KOMPETENZZENTRUM Wasser Berlin

Current European Innovation Actions on Resource Recovery from Wastewater

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Increasing the recovering of heat / energy from wastewater treatment plants

- Energy recovery using **chemical energy potential** as energy source

  -> **Carbon-extraction**
  - Goal: Extraction of Carbon from primary treatment to increase the biogas production in the anaerobic stage
  - Challenge: The C:N ratio in the biological stage has to be controlled to guarantee nitrification and de-nitrification

  -> **Power-to-Gas technology**
  - Goal: Upgrading the produced biogas for grid injection
  - Challenge: The concepts works if the electricity price is low compared to the gas price (e.g. excess renewable energy)

  -> **Microbial Fuel Cells technology**
  - Goal: Production of electricity using the wastewater (especially carbon)
  - Challenge: Small amounts of electricity can be produced up to now

BioCatProject
POWER-TO-GAS VIA BIOLOGICAL CATALYSIS

ENERWATER

MFC4Sludge

POWERSTEP

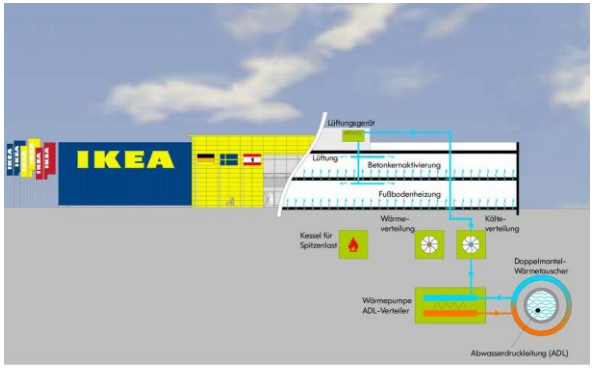
INCOVER

Increasing the recovering of heat / energy from wastewater treatment plants

- Energy recovery using **heat** as energy source

  -> <u>Heat exchanger</u>

  - Goal: Use the temperature difference in the sewer or in the WWTP effluent to produce heat (e.g. IKEA Berlin)
  - Challenge: Heat transfer rate, peak demand/average demand, availability of large scale sewer nearby



  -> <u>Thermo-electrical generators</u>

  - Goal: Use the temperature difference in the CHP exhaust gas to produce electricity (Heat2Power)
  - Challenge: Small amounts of electricity can be produced until now using high amount of thermo-electrical elements

POWERSTEP

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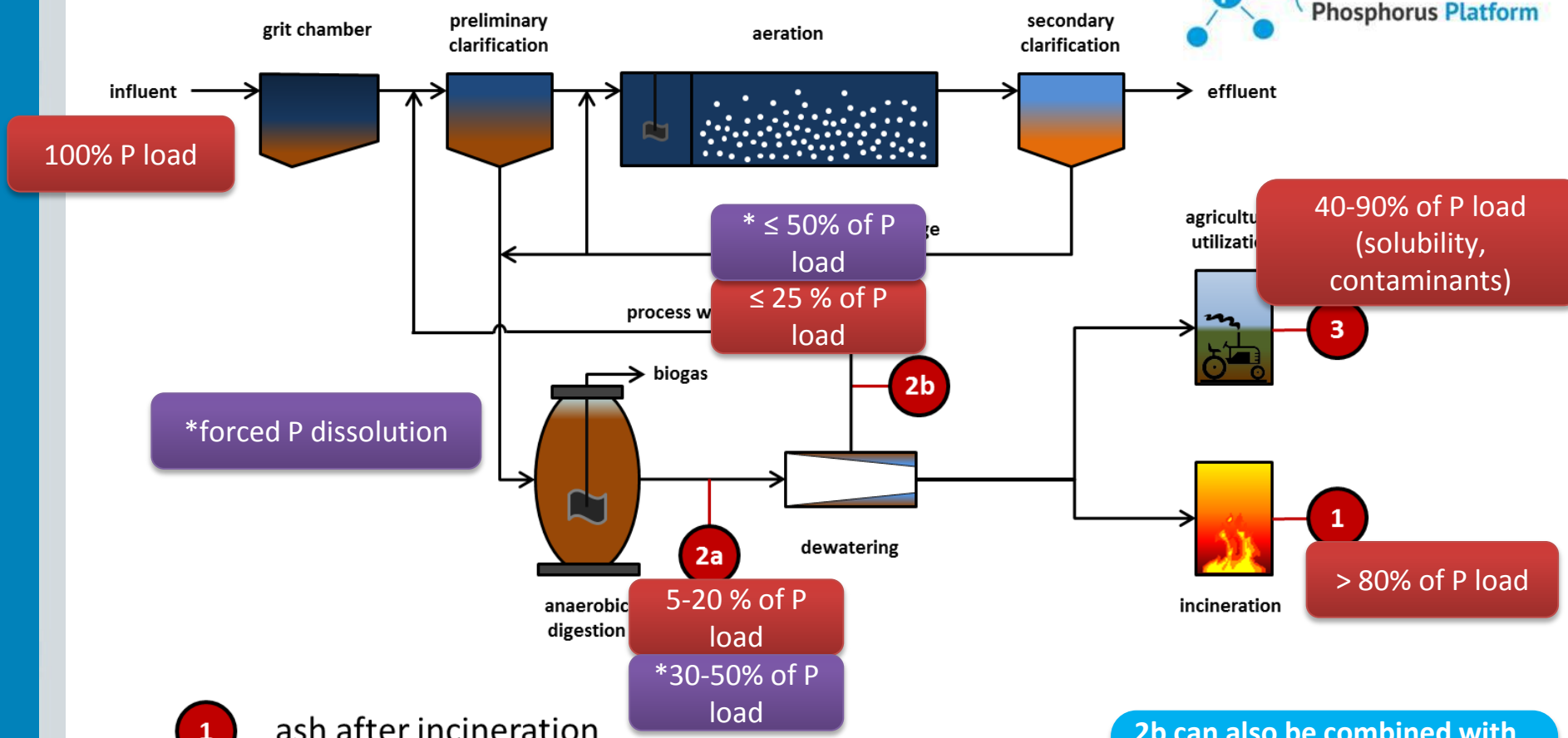
Nutrient recovery – hot spots

European Sustainable Phosphorus Platform



1 ash after incineration

2a undrained sludge after anaerobic digestion

2b sludge liquor after dewatering

3 direct agricultural utilisation of dewatered sludge

2b can also be combined with N recovery (via ammonia stripping) -> nutrient recovery cascade

R3 Water

Reuse, Recovery and Resource efficiency, Innovations in urban wastewater treatment

Newfert

Nutrient recovery – state of play

Full-scale | Demo / Pilot | Lab-scale

Wet sludge and liquor

Aqueous phase (dissolved P)

- **PEARL** Struvite
- **AirPrex** Struvite
- **NuReSys** Struvite
- **PHOSPAQ** Struvite
- **ANPHOS** Struvite
- **REPHOS** Struvite
- **PhosphoGreen** Struvite
- **STRUVIA** Struvite
- **NutriTec** Struvite, DAS
- **Naskeo** Struvite
- **PHORWater** Struvite
- **P-RoC** Struvite-CSH

With enforced P dissolution

- **EXTRAPHOS** DCP
- **Gifhorn** Struvite/CaP
- **Stuttgart** Struvite
- **LYSOGEST**
- **WASSTRIP**
- **TPH (general)**

Sludge and sludge ash

Acidic digestion /leaching

- **Fert. Industry** Mineral fertiliser
- **Electrodialyses** H_3PO_4
- **LEACHPHOS** H_3PO_4
- **ECOPHOS** H_3PO_4/DCP
- **TetraPhos** H_3PO_4
- **SERAPLANT DE** MCP

Thermal

- **MEPHREC** P-slag
- **AshDec (Outotec)** $CaNaPO_4$
- **PYREG** P-rich Pyrochar
- **THERMPHOS** P_4 †
- **RecoPhos ICL** H_3PO_4/P_4
- **KUBOTA** P-rich Slag

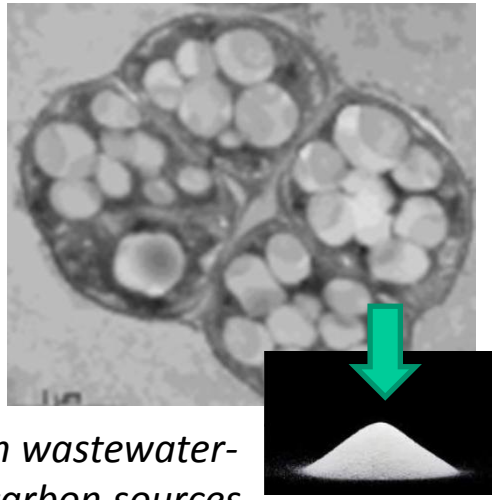
Check for recent tech implementation inventory here:
http://p-rex.eu/index.php?id=11

Recovering other valuable materials and resources

- Recovery of **cellulosic material**:
  - Fine sieving upstream of primary clarifier
  - Prevents operational problems (e.g. pumps, valves) and reduces energy demand
  - Harvested cellulose is cleaned/disinfected and can be used as fibres (e.g. bio-composites, asphalt), biofuel or carbon source (PLA, VFA, …)

Cellulosic fibers as secondary raw materials © BWA

- Recovery of **biopolymers** or proteins**:**
  - Specific bacteria can form polyhydroxyalkanoate (PHA) from carbon sources (e.g. VFA from wastewater)
  - PHA is a valuable building block for many products (e.g. packaging, plastics, agriculture, …)
  - Challenge: enrichment of bacteria, quality of product and economics!



PHA from wastewater-derived carbon sources