ARPA-E Energy from Wastewater

Breakout Group #2 - Clean Water and Energy from Wastewater: Utility, Federal/State/City Agency and Business Perspectives on Metrics and Requirements

Group 1: Quality and costs needed for water to be reused from wastewater

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What are the appropriate/critical constituents to measure? Do we have the appropriate analytical methods? What analytical methods would be required from any newly developed/implemented systems?

- Measure products and by-products quantities and quality in near real-time as it relates specifically to items of interest such as water reuse and energy recovery
- Measurement accuracy should be comparable to Standard Methods

For you to consider replacing current clean water/energy generating technologies/systems what specific level of performance would be required (purity of clean water, amount of clean water, life of system, etc)? What are the key metrics you are interested in? (Slide #1)

- Number is difficult to pinpoint as broad and based on variables
- Approach a net zero energy use or positive energy production in kwhr/kgal of system
- Reliability of energy source created with >90% availability
- Water available to meet needed reuse application >95%
- Maximize water recovery from the process
- System can meet a wide range of reuse applications
- Optimize sludge/biosolids production for beneficial use or near zero tons/mgal
- Reduce capital costs of system to x $/mgal
- Base design on life cycle cost analysis of capital and operating costs to include, energy, waste stream minimization and disposal, chemicals including air, GHG emissions, carbon footprint, beneficial byproducts

For you to consider replacing current clean water/energy generating technologies/systems what specific level of performance would be required (purity of clean water, amount of clean water, life of system, etc)? What are the key metrics you are interested in? (continued - Slide #2)

- Exceed process reliability of current processes
- Address variability of influent
- Reduce impacts to existing ecological systems
- Revenue positive system,
- Positive ROI including all income streams from by-products such as nitrogen, phosphorus, energy, metals, fuels, etc.- metric appropriate to scale, temporal, or regional applications
- Ecologically regenerative systems
- Compatible and adaptable with existing infrastructure and operations and management
- Minimizes safety and health hazards

What are acceptable costs (start-up, sustainment - $/m3)?

- See previous two slides where this is incorporated

What is acceptable energy usage? Are there different levels for treatment at the industrial, municipal, and agricultural levels?

What CECs are relevant for different reuse applications? What are possible surrogate parameters that represent a suite of CECs?

- Water issues
  - TOC, TIC, estrogenicity, endocrine disrupting compounds
  - Water quality, water toxicity (WET)
  - Viruses in near-real time
- Air issues
  - Canaries?
  - GHG emission (methane, nitrous oxide)

To facilitate the use of microbial systems, what could be some new methods for detecting microorganisms in reclaimed water, e.g. microarrays, free living amoeba, PCR for viruses?

- See previous slide

What would be the optimal methods to deal with the fate and risk of respiratory pathogens (e.g. legionella, mycobacterium, fungi), control of algae and algae related toxins, and control of bacterial regrowth in reclaimed water systems?

- Emerging concern of transfer of antibiotic resistance of microbes in waster water reuse
- Need to look at novel antibacterial biofouling agents (such as nano particles, alternative disinfection approaches, etc.) that are energy efficient