2021-12-02

EffiSludge Closing Event

Biogas, Carbon Footprint and Industrial Symbiosis Workshop on how biogas solutions practically contribute to climate change mitigation in energy intensive industry

organised in cooperation between

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.

WORKSHOP SUMMARY

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.

Session 1 - EffiSludge results and the role of biogas in industrial carbon reduction

The workshop kicked off with the presentation of the EffiSludge project results and achievements, presented by Francesco Ometto. He was followed by Hugo Salamanca from the IEA, who spoke about the path to carbon neutrality for the industrial sector. The last presentation of the session was given by Mieke Decorte and Marco Giacomatti from the European Biogas Association. They presented the results on a study involving the biogas potential from industrial wastewater, of which the wastewater from the pulp and paper industry plays a major role. In addition, Marco Giacomatti gave an overview of policy measures that could encourage industries to make the necessary technology investments for making maximum use of the potential. The session was closed with a panel discussion on: Industrial symbiosis of the future – what is the role of large-scale industries and biogas for achieving carbon neutrality? The panellists were two external guests:

- *Małgosia Rybak, the Climate Change & Energy Director from CEPI*
- *Henrik Dahlsson, the Senior Advisor Sustainable Transport at Scania Sweden*

as well as two representatives linked to the EffiSludge project:

- *Jon Henrik Steinsli, Norske Skog*
- *Jörgen Ejlertsson, Process and R&D Director, Scandinavian Biogas Fuels*

Highlights from the presentations and panel discussion:

- The EffiSludge concept achieves carbon reduction through several paths – less chemicals required, less energy consumed andrenewable energy production. Zero CO_2 emissions for the wastewater treatment can be achieved.
- Pulp and Paper industry is among the most energy intensive. Efficiency and energy source replacement are the main measures considered for the roadmap to emission reduction, but more is needed in order to achieve carbon neutrality. Renewable energy production is one possibility.
- “It is possible to recover 142 TWh of biogas per year by valorizing industrial wastewaters, from the spirits, biodiesel, pulp and paper, beer, vegetable oils, ethanol, meat and cheese sectors.” (Decorte, EBA)
- “Most biomethane potential studies in Europe do not yet consider biomethane from industrial wastewaters.” (Decorte, EBA)
- Pulp and paper wastewater treatment through aeration requires very high amounts of energy. Anaerobe treatment reduces GHG emissions by saving energy for treatment (up to 75%), producing renewable gas.
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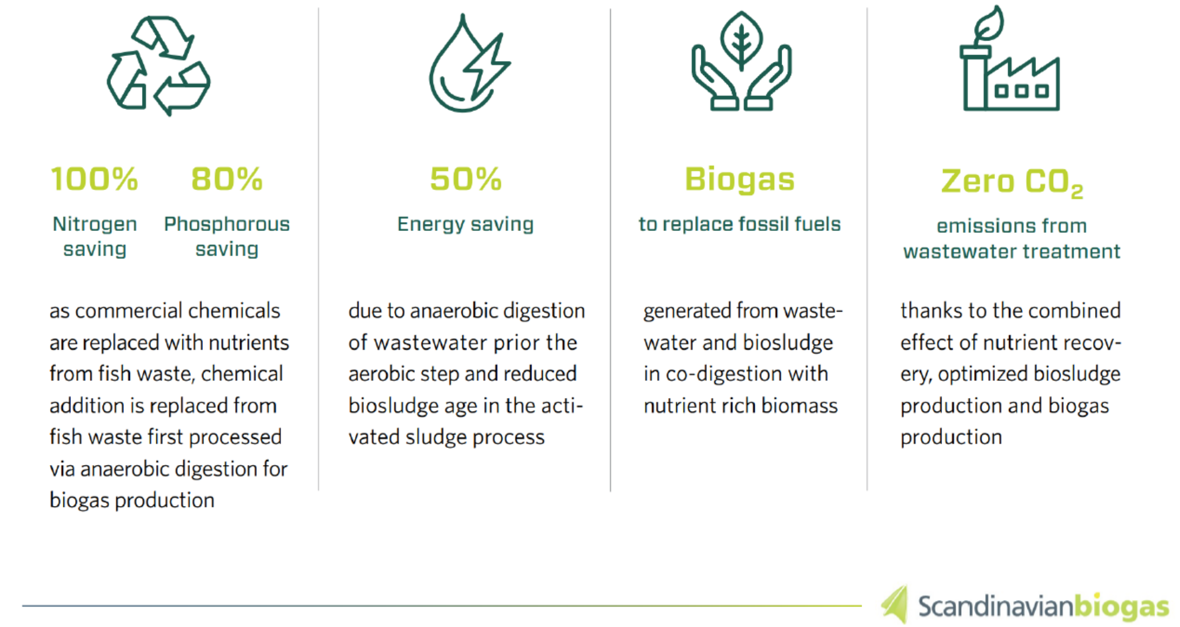

Figure 2 – EffiSludge targets (Ometto, Scandinavian Biogas Fuels).

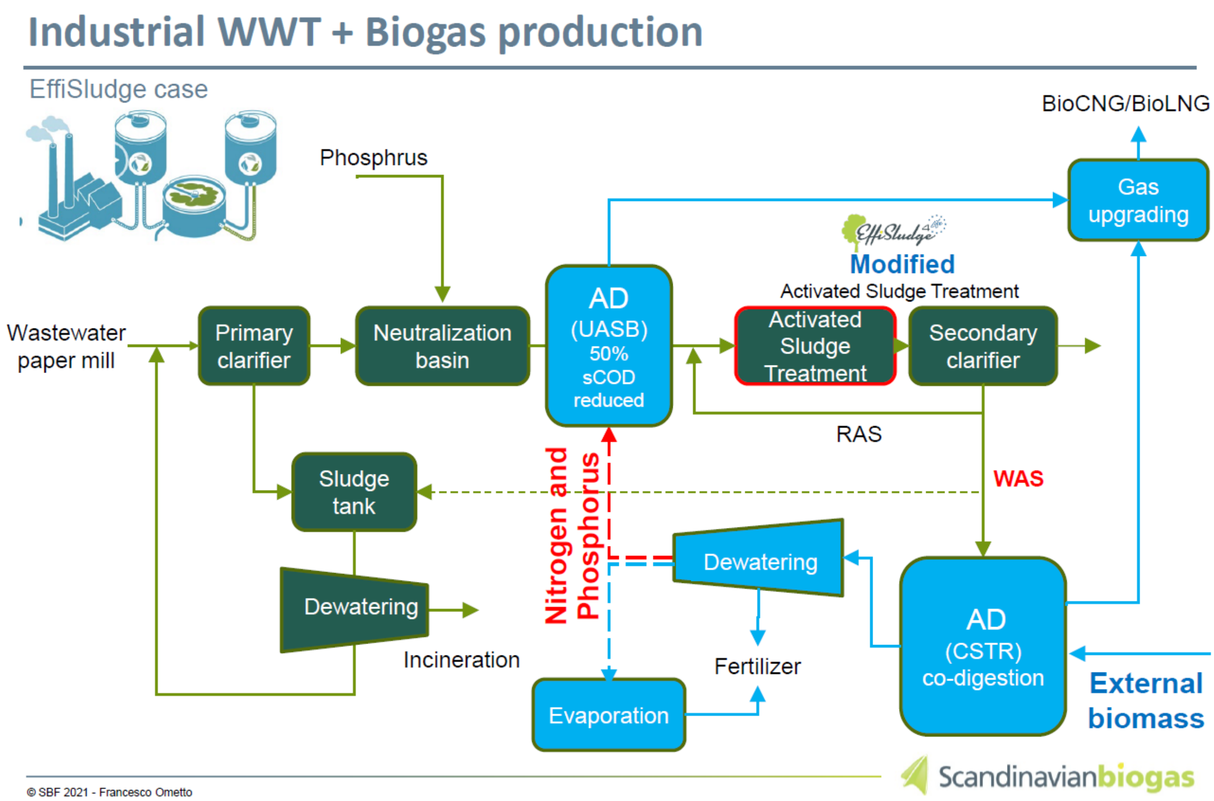

Figure 3 – EffiSludge overview (Ometto, Scandinavian Biogas Fuels).

Key parameters for evaluation of the reduction of fossil CO_2-release by implementing EffiSludge

Parameter	Unit	Before EffiSludge[1]	Present EffiSludge[2]	Future EffiSludge[3]
Sludge age	days	13	12	6-8
Energy demand	MWh/day	30	23	15
Nitrogen addition (urea)	kg N/day	1000	100	0
Phosphoric acid addition	kg P/day	100	10	30
Biomethane from biosludge	Nm^3/day	0	180	1700
Biomethane from direct WWT	Nm^3/day	0	3400	7100

[1]The Before EffiSludge case is calculated from actual values for the year 2017. [2]The Present EffiSludge case is based on data from the full-scale implementation at Skogn for November 2019. 65% of the wastewater was during this period treated in the anaerobic wastewater unit while 100 m^3/day of the biosludge was digested together with nutrient rich residues from the Norwegian fish industry. The biomethane potential of the biosludge was set to 81 Nm^3/tonne VS for this sludge, that value is based on actual BMP measurements. [3]The Future EffiSludge Case assumes that all wastewater is treated in the anaerobic unit giving a 50% reduction of the organic material in the wastewater before going to aeration. The amount of biosludge digested has been assumed to increase due to the shorter sludge age (a factor of 0,28 kg SS/kg of COD_{red} was used for estimating the amounts). The biomethane potential for this biosludge was assumed to be 250 Nm^3/tonne VS.

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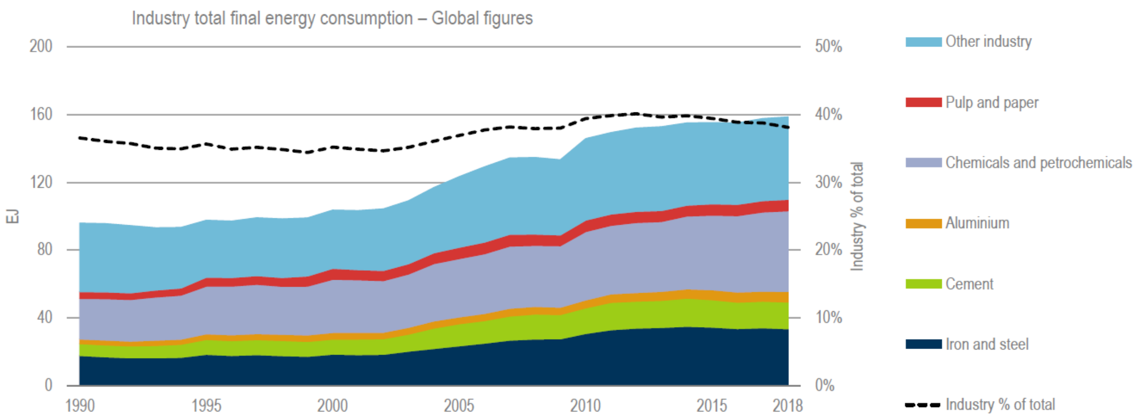
Figure 4 – EffiSludge LCA (Ometto, Scandinavian Biogas Fuels).

Industry contributes to a large share of global energy use



Globally, industry total energy use has grown more than one and a half times over the last 25 years driven by the doubling of energy use from the chemical and petrochemical and iron and steel sectors which represent more than 60% of that growth.

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Figure 5 – Final energy consumption of selected industries (Salamanca, IEA).

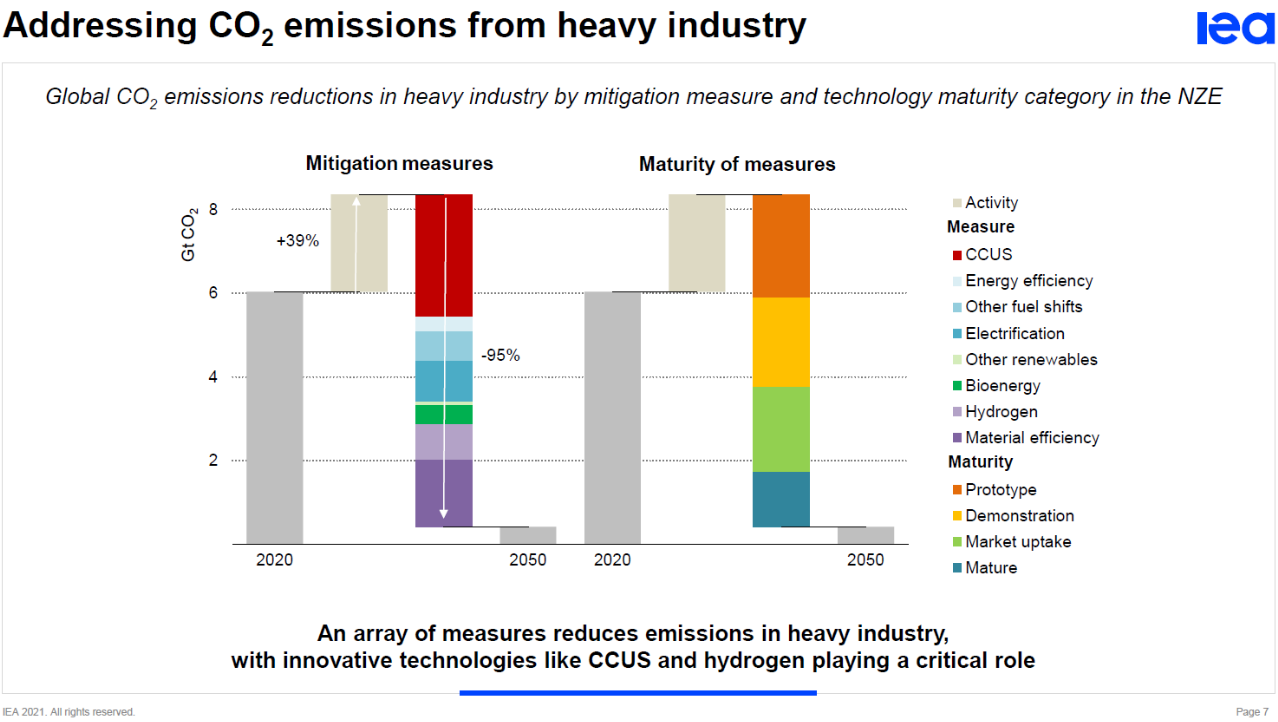

Figure 6 – Measures to reduce emissions and the level of maturity across the measures (Salamanca, IEA).

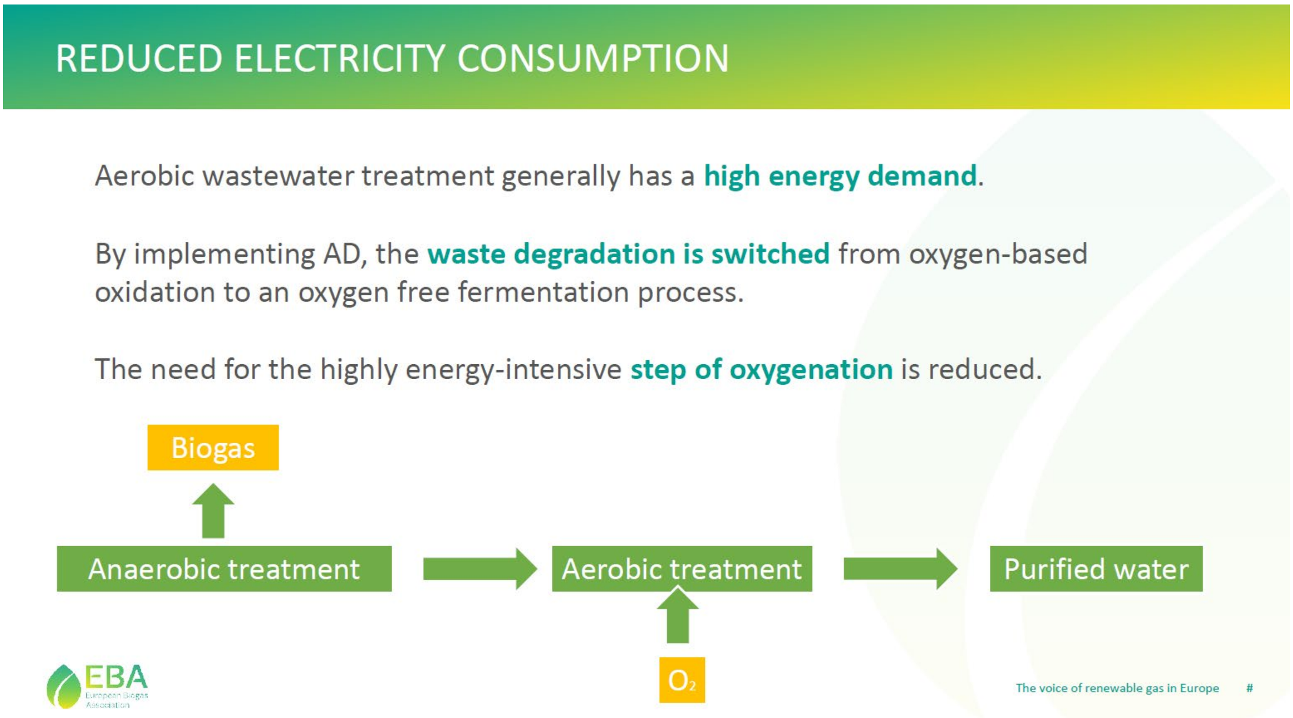

Figure 7 – Selected advantages of anaerobic wastewater treatment as opposed the aerobic. (Decorte, EBA).

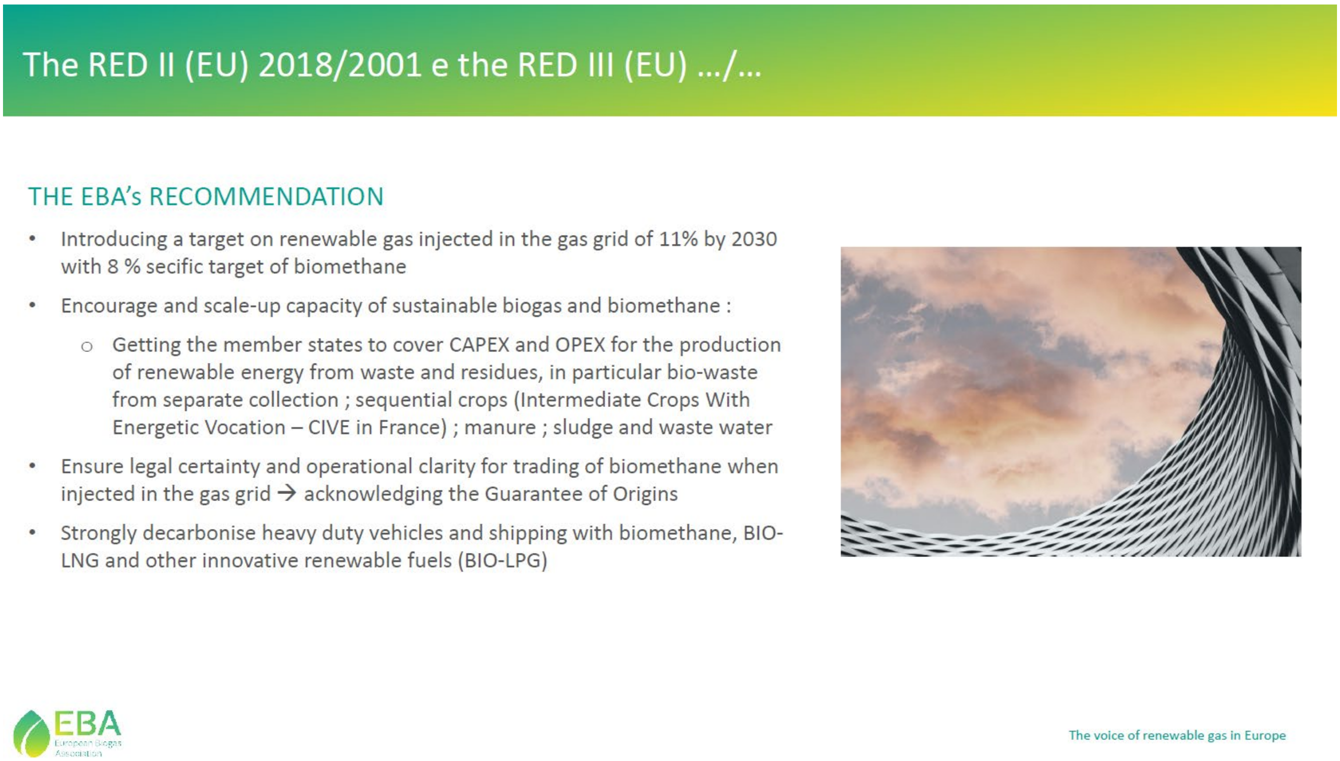

Figure 8 – Recommendations for motivating companies to invest in anaerobic technology. (Giacomazzi, EBA).

Session 2 - Carbon-saving potential with industrial symbiosis and alternative wastewater treatment – Projects and examples

The afternoon session placed emphasis on industrial symbiosis. It began with presentations from two LIFE projects, the LIFE Water Factory project and the LIFE Anadry project, presented by Frans Visser from Waterschap Vallei en Veluwe and Silvia Doñate from DAM Depuración de Aguas del Mediterráneo respectively. The LIFE projects focus on certain steps of wastewater treatment, which would improve resource extraction and the potential for further use.

The final two presentations were given by representatives from two industrial symbiosis examples - Pirkabio and ECO3 in Nokia, Finland and Kalundborg Symbiosis in Kalundborg, Denmark. The Finnish case was presented by Irina Simola and Sakari Ermala, the Danish case by Per Møller.

The session finished with a panel discussion on are the challenges for implementing industrial symbiosis. The panelists were:

- *Per Møller, Kalundborg Symbiosis*
- *Annika Björn, Linköping University*
- *Madeleine Larsson, Linköping University*
- *Magnus Johanson, Fiskeby Board*

Highlights from the presentations and discussion:

- Many obstacles for the case in Nokia, Finland were linked to legislation and it is vital to understand these.
- Systems thinking is needed in order invest money to achieve both as many environmental and economical benefits.
- The Kalundborg case has a 50-year history. Economics, not sustainability, was the motivation in the beginning. The main difference between Kalundborg and other industrial parks is willingness to communicate.

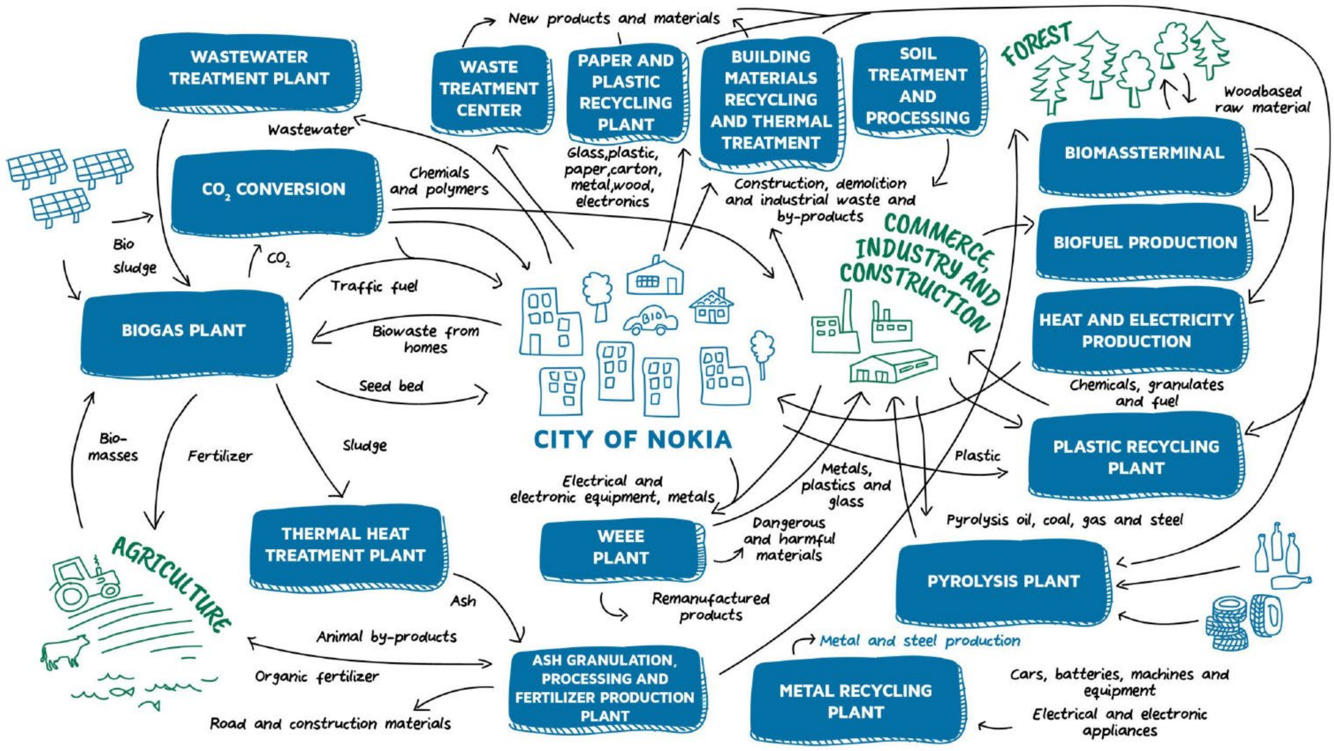

Figure 9 – Overview of the industrial scale circular economy business area in Nokia, Finland. (Ermala, Verte Oy).

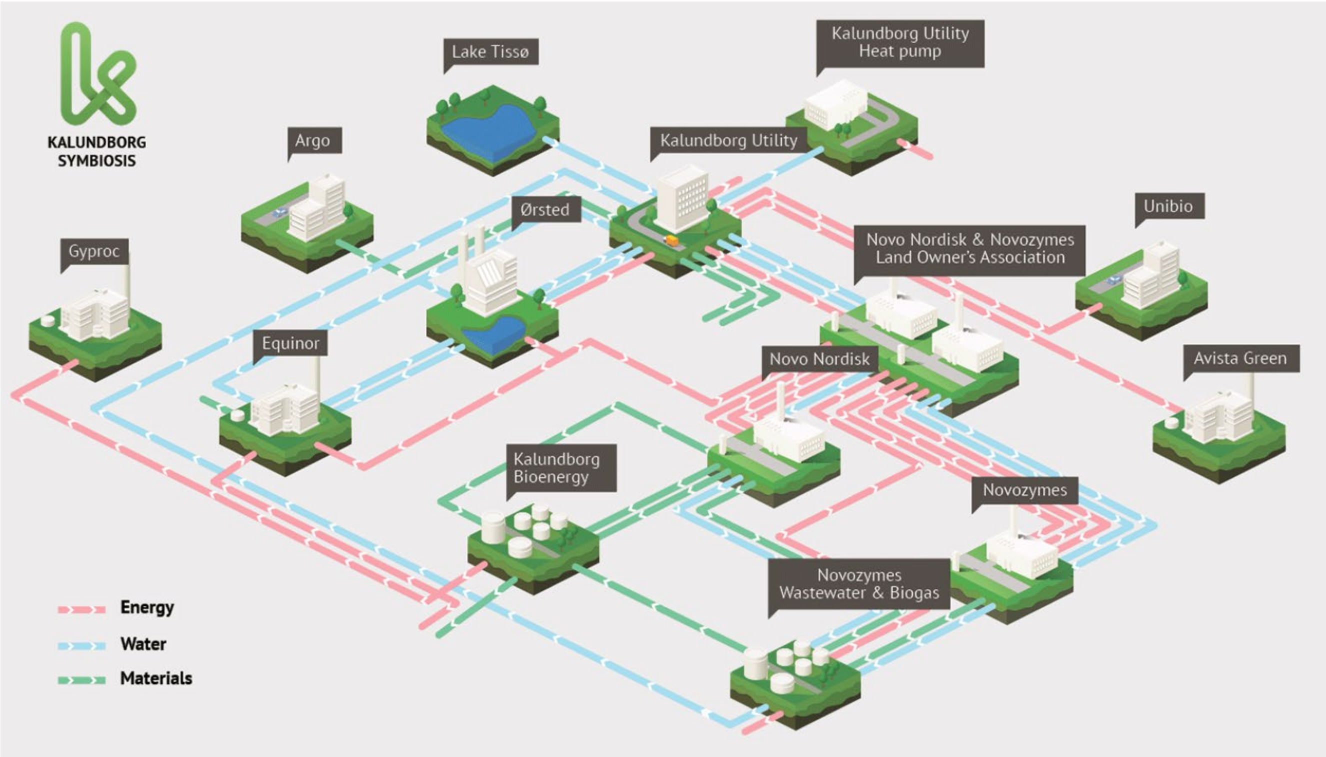

Figure 10 – Overview of the Kalundborg material flow between companies (Møller, Kalundborg Symbiosis).

Comments from the two panel discussions:

- Companies/organizations can and should do more on promoting industrial co-operation/ symbiosis and on implementing sustainable energy solutions.
- Big companies that take the lead on sustainable energy solutions can help the implementation by making necessary investments possible.
- Increase funding for development- and demonstration projects so that good ideas can be tested and realised
- Spread information on both good and bad examples of industrial symbiosis for "copying" and learning from mistakes respectively.
- Energy efficiency in all areas is one of the corner stones for the transition to carbon neutrality and much can be done in the specific case of wastewater treatment.
- Industrial symbiosis is business done in partnership with trust and communication as corner stones.
- Economy is the first driver in industrial symbiosis but now incentives as social responsibility, suitability and resilience are also playing large rolls.
- 1+1 will often be much more than two when industrial symbiosis is implemented.
- Hard to define general "low hanging fruits" as it depends on players and available products, but as biogas is often a hub in an industrial symbiosis, utilization of nutrients and the carbon dioxide in biogas should always be considered.
- "Systems and technology make it possible, and people make it work"
- Permitting processes need to be more open to/adapted to a systems perspective
- Industrial symbiosis thinking should be part of schools' curriculum

ACKNOWLEDGMENT

The organising committee, composed by Frank Scholwin, Angela Clinkscales, Francesco Ometto and Anna Karlsson, would like to thanks all delegates for their active participation to the workshop. Thanks to Scandinavian Biogas and the EU LIFE programme for the funding.

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