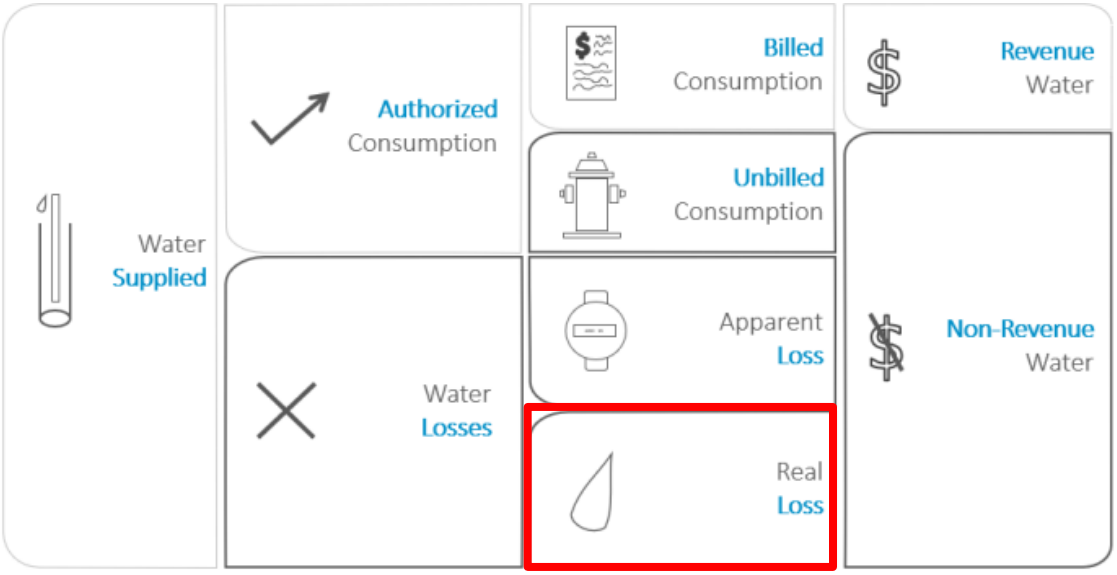
ComEd Water Infrastructure Leak Reduction Pilot CY2021 Evaluation Plan

Introduction

ComEd launched the Water Infrastructure Leak Reduction pilot in CY2020. This pilot fosters energy and water savings by incentivizing municipal water infrastructure improvements.[1] The pilot team recruited four communities in ComEd's service territory. The pilot team used geographic information system (GIS) modeling and energy use data to identify risk areas in the community's water infrastructure via Rezatec's software mapping system. The pilot team selected M.E. Simpson, a local company providing technical services to water utilities, to conduct leak assessments for the four communities in the areas identified as high risk. The leak assessments began in in August 2021. As communities were informed of the findings of the leak assessments, they decided to address the leaks identified. These actions will result in water and energy savings which were not previously anticipated as part of the pilot. The overall goal of the project is to demonstrate the potential for saving water and energy for these communities.

It is important to note that this pilot is designed to address only the real losses stemming from water leakage and not to address apparent losses. Apparent losses caused by measurement failures or theft could be addressed using other measures outside the scope of this pilot. Figure 1shows what contributes to revenue generating and non-revenue generating water pathways for utilities. The portion of water supplied that ends up as real loss is outlined in red in Figure 1.

Figure 1. Schematic of Water Supplied Pathways



Source: California Water Service Group 2019. California's Largest Private Water Agency Tackles Water Loss Control. https://ceregportal.com/wsi/documents/sessions/2019/W-1910.pdf

Guidehouse proposes to evaluate the pilot project using two methodologies: acoustic leak detection and a control volume analysis. The water savings determined from these two methods will then be converted to energy savings in kWh. If the results vary from the two approaches, Guidehouse will make a recommendation on which approach is most appropriate for estimating energy savings given the data

[1] ComEd Energy Efficiency Program. Municipal Water Infrastructure Leak Reduction Proposal Summary. https://www.comedemergingtech.com/project/water-infrastructure-leak-reduction

provided and conditions. In addition, Guidehouse will provide recommendations on estimating energy savings if these communities were to install continuous leakage monitoring systems and institute a continuous leakage repair program. Guidehouse has considered the risks and data needs relevant to this evaluation process.

Evaluation Approach

Guidehouse plans to evaluate this pilot using two methodologies, acoustic leak detection and control volume analysis, and then compare the findings. We describe the two evaluation approaches below.

Step 1: Estimate Annual Water Leakage Reduction

Method 1: Leverage estimated leakage from acoustic leak detection

- Review on site acoustic leak detection data from M.E. Simpson that identified leaks in areas with high risk as indicated in the analysis done by Rezatec
- Review information from communities on which leaks were repaired and when
- Estimate a total water loss reduction per community by adding the leakage rates for all the leaks that were repaired by the communities

Method 2: Conduct a control volume analysis

- Review utility water supply and customer usage data (as measured through aggregation of customer meters) from a sufficient period before and after leaks were fixed
- Quantify water loss percentage pre and post leak repair
- Compare estimated pre leak repair water loss percentage with latest AWWA Water Audit
    - If values differ by more than 30%, Guidehouse will assess potential reasons for discrepancies and identify a path forward. This may include, but is not limited to, collecting additional data, using AWWA pipe leakage data or interviewing water utility personnel.
- Calculate net change in water loss percentage and apply to communities' average annual water usage to estimate water loss reduction

Step 2: Estimate Annual Energy Savings in kWh

Both evaluation methods will provide an estimate of the annual water savings that resulted from pilot activity. These water savings will then be converted to energy savings using estimates specific to the Illinois water supply[2] and leveraged by the Illinois Technical Reference Manual (TRM). These values are displayed in Table 1. We will use a conversion rate of 2,571 kWh/MG to estimate energy savings.

[2] Guidehouse does not plan to consider any reduction in energy usage from the wastewater treatment system since it is unlikely that the leaks identified are impacting the wastewater treatment system.

Table 1. Illinois Water Supply Energy per Gallon Factor

Water Source	kWh/MG	Percent of IL Water Supplied	Weighted kWh/MG
Groundwater	2,844	67%	1,905
Surface Water	2,019	33%	666
		Water Supply kWh/MG	**2,571**

Source: Elevate Energy 2018. Illinois TRM: Energy per Gallon Factor
https://s3.amazonaws.com/ilsag/Elevate_Energy_Presentation_Overview_Energy_per_Gallon_Factor_6-21-18_SAG.pdf

Step 3: Provide Guidance on Energy Savings Estimation Approach for Continuous Leak Detection and Repair Programs

TRC is working with the four pilot communities to submit proposals for funding for continuous leak monitoring systems. These continuous monitoring systems can lead to extensive reductions in water leakage if they are also paired with an ongoing leakage repair program. Guidehouse will provide guidance on the data needs and methods for estimating the ongoing energy savings that could be achieved with these programs for the four communities. Specific items that will be addressed include:

- Considerations for measure life
- Data needs to calculate annual water savings estimates for continuous monitoring and repair programs
- Cost-effectiveness considerations

Evaluation Risks

Guidehouse has considered the risks associated with the two evaluation methodologies. In the first method, acoustic leak detection, technicians from M.E. Simpson listen for leaks at multiple points along the water supply system. When a leak is detected, two technicians estimate a leakage rate. In some cases, this may be a range. Inaccuracies in this method can be introduced if there are multiple leaks that are all detected at the same time but may be estimated to be a single leak. There is also potential for inaccuracies to be introduced during the data reporting and transfer from M.E. Simpson to TRC to Guidehouse. In addition, this method is dependent on TRC receiving data from at least one community that includes the location and timeline of when leaks were repaired.

The second method, control volume analysis, requires that water utilities provide sufficient flow data for the months following the leak repairs. Given the timeline of the pilot and the manner that utilities process this data, acquiring this data poses a challenge. A control volume analysis is also subject to influence by extraneous impacts such as new leaks or a reduction in leaks for reasons not related to pilot activity. These variables will need to be controlled for as best as possible.

Data Needs for Evaluation

Table 2 shows the data that Guidehouse requires for the evaluation approach outlined above. Dataset 1 is completed by M.E. Simpson. Guidehouse needs at least one of the pilot communities to supply datasets 2 through 5 to complete the proposed evaluation approach.

Table 2. Data Needs for Evaluation

#	Dataset	Purpose
1	Estimate of water leakage detected per community from M.E. Simpson	Method 1: Acoustic Leak Detection Analysis
2	Documentation of leakage repairs undertaken (location and timing)	Method 1: Acoustic Leak Detection Analysis
3	2020 AWWA Water Loss Audit	Method 2: Control Volume Analysis
4	Community Utility Supply and Usage Data – Three months before repair	Method 2: Control Volume Analysis
5	Community Utility Supply and Usage Data – At least one month after last documented repair was completed, preference is three months	Method 2: Control Volume Analysis

Evaluation Schedule and Deliverables

Table 3 outlines an evaluation schedule featuring deliverables with their responsible party and anticipated date of delivery.

Table 3. Schedule – Key Deadlines and Deliverables

Activity or Deliverable	Responsible Party	Date
Draft Evaluation Plan	Guidehouse	November 3, 2021
Meeting to review Evaluation Plan	Guidehouse	November 8, 2021
Comments on Draft Evaluation Plan	ComEd	November 24, 2021
Final Evaluation Plan	Guidehouse	December 10, 2021
Final Pilot Data	ComEd	January 30, 2022
Draft Report to ComEd	Guidehouse	March 8, 2022
Comments on Draft Report	ComEd	March 29, 2022
Revised Draft to ComEd	Guidehouse	April 5, 2022
Comments on Revised Draft	ComEd	April 12, 2022
Final Report to ComEd	Guidehouse	April 19, 2022