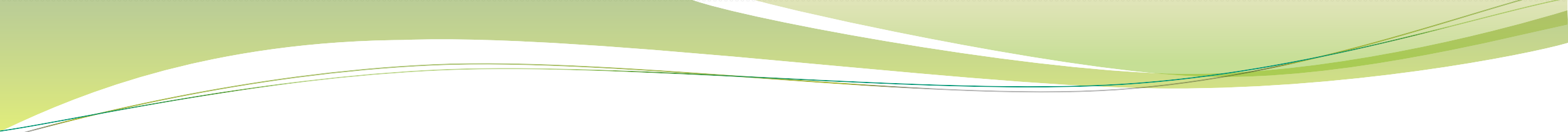


BIOECONOMY
BUSINESS EXCHANGE
PROGRAMME
MILAN, FEBRUARY 14–16 2023

**APPLICATION OF ALGAE AND MFC
TECHNOLOGIES
IN THE WASTE WATER TREATMENT AS EXAMPLES
FOR CIRCULAR ECONOMY APPROACH**

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- Few words about ERENDEM Bt.
 - Biogas production / co-fermentation
 - Waste water for agricultural use
 - Algae in WWTP
 - Finally; MFC

Biogas production / co-fermentation

- 18 + 1 WWTP
- 20-40 k inhabitants (small cities) + 1 „bigger” (300 k inhabitants)
- Goal; energy independency
- Raw material; WW Sludge + bioenergy crops + bio waste

Circular economy

- Quick overview :
 - Preserve resources
 - Clean products and services
 - “Closing the loop” through greater recycling and re-use
 - Extract the maximum value and use from all raw materials, products and waste
 - Energy savings and reducing Green House Gas emissions



Waste water for irrigation

- using waste water for irrigation the nutrients / pollutant content will be utilised and in the same time mean less environmental burden for the lakes and rivers,
- less chemicals need to be used in the final stage of waste water treatment,
- less fertilizers need to be used in the agricultural production where waste water is used for irrigation,
- the quality of wetlands can be improved,
- using waste water for irrigation there is less demand for the use of clean or cleaned water, what is extremely important mainly in case of water scarcity

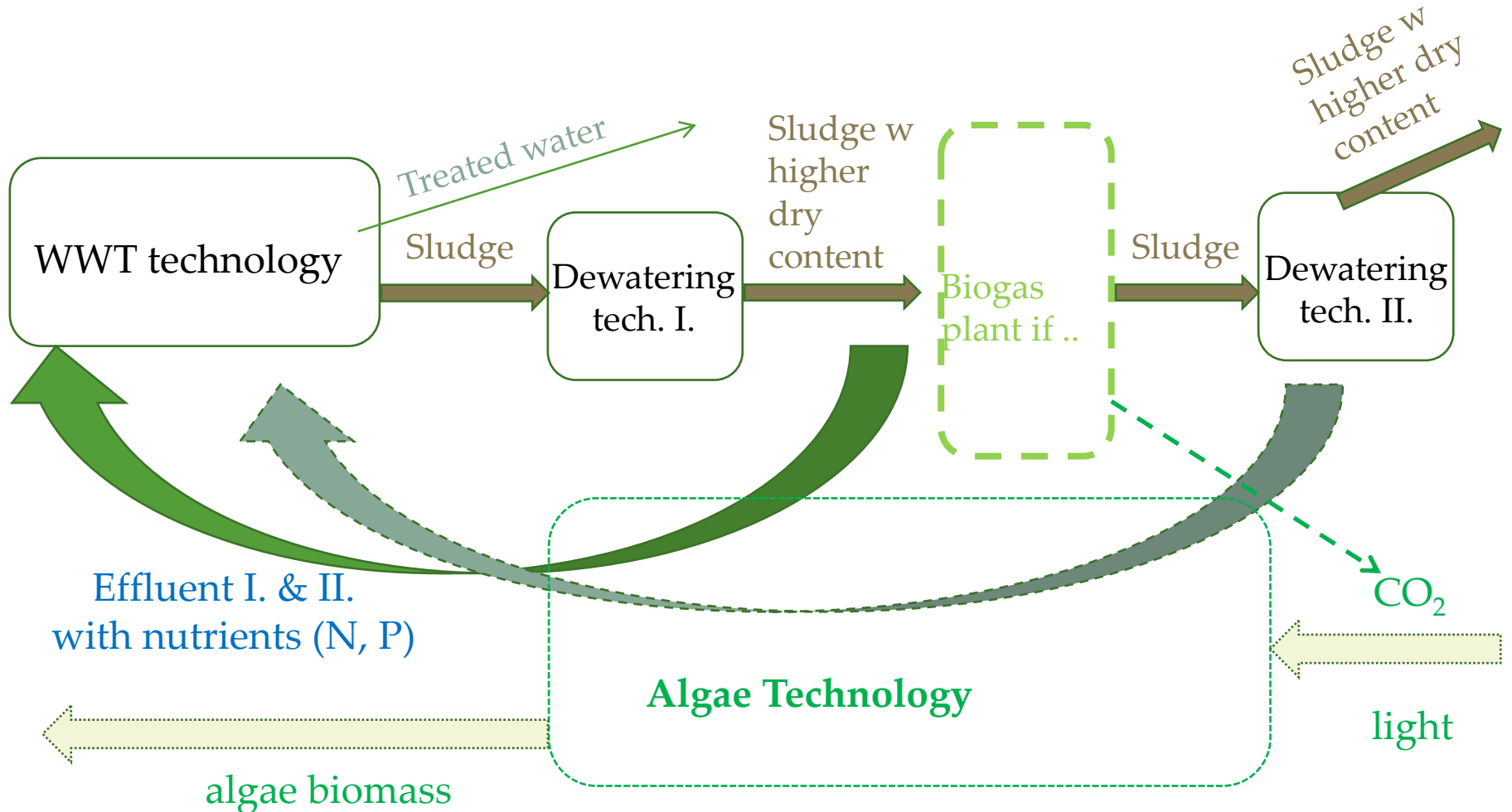
Wastewater treatment

- Activated sludge process in which aerobic microorganisms metabolize the organic waste –
- Energy consuming 21% and 30–55% of the total treatment energy demand.
- Traditional methods consuming between 950 and 2850 kJ/m³
- 9.3 times more energy in the wastewater than used to treat it.



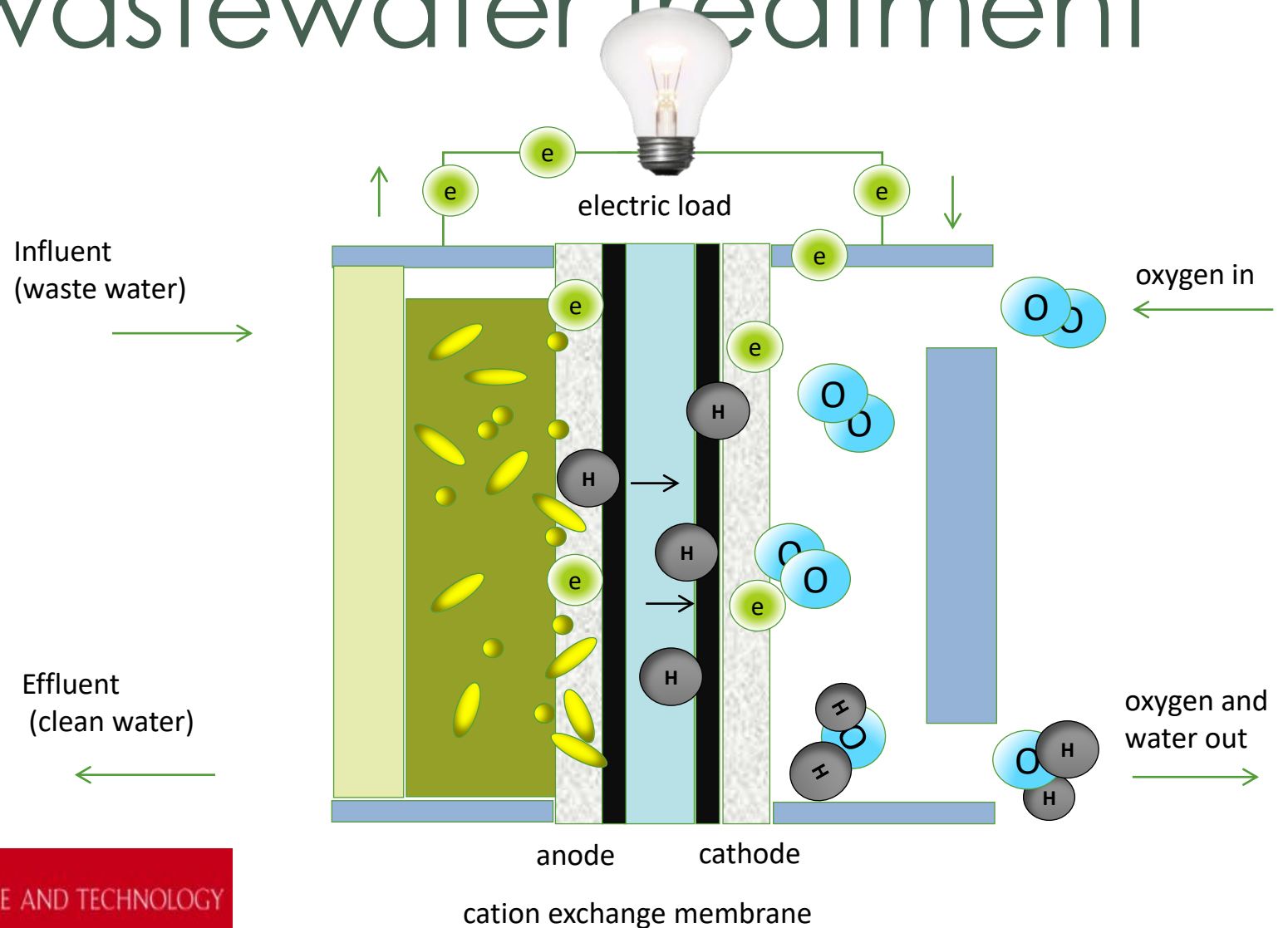
USE OF ALGE IN WWTP

Substrate:
liquid fraction
(effluent) after
sludge
dewatering
(biogas unit,
dewatering of
excess sludge)



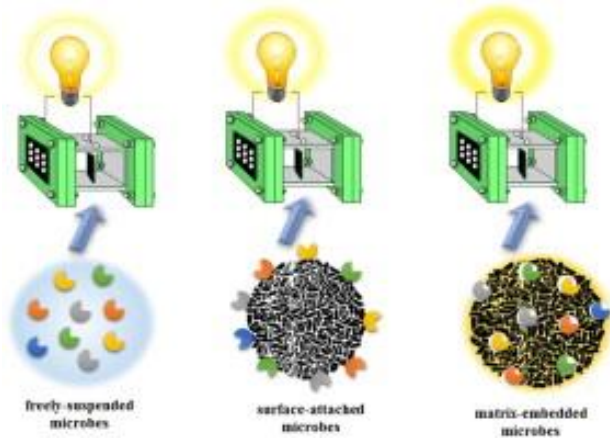
MFC for wastewater treatment

- ▶ Microbial Fuel Cells (MFCs) use bacteria to convert organic material into electrical energy – large potential in wastewater treatment
- ▶ Large interest in MFC scale-up and commercialization

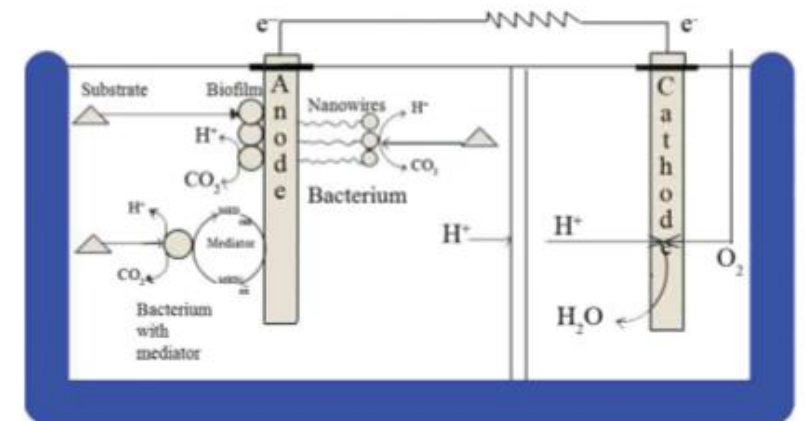


MICROBIAL FUEL AND ELECTRIC CELL

- MFC and MEC is a rapidly evolving field
 - Treat various types of wastewater with concomitant bioelectricity and hydrogen production
 - MFCs are capable of utilizing low-grade organic carbons
 - MFCs can be operated either in the batch mode or continuous mode
 - Biosensor for online water quality monitoring

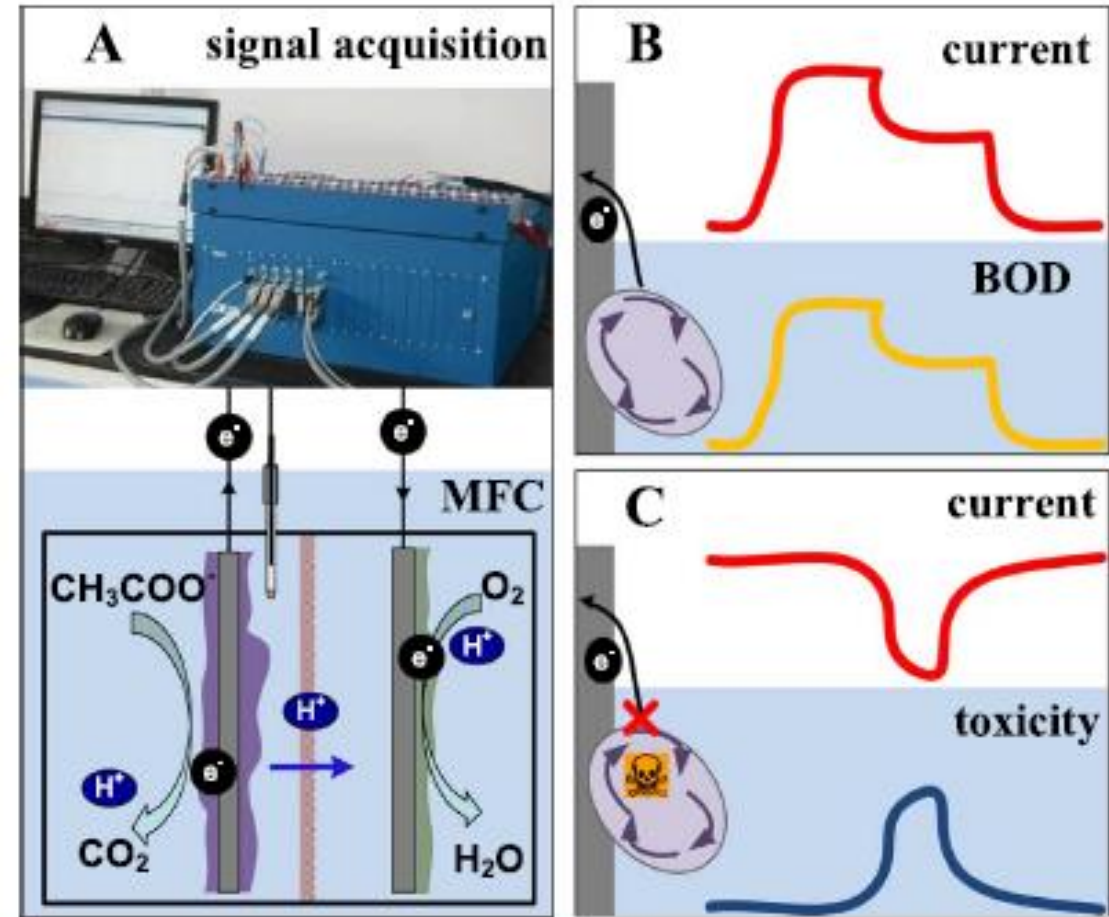


Can accomplish removal of organic matter without aeration



MFC for water monitoring

- ▶ Output current of MFC is proportional with the organic matter content (BOD) of the water
- ▶ The output of the MFC is the signal itself
- ▶ Aim is to develop an energy independent remote sensor for water monitoring with real time and online data reading
- ▶ Few companies active in this field but large potential



Source: Jiang et al (2018) Microbial fuel cell sensors for water quality early warning systems: Fundamentals, signal resolution, optimization and future challenges. Renewable and Sustainable Energy Reviews 81 (2018) 292–305

Bussiness plan

Potential market:

- MFC market is in the R&D phase and is expected to be commercialized by 2017. The global MFC market is estimated to be at USD 9.0 million in 2017, and is projected to grow at 9.5% between 2017 and 2025 (MicroMarketMonitor, 2016)

Exploitation of results:

BES Europe Ltd. has been established to commercialize MFC sensors with Budapest Waterworks Ltd. as first „client” and negotiate conditions in further involvement in development/distribution