

Integrating Acoustic Leak Detection Into Smart Water Metering

kamstrup

Kamstrup Team @ CRC Water Loss Conference 2023

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Agenda

- Kamstrup Water Metering LLC
- Non-Revenue Water & Challenges
- Integrated Acoustic Capabilities & Benefits
- Case Story: Oneida Water Department (Tennessee, USA)
- Case Story: Others
- Questions & FAQ

Kamstrup Water Metering LLC

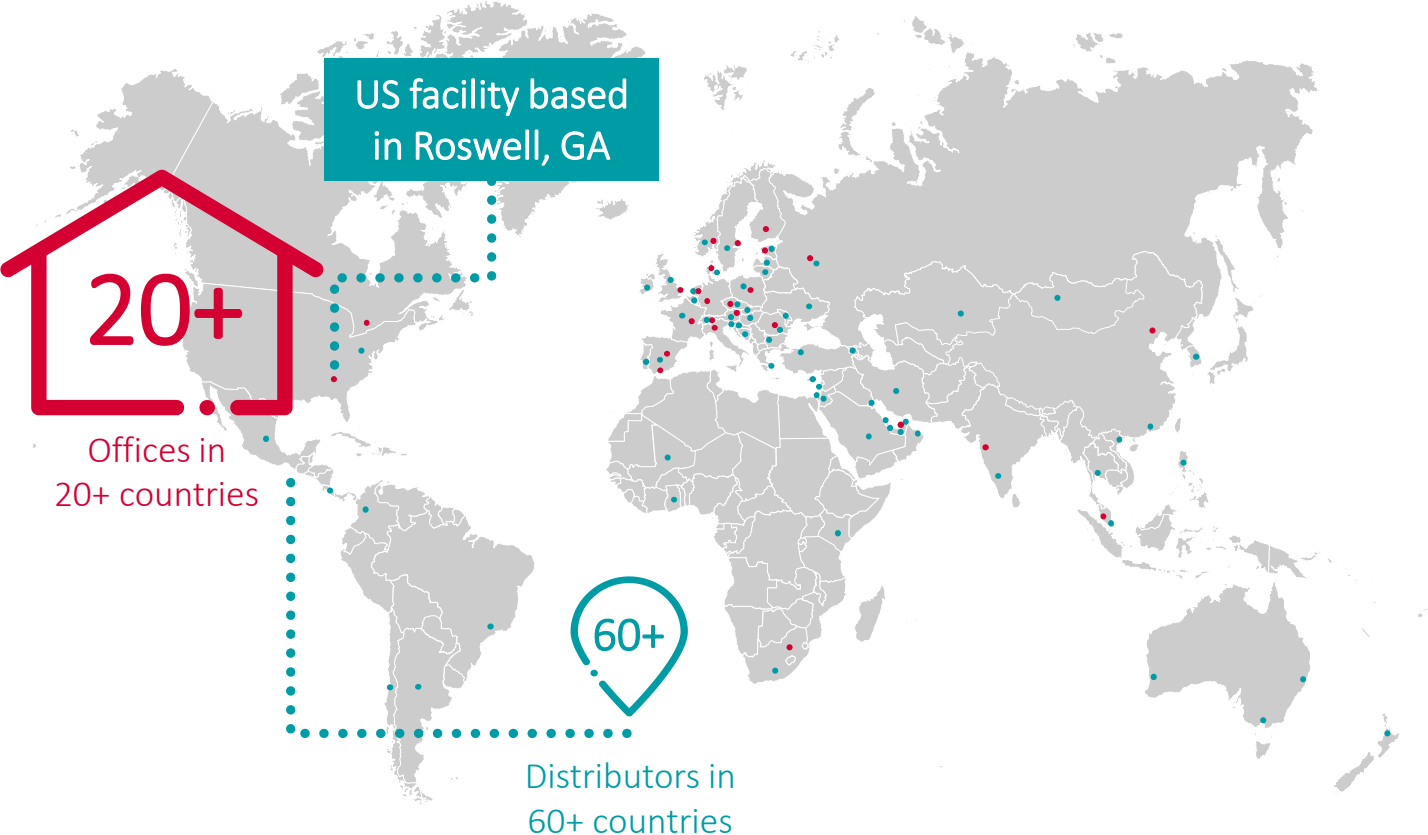
Technology and Innovation at our Core

At Kamstrup, we have **more than 30 years of experience** within ultrasonic metering

Patented technology and solutions portfolio focused on eliminating **Non-Revenue Water**



Global Expertise





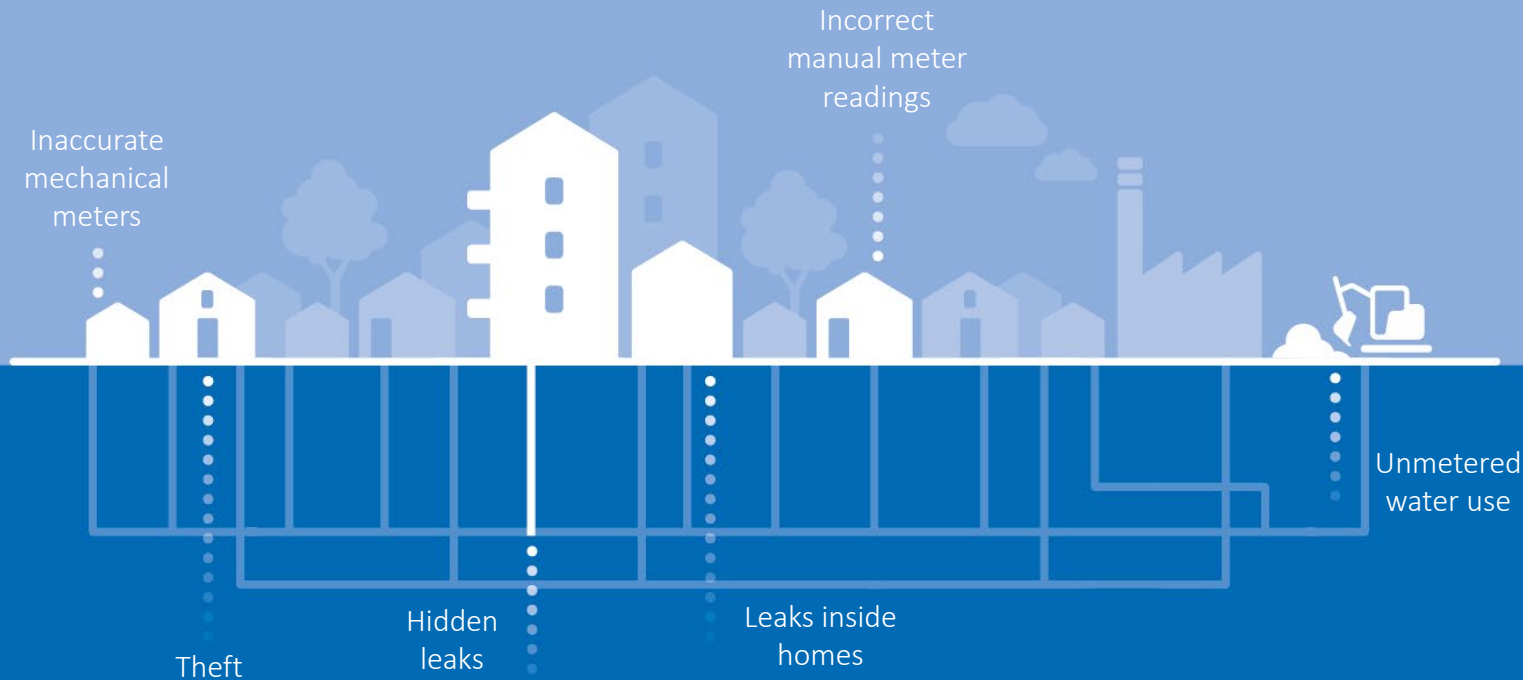
Everything we sell around the world is developed and manufactured by Kamstrup in automated production facilities

8M+ ultrasonic meters shipped with a global failure rate of 0.5%

Non-Revenue Water & Challenges



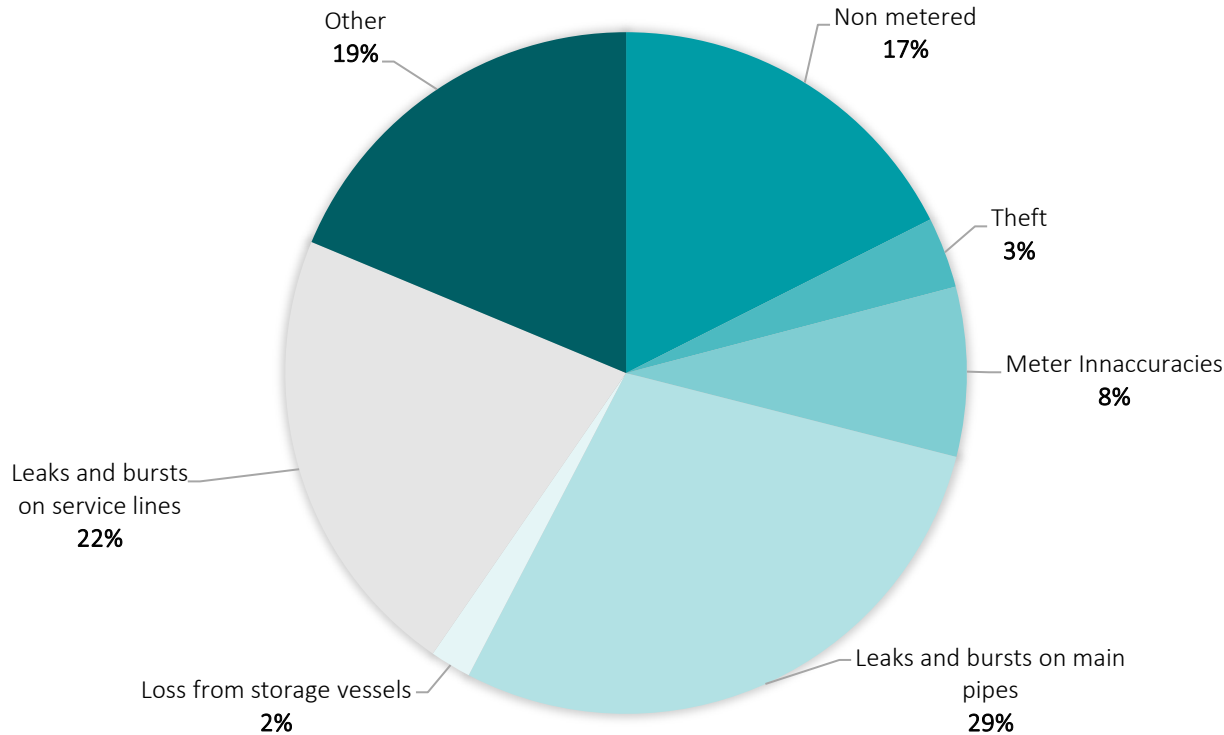
Non-Revenue Water is many things..



IWA/AWWA Water Balance

Water Supplied	Authorized consumption	Billed authorized consumption	Billed metered consumption	Non-Revenue Water
			Billed unmetered consumption	
		Unbilled Authorized consumption	Unbilled unmetered consumption	
			Unbilled metered consumption	
	Water loss	Apparent losses	Unauthorized consumption (Theft)	
			Metering inaccuracies	
		Real losses	Leaks on transmission and distribution mains	
			Leaks on overflow at utility storage tanks	
			Leaks on service connections up to metering points	

Distribution of Non-Revenue Water



Leaks and bursts on service lines

Leak Detection

Leaks and bursts on main pipes

Leak Detection

Non-Metered

Static metering

Meter Inaccuracies

Static metering

Theft

AMR/AMI metering

Loss from storage vessels

District Metered Area (DMA)

Other

Optimization of treatment plant

*Based on an independent survey
of 30+ US water utilities*

How are water utilities currently doing leak detection?



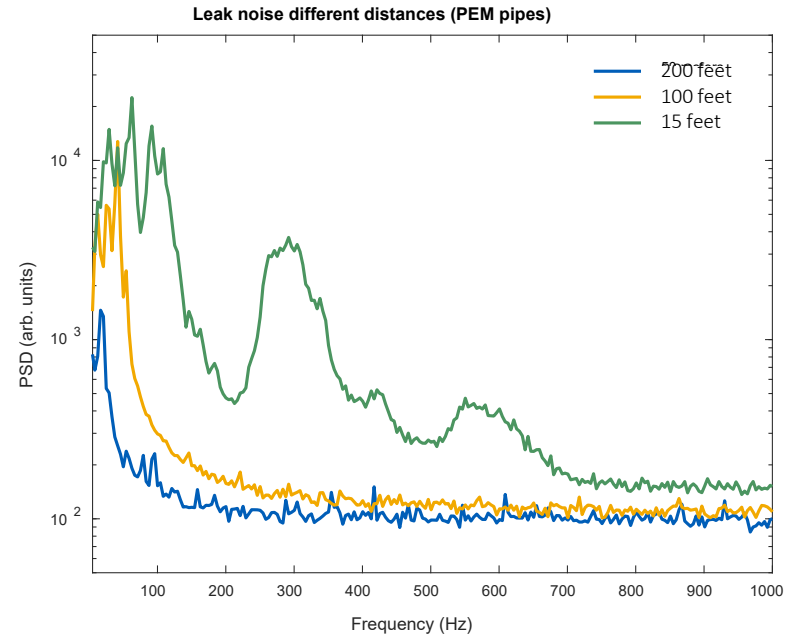
Challenges with Acoustic Leak Detection

Generation and propagation of leak noise governed by phenomena like:

- Turbulent flow at the hole
- Cavitation
- Bubble formation/oscillation
- Pipe material
- Pipe dimension
- Water pressure
- Pipe surroundings

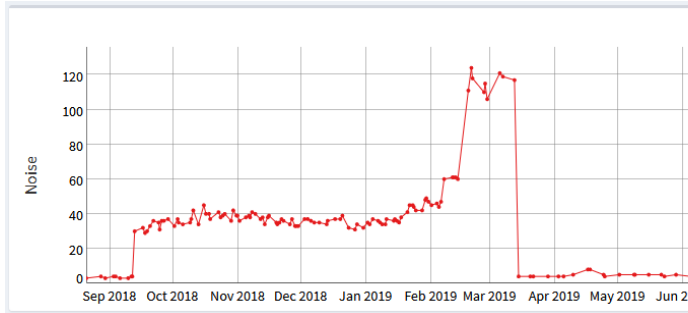
Sensor efficiency is highly dependent on:

- Sensor type
- Distance to leak
- Access to pipes
- Coupling of sound into sensor
- Data analysis

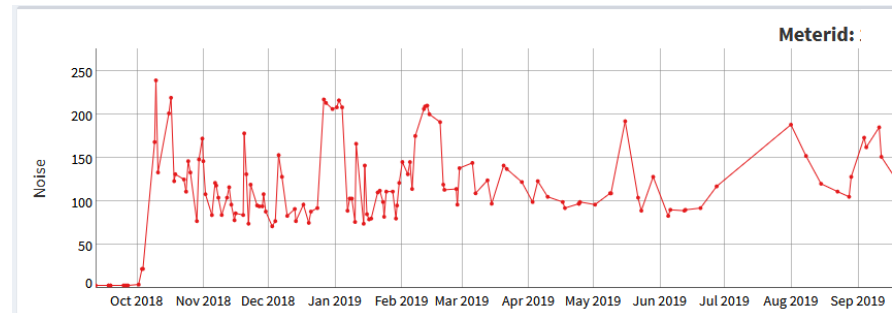
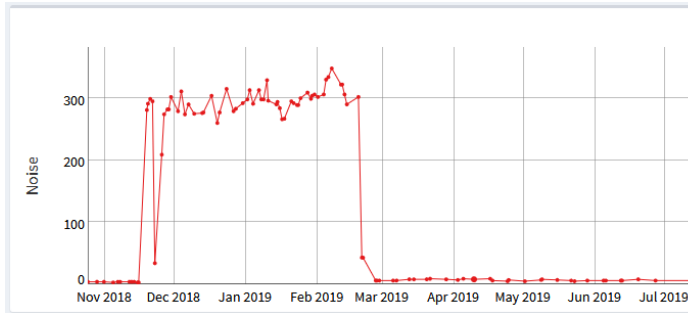
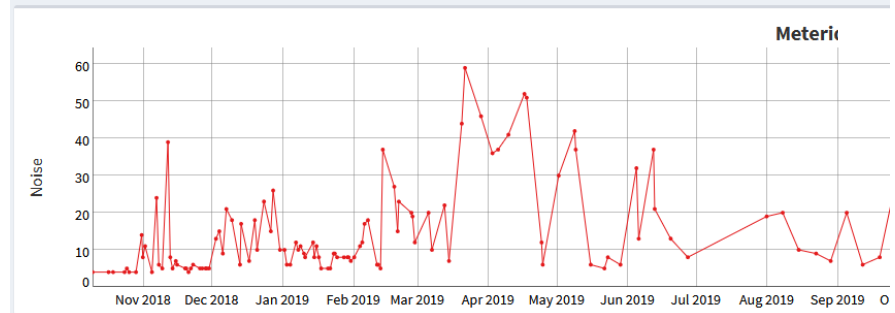


Challenges with Acoustic Leak Detection

Leak noise



Ambient noise

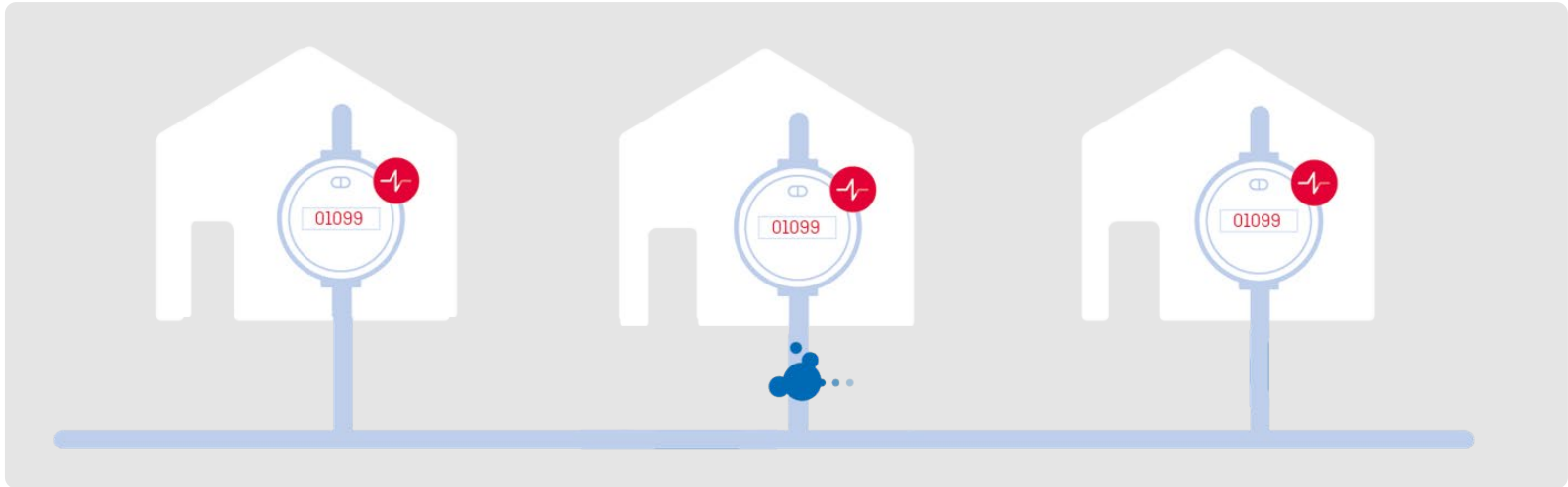


Integrated Acoustic Capabilities & Benefits

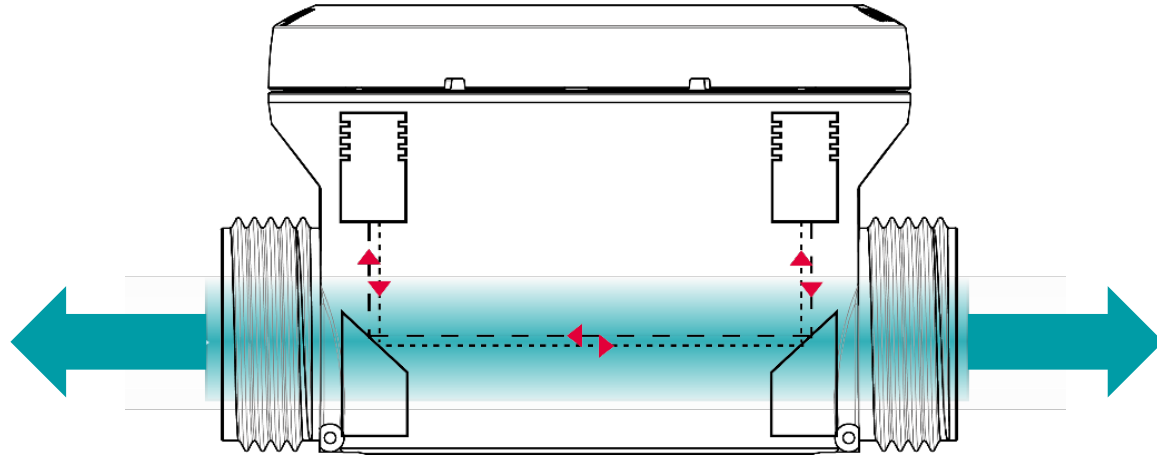
Integrating Acoustic Leak Detection into a Smart Meter

How does it work?

- It is known that if you have a leak, it will likely generate noise.
- With an integrated acoustic sensor, the meter is equipped with a new sensor that allows for measurement of acoustic noises.



Integrated acoustic sensor with the ultrasonic measuring principle



With the integrated acoustic sensor, it is possible to measure noise in both direction of the pipe.

The acoustic sensor does not influence the flow measurements at any time.

Different Technologies - Example of deployment

Main Line Focus



Ex. 30 Main Loggers => 1 Logger Per 800 Ft

Service and Main Line Focus



Ex. 450 Water Meters => 50 Ft



Increased coverage when compared to the mains/hydrant sensor leak sensor



No additional system purchases, maintenance, costs as well as a 20-year solution

Water meter-based sensor

Introducing an acoustic sensor into a water meter you obtain:

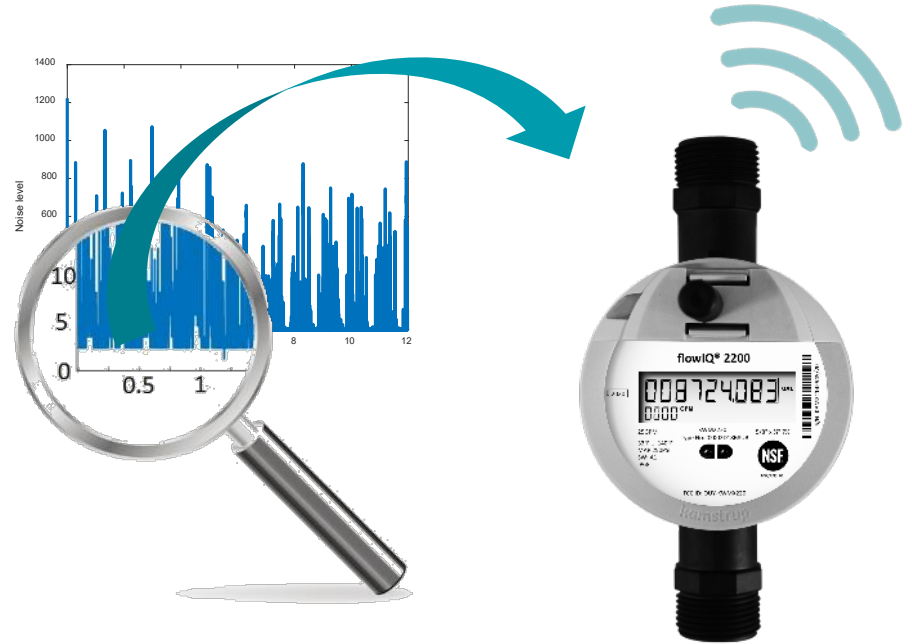
- Sensors installed throughout the grid
- Sensors coupled directly (strongly) to the water pipe
- Low maintenance
- Use of existing radio network

Challenges it addresses:

- Cost of retrofitting leak sensors
- Lift-and-shift
- Finding leaks efficiently on PE pipes
- 20-year battery lifetime covered under one warranty with the smart meter

How to avoid false-positives:

- Measuring acoustic noise 26 times a day
- Only using 1 out of the 26 measurements to determine the lowest noise
- 26 measurements ensures that measurements are random times everyday.



Advantages of an Integrated Acoustic Solution



Acoustic leak monitoring across the entire distribution network.



No additional infrastructure to install and maintain.

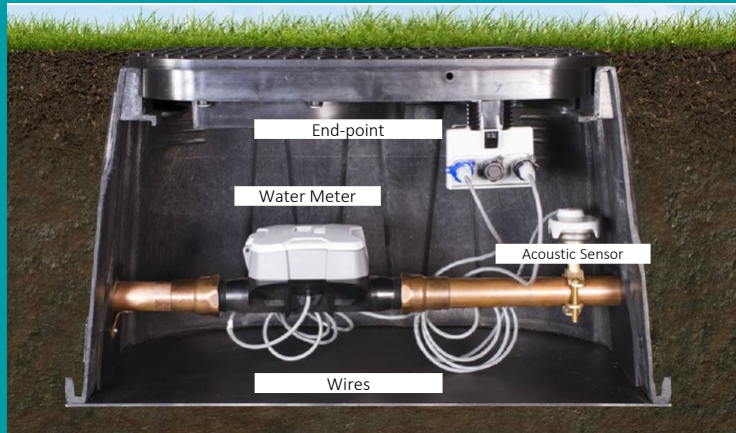


Prioritize maintenance in known problem areas.



Monitoring noise in the pipes to indicate potential leaks 24/7 - 365 days of the year.

Reduced Complexity



Add-on Leak Sensor

Meter price + Radio price + Leak Sensor price

Meter installation + Radio installation + Leak Sensor installation

2 wires

3 hardware components to manage / troubleshoot

3 different warranties

2 different vendors, multiple distributors



Integrated Acoustic Sensor

Meter price

Meter installation

No wires

1 hardware component to manage / troubleshoot

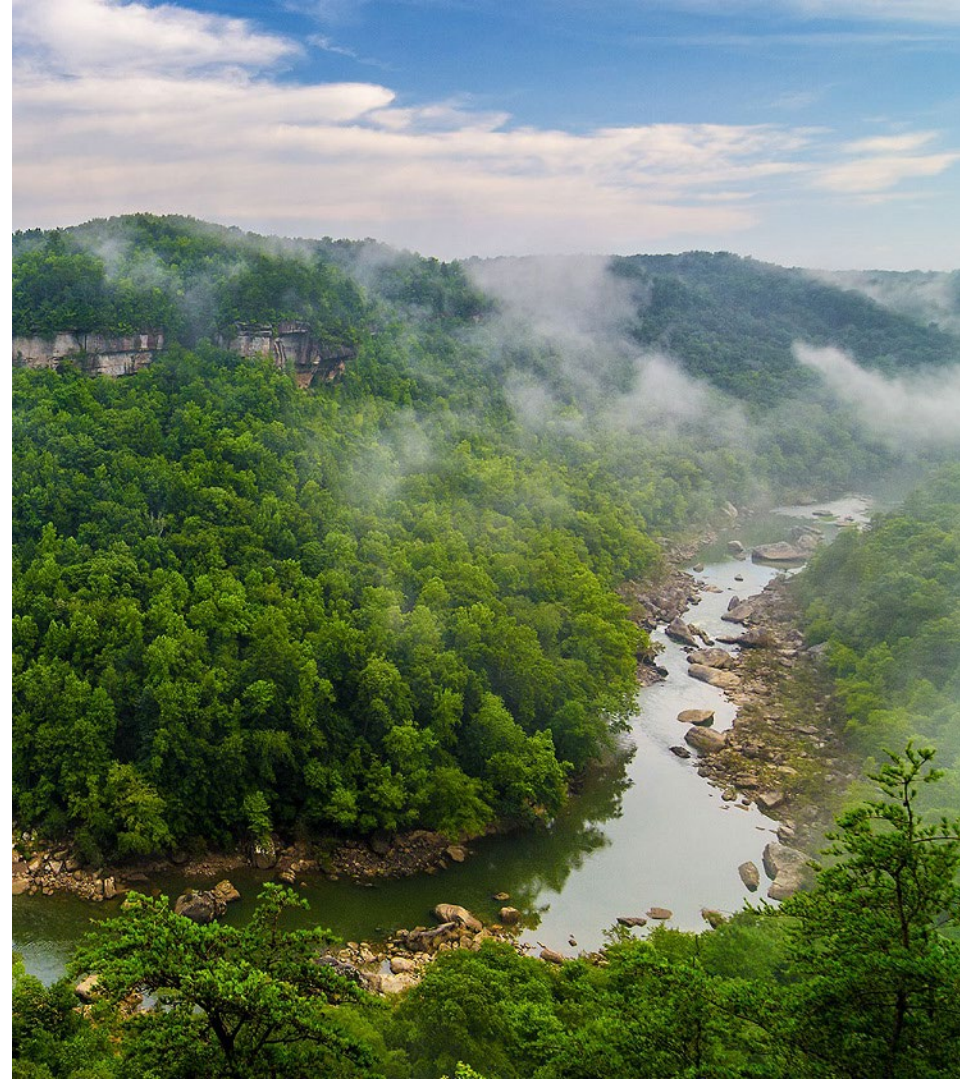
1 warranty

1 vendor, 1 distributor

Case Story: Oneida Water Department

Town of Oneida, TN

- 4,620 AMI / ALD Meters
- 15 Data Collectors
- 306 Square Kilometers (118 Square Miles)
- 515 Kilometers (322 Miles) of Mainline Pipe
- February – June Deployment Schedule



Oneida Changed out Mechanical 4,620 AMR Meters





Water Loss at 51%

- Oneida Water Department under new management seeing the water loss at 51%, chose to go with the new AMI/ALD meter due to its overwhelming accuracy and reliability.
- In the first 3 months, Oneida went from 51% water loss to 28%.
 - Of that, 10.7% was after the initial total changeout. Which indicates the existing water meters were not registering accurately.
 - At the initial Kamstrup meter startup Oneida had 77 meters that had acoustic sound levels over 100 decibels indicating possible leaks.



Water Loss Recovery

- Oneida initiated an aggressive water loss recovery program.
 - Placing **2 full time employees** with leak detection equipment.
 - Using ALD, **37 leaks** have been located and repaired by the Distribution repair crew.
- Currently we are at:
 - **28% water loss**, but we are on track and anticipate by the end of this year to be 20%
 - And by mid 2024 to be at **15% water loss** which will save approximately **\$140,000** in loss revenue and **gained 36** working days not having to read meters to spend more time finding water leaks.



Cost Savings

- Based on the **10.7% water loss reduction** on the initial change out alone, Oneida saved approximately **\$3,350 per month**.
- The meter system is on track to save us approximately **\$40,200 per year** on the meter change out alone.
- During the initial changeout, the water treatment plant was operating on average around **15 hours per day**.
- Currently, the treatment plant has been able to cut down the hours of operation to an average of **11 hours per day**.

Utility Service Line

- High noise detected on several meters
- Service line leak had been running a minimum of 5 months



Site visit with Oneida, TN

Leak estimated at 7.6 liter/min (2 GPM) and had been running for at least 5 months



Utility Service Line made from ductile iron



Distance to leak ranged between 10 meters to 50 meters

Customer Success

- High noise detected on single meter
- Service line leak had been running a minimum of **4.5 months**
- The revenue lost estimated around **\$21,000** in 12 months



Leak Detector



Site visit with Oneida, TN



Leak estimated at 15 liter/minute (4 GPM) and had been running for at least 4 months



Utility Service Line made of PVC



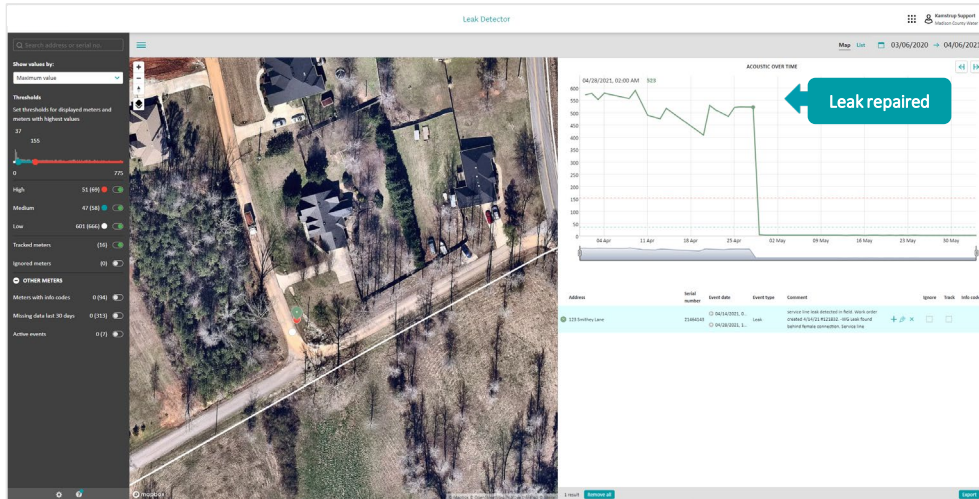
Distance to leak was approximately 15 meters

Case Story:

Madison County, AL & Row River Valley, OR

Customer Success

- Smaller suburban area in Madison County, AL
- Water leak never reached the surface (nearby creek absorbed it)
- Leak had been running for approximately **2 months**
- Total water lost accounted to **1,635 cubic meters (432,000 gallons)**
- *If the leak had been running for 12 months: 10,000 cubic meters (2,628,000 gallons)*



Leak Detector



Site visit with Madison County, TN



Leak was estimated around 19 liter/min (5 GPM) and had been running for at least 2 months



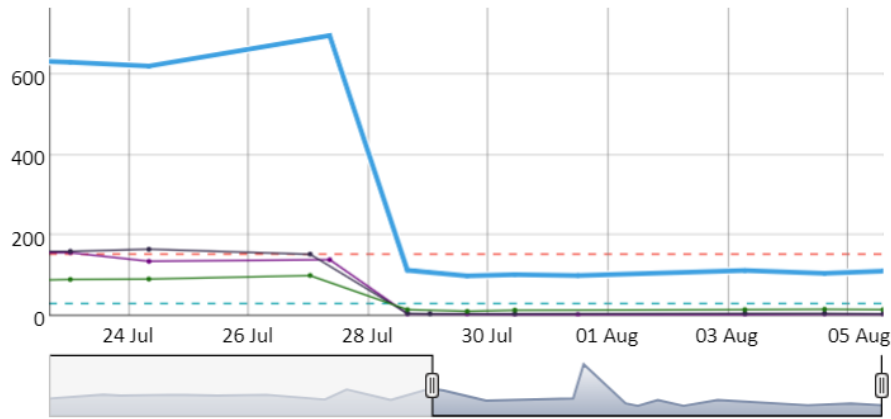
Utility Service Line made from polyethylene



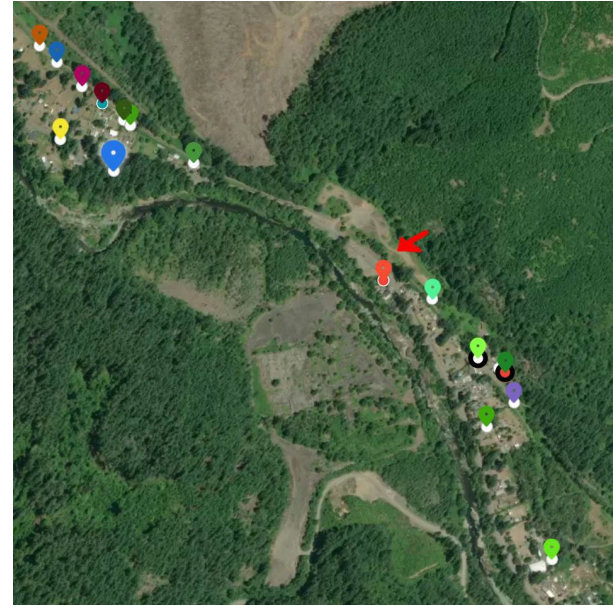
Distance to leak was approximately 2 meters

Customer Success

ACOUSTIC OVER TIME



Address	Event date	Event type	Comm...	Ignore
Dorena, 97434	07/30/2021 08/03/2021	Leak	Fixed 3...	<input type="checkbox"/>



Leak on a 14" main



114 liter/minute (30 GPM) rate of flow



Distance heard up to one kilometer on both ends from galvanized pipe



Thank you for listening!

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