



Achieving Sustainable Development Goals

The United Nations (UN) adopted 17 Sustainable Development Goals (SDGs) in 2015 as a call to action (see figure below) and identified 169 specific targets to help guide these actions. The goals aim to protect people and the planet and promote peace and prosperity to transform global socio-economic ecosystems by 2030.

We are five years into the effort and, so far, results are mixed. While some large multinational companies regularly publish annual sustainability reports and aggressively measure SDG-target progress, many have not yet adopted sustainable development objectives as a measure of corporate performance or as a tool to improve the bottom line.

Some organizations have developed guidance documents that build on the SDG goals and targets. KPMG published their SDG Industry Matrix series in 2017, which offers segment-specific activities that help each industry achieve targets. The publications feature best practices and existing collaborative efforts that can enable companies to achieve SDGs. The World Business Council for Sustainable Development published a Chemical Sector SDG Roadmap in 2018 that highlights the SDGs relevant to segments of the process industries. The roadmap also identifies product and process innovations that can be used to achieve SDG targets.

The RAPID Manufacturing Institute promotes technology development in the areas of process intensification (PI) and modular processing. Our success metrics have focused on improving process yields, reducing manufacturing footprints, and lowering energy use. However, our perspective is evolving, and we are starting to consider the impact PI and modular technologies can have on achieving the SDGs.

It is easy to see how RAPID technologies might help members meet SDG targets. For example, RAPID is already funding several projects that focus on the intersection of water and energy (Goal 6 and Goal 7). A novel membrane technology is being developed to concentrate wastewater streams in industrial processes and dramatically reduce the energy needs of the associated manufacturing plants. Other projects are developing sustainable and energy-efficient tech-

nologies to treat produced waters from the oil and gas industry. Another is developing unique 3D-printed membranes for low-energy separation of water and organic streams.

Major changes in the energy industry will need to continue to address climate change (Goal 13). As we transition electric generating assets to low-cost renewables, intermittent wind, and photovoltaics, we will need cost-effective energy storage options. Modular production technologies, especially those with electrified processes, may provide suitable storage alternatives to battery systems. These technologies could be integrated into the grid to produce chemicals and fuels as energy storage mechanisms. RAPID funds two projects to develop microwave-assisted chemical reactors that convert distributed raw materials, such as low-cost natural gas and biogas, to high-value chemicals.

Some of these PI-enabled and modular technologies could also be applied to the nitrogen value chain to reduce energy use and costs. Nitrogen is used to make fertilizers and other agricultural chemicals, which could directly impact Goal 2. The UN specifically calls out the need to double agricultural productivity and ensure sustainable food-production systems. Modular, PI-enabled process technology will provide options for distributed manufacture of ammonia and other agricultural chemicals, enabling production closer to the farms, optimizing supply-chain logistics, and reducing transportation costs and greenhouse gas emissions.

RAPID and its members are working to transform the way engineers design and deploy process technology (Goal 9) to more efficiently use raw materials and dramatically reduce energy consumption. These technology options could allow operating companies to rethink the scale and geographic distribution of their manufacturing footprint. Modular plants can be distributed, deployed to economically disadvantaged areas, and operated more efficiently than larger plants to create jobs and encourage economic development (Goal 8). In addition, supply chain redundancy and decentralized manufacturing improve resilience to natural disasters, raw material supply interruptions, and other unpredictable events. Investors and financial analysts are beginning to discuss the need for decentralization in a climate-constrained economy.

RAPID is in the early stages of mapping our PI and modular process technology options to the relevant SDGs. We are assessing current process technologies, looking for opportunities to improve yield and reduce energy and water use, and identifying new process options that could provide substantial gains. PI and modularization will naturally turn up during this process, as these technologies allow organizations to meet SDG targets while improving the bottom line. 

