



POWERSTEP

YOUR FLUSH, OUR ENERGY

FULL SCALE DEMONSTRATION OF ENERGY
POSITIVE SEWAGE TREATMENT PLANT
CONCEPTS TOWARDS MARKET PENETRATION



- *Christian Loderer*
- *Kompetenzzentrum Wasser Berlin gGmbH*
- 31.05.2018, NEREUS Inspiration day, Saint-Omer



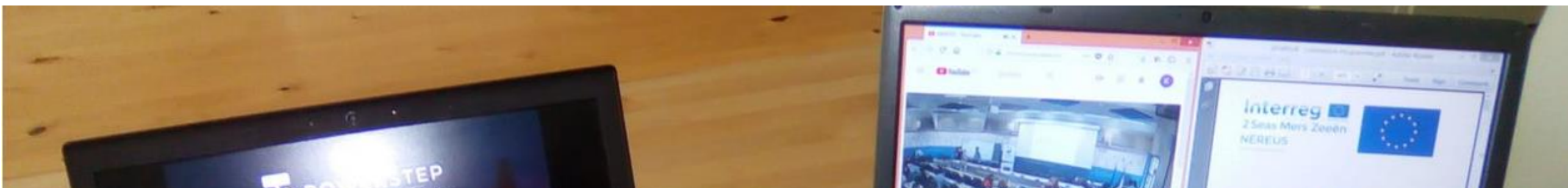
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Framework Programme
of the European Union

Grant agreement No. 641661



Innovative reuse of water, nutrients and energy recovery in Europe





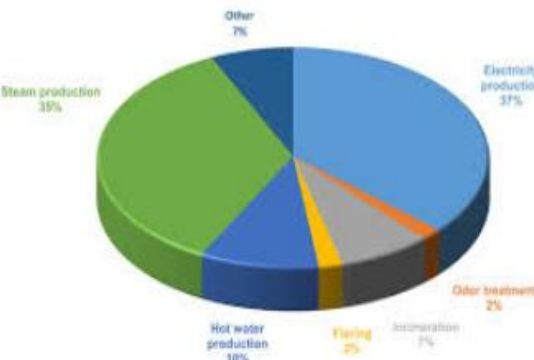
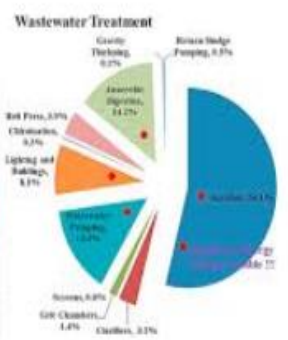
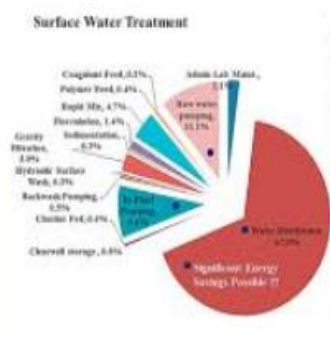
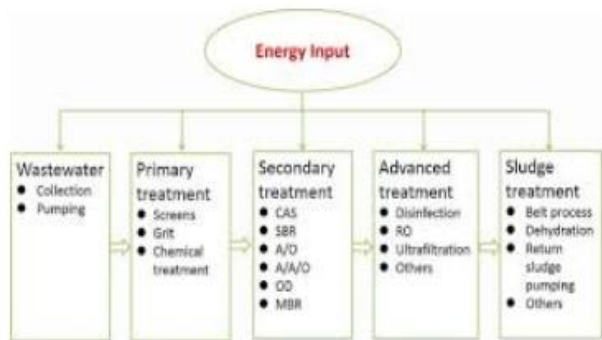
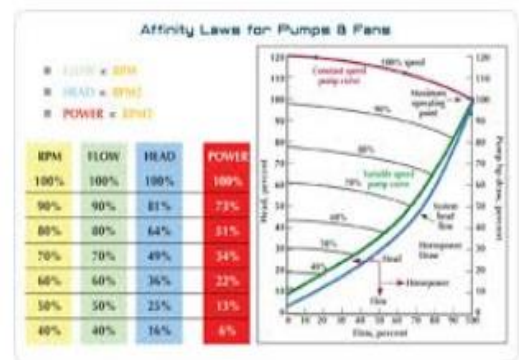
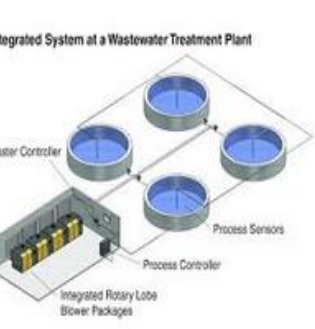
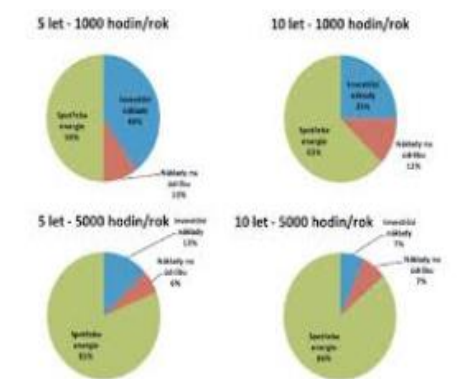
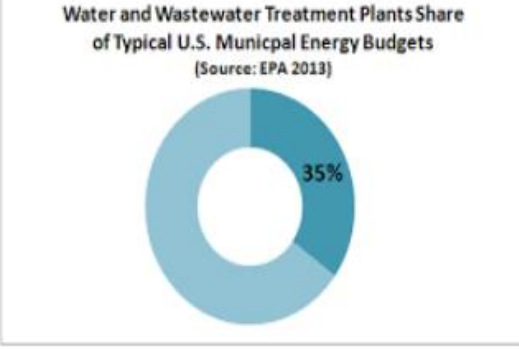
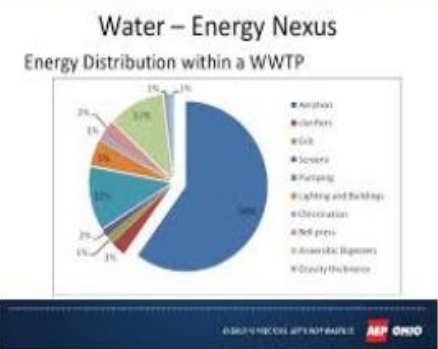
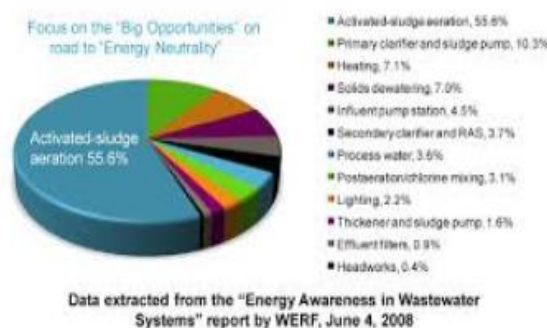
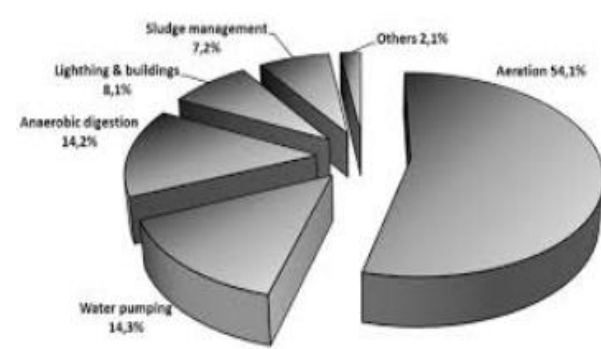
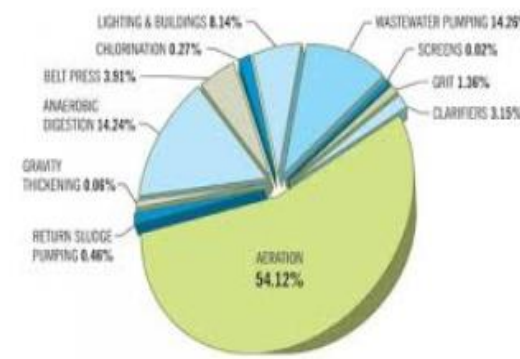
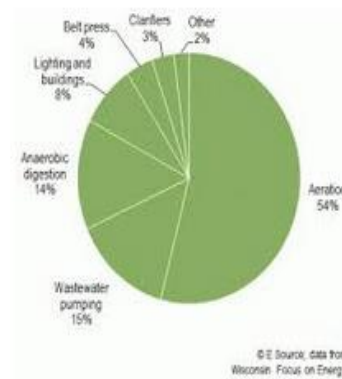
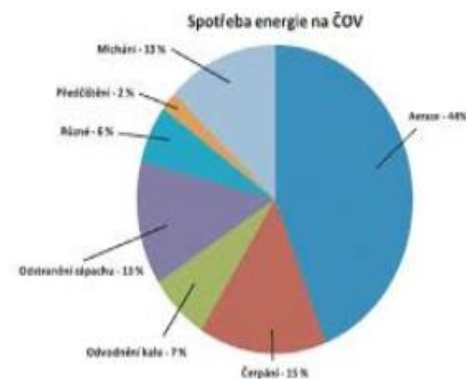
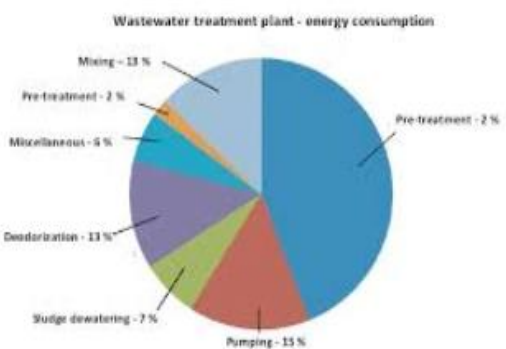
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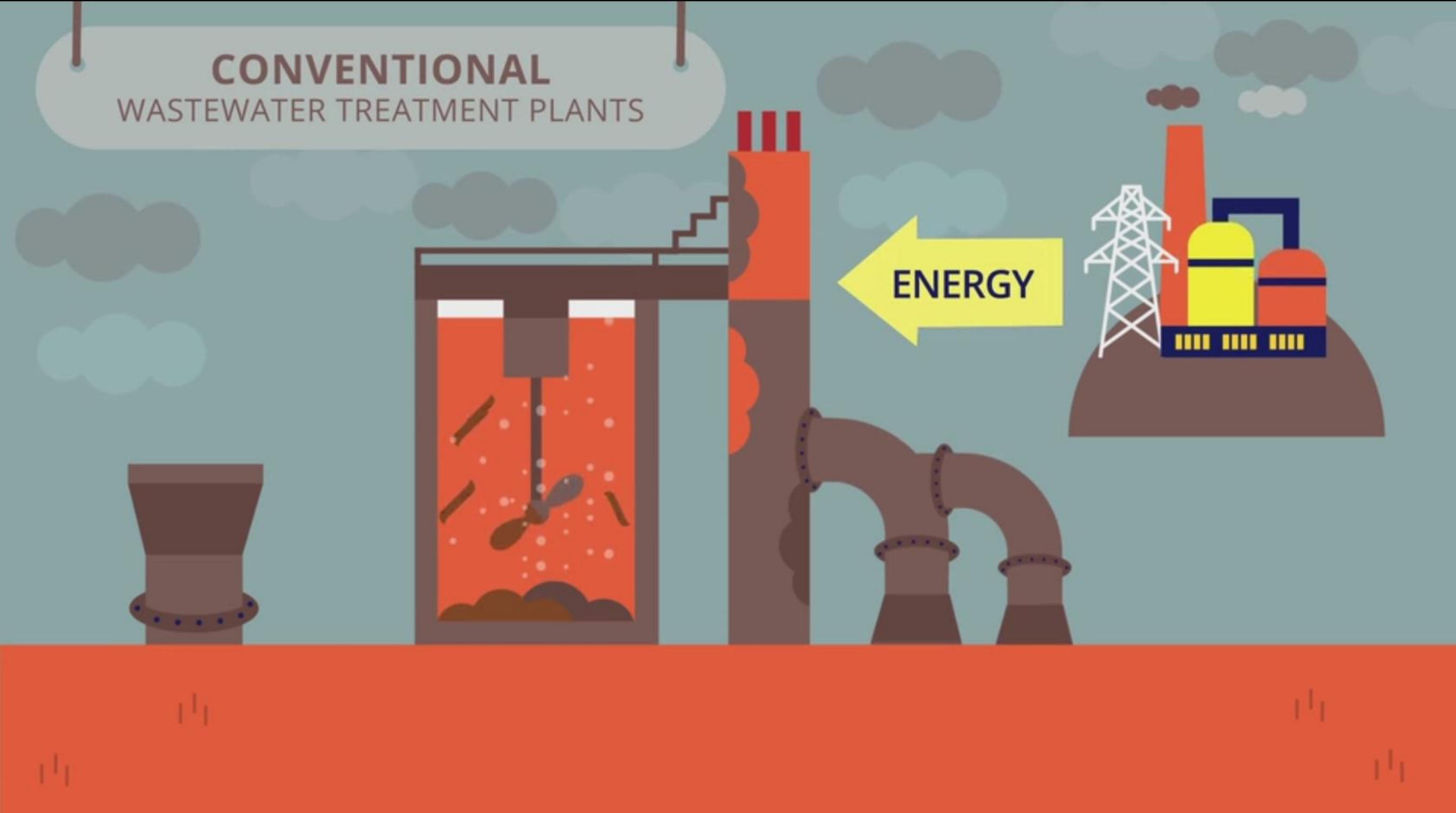
WWTP + energy consumers



Ungefähr 1.340.000 Ergebnisse (0,43 Sekunden)



CONVENTIONAL WASTEWATER TREATMENT PLANTS



**WWTPs are the highest energy consumer
in a municipality!**



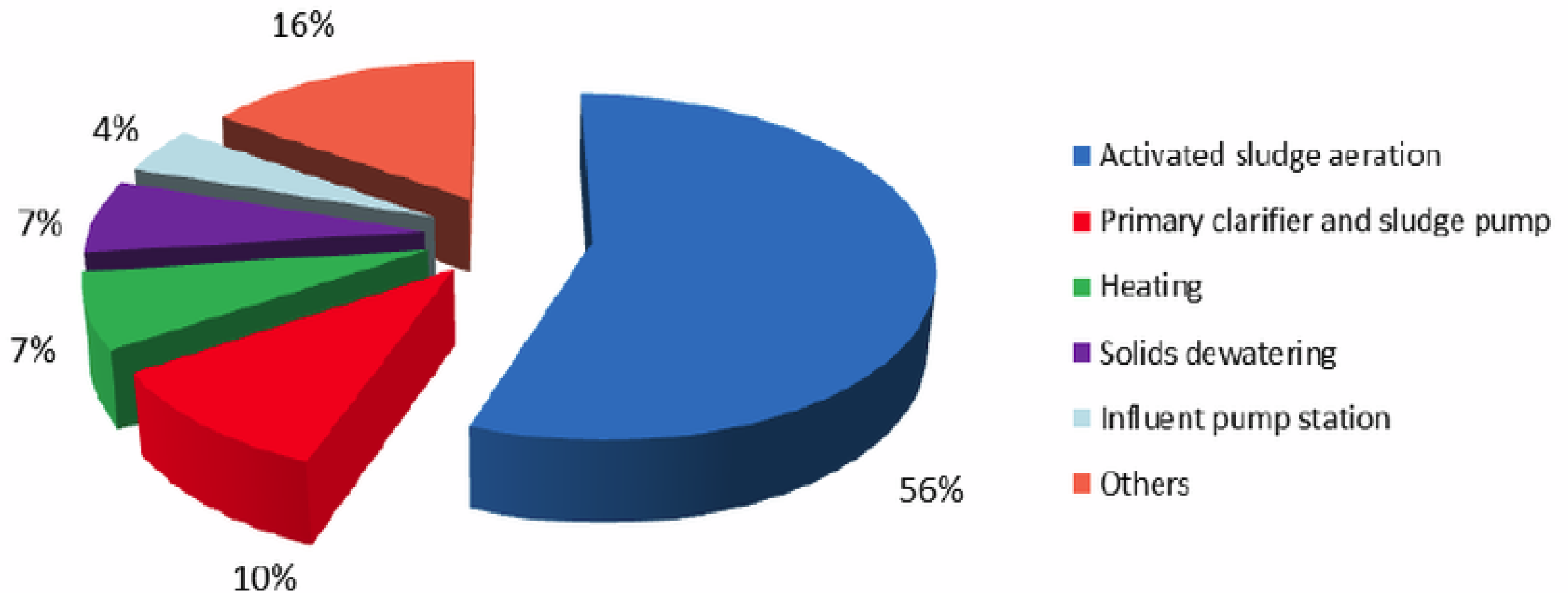
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WWTP the “Energy consumer”



Breakdown of % WWTP energy





BUT WWTPs try to improve themselves!





Energy-positive WWTP – a DREAM?



Is there a potential by treating your „**Pooh**“
to become **energy-neutral** or
energy-positive as WWTP?

(without using external renewable sources)



Are **energy-positive WWTPs**
without external renewable sources
still a **DREAM**?





We as a consortium say “NO” it’s no dream, energy-positive WWTPs are possible!



KOMPETENZZENTRUM
WasserBerlin

TU
WIEN TECHNISCHE
UNIVERSITÄT
WIEN

eawag
aquatic research ooo

Fraunhofer
IPM

VEOLIA

NEAS ENERGY

BIOFOS

Berliner
Wasserbetriebe

Umwelt
Bundesamt

Electrochaea
Renewable Natural Gas

aps
aqua plant solutions

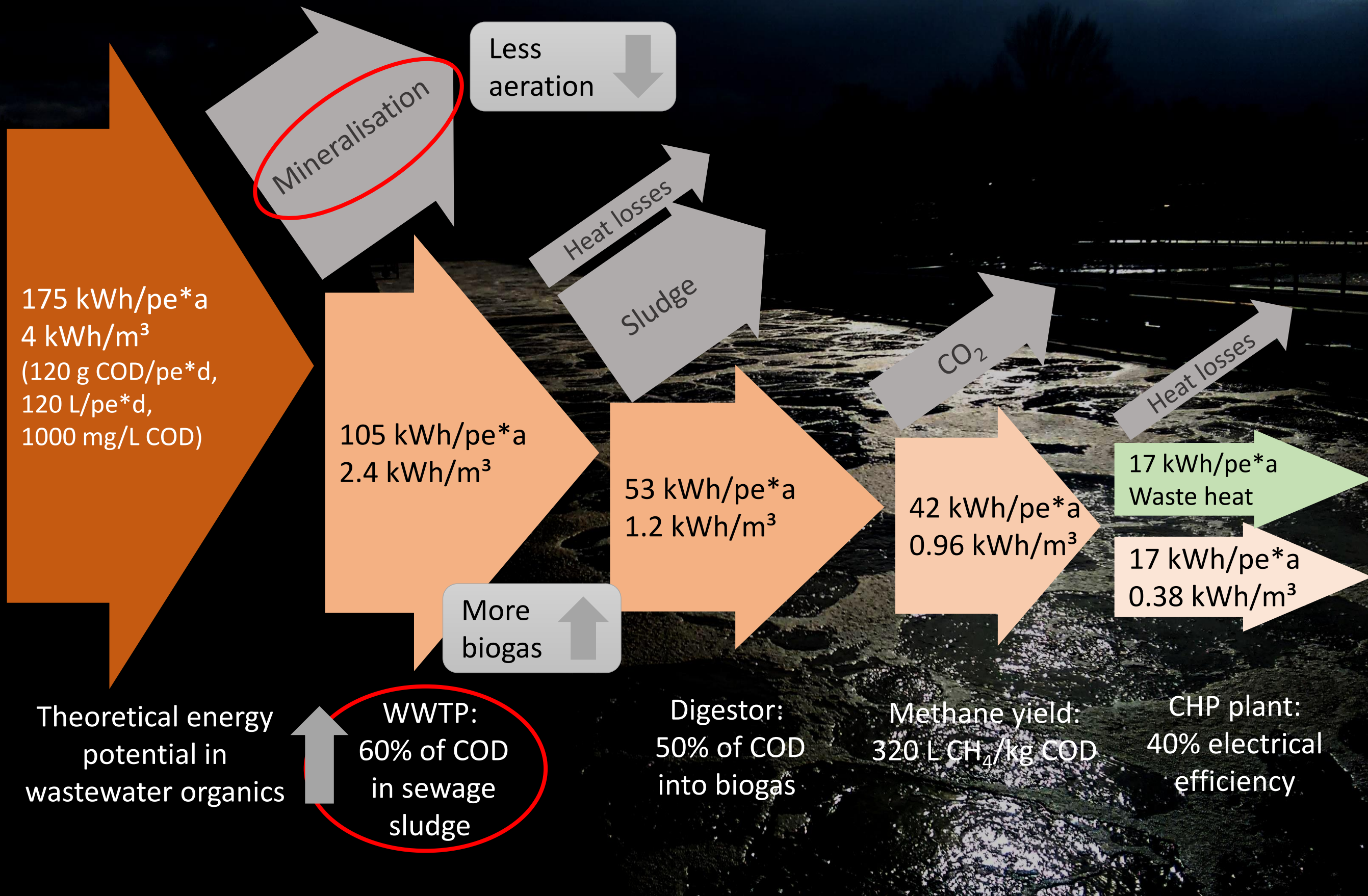
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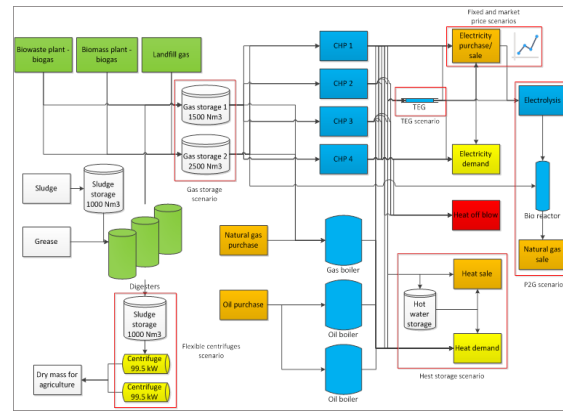
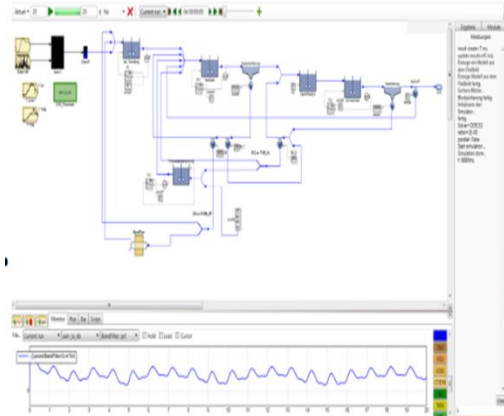
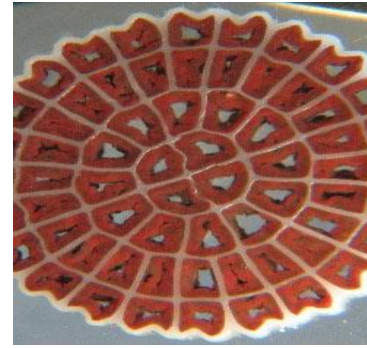
ATEMIS

Arctik



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The POWERSTEP case studies

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**CASE STUDY 1:
WESTEWITZ (DE)**

GOAL: enhanced Carbon extraction + Nitrogen removal

TECHNOLOGY: drum filter + SBR or duckweed reactor

SIZE: 2.000 pe (full-scale)




**CASE STUDY 2:
SJÖLUNDA (SE)**

GOAL: enhanced Carbon extraction + Nitrogen removal with innovative biological process

TECHNOLOGY: disc filter + 2-stage MBBR for nitrification/anammox

SIZE: 4 x 50m³ reactors (large pilot)

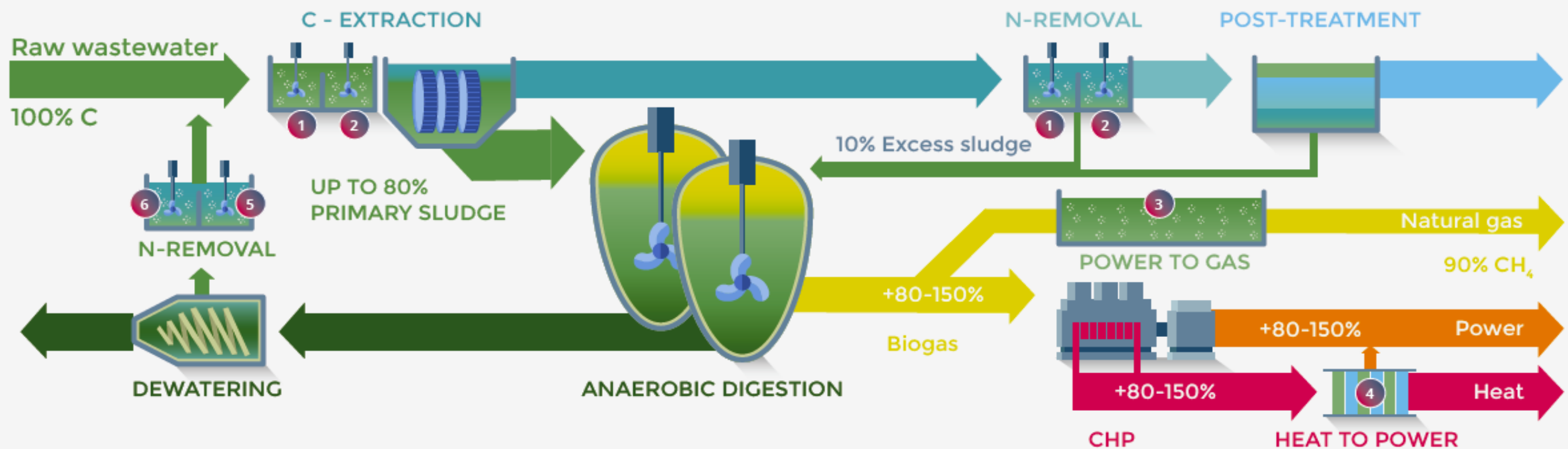


**CASE STUDY 3:
AVEDØRE (DK)**

GOAL: biogas upgrade to improve methane content („power-to-gas“)

TECHNOLOGY: biological methanisation

SIZE: 50Nm³ CO₂/h (large pilot), 1 MW electrolyzer



**CASE STUDY 6:
ALTENRHEIN (CH)**

GOAL: recovery of Nitrogen as a fertilizer in sidestream

TECHNOLOGY: membrane NH₃ stripping

SIZE: 75.000 m³/a (full-scale)



**CASE STUDY 5:
KIRCHBICHL (AT)**

GOAL: treatment of Nitrogen in sidestream and recovery of oxygen in mainstream

TECHNOLOGY: nitrification

SIZE: 100.000 pe (full-scale)



**CASE STUDY 4:
BRAUNSCHWEIG (DE)**

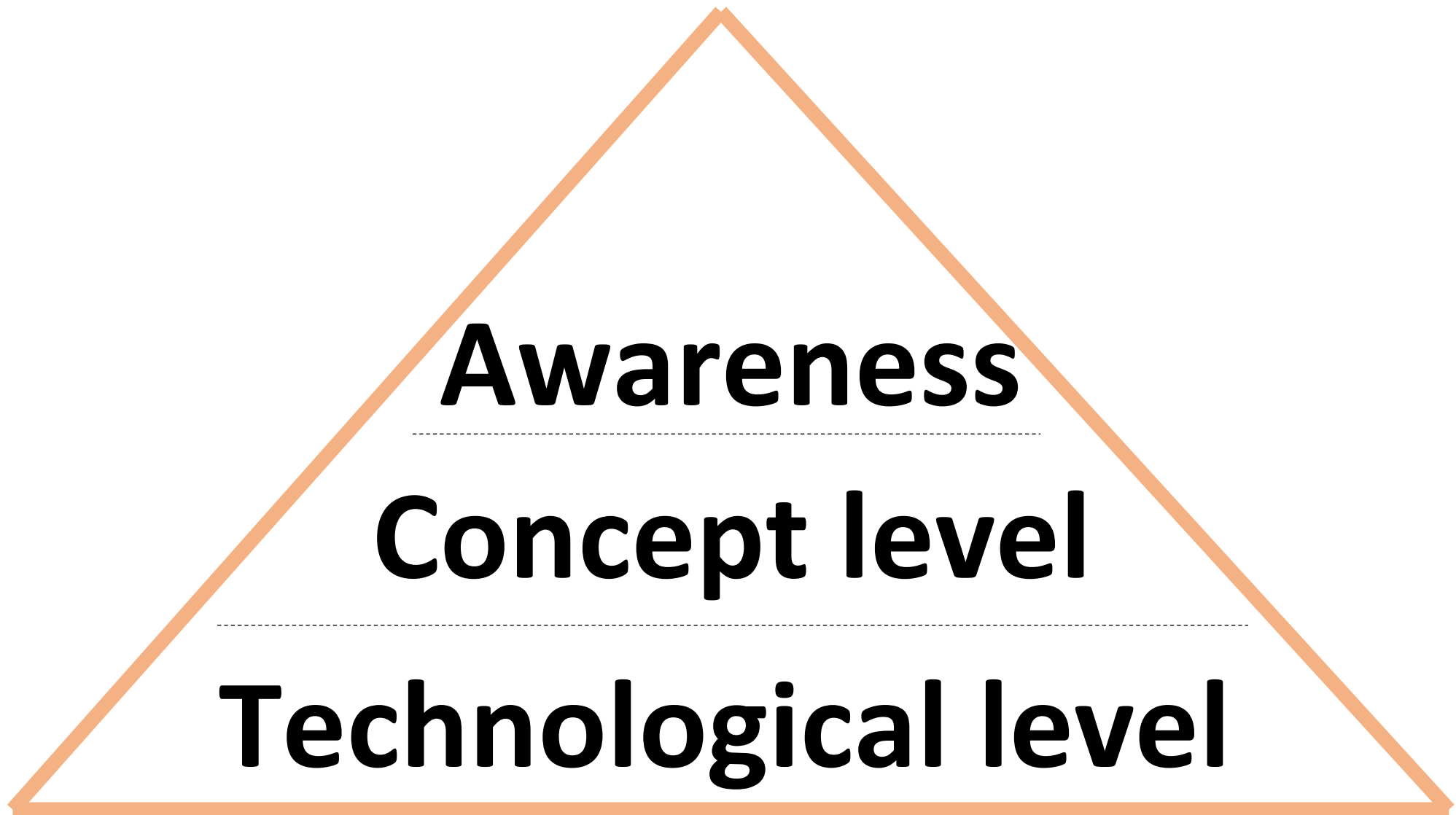
GOAL: increase the efficiency of CHP and implement a „smart-grid“ strategy

TECHNOLOGY: thermoelectric generators for „heat-to-power“ + energy sales modelling

SIZE: upgrade of 1 CHP (pilot) and model (full)



Results within www.POWERSTEP.eu

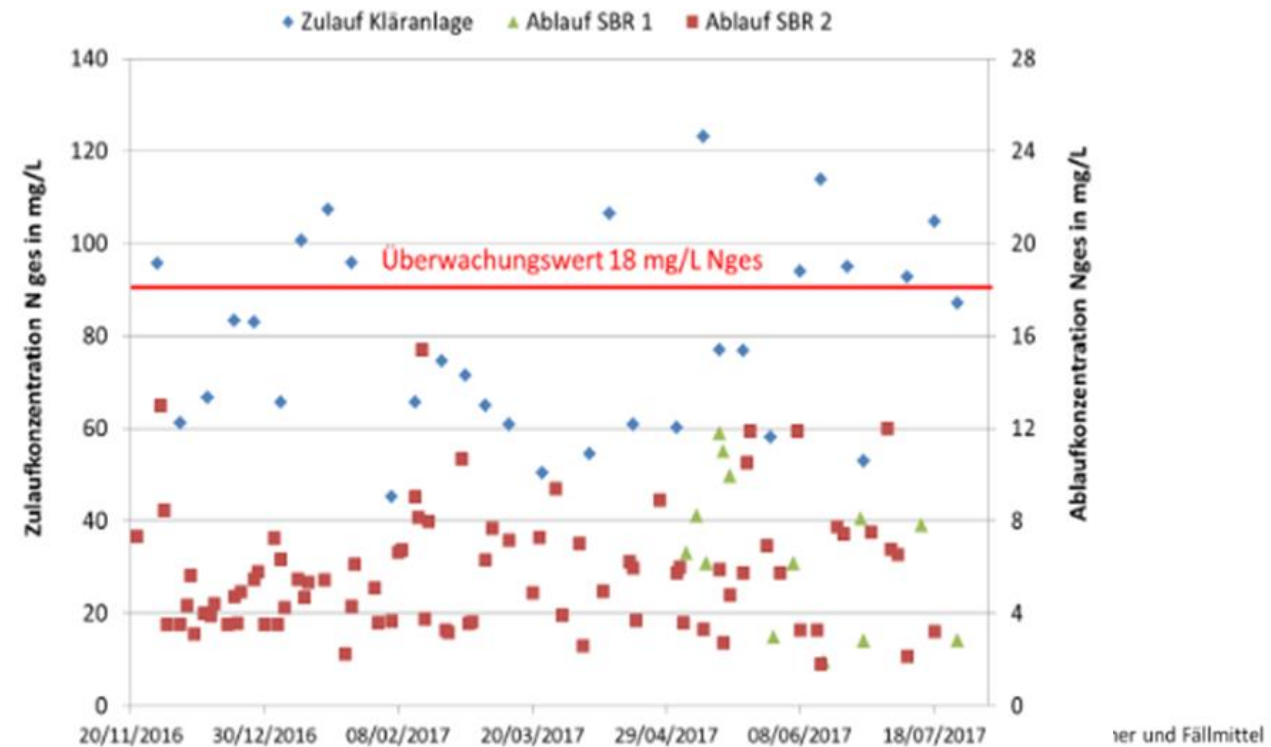




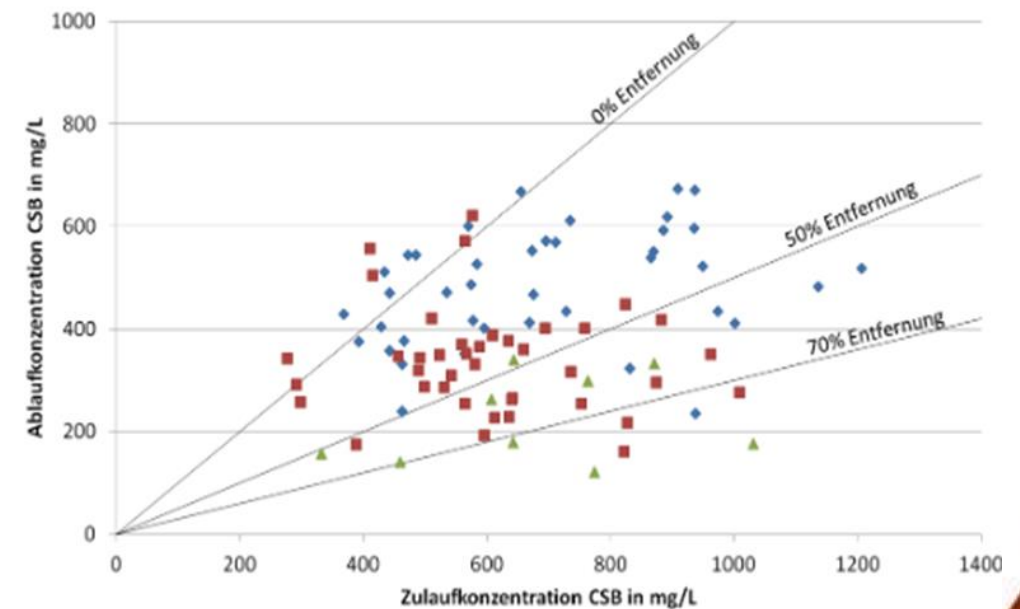
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Technological level



- Stable operation with an enhanced carbon extraction over 2 years
- Successful implementation of an advanced nitrogen control

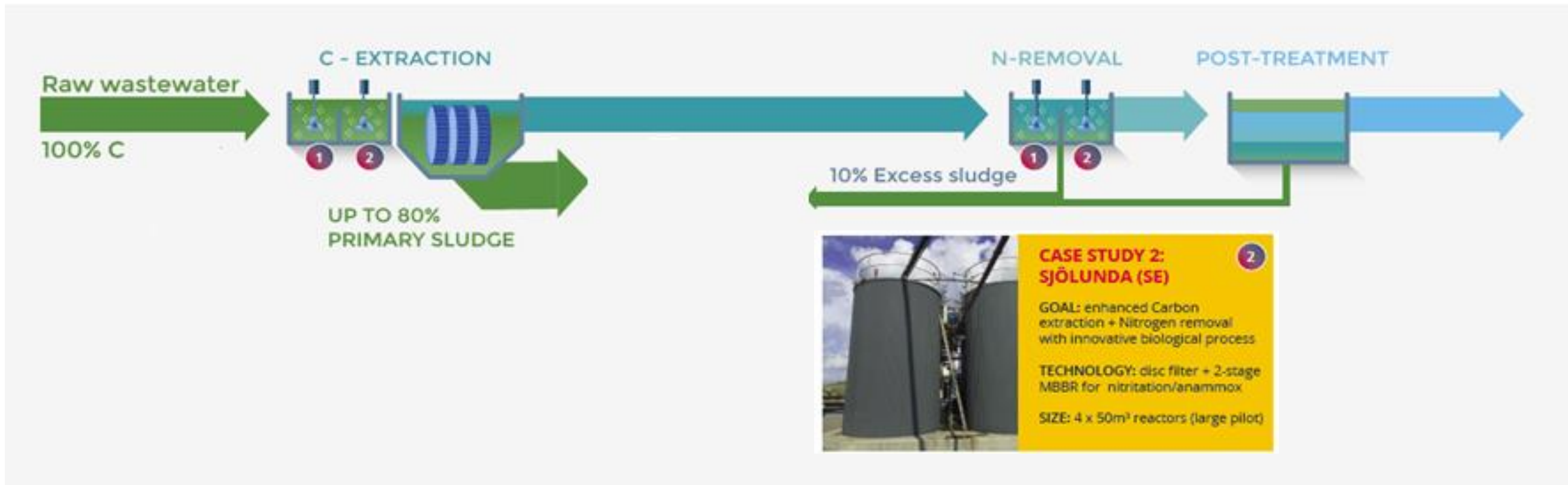




Results within POWERSTEP



Technological level



- First comparison of a full-scale 1-stage & 2-stage mainstream anammox process under real wastewater conditions
- New important finding concerning both processes from a operation as well as microbiology point of view



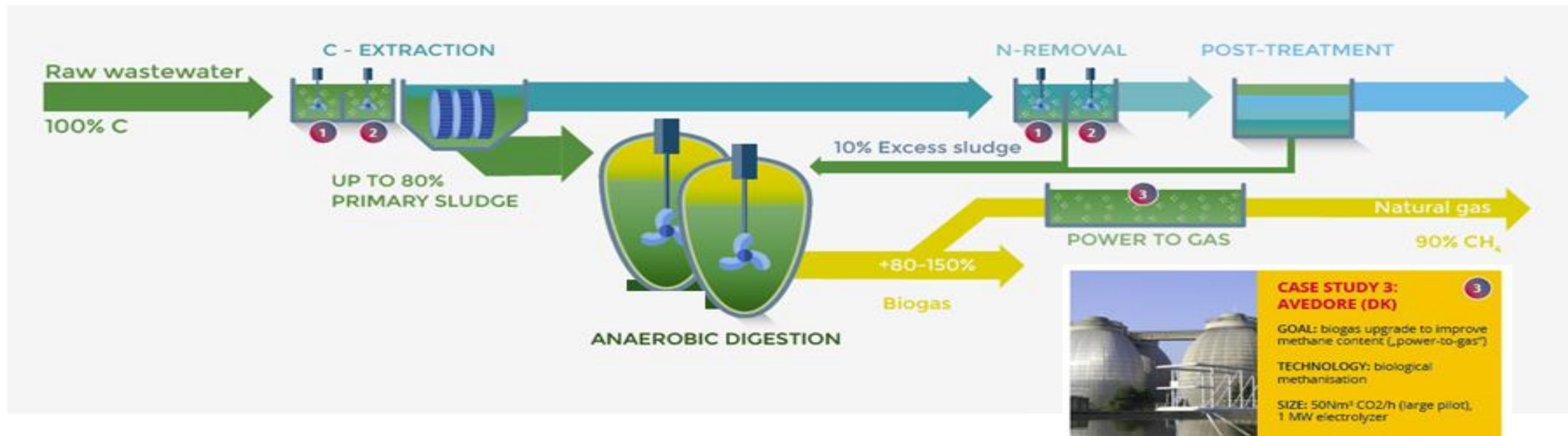
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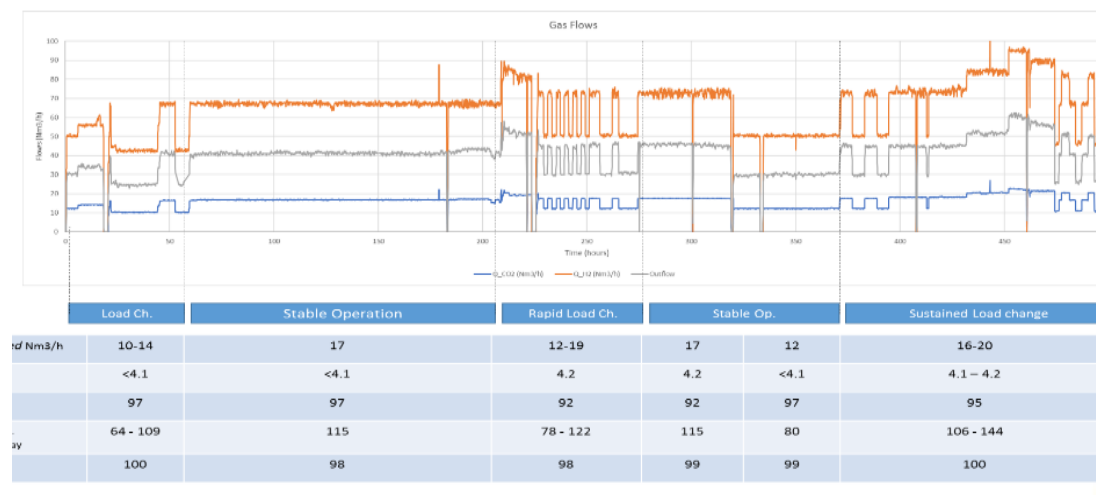
Results within POWERSTEP



Technological level



- On-off tests resulting in high transformation rates within short minutes
- Holistic concept how to use also “waste products” (e.g.: heat, oxygen and metabolic by-water) in the WWTP



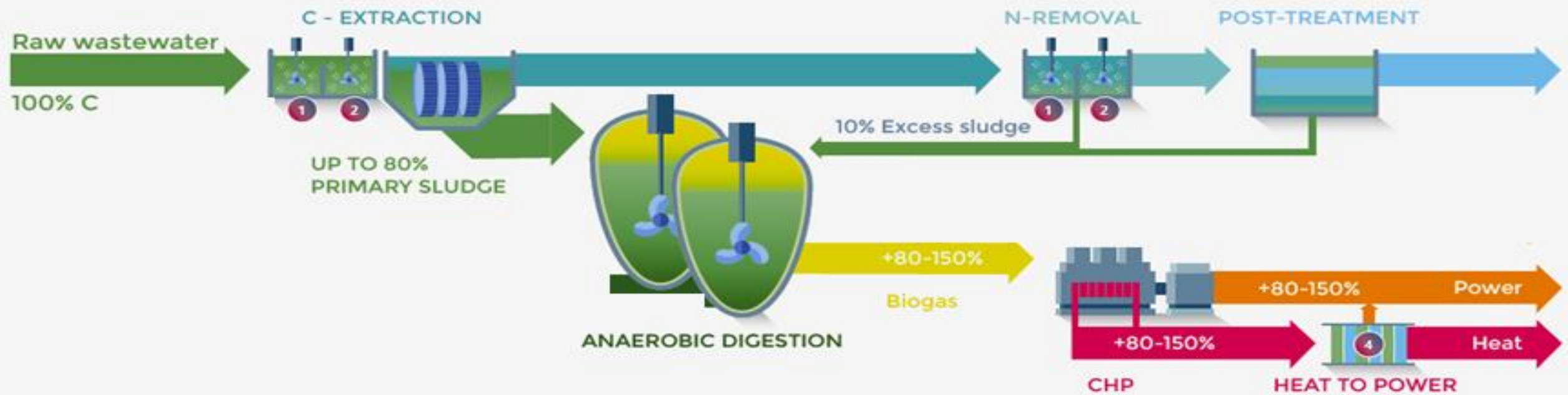
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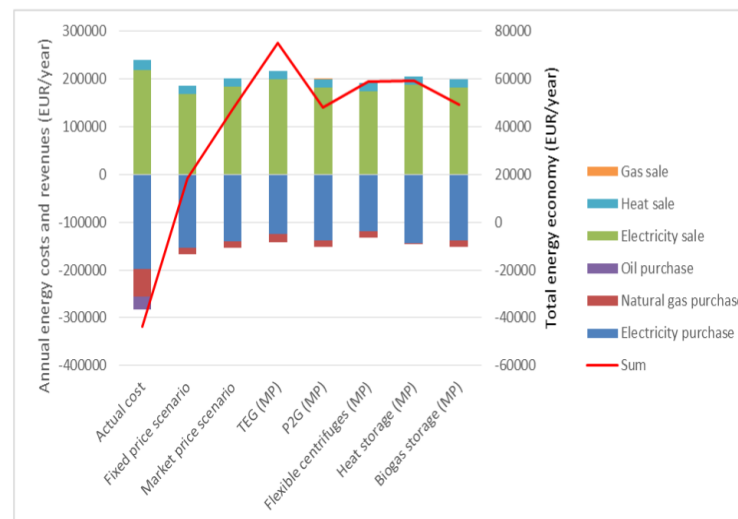
Results within POWERSTEP



Technological level



- Successful start-up and test of a Heat2Power pilot integrated in a CHP unit
- Creating an energy model calculating revenues using different valorization scenarios

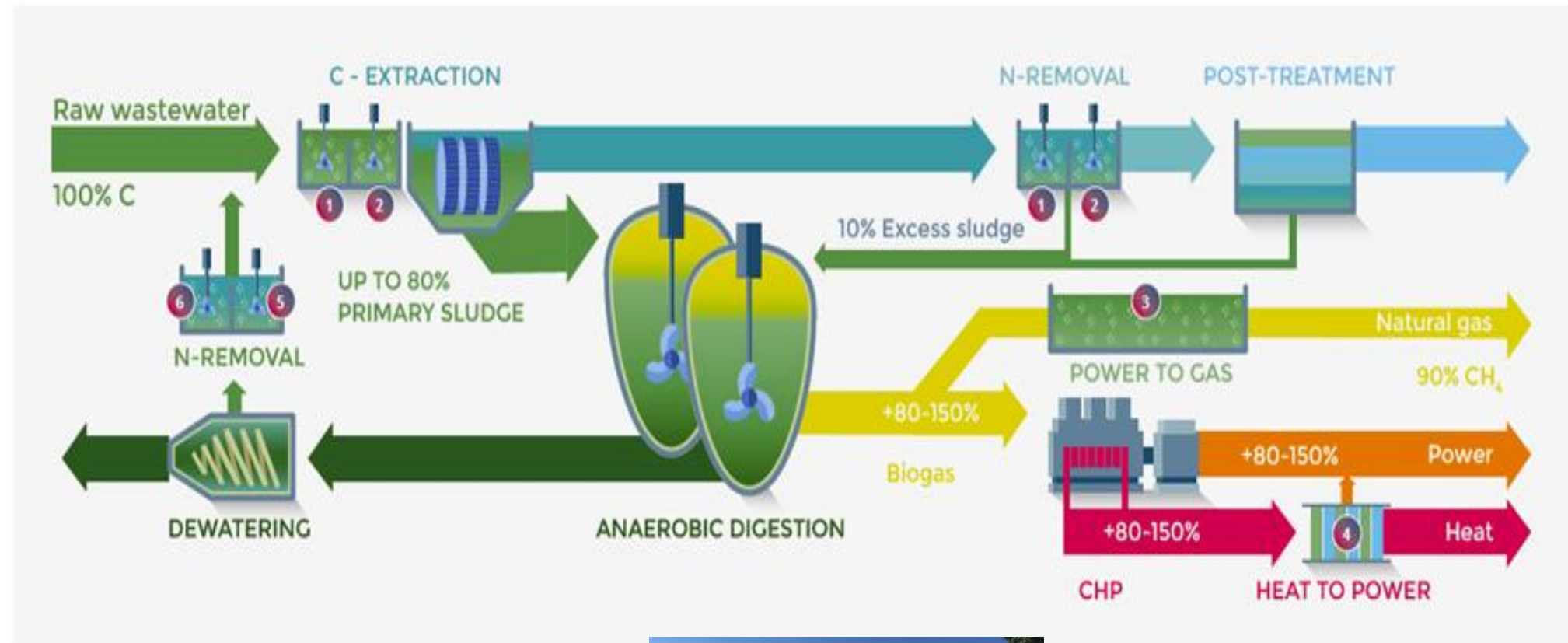




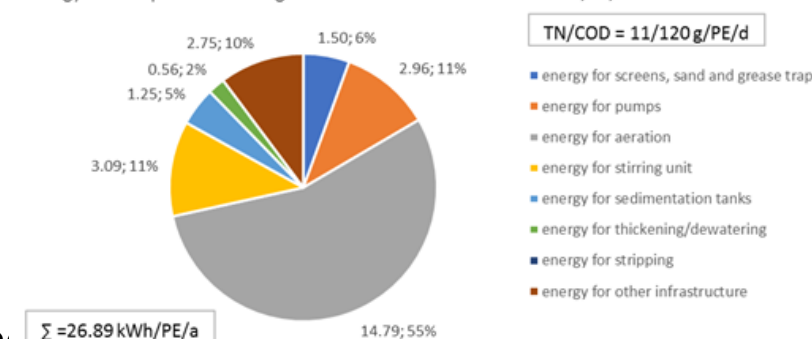
Results within POWERSTEP



Technological level



Energy consumption of a 1-stage WWTP with SDE Nitrification in kWh/PE/a



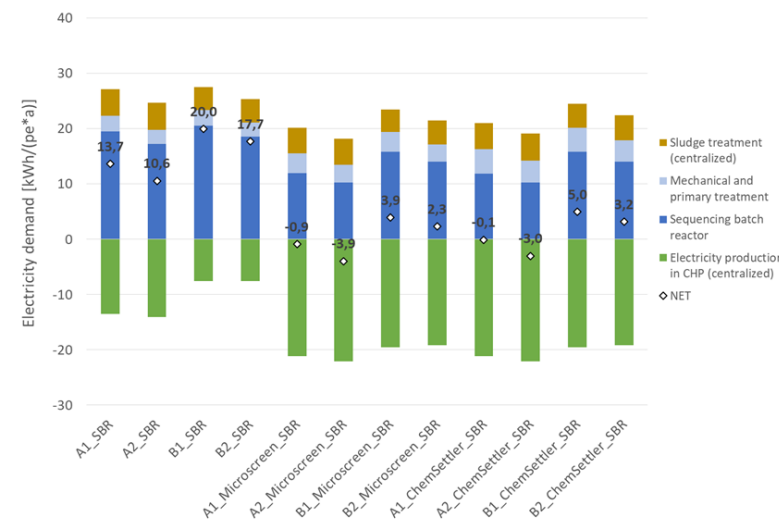
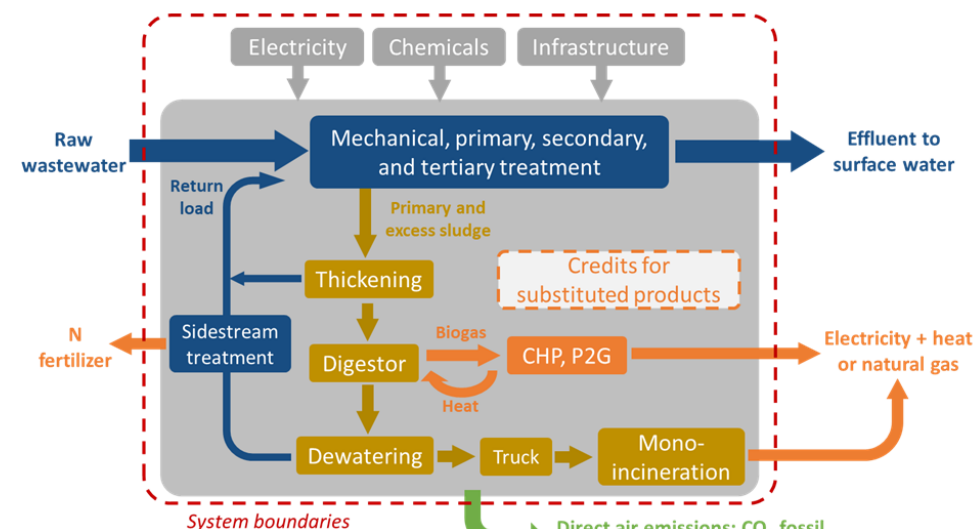
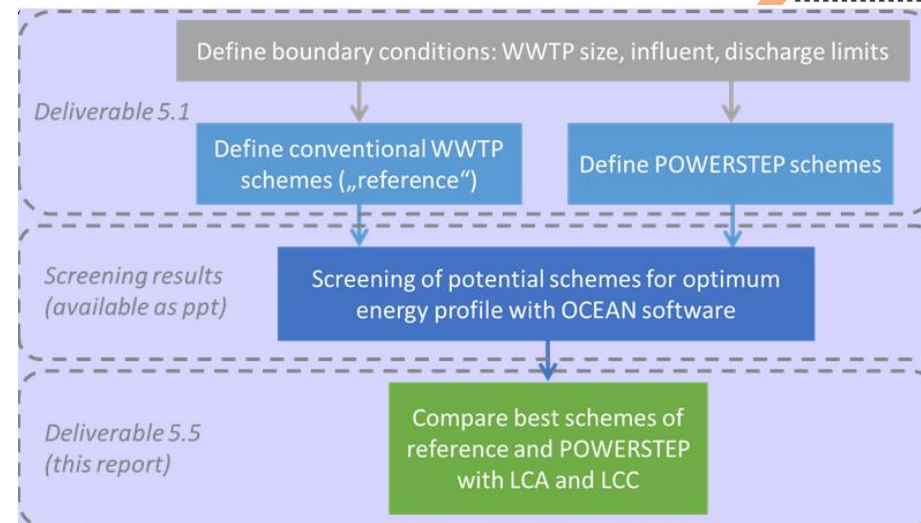


Results within POWERSTEP



- Nowadays **energy-neutral & energy-positive** WWTPs are possible with state-of-the-art technologies
- In the near future **energy-positive** (up to 170%) are possible with advanced technologies
- **Carbon-neutral** WWTPs still stay a dream also with advanced technologies

Concept level



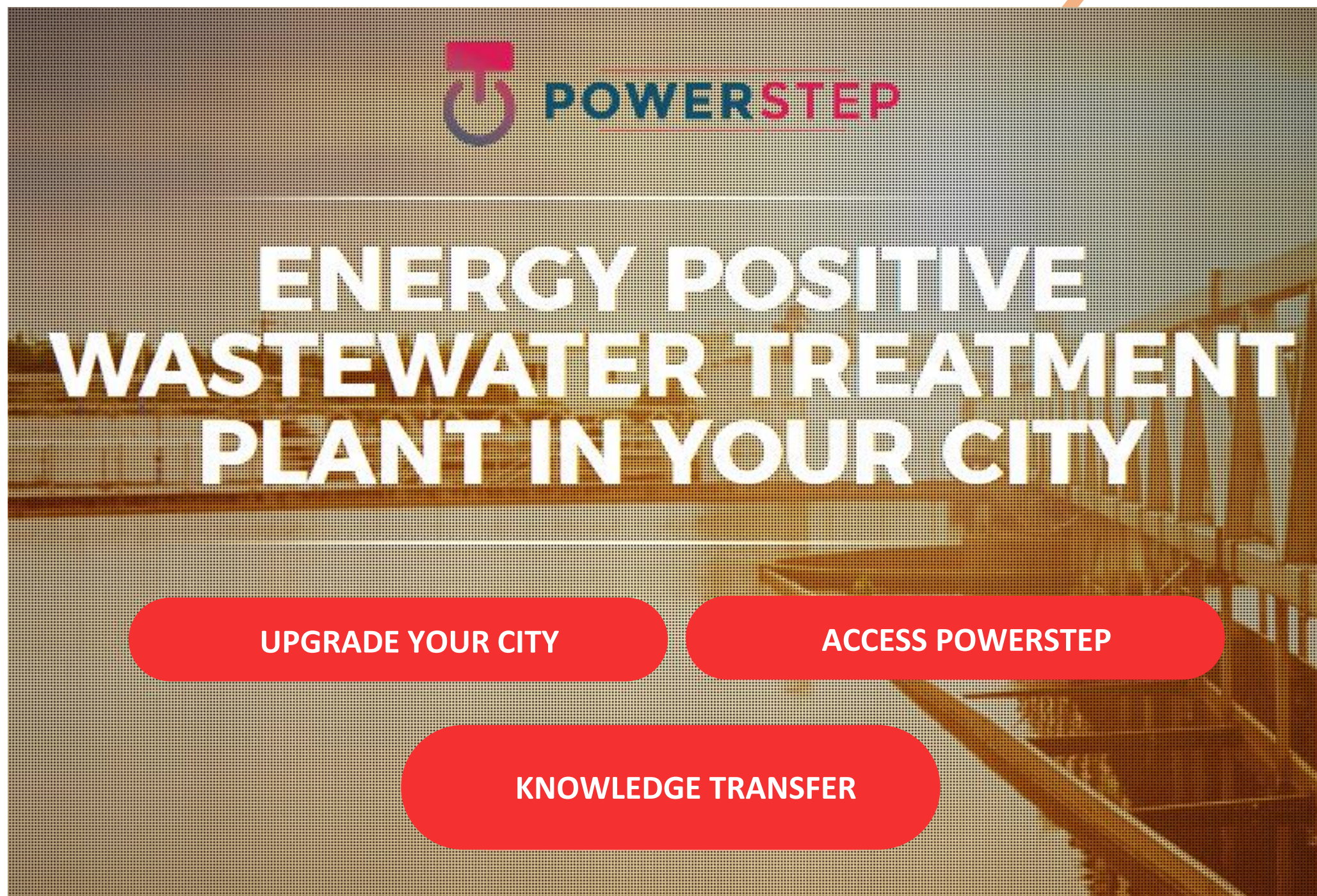
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Results within POWERSTEP



Awareness



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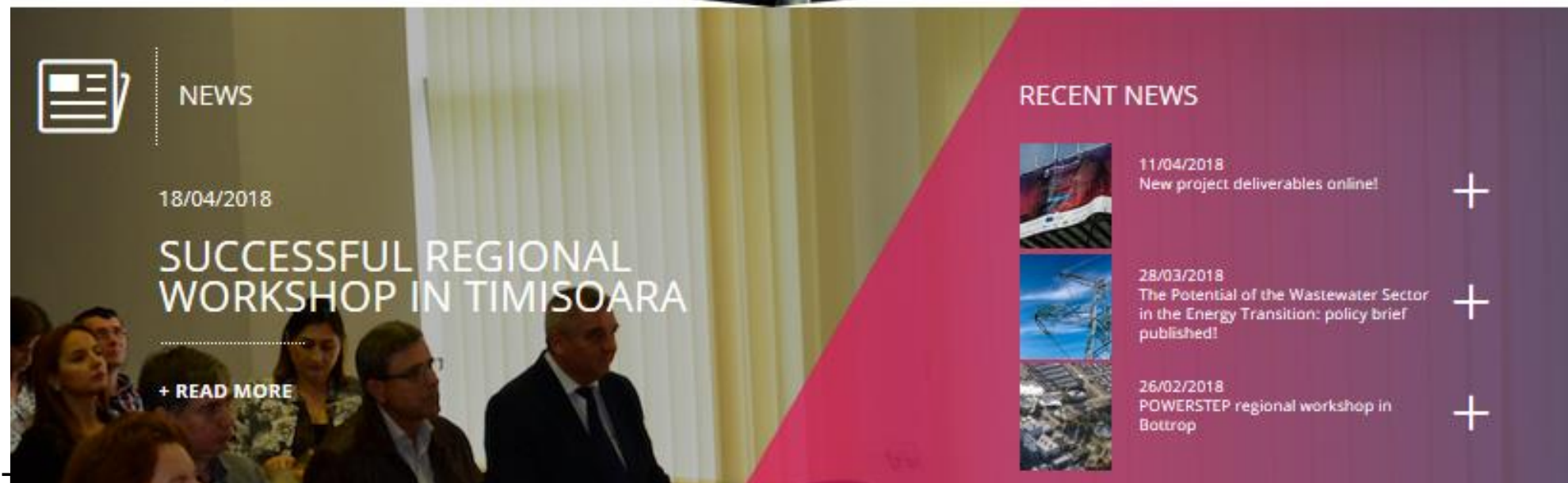


Results within POWERSTEP



ACCESS POWERSTEP

Awareness



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Results within POWERSTEP




Awareness

34 deliverables


Deliverable 1.1 - Optimised design of the microscreen and periphery for primary filtration

 [d1-1-optimized-design-of-microscreen-and-periphery-for-primary-filtration-0.pdf](#)


Deliverable 1.3 - Compendium of best practice of primary treatment for advanced carbon extraction

 [d1-3-compendium-of-best-practices-for-advanced-primary-treatment.pdf](#)


Deliverable 2.1 - Advanced control system for energy efficient nitrogen removal

 [d2-1-advanced-control-strategy-for-nitrogen-removal-final.pdf](#)


Deliverable 6.2 - Visual identity, flyer and website

 [020216 D.6.2 visual identity flyer website.pdf](#)

Deliverable 6.3 - Communication kit for demosites

 [d6-3-communication-kit-for-demosites.pdf](#)

Deliverable 6.4 - Innovative website

 [d6-4-innovative-website.pdf](#)



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Awareness

UPGRADE YOUR CITY

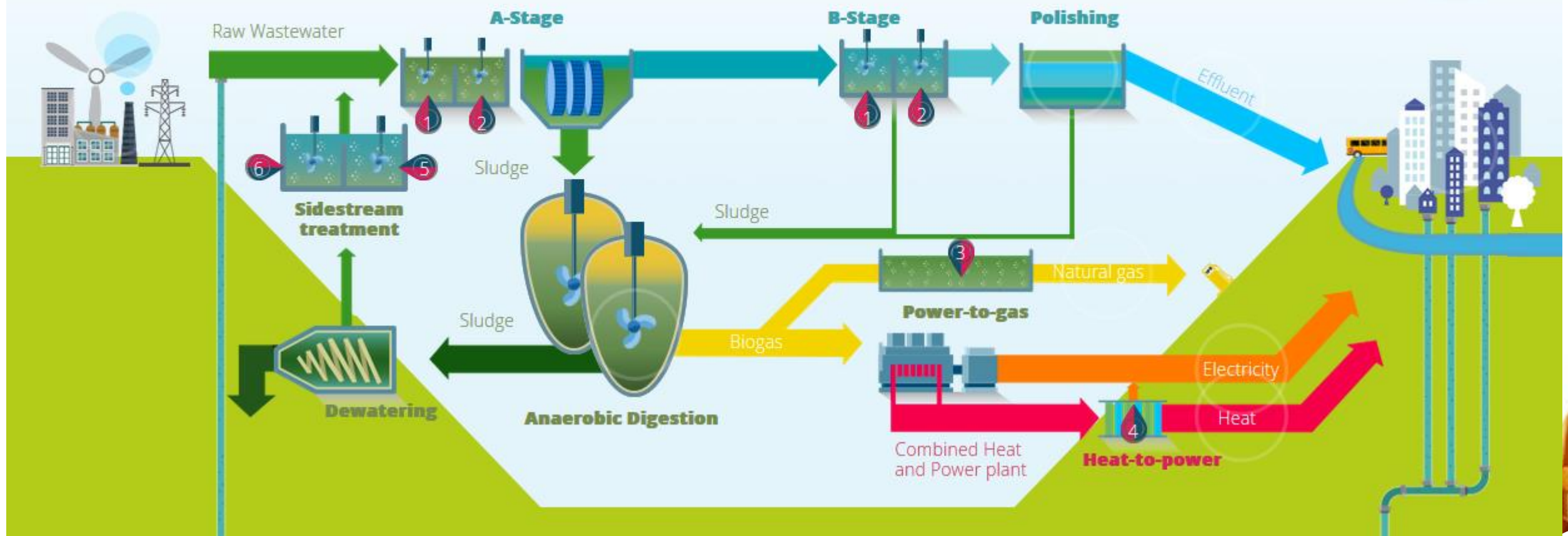


YOUR FLUSH, OUR ENERGY

MENU

Click here to go to dump city

ENERGY POSITIVE WASTEWATER TREATMENT PLANT



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Results within POWERSTEP



Awareness

KNOWLEDGE TRANSFER

YOUR OPTIONS FOR AN ENERGY-POSITIVE WWTP

I want to



reduce
electricity consumption of
my WWTP



increase
energy production of my
WWTP



make use
of excess energy at my
WWTP



my WWTP
to take part in a dynamic
energy market



recover
nutrients
from my WWTP



FIND THE DIFFERENT ENERGY-POSITIVE WWTP



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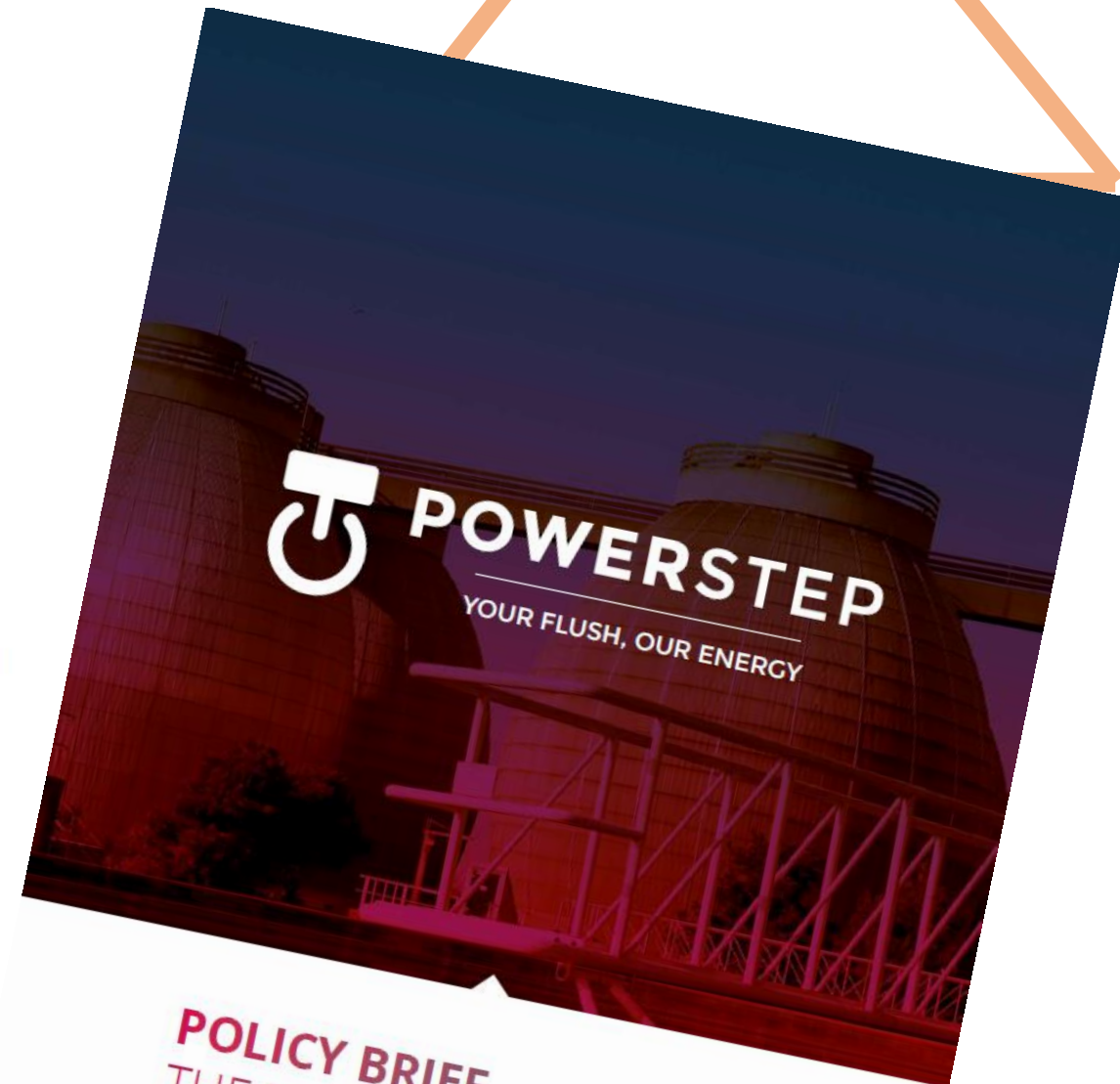
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Awareness



Deliverable 5.2:
Recommendations for WWTP operators, municipalities and WWTP technology providers willing to engage in renewable energy market



POLICY BRIEF
THE POTENTIAL OF
THE WASTEWATER SECTOR
IN THE ENERGY TRANSITION
..... #POWERSTEP_EU



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Awareness



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Awareness



Interview with Mr. Ristori (Director General DG Energy)
about POWERSTEP and how it fits into the EC Energy agenda



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Results within POWERSTEP



Awareness



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What POWERSTEP stands for?



P = Provide new insights in the field of Energy-positive WWTPs

O = Overview of new technologies that can be implemented

W = Well communicated project to different actors in the field

E = Energy as a key element in WWTPs of the future

R = Research under real conditions

S = Strategy to overcome future WWTP challenges

T = Teamwork as a driver for success

E = Efficient solutions for WWTPs of the future

P = People who follow the same passion





Acknowledgement



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Duration: 1/07/15 – 30/06/18



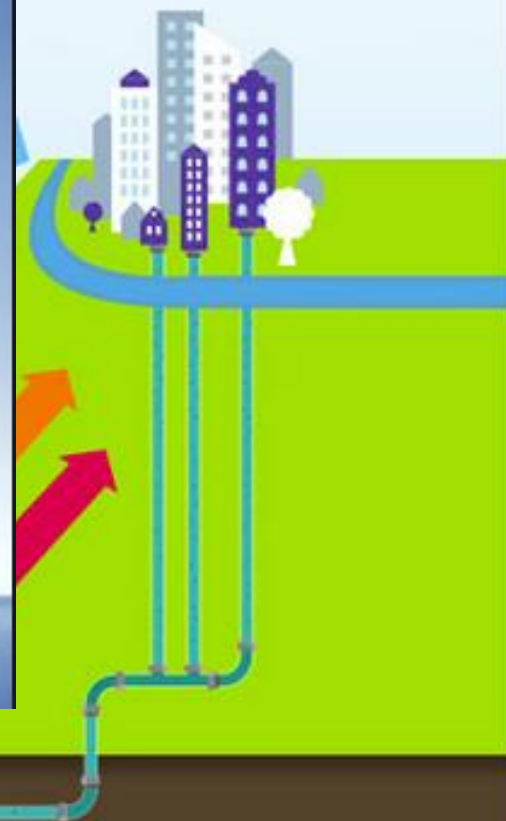
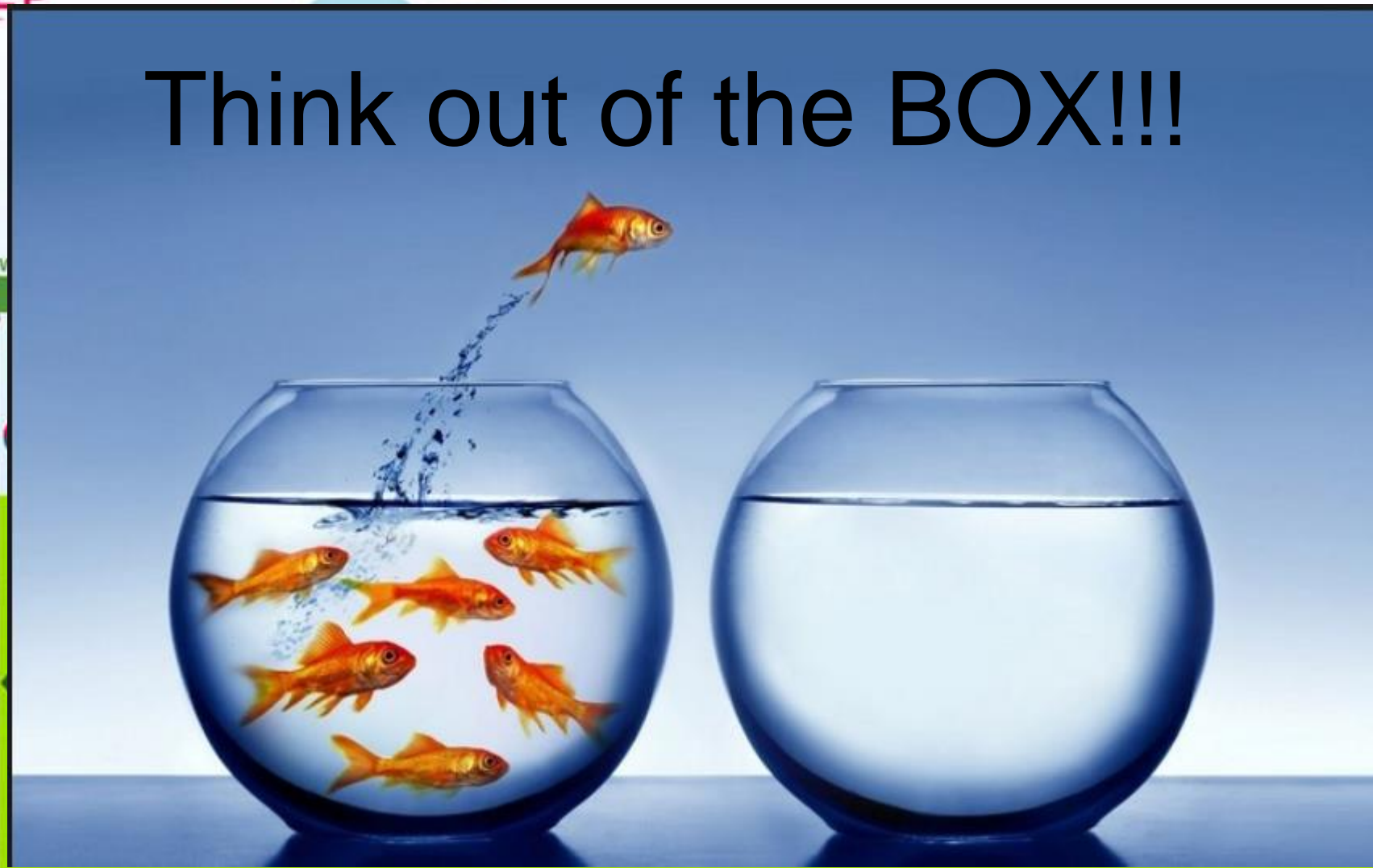
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Take-home message



Think out of the BOX!!!



ENERGY-POSITIVE WASTEWATER TREATMENT PLANT





Take-home message



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POSITIVE SEWAGE TREATMENT PLANT
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