Though far from commonplace, zero energy homes represent a growing trend in new home construction that could impact the gas industry’s share of the market.

The general idea behind “zero energy”—that a home can export enough renewable energy to offset its use of delivered energy—was born from a few forward-thinking builders in the early 2000s and fueled by technological advances that allowed solar power to be generated more efficiently and exported into the grid. However, a lack of consensus regarding how to define and measure zero energy homes has hampered growth by causing confusion in the marketplace.

The sticking point centered around whether the equation to get to zero energy would use a site energy approach, which refers only to energy consumed at the building site, or the more expansive source energy, which includes the
Builders, homeowners and policymakers are waking up to the efficiency benefits of natural gas. **BY ERIC JOHNSON**

energy consumed in the extraction, processing and transportation of the energy in addition to the energy lost in power generation.

“Without a source energy-based definition for zero energy homes or buildings, it would be very difficult for natural gas to compete in this market,” said Rick Murphy, the American Gas Association’s managing director for sustainable growth. That’s because on a site level, electricity would seem to be more energy efficient. But what happens at the site level only tells part of the story.

According to Murphy, for every hundred units of energy that enter the electric system, only about 32 units actually get to the home or business. However, with natural gas, 92 units of natural gas are delivered to home and businesses for every hundred units that enter the system. Therefore, not considering losses across the value chain can be misleading for consumers and policymakers, because while using electricity might be more efficient at the use of the product, when considered over the full fuel cycle, it’s considerably less efficient.

“When you look at the definition of zero energy buildings, we have always advocated that you need to look at the full-fuel cycle when measuring energy consumption and emissions,” Murphy said. “So we were very supportive of the U.S. Department of Energy’s efforts to establish a common definition for zero energy buildings and their
conclusions that in order to provide the consumer with the right information, you really do need to use a source energy-based approach.”

AGA was very engaged in the definition process and submitted comments to the DOE supporting this approach.

In September 2015, the DOE chose the broader interpretation in its official definition of zero energy—“An energy-efficient building, where on a source energy basis, the actual annual delivered energy is less than or equal to the on-site renewable exported energy.”

“In that definition, the DOE clearly articulates that source energy is the method that they chose for the definition rather than site energy,” said Ralph DiNola, CEO of New Building Institute, a nonprofit organization working to improve the energy performance of commercial buildings that assisted the DOE in creating the definition. “The DOE definition is a broader way, a more inclusive way, of looking at total energy consumption, because we need to be thinking about the kind of energy losses that result from generation and distribution.”

Given the efficiency of the natural gas value chain, the definition is considered positive for the gas industry and applauded by the American Gas Association.

Building Growth
While currently a very small percentage of the nation’s building stock, zero energy buildings are far from a passing fad.

According to the Net-Zero Energy Coalition, an organization pushing to accelerate the adoption of zero energy buildings across North America, there are more than 3,000 residential buildings and 6,000 residential units on the path to being zero energy.

“It’s still a tiny portion of the market, but that’s not the story,” said Shilpa Sankaran, Net-Zero Energy Coalition’s interim executive director. “[T]he story is that there weren’t 6,000 units just a few years ago. And now, not only are there 6,000 units, but there are thousands in the pipeline that are going to be built in the next few years, and that wasn’t happening before.”

According to Sankaran, the market transformation is in an early phase of a predictable pattern that started with the early adopters, was followed by those who chose zero energy to stand out from the pack and will eventually include developers who are content with the status quo but don’t want to miss out on the next big thing.

“This is the next big thing, and these are the folks who are going to be market leaders and establish their brands in this space,” she said. “And, of course, the mass market follows, which includes the other developers who eventually will see that the demand is coming and that it will become the new standard in construction.”

Builder Mark Nuzzolo, who is building zero energy-ready homes in Connecticut, is enthusiastic about the possibilities surrounding these energy-efficient homes, especially their ability to stand out in the Constitution State’s tough housing market.

“Because I’m competing in a really hard market, I had to make my product special and I had to make my product cost-effective,” he said. “But what we’re selling isn’t just the economic value—the house is quieter, it’s cleaner, it’s more comfortable and it’s healthier.”

While Sankaran is planning a marketing campaign geared toward stimulating demand, perhaps an even bigger market influence will be the changes in building codes that are beginning to favor zero energy.

DiNola said California wants to advance commercial building codes to zero energy by 2030 and residential codes by 2020. Other jurisdictions, such as the state of Washington, have a legislative requirement to reduce building energy consumption by 70 percent by 2031. Massachusetts, New York and Rhode Island are all looking at developing a plan that identifies zero energy target dates and creates a roadmap to get there.

The Role of Natural Gas
For Nuzzolo, natural gas provides vital flexibility.

“We use a natural gas furnace to heat, and obviously we have the duct work to connect the air conditioner to cool, but we also have a high filtration device and a circulation system,” he said. “So I like the fact that it allows me, through the first cost, to get heating, cooling, ventilation and filtration. It kind of gets me everything in one package.”

And after that first cost, there are other advantages to consider, like tankless water heaters, gas fireplaces and cooktops that are always popular with homebuyers. And those advantages translate to value.

“By using natural gas to heat the house and cook with and heat hot water with, we can put a smaller solar system on the house,” he said. Beyond that, Nuzzolo’s customers have a long history with—and a strong belief in—natural gas.

“The majority of my customers believe that natural gas is the most inexpensive way to heat their homes,” he said.

David Heslam, executive director of Earth Advantage, a Portland, Oregon-based nonprofit dedicated to the creation of better buildings, praises the efficiency of natural gas.

“The benefit of gas in building has historically really been in the fact that when you have direct use in a building, you’re talking about relatively efficient use of source energy to an actual end use,” he said. “From where the gas comes from the wellhead to where it gets to your door, the losses are relatively small.”
And then, Heslam said, if you can connect that useful energy at something even only 65 percent efficient, like a heating system connected to traditional duct work, which is about 30 percent less efficient, you’re still operating almost twice as efficiently than if you’re supplying gas to a power plant and getting electricity off the grid.

However, zero energy homes aren’t going to have those challenges with duct work. In fact, in a lot of cases, if a house has duct work at all, it will be inside the envelope, or the area intended to be heated and cooled. In a lot of houses, the duct work will fit in between the joists of the first and second floor so that the heat loss remains in the house and is usable, even if it doesn’t flow through a register.

That efficiency can make the home itself more affordable. A study by the American Society of Heating, Refrigerating and Air-Conditioning Engineers found that direct use of natural gas reduces the size and cost of the photovoltaic system needed to achieve zero energy when compared to houses powered solely by electricity.

Utilities Offer Support
Understanding the complicated challenges surrounding zero energy, gas utilities have developed programs to help builders make the most of the opportunity.

In California, a leader when it comes to zero energy, Pacific Gas and Electric works with builders in support of the state’s long-term energy goals through the Zero Net Energy Production Builder Demonstration project. Through this project, PG&E collaborates with builders to provide design consultation and energy performance monitoring for the development of zero energy homes. Once construction is complete and the home is purchased, PG&E tracks the energy performance of the home for a year.

Another California gas utility, Southern California Gas Co., actively supports sustainability with incentive programs like the California Advanced Homes Program and Zero Net Energy Demonstration Projects like the KB Home Dawn Creek Project, which features a 2,500-square-foot energy-efficient home that, along with a 96 percent efficient tankless water heater, includes a wireless thermostat and a natural gas home refueling appliance for cars.

Heslam, a former builder who built one of the first zero energy homes in 2004, sees potential in the use of natural gas in multifamily buildings, which have been an area of major activity in recent years.

Again, it’s a question of scale, both in terms of numbers and in terms of the structures themselves.

According to Heslam, as the single-family home gets more efficient, the heating load drops, making the domestic hot water load the largest load in the home. The same equation, he says, has been true for multifamily buildings for quite a while, because even without the efficient shell of a zero energy home, the residents and their activities largely heat the building, meaning water heating is the largest load.

“And that’s where gas technology has really shined,” Heslam said. “High-efficiency central gas water heating has been in the current crop of high-efficiency buildings, and it’s been a key aspect in allowing those buildings to hit the high levels of performance they need to hit.”

Capitalizing on that idea, Heslam said promoting cogeneration systems could be a positive move for the gas industry.

“Instead of shipping the gas off to the power plant and then getting electricity back at a 32 percent efficiency rate, why not just supply the gas to the building to meet the hot water load while simultaneously making electricity at the local level?” he said.

That kind of district-level approach is something Heslam has been bringing up with developers and utilities. It’s not new, but it’s becoming part of the conversation because zero energy is requiring builders to squeeze so much out of their systems.

“When we weren’t so concerned and a 32 percent efficiency grid was fine, you didn’t have to think about this stuff,” Heslam said. “But now, in conversations around the country, it’s coming back into play, and when you’re talking about zero energy building, it does scale pretty well for apartment buildings or townhomes or neighborhoods because the infrastructure is easier to do.”

Ultimately, whether in multifamily homes or in single-family homes—or in the government buildings and schools that certain jurisdictions are requiring to reach the mark—zero energy looks to be here to stay, and natural gas often makes getting to zero easier and more affordable.