

# Kenosha Water Utility Energy Optimization Resource Recovery Project

Transforming Municipal Waste By-Product  
into Energy-Independent, Eco-Friendly Solutions



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# KWUs Holistic Solution for a Self-Reliant Future in Wastewater Treatment



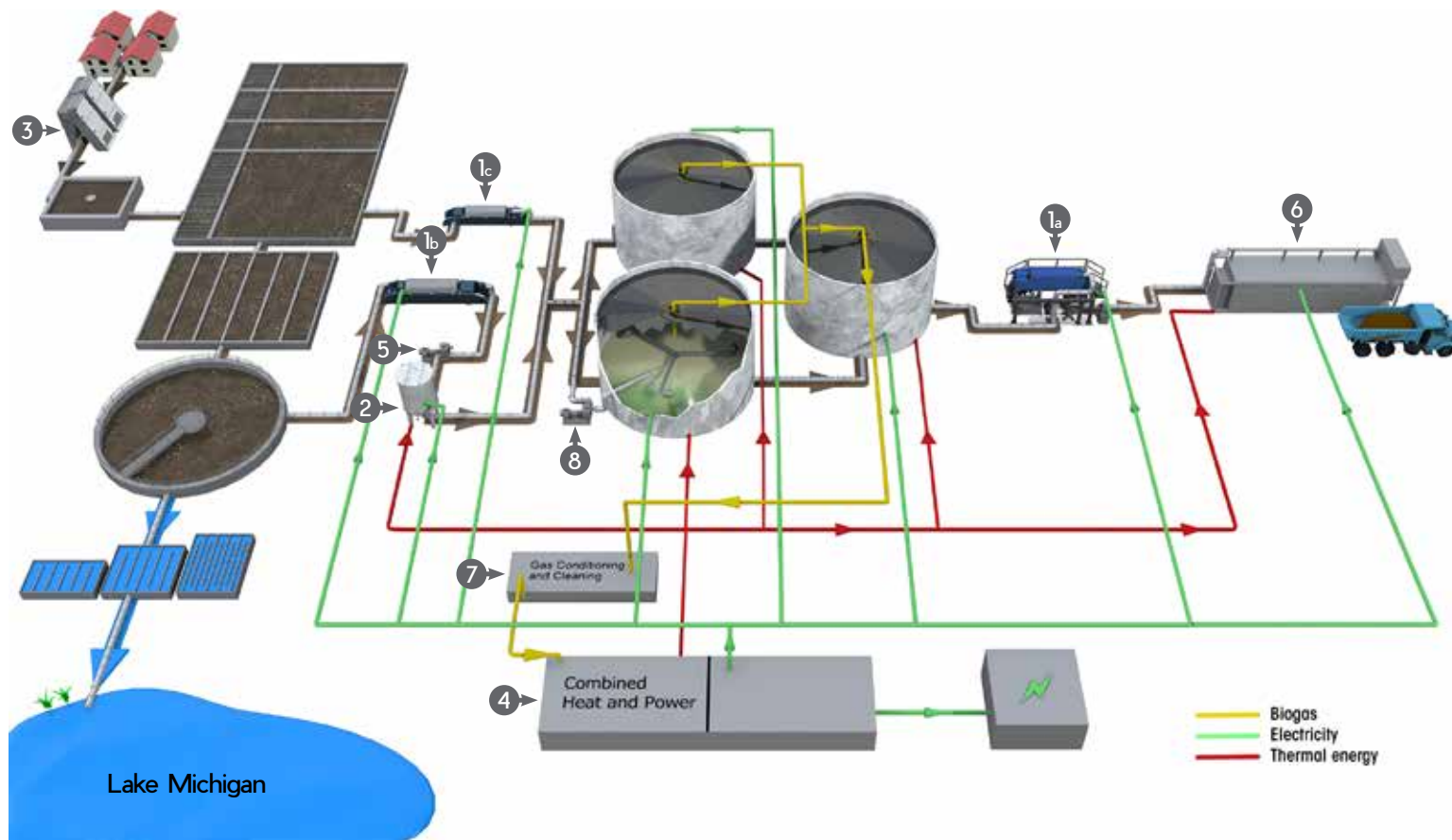
Kenosha Water Utility operates a regional wastewater treatment plant with an average daily flow of 22 MGD. In 2013, KWU decided to modify the entire solids process. The goals were: create more biogas, convert gas to energy, achieve Class A biosolids and reduce the amount of rags entering the plant. KWU wanted to lower electrical bills, be more efficient and fully utilize the resources produced as byproducts.

The project was a design-build set with a tight timeline to meet a Focus on Energy grant deadline. Many challenges arose during construction, start-up and optimization by integrating so many new pieces of equipment at one time.

Operational since November 2015, all project goals were met. The FSM perforated plate screens significantly reduced downstream plant maintenance and improved the end-product. The Rotamix System fully mixed and homogenized the digesters. Centrisys' primary and waste activated sludge thickeners reduced digester capacity needs in half. PONDUS increased biogas production by 25%. Unison cleaned and conditioned the biogas, to fuel Kraft's cogeneration or combined heat and power units (CHPs). Thermal energy produced by the CHPs heat the Klein dryer and PONDUS sludge; with excess to heat the plant. A quarter of the CHP generated electricity powered the new equipment and the plant used the rest, which is one-third of the plants overall electrical needs. The biosolids were approved as Class A. The project transformed KWU's solids process and KWU plans to continue making improvements.



**(1a)** 2009: Centrisys' CS21-4HC dewatering centrifuge replaced three plate and frame presses, reducing the dewatering footprint, chemical usage (lime and ferric), disposal and operation costs. The ROI was 1.5 years. **(1b)** 2011: KWU replaced four DAFT units with one Centrisys THK200 for WAS. The THK200 operated 24/7 and used no polymer and achieved 5% TS cake, 95% capture. KWU also avoided \$100k in DAFT repairs. In 2015, with the Energy Optimization Project, the THK200 (WAS) was slightly modified to currently use a low polymer dosage to extend the operating range to 6-7% TS thickened solids for PONDUS. **(1c)** 2015: KWU installed a THK200 for primary sludge. The ambient temperature of the thickened primary solids mixes with the hydrolyzed sludge to yield ideal digester temperature (no steam required). The THK200 (primary) reduces volume and provides consistent solids concentrations flow into the digester and greater solids handling capacity.



**(2)** Installed in 2015, CNP's PONDUS Thermo-Chemical Hydrolysis Process (TCHP) optimizes KWU's sludge treatment process. PONDUS drastically minimizes KWU's overall carbon footprint and increases biogas production up to 30%. PONDUS is an energy-efficient system that requires no sludge cooling prior to anaerobic digestion. PONDUS decreases KWU's thickened WAS viscosity by 80%. Both PONDUS and the Centrisys THK200 allows for the reduction of anaerobic digestion volume by 50%. PONDUS also increases the dewaterability of dry cake solids up to 5%.



**(3)** Two Enviro-Care FSM<sup>®</sup> perforated plate Filterscreens with verified solids capture of >85%. Each screen has 6 mm holes and is equipped with FSM proprietary auto adjusting cleaning brushes. These high capture screens significantly improve downstream processes including digester performance and help produce a cleaner biosolid. Each screen is rated for a peak flow of 50 MGD. Two FSM washer compactors each with a capacity of 176 ft<sup>3</sup>/hr. produce >40% dry solids and achieve 60 - 85% volume/weight reduction.



**(5)** NETZSCH's maintenance-friendly Full-Service-in-Place (FSIP<sup>®</sup>) NEMO<sup>®</sup> progressive cavity pump has a large inspection cover that provides full access to all rotating parts of the pump. The FSIP<sup>®</sup> design pump allows users to conveniently open the pump cavity on-site and dismantle all rotating parts and simply replace them again without having to remove the pump from the pipe assembly. This significantly reduces installation and maintenance time. This pump is being tested by Kenosha and runs 24/7.



**(6)** A compact, low temperature, dual belt sludge dryer was installed in 2015. With an integrated heat recovery system to utilize the waste heat from the CHP units, it is one of the most efficient and safest drying systems worldwide. The dewatered biosolids fed at 30% DS are dried to over 90% DS to meet Class A requirements. Since dryer optimization, the biosolids disposal weight is reduced to one-third. Included is an air treatment/odor control unit that eliminates ammonia and hydrogen sulfide odors.



**(7)** Unison Solutions, Inc. designs and manufactures biogas conditioning equipment. The 300 scfm blower system at Kenosha removes particulates, moisture and siloxanes from the saturated biogas. The fuel produced is used in a Senergie IC engine to produce electricity and heat for use at the plant. Other systems from Unison operate with turbines for electricity production and to produce renewable natural gas (RNG) for vehicle fuel. Based in Dubuque, Iowa, Unison has over 250 systems operational.



Donohue & Associates provided planning and design engineering for KWU. The design-build project successfully integrated innovative technologies into existing infrastructure and resulted in a practical, sustainable solution. The design included anaerobic digestion, medium-temperature thermal biosolids drying, combined heat and power energy recovery, and North America's first PONDUS thermo-chemical hydrolysis system to enhance energy recovery. The project received an Engineering Excellence Grand Award from ACEC Wisconsin, awarded annually to one Wisconsin project.



**(4)** Simultaneous production of electrical and thermal power makes CHP an efficient and sustainable technology. Kenosha's two CHP units supplied by Kraft Power are each capable of producing 330 kWe of electrical power. Waste heat is recovered from the engine jacket water circuit for 828,600 BTU/Hr of thermal recovery; and from the engine exhaust adding 603,600 BTU/Hr. This CHP skid mounted recovery system achieves 48.2% thermal efficiency with a combined electrical and thermal efficiency of 86%.



**(8)** Vaughan Rotamix is today's most cost effective and efficient means of hydraulic mixing, using an engineered arrangement of mixing assemblies fed by a Vaughan Chopper Pump. Computational Fluid Dynamics simulation allows Vaughan to analyze each application to optimize mixing energy and achieve the desired mixing pattern. Kenosha chose the Rotamix system to remove rag build-up and stratification. The digesters are now evenly mixed and heated which results in greater volatile solids reduction and gas production.



## PONDUS Thermo Chemical Hydrolysis Process (TCHP)

### Benefits:

- Increased Biogas Production between 25 to 35%
- Reduced disposal costs
- Reduced polymer costs for dewatering
- Increased digester capacity
- Reduction of digester foaming

### In Summary

More biogas, lower biosolids treatment and disposal costs, PONDUS Hydrolysis is **simple** and **effective** without the use of steam.

“ While the technologies each individually bring value, it is their holistic approach, as well as the collaboration of partners involved, that make this project special. The key for this successful initiative is trust among partners – Kenosha Water Utility, Centrisys and CNP leaders – and trust from the City of Kenosha in these leaders to deliver. ”

**Ed St. Peter, General Manager**

The partnership for this project is a continuation of the partnership that began in 2011 between Kenosha Water Utility and Centrisys with previous plant installations, including the dewatering centrifuge and waste activated sludge thickener. This set the stage and confidence for this flagship project.

In spite of the groundbreaking technology and system upgrade, the taxpayers may not even notice, thanks to this first-of-its-kind self-financing solution that will generate power, heat sources, and provide more cost-effective disposal.

**It's a win for everyone, and the ecosystem, too.**

## Questions about Centrisys technologies?

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CSK02017V1EN