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PowerStep - Wastewater as source of biomass for renewable energy

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The EC funded project POWERSTEP is built to achieve a real paradigm shift in wastewater treatment processes: the overarching goal is to convert sewage treatment plants (STEPs) in power production facilities (POWER) while still achieving a high effluent quality for the treated wastewater.
Municipal wastewater treatment in Europe currently requires a significant amount of energy to eliminate organic matter and nutrients such as nitrogen and phosphorus from the sewage prior to its discharge to receiving waters. Under the assumption of an average electricity demand of 32 kWh per capita and year for large wastewater treatment plants (WWTP) as current benchmark the municipal wastewater sector within the European Union (EU) consumes at least 16,000 Gigawatthours (GWh) per year for its service, which is equivalent to the annual power generation of two large (1,000 Megawatt) power plants.
On the other hand, the organic matter contained in municipal wastewater has an internal chemical energy content of 14.4 MJ or 4 kWh per kg of chemical oxygen demand (COD). Based on an organic matter load of 120 g COD per capita (PE) and year, the theoretical energy potential in municipal wastewater amounts to 175 kWh/(PE*a) or 87,500 GWh per year for the entire EU25+3, which is equivalent to the electricity produced by 12 large power plants. If this chemical energy potential is compared to the current benchmark of energy demand for wastewater treatment stated above, it is obvious that municipal wastewater contains significantly more energy in its organic matter than is required for its treatment. Thus, an energy-neutral or even substantially energy-positive wastewater treatment process is theoretically possible by converting this chemical energy into usable types of “renewable” energy.
The six full-scale references in POWERSTEP represent the core element of the planned work within the consortium. Acting as show-cases for process viability and market potential, the case studies are located at operating WWTP sites of different sizes (up to 350,000 pe) and involving various and representative state-of-the-art treatment processes, which underlines both the realistic nature of testing conditions and also the interest of associated partners and utilities in the innovative potential of the investigated technologies and concepts.
Within the next three years the following goals should be achieved:
• Breakthough innovation: the WWTP will be net energy producer. Wastewater as the last forgotten source of biomass for renewable energy.
• No additional needs for power infrastructure, as WWTPs are already well connected in energy supply network and close to power demand (big cities).
• First coordinated European project demonstrating energy positive WWTPs as cost effective combination of technological solutions.
• Demonstration with first large-scale references: Best practices for next generation WWTPs integrated with global assessment.
• Outstanding market and environment impact: Global yearly market value of up $30 Billion, energy cost savings for WWTP operators in Europe of at least €.7 Billion per year and 5.9 Million tCO_2 reduction per year.