

Billund Biorefinery

Positive energy balance and reuse of
hygieniced sludge at Billund
Biorefinery.

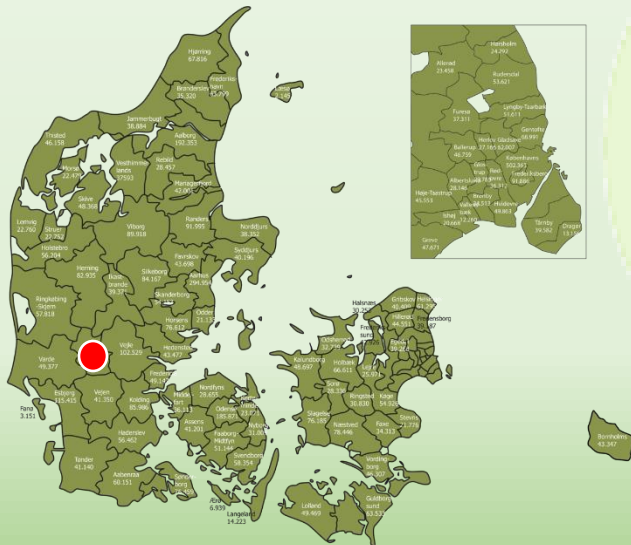


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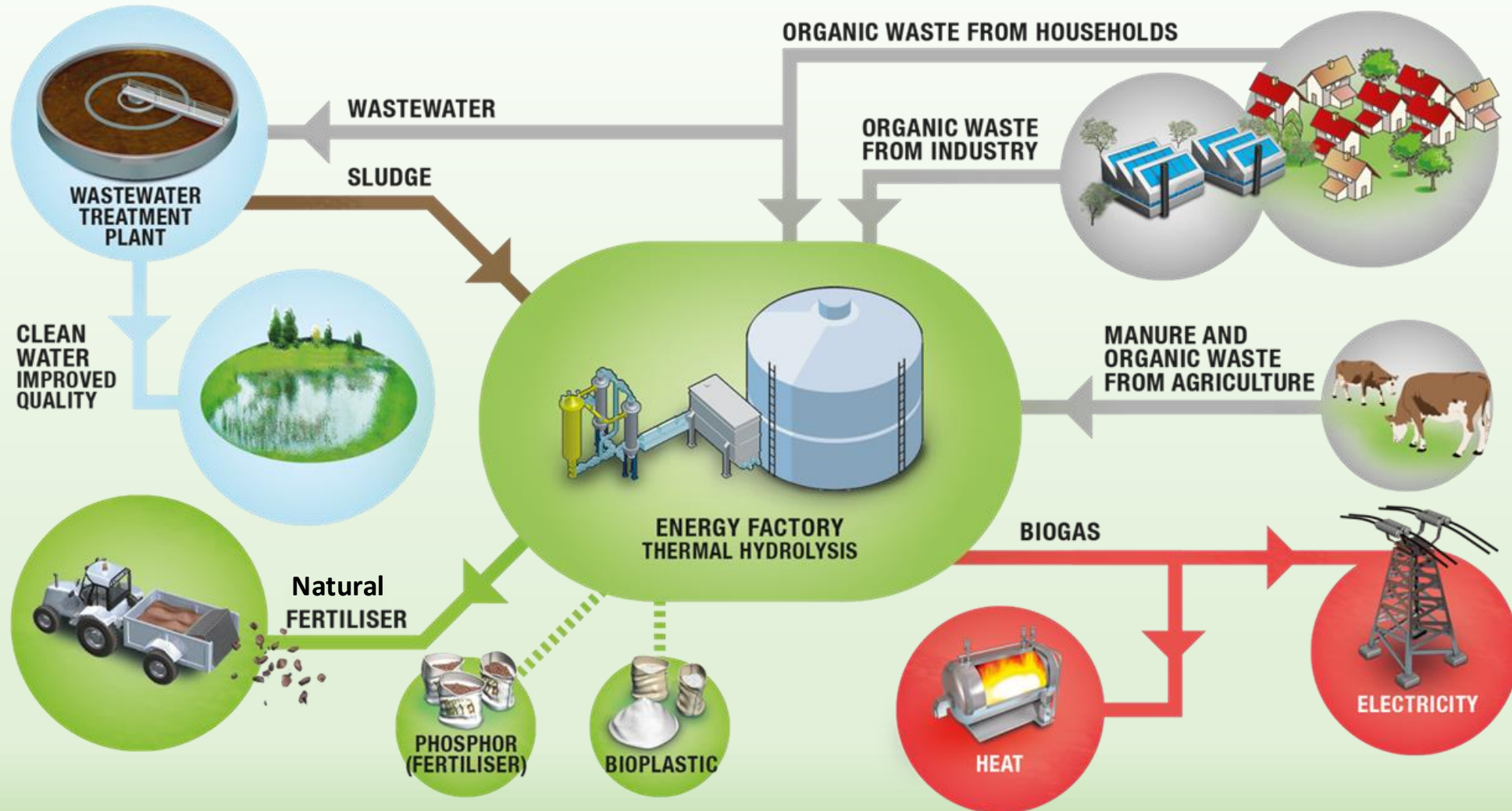
■ Who are we?

- Public utility company
- Owned by the municipality of Billund
- Consists of four companies
 - Billund Drinking Water
 - Billund Wastewater
 - Grindsted Wastewater } Billund Biorefinery
 - Billund Energy



A short history of BBR

- Grindsted wastewater treatment plant
 - Commissioned in 1996
 - Combined treatment of wastewater and organic wastes from WWTP, households and industries
 - One of the first in the world
- 2013 - A competition about defining the WWTP of the future – a lighthouse project by the Miljøstyrelsen
 - Governmental grant as reward for the best ideas
- Grant amount
 - 15 million DKK (≈2 million Euros or 2.3 million USD)
- Total budget
 - 72.5 million DKK (≈ 9.7 million Euros or 11.2 million USD)
- Public private partnership
 - Billund Vand A/S and Krüger-Veolia
 - Bilateral learning
- Add-ons to enhance existing biorefinery



BBR products (2020)

- Energy produced:
 - Total 16 GWh/y
 - Power 7.1 GWh/y
 - Heat 8.9 GWh/y

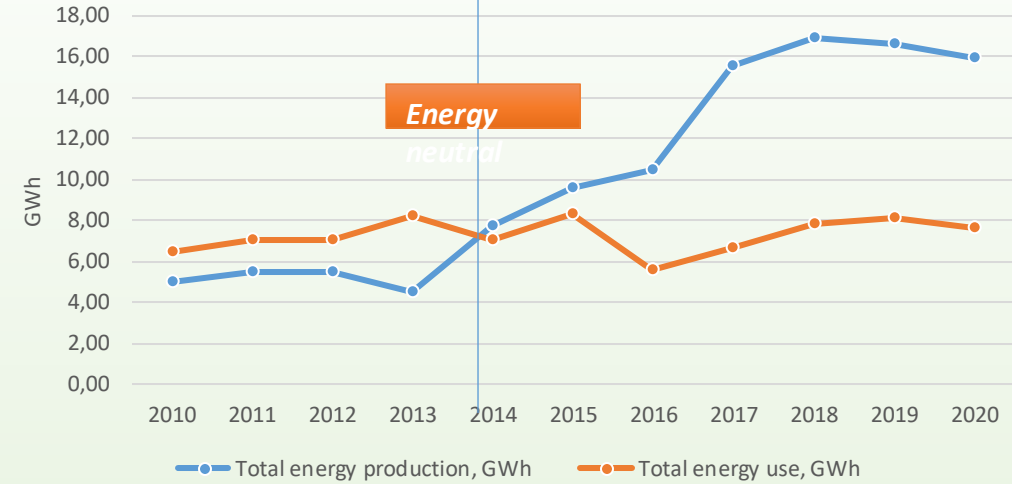
- Energy utilized in the entire concern:
 - Total 7.6 GWh/y
 - Power 4.2 GWh/y
 - Heat 3.4 GWh/y

• **Energy production is more than 2 times than that used in the entire company**
 This includes the supply of drinking water, sewerage, wastewater cleaning and the production of energy itself

• Cleaned water: 3.8 million m³/y

- Nutrients
 - Natural Fertilizer (24% DS) 4300 ton/y
 - Nitrogen 51 ton/y
 - Phosphorus 27 ton/y
 - Potassium 1.2 ton/y

Annual energy production and usage



Energy positive

Thermophilic, 55°C (131°F)
1500 m³
Residence time: 13 days
Sulzer mixer, recirculation
Gaswasher
3200 Nm³/day (63 % CH₄)



Digester

Exelys
Continuous thermal hydrolysis unit
15 to 18% input DS
160°C (320°F) at 8 bars for 30 min



Lysis

Mesophilic, 37°C (99°F)
2800 m³
Residence time: 27 days
Halberg mixer, recirculation
6200 Nm³/day (69 % CH₄)



Digester



Billund Biorefinery is a high profile project launched in 2014 by Krüger-Veolia and Billund Vand A/S in a Public-Private partnership

Thank you for your attention

Best Regards,
Thomas Kruse Madsen





Economical sustainability



Taxes and charges in Denmark

- Used for financing public services but also as incitements
 - A way of trying to motivate people's behavior
 - Waste handling – promote recycling, less use of hazardous materials
 - Promote sustainable energy production (wind, solar, biogas etc.)



Is Billund BioRefinery economical sustainable?

- BBR was a state-of-the-art project
 - Today - bigger and less establishment costs
- Governmental subsidies
 - Biogas production (electricity) – now market price
- Income/cost from receiving input materials (biomass)
 - Primary-/biosludge from WWTPs
 - Waste from households
 - Industrial waste
- Income/cost from dispose of output materials (natural fertilizer)
 - A cost for now – future depends on...
 - Difference between price on sludge – natural fertilizer – synthetic fertilizer



Politics and Legislation

- Difficulties when mixing different legislations areas
 - Garbage, Wastewater, Environment, Energy, Taxes
- Put together VIPs from different ministry offices
 - Show them the good case
 - Sustainable waste handling
 - Energy production
 - Environmental good solutions
 - Less costs – possible income
 - Enact the openminded politicians





Employees during the transition period

- During the project period (2013-2016)
 - Massive changes for everyone in Billund Vand & Energi
 - Demands for education and development of skills
 - From 12 technical staffmembers before to 15 today (most of them is still here)
 - Higher skills more responsibility
- In 2017 we became no. 1 for small companies in a great European examination of employee satisfaction.
- Unions in Denmark likes that members is developing and become more valuable for the labour market.

