

Opportunities for the pulp and paper industry to recovery energy from residues: industrial symbiosis with biogas as the hub

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Mission:

” Scandinavian Biogas mission is to contribute to and facilitate the transition from fossil fuel to renewable energy

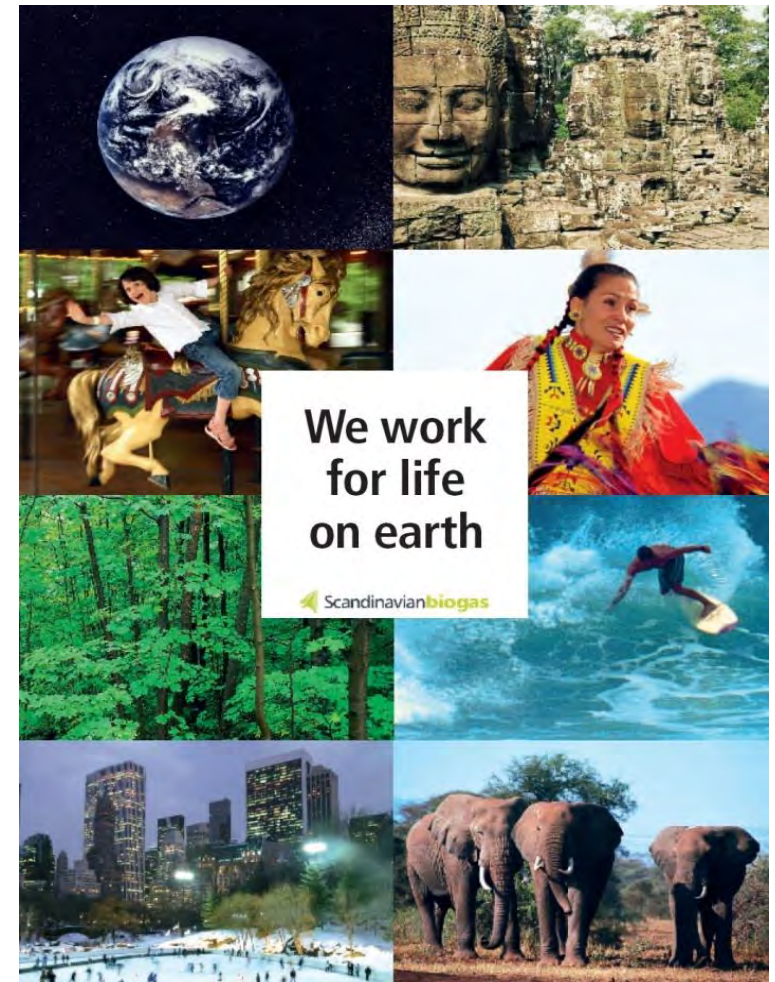


Matti Vikkula
CEO

Scandinavian Biogas in brief

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- Founded in December 2005
- Former Prime Minister of Sweden Göran Persson as Chairman of the Board
- Globally leading ability to prove and optimize concepts in both laboratory, pilot- and full scale.
- Head office in Stockholm
- Waste management and Biogas production in Sweden, Norway and Korea
- R&D and Process Department at Linköping University
- 70+ employees – specialists in biogas processes and technology



Current plants in SBF portfolio

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Projects running	Client / Partner	Substrate	Production GWh/y (est.)	
Bromma	Stockholm Vatten: SE	Sewage sludge, EOM	22 – (26)	Well functioning plant with proven PSA-technology. Planned extension for EOM dosing 2016
Henriksdal	Stockholm Vatten: SE	Sewage sludge, EOM	100 – (200)	Well functioning plant with proven technology. Extended 2015-16 with 3 rd up-grading line and EOM dosing
Södertörn	SRV: Stockholm, SE	Food waste	75 – (85)	Launched in Aug 2015. Top of the line process solutions with off-the-shelf hardware. HOLD concept based
Ulsan	City of Ulsan: Korea	Sludge and food waste	61 (60)	Well functioning plant. Appointed to be the best food waste based biogas plant in Korea.
Trondheim	Skogn: Trondheim, NO	Fish waste, slaughter waste, paper mill sludge	95 (125)	Project have CSTR for fish farming waste and ECSB for pulp and paper process water. Liquefied methane for sale. HOLD concept based



Scandinavian Biogas - 2019 Group performance



352 GWh
Group sales 2019

198 ktonnes
Organic waste
handled 2019

95 ktonnes
CO₂ reduction 2019



Industrial symbiosis

” Industrial symbiosis engages **diverse organisations**
in a network to foster eco-innovation
and long-term culture change. ”

Lombardi and Laybourn, 2012

Possible opportunities for symbiosis with a mill

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- Biogas up-grading
- Process heat

Biogas substrates

- H₂ and CO (syngas)
- Fed directly to digesters

Dewatering

Steam (6 bar)

Hot water 60-80 C

Bark and fibers

Process water

Bio-sludge

Methanol

Fibers

Heating other industries

District heating

CHP

Pellets to sell

Soil improver

Biodiesel

Possible connections

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- **Biogas**
- **Liquid digestate**
 - or
 - **Centrifuge accept (cake)**
 - **Nutritious rejected water**

- Vehicle fuel**
- Process water treatment**
 - **Electricity consumption**
 - **Need for Nitrogen and Phosphorous**

Internal substrates possible for biogas production on a generic mill are currently not big enough for industrial scale biogas production – 20-40 GWh.

However – the addition of such biogas to another biogas plant can be synergetic!

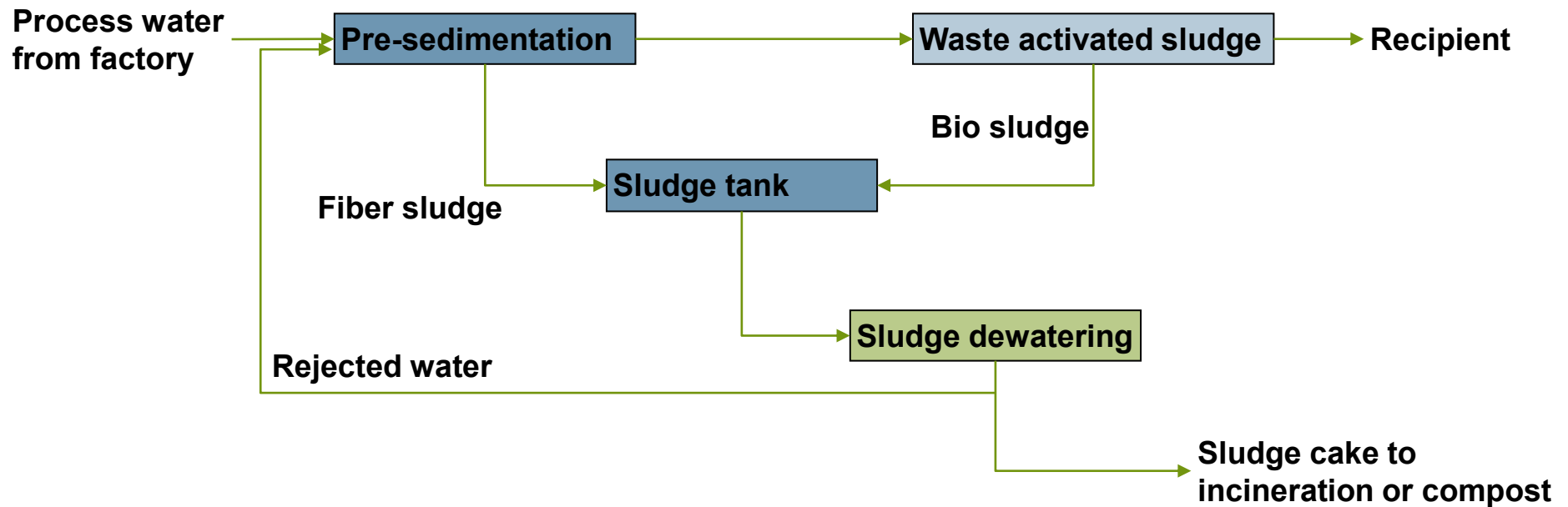
Internal:

- Heat and power production
 - Boilers with environmental restrictions
- Replacement of fossil fuel
 - IR-drying of coating
- Vehicle fuel
 - Used for own vehicles

External:

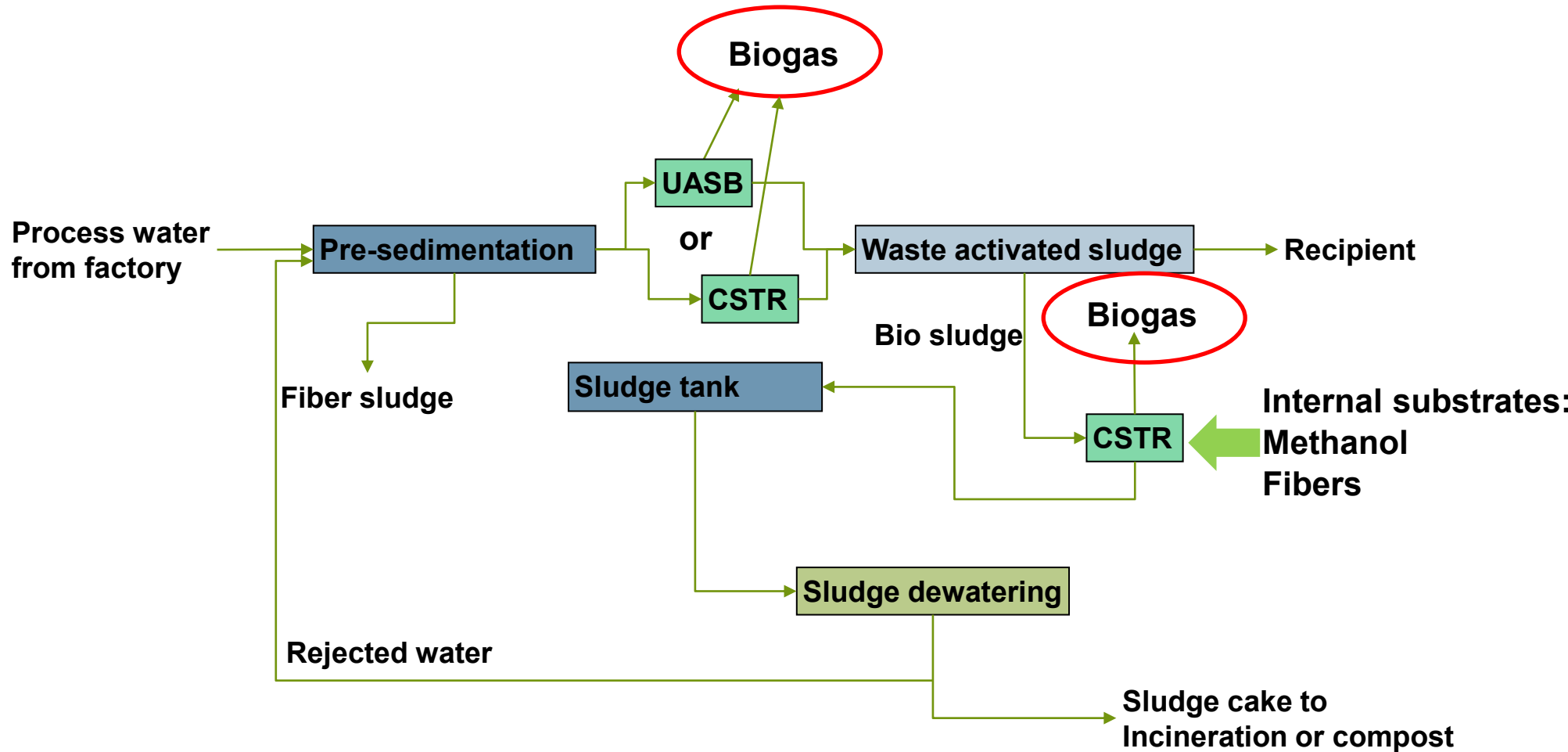
- Vehicle fuel
 - Up-graded and sold on the market
 - Raw gas sales to gas company for upgrading to vehicle fuel
- Green gas
 - Up-graded and injected to gas grid as green gas

Traditional treatment of process water streams at PPI

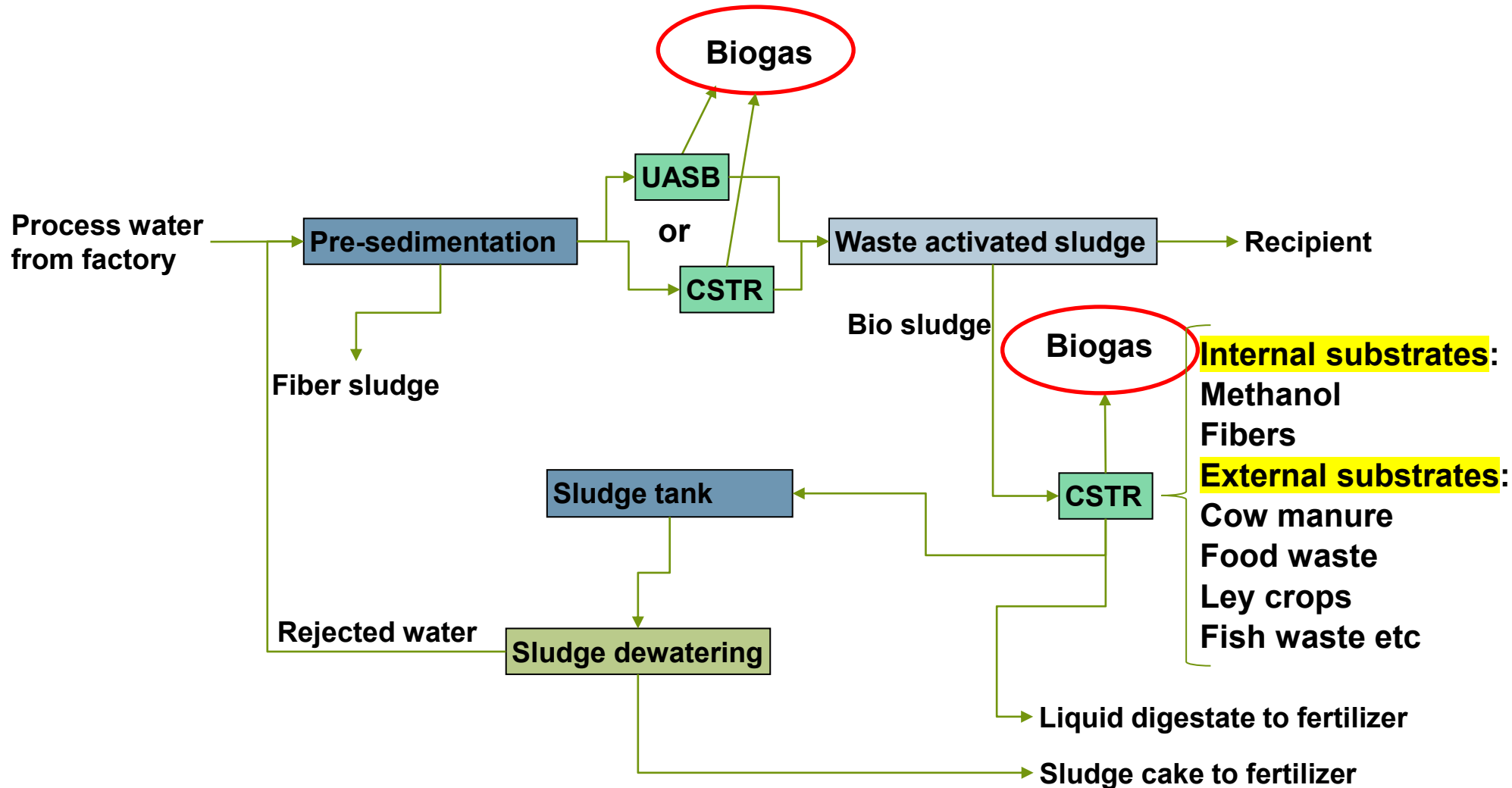


Possible treatment of process water streams at PPI

Example 1



Example 2



An example of industrial symbiosis between biogas production and pulp and paper industry



Skogn site - Norway





2011

Project started with agreements and lab scale reactors

2015

Ground work started

2016-2017

Engineering work

An aerial photograph of an industrial facility, likely a biorefinery, featuring several large green cylindrical storage tanks and a tall white distillation column. The facility is situated near a body of water, with a rocky shoreline in the foreground. In the background, a larger industrial complex with smokestacks emitting white smoke is visible.

2018

June

Inoculation CSTRs

July

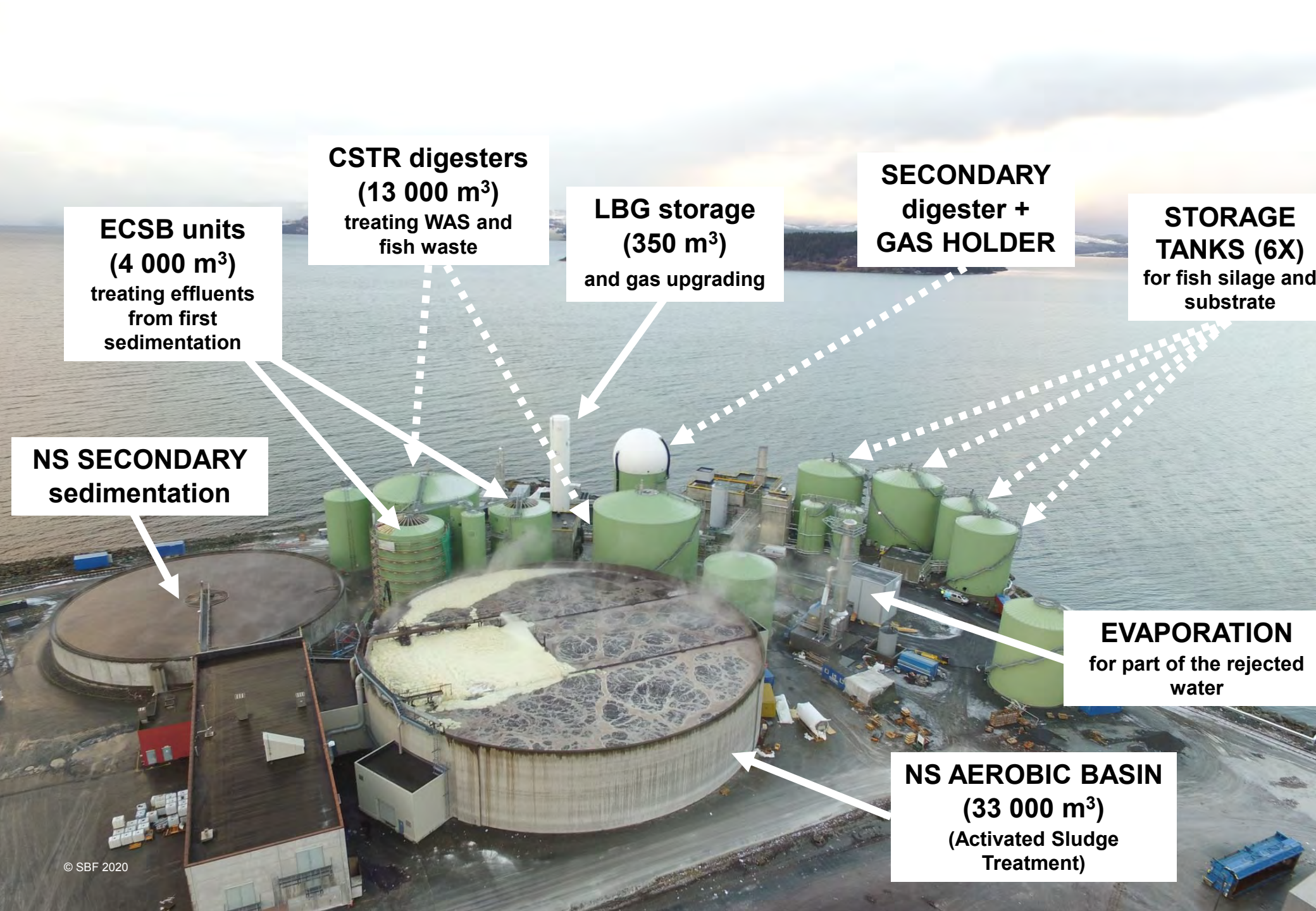
Start-up operation

September

First delivery of LBG

November

Start-up of ECSB



**ECSB units
(4 000 m³)**
treating effluents
from first
sedimentation

**CSTR digesters
(13 000 m³)**
treating WAS and
fish waste

**LBG storage
(350 m³)**
and gas upgrading

**SECONDARY
digester +
GAS HOLDER**

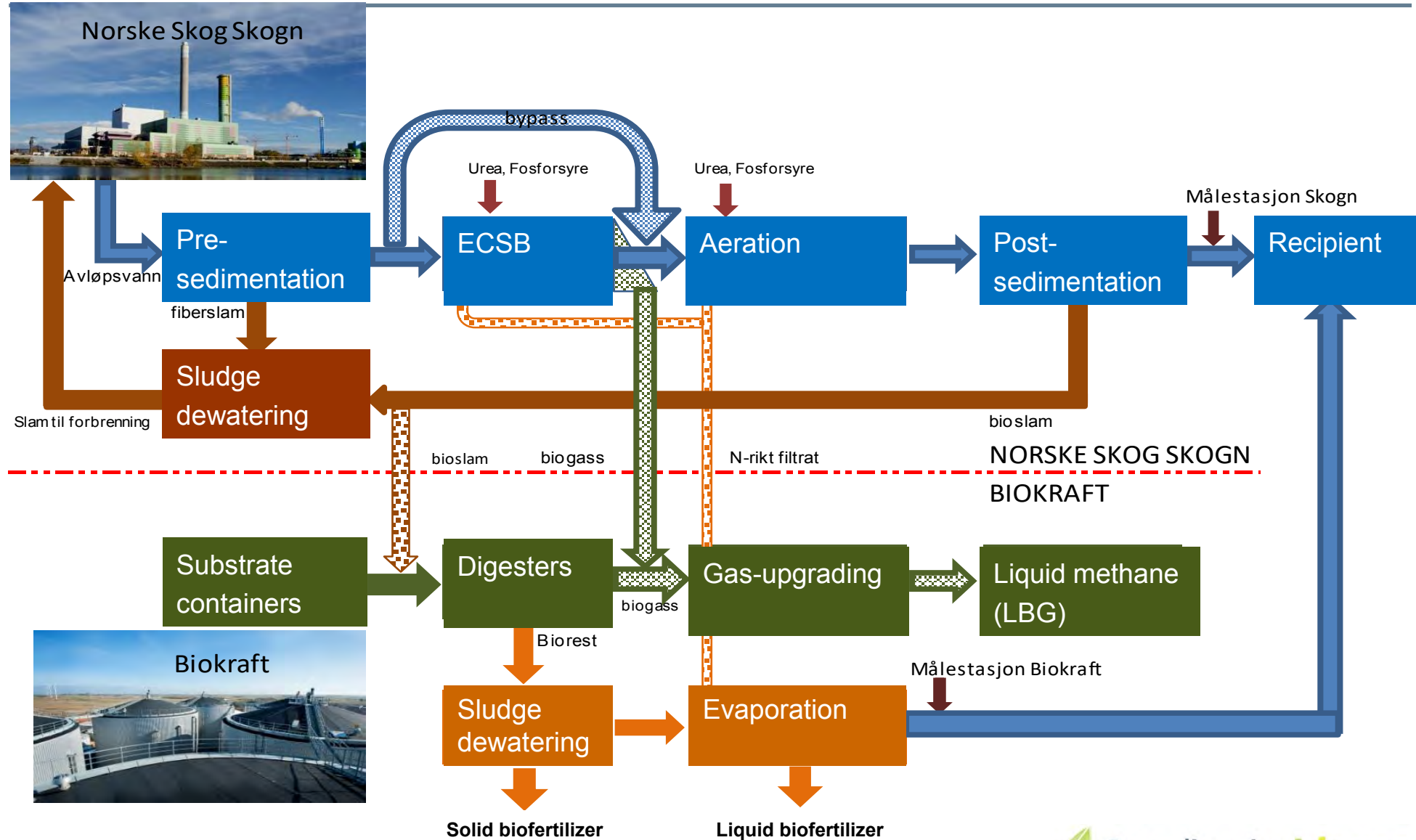
**STORAGE
TANKS (6X)**
for fish silage and
substrate

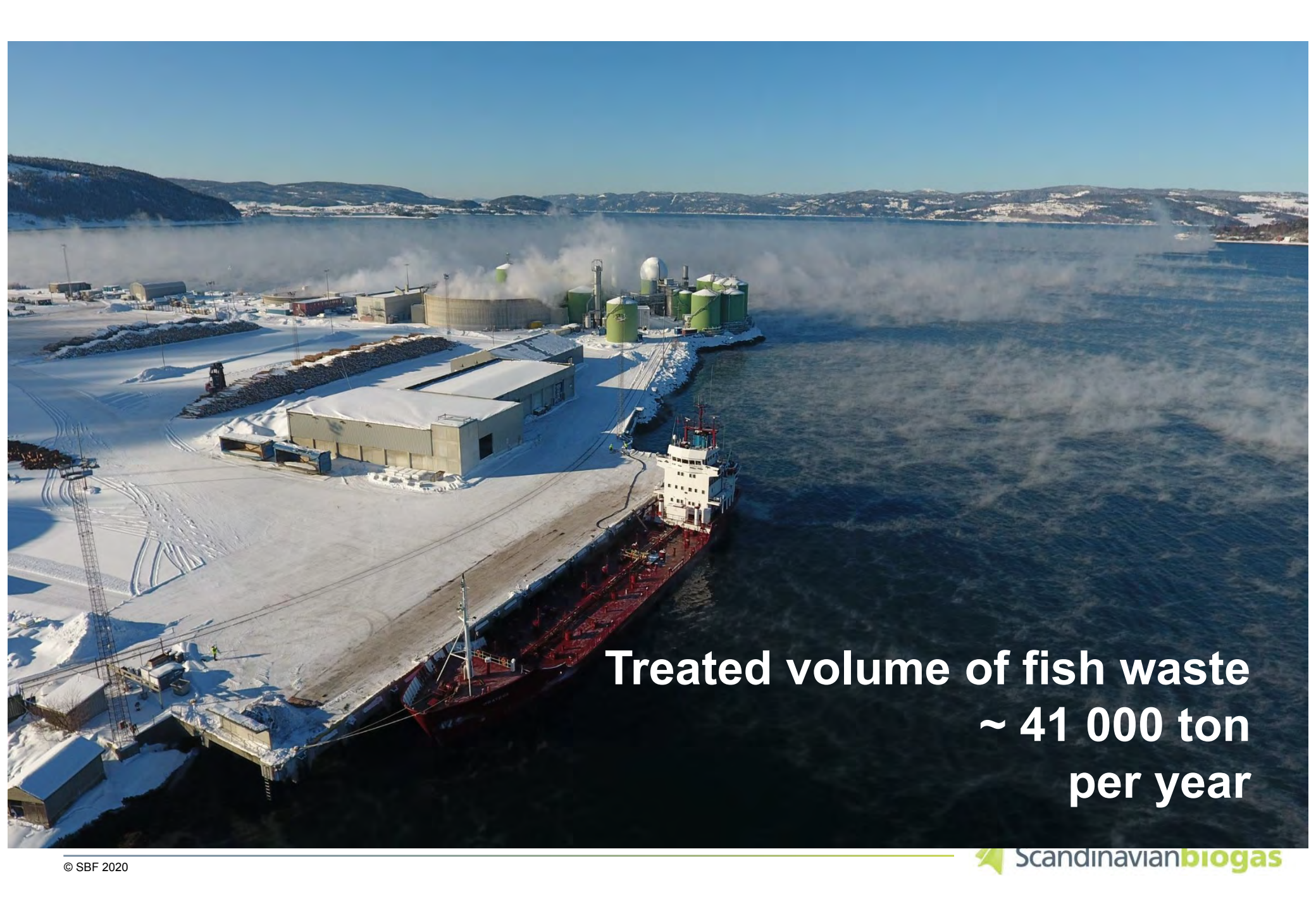
**NS SECONDARY
sedimentation**

EVAPORATION
for part of the rejected
water

**NS AEROBIC BASIN
(33 000 m³)**
(Activated Sludge
Treatment)

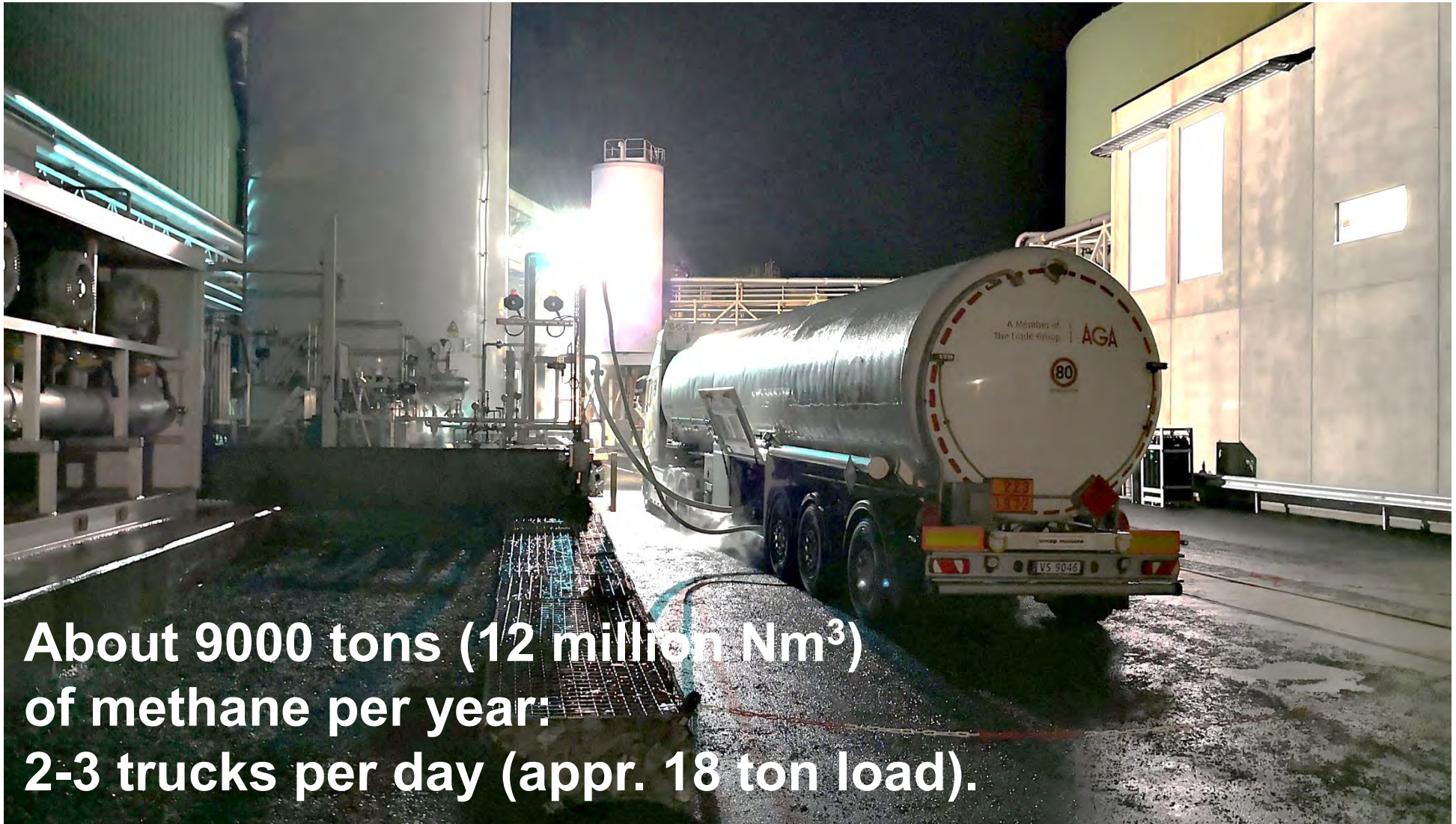
Original idea of integration of Biokraft at the Skogn site



An aerial photograph of a large industrial facility, likely a fish waste treatment plant, situated on a snowy peninsula or island. The facility features several large green cylindrical storage tanks, a white dome-shaped structure, and various industrial buildings. A large red ship is docked at a pier in the foreground, with a white tugboat or service vessel alongside it. The surrounding area is covered in snow, and the background shows a body of water and distant hills under a clear blue sky. Steam or smoke is visible rising from the facility.

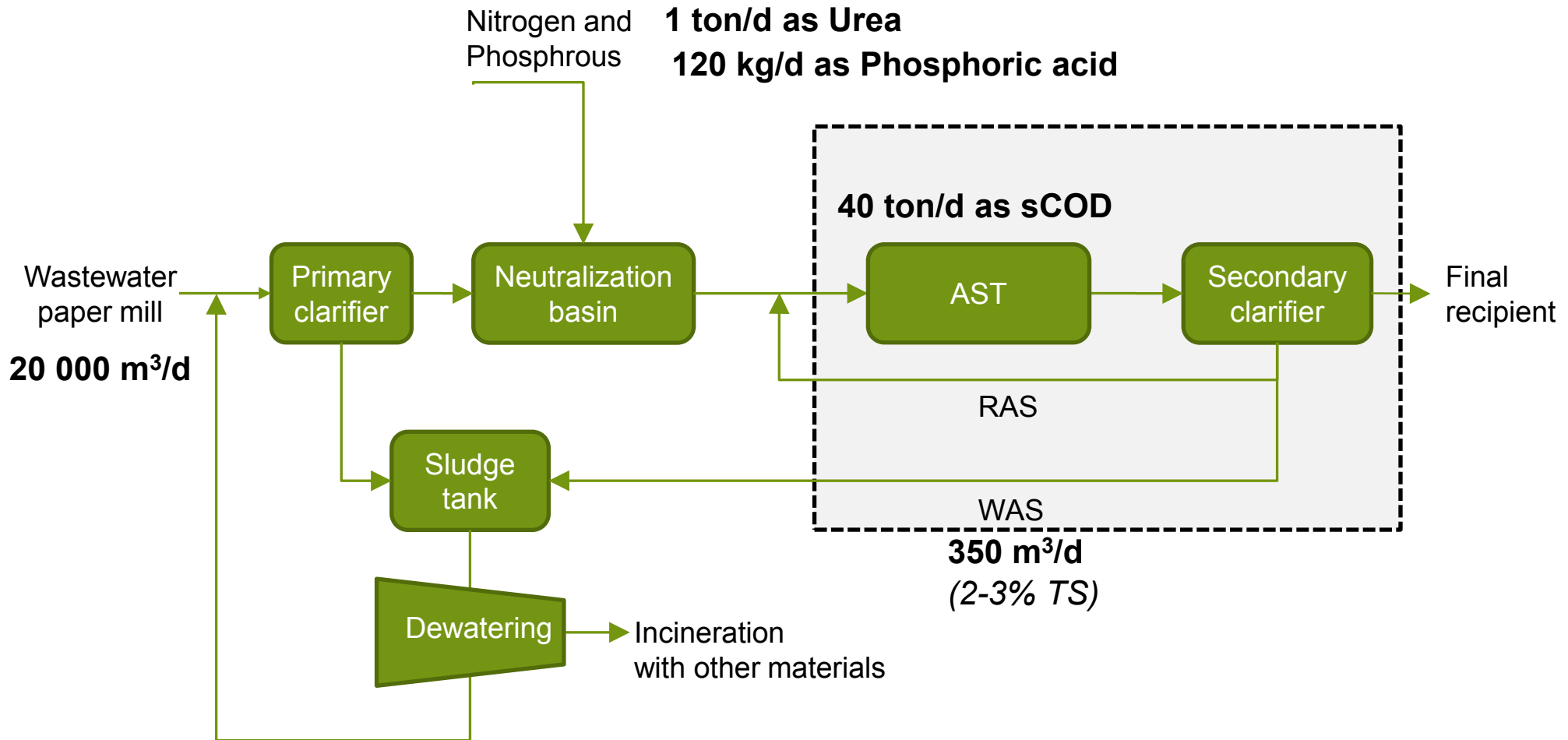
**Treated volume of fish waste
~ 41 000 ton
per year**

LBG is transported from the site to final users



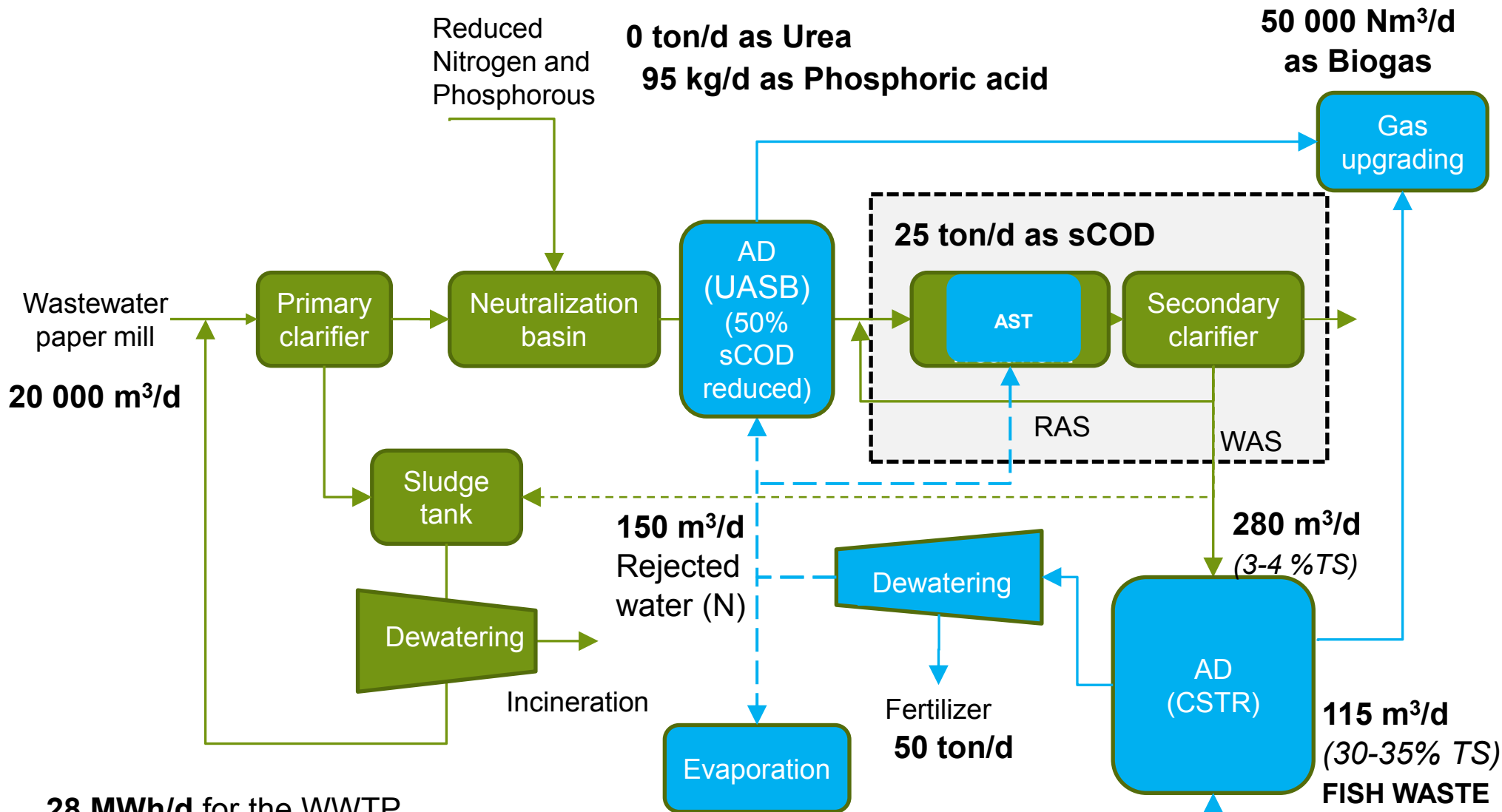
**About 9000 tons (12 million Nm³)
of methane per year:
2-3 trucks per day (appr. 18 ton load).**

Mill's WWTP – Today (mass balance)

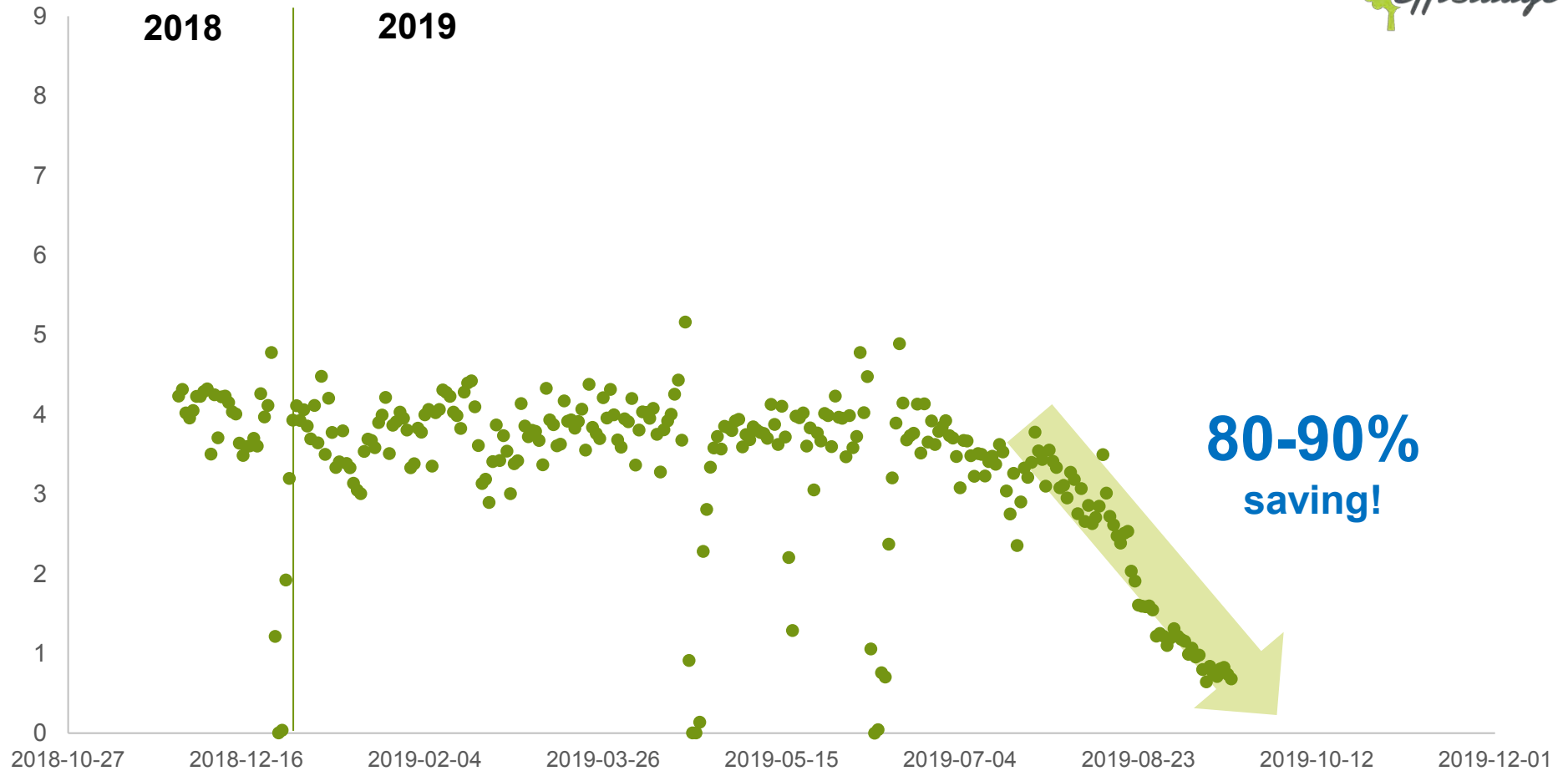


45-50 MWh/d for the WWTP (ca. 60% from aeration)

Mill's WWT – EffiSludge (mass balance)



Urea dosing (m³/day)



Ongoing project linked to the Skogn site



EU funding for climate change mitigation (CCM)



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A cooperation between



Thanks for the attention!

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...follow our project developments on twitter #EffiSludge...