

## **3D-Printed Homes**

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At nearly 4 million homes short of demand<sup>1</sup>, the United States is facing a supply and affordability crisis in the housing market. To some extent, 3D-printed homes may offer hope.

### **Use by Habitat for Humanity**

In late February, the PBS NewsHour ran a report on recent developments related to the growth of 3D-printed homes.<sup>2</sup> They featured CEO of Habitat for Humanity, Jonathan Reckford, who expressed “the hope is that this is the beginning of the curve but will lead to learnings that could mainstream ways that could either speed up construction or lower the cost of construction for us”. This, ‘at a time when labor and material costs are sky-rocketing and affordable housing is more and more scarce’. Habitat for Humanity is a nonprofit organization that supports those in need to either build or upgrade homes.

On the program, the NewsHour interviewed a recent homeowner who benefited from one of these Habitat for Humanity projects and toured her new 3D-printed home. The frame of the home was built with a printing machine of sorts, that dispensed the layers and layers of concrete based on a digitally programed ‘blueprint’. All of this was done over the course of a single day.

### **ICON and the Vision of 3D-Printed Homes**

The benefits noted by Reckford mirror the vision of ICON Technology CEO, Jason Ballard. ICON is an Austin-based company that has pioneered the technology for this form of construction, having built the first permitted 3D-printed home back in 2018. He feels that the best way to confront the problems of supply and affordability is with ‘robotic approaches to construction’. In his view, “t he more affordadble and simplified supply chain, combined with an order of magnitude fewer humans gives you this initial jolt of cost savings and improvements in speed of delivery”.<sup>3</sup>

### **Challenges**

The problem is that 3D-printers only addresses the issues related to a home’s frame. Mark Stapp, Director of Arizona State University’s real estate program, explains that “you've got plumbing, electrical, mechanical – air-conditioning and heating, that all need to be incorporated. You have finishes, the walls, windows that have to be installed. Products have to be adapted and ...you have to train the labor”.<sup>4</sup> Not to mention, there are proprietary blends of building materials that are relatively untested as compared with traditional materials.

### **Going Forward**

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<sup>1</sup> Housing Supply: A Growing Deficit. FreddieMac. May 7, 2021. Available at:

<https://www.freddiemac.com/research/insight/20210507-housing-supply>. Accessed on March 7, 2021.

<sup>2</sup> Sy, Stephanie. Can 3D printing become a solution for the housing shortage? PBS NewsHour. February 23, 2022. Available at: <https://www.pbs.org/video/3-d-printed-houses-1645656781/> Accessed on March 7, 2022.

<sup>3</sup> *Ibid.*.

<sup>4</sup> *Ibid.*

Despite these challenges, even Stapp admits that there is likely to be increasing traction with the approach to building. The global 3D-printed construction market – estimated at roughly \$18 million in 2022 (\$11.3M in 2021) – is projected to reach almost \$5 billion in 2030.<sup>5</sup> That’s an impressive compound annual growth rate (CAGR) of just over 100 percent. It is worth noting that of the \$11.3 million market size in 2021, about \$1.6 million represented the size of the U.S. market. The Asia Pacific region dominated the global market with about a 39.5 percent share of the global revenue in 2021. Further insights on this market growth and a list of major companies in this space can be accessed in the Report Summary of the recently published Grand View Research report notated in reference to these numbers.

An interesting model home will be displayed for the upcoming South by Southwest Conference and Festival in Austin, TX. ICON worked with San Antonio and Austin-based architecture studio Lake Flato to design what they are calling ‘House Zero’. Built with ICON's Vulcan construction system, the home construction is reinforced by steel [and] ‘the walls are printed with a proprietary material ICON calls Lavacrete – a cement-like substance that is air-tight while also providing increased insulation’.<sup>6</sup>

With this technology, it would seem far too simplistic to equate 3D-printing with just the frame of the house. Lewis McNeel, associate partner at Lake Flato explains that "[y]ou can eliminate a number of separate materials and construction steps on a job site if you can print the equivalent of cladding, sheathing, thermal breaks, formwork for structure and interior finish all in one pass of the printer," he said.

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<sup>5</sup> 3D Printing Construction Market Size, Share & Trends Analysis Report By Construction Method (Extrusion, Powder Bonding), By Material Type (Concrete, Metal), By End-user (Building, Infrastructure), And Segment Forecasts, 2022 – 2030. Grand View Research. February 2022. Available at: <https://www.grandviewresearch.com/industry-analysis/3d-printing-constructions-market> Accessed on March 7, 2022.

<sup>6</sup> Dreith, Ben. ICON and Lake Flato build 3D-printed House Zero in Austin. Dezeen. March 4, 2022. Available at: <https://www.dezeen.com/2022/03/04/icon-lake-flato-3d-printed-house-zero-austin/> Accessed on March 7, 2022.