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Micron's concrete dilemma: Building the vast complex in Clay conflicts with green promises

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This 2022 rendering shows Micron Technology Inc.'s planned semiconductor fabrication facility in Clay. Micron says it plans to have zero net carbon dioxide emissions in its operations, but construction of the Clay complex would spew enormous amounts of CO2 into the environment. (Micron Technology)



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Syracuse, N.Y. – To build its massive chipmaking complex in Central New York, [Micron Technology](#) would have to pour six times more concrete than it took to build the Pentagon.

Micron would also use four times more steel than is in the Golden Gate Bridge.

The eye-popping amounts of concrete and steel needed to build Micron's four fabrication plants, or fabs, underscores challenging contradictions both in chipmaking and in the company's long-term pledge toward carbon-neutral emissions.

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Micron has pledged to release net zero greenhouse gases by 2050. Yet buildings the size of NFL stadiums are needed to produce the essential fingernail-sized computer chips essential to modern life.

And erecting those buildings takes staggering amounts of concrete and steel, two materials whose production ranks among the biggest emitters of greenhouse gases in the world.

"Just making concrete and steel has released 15% of all of the greenhouse gases in the atmosphere," said Paul Crovella, a professor of construction management and sustainability at SUNY College of Environmental Science and Forestry.

READ MORE: [Taxpayers will subsidize 40% of Micron's first phase in Clay](#)

For now, there's no other way to make gigantic buildings that can guarantee the near-absolute stability needed to make the tiny and powerful computer chips.

The concrete and steel industries pledge to make their processes more climate-friendly, but in the meantime they emit five times more carbon dioxide, the biggest contributor to global warming, than the entire global shipping industry.

In 2050, Micron says, it will reach net zero emissions in both its operations and the energy it buys. Net zero means that greenhouse gases are reduced, but those that are emitted are offset elsewhere.

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At the same time, Micron's most recent sustainability and climate change reports never mention the words "concrete" or "steel."

The initial agreement between Micron and New York state, signed in 2022, doesn't require Micron to use low-carbon emissions steel or concrete to build its complex in the town of Clay. That agreement, which laid the groundwork for Micron to receive up to \$5.5 billion in state taxpayer dollars, requires Micron only to "encourage contractors to utilize, to the extent they are reasonably available, suitable, and cost-effective, low-carbon construction vehicles and equipment and incorporate low-carbon building materials."

The agreement did not specify what "green" meant, and Micron did not mention this in an email response to [syracuse.com](https://www.syracuse.com).

The absence of those requirements shows the reality of building a factory complex bigger than Syracuse University's main campus while aiming to lessen adverse environmental effects.

And it's not just Micron: All of the world's leading chipmakers are building massive new plants across the country and the world as the demand for chips soars with the burgeoning artificial intelligence and data center industries. The \$500 billion global chip industry is expected to top \$1 trillion in a few years.

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Yet the production of enough concrete and steel for Micron's Clay complex could spew as many greenhouse gasses into the atmosphere as almost 200,000 typical New Yorkers as they drive cars, heat their homes and otherwise use energy in a year.

Micron says it has little choice.

"Use of concrete and rebar is standard practice in modern construction for multi-story industrial buildings that are designed to support advanced manufacturing processes, such as chip fabs," Micron said in a statement to [syracuse.com](https://www.syracuse.com) | The Post-Standard. "Micron is committed to sustainability practices and actively explores strategies to minimize its environmental impact."

“We focus on recycling and reusing construction materials, which may include blast furnace cement, slag and steel moldboards,” the statement said. “Materials like these may offer economic advantages, environmental benefits and may be well-suited to meet our operational requirements.”

The company declined to answer followup questions.

There are ways to reduce the greenhouse gas emissions from the production of concrete, Crovella said.

“The use of ground glass from recycling can reduce the carbon impact from cement by 40%,” Crovella said.

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Crovella pointed to a small Binghamton company, KLAW Industries, that pulverizes broken glass to form a fine powder that replaces cement. The ground glass can replace about 20% of the cement used for a typical batch of concrete, said Jake Kumpon, co-founder of KLAW.

Yet even if all of the nation’s 7.5 million tons of glass ending up in landfills were ground into powder, it would replace just 3% of the cement used in the U.S. each year.

Mammoth materials

Each Micron’s four fabs would cover about 27 acres of land, and the entire fab complex would be about a mile long and a half mile wide. The buildings would stand 165 feet high – higher than the JMA Wireless Dome. Some concrete floors in the three-story fabs would be up to 4 feet thick, Crovella said.

Estimates of Micron’s use of concrete and steel are based on an interview with Crovella and a 2019 presentation by global fab builder Exyte, which is the construction manager for Micron’s fab in Idaho. While Exyte’s PowerPoint presentation does not name Micron, the generic fab it profiles is the same size as the ones Micron plans to build in Boise and Clay.

The title of the presentation is “Creating Sustainable Wafer Fabs for the Future.”

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The main raw material for a fab is pizza-sized silicon wafers that undergo more than 1,000 processes before being cut into tiny microchips.

Exyte says each fab would require the equivalent of 680,000 cubic yards of concrete, for a total of 2.7 million cubic yards for all four Clay fabs. That's 90 times more concrete than it took to build the original Carrier Dome.

Each fab would also require 80,000 tons of steel rebar, the rods that reinforce the concrete and give it greater strength.

"One of these facilities requires as much steel as the Golden Gate Bridge," Manish Bhatia, Micron's executive vice president of global operations, told President Joe Biden in Syracuse two months ago.

That's a total of 320,000 tons for all four fabs. That is eight times more steel than it took to build the world's tallest building, the Burj Khalifa, in Dubai, which is a half-mile tall.

Concrete and steel estimates used in this story are only for the four fabs. They don't include office buildings, utility buildings, warehouses and other necessary structures. Those buildings would add up to more than 1.5 million square feet of floor space and require substantial amounts of concrete and steel in addition to that used for the fabs.

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Micron also plans to build more than 9,000 parking spaces, about the same as Destiny USA.

Micron has already started building a fab in Boise that will be the same size as each of the Clay fabs. The company could get [more than \\$20 billion in taxpayer subsidies](#) to build the first two fabs in Clay and the one in Boise.

In Boise, Micron has three concrete batch plants on site that will soon generate 15,000 cubic yards of concrete every week, the [Idaho Statesman reported](#). That's equal to about 1,200 dump trucks full.

The concrete challenge

The production of concrete and steel are among the biggest sources of the world's emission of carbon dioxide, the key chemical in trapping heat at the earth's surface.

Most of the emissions emitted to make concrete are generated in the production of cement, the powder that binds water, sand and crushed stone to make concrete. The process of making cement from limestone is highly energy-intensive, requiring grinding of rocks and heating them to 2,500 degrees.

"If cement were a country," Crovella said, "it would have the third-highest emissions in the world behind the U.S. and China."

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The cement industry has pledged to change its production process to reduce greenhouse gas emissions. A carbon-neutral cement plant is under construction in Norway.

Cement won't be made in Clay but will be shipped in along with the other components. There are about 100 cement plants in the U.S. that produce more than 80 million tons of cement annually.

Steel production has a similar environmental impact, accounting for about 7% of the world's greenhouse gas emissions. Most of the carbon dioxide comes as steel is made in blast furnaces, which reach temperatures of more than 2,000 degrees.

Efforts to reduce the use of coal and other fossil fuels to produce steel are in the early stages. The Biden administration in March awarded up to \$1.5 billion to steelmakers to reduce greenhouse gas emissions, including through the use of "green" hydrogen. Another \$1.5 billion was awarded to manufacturers of cement and concrete to reduce their greenhouse gas footprint.

Micron's fabs will join more than 100 others worldwide that produce some kind of computer chips. At full buildout, Micron says, its fabs in Clay and Idaho will increase the U.S. share of the global market for the main type of memory chip from 2% to 12%.

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