning experience
- Beamline scientists are the experts on analysis
- Describe samples well to find suitable measurement strategy
- Realise that you generate lots of data
- Bring enough people for 24 to 96 hours continuous measurement

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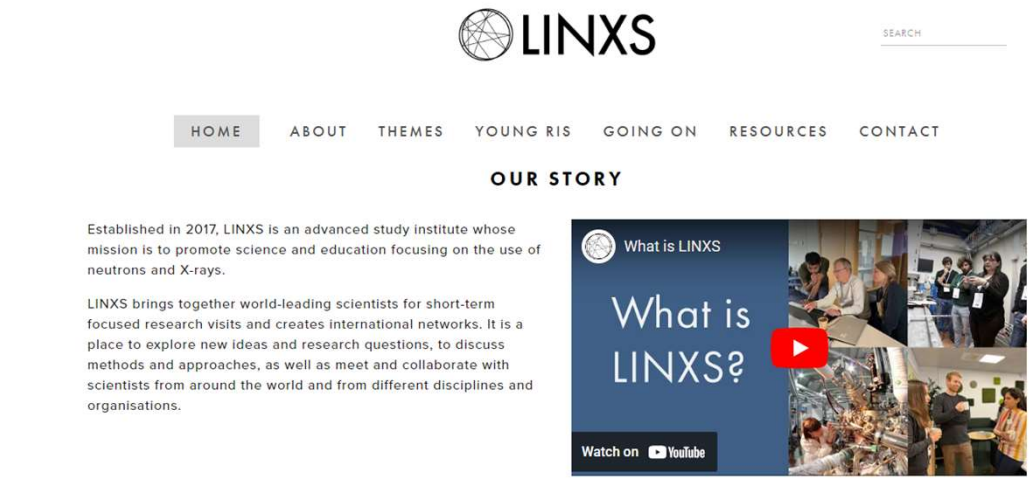
What to do with all the data?

- Ask someone experienced
- Participate in training courses
- XRT (LTU, UmU)
- XRD (UmU, LTU)
- XAS (SLU, UmU, LTU)
- XPS (UmU)
- Set time aside!



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What are your thoughts?

- Pick up phone or laptop
- Either scan QR-code OR
  join at menti.com with code
  7468 5385
- Questions will be shown in
  screen

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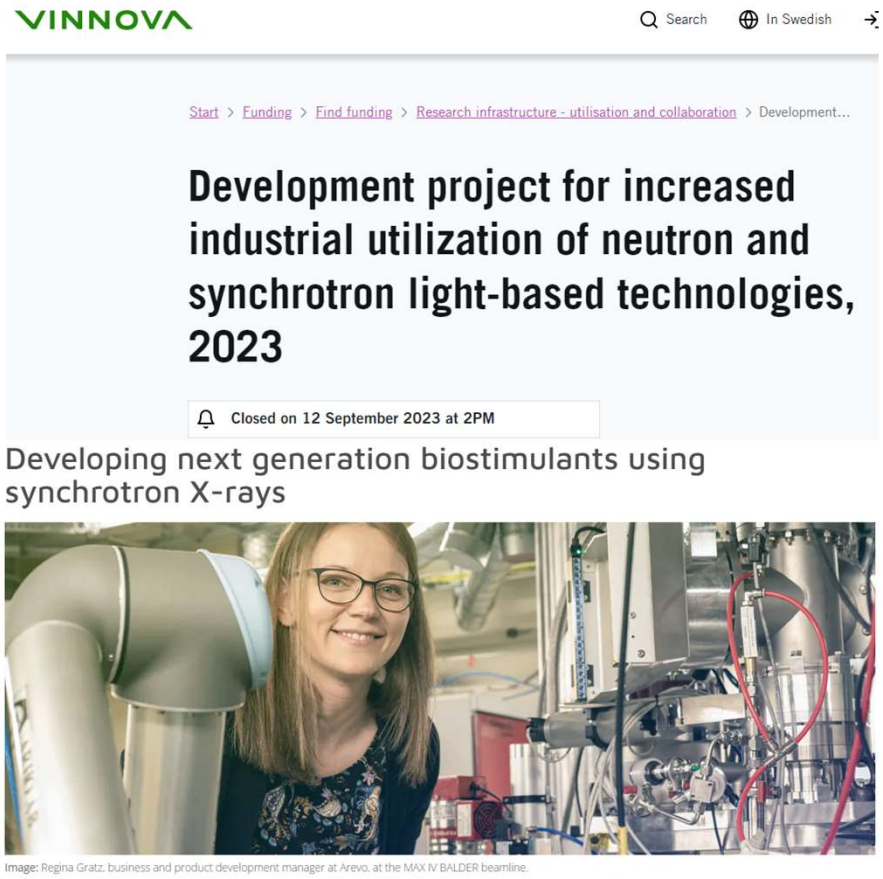
Industrial collaboration

- Industrial collaborations generally not considered in beam time applications
- However, often measured at the facilities as societal impact
- Vinnova have previously had calls for introducing industrial users to these techniques
- Uncertainty about 2024 ->



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PRISMAS – another initiative to broaden use

- EU COFUND MSCA programme with MAX IV as main applicant
- 40 PhD students across Sweden
- 3 LTU, 2 UmU
- 2 related to Bio4Energy researchers
- Secondment at FORMAX and Balder

PRISMAS PhD Programme

PRISMAS

Affiliation	Total
Lund University	14
Stockholm University	8
Uppsala University	7
Malmö University	3
Luleå University of Technology	3
Karlstad University	2
Umeå University	2
University of Gothenburg	1
KTH	0
SLU	0
SUM	40

Co-funded by the European Union

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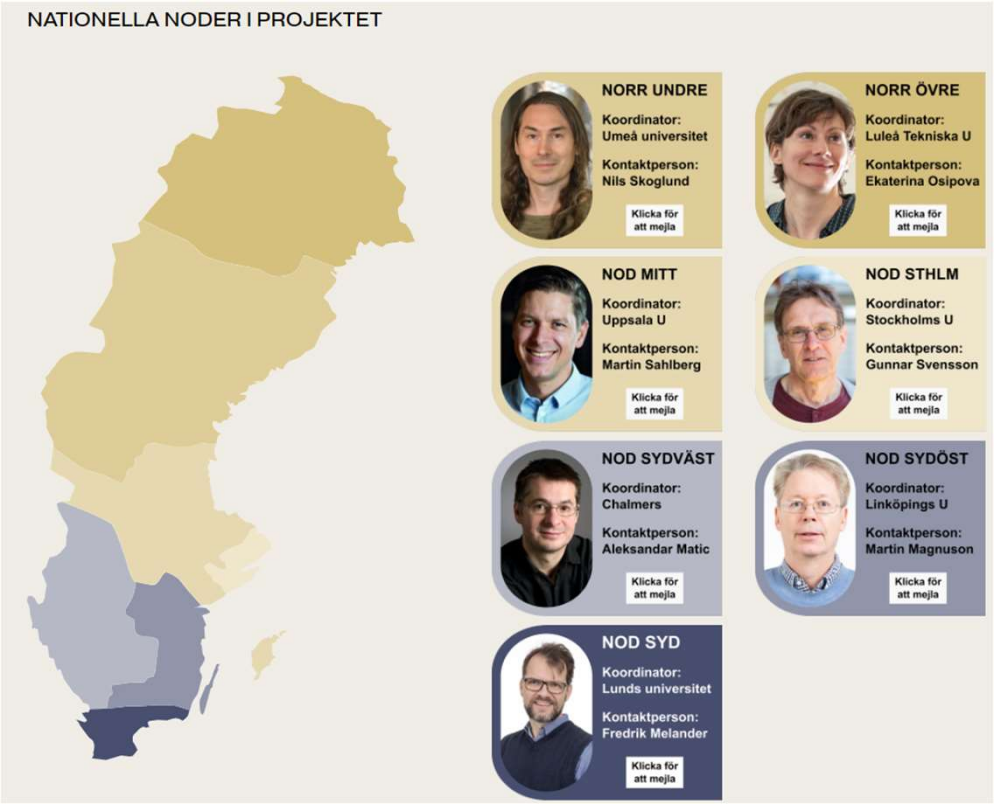
Vinnova SPIRIT

- 3rd attempt to increase industrial engagement at MAX IV and ESS
- Purpose is to open up academic competence to industry and public sector
- National system of nodes
- Framework likely started in 2024 (application pending)
- Reports on synchrotron and neutron use on national level



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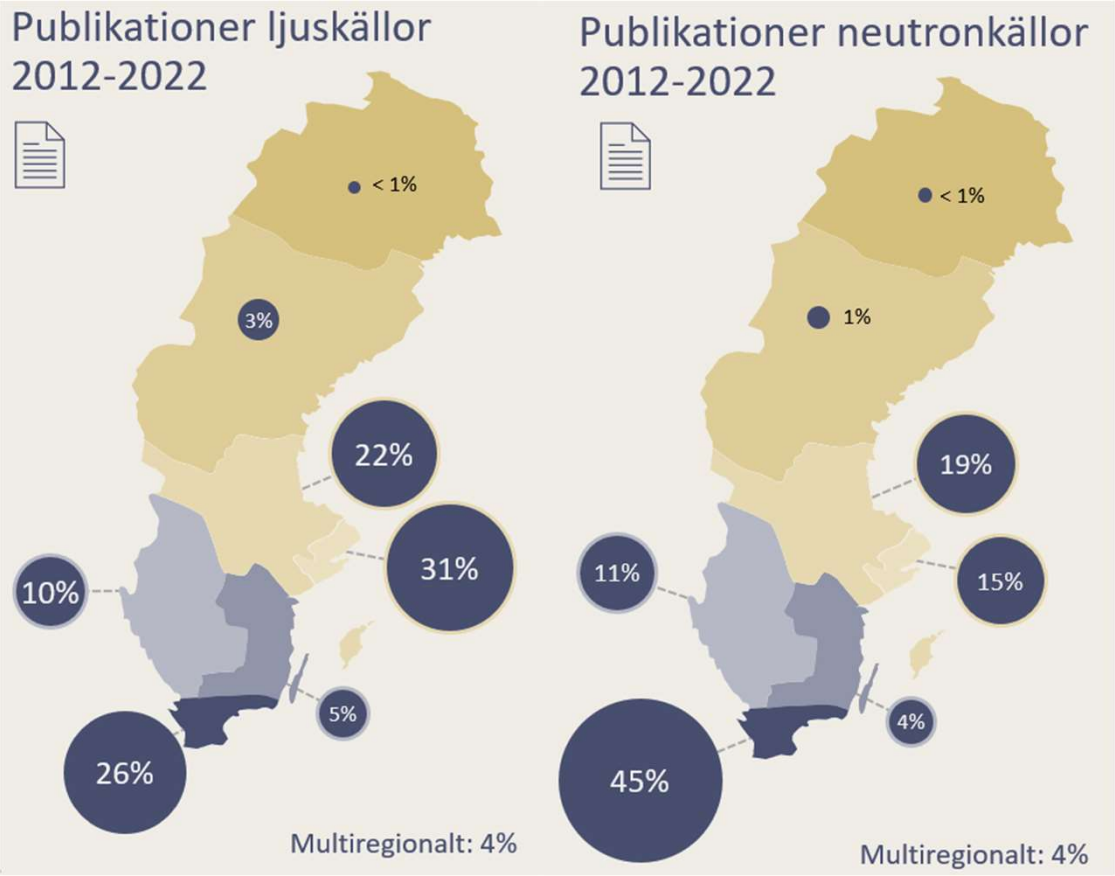
Vinnova SPIRIT

- Current status – share of Swedish publications in the node regions
- Bio4Energy represented from UmU, LTU, SLU
- Engagement in LINXS themes may improve chances for beam time
- Also suitable for industrial collaborations



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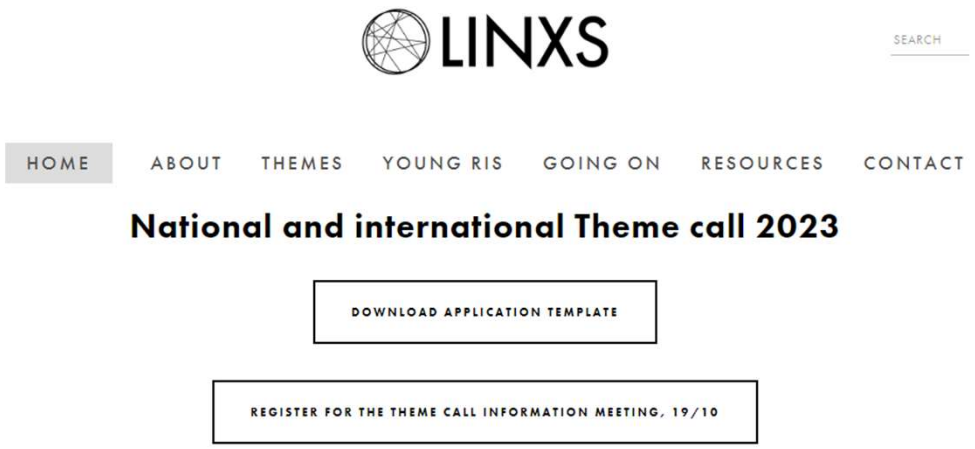
LINXS theme – good start within Bio4Energy?

- Actors from multiple partners permitted
- 3-year themes
- Earlier examples have started solid collaborations between academia and actors in industry or public sector
- Any existing collaborations where it fits?



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Questions? Ask a Bio4Energy researcher!

- Umeå university – Nils Skoglund (MAXS), Anna Strandberg
- Swedish University of Agricultural Sciences – Mikael Thyrel
- Luleå University of Technology – Fredrik Forsberg (LUMIA)

Anna Strandberg

Min forskning är inom bioenergi och resursåtervinning. Jag studerar biokol och askor från restströmmar med avseende på vatten- och markapplikationer och återvinning av näringsämnen.

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