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The innovation issue

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Pandemic.
Inequality.
Misinformation.
Unrest.

Technology has let us down.

Here's how to make it work for us again ...
and 35 young innovators leading the charge

"Globally, we are truly tapping out our water resources."

DAVID WARSINGER

Purdue University

Age 32 | Country of birth: US

His system could alleviate the drawbacks of existing desalination plants.

David Warsinger thinks he's found an innovation that could help combat one of the 21st century's great environmental challenges: water shortages around the globe.

His fix is an improved form of reverse osmosis—the most common method of desalination. Today, an estimated 5% of the world's population relies on desalinated water, drawn from the ocean or brackish inland sources, to meet at least some daily needs. This figure will continue to rise as aquifers are further squeezed by pollution, overuse, and shifting rainfall patterns linked to climate change. According to the United Nations, some 3.6 billion people live in areas that experience water scarcity at least one month of the year—and that number is likely to exceed five billion by 2050. "Globally, we are truly tapping out our water resources," Warsinger says.

Yet desalination today has major limitations. Traditional reverse osmosis, in which pressurized water is forced through a salt-removing membrane, uses a lot of energy and is costly. It also leaves behind a large part of the water as brine—an especially big problem for inland plants, where source water is scarcer.

Warsinger's system, which he developed with Emily Tow while they were both at MIT, is known as batch reverse osmosis, and it is designed to make the process more efficient. The technique allows desalination to occur in batches, with salinity and pressure varying over time. Whereas traditional reverse osmosis systems apply constant pressure, the batch system is engineered to apply less pressure to water that's less salty, saving a considerable amount of energy. It also increases the rate of fresh water extraction by minimizing the build-up of salt on the membranes.

Warsinger's lab at Purdue, where he's now a professor of mechanical engineering, has since worked to refine the batch design. His team has developed a trailer-sized prototype it hopes to use for pilot plants in Peru and Kenya. *—Jonathan W. Rosen*

ALEX Le ROUX

Icon

Age 27 | Country of birth: Canada

A massive 3D-printing project in Mexico could point the way to the future of affordable housing.

Alex Le Roux thinks 3D printing can open new possibilities for architectural design and cut the cost of building housing around the world.

As cofounder of Icon, a startup based in Austin, Texas, Le Roux is the mastermind behind the Vulcan, an industrial-scale 3D printer that can construct the wall system of an entire house in just 24 hours of print time. According to the United Nations, some 1.6 billion people lack adequate shelter, and a third of the world's urban population lives in informal settlements or slums. Part of the reason, Le Roux says, is that traditional building methods lead to wasted materials and excess labor costs, driving up housing prices beyond the reach of many poor families.

The Vulcan is designed to change that by introducing automation to the process. The 12-foot-tall robotic device works by extruding inch-thick layers of a special concrete mix fed in from a separate machine, much like a giant tube of toothpaste. Icon programs its home designs ahead of time to make the operator's job as simple as possible. "Once these two machines are set up on a job site, you download an app and you're off to the races," Le Roux says.

In March 2018, Icon built the US's first officially permitted 3D-printed house. It has now built 16 houses in Austin and in Mexico, where it's constructing the world's first 3D-printed community, designed to accommodate 50 low-income families. Icon's ultimate goal, Le Roux says, is to reduce the cost of homebuilding by 50%.

—Jonathan W. Rosen

SAM KERR (WARSINGER); NATALIE CASS, SCORE HEADSHOTS (LE ROUX)