Results & Conclusions from WAB project

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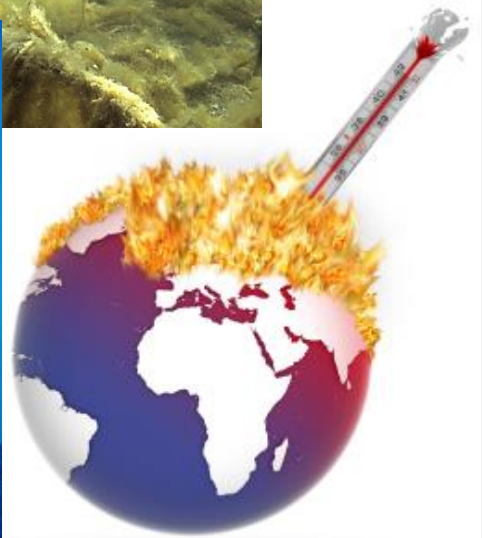
CHALLENGE:
Climate change, eutrophication, peak oil and peak phosphorous



Wetlands Algae Biogas
South Baltic PROGRAMME
Part financed by the European Union
(European Regional Development fund)

IMPACT: Algae in Trelleborg and Sopot

About the WAB Project

A Southern Baltic Sea eutrophication counteract project
Nutrient recycling, renewable energy and increased biodiversity!

Funding: South Baltic Programme

Goal:

- The WAB project is a co-operation between 11 organizations working with water management, research, organization and agricultural issues in Poland and Sweden. The project aimed at establishing a local full-scale nutrient reduction cycle involving water biomass such as marine macroalgae and wetland plants/ freshwater plants as co-substrates for biogas production. POMCERT/ UG conducted experiments in a mobile biogas installation to test the effectiveness of biogas production from water biomass as co-substrates and agronomic effectiveness of digestate via glasshouse experiment. POMCERT/ UG also prepared a feasibility study regarding the preconditions in the Pomorskie region for utilization of water biomass for biogas production. Other partners worked on predicting algae occurrences via monitoring station, trying out new techniques for collection of algae, spreading information about wetlands and the potential for biogas production to farmers and exchanging ideas with Swedish partners.

Wetlands

Restoration of wetlands to reduce nutrient leakage from farmlands and cultivation of algae and reed for biogas production

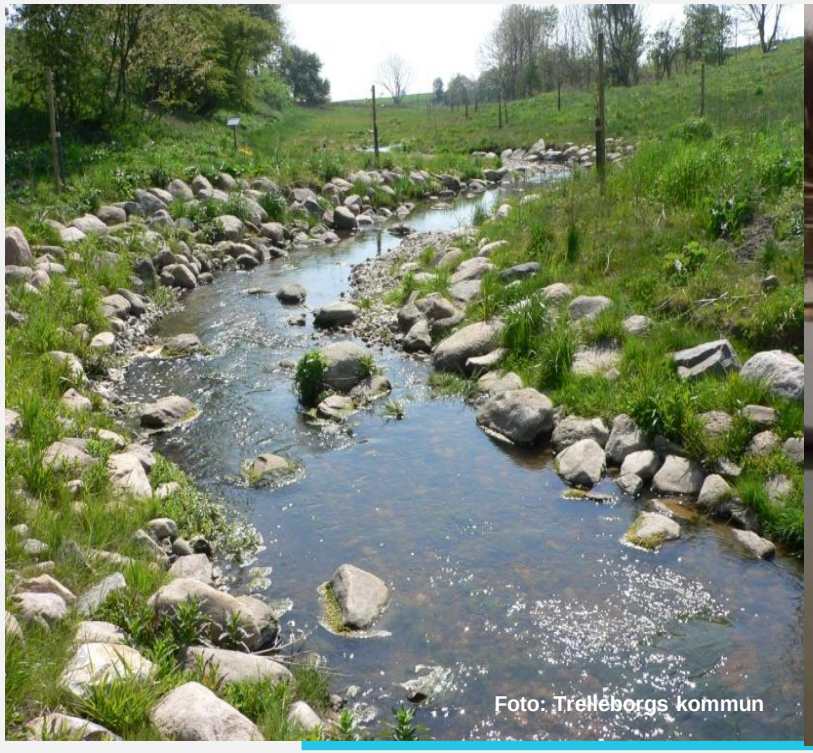


Foto: Trelleborgs kommun

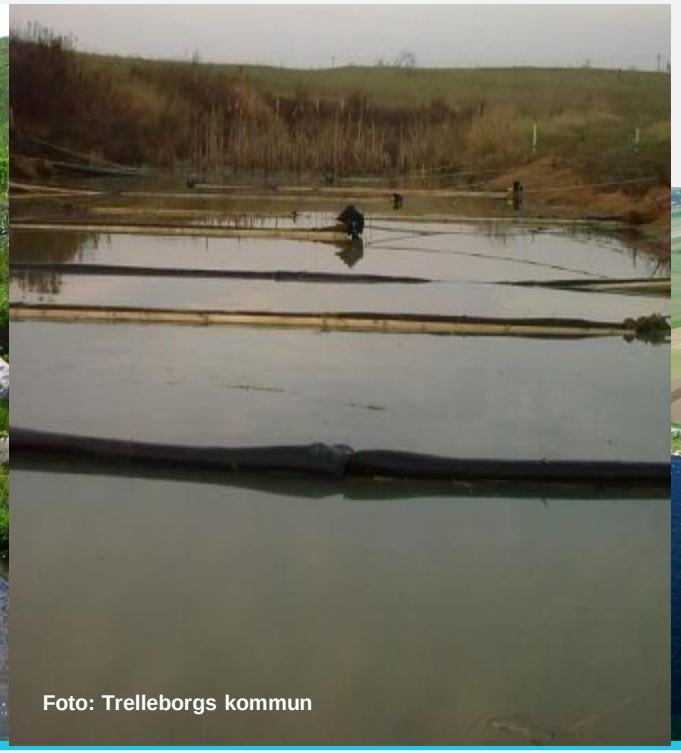


Foto: Trelleborgs kommun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Wetlands Algae Biogas

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Algae

Collection of algae by the beach, extraction of nutrients from the Baltic Sea.

Wetlands Algae Biogas

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Biogas

Production of biogas for renewable energy and recycling of nutrients


Photo: Patrick Finnis

Photo: Skånetrafiken AB

Photo: LRF

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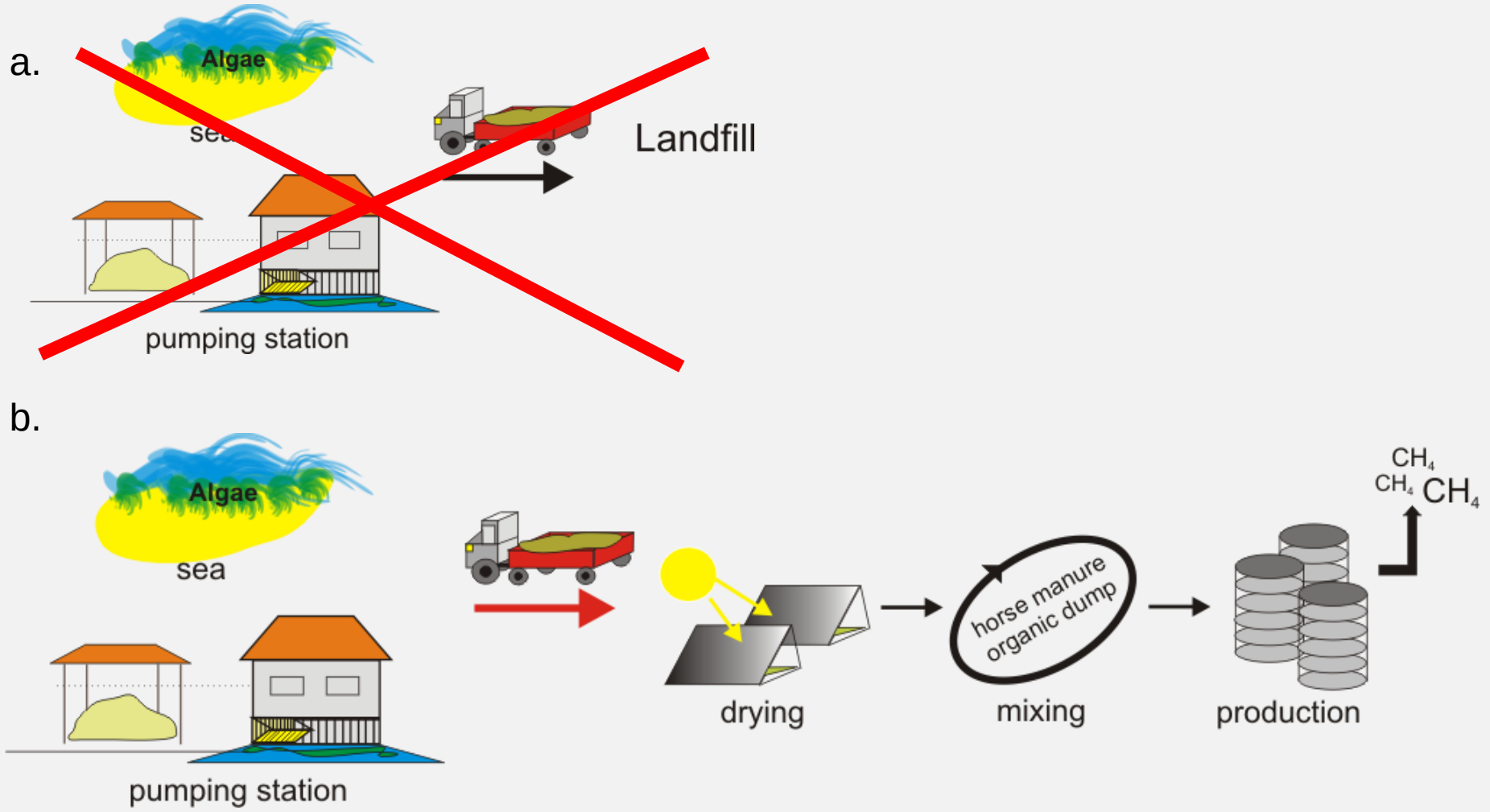
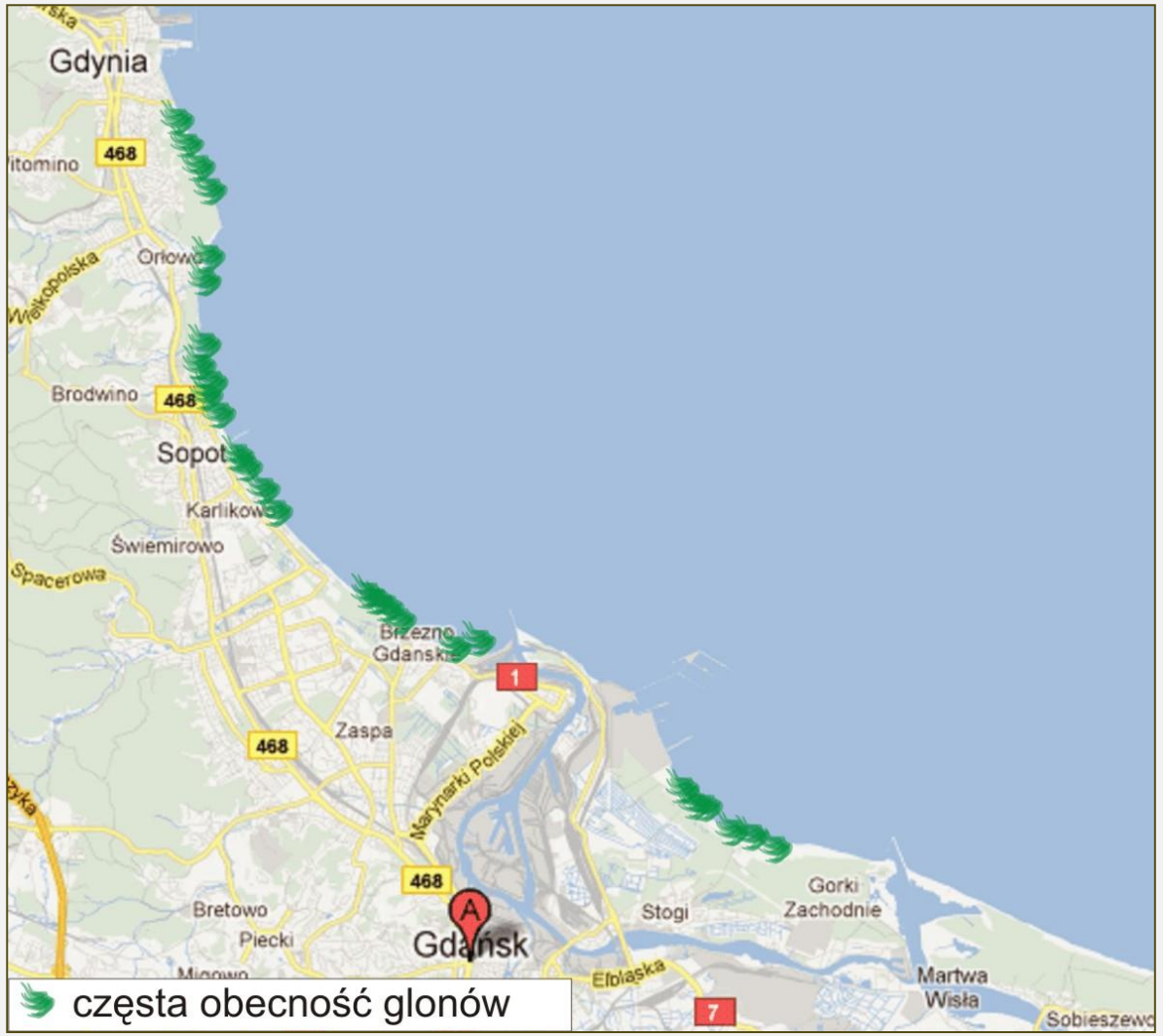
New system approach to waste algae utilisation



Marine biomass availability in Gdańsk Region



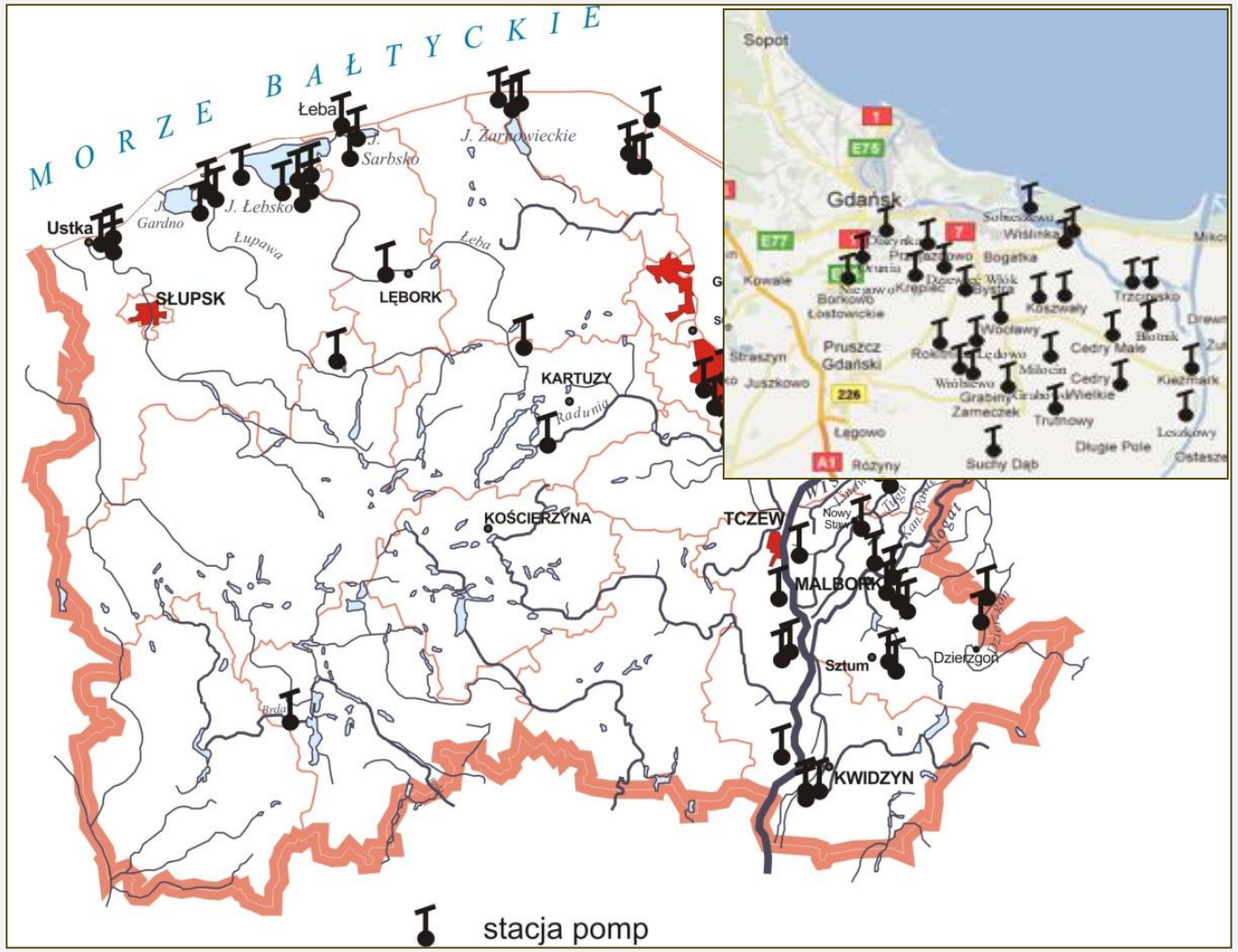
Location:
Gdynia Redłowo-Orłowo
Sopot
Gdańsk Brzeźno, Stogi

Biomass generation:
From the beach: 180-795 t/season (MOSiR, 2008-10)
From water: 700 t/season (ZOM, 2010)
Modelled: 220-440 t/season (IO PAN, 2004-06)

Total biomass potential:
Max: 1000 t/season

Availability:
Summer
Big variability depending on temp. wind & currents)

Freshwater biomass availability in Pomorskie



Pump stations:

95 pump stations in Pomorskie
28 pump stations in Gdańsk Region

Unit biomass generation:

32 – 48 t biomass/year/pump station

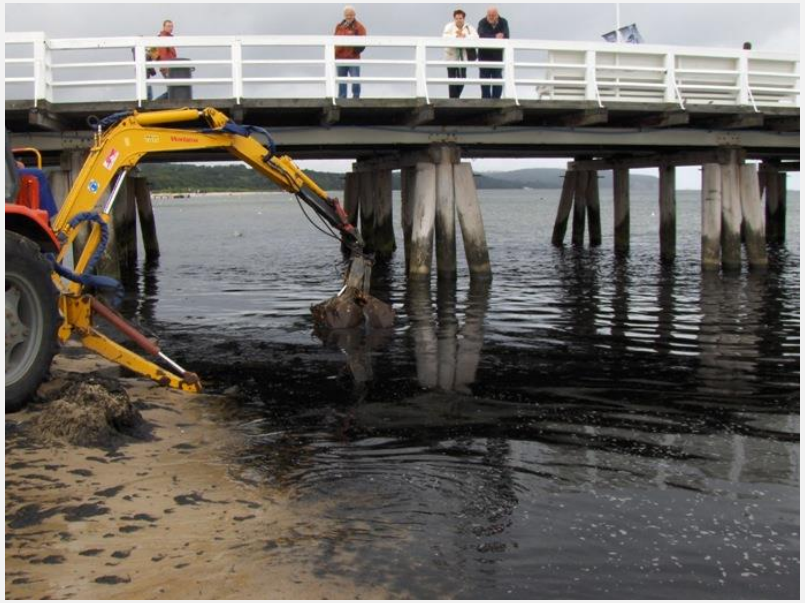
Total biomass potential:

in Pomorskie: 3040 - 4560 t/year
in Gdańsk Region: 896 - 1344 t/year

Availability:

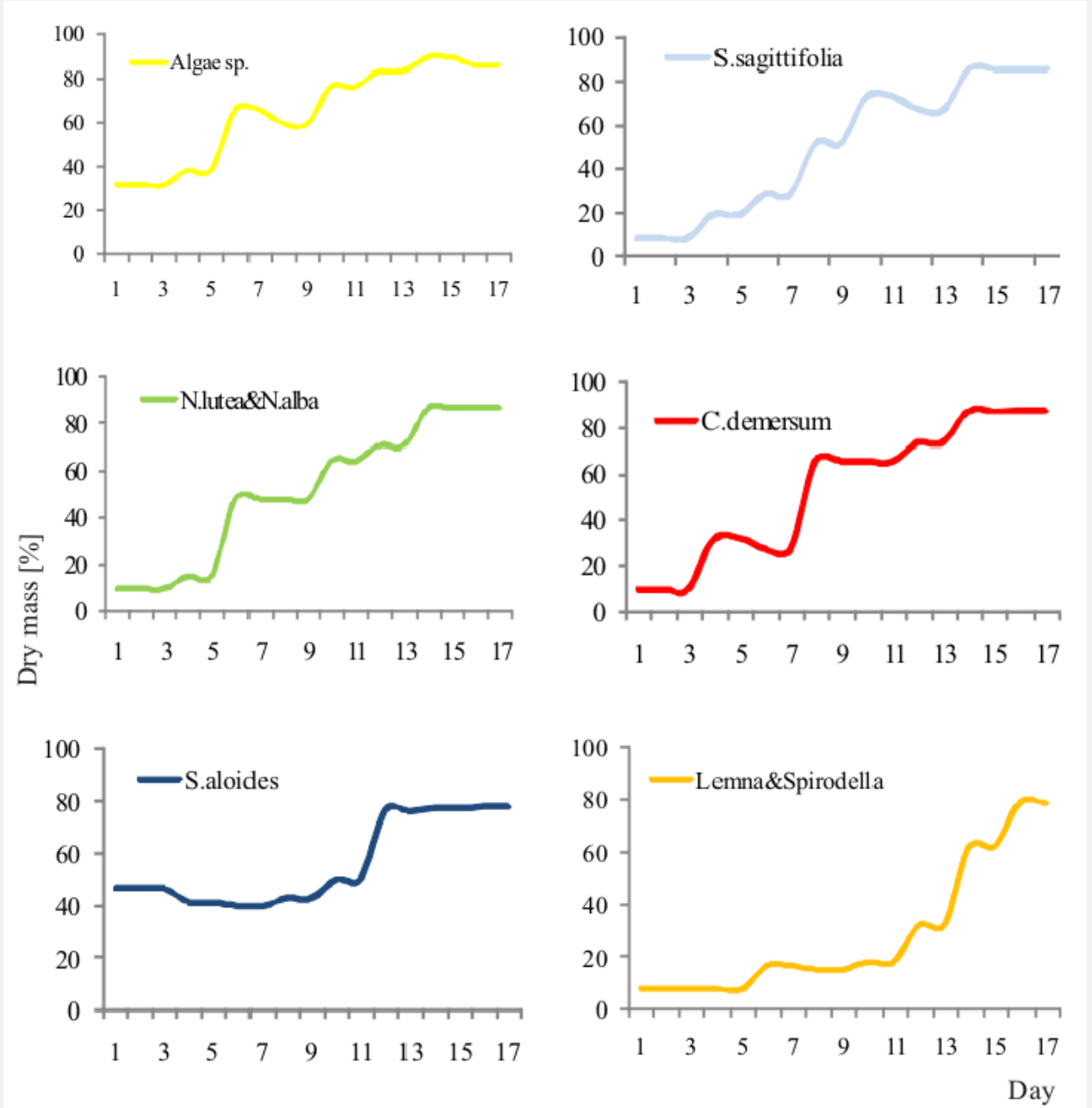
Summer - autumn

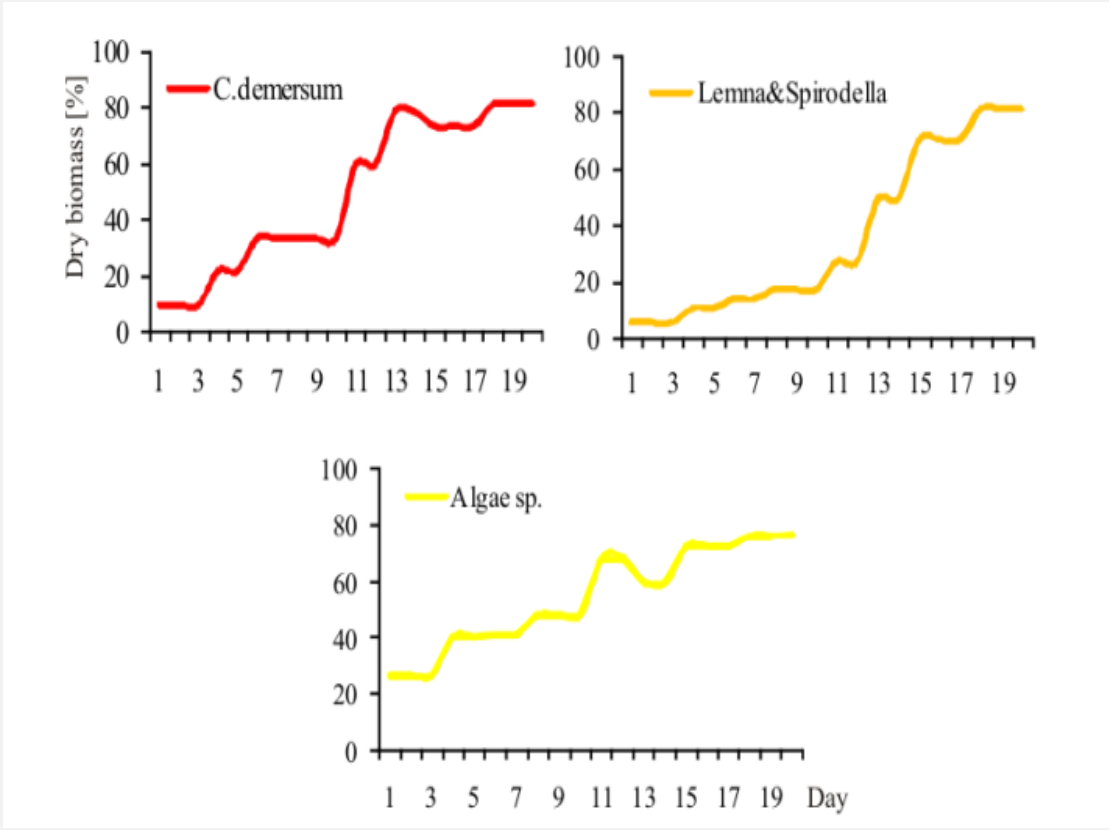
Collection of aquatic biomass



Solar drying

Solar drying – results (August & September)



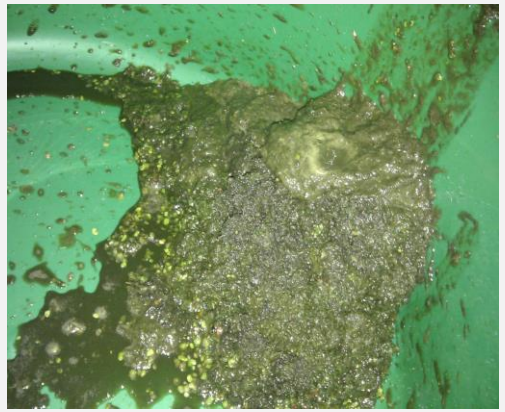


Preparation of mixtures for dry and wet process

Mixture for dry process

- Composition of the substrates in the mixture,
- Addition of postferment from WWTP,
- Preincubation (for 10 days) for predegradation by the correct bacteria,

Mixture for wet process



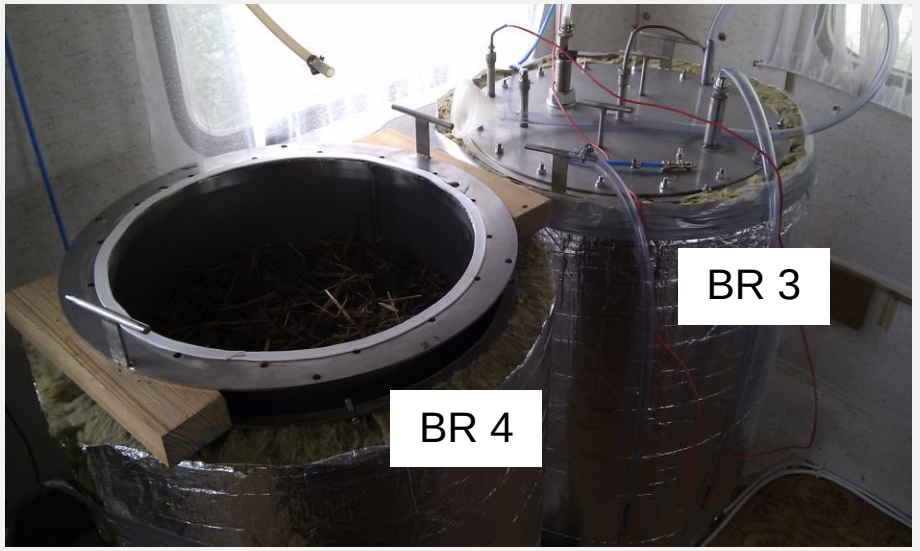
- Defragmentation and homogenisation of substrates,
- Composition of the substrates in the mixture,
- Addition of postferment from WWTP,
- Preincubation for 10 days.

Characteristics of inputs

Input characteristics				
Mixture	FB + HM	MB + HM	FB + HM	MB + HM
Process	Wet (BR1)	Wet (BR2)	Dry (BR3)	Dry (BR4)
Mass [kg]	44,4	49.1	13	13.1
Dry matter [%]	7.3	7.7	45,1	46.6
Substrates proportion	1:1 (DM)	1:1 (DM)	1:1 (DM)	1:1 (DM)

FB – Freshwater Biomass **HM – Horse Manure** **MB – Marine Biomass**

Mobile laboratory with biogas reactors

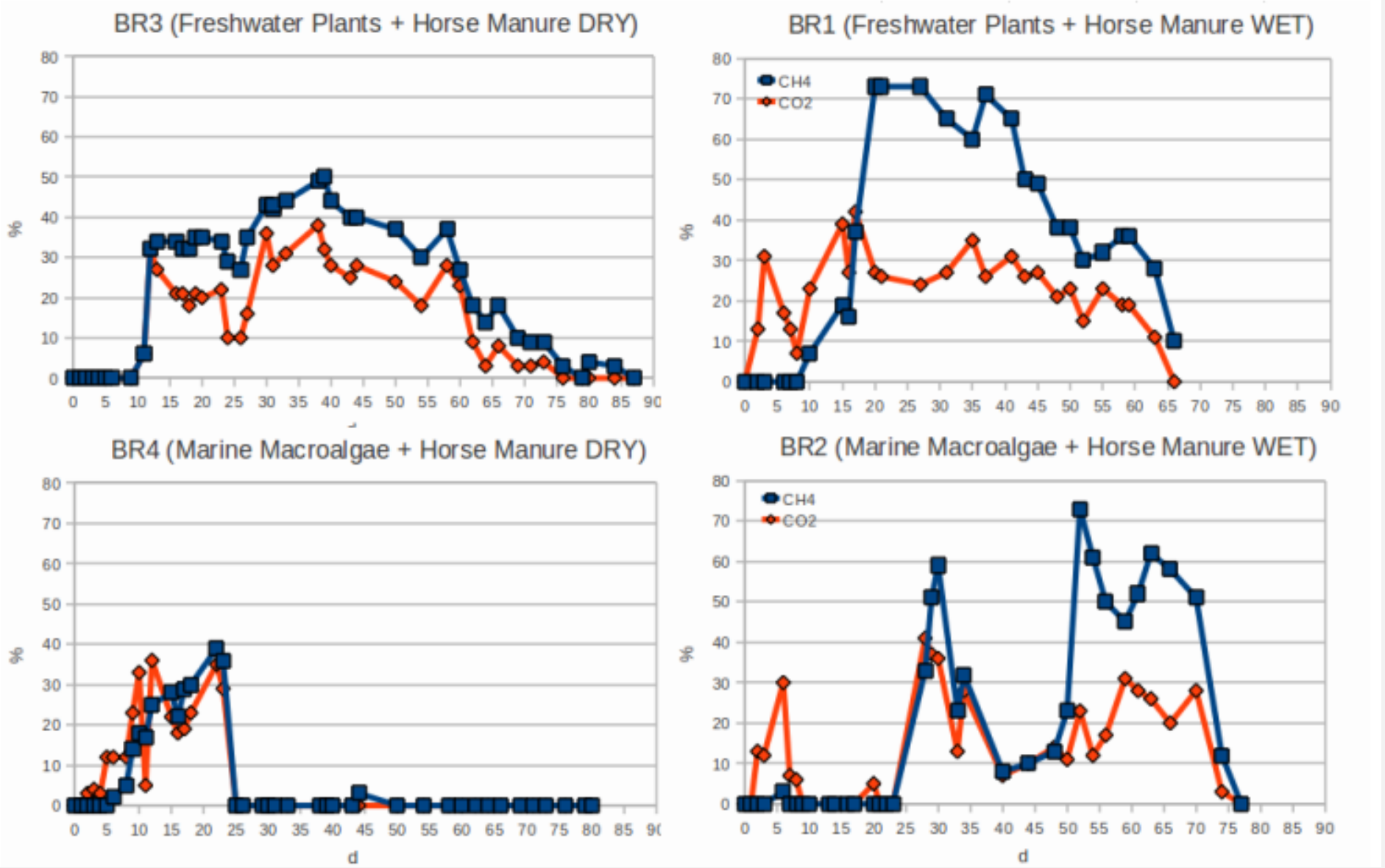


DRY PROCESS (30-50% dm)
2 independent dry reactors with showering option *(batch reactor)*

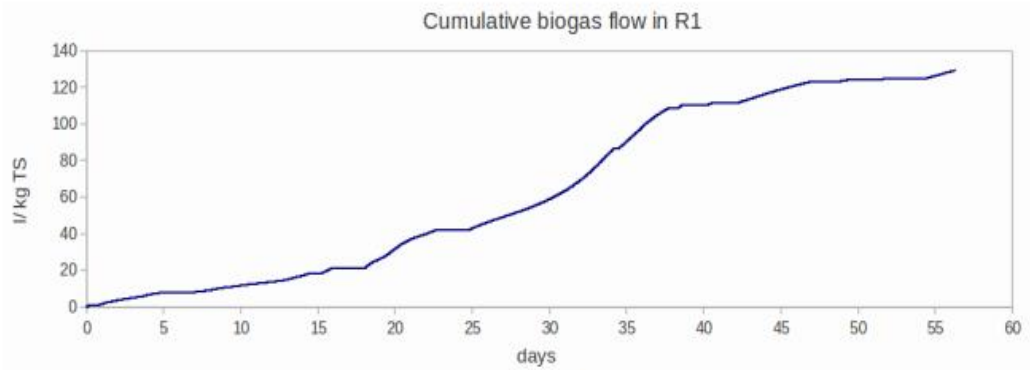
WET PROCESS (< 8% dm)
2 wet reactors connected (with optional independent operation) with stirring and pumping *(continuous stirred tank reactor)*

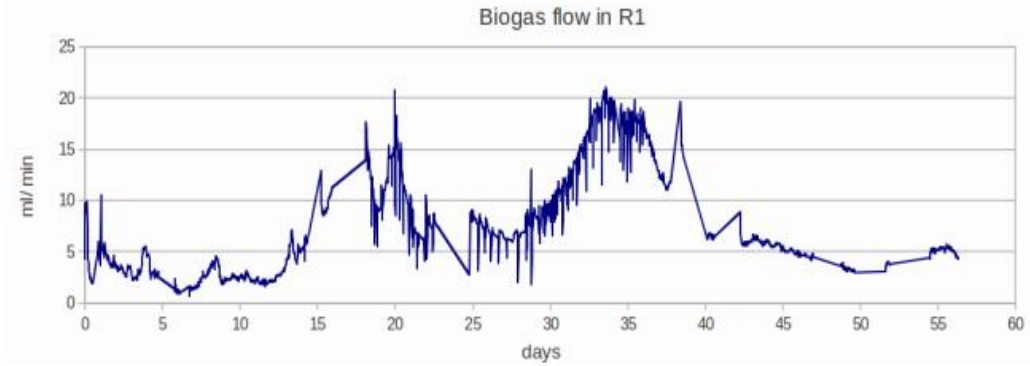
Common characteristics of the process:
V = 50 l
T ~ 35-40^{o}C (mesophilic process),
Autmatic measurement of: temperaturę, gas flow and pressure,
Manual measurements with mobile instrument: CH_4, CO_2, H_2S, NH_3

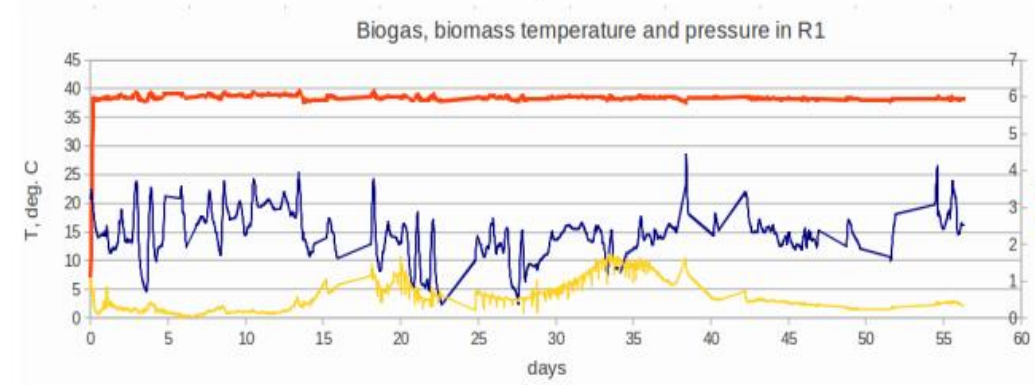
Mobile laboratory with biogas reactors - Results

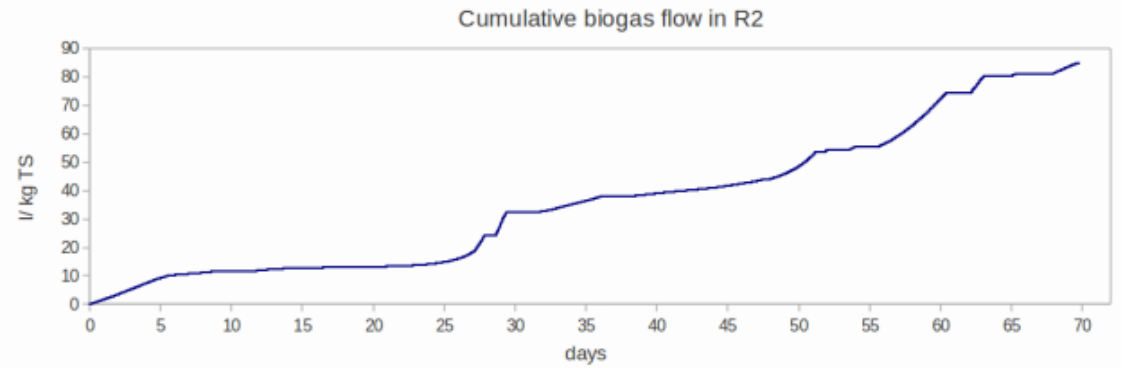


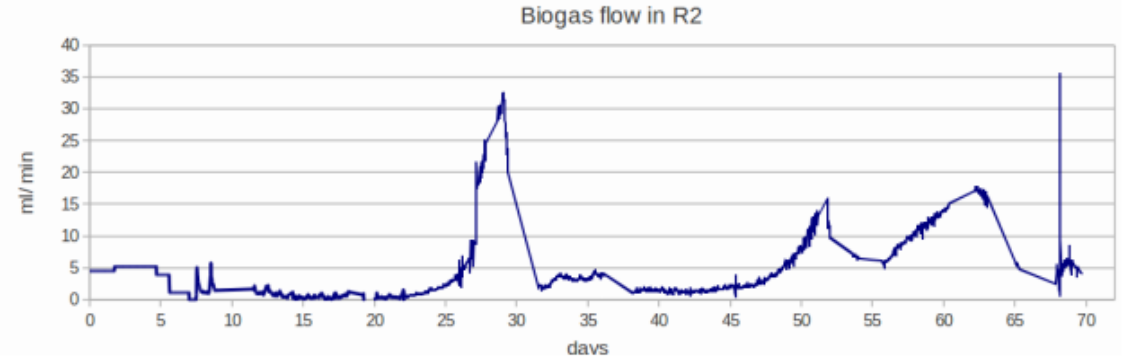
Results of Mobile laboratory with reactors BR1, BR2.

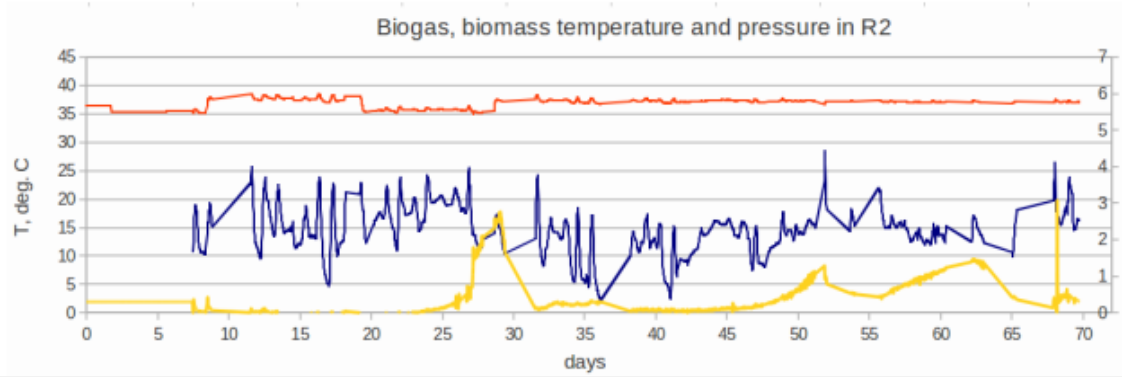




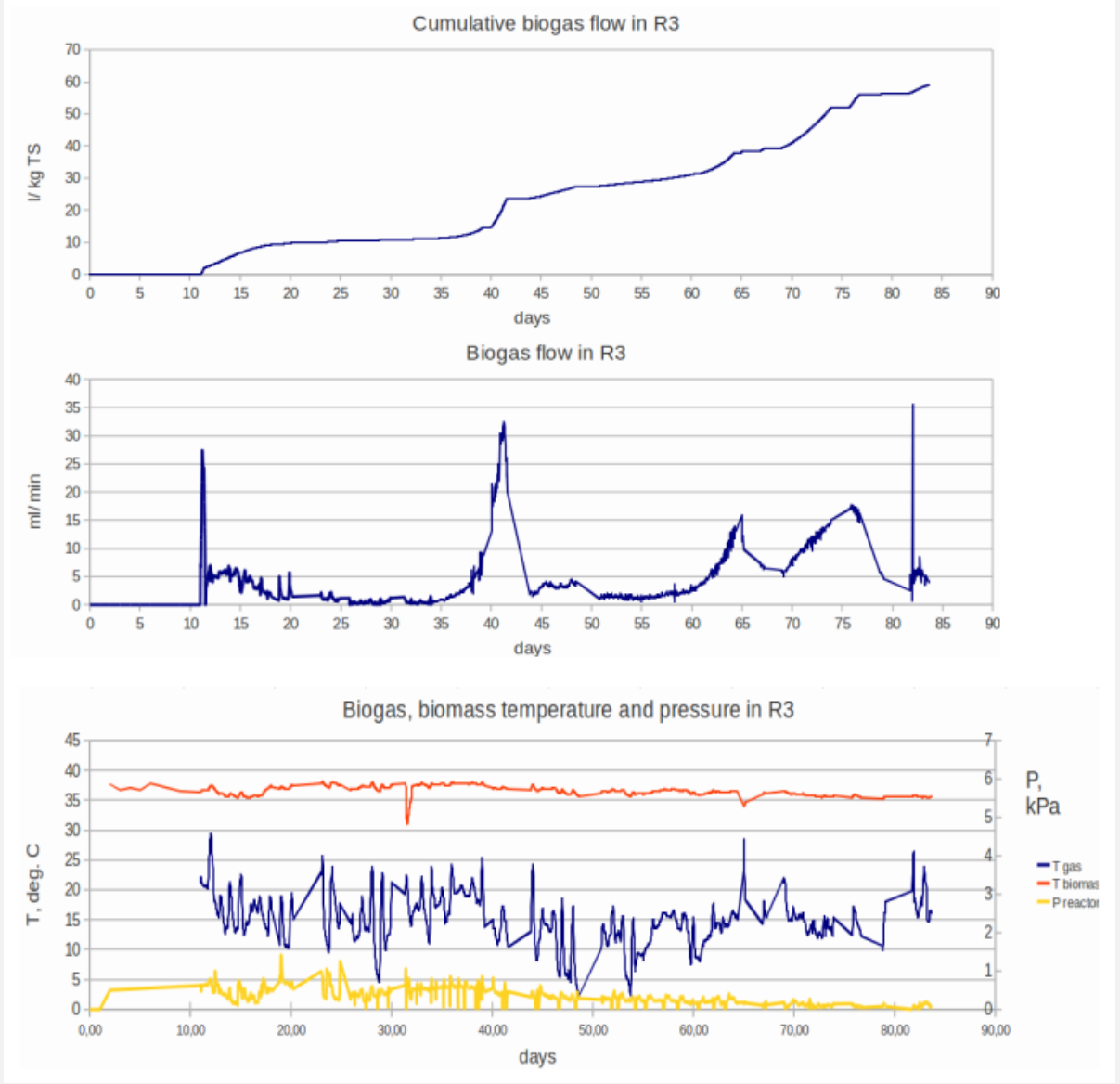


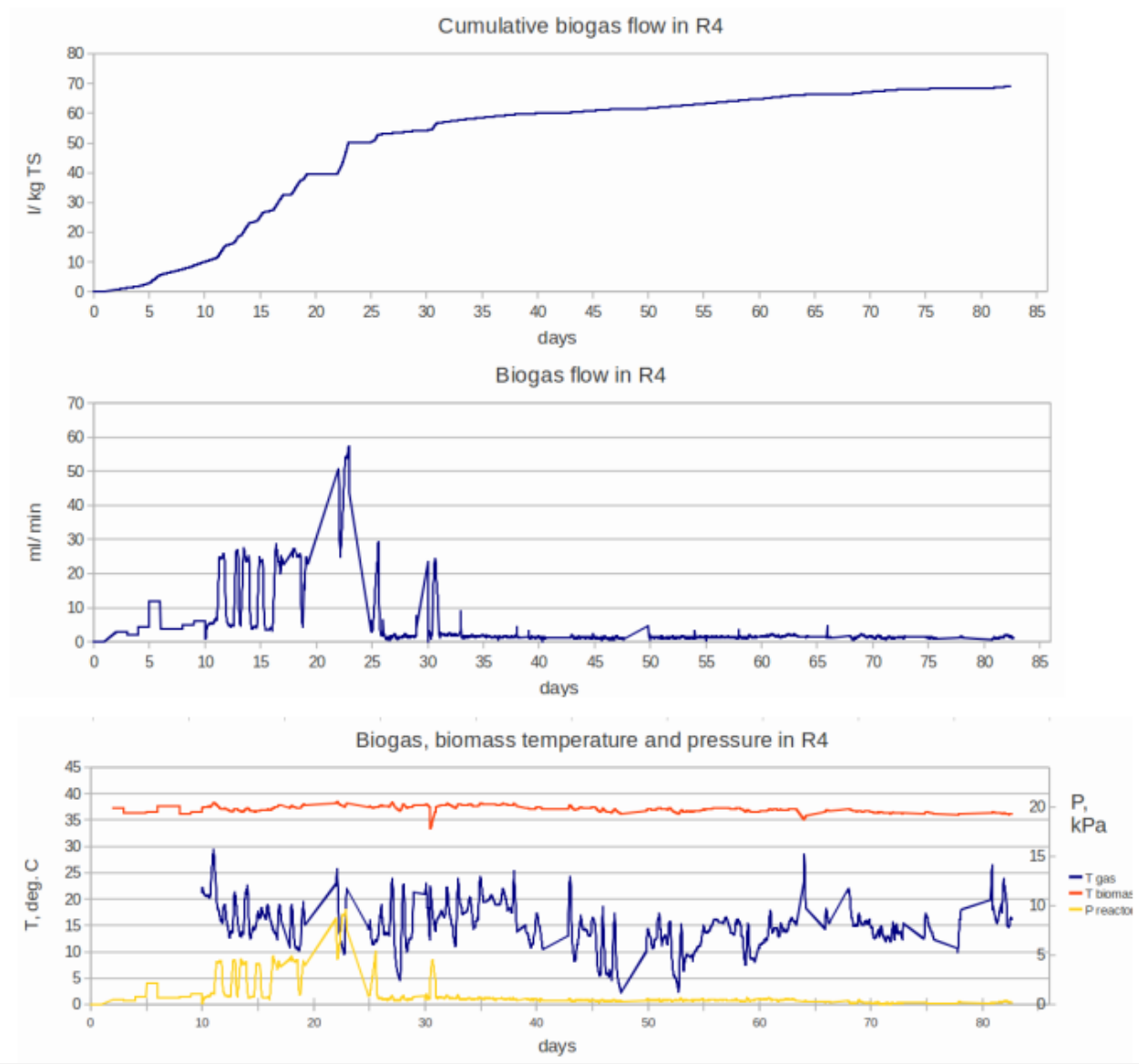






Results of Mobile laboratory with reactors BR3, BR4.





Summary & Conclusions

Biogas Production:

Wet fermentation is better than dry fermentation:
1.5 x (marine algae) i 3 x (freshwater biomass)

Wet Process with Marine Algae: 90 l/kg DM (140-180 l/kg DOM),
Wet Process with Freshwater Biomass: 150 l/kg DM (300-370 l/kg DOM),
over 80 days

In Dry Process there are small differences between substrates:
Dry Process with Marine Algae: 60 l/kg DM (90-120 l/kg DOM),
Dry Process with Freshwater Biomass: 50 l/kg DM (100-120 l/kg DOM),
over 80 days

Biogas composition:

Up to 75% methane in biogas in wet process,
Up to 50% methane in biogas in dry process,
Excessive sufphurhydroxide in marine algae fermentation

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ThankYou !

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