

Redefining manufacturing for a sustainable future

RIT and the REMADE Institute promise to make the circular economy possible

By **NABIL NASR**

Each year, the American manufacturing sector uses about a third of all energy consumed in the United States. About half of it becomes embodied within the materials the manufacturing sector produces. Annually, this creates over 1.6 billion tons of greenhouse gases, which contribute significantly to climate change across the globe. But for all its efforts, U.S. industry still creates more than 7.5 billion tons of material waste every year—more than the entire European Union—and most of it ends up in landfill.

These inefficiencies, it turns out, are directly related to the manufacturing sector's struggle to remain competitive over the past several decades.

In order to restore the competitiveness of U.S. manufacturing in an era when environmental concerns are as valuable as (and increasingly tied to) economic ones, researchers have long contended that we have to rethink our approach to manufacturing. The challenge, of course, is to find a way that businesses can adopt new technologies and paradigms that make them more competitive and sustainable for the future, without imposing costs that impinge the ability to survive right now.

For that, we have the Manufacturing USA program, a public-private partnership initiative focused on addressing the knowledge gaps and barriers to advancing the state of industry. By combining resources in a collaborative model, Manufacturing USA makes breakthrough innovation a group effort, with the returns for participation multiplying each group's investments nearly tenfold.

And in this initiative, the REMADE Institute leads the way in redefining what it means to be a manufacturer.

Short for Reducing Embodied Energy and Decreasing Emissions, REMADE is a consortium of research and industry resources that specialize in materials manufacturing and energy efficiency. It's headquartered in Rochester, not far from the Rochester Institute of Technology campus where it all started.

RIT was instrumental in establishing the Institute from the beginning and will continue to play a role in leading REMADE's endeavors. By sharing technology development resources from the Golisano Institute for Sustainability, or GIS, expertise in remanufacturing to lead the Institute's Remanufacturing and Re-use research node, and even executive leadership personnel, RIT will be a driving force for necessary change.

But how will it transform the manufacturing industry? The first step is recognizing challenges that need to be addressed. In this, REMADE aims to change the

perspective with which manufacturers approach operations—so when industry throws away those 7.5 billion tons of material, they think of it as more than just a necessary byproduct of business. Rather, REMADE encourages manufacturers to understand that in creating and disposing that waste, they also throw away all the money spent on energy, feedstocks, and labor that went into making that material.

cycle aluminum into a secondary raw material uses 90 percent less energy than producing new aluminum from scratch. The potential savings in costs and emissions by using recycled aluminum in manufacturing are thus immense; yet, many product designs require virgin aluminum, even though the recycled option can perform just the same in most cases. Because of this, demand for recycled aluminum is lower than it could be, reducing the market strength of secondary materials. And as a result, customers have little incentive to recycle it; 80 percent of the aluminum Americans throw away ends up in landfill, despite virtually all of it being recoverable.

To avoid situations like this, the REMADE Institute has set a goal to make secondary materials more cost-effective to source and use—putting them on the same level as virgin materials. Other goals include reducing new material

consumption in general by 30 percent across the manufacturing sector; improving the energy efficiency of processing secondary materials by 30 percent; and reducing the embodied energy of the most commonly used and critical manufacturing materials by 25 percent. On top of all this—and in many ways supporting these goals—the Institute aims to develop technologies capable of significantly increasing the market share of remanufactured products.

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board, the potential for resource sharing and collaborative innovation is unprecedented. Still, some will ask why we must redefine manufacturing at all. There are two parts to the answer. First, U.S. manufacturing in particular has struggled to contend with global competitors who have access to inexpensive labor and materials. In order to sharpen our competitive edge, we must make changes. This means lowering material and process costs through technologies that improve energy and material efficiency, but it also means bringing something to the market that global competitors currently do not. For us, that key is sustainably manufactured products that capture growing customer demand for environmental stewardship.

The second part explains why the first is necessary. In order to sustain manufacturing as a pillar of our economy, we must circularize our patterns of resource use. Rather than take virgin materials from the ground, make them into valuable products through manufacturing, and then throw them away at the end of their use, we must close the loop so that the manufacturing industry is supplied not by the earth alone, but by the wealth of in-use products that exist and circulate within the economy. Giving new life to resilient materials not only reduces the environmental impacts of resource depletion, but also saves time, money, and energy—not coincidentally, keys to economic success. And according to the Ellen MacArthur Foundation, the leading proponents of circular economy research, such reciprocally restorative industrial systems hold more than \$1 trillion in economic opportunity.

By decoupling economic growth from environmental degradation, then, we can ensure stability and sustainability in the manufacturing industry for generations to come. And while this future may seem a long way off, RIT and the REMADE Institute are already leading us there.

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RIT's Golisano Institute for Sustainability (GIS), which led the effort to establish the REMADE Institute headquarters in Rochester, and with whom REMADE shares resources and expertise.

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