Technical University of Crete
School of Chemical and
Environmental Engineering

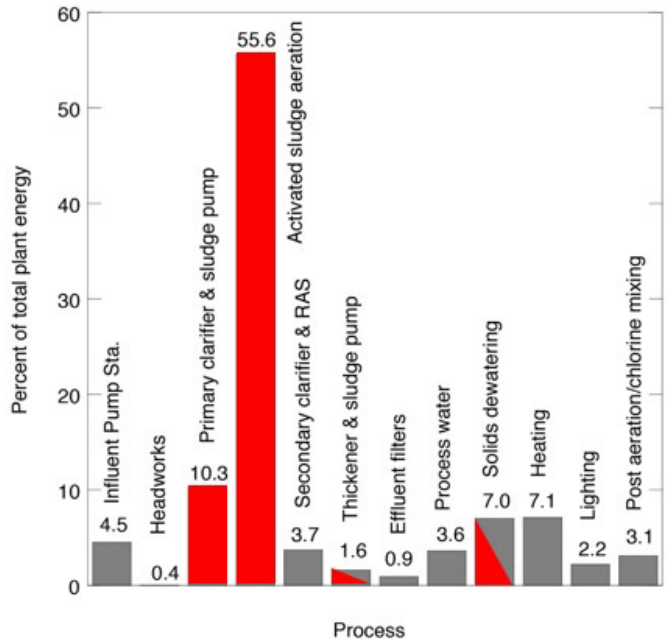
Design of Environmental Processes Lab

Application of the Advanced Primary Filtration (APF) process for upgrading overloaded Wastewater Treatments Plants

www.anelixi.tuc.gr

Overloaded Wastewater Treatments Plants (WWTPS)

Energy distribution in conventional activated sludge systems



> 70% consumed for aeration and treatment of primary sludge (Siatou et al., 2020)

Typical problems of overloaded WWTPs

Advanced Primary Filtration Systems (APFS): Microscreens

- **APFs** are emerging technologies in wastewater treatment.
- The **goal** is to reduce the organic loading to the secondary treatment process.

→ **increasing capacity and saving energy**

Primary Filtration Main Objectives and Advantages

The advantages of the primary filtration process are:

- Reduced electrical energy required for aeration in secondary treatment,
- More biogas energy production in the anaerobic digestion process,
- Potential expanded plant capacity,
- Reduction of footprint required for primary treatment.

What is the most important criteria for design and operation of a primary treatment system?

A — Operational simplicity / flexibility

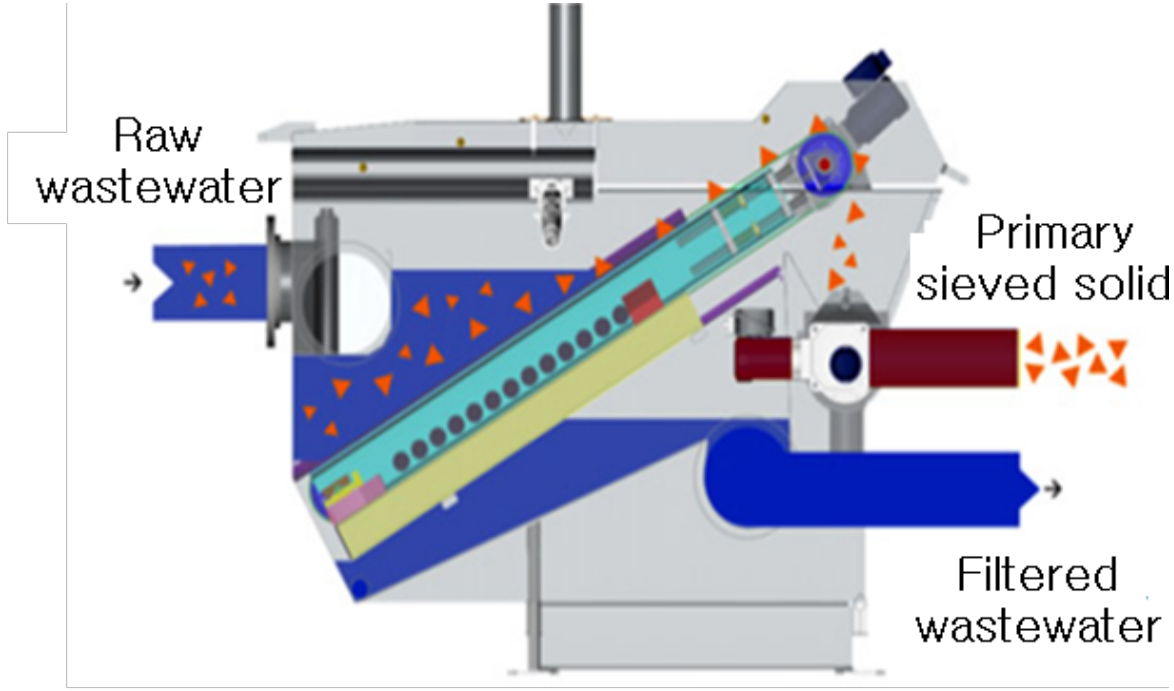
B — Treatment performance

C — Footprint

D — Capital and operational costs

E — Carbon management / diversion

Microscreen

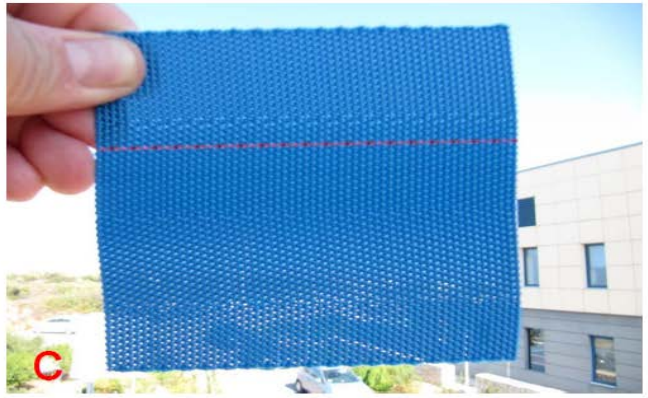


Main advantages:

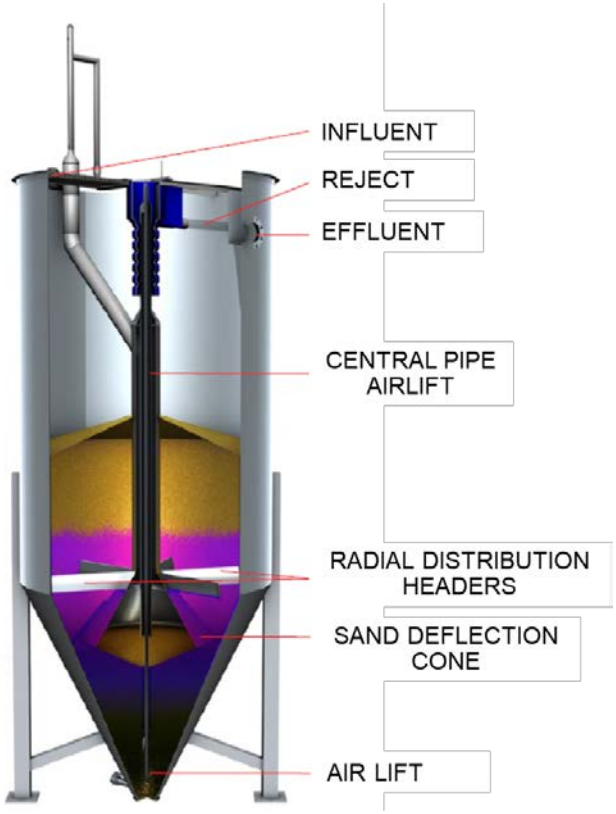
- Self-cleaning filtration devices in continuous operation using a fine mesh screen.
- Biosolids production over 35% solids.
- Space requirement is 1/20 compared to primary sedimentation.

Microscreen

a. Microscreenn with open housing
b. Sludge removal (45% TS)
c. Microscreen cloth (100-350 µm openings)



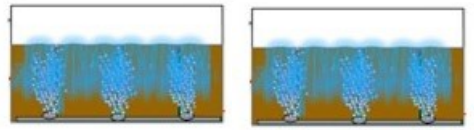
Continuous Backwash Upflow Media Filter (CBUMF)



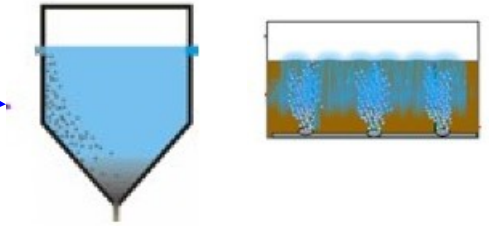
Main advantages:

- Sand filtration system with self-cleaning system of the sand bed.
- Uninterrupted operation and processing.
- Continuous backwashing.
- Low energy consumption
- Low monitoring and maintenance costs

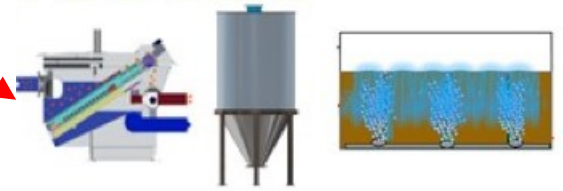
Solutions for upgrade of overloaded WWTP



Expansion of aeration tank



Addition of primary clarifiers



Addition of APFS

ANELIXI project in the frame of Interreg V-A Greece-Cyprus 2014-2020

- **Title:** Upgrade of WWTPs for the management of increased demands and the reduction of the operational cost
- **Acronyme:** Anelixi
- **Project duration:** 01/08/2021-31/10/2023
- **Total Budget:** about 1,000,000 €
- **Website:** anelixi.tuc.gr
- **Funders:**
  - ❖ European Union
  - ❖ National Funds of Greece and Cyprus

Coordinator

ΠΟΛΥΤΕΧΝΕΙΟ ΚΡΗΤΗΣ
TECHNICAL UNIVERSITY OF CRETE

Design of Environmental Processes Lab

ANELIXI Project

Interreg Ελλάδα-Κύπρος
Ευρωπαϊκό Ταμείο Περιφερειακής Ανάπτυξης
ΑΝΕΛΙΞΗ

Partners

DEYAP
Paros Water Supply & Sewerage Company

Sewerage Board of Kyperounda
Κυπριακή Δημοκρατία

ANELIXI project in the frame of Interreg V-A Greece-Cyprus 2014-2020

The main objectives of the ANELIXI project:

- Increase the capacity of existing WWTPs
- Low construction and operation cost compared to alternative technologies
- Reduction of energy cost of existing WWTPs by approximately 35%
- Production of biosolids with solids content over 35%

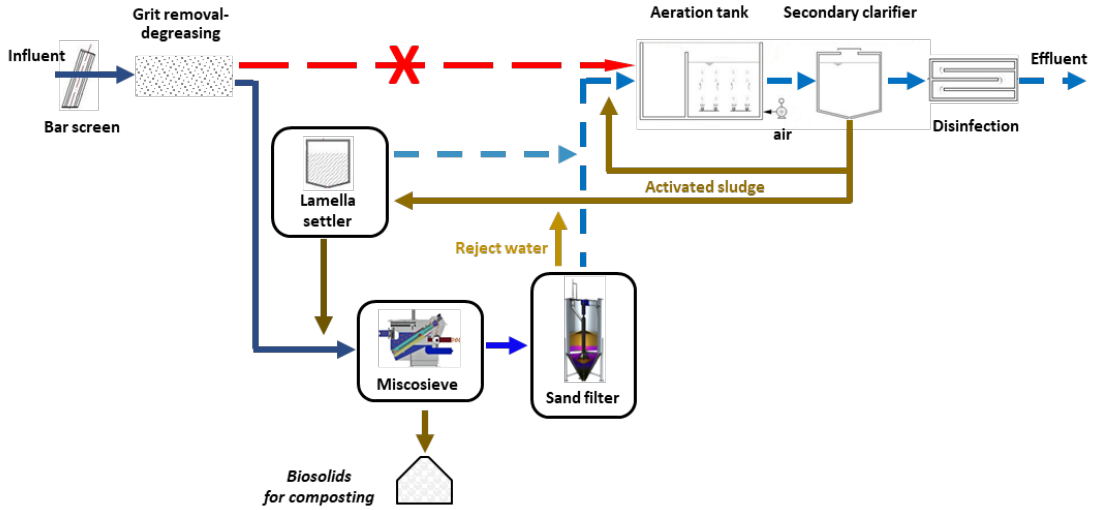
ANELIXI project in the frame of Interreg V-A Greece-Cyprus

❑ Problem

Insufficient performance of WWTPs due to overloading.
High energy consumption of activated sludge plants.

❑ Suggested solution

Application of filtration systems upstream of the aeration tank
Locations: Kyperounta,Cyprus/ Paros,Greece.
Capacities: 600/1,200 m^3/d.
Solids removal: 80-90%



❑ Expected results

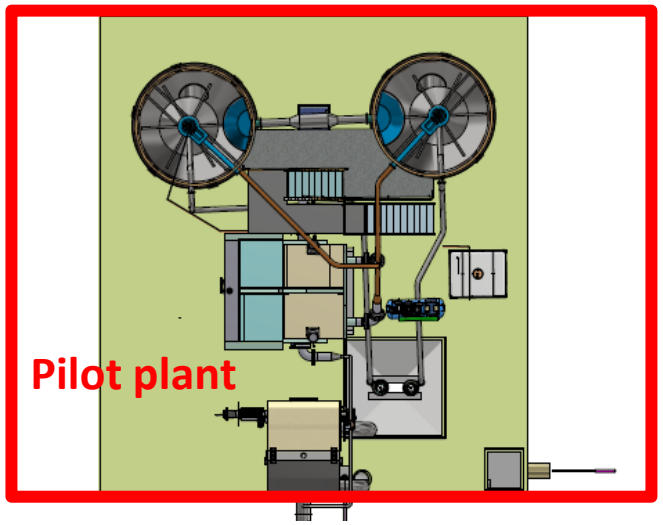
Managing increased input loads.
Reduction of the total electricity consumption of WWTPs by 30-35%.

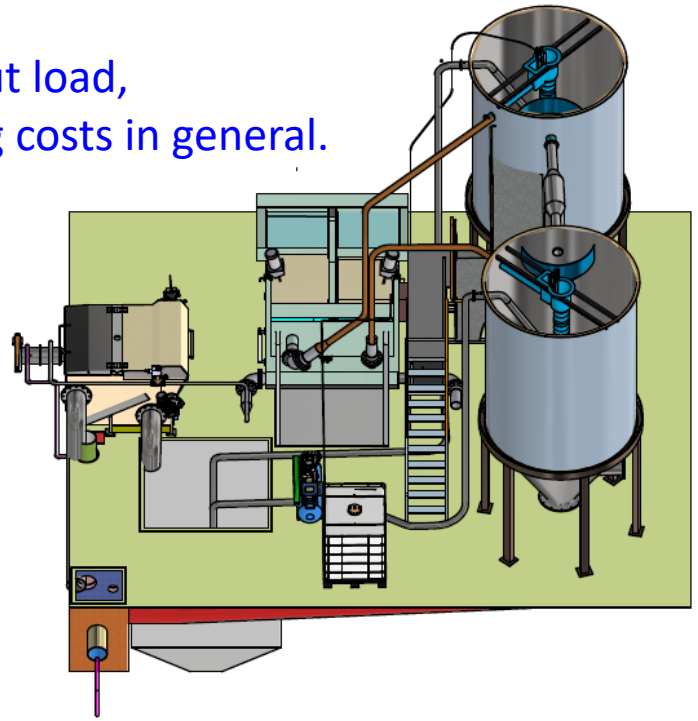
DEYAP
Paros Water Supply & Sewerage Company

WWTP of Marpissa, Greece-Case study I

Characteristics of the project ANELIXI

- **Maximum hydraulic capacity:** 2,500 m^3/d
- **Targets:**
  - ❑ Acceptance of increased input load,
  - ❑ Reduce energy and operating costs in general.





Marpissa's WWTP

- ❖ 5,000 EI
- ❖ Maximum flow rate: 865 m^3/d

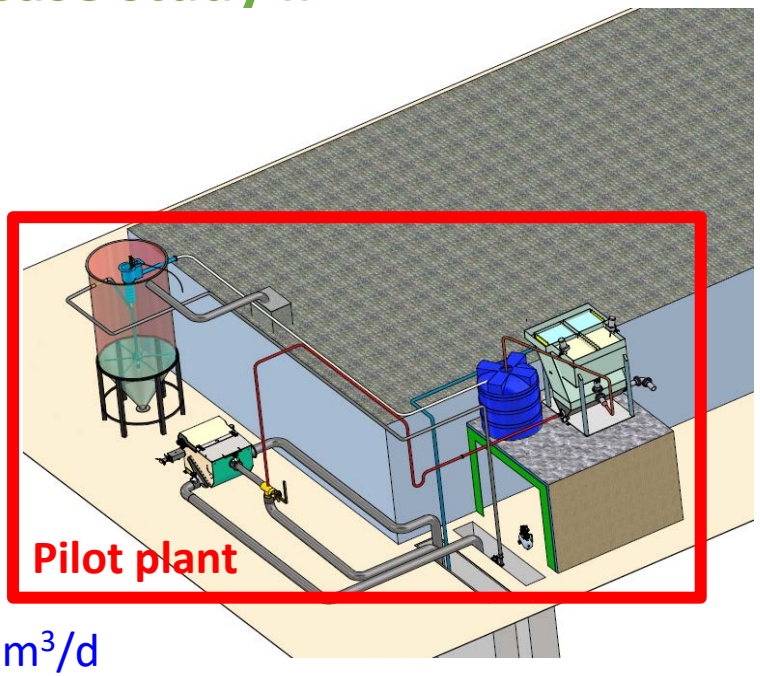
Operational Challenges:
70-105 kg/d of biosolids (wet base)

Sewerage Board of Kyperounda
Κυπριακή Δημοκρατία

WWTP of Kyperounda, Cyprus – Case study II

Characteristics of the project ANELIXI

- **Maximum hydraulic capacity: 600 m^3/d**
- **Targets:**
  - ❑ Acceptance of increased input load,
  - ❑ Reduce energy and operating costs in general



Kyperounda's WWTP

- ❖ 2,400 EI
- ❖ Maximum flow rate: 300 m^3/d

- Operational Challenges:

127-197 kg/d of biosolids (wet base)

Conclusions

- Biosolids removal, upfront of the aeration tank will significantly improve the performance of existing WWTP.
- Microsieving is a **viable option** for the expansion and upgrade of overloaded WWTPs, compared to the primary clarifiers
- The produced biosolids (sewage sludge) with solids content over **35%** are ideal for the production of fertilizer or energy utilization.
- The wastewater treatment process should be redesigned in **light of recent technological advances** and the **requirements** of contemporary society.