

**N-E-W Tech™: Advancing the Animal Agriculture Circular Economy**  
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**Abstract:** To intensify the recovery of resources from dairy and swine animal agriculture operations, we propose to employ a serial treatment train that addresses nitrogen, phosphorus, and fiber recovery, while producing sterilized reuse water, biomass energy, a nutrient upcycled Enhanced Efficiency Fertilizer (EEF) and carbon sequestration. Central to our novel approach is N-E-W Tech™, a patent pending innovative water treatment process at the nutrient, energy, water nexus. N-E-W Tech™ is a biochar-catalytic oxidation-reactive filtration wastewater treatment process. Our modified biochar allows for efficient removal and recovery of total phosphorus to below 0.010 mg/L and some nitrogen species, while acting as a sacrificial catalyst in catalytic ozonation for destructive removal of trace organic compounds (e.g. hormones, antibiotics). In addition, catalytic oxidation potentials (Eh) of 1000-1300 mV and a contact time of about 15 minutes yield the demonstrated capability for complete sterilization, not just disinfection, of pathogens including spore forming bacteria, viruses and prions.

N-E-W Tech™ is a new third-generation reactive filtration technology developed at the University of Idaho and built on an award-winning water treatment platform that has seen rapid commercial success across the United States and in several other countries because of its low CAPEX and OPEX in achieving limit-of-performance results in water treatment, especially in high efficiency nutrient removal. The first- and second-generation foundational reactive filtration technology developed at University of Idaho and licensed to our strategic partner Blue Water Technologies, Inc. is available as package plants for tens of gallons per minute to full scale wastewater treatment plants at 10+ MGD. In our Nutrient Recycling Challenge concept, most current or newly developed conventional physical, biological and chemical manure management approaches can be efficiently integrated with N-E-W Tech™ in a whole system architecture approach that is adaptable to the highly variable sites, climates, and operational conditions that exists at animal agriculture facilities across the United States. Our concept for whole system waste management architecture centered on N-E-W Tech™ for animal agriculture operations is:

- 1) Slurry, non-feedlot, animal agriculture operations transitioning from flush systems towards scrape or hose systems yielding water savings and greenhouse gas emission reduction.
- 2) Sequential slope screen, screw presses, and rotatory presses, or newer more efficient 15 micron cross-flow centrifugal filtration for solid-liquid separation to remove fibrous-based coarse solids.
- 3) Advancing the economics and installation of anaerobic digesters (AD) for biogas and/or biochar pyrolysis units for separated manure fiber biochar and syngas generation by whole system nitrogen, phosphorus and energy recovery, with water recovery using 15 micron cross-flow centrifugal filtration for solid-liquid separation, followed by ammonia stripping and reaction with sulfuric acid to form ammonium sulfate, followed by N-E-W Tech™ for N/P upcycled biochar fertilizer and unrestricted reuse water; OR
- 4) Advancing composting of the raw or AD solid manure fractions following 15 micron cross-flow centrifugal filtration for solid-liquid separation, followed by water phase ammonia stripping to form ammonium sulfate, followed by N-E-W Tech™ for N/P upcycled biochar fertilizer, and unrestricted reuse water.