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EffiSludge Web Conference

Industrial Wastewater Management: Exploring higher energy efficiency, carbon-saving solutions - special focus on pulp and paper residues

organised in cooperation between



Institute for Biogas
Waste Management & Energy



with the financial contribution of



Thanks for your participation



Figure 1 – Answers given to the opening poll asking where the participants were joining the web conference from - the larger the text, the more times it was mentioned by the participants.

TAKE HOME MESSAGE

Here a summary of the most discussed aspects during the day. This information has been collected and elaborated on by the organising committee based on the presentations and the panel discussions.

- Industrial symbiosis is a growing reality across different sectors. In Europe, industrial symbiosis between the pulp and paper industry and the biogas sector is represented by a number of real cases already.
- “Back to the future” – a look at the history of pulp and paper plants shows how efficiently they could be when integrated with other industries. Often, a mill is surrounded by a certain amount of infrastructure, which provides a great advantage for the development of business opportunities with other sectors.
- Models are powerful tools for predicting the effects of potential industrial symbiosis. Thanks to current advance modelling, it’s clear that integrated biogas solutions offer a valuable option to conventional alternatives. However, the engineering and flexibility of anaerobic digestion systems is often underestimated.
- The large variations in flows, concentrations of suspended solids, COD and process chemicals of the process water from many mills sets high demands on anaerobic digestion-knowhow and needs to be combined with high frequency process monitoring and steering to obtain stable processes. More research and development can increase the suitability of anaerobic digestion for the pulp and paper industry.
- There is a clear need for efficient carbon-saving solutions within industrial wastewater treatments. Representatives from pulp and paper mills confirmed that awareness of environmental issues has increased in the industry.
- Carbon and energy savings can sometimes be found in unexpected places. EffiSludge is an example: in this case, post digestion reject water replaces chemical dosing of N and P within an industrial wastewater treatment.
- Legislation and environmental issues could be the most important drivers for increased industrial symbiosis (with the goal of CO₂-reduction) in the pulp and paper industry. Stricter environmental regulations are most likely the best way to challenge conservative industries, in which challenges typically outweigh the benefits.

FROM THE WORKSHOP...

Session 1 - Biogas as the hub in industrial symbiosis

The workshop started with opening remarks on the EffiSludge project and why it is an example of biogas as the hub in industrial symbiosis. The keynote was given by Jörgen Ejlertsson from Scandinavian Biogas Fuels. He was followed by Åsa Sivard and Xu-Bin Truong from AFRY. The session was closed with a panel discussion, which included all of the session's speakers as well as Magnus Johansson, development strategist at Fiskeby Board.

Highlights from the presentations and panel discussion:

- When considering possibilities for carbon reduction you have to think in many directions. One of the many benefits of the EffiSludge project is the possibility to replace urea as a nitrogen source with reject water from an AD-process treating nutrient rich waste – saving up to 90% of the typical urea dosing.
- Economic investment requires additional substrate than that which can be derived from the bio-sludge produced in the WWT. (In the EffiSludge pilot the wastewater sludge is co-digested with fish waste from fish farming.)
- One suggestion for improving the business case for AD at pulp and paper mill was scaling up, such as mentioned above with co-substrates. However, there may be several reasons, which outweigh the economic factors in the decision process (e.g. need to expand wastewater processing capacity).
- Trends in the pulp and paper industry:
 - more packaging (i.e. craft mills)
 - more COD and higher degree of bleaching
- The main consumer of energy in treatment of pulp and paper wastewater is the aeration.
- Drivers in European advancements of more efficient wastewater treatment:
 - Environmental awareness of carbon emissions
 - Legislation (potentially)
- Limiting factors for further implementation of biogas projects (and other environmental innovations) in pulp and paper plants:
 - Focus only on the core product of paper/packageging. This seems to be changing because stricter environmental regulations (reduction of water use and CO₂-emissions) will make the PPI look at the whole process and from this perspective find new areas for improvement.
 - Large variations in flows, COD loads etc make stable high rate AD challenging
 - Finding partners for business opportunities

Possible connections



- **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!

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Figure 2 – Possible connections between biogas and the pulp and paper industry (Ejlertsson, Scandinavian Biogas).

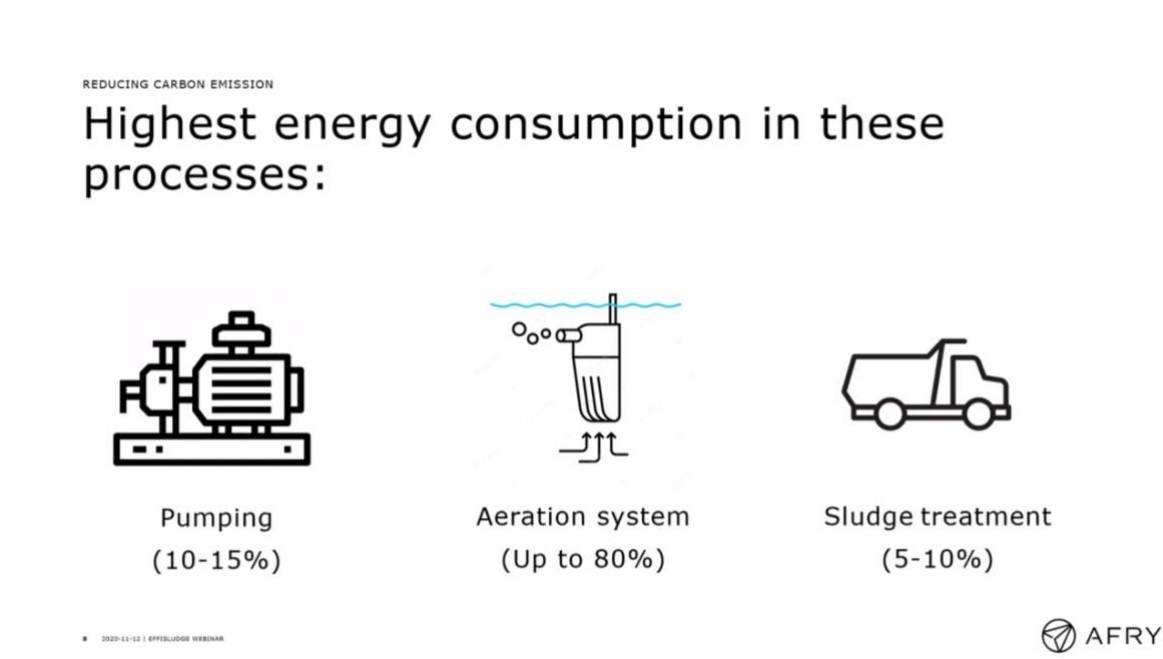


Figure 3 – Highest energy consumption in the PPI wastewater treatment process and respective potential for CO₂ reduction (Truong, AFRY).


Session 2 - Wastewater treatment and biogas

Session 2 began with looking at modelling the wastewater treatment process and its advantages. The presentation was done by Magnus Arnell from RISE Sweden followed by two practical cases from paper mills, which have implemented anaerobic digestion in their wastewater treatment – presented by Elmar Fischer from Julius Schulte Trebsen, Germany and Nils Hauri from Rottneros Mill, Sweden.

Highlights from the presentations:

- The aim of modelling is to predict and evaluate the impact of industrial symbiosis possibilities, for example:
 - Optimizing the AD-substrate mix
 - Impact on water quality
 - Optimize nutrient additions
- The pulp and paper production is a continuous process and disruptions of any kind are disadvantageous and the producers will avoid any processes, which could potentially cause disruptions. Conventional waste activated sludge systems are easy to operate. The inclusion of AD solutions needs to be able to secure stable and long-term operations.
- Very uneven process with respect to, among others, the sodium bisulphate load, temperature and load of suspended solids and COD-concentrations in the wastewater.

WWT Process Model

- Hydraulics
 - Biological processes
 - Chemical Processes
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- Sub models
 - Activated sludge
 - Anaerobic digestion
 - Settling
 - Etc.
 - Mathematical equations implemented in a computational software for simulations

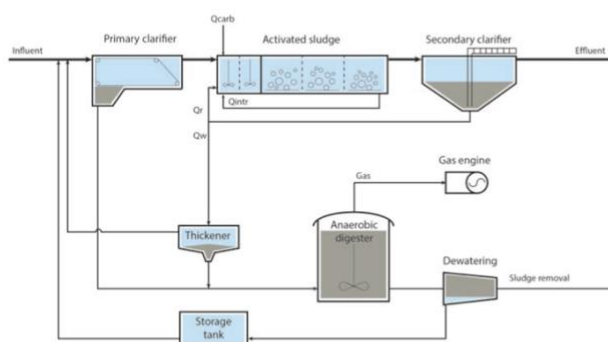


Figure 4 – Highest energy consumption in the PPI wastewater treatment process and respective potential for CO₂ reduction (Arnell, RISE).

Session 3 - Carbon-saving projects and industrial symbiosis

The final session began with a presentation from Mats Eklund on “Carbon saving potentials from industrial symbiosis implementations”, which took a look at the history of pulp and paper plants in order to find inspiration for the future. The second presentation from Juan Carlos Fernandez, a representative from the Barcelona Metropolitan Area (AMB), gave insight into one of the largest metropolitan areas in Europe and how they are tackling waste management working step-by-step to implement innovative technology and reduce its environmental impact. The final presentation given by Félix Elbert from Bähler Biogas showed the situation for biogas production in Canada.

Highlights from the presentations:

- Pulp and paper mills began as something more of a biorefinery – trees went in and a plethora of products came out. Just as is the case in many industries, the PPI with time concentrated increasingly on its core products and to scaling them. This led to higher economic efficiency within the core but less circularity in the process, creating more waste and non-used residues.
- Examples of reconnecting industries and making waste products valuable were shown, such as Elleholms tomatoes linked to the pulp mill in Mörrum.



Figure 5 – Example of reconnection of industries – heat from a pulp mill and CO₂ from liquor production used at a greenhouse for the cultivation of tomatoes, which have a 20 times better CO₂ footprint than their common counterparts (Eklund).

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- The municipal solid waste in the Barcelona metropolitan area contains around 36% organic matter and plans are in place to significantly increase the amount of source separated organic waste. More AD units as well as collaboration (and co-digestion) with other waste/wastewater industries are in planning. The region has tested biomethane in refuse trucks and intends to increase production of biomethane and bioethanol.
 - The market in Canada is driven by similar factors as in Europe, but the environmental legislation, which has the most impact still lies ahead. For example, many European countries have already implemented the EU Landfill Directive and are required to divert organic waste from landfills or incinerate it before disposal. This will not be the case in Canada until 2022.
 - Other market drivers for biogas in Canada:
 - Subsidies
 - Energy targets
 - Greenhouse Gas Act (GHG Act)
 - Occasionally lucrative spot markets

ACKNOWLEDGMENT

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