AT&T 10x Case Study:

Multi-party collaboration leverages AT&T connectivity to help Gwinnett County reduce water consumption and carbon footprint

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AT&T believes technology plays a critical role in reducing carbon emissions. So, we're using the power of our network to create a better, more environmentally sustainable world. We've set a goal to enable carbon savings 10x the footprint of our operations by the end of 2025.

To meet this, we're working to make our operations more efficient across the company. We're also working with our customers and technology partners to implement and scale carbon-saving solutions. This case study discusses and quantifies the carbon benefits of using AT&T technology to boost efficiency. This is one study in a series we're sharing as we progress toward our 10x goal.

Learn about our goals, our progress, and more case studies like this at att.com/10x.

Summary

As cities and counties come under increasing pressure to reduce costs, improve efficiency and minimize environmental impact, they are looking for expertise to help them meet these challenges. AT&T Internet of Things (IoT) connectivity solutions can work with a wide range of technology equipment and service providers to deliver solutions that help them succeed.

Working with Qualcomm Technologies, Jacobs and Gwinnett County, GA, AT&T implemented an advanced metering infrastructure (AMI) pilot that helped Gwinnett County Department of Water Resources (GCDWR) increase visibility of the performance of their water utility and improve water safety while reducing water-related waste and costs.

The 500-house pilot used a combination of AT&T LTE connectivity, smart meters using Qualcomm Technologies' LTE cellular modems and Jacobs digital solutions to create performance metrics and alerts that helped GCDWR identify water quality risks and leaks.

Over the course of the one-year pilot, GCDWR identified and addressed several water safety issues that previously would have gone undetected. In addition, the increased visibility highlighted several substantial leaks in the utility's infrastructure and at customers' homes that they addressed quickly, reducing average water usage by **1.4 gallons** per home per day. This may not sound like much, but it adds up to almost **500 million gallons** of water a year for a community of around a million homes, helping to lower water consumption and costs. Because water treatment and pumping uses so much energy, saving water also effectively reduces community greenhouse gas (GHG) emissions. For a community of about a million homes, over the course of a year, these water savings could add up to GHG emissions reductions equal to burning over **55,000 gallons of gasoline.**[1]

Estimated annual benefits of advanced metering infrastructure for a community of 1 million houses:

Almost **500 million gallons** of water saved

GHG emissions avoided equivalent to over **55,000 gallons of gasoline**[1]

Improved water safety

Lower customer water bills

The Challenge: Finding the right resources to develop a technical solution to help reduce water safety risks while reducing consumption and costs

Gwinnett County, located less than an hour drive to the northeast of downtown Atlanta, GA, is in a drought-prone region, so minimizing water losses systemwide, for both the utility and its customers, can help maintain service, especially during periods of insufficient rainfall.

GCDWR recognized that a connected water infrastructure has the potential to help them identify opportunities to increase the safety of the system while reducing water waste due to leaks. As a county that is working to integrate sustainability into their community, they're also working to reduce GHG emissions. They realized that a smart water system also has a hidden GHG benefit because most water is cleaned and pumped before it is used, a process that can be energy intensive. As a result, reducing water waste also reduces energy and associated GHG emissions.

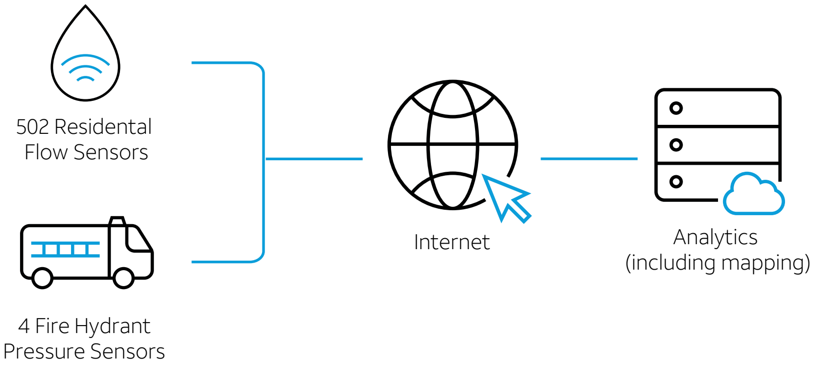
GCDWR realized that there were many benefits to creating a smart water infrastructure, but they didn't have the internal expertise to develop such a solution.

The Solution: AT&T, Qualcomm Technologies and Jacobs collaborate to implement advanced metering infrastructure

GCDWR engaged AT&T, Qualcomm Technologies and Jacobs to conduct a targeted trial in a neighborhood with 502 houses over the course of a year.[2] To enable real-time monitoring and tracking of water usage, AT&T provided the highly secure cellular LTE connectivity that enabled reliable, plug and play connectivity for the smart meters that use Qualcomm Technologies' power-efficient LTE modems. Qualcomm Technologies solutions can support a wide range of use cases from residential to industrial meters and a variety of different communications technologies. Jacobs acted as the systems integrator, advanced software applications developer, and project manager to oversee the success of the project.

The AMI solution was comprised of 4 key components:

- Residential flow sensors
- Fire hydrant pressure sensors
- Cellular connectivity
- Analytics (including mapping)



The team installed flow sensors at 502 homes and a community center in the test neighborhood. They also installed pressure sensors on 4 fire hydrants. The residential meters collected data every 15 minutes and sent it to the cloud every 6 hours. However, if there was an alert, the information was sent immediately so that the issue could be fixed quickly. The fire hydrant pressure sensors measured the water flow every 1/10 of a second and sent the data to the cloud every hour. All data was transmitted by the AT&T 4G cellular network to provide the highly secure connectivity needed for this critical infrastructure.

The AMI system allowed for user-defined thresholds that could be used to alert the GCDWR if there were unexpected issues, including:

⚠ Alert Type	ⓘ Problem	🔑 Key Issue
Unusual water flow	Water leak	Water consumption
Backflow	Dirty water flowing into potable water	Water safety
System offline	Water meter tampering	Water resilience

If the system identified a sudden spike, GCDWR customer service called the homeowner to alert them of the issue, then sent a customer service representative to the house to resolve the problem, which was typically a leaking toilet, water heater or irrigation system.

In addition to the alert system, the AMI system included analytics tools that incorporated a geographic information system (GIS). This overlay created a map that the team could use to identify if the problems were clustered in one place, indicating a broader, system-wide issue that may not have been visible otherwise.

EPA

Spotlight on Resilience

The USEPA Water Security Division was invited to join the pilot project to evaluate the backflow and meter tampering data streams. As part of the pilot, USEPA experts conducted a resiliency and security workshop with GCDWR and funded the development of advanced analytics for evaluating backflow and tampering data.

Sustainability Impact: Connectivity, sensors and analytics spotlight waste and safety issues

The GCDWR pilot is a great example of how an ecosystem of technology and solution providers can come together to build a robust solution that benefits a utility and its customers. It created value for Gwinnett County, its residents and the environment through remote monitoring of data and trends enabled by the AT&T LTE network, sensors, and analytics. It also shows the potential for these types of efforts to be done at a broader scale and bring expanded benefits for many more communities.

Using the AMI system, Gwinnett County was able to fine-tune their operations, save water on the utility side, and provide better and more secure customer experience. For instance, water pressure optimization helped provide consistent water flow for customers, but helped reduce the risk of leakage because of excessive water pressure. It spotlighted leaks quickly and gave the utility the information it needed to update policies to try to avoid leaks in the future. In addition to reducing water loss, the system helped identify backflow and tampering events that could impact public safety and are signs of water theft, saving money for the county. And for customers, the system helped customers reduce water usage. During the pilot, customer water usage declined 6.4%, which could lead to lower water bills.

6.4% water savings

Residential leak fixed within 24 hours thanks to system alert

Wider adoption of this type of AMI system could have substantial environmental benefits. If a community of 3 million people got similar results using an AMI setup to increase the efficiency and safety of their municipal water utility, they could reduce usage by **almost 1.5 billion gallons of water** and reduce GHG emissions by **almost 1,500 metric tons.**

Water Savings

87.2 million

The eqivalent of the number of US citizens skipping a shower[3] (as if all of Chicago didn't shower for the month of July!)

GHG Emissions Reduction

165,000 gal

The equivalent of gallons of gasoline not burned[4]

Applying the 10x Carbon Impact Methodology

Carbon Trust and BSR collaborated with AT&T in the development of a methodology to measure the carbon benefits of AT&T's technology. Details of the methodology can be found on the AT&T 10x website. The table below summarizes how the 10x methodology was applied to estimate the environmental impacts described in this case study.

Description of the Enabling Technology	AT&T connectivity enables advanced metering infrastructure (AMI), allowing for increased visibility of the performance of water utilities, improving water safety, reducing water leakages and thereby reducing water-related waste, emissions and costs.
Impact Category	This case study focuses on water savings resulting from the implementation of AMI in a pilot in Gwinnett County, GA.
Materiality	IoT-enabled AMI system allows for improved monitoring, which reduces water losses and associated GHG emissions, arising from a reduction in the energy used for the processing and pumping of the water.

Attribution of Impacts	The water and GHG savings described in this case study are a result of the design and manufacture of the AMI by Qualcomm, combined with the use of AT&T's IoT technology, as well as Jacobs' system integration and project management of the pilot. All parties, AT&T, Qualcomm, and Jacobs were fundamental in enabling the environmental benefits of the AMI.
Primary Effects	The implementation of AT&T-enabled AMI systems delivers measurable water, energy and cost savings. It decreases water consumption by monitoring for leaks, having allowed GCDWR to identify and address several water leaks and safety issues that previously would have gone undetected. It thereby also decreases the energy usage required for processing and pumping the water and the associated GHG emissions. Lastly, there are also direct cost savings associated with reducing water consumption.
Secondary Effects	Installing AMI may reduce vehicles emissions from unnecessary utility routine check-ups. This was not included in the study.
Rebound Effects	No rebound effects were identified.
Trade-Offs or Negative Effects	This technology does not appear to create other outsized or irreparable environmental or social impacts.
Carbon Burden from the Enabling Technology	The carbon burden is likely to consist of the embodied emissions of the IoT devices, and the Qualcomm and Jacobs equipment, as well as the emissions derived from the installation, use, and maintenance of the AMI system. The carbon burden of the enabling technology has not been considered.
Scope	The scope of the carbon abatement calculation covered the 502 houses based in Gwinnett County, GA, which were included in the 2018 pilot.

Timeframe	The calculations of GHG savings considered pre and post-installation water loss data of the advanced metering infrastructure. The data reviewed by the Carbon Trust was made up of a data set which covered the 502 houses included in the pilot: • The water loss before and after final installation was used as the basis for the calculations (Initial Phase and Phase II). • The Initial Phase is the baseline before the AMI was installed. Phase I included leak detection and Phase II was when the regulator was added to even out the pressure so it was easier to detect leakages, allowing for even greater visibility. **The assessment ran for the days listed below:** • Initial Phase: 1 May – 22 May 2018 • Phase I: 23 May – 5 June 2018 • Phase II: 6 June – 20 June 2018 Baseline water loss in this case study was determined by calculating the average across the Initial Phase (1 May – 22 May). This was subsequently compared to the average water loss of Phase II (6 June – 20 June) to determine avoided water loss.
Functional Unit	The functional unit for the GHG emissions reduction is metric tons of CO_2e (tCO_2e) per house.
Methodology	Water savings as a result of the AMI pilot were calculated by comparing the Initial Phase average loss (kgallons) to the Phase II average loss (kgallons). This difference was then extrapolated to cover a full year and also scaled up to estimate the potential water savings impact if this technology were to be implemented in all houses in Gwinnett. To calculate GHG emissions savings as a result of water savings, it was necessary to determine the average life cycle emissions intensity of the water within Atlanta, in order to develop Atlanta's average water emissions intensity carbon factor. The emissions intensity of a public water supply varies depending on the source of the water (i.e., ground source vs. surface), the topography of the land over which it is distributed (e.g., steep terrain requires more electricity to pump the water), the level of the water and wastewater treatment and the carbon-intensity of the electricity grid that powers the water processing and pumping. State level data covering grid emissions factors (including transmission and distribution (T&D) losses)[5] and water source breakdowns for public supply[6] was used with assumptions of water levels and wastewater treatment which were

Methodology (cont.)

based upon the standard practice of public water utilities in the U.S.[7] Energy usage figures for water distribution[8] and Well to Tank (WTT) emissions[9] were included in the calculation.

Key Assumptions

The testing period between 1 May and 20 June 2018 is assumed to be representative of water loss with and without the AMI. The following assumptions were made on the levels of water and wastewater treatment to determine the embodied emissions of Atlanta's water:

- The energy intensity of water treatment included coagulation, flocculation, filtration, microfiltration and disinfection. All of these processes are considered standard for a public water supply.[10]
- Tertiary wastewater treatment was assumed, as it is the most common degree of wastewater treatment.[11]

Figures for the energy intensity (EI) of total water supply and wastewater treatment (including treatment and distribution) were calculated using data (given in kWh/MG) taken from a California Public Utilities Commission study.[12] Figures were given in this study for the EI of supply and conveyance from various sources, different degrees of water and wastewater treatment and water distribution. Although data from the study is state specific, we believe it is reasonable to assume that water supply and wastewater treatment practices are largely consistent across the United States. In order to be conservative, where ranges in energy intensity of water treatment, wastewater treatment, conveyance, etc., were given, lower bounds of these ranges were taken.

The energy required to process the water was assumed to come from the local electricity grid. Some utilities may use fuel-powered pumps or systems, which are more carbon intensive than the grid. Likewise, they could also use electricity with a renewable energy guaranteed source of origin for all their operations, which would nullify the carbon intensity of the water. Having reviewed the energy usage of water utilities in the UK (which can be found in annual reports), it was apparent that using electricity from the grid is normal practice in water processing. Therefore, this assumption is reasonable and a more granular approach is not necessary.

The amount of water consumed (i.e., deferred from treatment) was calculated using FAO data,[13] which published figures for the total municipal water withdrawal in the United States and the amount of treated municipal wastewater. This figure was used to determine the percentage of water supplied that was treated after use in municipal wastewater facilities. According to the Compendium of Sanitation Systems and Technologies, 2nd revised edition by eawag,[14] wastewater includes used water from agricultural activities, surface runoff or storm water.

Exclusions	The embodied emissions of the IoT devices, and the Qualcomm and Jacobs equipment, as well as the emissions derived from the installation, use, and maintenance of the AMI system.
Data Sources	• California Public Utilities Commission. (2010). Embedded Energy in Water Studies, Study 2: Water Agency and Function Component Study and Embedded Energy - Water Load Profiles. GEI Consultants/Navigant Consulting. Retrieved from https://calisphere.org/item/ark:/86086/n2hq3xr1/ • DEFRA. (2017). Greenhouse gas reporting: conversion factors 2017. Retrieved from https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2017 • EPA. (2016). Emissions & Generation Resource Integrated Database (eGrid). Retrieved from https://www.epa.gov/energy/emissions-generationresource-integrated-database-egrid • Food and Agriculture Organization of the United Nations. (2012). AQUASTAT. Retrieved from http://www.fao.org/nr/water/aquastat/wastewater/index.stm • Molly A. Maupin, J. F. (2014). Estimated Use of Water in the United States in 2010. Virginia. Retrieved from https://pubs.usgs.gov/circ/1405/pdf/circ1405.pdf • Elizabeth Tilley, L. U. (n.d.). Compendium of Sanitation Systems and Technologies. eawag. Retrieved from http://www.iwa-network.org/wp-content/uploads/2016/06/Compendium-Sanitation-Systems-andTechnologies.pdf • Stanford Woods Institute, B. L. (2013). Water and Energy Nexus: A Literature Review. Water in the West. Retrieved from http://waterinthewest.stanford.edu/sites/default/files/Water-Energy_Lit_Review.pdf • Centers for Disease Control and Prevention. (2015, January 20). Retrieved from https://www.cdc.gov/healthywater/drinking/public/water_treatment.html • Gwinnett 502-house Pilot: District Measured Area metered flow and volume from 1 May and 20 June 2018 • Gwinnett 502-house Pilot: Total metered flow and volume (water metered in houses) from 1 May and 20 June 2018
Results	
Carbon Abatement Factor	Calculations concluded that installation of the advanced metering infrastructure produces annual emission savings of 0.00052 metric tons of CO_2e (tCO_2e) per house annually. The average emissions intensity factor of the water equated to 1.022 tCO_2e / million gallons.
Water Savings Factor	Annual water savings from implementation of the advanced metering infrastructure is approximately 504 U.S. gallons per house (253,000 U.S. gallons for the 502-house pilot).

Endnotes

1. Greenhouse Gas Equivalency Calculator," U.S. Environmental Protection Agency, August 16, 2019, https://www.epa.gov/energy/greenhouse-gas-equivalenciescalculator (Note, average eGRID electricity factors have been used rather than marginal AVERT electricity factors, this being a more conservative savings estimate).
2. June, 2017 – June, 2018
3. https://www.home-water-works.org/indoor-use/showers | 1.5 billion gallons/17.2 gallons per shower = 87.2 million showers
4. Greenhouse Gas Equivalency Calculator," U.S. Environmental Protection Agency, August 16, 2019, https://www.epa.gov/energy/greenhouse-gas-equivalenciescalculator (Note, average eGRID electricity factors have been used rather than marginal AVERT electricity factors, this being a more conservative savings estimate).
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