

CREATING A SMART GAS SHUTOFF SAFETY SYSTEM



In a day, a week, a month — and especially in a year — four minutes isn't a lot of time. There's a finite number of tasks that can be completed in four minutes. Maybe you read the first pages of a new book. Or maybe you run half of a mile.

Now, think about four minutes as a time marker, as an interval. This changes things. The minutes go by fast. If you count just how often a four-minute interval occurs, you'd count it 15 times in an hour, 360 times in a day, 2,520 times in a month and 131,040 times in a year.

If something good happened every four minutes, we'd celebrate. If something bad happened every four minutes, we'd do our best to stop it.

And right now, that's what government agencies, state commissions and gas utilities are trying to do. Every four minutes (plus a few seconds more), there's a natural gas leak in the United States. This means, every four minutes, dangerous conditions are created, emergency response resources are stretched even thinner and the atmosphere takes another sustainability blow.¹

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AN INVISIBLE, EVER-PRESENT THREAT

A result of aging utility infrastructure, poorly maintained appliances and careless underground digging, residential and commercial gas leaks aren't a new risk. A historic issue, they've always been detrimental to public safety, a burden to state and federal funds and a prohibitor of environmental progress. For example, in 2022, more than 2,600 hazardous gas pipeline leaks in the United States caused more than \$4 billion in damages and emergency services, killed 122 people and released 26.6 billion cubic feet of fuel as methane or carbon dioxide into the air.²

Dissolving and defeating this trifecta of negative effects must be prioritized before the quantity of gas leaks becomes unmanageable and *before* more irreversible damage is done.

A PROACTIVE STRATEGY AND SOLUTION

Proactive approaches – stopping gas leaks before they start – are effective methods for managing these dangerous, devastating, disruptive events. Thankfully, in an era booming with smart technologies, defensive solutions exist, including those that proactively prevent gas leaks or immediately notify utilities and emergency personnel of threats. But because implementation of these next-generation solutions requires significant investment and change to current systems, adoption rates are slower than expected – and needed.

The California Energy Commission (CEC), however, is one organization that's leaning into investment and change to help reduce gas leaks by making smart upgrades to existing infrastructure. The CEC is the Golden State's primary energy policy and planning agency that works to create an energy system of the future.³ To name a few, this agency is responsible for undertakings such as appliance efficiency regulations, policy implementation for gas decarbonization proceedings and energy-emergency preparation. And a few years ago, a considerable component of their efforts and focus was the creation of a **smart gas shutoff safety system**. The official project details are summarized below:

- The CEC Project PIR-19-003, "Smart Shutoff Technology for Commercial and Residential Buildings," involved researching, developing, testing and implementing a comprehensive smart gas shutoff safety system for residential and commercial gas customers.
- This now-completed project was a joint effort between the CEC and GTI Energy, a leading technology development institution consisting of the top 27 gas utilities in the world, that helps provide innovative solutions to critical challenges across the entire gas value chain.⁴
- The smart gas shutoff system includes sensors that serve as natural gas detectors, an autonomous shutoff device, a communication network and a user interface for operational visibility and management. This four-part system is an example of [advanced metering infrastructure 2.0](#).

This system was also demonstrated in residential or commercial settings without needing to swap solutions based on the differing environments; apartments, homes and office buildings could use the same system.

HOW THE SMART GAS SHUTOFF SAFETY SYSTEM WORKS

The CEC's push for improvement and its equal effort in changing the status quo of gas leaks wouldn't be possible without each element of the smart gas shutoff safety system. Playing their own important roles, the four components work in harmony to create a whole greater than each part.

First, the **smart methane sensors** help identify leaks in a natural gas network in real time. Once methane is detected, the sensors communicate with a **smart shutoff device** to stop the flow of natural gas. For this project, the CEC and GTI Energy selected Honeywell's AC-250 NXS smart gas meter as its shutoff device. The AC-250 NXS sets the standard for accurate, reliable and safe gas operations. Not only does this solution help gas utilities measure consumption, but its intelligent shutoff valve autonomously triggers an almost-instant gas shutoff response when system anomalies, including leaks, are detected. This smart shutoff device also collects important data to help utilities and first responders take swift action.

This critical information is communicated to necessary parties over the air using a LoRa **communication network**, which helps facilitate constant conversations between the smart methane sensors and Honeywell's smart shutoff device.

Finally, after information is collected, processed and used by the smart devices to detect leaks and stop the flow of gas, it's sent to a **digital user interface** that helps gas utilities monitor the conditions of infrastructure, manage leaks and other concerning irregularities and oversee the health of the assets that comprise the smart gas shutoff safety system. Using the digital platform that displays all data and all assets, gas utilities can identify and analyze trends to help predict — and prevent — leaks, their effects and other dangers.

Residential Building

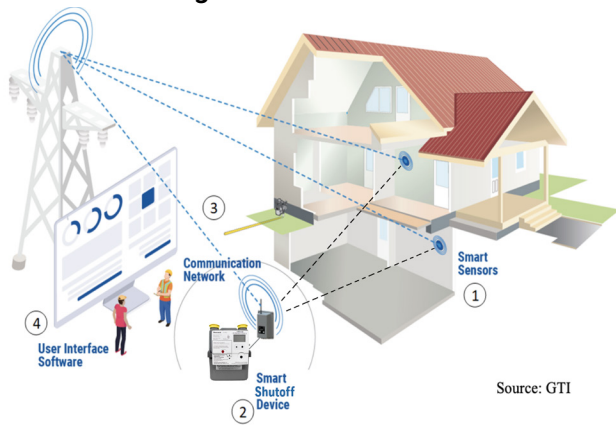


Figure 1. Residential Building CGSSSS

Commercial Building

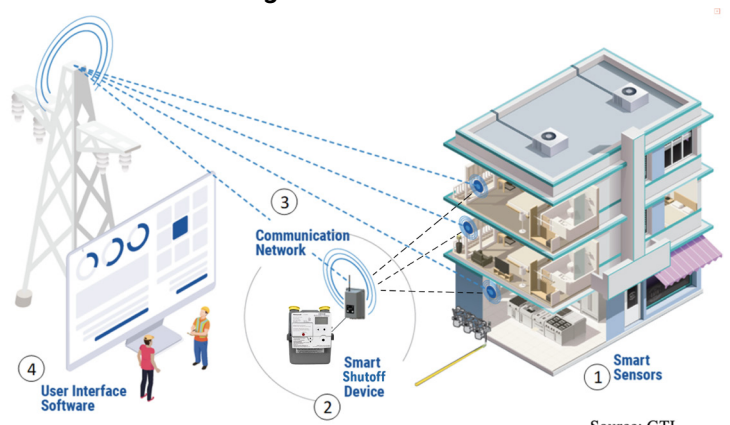


Figure 2. Commercial Building CGSSSS

1. Smart Sensors
2. Smart Shutoff Device
3. Communication Network
4. User Interface Software

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This connectivity-based process happens fluidly and with more speed than the explanation above, helping deliver fast, meaningful results.



A CLOSER LOOK AT AUTONOMOUS, INTELLIGENT SHUTOFF

For this CEC project, the Honeywell AC-250 NXS was reconfigured to enhance its compatibility with the system's methane sensors and network. This smart diaphragm gas meter was already known for:

- Remote valve shutoff and autonomous shutoff based on high pressure, high temperature, high flow rate and tampering
- Its measuring unit and integrated metrological unit with optical pickup
- Reliable communication with the head-end system (>99% communication success)
- Highly secure end-to-end industry-standard encryption and authentication methods

With specific project goals to achieve, however, the AC-250 NXS's cellular modem was replaced to operate on an atypical gateway. It was also engineered with new code to talk to the methane sensors every ten seconds if network connection was lost. And, if the sensors lost total communication with the rest of the system, the AC-250 NXS would shut off the flow of gas precautionarily.

Sensing abnormalities, then shutting off the flow of gas helps prevent leaks, the wasteful (and costly) loss of a resource and an undesired release of harmful emissions. The flexibility in reconfiguration, without compromising control of gas leak shutoff, is how Honeywell added value to the CEC's and GTI Energy's smart gas shutoff safety system.

GAS UTILITY SAFETY IN THE GOLDEN STATE

There isn't a city that's completely agnostic to gas leaks, their dangers and the disruption they cause. But this smart gas shutoff safety system, with promises of greater safety, savings and sustainability, is especially important to California.

California is also the most-populated state in the U.S., meaning its natural gas utilities provide service to over 11 million gas customers.⁵ And that means the implementation of a safety system such as this can help protect a large portion of the U.S. population from the devastation of gas leaks — including fire in a state that's already run rampant by wildfires, natural gas poisoning, explosions, property loss and release of greenhouse gases into the atmosphere.

The success of this project, in creation of the system and deployment (measured by increases in safety and savings and sustainability), GTI Energy has been approached by other states' energy commissions who want to achieve the same results by using a version of the same system.

It's been (roughly) four minutes since you started reading this article. Somewhere in the United States, gas started to leak. Add another tally to the growing count.

Source: Verzoni, Angelo. "Perspective: Early Warning." *NFPA Journal*. 1 November 2020. <https://www.nfpa.org/news-blogs-and-articles/nfpa-journal/2020/11/01/gas>.

CONCLUSION

Human intervention is still the preferred approach to managing gas leaks, but a smart gas safety shutoff system helps humans intervene faster. Stopping gas leaks before they start with a smart shutoff system — a proactive approach — can help stop fires, explosions, public safety concerns and resource losses before they occur. Honeywell is proud to provide solutions that help organizations like CEC and GTI Energy improve the life, safety and environmental impact of people and cities.



RESOURCES

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For more information

<https://automation.honeywell.com/us/en/solutions/smart-energy>

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