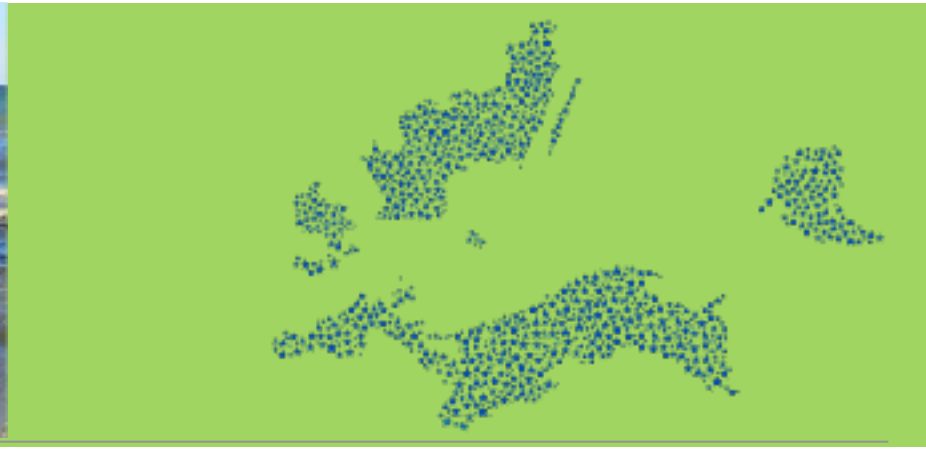
COASTAL Biogas

Cluster **O**n **A**naerobic digestion, environmental **S**ervices and Nu**T**rients remov**AL**

5th Coastal Biogas (Web) Conference
17th June 2021

Beach cleaning and pre-treatment methods for seaweed

Tyge Kjær
Roskilde University



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Introduction

- **Beach cleaning:** As soon as possible after the seaweed has been torn up and arrived at the beach area:
  - Why? Less odor, more biogas, less losses of nutrients.
- **Beach cleaning methods:**
  - depends on the circumstances, has to be adapted to the type of sea area
  - reduction in sand
  - affordable option
- **Pretreatment**
  - Separation of sand: two options - a) mechanical or b) hot water
  - affordable option
- **Conclusion**

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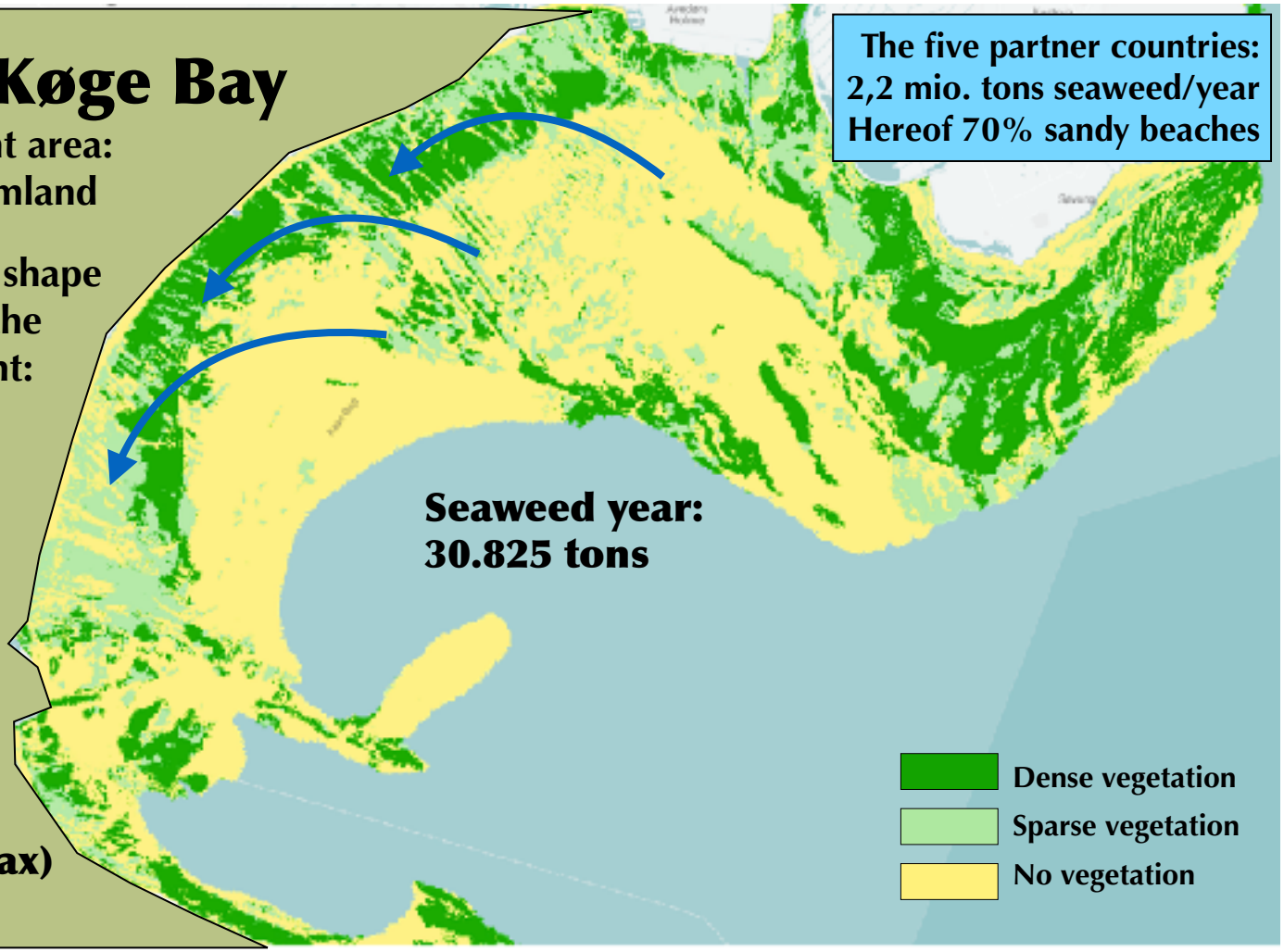
Estimates Køge Bay

Køge Bay catchment area:
49.492 hectar farmland

Surplus nitrogen in shape of nitrogen loss to the aquatic environment:
1.658 tons/year
About 20% losses

Estimated seaweed production in Køge bay:
30.825 tons/year

Estimated yearly Nitrogen uptake:
444 tons/year (max)



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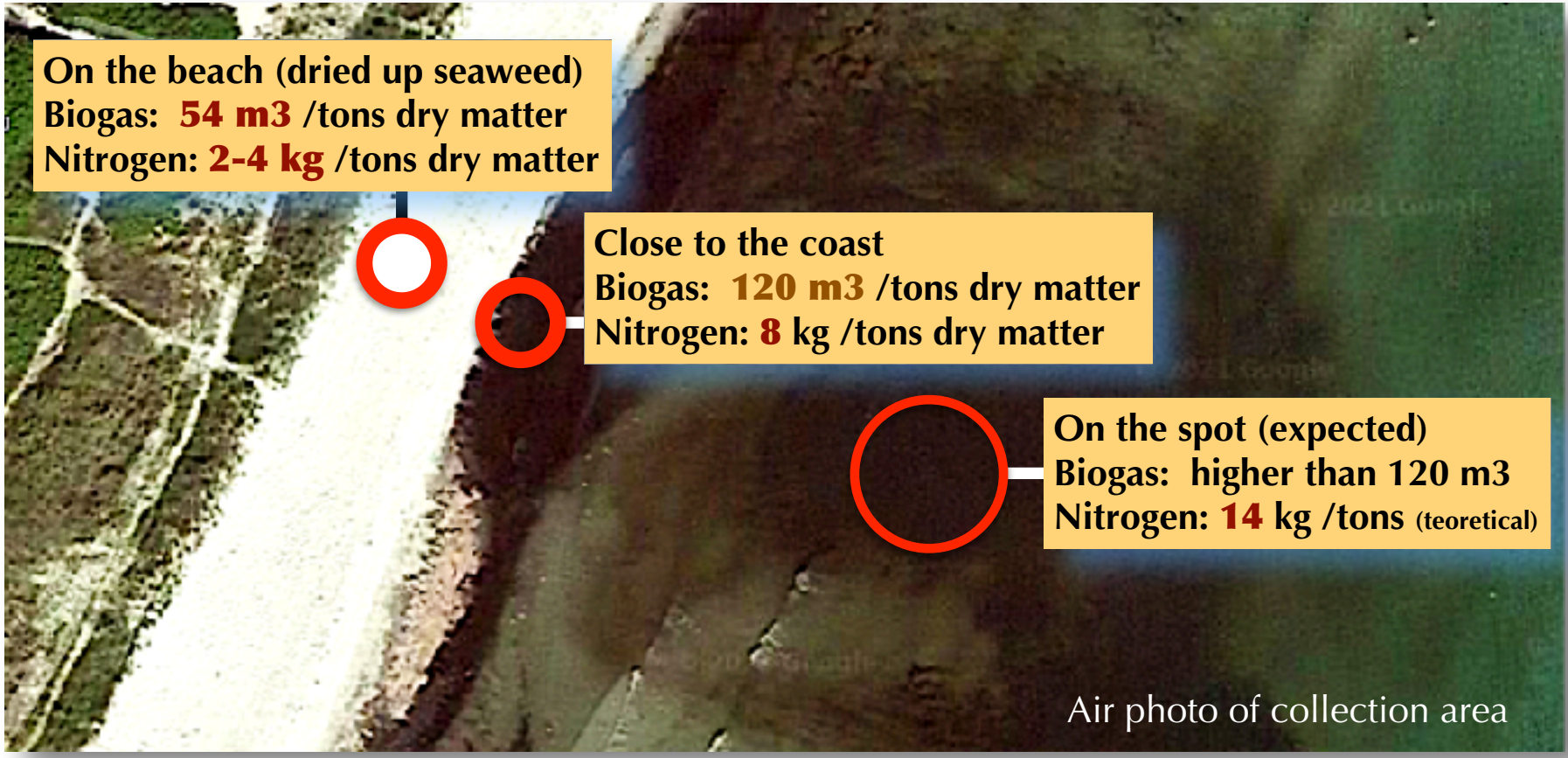
Collection: As fresh seaweed as possible: More biogas, more nutrients, less sand and smell



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Direct collection at the beach
Different solutions • Problem: SAND

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The monster - Testing

Better, men still not sufficient:

Test results (% of dry matter):

Collected at the beach:
- 48% Seaweed
- 40% sand
- 12% ash substances

Collected in the water:
- 49% Seaweed
- 33% sand
- 18% ash substances

Control - manual collected:
- 64% Seaweed
- 18% sand
- 18% ash substances

The Monster

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Monster + sand separation on the beach

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How do the seaweed end up on the beach?

(1) Strong storm tears the seaweed up and leads it towards the coast - or
(2) Currents and waves bring the decomposed seaweed into the shore as a mixed, mushy mass.

Some of the seaweed is transported at the surface or close to the surface; but the major part is transported below the surface, carried by the inward sea currents.

Seaweed types and weather thus play a major role

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Seaweed in Køge Bay

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Mixed mushy mass

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Seaweed collected in pile
Tranport to the biogasplant

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Pre-treatment

- Pre-treatment at the biogasplant

Today at the biogas plant

- Seaweed is decomposed and diluted with material from the biogas reactor

+

Two sand experiments

(1)Mechanical separation

Sand washer - high efficiency - very expensive

(2) Pretreatment with hot water

Temperatur at 50-52°C. Available from the biogas plant (thermophilic plant) with process temperatures around 55°C

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Pre-treatment hot water

Hot water - temperature at the level of biogas plant output - 50-52°C

Pile collected material:
- 56,2% seaweed untreated
- 61,7% seaweed after hot water treatment

Seaweed from the beach:
- 41,2% seaweed untreated
- 62,5% seaweed after hot water treatment

Seaweed collected in the water:
- 47,2% seaweed untreated
- 55,0% seaweed after hot water treatment

Control - manual collected:
- 64% Seaweed
- 18% sand
- 18% ash substances

The big shovel

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Affordable pre-treatment

Sand separation

Sand level as low as possible in the collection at the coast. It implies less cost for collection, transport and pre-creatment of seaweed.

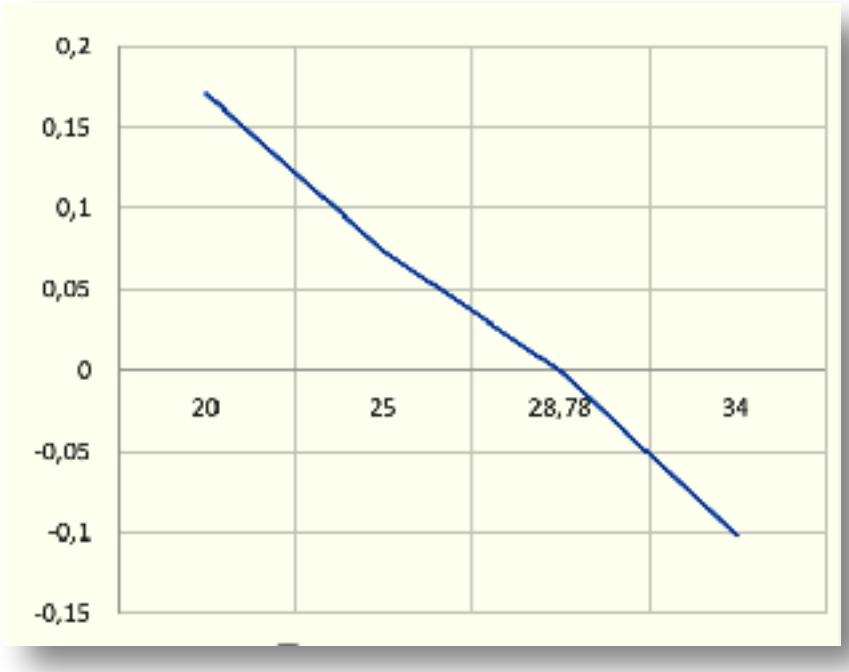
Cost efficiency

Collection of seaweed is a cost-effective method of reducing the nitrogen load.

However, the cost level is a critical factor. If the cost of collection, transport and pre-treatment is higher than **28-29 € per** tons, the use of seaweed will no longer be a cost-effective methods

Calculation of cost efficiency

(Cost structure Solrød Biogas)



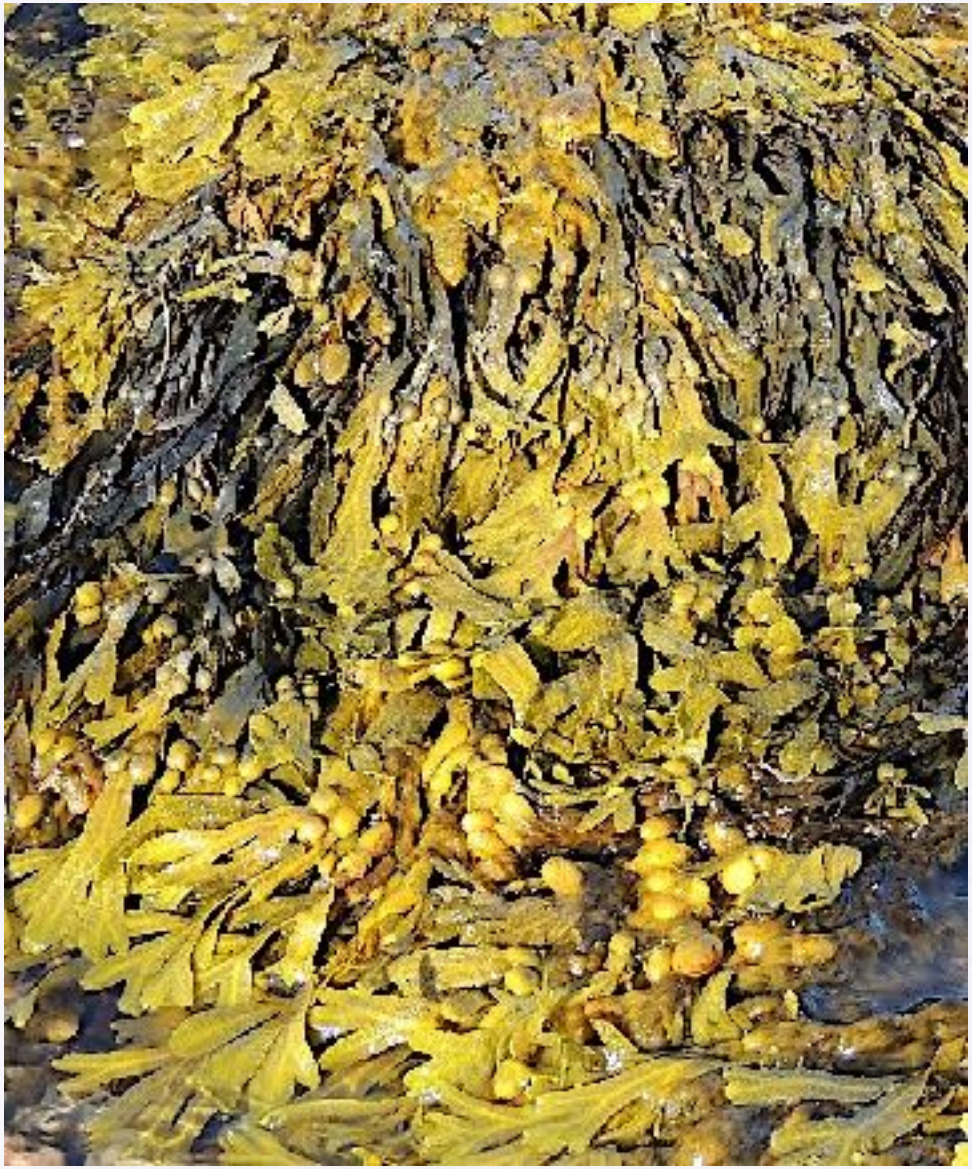
Seaweed Køge Bay

One of the five main types of seaweed

Danish:
Blæretang

Latin:
Fucus vesiculosus

Habitat:
The bladder roof grows in tidal zones, and is found on all coasts of Denmark; it prefers to grow in shallow water up to 5 meters deep



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Contact: Nanna Skov Larsen: nskov@ruc.dk
& Tyge Kjær: tk@ruc.dk

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