Combined Heat and Power (CHP) and American Manufacturing

After decades of watching America's supply chains migrate overseas, we are facing the reality that dependence on foreign producers has weakened the nation's resilience, security, and economy. When factories leave the U.S., we lose not only factory jobs, but also the associated suppliers, expertise, and innovation. When a crisis strikes, vital supplies are unavailable. When productivity growth and innovation are needed, they are nowhere to be found. COVID-19 has highlighted the importance of local manufacturing and supply chains.

Sheet metal worker at a SMART training center in Pittsburgh, PA[1]

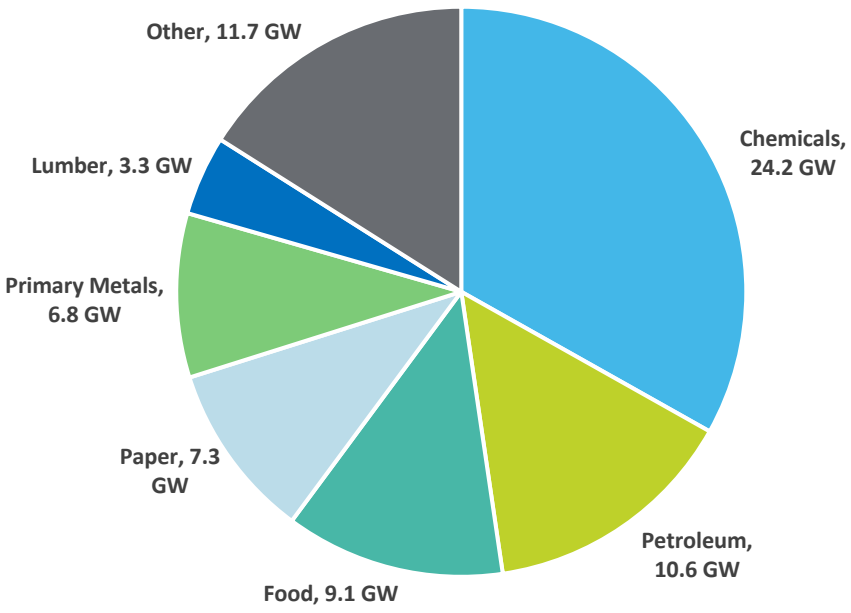
Policy makers are now focusing on the question of how to bring manufacturing back to the U.S. and make American manufacturing globally competitive. While there are many policy options to explore, this factsheet focuses on energy policy. Energy cost, reliability, and sustainability are all critical factors in the ultimate production cost of any plant. Combined heat and power (CHP) systems, also known as cogeneration, have long been a mainstay of American manufacturing plants in the chemical, petrochemical, pulp and paper, pharmaceutical, and automotive industries. Anywhere electricity and thermal energy are required to produce products, CHP can be found. In fact, today, properly applied natural gas-based CHP systems in manufacturing plants are likely the most efficient means of delivering electric and thermal energy, providing a resilient solution in times of electric grid failure, and the most cost-effective means of reducing carbon emissions.

Given CHP's strong track record in the U.S. manufacturing sector, with over 1,200 existing industrial CHP facilities totaling about 66 GW of capacity[2], CHP should be at the forefront of U.S. energy policy. Federal and state programs seeking to promote new manufacturing development should include energy cost, reliability, and sustainability in their policy strategies.

Looking to the future, the U.S. Department of Energy has identified over 73 GW of remaining CHP technical potential capacity at over 50,000 industrial sector sites nationwide.[3] (Figure 1). This potential, coupled with increasing the use of digester and landfill gas will yield ultra-low carbon emission CHP plants, can provide significant reduction of carbon emissions at a very low societal cost. Additionally, increased use of green hydrogen fueled CHP plants, some of which are operating today, can yield zero emission CHP systems.

The following case studies are examples of CHP systems that have contributed to U.S. plant competitiveness, retained high paying manufacturing jobs, and improved the environment.

Fig. 1: On-site Industrial Sector CHP Technical Potential



[1] Photo from Sheet Metal, Air, Rail & Transportation Workers (SMART) Local 12 Training Center in Pittsburgh, PA.
[2,3] U.S. Department of Energy. "Combined Heat and Power (CHP) Technical Potential in the United States." March 2016. https://www.energy.gov/sites/prod/files/2016/04/f30/CHP%20Technical%20Potential%20Study%203-31-2016%20Final.pdf

Procter and Gamble (P&G) Paper Products Mehoopany, Pennsylvania[4]

When Procter and Gamble (P&G) put one of its biggest paper products plants in Mehoopany in 1966, its reasons for doing so were more than paper thin. The location—driven by access to wood, water, and workforce—put the company's products in close proximity to more than half the U.S. population. Today, it's home to approximately 2,000 employees, 1,000 associated contractors, and a payroll of over $200 million annually. Next year, the facility will celebrate 50 years of continuous operation without a single layoff.

The P&G plant in Mehoopany, PA manufactures many items that were in short supply in the early months of the COVID-19 pandemic. Bounty paper towels and napkins, Pampers and Luvs diapers, and Charmin toilet paper are all made at P&G's largest U.S. factory, which has also added face masks to its output.

Two CHP systems have kept the Mehoopany plant energy cost competitive through many market upheavals since 1985. P&G Cogen 1 is a 52 MW Westinghouse gas turbine-powered genset that has been operating on pipeline gas since July of 1985, but now is fueled by Marcellus gas and uses its exhaust gas for drying paper on six production lines. P&G Cogen 2 is a 64 MW Rolls-Royce gas turbine-powered electric generator, has a heat recovery boiler that captures 140,000 pounds of steam per hour for paper drying and plant heat, and additionally creates more hot air at 400 degrees Fahrenheit for drying paper on product lines #7 and #8. In 2013, Cogen 2 was added using 100 percent local natural gas, much of which comes from the ground under the plant.[5]

Given that the Mehoopany facility is nearly 20 percent of P&G's global energy footprint, the CHP systems have represented a major step toward the company's business objective to improve both its finances and its environmental record. The plant is now totally independent for its site energy needs, is selling excess electricity back to the local grid, and is realizing an annual gross savings of $16.5 million per year.

F-D-S Manufacturing Company, Pomona, California[6]

Stationed in a region of fertile California soil, flourishing vineyards, and a rooted citrus community, F-D-S Manufacturing employs 130 workers and is a crucial player in the West Coast agriculture industry. For more than six decades, the company has made packaging material for major California growers, distributors, grocers, and universities. F-D-S manufactures packaging products for agricultural and industrial markets including fruit and vegetable baskets, clamshells and fruit tray liners, single face corrugated rolls, sheets, die cuts and angle and corner pads, stretch film, wax paper, and polyethylene terephthalate (PET) sheets. In 2009, the company installed a new plastics extruder line that requires large amounts of electricity, hot air, and chilled water.

After a widespread search, executives selected six Capstone C65 MicroTurbines® to meet the facility's forecasted combined cooling, heating, and power (CCHP) needs, and significantly shrink the faciliy's energy bill and carbon footprint. The grid-connected CCHP system generates 0.32 MW of electricity and supports 20 percent of the site's total power usage. The natural gas-fueled microturbines operate at near 80 percent efficiency, saving F-D-S Manufacturing an estimated $35,000 per month – a 1/6th reduction of the facility's entire energy bill. The microturbines have safeguarded the company's power supply through California electric grid brownouts and cut costs, and reinforced F-D-S's reputation as a leader in the green packaging market.[7]

[4] Photo of Procter and Gamble's Mehoopany Plant. https://pgmehoopany.com/index.html
[5] Susquehanna Independent. "P&G moves beyond paper." November 2013. http://www.susqcoindy.com/PS/2013/11/27/pg-moves-beyond-paper/
[6] Photo of Capstone C65 MicroTurbines located at the F-D-S Manufacturing facility.
[7] Capstone Turbine Case Study. "F-D-S Manufacturing Company." CS_CAP410_FDS_lowres.pdf