

# Overview on PURE-project's findings in sludge handling in the Baltic Sea Region



**PÖYRY**

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# Main Drivers of Sustainable Sludge Handling and Disposal

- Legal and regulatory drivers
  - Costs and regulatory limitations of disposal of organic materials to landfills in the EU
  - Technical standards and regulatory limitations for safe handling and disposal of sludge to agricultural land
- Macro- or micro-economic drivers
  - Depletion of mineral reserves of apatite / phosphorus and recycling of phosphorus from waste water sludge to beneficial uses of it
  - Energy recovery from sludge, biogas or thermal treatment of sludge
  - Price and country-specific subsidies of mineral fertilisers as well as feed-in tariffs of energy which is produced from biogas

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## Emerging trend # 1 in energy efficiency – Heat recovery and other developing issues

Underlying trend in the Baltic Sea Region – Heat is increasingly recovered already from incoming waste water in several modern waste water treatment plants

- Energy efficient sludge treatment
  - The Finnish research project TERMOS financed by Tekes has published new aspects on energy efficient sludge treatment
  - Modification of mesophilic digester to thermophilic digestion and operation
  - Different process loading between mesophilic and thermophilic digestion
  - Based on the pilot trials;
    - Changing the digester operation from mesophilic to thermophilic range was successful and relative fast with no major disturbance
    - Thermophilic process decomposed the organic matter more effectively and produced more biogas compared to mesophilic digestion
    - Dewatering of thermophilic sludge is more difficult and the reject water is more concentrated
- Heat recovery from the digested or hygienised sludge
  - Suitable especially after mesophilic or thermophilic digestion and hygienic treatment
  - Pöyry has applied this method with sludge/water heat exchanger in the Kokkola biogas plant
  - The recovered heat is used in the ventilation system and preheating of the cold water
  - There are several equipment manufacturers who can supply these solutions

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## Emerging trend # 2 in operating conditions – Higher DS - content

Underlying trend in the Baltic Sea Region – Higher Dry Solids (DS) – technology has been widely applied in process industry and now these solutions are becoming more and more common also in waste water plants

- Increasing the feed sludge concentration from 2 – 4 % to 8 – 10 % DS
  - Significant cost savings can be achieved as the volume of the digesters can be reduced, when the sludge amount is smaller without excess water
  - Hydraulic sludge detention time can be increased to 20...25 days
  - Loading capacity of the existing digester can be increased and stabilized
  - Gas production is increased
- Boosting the mixing capacity
  - Effective mixing is needed when the sludge concentration is increased
  - Mechanical stirring with low-speed mixer is applicable and cost-effective with higher sludge concentration 8 – 10 % DS
  - Mixing with pumping is also used, but it is not as cost effective as mechanical mixing
  - N.B. Gas mixing with recycling the produced biogas was extensively used earlier with low DS-concentrations of 2 – 4 %

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## Emerging technology in sludge dewatering in the Baltic Sea Region - Bucher hydraulic press

- References currently at least in Switzerland, Germany and Sweden

### Swedish Case / Stockholm

- Used in Käppala WWTP in Stockholm after the KemiCond treatment process
- High dewatered sludge concentration up to 50 % DS
- Several impulse filling cycles with continuous operation
- The equipment consist of polypropylene pipes for sludge water suction
- There is a plastic body inside the polypropylene pipes



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## Emerging challenge – More cost-effective biogas production

- Basic process technology is proven and a lot of technical solutions are available in the market
- Unit size of operations and generated biogas volumes are relatively small in most cities
- Co-digestion with biological fraction of municipal solid waste (MSW) or with other organic wastes from agriculture or food industry is attractive, but sometimes limited by the interpretation of national regulations on the disposal of solid residues to agricultural land or other beneficial purposes
- Combining the above mentioned two material streams is somewhat challenging as the waste water sludge reactors are typically based on wet digestion whereas the MSW biofraction is often treated with dry digestion technology

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## Still emerging issue in early stage of development – Phosphorus recycling from municipal waste water sludge

- Several technologies in pilot scale trials and first full-scale testing
- Chemical precipitation solutions still too complex and expensive
- Solutions related to incineration are facing regulatory challenges in most countries
- Mineral fertiliser prices have increased but they are so low that they are cheaper for the farmers and other end-users of fertilisers



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