

COASTAL Biogas

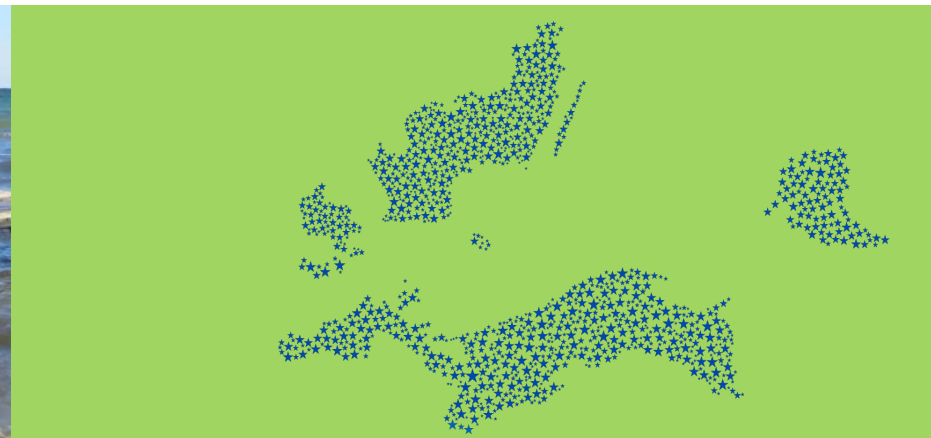
Cluster On Anaerobic digestion, environmental Services and NuTrients removal

Conference Lithuania • 30 September 2020, Internet

Experiences from Solrød

Development at Roskilde University

Michelle Diana Hansen & Tyge Kjær



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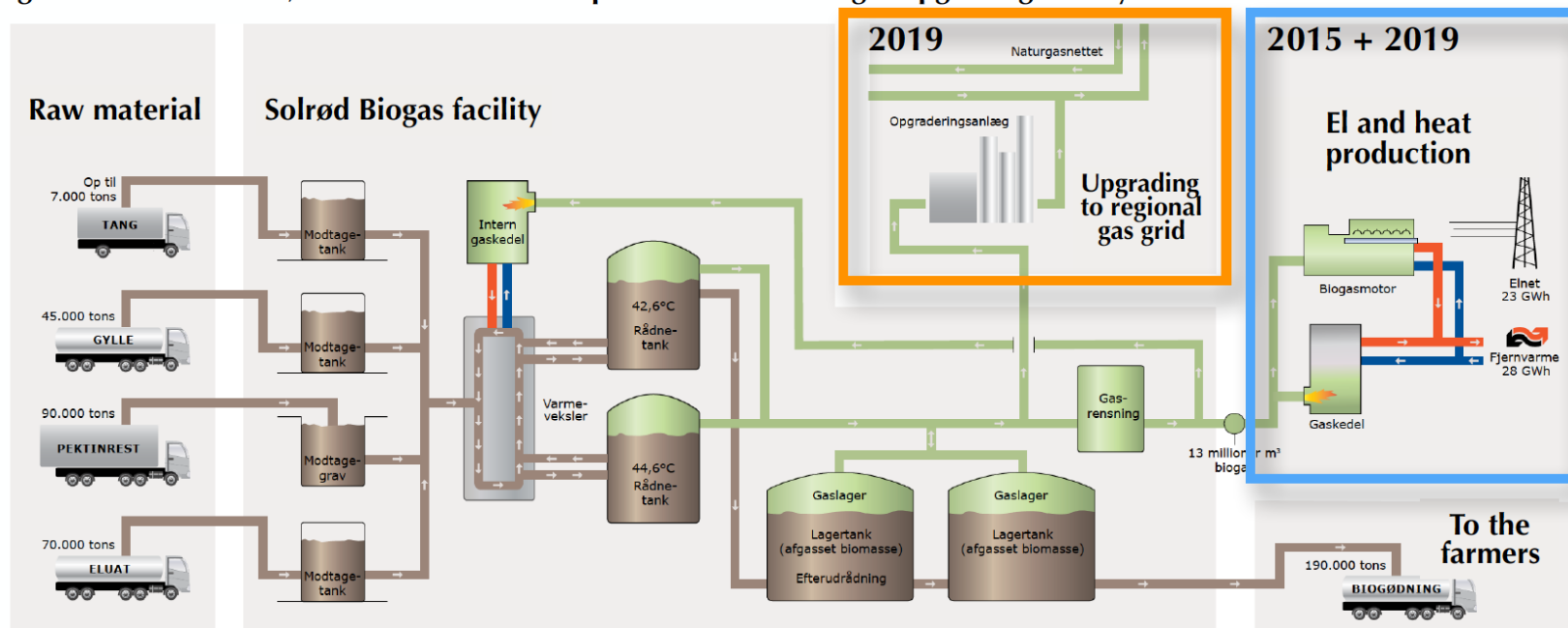
Local energy leadership

From Heating plan -> Climate action Plan => Building a biogas plant



Biogas • 226.000 tons • Raw materials

Designed for around 226,000 tons - has been expanded with a new gas upgrading facility



Biomass	Amount (tons)	Biogas	Main contribution
Manure, seaweed, other	51,000	6.0%	Gas production and process stability
CPKelco: Pectin, carrageenan	95,000	59.1%	Gas production
Chr.Hansen: Eluat (BioTech)	60,000	12.6%	Gas production and nutrients
Biopulp (Organic waste)	20,000	22,3%	Gas production and nutrients
Ialt	226,000		

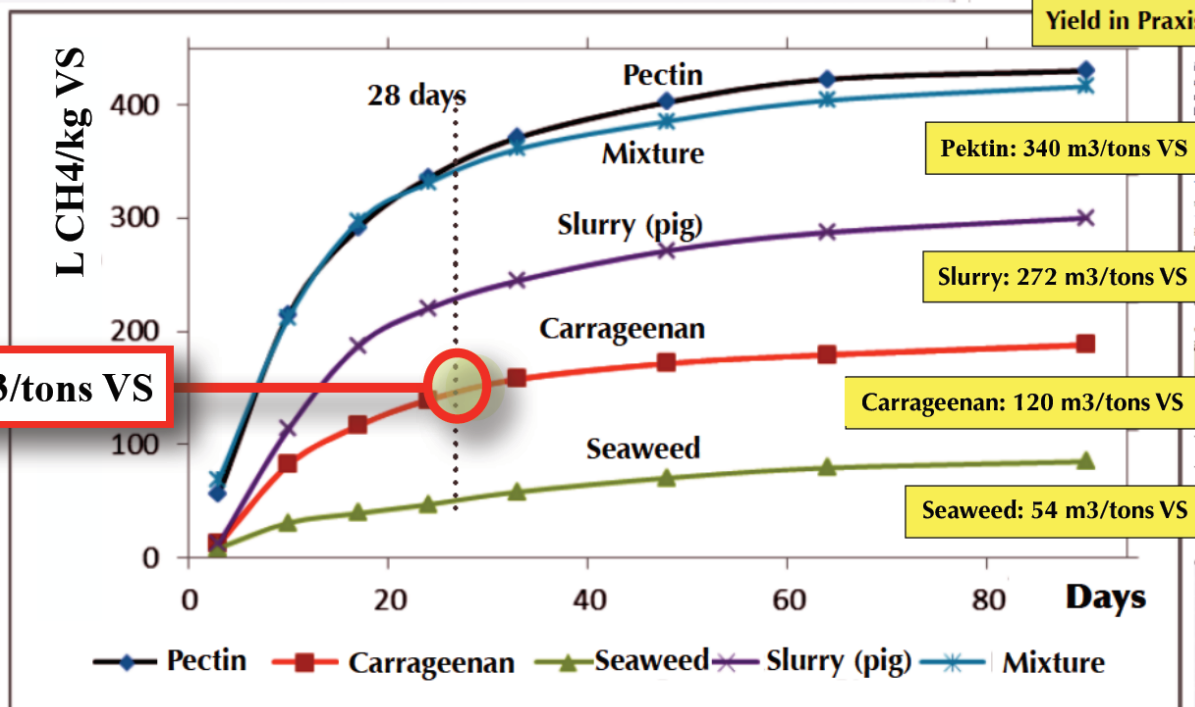
Tests of raw materials

Test of different raw materials and combination of different raw materials

Henrik B. Møller, Foulum / Århus Universitet and Roskilde Universitet

A number of tests has been initiated.

- Average level in the start up: 54 m³ per tons VS
- New test (ongoing) indicates 120 m³ per tons VS, if the material is fresh from sea



Biogas forbrug med alternativ biomasse til Solrød biogas

2013

Biogas forsøg med alternativ biomasse til Solrød biogasanlæg – Fase 2

Henrik Bjarne Møller
Århus Universitet, Institut for ingeniervidenskab

Ressource

Biogas behandling af tang, pektinrestprodukter og husdyrgødning

Henrik Bjarne Møller og Dhan Prasad Ghossein
Århus Universitet, Institut for ingeniervidenskab

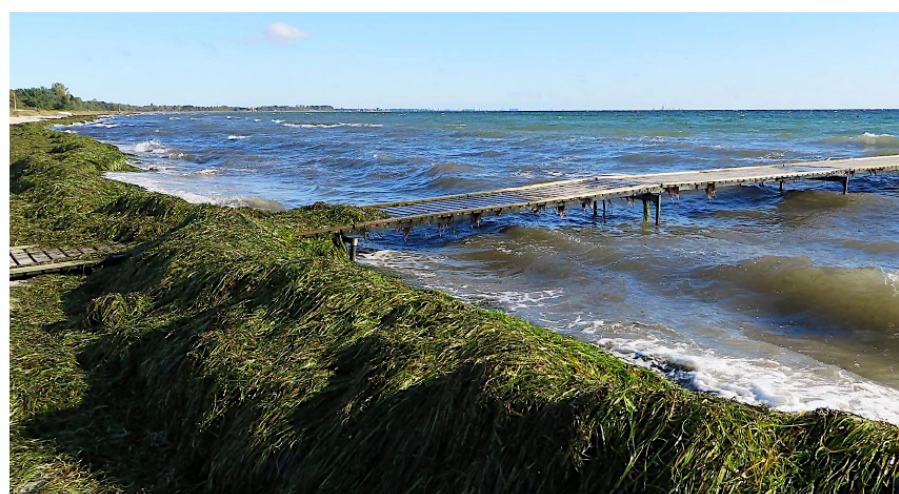
Logen forsøg med den planlagte biomasseanvendelse på et med forøget er at bestemme biogasudbytte og processnæssemængde på det kommende biogasanlæg i le produkti berunder gødningsindfødt. Første del af rapporten appendiks med en mere fyldstøgende beskrivelse på

rt i 2 reaktorer med blv: 3 og 15 liters aktivt volumen i kort kontinuerlig og stabilt på svingeyle med ca. 5% tørstof leretter er forsøget startet op med den blandede biomasse et løbende målinger af gasproduktion og processnæsme tre dere er der udført metanaudbytte målinger i batch af de

temple af tabel 1.

Indtækt (VS), %	Andel i vægt
23.6±0.6	4
19.8±0.1	57
7.1±0.2	2
5.3±0.1	37
14.4	100

Supplies



CPKelco skal levere restprodukter fra pektinproduktionen til Solrød Biogas



Solrød Kommune

CPKelco
A HANSEN COMPANY

CHR. HANSEN
improving food & health

VEKS
ENERGIFORNYING OG VEKST

Landbruget



Three steps in the collection

Three steps: Collection in piles, dewatering and direct transport to the biogas plant

The seaweed are picked up with a grate grab



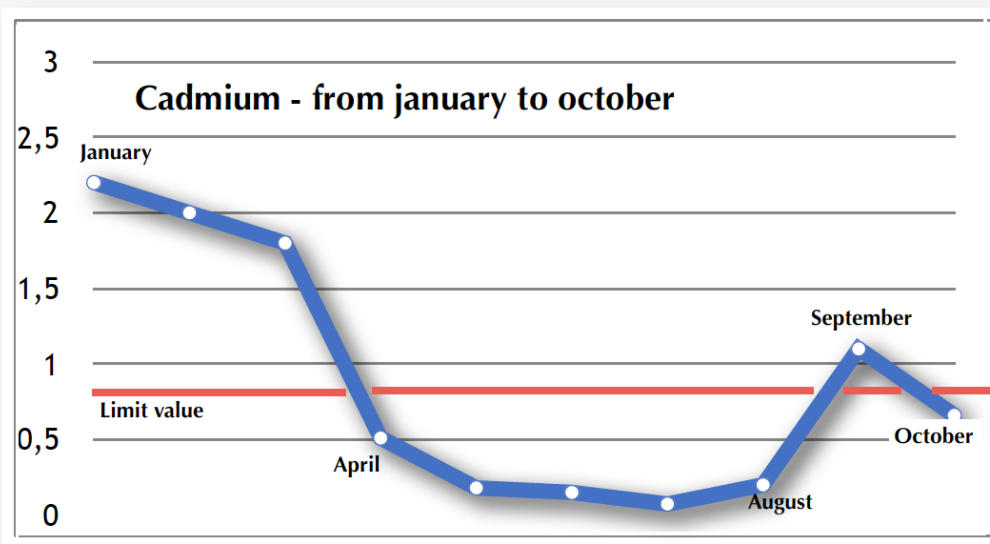
Seaweed - requirements

Supplier: Solrød Strand Beach Cleaning Laug

Delivery requirements:

- Cadmium and other below limit values
- No visible plastic, metal and big stone
- Sand maximum of 60% of dry matter

Collected in 2019: 1.522 tons



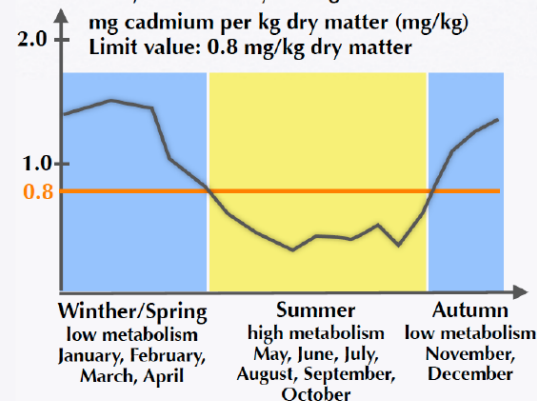
Measurement

2009-2013 - mg/Kg dry matter

Parameters	Average	Limit value
Nitrogen, total	46,340	Non
Phosphor, total	732	Non
Lead (Pb)	<3.58	120
Cadmium (Cd)	0.52	0.80
Chromium	<2.40	100
Mercury (Hg)	<0.01	0.80
Nickel (Ni)	3.5	30
Zinc	38	4,000
DEHP	<0.50	50
Nonylphenol	0.64	10
PAH (sum of 9)	2.41	3
LAS	<50	1,300

Expected cadmium content

Study from the bay of Køge



Benefit of the biogas plant

Win-win situation

First of all: Production of renewable energy

Local benefits form the biogas plant:

- **Odors:** Solve problems with odors from seaweed & algae by removing the seaweed and use it in a biogas plant
- **Climate:** Contribution to solve the climate problem: Using seaweed and organic waste from Kelco in a biogas plant will contribute to reduce the use of fossil fuels in the energy consumption in the area
- **Nutrients:** Contributing to solve problems with marine pollution. Removing the seaweed of the Køge Bay will diminish the load of nutrients, which today is a major problem of the aquatic environment
- **Fertilizer:** Contribute to useful nutrients. The residues from the gas plant will be used for fertilizer to replace chemical fertilizer.

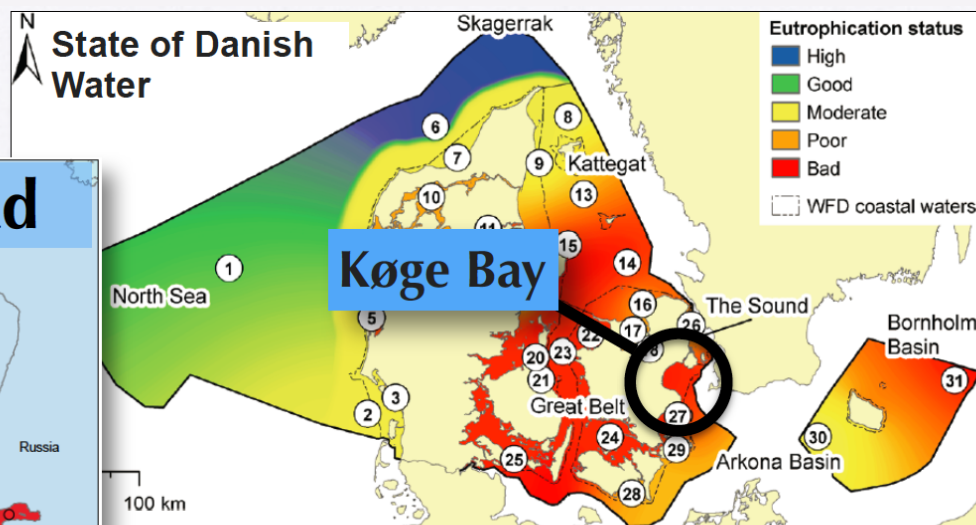
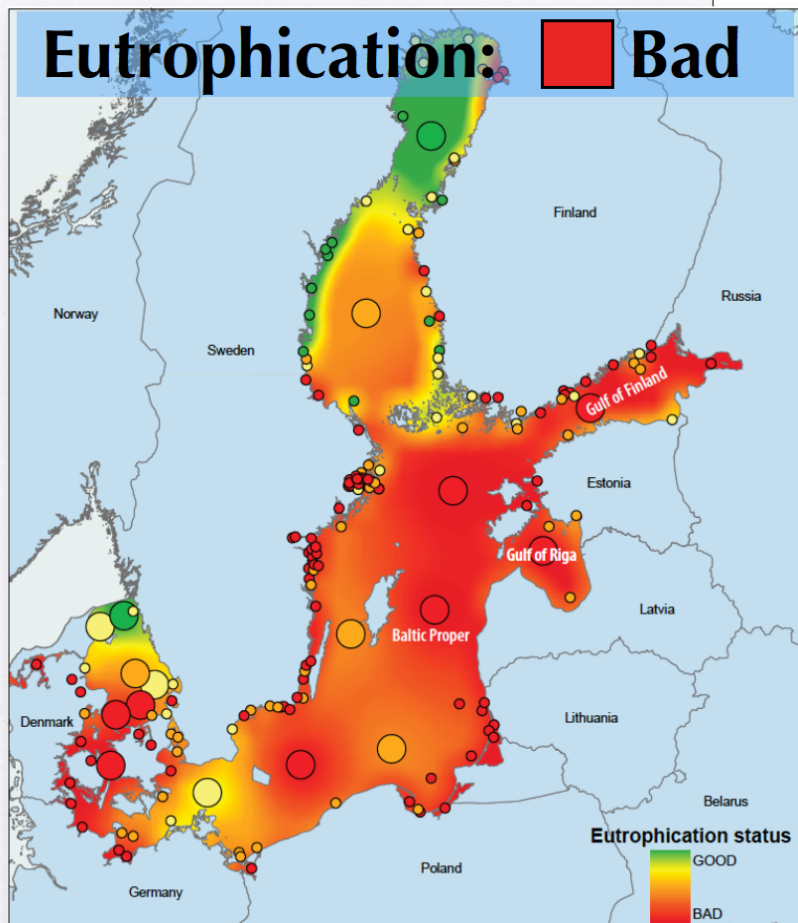


Company benefits form the biogas plant:

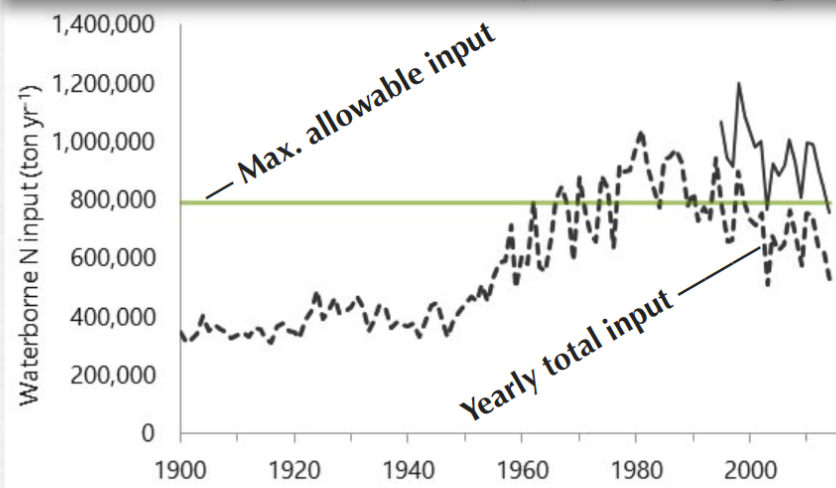
- Two of the involved companies will benefit from use of more renewable energy, because of the restrictions caused by CO₂ allowances and energy taxation
- And all companies will of course also benefit from community reputation from their contribution to mitigate the greenhouse gasses

Nitrogen/Phosphorus

Helcom



Helcom, State of the Baltic Sea, 2018 - Nitrogen



EU Waterframework Actionplan 2015-2021

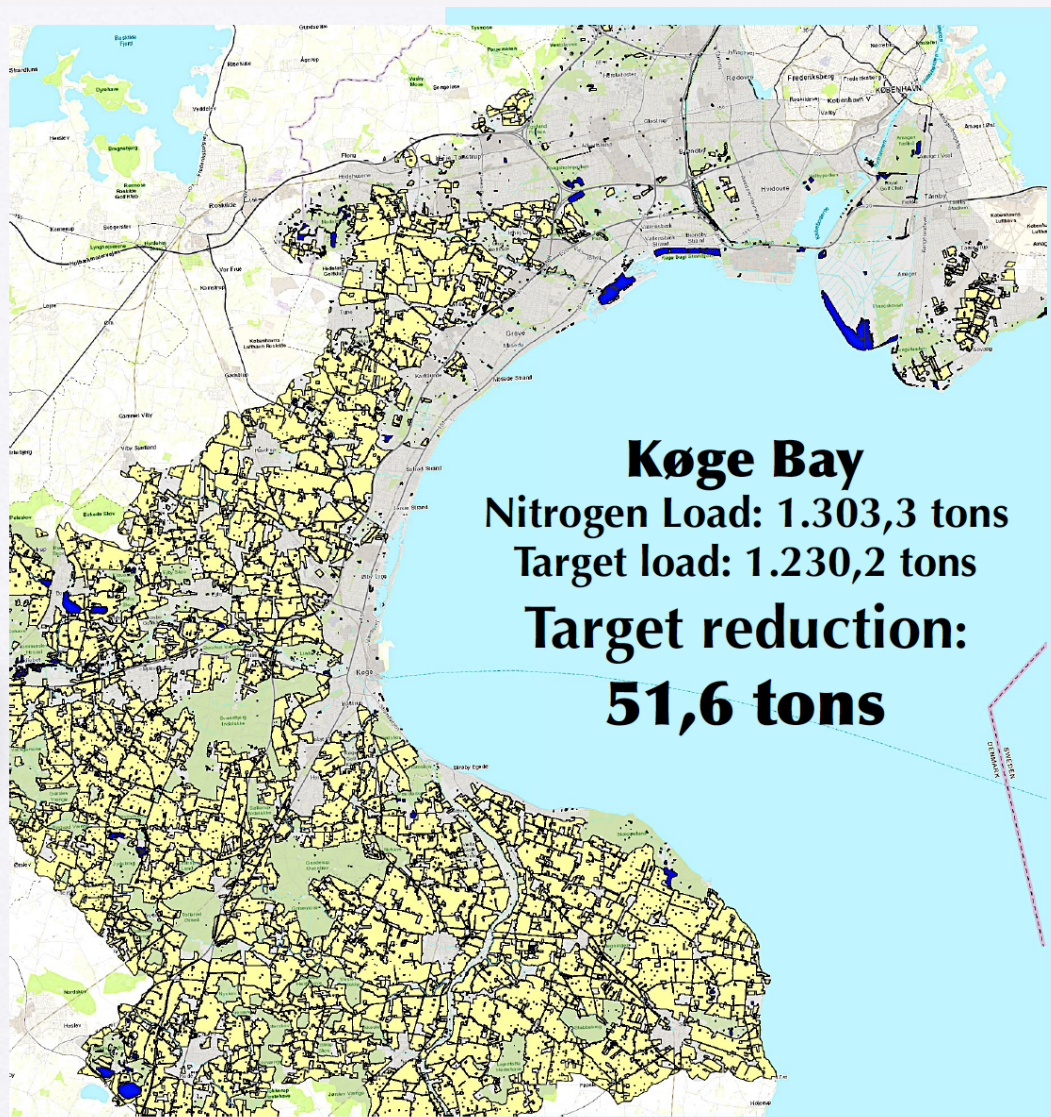
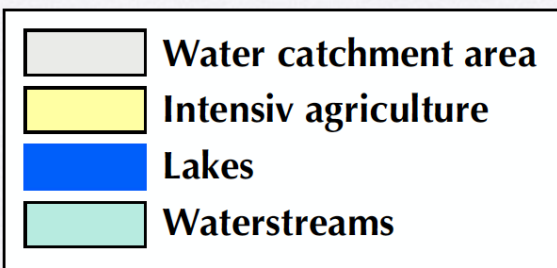
Nitrogen Load Køge Bay

• Baseline 2021: 1.303,3 tons
Target load 2021: 1.230,2 tons
Needed effort: 73,1 tons

Instruments in Køge Bay

Wetlands: 2,6 tons
Lowland projects: 0,2 tons
Afforestation: 0,2 tons
Wastewater: 2,7 tons

N sensitive areas: 15,8 tons
Targeted regulation: 51,6 tons

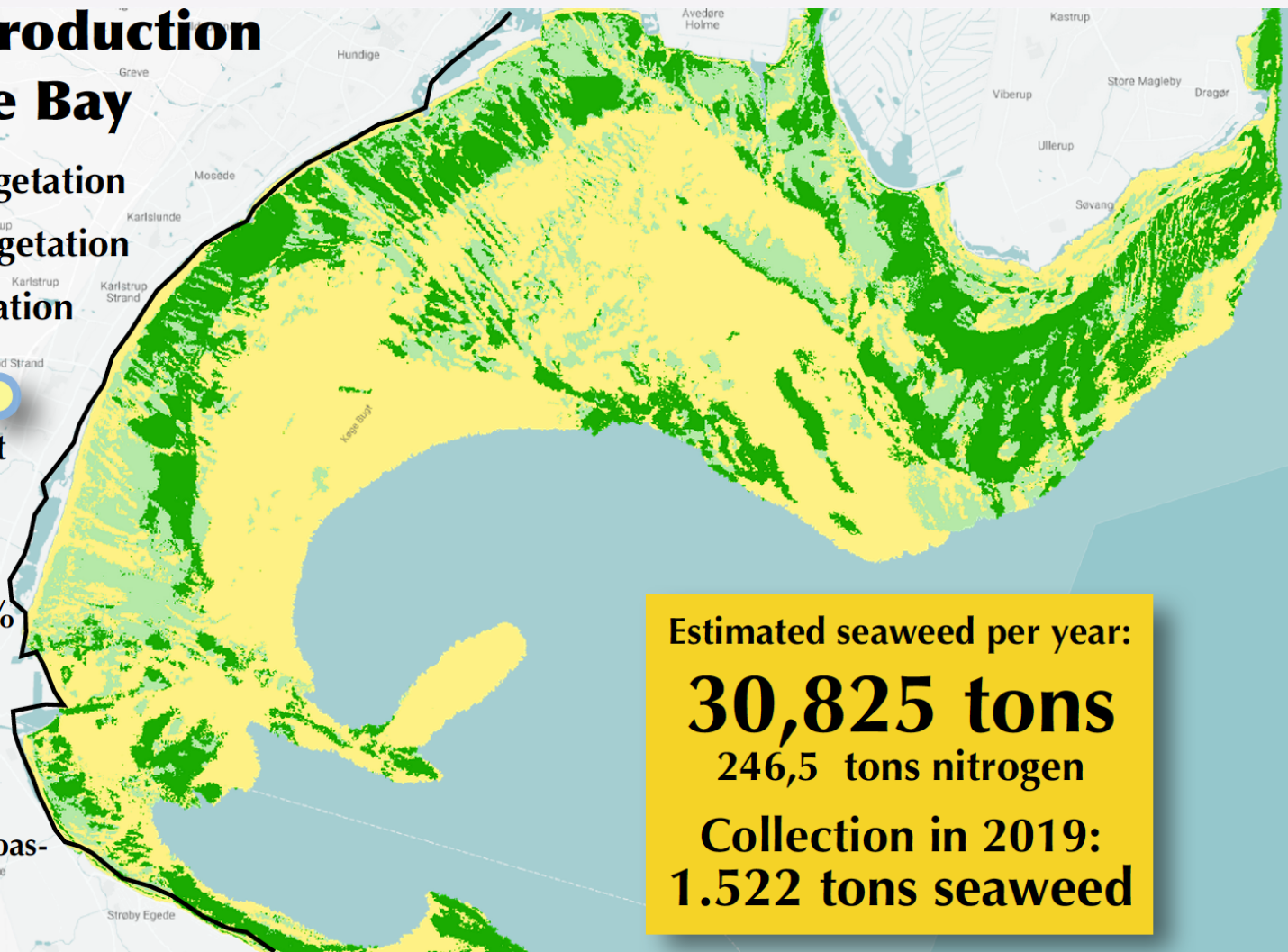


Seaweed production in the Køge Bay

- Dense vegetation
- Sparse vegetation
- No vegetation

Solrød
Biogas plant

Retention: 20-60%
Retention on 20-60% means that 20-60% of the nitrogen leached from the root zone of the fields is converted before it reaches the coastal water.



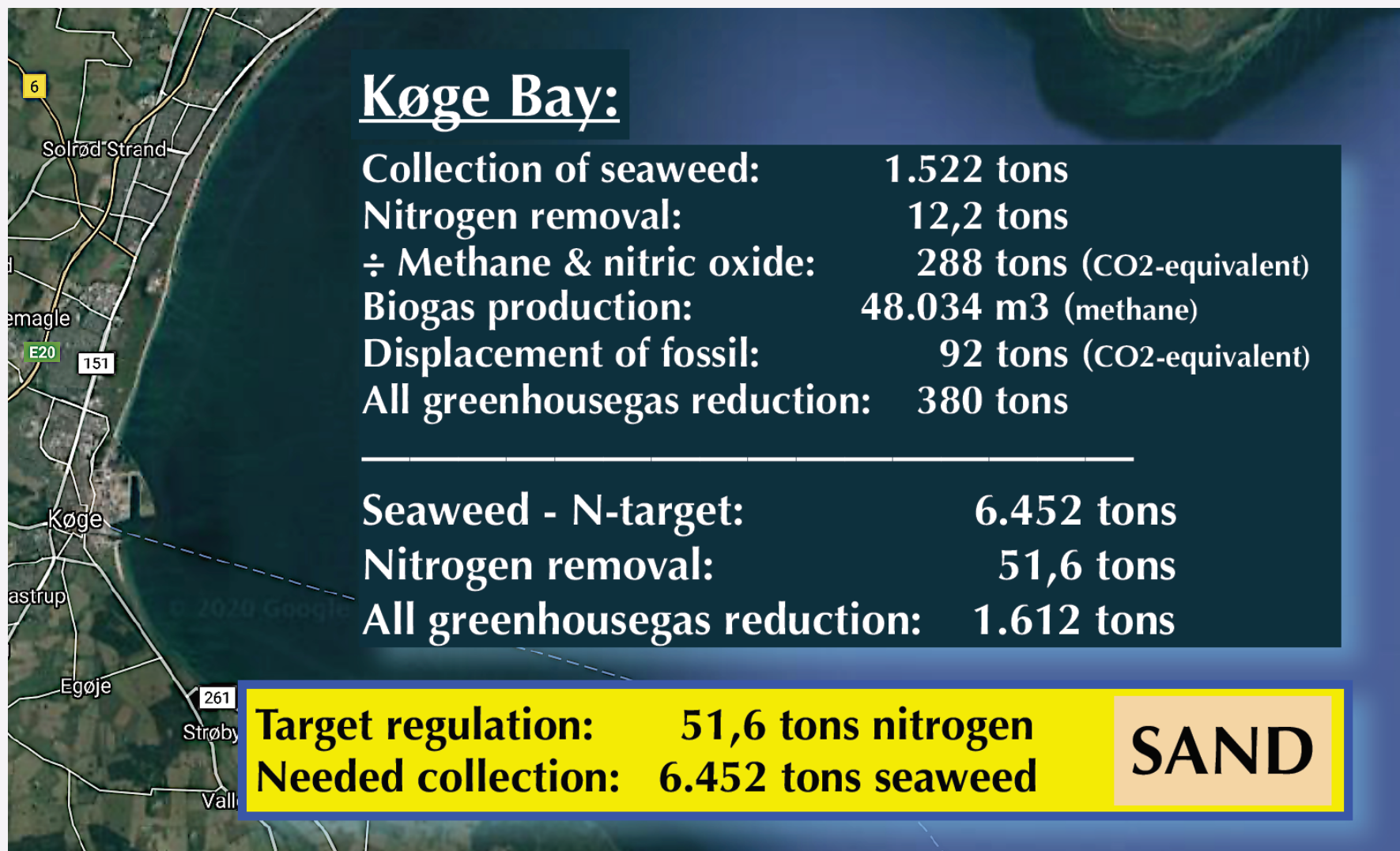
Estimated seaweed per year:

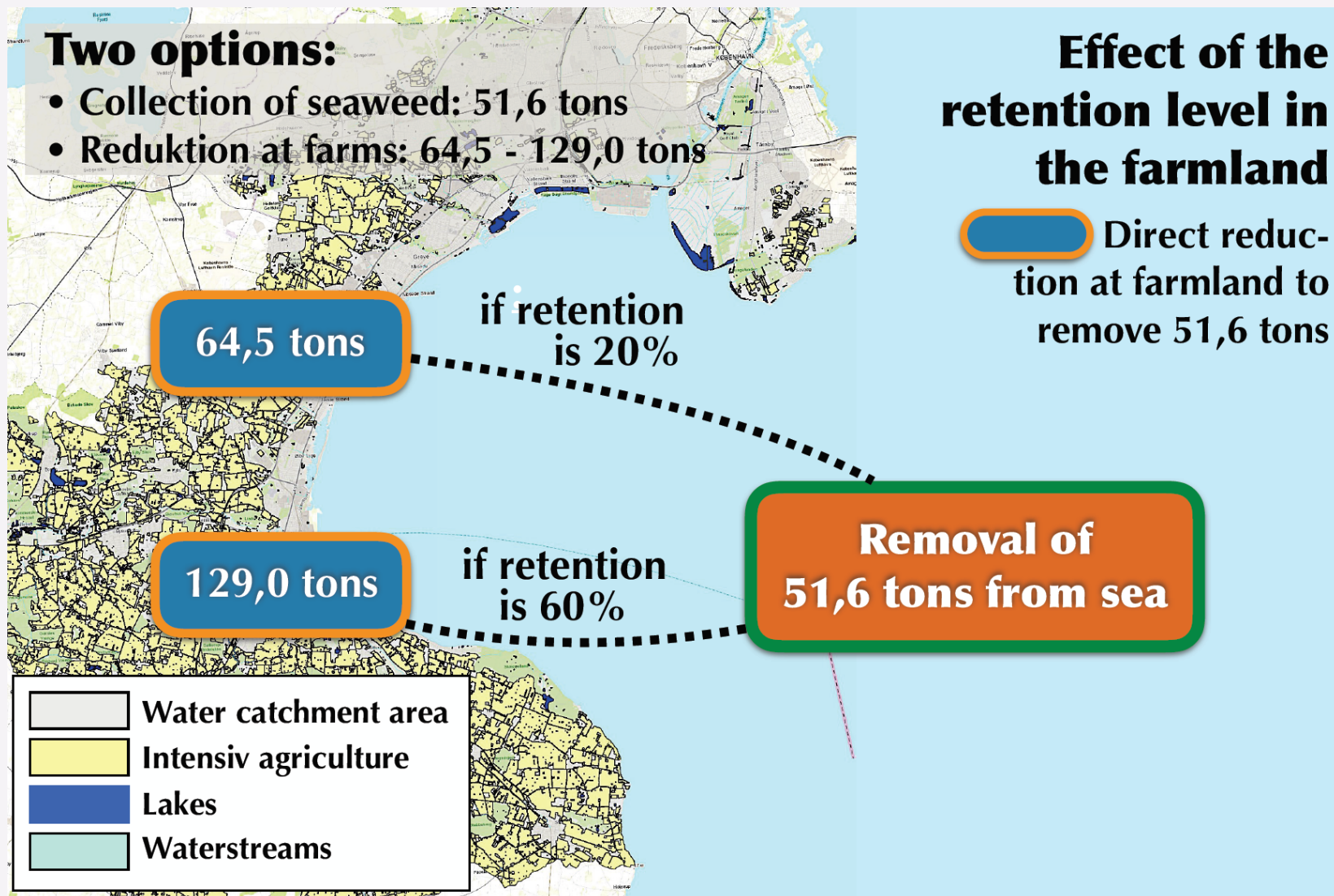
30,825 tons

246,5 tons nitrogen

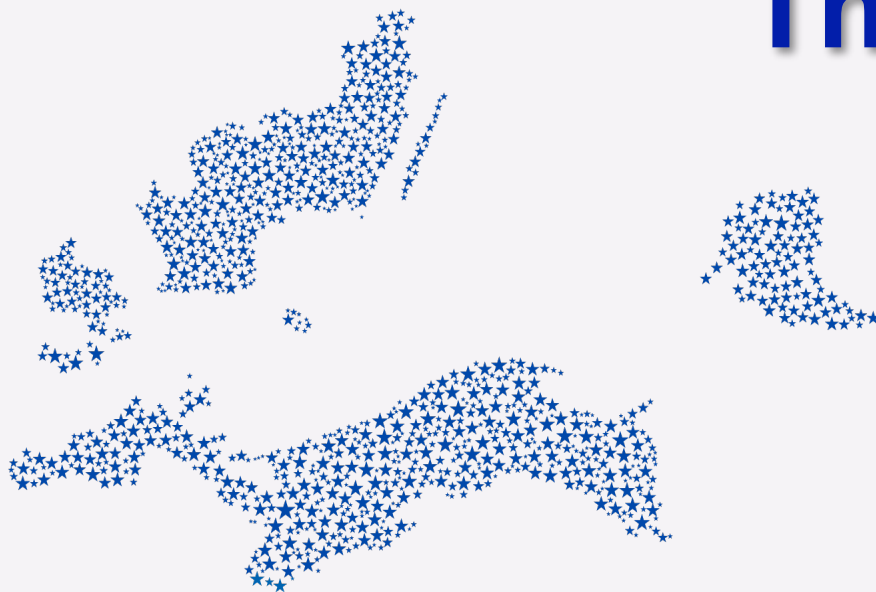
Collection in 2019:

1.522 tons seaweed





Thank you!



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& Tyge Kjær: tk@ruc.dk**