



Workers at a 3D-printed house in the Wolf Ranch community.

Construction experts say that 3D printing is a significantly cheaper and faster way to build homes, with most estimates citing a cost savings of around 30%.

Each of the homes in Wolf Ranch was built in three weeks or less by a 4.75-ton (4.3-tonne) industrial printer that poured both its exterior and interior walls with lavacrete, a proprietary material made from pulverised red lava rock, cement and water that is squeezed out in layers, much like toothpaste onto a brush.

As an insulator, concrete helps to keep homes naturally cooler in the summer and warmer in the winter.

Icon estimates its homeowners pay 45% to 60% less on energy bills than their neighbours with traditional stick-built houses.

The homes, which are significantly more durable than those made with bricks or wood, are more than three times stronger than the Texas building standard. The walls are certified to handle 200mph (322kmh) winds and at least two hours of fire.

Despite its construction, Wolf Ranch's vibe is suburbia, not sci-fi. It has big master planned energy. But look closely at the homes' exteriors and you'll see there are no sharp edges.

Constructed by robot, all walls, both inside and out, have soft curved angles and are ridged like corduroy pants.

"The world of real estate is governed by self-fulfilling prophecies, and what is on the market tends to perpetuate itself," said Bjarke Ingels, the architect.

"We pioneers need to start offering something else."

The Icon houses come with



Ballard believes 3D printing is the solution to fill the affordable housing gap in the US.

fixtures, like solar panels and a standing seam metal roof, that are usually reserved for those at a higher cost. The roofs are more durable, energy-efficient and fire-resistant than traditional ones. Wolf Ranch has access to walking trails, fitness centres and a community centre with a swimming pool.

From Mexico to Marfa to the moon

Icon has built other housing in Austin, including 60 tiny homes for chronically homeless residents, with another 60 on the way, and five luxury houses of 3,000-4,000sq ft (279-372sq m) in Wimberley, an Austin exurb that is rapidly developing.

The company has projects in other countries, too – including a small village of 3D-printed houses for impoverished residents of Nacajuca, Mexico – and even other atmospheres.

Through a partnership with Nasa, the company is gearing up to print houses on the moon.

Nacajuca sits in a seismic zone, and the homes there have already withstood a magnitude

7.4 earthquake despite extensive regional damage.

The company has also printed army barracks for the US armed forces and a 2,000sq ft (186sq m), mid-century modern ranch house in East Austin with a net-zero energy output.

It is beginning work on El Cosmico, a 60-acre (24ha) site in Marfa, Texas, which eventually will house model homes, a restaurant and the world's first 3D-printed hotel, all printed on site in the desert in sand-coloured loops and domes.

"Everyone laughed about the Internet and smartphones, too, at first," Ballard said. "There will be a breaking point when we break through."

That breaking point might be closer than ever.

In 2023, the International Code Council, which is widely seen as the arbiter of building codes throughout the US, began working to lay out standards for 3D-printed construction. The move will streamline developers' approval process for 3D-printed houses at the local level.

Building codes, said Patti Harburg-Petrich, a structural engineer who serves as design executive at the construction company Swinerton, are the number one factor currently preventing the technology from scaling.

"For new technology to get permitted, there are a lot of checks," she said. "That's really the big driver in terms of why things take so long."

Those standards are likely to be adopted as soon as 2027.

It's a shift that could bring significant relief to an industry where tariffs, supply chain disruptions and an increase in the price of building materials have caused prices to skyrocket.

But the cost of building the printers – US\$500,000 (RM2mil) or more – plus the cost of land have slowed the adoption of 3D printing, said Jenny Schuetz, a former senior fellow at the Brookings Institution who specialises in housing policy. She now oversees housing strategies for Arnold Ventures, a philanthropic foundation.

Phoenix, and rising

Still, Icon is moving forward, with 17 active Vulcan printers in its fleet. But in the next two years, the company plans to debut a new prototype, the Phoenix, which it says can print foundations and roofs as well as walls and will be able to build not just houses, but multi-family apartment buildings.

In tandem with the development of Phoenix, Icon has created a digital catalogue of 60 home designs that its technology can print. They come in five categories: Texas modern, fire-resilient, storm-resilient, affordable and avant-garde.

An artificial intelligence architect, currently in the pilot stage, could allow users to input specific preferences for a home and eventually create custom home-build designs that can then be printed on demand.

"It's impossible to solve the global housing crisis doing things the way we've been doing them," Ballard said. "The way it will be solved is through robotics and automation."

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A 3D-printed house with a metal roof in Wolf Ranch Community.