How can biogas plants support better utilization of nutrients in agriculture?

Torkild Birkmose
SEGES innovation

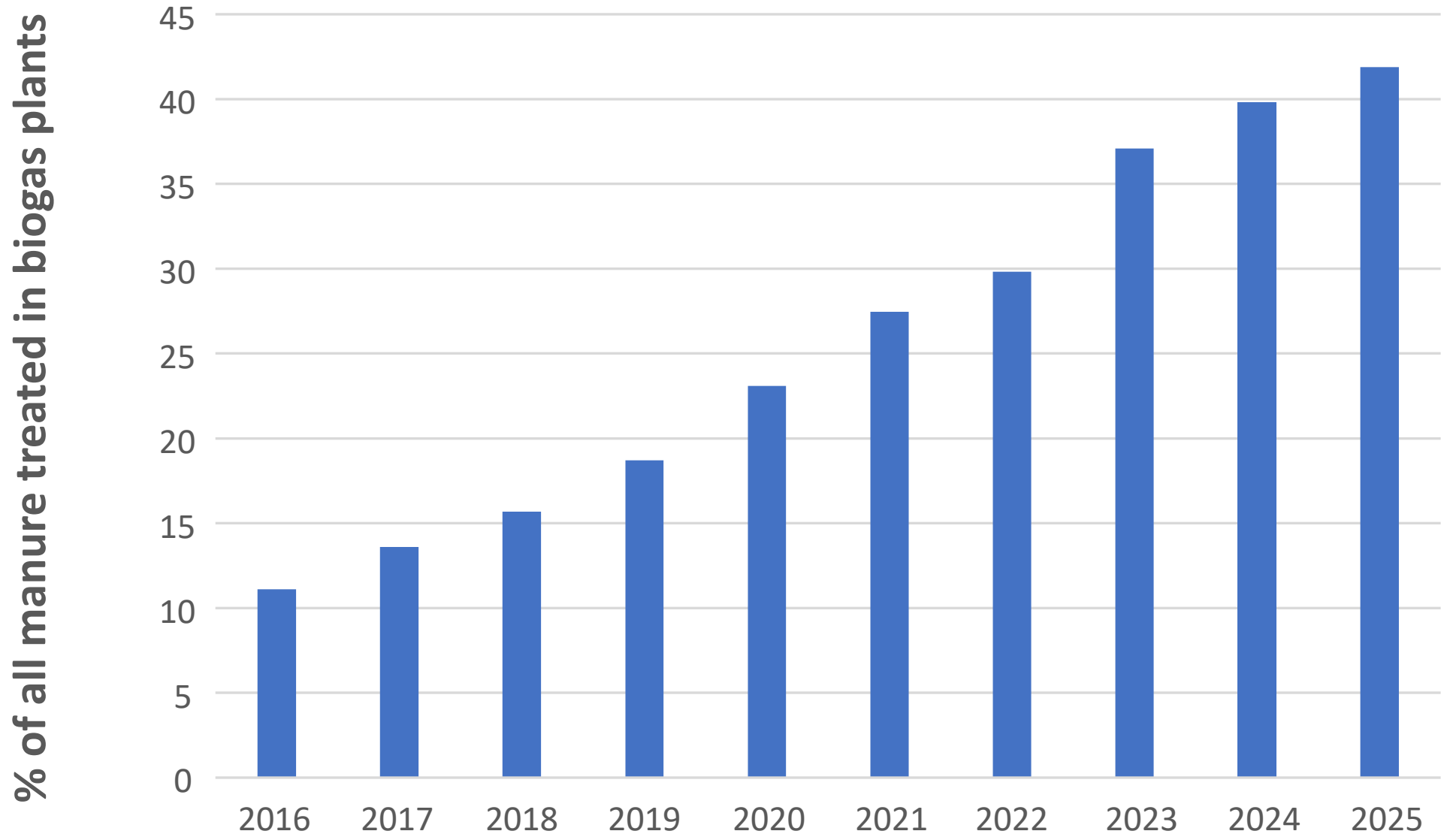
STØTTET AF
Planteafgiftsfonden

Agenda – very simple!

- Biogas in Denmark today vs 25 years ago
  - What has changed?
- What can we do about it?

SEGES INNOVATION

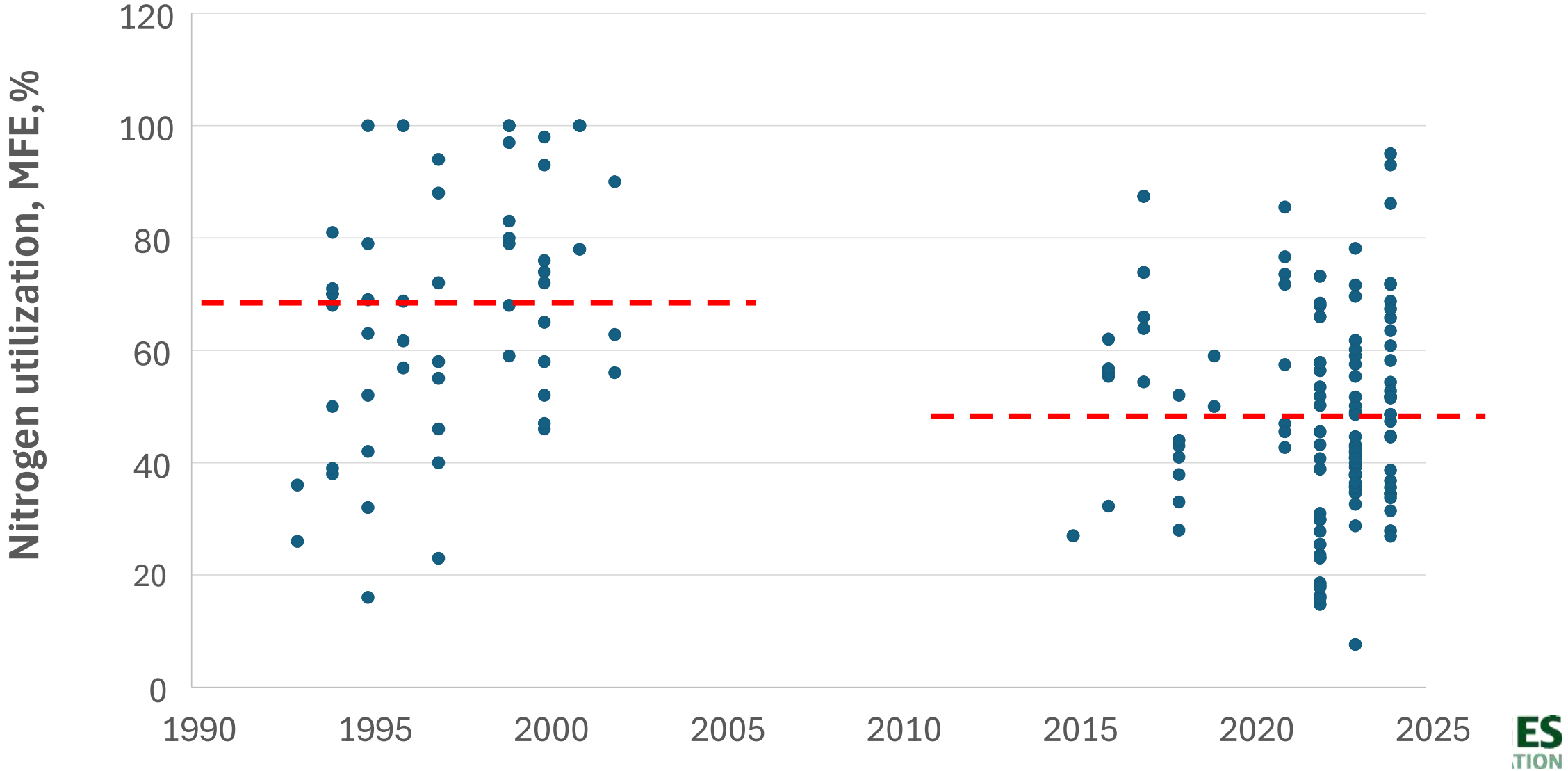
42% of all manure was treated in biogas plants



Source: The Danish Energy Agency

SEGES INNOVATION

Nitrogen utilization in digested manure applied to winter wheat trials, 1993-2024



Source: SEGES Innovation

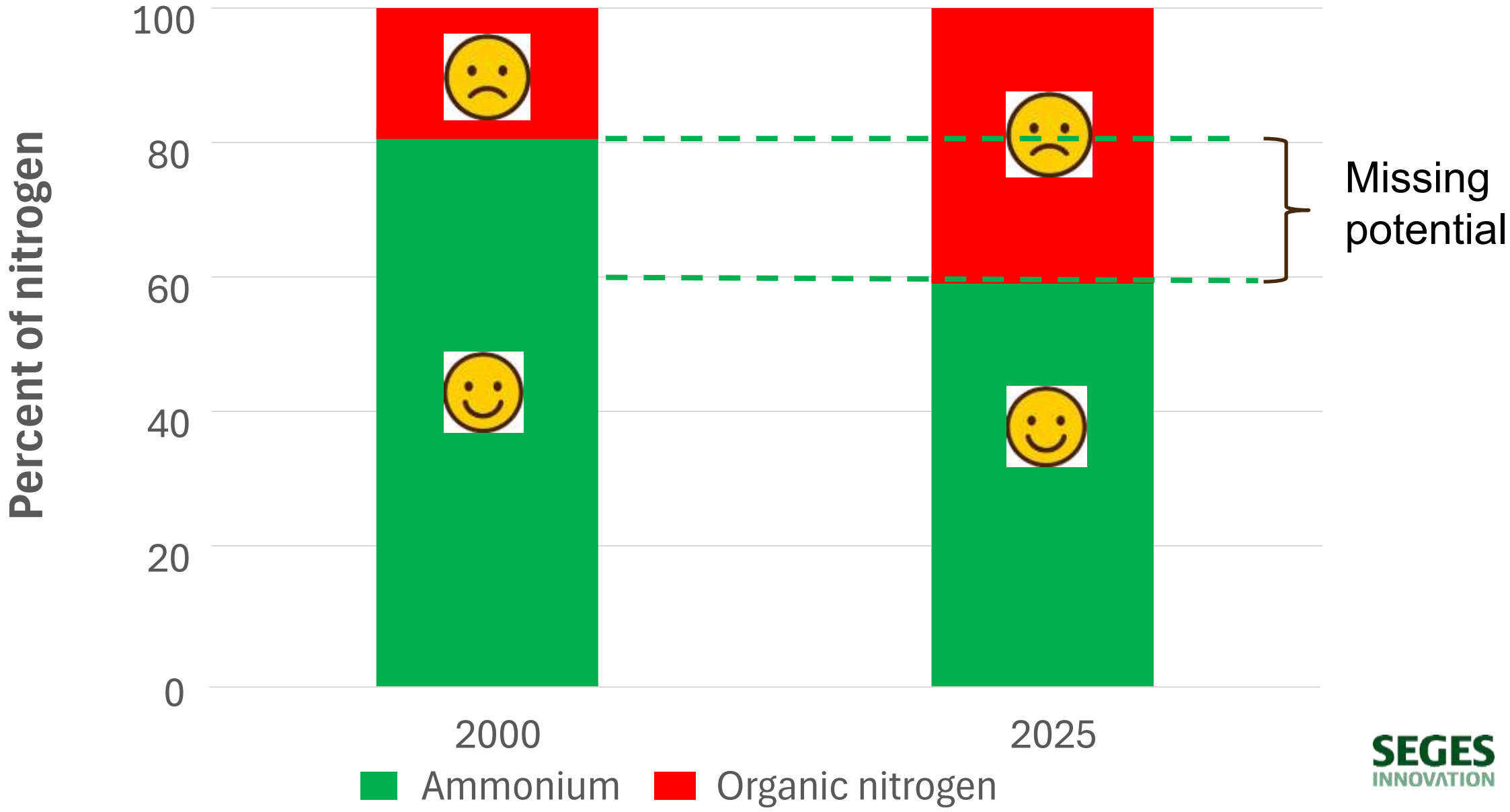
Typical biomasses used in biogas plants before and today

1980-2010	2010-2020	2020 -
• Slurry • Easy digestible waste	• Slurry • Easy digestible waste • Energy crops • Deep litter	• Slurry • Easy digestible waste • (Energy crops) • Deep litter • Straw

Easy digestible biomasses → Harder digestible biomasses

SEGES INNOVATION

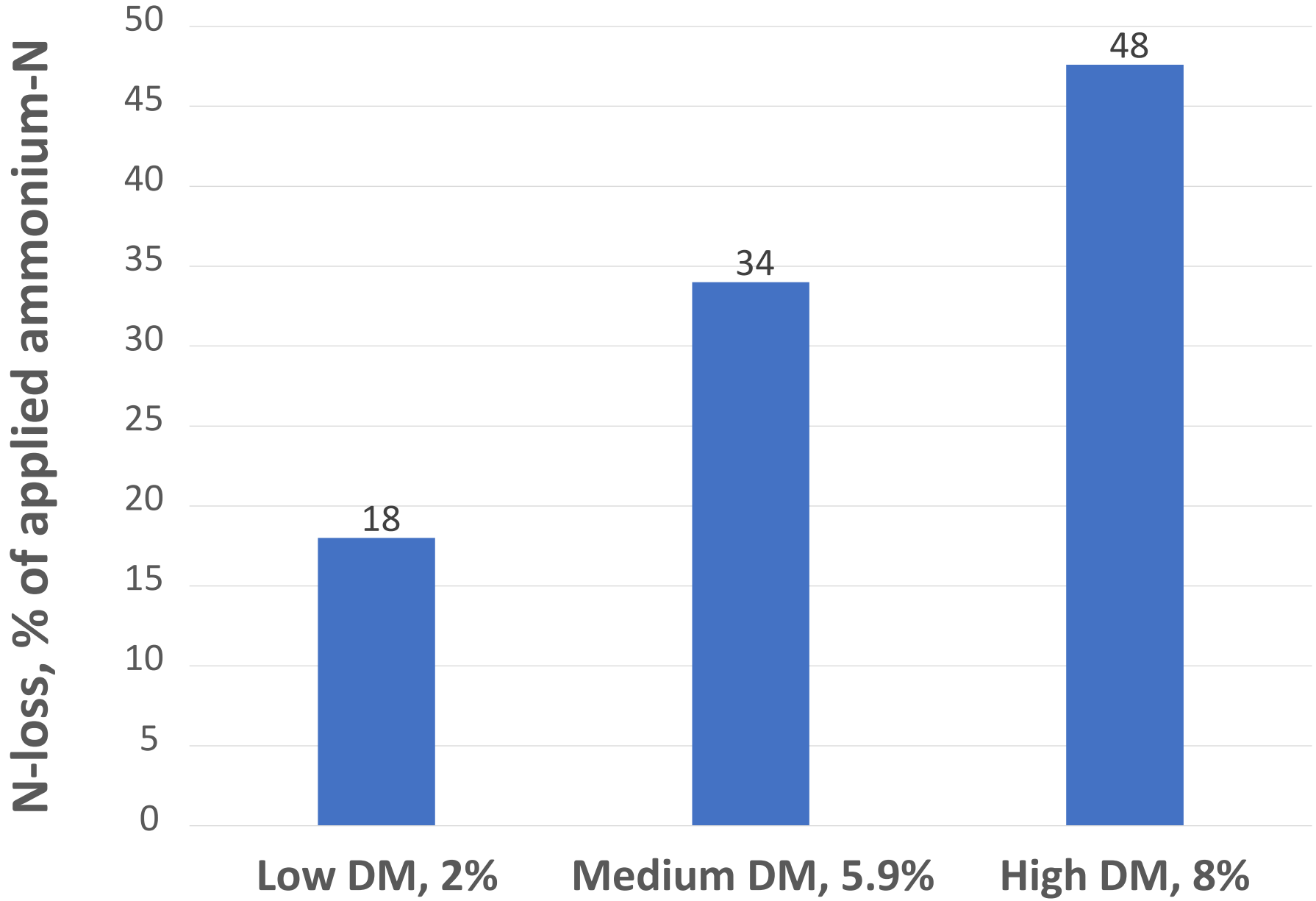
Composition of nitrogen before and now – lower fertilizer potential



Source: SEGES Innovation

SEGES INNOVATION

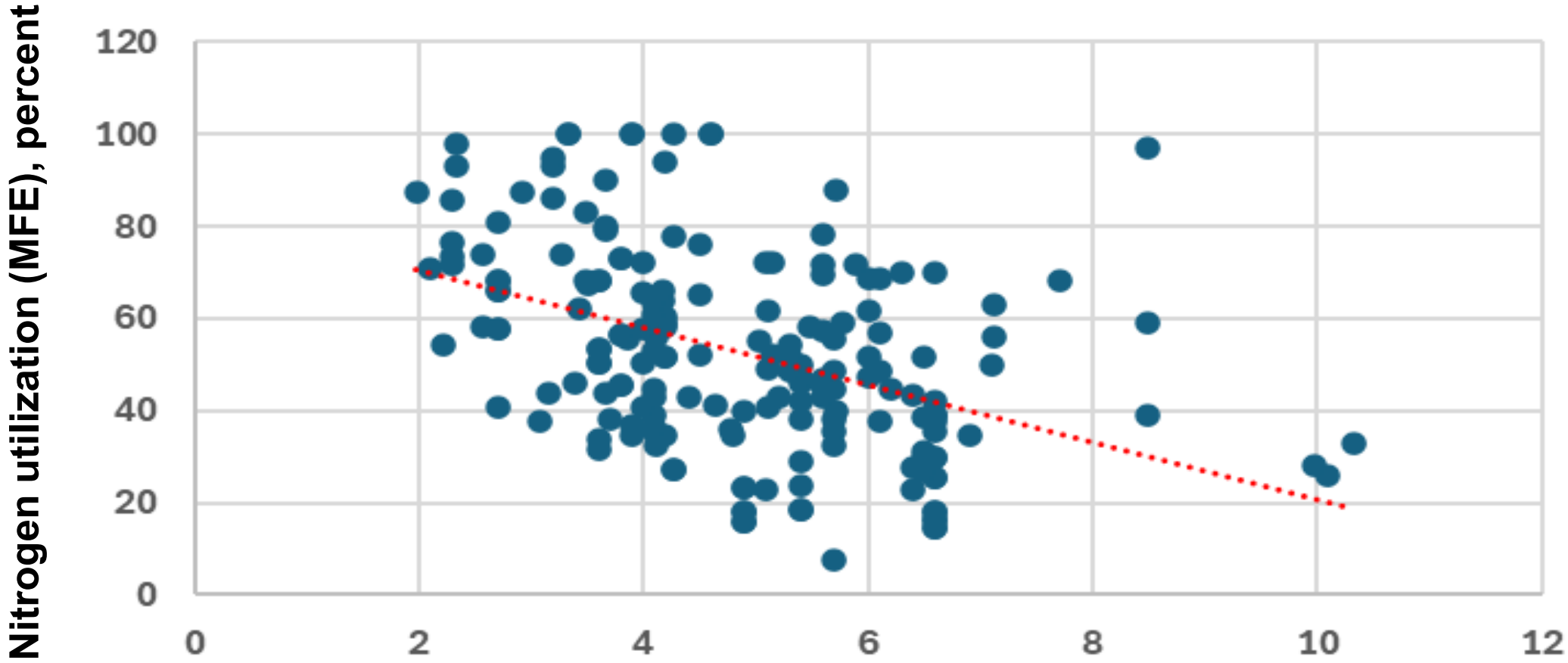
High dry matter contend also results in high ammonia volatilization when surface applied



Source: Anders Peter Adamsen, Aarhus University

SEGES INNOVATION

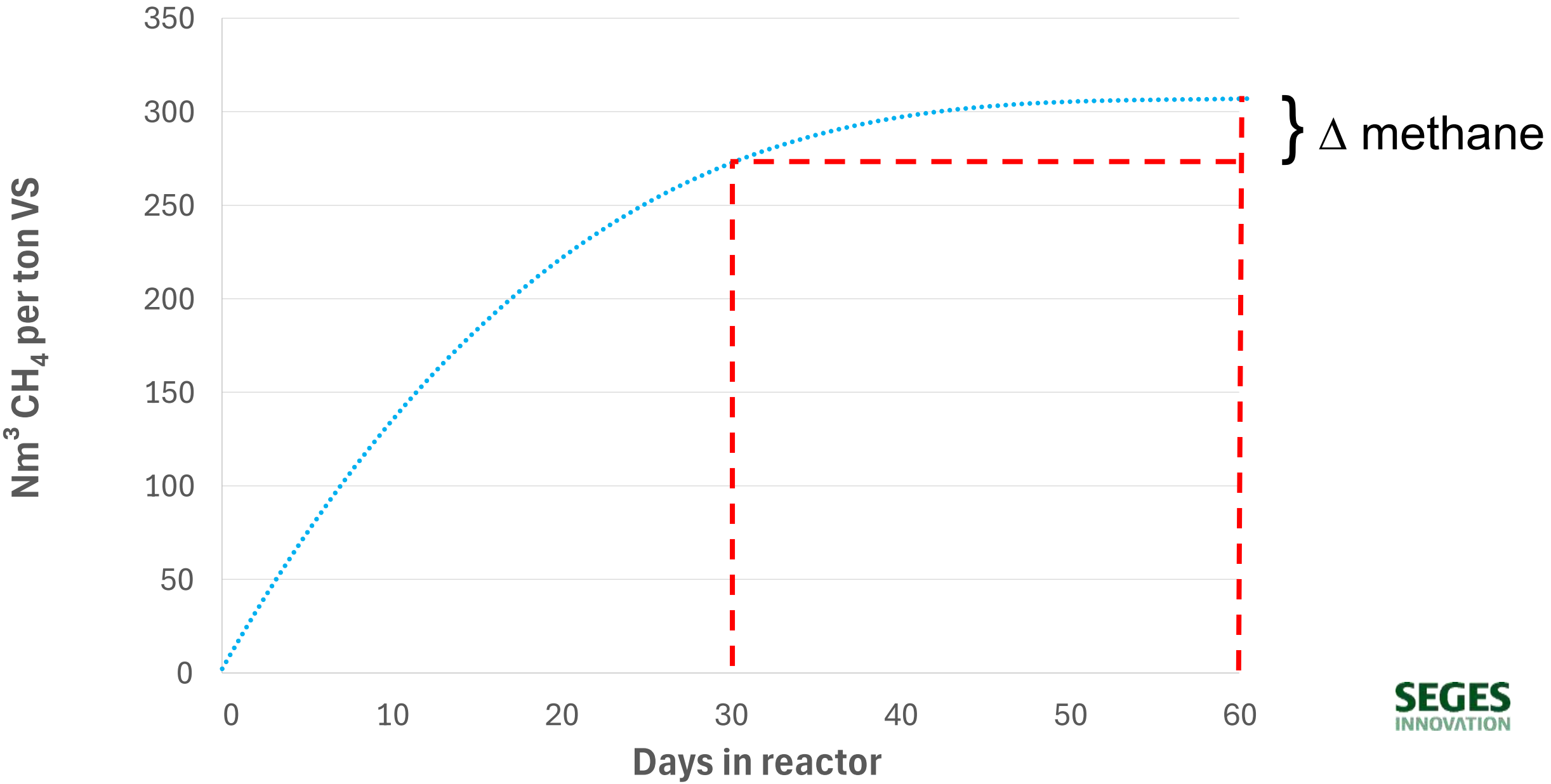
High dry matter contend results in low nitrogen utilization



Source: SEGES Innovation

SEGES INNOVATION

Longer retention time in biogas plants helps – a little…



SEGES INNOVATION

Can’t we just get rid of the dry matter?

Digested biomass

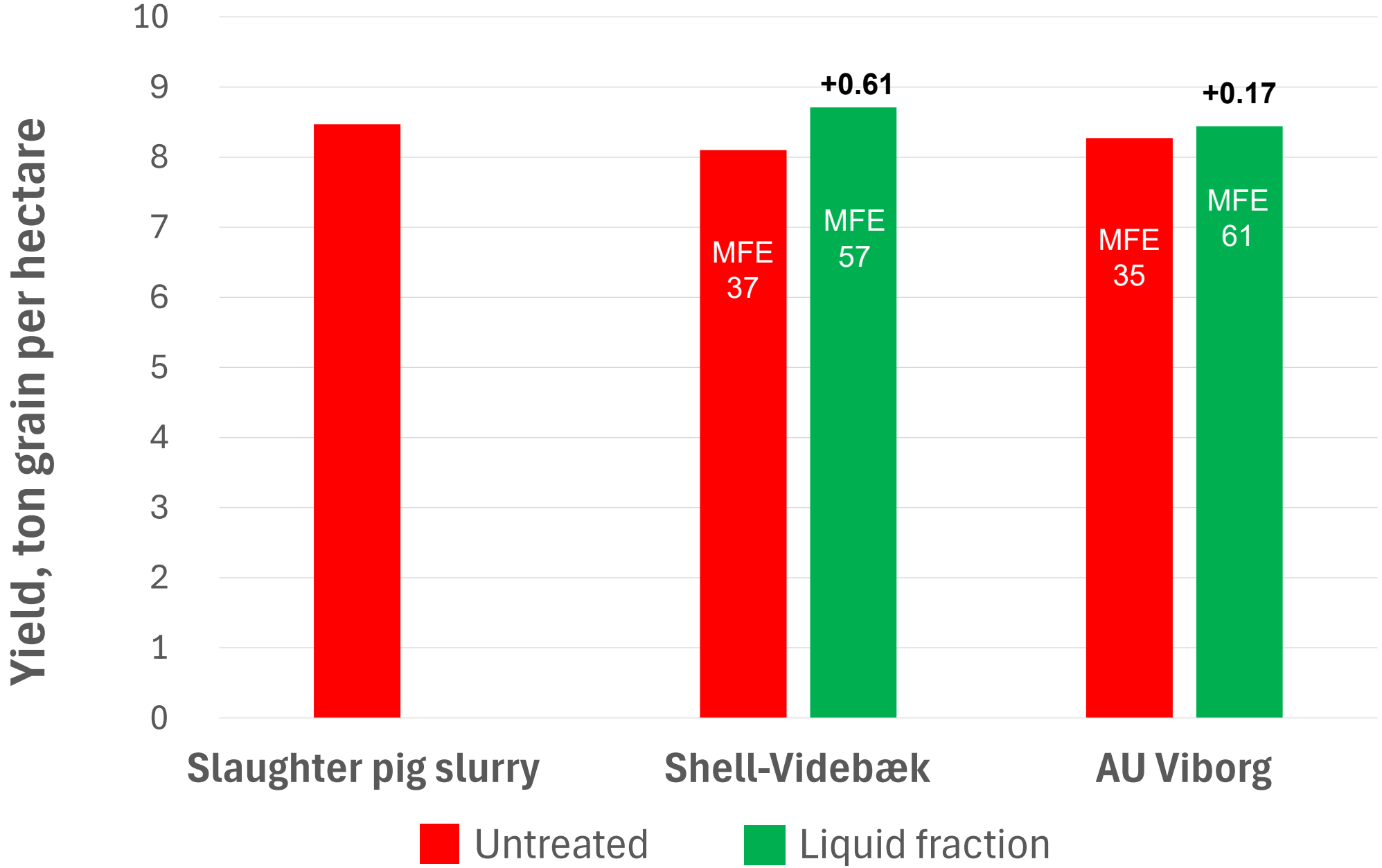
Liquid fraction after separation

Photo: Martin Nørregaard Hansen, SEGES Innovation

SEGES INNOVATION

Separation can remove some of the dry matter
BÖRGER
SEGES
INNOVATION

Effect of separation with decanter centrifuge, 9 field trials in winter wheat, 2022-24



Source: SEGES Innovation

SEGES INNOVATION

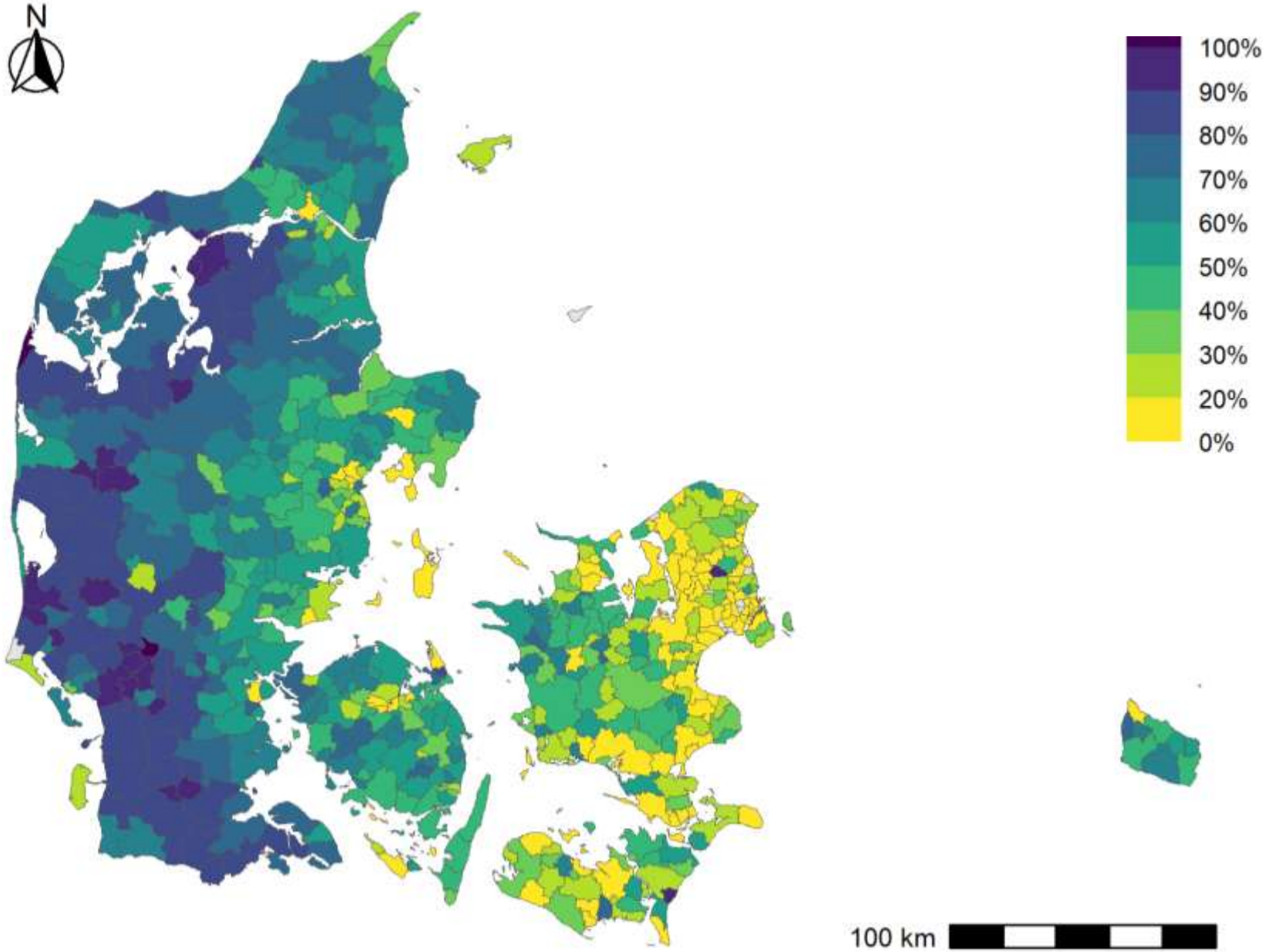
Effect of separation with screw press and decanter centrifuge

	Dry matter, %	NH_4/total -N, %	N/P ratio
Unseparated digestate biomass	7,1	60	5,3
Liquid fraction, screw press	4,9	64	5,8
Liquid fraction, decanter centrifuge	4,1	68	7,7

Source: Aarhus University

SEGES INNOVATION

Farm area utilized for application of manure



Source: SEGES Innovation

SEGES INNOVATION

More technology – fx pyrolyzis and production of biochar

SEGES INNOVATION

Examples of other benefits of biogas plants

- Transport of slurry – optimizing farmers logistics
- Storage capacity
- Odor reduction
- Safe utilization of waste products
- Adaption to new Danish CO_2-tax

SEGES INNOVATION

Biogas plants can be a Kinder Egg for farmers…

SEGES INNOVATION

Take home…

- Biogas is booming in Denmark!
- Digested biomass has changes considerably during the last 25 years, and the fertilizer quality has decreased significantly
- Intelligent use of biomasses, optimizing of biogas processes, separation and pyrolyzes may be parts of the solution
- Biogas plants and farmers are depending on each other

=> collaboration is the only way forward!

SEGES INNOVATION

Thanks for your attention…