

WATER SOLUTION PROVIDER PROJECT EXECUTIVE SUMMARY

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Prepared For
Commonwealth Edison Company

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This project was developed as part of the Emerging Technologies initiative within the ComEd Energy Efficiency Program. Axiom Marketing produced this report for the Emerging Technologies Team with overall guidance and management from Kelly Gunn. For more information on this project and to request the final report, contact EmergingTech@ComEd.com.

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1.0 EXECUTIVE SUMMARY

The Water Solution Provider Project (the Project) identifies win-win opportunities for ComEd and for the water sector where electricity and water utilities intersect (sometimes called the water/energy nexus) in the ComEd service territory around Chicago.

“Water Solution Provider” (WSP) refers to multiple tiers of water industry professionals providing equipment, services (including consulting engineering) and/or financing to water operations (water supply, water process operations in industry and wastewater treatment.)

Axiom estimates minimum energy savings potential in the Greater Chicago area to be at least 14-38 GWh per year through similar existing pilots and energy savings programs, perhaps more. This is based on the estimated 2,722 GWh of total electricity used in the public supply water infrastructure¹ as defined by ComEd and supported by data analysis conducted in a 2019 ComEd Water Study.^{2,3}

Project Goals

1. Deepen understanding of business goals and needs of water solution providers so ComEd can collaborate with them to implement significant water and energy savings. Target water solution provider segments include:
 - Consulting engineers at firms employed by municipalities and manufacturers to specify their water projects
 - Sales engineers employed by manufacturers of filtration equipment (that is more energy efficient than RO films), water pumps, water aeration and water system controls
2. Identify and structure win/win collaboration scenarios between water solution providers and ComEd to maximize the chances that ComEd energy efficiency programs and incentives will be presented to municipal and manufacturer customers by water solution providers
3. Identify potential pilot programs and new collaborative program designs

Methodology

The project seeks to deepen understanding of business goals and needs of water solution providers so ComEd can collaborate with them to implement significant water and energy savings. The methodology for the project included individual depth interviews conducted in two separate groups in the fall of 2020 – results of which were presented in a mid-project summary⁴ – and in early 2021. Interviewees included key water industry representatives and decision makers at:

Phase One – Fall 2020:

- Municipal water utilities
- Industrial manufacturers in the Greater Chicago area
- Informal discussions with association members, special interest groups (SIGs) and influencers at nonprofit organizations in the Chicago area about past, current and planned projects in the area

Phase Two – Early 2021:

- Consulting engineering firms hired by municipalities and manufacturers to design and specify their water management needs
- Manufacturers of equipment and technologies used in water delivery and treatment

A total of 21 formal interviews and eight informal discussions were conducted with these representatives. The 45-60 minute interviews focused on defining the barriers, needs and opportunities for ComEd to provide new programs and participate in pilots. In addition, the interviews helped inform how and why existing ComEd programs are/are not being used within the water industry. Last, respondents were asked about their past involvement in programs and pilots and the types of that are of greatest interest to them.

Respondents provided perspective on:

- Past, current and potential pilot program opportunities
- Barriers faced in working with utilities
- Savings and incentive programs offered through a variety of entities (both successful and unsuccessful)
- Processes for prioritizing capital expenditures and managing projects to completion
- Why projects are and are not funded
- Possible commitments to conservation efforts and goals
- Program elements they believe are needed for successfully advancing energy efficiency and water conservation

The interview process identified two key areas fundamental to the project:

1. Exploration of potential ComEd program opportunities and pilot program partnerships, which address barriers and increase participation in ComEd energy-savings programs.
2. Creation of a database of high-potential pilot programs and new collaborative program designs. The database summarizes the program opportunities, potential partners, estimated energy savings (where possible), the

respondents suggesting the programs and other information that may be important during the selection of pilot ideas to pursue.

Barriers, Needs Leading to Program Opportunities

The barriers identified by respondents during the research are examined in the report in three ways.

4. What barriers are preventing WSPs from achieving energy savings potential with their clients and customers?
5. What barriers prevent WSPs from working with ComEd?
6. How ComEd can strengthen relationships with WSPs and increase energy savings related to water?

Barriers Identified at Utilities and Industries

1. Aging and inefficient equipment, systems and infrastructure at water facilities, industrial manufacturing and in communities served
 - **Need:** Ability to quantify and prioritize equipment upgrades
 - **Implication:** Offer audit and planning assistance to identify opportunities. Build awareness of ComEd's interest in the water sector. Demonstrate interest with programs aimed at needs of the water sector. Build flexibility and simplicity into programs to encourage participation and meet the needs of the industry
2. Significant energy losses from aging water supply infrastructures that, unless addressed, will continue to limit energy efficiency across systems
 - **Need:** technologies and systems to address and fix inefficiencies
 - **Implication:** An ability to address infrastructure inefficiencies to clear the way for energy efficiency. Quantify energy waste based on water loss information to help utilities make a case for immediate action
3. Financing first-cost of improvements at water utilities and manufacturers (a well-known issue)
 - **Need:** Additional financing options to consider
 - **Implication:** Adapt financing structures, offer new options and/or incentives to encourage installation of energy saving equipment and technologies
4. Long lead times and complex processes preceding project approval
 - **Need:** Ways to prioritize needs and simplify processes

- **Implication:** Provide resources for WSPs and their clients/customers to identify and prioritize projects. Simplify program identification and application to make participation easy and efficient
5. Risk aversion to processes and technologies new to staff at water utilities and manufacturers, who value both reliability and energy efficiency
 - **Need:** Assurance and proof of reliability and energy savings potential
 - **Implication:** Recognize improvements in energy efficiency as a whole system. Incentivize incremental energy savings and technologies new to utilities and manufacturers, but perhaps not the latest technologies

Barriers Regarding Working with ComEd

1. Lack of information among water utilities and manufacturers about energy loads within facilities and energy-saving alternatives
 - **Need:** Audits and energy planning assistance to create a baseline and roadmap for future energy savings improvements
 - **Implication:** Fund or supplement audit or energy planning services
2. Minimal awareness of ComEd's interest in the water sector among consultants and design engineers in the water industry
 - **Need:** Communication and easy access to program information and resources
 - **Implication:** Improve ComEd outreach to the water industry and provide easily accessible resources to find program information
3. Perceptions that ComEd has few programs that support the specific needs of the water industry
 - **Need:** Programs designed to address unique needs of WSPs that go beyond existing ComEd incentive and custom program approaches
 - **Implication:** Develop new program concepts specific to the water industry and test with select WSPs prior to launch. Educate and build program awareness
4. Lack of water industry knowledge and a single point of contact at ComEd to support account reps and their customers in the water sector
 - **Need:** Deeper water industry knowledge and experience at ComEd to support the company's account representatives
 - **Implication:** Build or acquire water industry expertise to support sales representatives and their water industry customers.
5. Little, if any, counsel available at ComEd during the application process. Redundancies and repetition requiring frequent explanation of project details

and resubmission of information, which lengthens timelines and can lead to abandoning program participation

- **Need:** Improved communication about the application process and, possibly, a single point-of-contact or online resource at ComEd to access application status
 - **Implication:** Provide single point of contact to answer questions and guide applicants through the process. Help WSPs navigate the application process from start to finish Build a system to track status and progress of program applications and access past applications for reference and efficiency
6. Resistance to program participation within the industry due to complexity of programs, the cost of time spent applying for programs outweighing the benefit gained, and real and perceived inflexibility of the programs offered
- **Need:** Broader program qualifications and simpler, less time-consuming application processes
 - **Implication:** Review the current application procedures for opportunities to simplify and streamline the process. Expand the scope of qualifications and simplify processes to save time, increase participation and, ultimately, save more energy. Conceive and test program concepts, details and requirements with WSPs prior to launch

Success lies in resolving these barriers at ComEd and paving the way for energy efficiency with customers. Outreach and collaboration by ComEd are two main themes emerging from these responses. Respondents are interested in working with ComEd and were encouraged by the company's willingness to work with customers like them.

Some interviewees, however, expressed frustration engaging with ComEd at times, and often find it difficult to get to the right person, and specifically someone that understands the technologies and processes unique to water systems. They know that water systems are complex capital- and equipment-intensive operations. Projects have long lead times and budget considerations to manage before final approval. With complexity already a part of the water sector, respondents want simplicity, clarity and support to improve energy efficiency and water conservation.

Potential Opportunities for ComEd:

Ideas for energy savings and water conservation emerged throughout the interview process and while conducting additional research of successful programs in the region and across the U.S. Program opportunities include:

1. Ways for ComEd to build programs and pilots by collaborating with water consulting engineers and working with them as a conduit to increase program awareness and implementation

2. Providing water-specific technical support to ComEd representatives to build stronger relationships among water industry customers. Access to knowledge at this technical level will maximize build program participation and provide opportunities to possibly explore new technologies together
3. Pathways for ComEd to potentially address the biggest barriers to water industry efficiency – managing first costs and addressing risk when building facilities and replacing aging, inefficient equipment – through partnership with Energy Service Companies (ESCOs) and other financing structures
4. Assisting water utilities and manufacturers with auditing and energy planning to provide insight to energy use and conservation and a roadmap for energy efficiency improvements
5. Opportunities to simplify program identification and the application process
6. Partnering with consultants to provide energy expertise in solving well-known water loss problems, primarily leakage in the water supply

Top Seven Program Opportunities

Summarized here are the top seven concepts of 20 vetted throughout the project, the balance of which is in the Appendix. Included are specific program and pilot ideas for discussion with ComEd management. Each concept was discussed and evaluated by Axiom researchers, engineers and water industry experts based on overall need, feasibility, potential scalability, ROI opportunity and energy savings impact (when calculable at this stage.) Following approval, program opportunities will need additional vetting in the final stage of the WSP project.

Program Proposition	Possible Pilot Participants	Pilot Opportunities – explanation & high-level description(s)	Energy & Energy Business Impacts	Pilot Source (Phase 1 & Phase 2)	Previous Pilots
<p>1. Wastewater Treatment Plant (WWTP) aeration improvements to provide substantial electricity conservation with newer technology</p>	<ul style="list-style-type: none"> • Smart Energy Design Assistance Center (SEDAC) – open to partnering • Springbrook Water Reclamation Center • Aurora WWTP 	<ul style="list-style-type: none"> • Aeration is the largest single electricity consumer for WWTP • Support wastewater treatment plant pilot projects, such as: <ol style="list-style-type: none"> 1. Fine Bubble Aeration 2. Smart (sensor controlled by tank) blower controls 3. Rightsizing Blowers and/or efficiency determined Blower use 4. Bubble Pulsing (blower timing) 	<ul style="list-style-type: none"> • Annawan example: 101 MWh/Year electricity savings for WWTP facility serving a population of less than 1,000⁵ • Aeration at Chicago-area Metro Wastewater Reclamation District is typically 1-3 GWh/day⁶ 	<p>Secondary research</p> <p>Phase 1 depth interview</p> <ul style="list-style-type: none"> • <i>University of Chicago</i> • <i>Strand Associates</i> • <i>Water Environment Federation</i> <p>Phase 2 depth interview</p> <ul style="list-style-type: none"> • <i>Greeley and Hansen</i> • <i>Baxter & Woodman</i> • <i>Evoqua</i> 	<ul style="list-style-type: none"> • Not new; this is being done successfully around the country, but wastewater plants are often unique and may need to see pilot results before permanent adoption. • Xcel Energy with metro Minnesota • Project was completed in 2020 in Annawan, IL⁷

Barriers Addressed

Aging/inefficient equipment requiring high levels of electricity. Audit needs

<p>2. ComEd supporting water supply and wastewater plant(s) taking formal step-wise energy planning program will increase water agency awareness and internal support and thus save water and energy</p>	<ul style="list-style-type: none"> • Illinois AWWA – open to partnering • CMAP – open to partnering • University of Illinois – open to partnering • University of Chicago – open to partnering • Argonne National Laboratories – open to partnering 	<ul style="list-style-type: none"> • Create pilot project to test ways to educate and collaborate with municipal, industrial and commercial customers. This may include: <ol style="list-style-type: none"> 1. Establishing organizational commitment to conservation goal(s) 2. Assembling and initiating an energy team with a high level ComEd champion 3. Developing facility baselines and/or equipment energy use 4. Identifying, assessing and prioritizing energy conservation measures (ECMs) 5. Developing an implementation plan 6. Tracking and reporting (and with ComEd communicating successes) 7. Continually updating plan (and setting higher goals) 	<ul style="list-style-type: none"> • TBD 	<p>Phase 1 depth interview</p> <ul style="list-style-type: none"> • <i>Northwest Suburban Municipal JAWA</i> • <i>Strand Associates</i> • <i>University of Chicago</i> <p>Phase 2 depth interview</p> <ul style="list-style-type: none"> • <i>Peterson and Matz</i> • <i>Greeley and Hansen</i> • <i>Baxter & Woodman</i> • <i>Earthwise Environmental</i> 	<ul style="list-style-type: none"> • EPRI • Wisconsin’s Focus on Energy⁸ advocates using similar approach • Xcel has funded these planning steps • Massachusetts Clean Energy Center⁹ • New England Water Environment Association¹⁰
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Barriers Addressed

Auditing and energy planning assistance, lengthy approval timelines, first-cost, ComEd program awareness

<p>3.</p> <ul style="list-style-type: none"> • Univ. of Illinois – open to partnering • Univ. of Chicago – open to partnering • National laboratories may also be potential partner • Baxter & Woodman 	<ul style="list-style-type: none"> • Funding the audits, but allowing plant management to select or participate in the selection of the auditors will enhance adoption of the recommendations. • Moreover, ComEd paying for the audits will often overcome procurement constraints and reduce or eliminate financial expense approvals 	<ul style="list-style-type: none"> • Carthage, TN example: By adjusting their aeration process, reduced electricity use by 14%, (while seeing a 15% increase in wastewater loading). Over 7,000 kWh/month savings for 330,000 GPD facility¹¹ • Theoretical WWTPs savings in ComEd area at 7% would be: 167 GWh¹² • Potentially similar savings at water supply treatment plants 	<p>Secondary research</p> <p>Phase 1 depth interview</p> <ul style="list-style-type: none"> • <i>Avelino D. – University of Chicago</i> • <i>Brian D. – Univ. of Ill Smart Energy Design Assistance Center</i> • <i>Barry L. – Water Env. Federation</i> <p>Phase 2 depth interview</p> <ul style="list-style-type: none"> • <i>Brent P. – Baxter & Woodman</i> 	<ul style="list-style-type: none"> • Not new; happening widespread across the country • Carthage WWTP¹³ (TN) • TN Environment & Conservation¹⁴ • Univ. of Memphis¹⁵ • Univ. of Tennessee¹⁶ • MCES, with funding from Xcel (Minnesota) has done audits for all its WWTPs 	<ul style="list-style-type: none"> • Univ. of Illinois – open to partnering • Univ. of Chicago – open to partnering • National laboratories may also be potential partners • Baxter & Woodman
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Barriers Addressed

Long lead-times for expenditure approval, approved-vendor constraints, risk aversion by facility staff, benchmark data about equipment and energy use, and awareness of ComEd programs

<p>4.</p> <p>Advanced Metering Infrastructure (AMI) - Facilitating improved (e.g. real time) metering will allow earlier detection of water leaks, reducing electricity waste for pumping</p>	<ul style="list-style-type: none"> • City of Joliet – open to partnering • Veolia – open to partnering • Core & Main 	<ul style="list-style-type: none"> • AMI is growing trend for water supply industry and in addition to likely water and concomitant energy saving provides other management benefits for water utilities. • Partner with WSPs already involved with AMI to further clarify needs ComEd could fulfill with pilot opportunities 	<ul style="list-style-type: none"> • Electricity wasted in leakage in ComEd service territory is estimated at 0.3-0.4 GWh/day¹⁷ 	<p>Phase 1 depth interview</p> <ul style="list-style-type: none"> • <i>Water Environment Federation</i> • <i>City of Joliet</i> <p>Phase 2 depth interview</p> <ul style="list-style-type: none"> • <i>Veolia</i> 	<ul style="list-style-type: none"> • Ongoing project in Naperville¹⁸ • Core & Main is a partner in this program
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Barriers Addressed

Addressing aging infrastructure needs

<p>5. On-bill energy financing program by ComEd to cover first-cost of large-scale energy savings programs with on-bill payments to recover investments</p>	<ul style="list-style-type: none"> Industrial or municipal customers Selected firm(s) to identify and qualify investment opportunities 	<ul style="list-style-type: none"> Create pilot project that provides energy audits at ComEd's expense by a qualified engineering firm to determine potential energy savings for industrial or municipal customers Establish lowest risk saving estimates for the project Customer pays the same average electric bill equal to or slightly lower to the amount prior to the implementation until the financing is paid off 	<ul style="list-style-type: none"> Lake in the Hills WWTP alone saw savings of 390MWh/Year¹⁹ 	<p>Secondary research Phase 2 depth interview</p> <ul style="list-style-type: none"> <i>Peterson and Matz</i> <i>Brown and Campbell</i> <p>Lake in the Hills WWTP Post interview conversations</p>	<ul style="list-style-type: none"> Not new, done successfully by utilities across the country
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Barriers Addressed Risk aversion, long lead times, capital expenditure concerns, first-cost

<p>6. ComEd might become an Energy Servicing Company (ESCO), venture with, qualify, or facilitate water companies' use of ESCOs to overcome first cost and risk aversion</p>	<ul style="list-style-type: none"> Peterson and Matz – open to partnering Other existing Chicago area ESCOs: <ul style="list-style-type: none"> GRP Wegman (Bethalto, IL) Burns & McDonnell (Chicago) APTIM Corp (Chicago) Santanna Energy (Bolingbrook, IL) Navigate Power (Chicago) 	<ul style="list-style-type: none"> ESCOs provide a performance saving guarantee, and usually offer up front funding as needed as well Further identify ESCOs in ComEd service territory dealing with water technology Collaborate to develop pilot test programs dealing specifically with: <ol style="list-style-type: none"> Aeration 	<ul style="list-style-type: none"> In Colorado, Xcel Energy acts as an ESCO and one single program provided 7.8 GWh/year of electricity savings²⁰ 	<p>Secondary research Phase 1 depth interviews</p> <ul style="list-style-type: none"> <i>Erik B. – Clean Energy Trust</i> <p>Phase 2 depth interview</p> <ul style="list-style-type: none"> <i>Earthwise Environmental</i> <i>Veolia</i> <i>Greeley and Hansen</i> <i>Peterson and Matz</i> <i>Brown and Campbell</i> <i>Evoqua</i> 	<ul style="list-style-type: none"> Not new; ESCOs are used in many states Federal DOE qualified ESCOs²¹
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	<ul style="list-style-type: none"> ▪ BKE Energy (Orland Park, IL) 	<ol style="list-style-type: none"> 2. Pumping 3. Filtration 			
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Barriers Addressed Performance ambiguity (w/ savings guarantee), risk aversion, first-cost

<p>7. New and/or expanded incentives (e.g., funding assistance) for high-volume or old (e.g., 2000 or older) water pumping and conditioning equipment replacement can save substantial electricity</p>	<ul style="list-style-type: none"> • Outer suburbs that pump groundwater for water supply • Wastewater collection systems “force mains” (pipes under pressure) or in plant pumping, if needed 	<ul style="list-style-type: none"> • While VFDs are already rebated this pilot would expand the knowledge of that program and could help facilitate more use of it with study dollars and capital assistance • Program could use “asset management” parameters like an age parameter (e.g., 10- 15 years old) instead of a year (e.g., 1990) so additional equipment would age into eligibility every year. For large scale systems predictive maintenance and engineering estimates could determine eligibility through the custom rebate program 	<ul style="list-style-type: none"> • Ashland, MA example: 194 MWh of electricity savings/year for municipality of 16,000²² • ComEd territory extrapolates to ~105 GWh/year savings (scaled on gallons of water); note: bigger water utilities likely have already done much of this 	<p>Secondary research</p> <p>Phase 1 interview</p> <ul style="list-style-type: none"> • <i>Northwest Suburban Municipal JAWA</i> • <i>City of Joliet</i> <p>Phase 2 interview</p> <ul style="list-style-type: none"> • <i>Brown and Campbell</i> • – <i>Evoqua</i> <p>2019 Axiom/ComEd depth interviews</p>	<ul style="list-style-type: none"> • Not new • Recently completed by City of Ashland, MA²³ • Massachusetts Department of Energy Resources (MA DOER) is a program partner²⁴
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Barriers Addressed Equipment eligibility constraints, process reliability, knowledge of equipment in use aging equipment

Endnotes, Documentation and Data Sources

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- ¹ [Total Water Sector Energy Usage in ComEd Service Territory](#), ComEd 2019
 - ² [ComEd 2019 Water Study Final Report](#), ComEd December 2019
 - ³ [ComEd 2019 Water Study Executive Summary](#), ComEd December 2019
 - ⁴ Phase One [Executive Summary](#)
 - ⁵ [SEDAC case study, Annawan, IL](#)
 - ⁶ Chicago Metropolitan Water Reclamation District (MWRD), [monthly operating data](#)
 - ⁷ [SEDAC case study, Annawan, IL](#)
 - ⁸ [Wisconsin Focus on Energy](#)
 - ⁹ Massachusetts Clean Energy Center, [Water Innovation programs](#)
 - ¹⁰ [New England Water Environment](#) project
 - ¹¹ Carthage, TN [Wastewater Treatment Plant Case Study](#)
 - ¹² Based on total MWRD energy use and estimated savings ratios of similar projects
 - ¹³ Carthage, TN [Wastewater Treatment Plant Case Study](#)
 - ¹⁴ Tennessee Environment & Conservation, [Energy Conservation and Efficiency](#)
 - ¹⁵ [Tennessee Industrial Assessment Center](#), Joint project with University of Memphis and Tenn. Dept. of Environment & Conservation
 - ¹⁶ University of Tennessee, Office of Sustainability, [Energy Use Sustainability Master Plan](#)
 - ¹⁷ Energy Central, [How Much Water Does a Water Leak Waste](#)
 - ¹⁸ Naperville, IL, [Water 2.0 Project](#)
 - ¹⁹ [Lake in the Hills Sanitary District](#)
 - ²⁰ Xcel Energy, [Demand-Side Management Plan 2021-22](#), Energy and Demand Savings Targets, page 13
 - ²¹ U.S. Department of Energy, [Qualified Energy Service Companies](#)
 - ²² Ashland Howe Street Wastewater Treatment Plant, [Case Study](#)
 - ²³ Ashland Howe Street Wastewater Treatment Plant, [Case Study](#)
 - ²⁴ Mass. Department of Energy, [Clean Energy Results Program](#)