



# THE ULTIMATE GUIDE TO COMMERCIAL TANKLESS WATER HEATING

INSIGHTS ON THE FUTURE OF THIS RAPIDLY GROWING TECHNOLOGY.



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# THE EMERGENCE OF TANKLESS

**OVER THE PAST 10-15 YEARS, COMMERCIAL TANKLESS WATER HEATERS HAVE EVOLVED FROM AN OBSCURE AND NOVEL OPTION TO EMERGE AS A GROWING MAINSTREAM WATER-HEATING SPECIFICATION.**

Commercial tankless water heaters have the versatility to meet a wide range of load types while offering reliability, energy-efficient performance, and a space-saving footprint. They're available in a range of capacities and can be combined into larger arrays for water output rates of several hundred gallons per minute. And they don't waste energy or space keeping a large water tank hot at all hours.

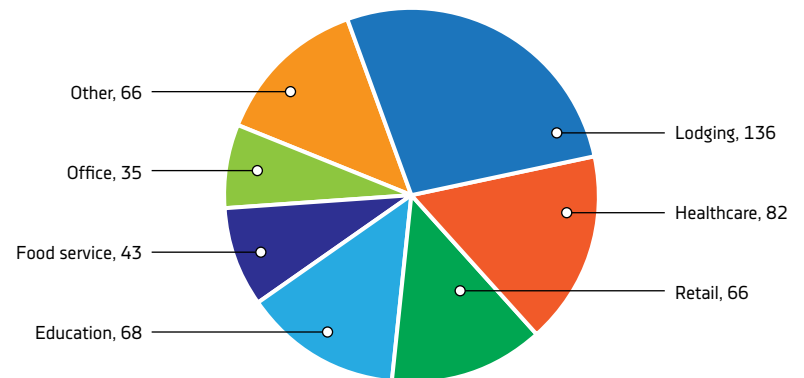
If architects, engineers, and building owners aren't paying attention to the energy use of the water-heating systems in their buildings, they're missing out on an important opportunity for savings, especially in certain building types. Water-

heating energy represents a significant 7 percent of all energy use in commercial buildings. But a group of just six building types — lodging, healthcare, retail, education, food service, and office — represents about 85 percent of all commercial building water-heating energy consumption.

This e-book collects our most valuable resources on commercial tankless water heating in a comprehensive format to make it simpler to evaluate whether this exciting technology is right for your project. It provides an overview of tankless technology basics and recent innovations in commercial systems. It includes research and training on why more commercial buildings are going tankless and highlights case studies that illustrate the real-world potential of these systems.

With the data and insights gathered in *The Ultimate Guide to Commercial Tankless Water Heating*, you'll be ready to select a water-heating system that maximizes space, efficiency, occupant comfort, and the overall performance of your buildings.

## WATER-HEATING ENERGY CONSUMPTION (PER TRILLION BTU) BY BUILDING TYPE



Lodging, healthcare, retail, education, food service, and office represent about 85 percent of all commercial building water-heating energy consumption and 6 percent of the energy use in the entire commercial buildings market.



# TECHNOLOGY OVERVIEW: TANKLESS WATER HEATERS

## HOW TANKLESS WATER HEATERS BOOST PERFORMANCE IN COMMERCIAL BUILDINGS.

Tankless water-heating systems can offer commercial buildings big improvements in terms of performance, energy use, and energy costs. In fact, Energy Star-rated tankless water heaters have the potential to use 25 percent less energy than a conventional commercial water heater.

Here's how they work.

Instead of storing water, tankless systems use a heat exchanger to heat water just as it's needed in a building. For example, when a guest turns on a shower in a hotel, a propane or natural gas burner in the tankless unit quickly heats up the heat exchanger. In very high-efficiency models, incoming cold water is preheated from the combustion exhaust. Then the water continues to be heated as it passes through the unit's heat exchanger and exits from the tankless unit at the hot-water outlet pipe, where it then flows to the shower to meet the hot-water demand.

One of the most important benefits of using tankless technology in commercial buildings is this technology's flexibility to meet a wide range of load types. Many commercial tankless systems are modular, so individual tankless units can be combined to create a larger system, offering a wide range of capacity and hot-water output. The big advantage of these systems is that they remain very efficient even when they're running at less than full capacity. Whereas a storage tank system has to be designed for a building's peak load and keep a full tank constantly heated, a tankless system can rely on just a portion of the tankless units during off-peak times. As the hot-water demand increases, the tankless water heater can increase its combustion rate. When demand gets even higher, the system controller will turn on another tankless unit and share the demand across both units.

### Installation and ventilation flexibility

Whether a building is a hotel, restaurant, school, or brewery, building owners and operators need to maximize space to provide key functions and services. And the days of giant boiler rooms are over. Because they don't store water, tankless water heaters are very compact. And commercial tankless arrays can be free-standing, wall-mounted, installed in corner layouts, or even located outside of the building. They can even be integrated with a storage tank for easy replacements of old tank-style water heaters.

Propane and gas tankless water heaters require venting to exhaust combustion gases, and manufacturers offer a variety of venting innovations to simplify installation. For example, multiple units can use a common vent system that reduces space needs, labor and materials, and building penetrations.

**SEE THE ANIMATION.**  
**CHECK OUT OUR MOTION GRAPHIC**  
**ILLUSTRATING HOW TANKLESS WATER**  
**HEATERS OFFER ENERGY EFFICIENCY**  
**AND VALUABLE SPACE SAVINGS IN**  
**COMMERCIAL BUILDINGS.**

# TANKLESS WATER-HEATING INNOVATIONS

## Tankless water heater arrays



Tankless water heater arrays can be free-standing or wall-mounted and are available with common venting systems.

Linking a system of multiple tankless water heaters together used to be a time-consuming process for contractors. But in recent years, manufacturers have simplified the process with tankless water heater arrays or racks: free-standing or wall-mounted multi-unit systems shipped to projects fully assembled, including gas and

water manifolds. They are also available with common venting systems, which further speeds installation by allowing the entire rack to use the same exhaust and intake venting.

In many commercial tankless systems, the capacity of an individual tankless unit is roughly 199,000 Btus. By combining these units in larger configurations, tankless arrays can provide hot-water output rates of several hundred gallons per minute.

Manufacturers can customize these arrays to prioritize reliability, space savings, energy efficiency, or first-hour water delivery, depending on the application, including combining tankless units with storage tanks where appropriate. That's a vital service with different types of commercial buildings having vastly different needs.

## Commercial hybrid water heaters

Commercial hybrid water-heating systems such as Rinnai's Demand Duo combine the on-demand, continuous hot-water supply of a tankless water heater with

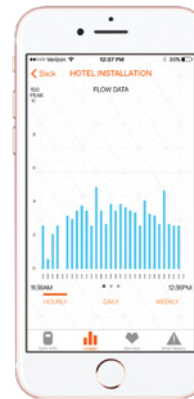


Rinnai's Demand Duo 2 hybrid water heater features a 119-gallon storage tank along with two tankless water heaters.

a hot-water storage tank. Although tankless water heaters have made inroads in the commercial market in recent years, storage tank water heaters remain the predominant technology in place. Hybrid systems combine the best of both worlds — installing just like a storage tank for easy replacement of old units but performing like a

tankless water heater with a continuous flow of hot water. That means hybrid units provide more hot water in the first hour than other systems on the market and with a faster recovery time than a traditional storage tank system, according to Rinnai.

## AI, smart controls, and larger capacities



A screenshot from Intellihot's mobile controls displays hourly flow data from a hotel installation.

Computerized controls allow even large tankless water heater arrays to precisely track the water-heating load of a building and activate individual units accordingly. Those controls are what make it possible for the tankless system to ramp up to meet a building's peak load and then ramp back down so just a single unit is active.

Today, commercial tankless water heaters have joined other building technologies in offering wireless connectivity and remote monitoring and controls. Many units offer smartphone or app-based connectivity to provide facility managers or contractors with mobile access to their units.

Tankless water heaters are even utilizing artificial intelligence. Water heater manufacturer Intellihot Green

Technologies touts AI built into its units that analyzes a building's hot-water usage patterns, identifying and predicting the timing of peak loads so that the units can fire up and activate a building's recirculation system in preparation for the higher hot-water demand. The manufacturer also offers larger on-demand systems with individual unit heating capacity up to 3 million Btus.

# FLEXIBLE WATER HEATING FOR ANY PROJECT

HERE ARE A FEW EXAMPLES OF HOW PROPANE TANKLESS WATER HEATERS CAN SOLVE YOUR WATER-HEATING CHALLENGES.

## Small restaurant



**Primary concerns:** Space savings, performance

**Hot-water needs:** Sinks, dishwashers, cooking, bathrooms

**Challenges:** Meeting high supply temperatures required by code with tight space constraints

**Solution:** 1 high-efficiency tankless water heater

**Result:** A 96% efficient unit provides 140-degree water for dishwashing and cooking with no drop-off in capacity, and it can be installed outside or tucked away with a wall mount

## Mid-size hotel



**Primary concerns:** Efficiency, space savings

**Hot-water needs:** 130 guest rooms, restaurant, laundry

**Challenges:** Efficiently meeting high peak demand with tight space constraints

**Solution:** 17 tankless water heaters in 3 arrays

**Result:** By combining wall-hung tankless units into arrays with common vents, the system can fit into a tight mechanical space while ensuring an efficient water supply that meets peak demand

## College residence hall



**Primary concerns:** Efficiency, performance

**Hot-water needs:** Shower and bath facilities for 120 residents

**Challenges:** Efficiently meeting high peak demand alongside extended partial-load periods

**Solution:** 3 high-capacity tankless water heaters

**Result:** With a total capacity of 750,000 Btus, this array can easily modulate to meet high-demand periods without the standby losses of storage tank water heaters

## Vacation resort



**Primary concerns:** Performance, reliability

**Hot-water needs:** 700 guest rooms, 3 restaurants, large laundry facility

**Challenges:** Meeting high peak demand so guests don't experience cold showers

**Solution:** 175 tankless water heaters

**Result:** Rather than the expense of heating enormous hot-water storage tanks, a large resort can efficiently meet demand when needed and have peace of mind knowing guests are happy

# WHY ARE COMMERCIAL BUILDINGS TURNING TO TANKLESS?

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When the 130-room Residence Inn by Marriott in Florence, Alabama, was replacing its water-heating system in a renovation, the original replacement system specification called for two 750-gallon boilers, each measuring 5 feet by 12 feet. The plan would have almost worked — it left a few inches of clearance in the boiler room — but with so little space, maintenance would have been impossible without shutting down the entire water-heating system.

So the hotel changed course, implementing a 17-unit gas tankless water heater array that provided enough space in the mechanical room to service the units. Plus, there were energy-efficiency benefits: The new design eliminated the energy losses from storing 1,500 gallons of hot water, reducing energy use for the hotel.

As the hotel's successful renovation shows, propane and gas tankless water heaters offer an innovative opportunity to provide energy-efficient water heating with flexible system designs that can be tailored to a building's space constraints and hot-water demand.

A new training course from engineering consultants Newport Partners LLC and the Propane Education & Research Council, "Propane Tankless Water Heating in Commercial Building Applications," offers insights into how commercial building professionals can use tankless systems to maximize a building's water-heating performance for both existing buildings and new construction. And because virtually all tankless water heaters can run on readily available propane, they're an option even for projects that lack access to natural gas.

## **Flexibility for peaks and low points**

One of the primary benefits the course highlights is the flexibility of tankless water-heating systems to meet a variety of water-heating loads. Many commercial tankless water-heating systems are modular: Individual tankless units can be



Contractor Anthony Crouch, owner of Crouch & Sons Plumbing in Florence, Alabama, examines the Residence Inn by Marriott's tankless water heater array with distributor Jason Veal of the Tallman Company. Photo credit: Randy Crow

combined together in racks or arrays to provide a range of water-heating capacity and output. That means a system could be designed for a large peak load that requires several hundred gallons per minute of hot-water output but still respond well when only a small portion of that hot water is needed.

Hotels are a particularly common use case for this strategy, says Jamie Lyons, a senior consultant with Newport Partners. "Even though the peak demand for hot water happens really infrequently, they still have to be ready for it or else they have unhappy customers," he says. "The value proposition for tankless there is really strong because you can use an array of tankless units that can ramp up to meet the peak when it happens, even if it only happens a really small percentage of the time. You're ready for it, but you're not storing hundreds or thousands of gallons of hot water all the time."



The Residence Inn by Marriott in Florence, Alabama, used a 17-unit gas tankless water heater array to save space in the mechanical room and allow room to service the units.

Instead of simply keeping water hot in a large storage tank, tankless systems use sophisticated controls to modulate the heating capacity of an individual unit higher or lower to meet the demand for hot water. When additional capacity is needed, the system can bring on additional units to share the load and increase output. The controller also spreads the duty cycle out so that one unit won't wear out before the rest.

At the Residence Inn by Marriott, for instance, the 17-unit tankless array includes 12 units to supply hot water to the 130 guest rooms and five units for the hotel's dining and laundry operations. Each tankless unit has a capacity of just under 200,000 Btus per hour. Because each individual tankless unit can modulate as low as 11,000 Btus per hour, the overall system has a huge capacity range from over 3 million down to 11,000 Btus per hour.

### **More space to do business**

The training course also covers important considerations for the size and ventilation considerations of a building's water-heating system. Because boilers and tank-style water heaters store water, they have a larger physical footprint than tankless units, which can be arranged in self-supporting racks or wall-mounted, depending on project needs. While it's unsurprising that those space savings can benefit a retrofit project like the Residence Inn by Marriott, that flexibility can be helpful in new construction as well, Lyons says.

**“YOU CAN USE AN ARRAY OF TANKLESS UNITS THAT CAN RAMP UP TO MEET THE PEAK WHEN IT HAPPENS, EVEN IF IT ONLY HAPPENS A REALLY SMALL PERCENTAGE OF THE TIME.”**

— JAMIE LYONS, SENIOR CONSULTANT, NEWPORT PARTNERS

“Even on the new-construction side, we saw one or two projects where the physical footprint was a sticking point,” he says. “They want to maximize the space in the building that’s providing key services or generating revenue, as opposed to just creating space for boilers or water heaters.”

While providing ventilation for 17 tankless water heaters might sound messy, common venting options are available that save space and reduce wall penetrations. The Residence Inn by Marriott used common-vent runs for two banks of water heaters and had one standalone unit. “So they ended up with three building envelope penetrations and venting runs instead of all 17,” Lyons says.

The course highlights the diversity of tankless product offerings available from a variety of manufacturers. That includes many at efficiency levels high enough to meet the prescriptive requirements or energy-modeling savings needed for LEED v4 for Building Design and Construction. “Most, if not all, of these natural gas tankless water heaters are convertible to propane, so the offering’s pretty broad,” Lyons says.

*To learn more about the contributions that tankless water heaters can make toward LEED certification and see more project examples, check out [“Propane Tankless Water Heating in Commercial Building Applications”](#) in the Propane Training Academy.*





A propane tankless array serves all of the casino's potable hot-water needs, from the dishwashers to the restrooms.

# WHY ONE CASINO RESORT FACILITY MANAGER CHOSE TANKLESS

The Pala Casino Spa and Resort prides itself on luxurious hospitality and world-class amenities. And as director of facilities, Bob Halsted plays an important role in ensuring the casino's guests have an exceptional experience — with no unexpected problems.

So when the Southern California casino's three water heaters began to show signs of age, Halsted saw an opportunity to improve the hot-water system's reliability and performance while also reducing energy costs. Instead of three large tanks, Halsted turned to a large array of 19 propane-fueled tankless water heaters to ensure the hot-water system never experienced downtime.

"Our job is to provide a nice, comfortable environment for our guests," Halsted says. "We're open 24/7. We have a lot of restaurants; we need hot water to clean dishes with. Whether it's the heating, the hot water, or air conditioning, we always have some kind of built-in redundancy so our guests are not affected."

With three tanks, at least two of the systems needed to be running full time, so an outage in any of the units could put performance in jeopardy. The new Rinnai tankless array typically uses only about half of the units, providing the uptime and reliability the facility manager requires.

## Readily available and affordable

Upgrading to a tankless array wouldn't have been possible, however, without propane, which provides energy for dozens of applications throughout the resort. Pala was opened in 2001 by the Pala Band of Mission Indians, becoming the first brick-and-mortar tribal casino built in the area. The casino is located on rural tribal lands in the Palomar Mountain area, about 60 miles north of San Diego.

Running natural gas from the main several miles away would be too costly. And electricity can't meet the enormous hot-water and heating demands of a resort with a Las Vegas-style casino, 507 hotel rooms, a 10,000-square-foot spa, and 40,000 square feet of meeting and convention space. Instead, the resort relies on readily available propane for the water heating and other critical needs. "Propane is the least expensive versus electric," Halsted says. "We've got a lot of water we're heating. I couldn't imagine the size of an electric water heater that we would be using." Plus, the resort has several peak demand periods each year when the price



As the Pala Casino Spa and Resort grows for the future, tankless water heaters provide the uptime and reliability every facility manager craves.

of electricity skyrockets. "We get affected by that pretty drastically just with what we've got," he says. "I couldn't imagine if we used electricity to do heating and hot water also here, what we would be facing on those days."



All of the Pala Casino Spa & Resort's pools and spas are heated by propane, including a pool and two hot tubs at Pala's award-winning RV resort.

### Amenities without sacrifices

The propane tankless array serves all of the casino's potable hot-water needs, from the dishwashers to the restrooms. Propane boilers provide heating hot water to fan coil units, allowing the casino's offices to control temperature individually. The casino floor uses propane rooftop package units for heating. And in the hotel, four separate propane boilers provide domestic hot water to the guest rooms. The laundry room includes two large propane commercial clothes dryers.

All of the resort's pools and spas are heated by propane, including a pool and two hot tubs at Pala's new RV resort. The resort opened in May 2016 and has been sold out every week after winning Best RV Resort Casino and Best Campground Resort awards from *Trailer Life* and *Motorhome* magazines.

This July, Pala announced a \$170 million renovation and expansion that will add a 349-room hotel tower, convert the existing resort pool into a multi-pool and entertainment resort complex, and refresh other resort spaces. Like the tankless water heater upgrade, the project will ensure the resort not only meets guests' expectations but also attracts new visitors for years to come.

### CHEF'S SECRET WEAPON

Guaranteeing guests' comfort may simply be table stakes in the casino and hospitality industry, but Pala's other amenities help it truly stand out from the competition. The resort's 11 restaurants are anchored by Choices, the largest buffet in Southern California at 630 seats, and the Oak Room, a high-end, elegant dining room focusing on steaks and chops. The Oak Room's secret weapon? A 1,600-degree propane grill. "Our high-temperature grill sears the meat and seals in the flavors," says Robert Camerota, Pala's executive chef. "A regular grill would only cook the meat at around 500 degrees. The 1,600-degree grill sets the flavor at an entirely new level."





Using more-efficient tankless water heaters, Ruby's Inn is projected to save \$6,000 a month in propane costs.

# AT RUBY'S INN, TANKLESS WATER HEATERS ENSURE ALL VISITORS GET A HOT SHOWER

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For most hotel operators, tour buses full of guests showing up to check in would be a great sign of a healthy property with low vacancy.

But at Ruby's Inn, a major resort and tourist destination located near Bryce Canyon in Utah, an aging water-heating system made those tour buses a source of anxiety. The resort includes 19 buildings, 700 hotel rooms, three restaurants, an RV park, a campground, three swimming pools, and a laundry facility that does 19 tons of laundry per day. On any given night, the resort could have up to 4,000 guests on the premises.

With that much demand, the resort's old water-heating system was under a lot of strain.

"We've got some unique challenges in that a lot of our business is tour buses and they show up late at night and the first thing they want to do is all shower," says Lance Syrett, general manager of Ruby's Inn. "Historically, that's always been a problem because you just can't keep up with 40 showers at the same time."

## Avoiding a negative guest experience

One of the primary issues with the resort's water-heating infrastructure was a lack of redundancy in its boilers. If a unit went down, the resort could go for up to two hours without hot water. The negative impact on the guest experience was clear — and costly. "Our goal is a reduction in the discounts we have to give," says Ron Harris, manager of Ruby's Inn. "Or we have to completely refund a room and sometimes an entire building block because they took a cold shower in the morning. We look at about \$60,000 a year in discounts and refunds."

Ruby's Inn management brought in tankless water heater manufacturer Rinnai's commercial water-heating team to assess the problem. With the help of propane provider Blue Star Gas, Rinnai designed a customized system for the resort, with a plan for every building. The plan highlighted the efficiency and reliability of switching to a tankless water-heating system.

"Rinnai as well as Blue Star came back with a 30 percent savings, which calculated back on the fuel savings, would have been 7,000 gallons of propane per month," says Steve Rutherford, division manager for Blue Star Gas.

The solution ultimately included 175 new propane tankless water heaters, 35 tankless rack systems, and four Demand Duo hybrid commercial water-heating systems. With the more-efficient tankless units in place, Ruby's Inn is projected to save \$6,000 per month on propane alone. And perhaps just as importantly, the resort has had no issues with hot-water supply or customer complaints, freeing staff time and money for other efforts at the resort.

"There's no commercial business that can keep their doors open without hot water, so the reliability and the redundancy of a tankless water-heating system is really key to any business owner," says Brian Watts, senior commercial business manager for Rinnai.



**RUBY'S INN REMAINS ON THE FRONTIER  
WITH NO NATURAL GAS LINE WITHIN 25 MILES.**

**IN THE PLACE OF NATURAL GAS, THE RESORT  
HAS RELIED ON PROPANE  
FOR ITS WATER HEATING AND OTHER ENERGY NEEDS.**

### **History of stewardship**


Ruby's Inn was founded in 1916 by Lance Syrett's great-grandfather Reuben "Ruby" Syrett, who bought the land sight unseen before Bryce Canyon became a national park. "He went up there and saw that with his wife and his two children, and they said, 'This is absolutely beautiful, and we think people are going to want to come see this someday,'" Lance Syrett says.

Ruby Syrett got permission from the state of Utah to build a facility at the rim of the canyon called "Tourist Rest." In 1923, when Bryce Canyon became a national monument, Ruby Syrett moved Tourist Rest to the location of the ranch and named it Ruby's Inn. Over time, the inn grew to include multiple hotels, restaurants, and the RV park and campground.

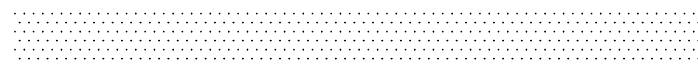
Even today, however, Ruby's Inn remains on the frontier, with no natural gas line within 25 miles. In the place of natural gas, the resort has relied on propane for its water heating and other energy needs.

"I believe that this entire property exists because of the propane option," Watts says. "It's great working with the propane along with our product to get them the most-efficient water-heating system on the market."

Propane also serves as a clean form of energy for Ruby's Inn, which prides itself on being a steward of the environment at Bryce Canyon. "We like to think we're good stewards of the national park," Lance Syrett says. "We give back; we've got a lot of programs. We try to be as environmentally conscious as we can be. And this partnership with Blue Star Gas and with Rinnai is just another rung in that ladder."



**CHECK OUT THE RUBY'S INN VIDEO  
ON [PROPANE.COM](https://www.propane.com) TO SEE HOW  
RUBY'S INN WORKED WITH RINNAI AND  
BLUE STAR GAS TO OVERHAUL ITS  
WATER-HEATING SYSTEM THROUGHOUT  
THE 19-BUILDING PROPERTY.**





## PROJECT SNAPSHOTS

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Available in the [Propane Training Academy](#), the “[Propane Tankless Water Heating in Commercial Building Applications](#)” training course highlights several additional project examples. Check out the course to learn more about how these buildings used tankless water heaters to meet high peak demand needs, reduce standby energy losses, and save space used for mechanical equipment.

### Sutton Hall — Milligan College, Tennessee



This 64-room, 120-residence hall originally used an 80-gallon, 199,000 Btu/hour tank water heater coupled with two 100-gallon storage tanks. But the system experienced frequent leaks, inefficient operation, and inconsistency in being able to meet the building’s demand. The school replaced the

old system with a bank of three tankless units from the manufacturer Intellihot. The total capacity of these tankless systems is 750,000 Btus per hour, providing enough heating capacity to meet peak load while not actually storing any water.

### Residence Inn by Marriott — Florence, Alabama



A renovation for this 130-room hotel included a new water-heating system, which was initially specified to include two 750-gallon, 750,000 Btu/hour boilers to provide hot water to the hotel. However, the hotel’s mechanical room could barely accommodate the two boilers, leaving just a few inches

of clearance between the units and the surrounding walls. Instead, a 17-unit, wall-hung tankless array provided space savings and enough space within the mechanical room for servicing the units.

### Tomato House Restaurant — Senoia, Georgia



With an older tank water heater, this restaurant could not reliably produce high-enough temperatures to meet health code standards. The not-so-hot water also meant it took 30 minutes to get water to boil, slowing down the kitchen. Plus, space was very tight. So instead of a larger

tank, the restaurant selected a 96-percent-efficient tankless unit that provides 140-degree water with no drop-off in capacity — and the small unit could be installed in the ceiling to free additional space.



# ACCESS ADDITIONAL RESOURCES AT PROPANE.COM

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