Combating Energy Loss and Protecting Revenue with Operations Optimizer

PROJECT OVERVIEW

Headquartered in Chicago, ComEd is one of America's largest utilities with more than four million customers across 11,000 square miles of mostly rural northern Illinois. In 2001, the Energy Infrastructure Modernization Act (EIMA) passed by the state legislature authorized ComEd to deploy smart meters to 100% of its customer base. One condition of the mandate was a requirement for ComEd to use the new technology to reduce non-technical energy losses to lessen the burden on ratepayers. The utility was required to shrink unaccounted for energy (UFE) by 50% and consumption on inactive meters (CIM) by 90% between 2013 and 2023. To help achieve the goals, ComEd used Itron's Operations Optimizer Revenue Assurance application to automate the analysis of data reported by its new fleet of smart meters.

THE PILOT

In 2012, Itron was one of the only vendors introducing revenue assurance analytics for smart meter data, and the partnership with ComEd was key to refining both the software and the service-delivery model. ComEd had already been working with Itron to address non-technical losses before smart-meter data was available. Each month, a team of Itron analysts would compare meter reads with information from ComEd's other enterprise systems—as well as third-party data—to generate a list of accounts with suspicious consumption patterns in need of field investigations (meter readers also received incentives for spotting theft in the field).

Beginning in the suburbs of Chicago, Itron and ComEd began testing the ability of algorithms to crunch the incoming data from the new smart meters and find non-technical losses. The analytics pilot was a success, and together Itron and ComEd worked to customize automated action schedules for a new, more-powerful revenue-assurance process that could scale with the full deployment of smart meters across the service territory.

CUSTOMER

Commonwealth Edison (ComEd)

- Headquartered in Chicago, IL
- Serves 4 million+ customers
- 11,000 square-mile territory

GOALS

- Achieve revenue assurance mandates
- Improve operational efficiency and customer experience
- Leverage AMI data for innovative grid modernization

RESULTS

- Exceeded mandated targets four years ahead of schedule
  - Over 93% reduction in consumption on inactive meters (CIM)
  - Reduced unaccounted for energy by over 800,000 MWh per year
- Improved billing accuracy and transparency
- Developed scalable analytical workflows

SOLUTION

- Revenue Assurance (Operations Optimizer)

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THE PROCESS

Full deployment of ComEd's roughly 4 million smart meters began in 2013. At that point, annual CIM was 516,000 megawatt hours (MWh), and the annual UFE baseline was 880,000 MWh. CIM is electricity usage recorded by a meter that is not associated with an active billing account, often indicating unauthorized consumption and/or erroneous account closure. UFE is the difference between the total energy supplied into a distribution network and the total energy recorded as consumed. After accounting for technical losses, the remainder is typically due to theft.

"Before smart meters, we had no line of sight into the theft," said Anthony Monreal, ComEd's Manager of Customer Analytics & AMI Operations. "When we began using Operations Optimizer, we had a line of sight into both UFE and CIM. Now, the smart meters are essentially our eyes in the field, and we can see what happens with all 4.2 million of them."

Operations Optimizer (OO) is Itron's analytics platform for AMI data integration. The algorithms and customization options refined through the partnership with ComEd are now the core of OO's revenue assurance application and others. In the case of revenue assurance, the computing platform does the analysis of incoming smart meter data that was previously done by human analysts. Its algorithms can complete data reconciliation much faster by comparing SCADA and substation outflows with aggregated meter-level consumption, billing and third-party data. Using pattern recognition, loss estimation models and meter data validation, the software flags unusual accounts for human analysis, or automatically generates work tickets for a crew to investigate in the field.

Before OO, human analysts were identifying 10 to 15 accounts per week that justified field investigations. By comparison, the revenue assurance algorithms can analyze ComEd's entire fleet of smart meters overnight. The pace at which ComEd was able to achieve its mandated goals was primarily limited by the speed of the ongoing smart meter deployment and the time required to perform investigations in the field.

Expanding the Use of Analytics

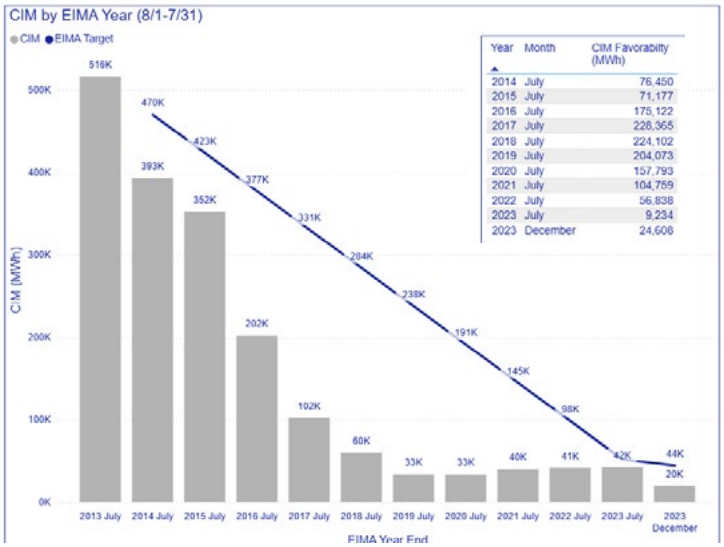
After developing the analytical workflows needed to address non-technical losses and revenue assurance, ComEd and Itron began expanding the use of analytics to create additional operational value. "Initially we focused on setting baselines for all the different types of data we suddenly had access to with AMI," said Anthony Monreal, ComEd's Manager of Customer Analytics & AMI Operations. "Then gradually, we got better at analyzing the data by adding custom views, queries and rules that revealed what we wanted to know."

Within the AMI Operations application this included organizing sub-groups of meters throughout downtown Chicago, creating custom views of high-consumption customers like Wrigley Field, and investigating unreachable meters and those that weren't certifying in ComEd's billing system, regardless of where they were in the territory. Separately, power quality analysis helped reveal loading on current transformers (CTs) and primary transformers (PTs) and discover the causes of frequently recurring outages.

Analysts set up the Meter Temperature Monitoring application to record temperatures for each meter in the field every four hours. The software would then analyze the results and sort them into color-coded grids that prioritized meters that may need attention based on highest recorded temperature, the time of day at which it occurred, the total number of high-temperature days and whether the meter had any previous service orders associated with it. In addition, if any meter hit 203ºF, the application immediately issued an alert for a field inspection.

THE RESULTS

ComEd completed full deployment of its 4.2 million smart meters in 2019 and met (and exceeded) its UFE and CIM goals the same year *— four years ahead of the timeline set by legislators.*



ComEd's CIM rates over time as compared to the Illinois Energy Infrastructure Modernization Act's goals

Unfortunately, UFE and CIM are not one-time problems, because new thefts occur all the time and the account actions that can lead to CIM are never-ending. But since 2019, ComEd's revenue assurance tools and processes have kept their non-technical loss rates well below the mandated goals, while dealing with theft on anywhere between 1,500 and 3,000 meters per month.

"Before using the smart meter data for revenue assurance, the analysts were focused on finding just the biggest losses that were costing thousands of dollars," said Natalie Hammer who was a Senior Manager of AMI Strategy & Data Analytics with ComEd before joining Itron in 2023. "Now ComEd is doing much higher volume using OO's algorithms in-house to continue cost savings and keep billing records cleaned up."

Automating remote shutoffs has played an important part in keeping CIM rates in check. Each day, OO processes a list of newly closed or suspended accounts, ensuring no lag time and no ongoing consumption through the meter. If a meter report comes back as "unreachable" during this process—or any analytical process—there's a high likelihood the meter has been tampered with and perhaps jumpered to enable theft.

ComEd's Monreal tracks the hit rate on all the theft algorithms to share with company leadership monthly, including how many orders were issued and fielded, and how many actually found tampering. "We want to be sure we're not wasting truck rolls and sending people out for something that we didn't have to," he said. "Billing is how we generate our revenue, and with OO we have more accurate billing and greater awareness on consumption."

THEFT ALGORITHMS

	December 2023 Orders Completed			2023 YTD	
	# Success/ # Completed	December Success Rate	# Tampered/ # Completed	Success Rate	# Tampered/ # Completed
Algorithms—Field Visits					
Disconnected Unreachable	268/283	95%	57%	95%	52%
Bypassed/Load-Side Voltage	165/165	88%	75%	89%	74%
Events After Non-Payment Disconnect	21/22	76%	76%	84%	79%
Events After CIM Disconnect	45/45	87%	42%	55%	35%
Channel Reverse Energy	28/31	93%	57%	90%	64%
AMI Drop-on Event	6/6	67%	33%	85%	39%
Disconnected with Usage (auto)	2/2	50%	50%	68%	39%
AMI Phase Angle/Power Quality	0/0	0%	0%	100%	0%
Field Visit Totals	**535/554**	**90%**	**69%**	**89%**	**52%**
Grand Total	**564/585**	**96%**	**64%**	**91%**	**57%**

December 2023 and year-to-date results for theft algorithms and success rates

THE OPERATIONS OPTIMIZER SOLUTION

The Operations Optimizer solution is used to integrate data from multiple sources and leverage big data technologies to maximize analytic performance and support various outcomes in addition to revenue assurance.

After establishing the analytical program for revenue assurance, ComEd began using separate analytics applications in 2017 to monitor meter temperature, power quality and general AMI operations. The Meter Temperature Monitoring application allowed the utility to pre-emptively identify meters that were beginning to overheat, power quality gave visibility into service and equipment performance, and the AMI Operations application helped troubleshoot missing AMI data and query and organize the data for actionable insights. (See sidebar for more detail.)

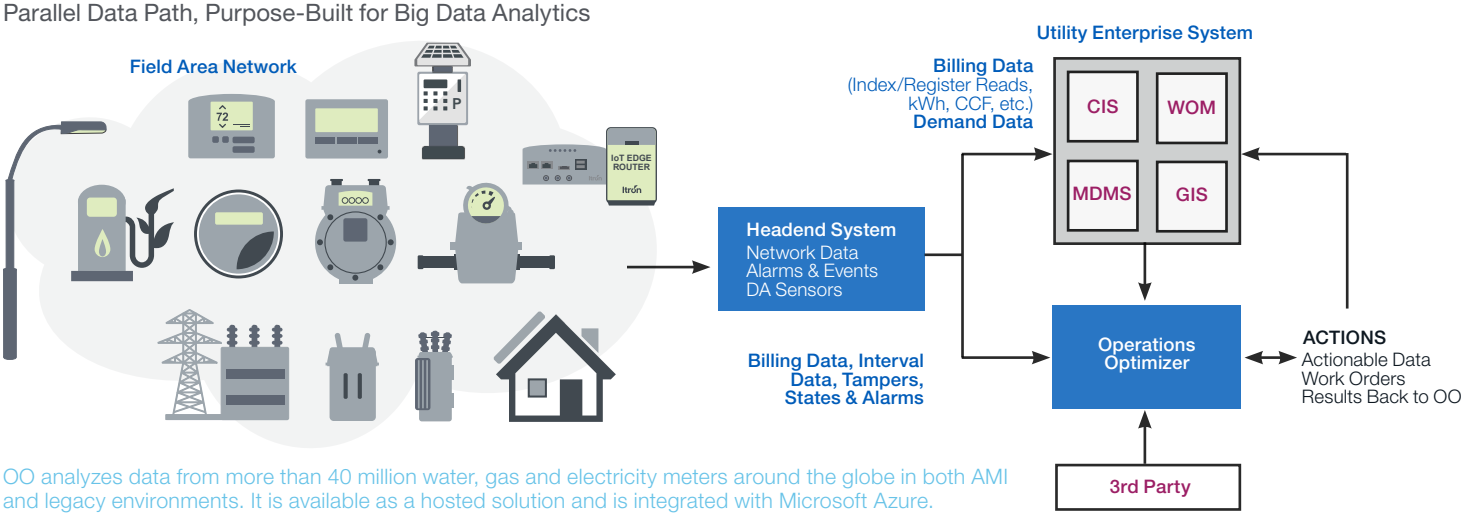
"The OO user interface makes it simple to find the information you want all in one spot," said Monreal. "Plus, the support we've received from Itron over the years has been incredible."

In 2025, ComEd and Itron launched a new pilot with 3,500 distributed intelligence (DI) smart meters in the same Chicago neighborhoods where they previously piloted the first-generation deployment. With the expanded capabilities of these next-generation meters, they'll be evaluating numerous distributed intelligence applications.

Learn more about what's possible with Operations Optimizer, Revenue Assurance and Grid Edge Intelligence.

OO SOLUTION OVERVIEW

Parallel Data Path, Purpose-Built for Big Data Analytics



OO analyzes data from more than 40 million water, gas and electricity meters around the globe in both AMI and legacy environments. It is available as a hosted solution and is integrated with Microsoft Azure.

Itron

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