29 June/6 July 2020
chemweek.com

IHS Markit®

Chemical Week

Raising the bar

Responsible Care gets a fresh look as stakeholder concerns evolve

Contents

↘ 29 June/6 July 2020
↘ For more, visit *chemweek.com*
↘ Issue: 182 ↘ number: 15

IHS Markit

MOHAMMADI: Big plans in Iran.

BABILAS: Continuous growth for Altana.

SCHWEDEL: Encina's circular economy.

BOCK: Former CEO to chair BASF board.

On the cover ↘23

Raising the bar on performance: Responsible Care gets a fresh look

Responsible Care—the American Chemistry Council (ACC) signature environmental, health, safety, and security initiative—continues to be the guiding ethos of the chemical industry.

Encina finds its future in plastic waste

A surprising discovery led the BTX producer away from coal and into the circular economy

Clay Boswell

Encina (The Woodlands, Texas) was founded to produce benzene, toluene, and xylenes (BTX) from coal, but the company made a sharp change in direction last October after discovering that an alternative feedstock—plastic waste—dramatically improved the economics of its process. Advanced plans to build a coal-based facility in Wyoming have since been scrapped, and Encina will soon announce the location for a $255-million, 100,000-metric tons/year plastics-to-BTX facility. Construction is slated to begin during the first quarter of 2021, and additional plants are in the pipeline.

"Our business plan is to have at least five operating facilities with expansion capabilities [located] globally to tackle the plastic problem," says David Schwedel, founder and executive director. "We're looking to do an IPO in about two years, and we're positioning ourselves to be the go-to waste-plastics-to-chemical/fuels company in the world. That is our focus."

Encina's process is based on pyrolysis technology developed to produce clean coal and later adapted to produce activated carbon. Encina licensed the technology with the idea of optimizing the yield of a by-product—pyrolysis gas, the aromatics-rich hydrocarbon typically produced by the steam cracking of naphtha. Working with engineering and construction firm Worley, Encina modeled the yield of BTX from coal to 6–8%, and in 2018, the company announced it would build a BTX/activated carbon production facility in Wyoming.

Encina's engineers continued to refine the process, and while looking for a way to make it carbon neutral, they began experimenting with plastic waste. If plastic could be included on the feedslate without reducing yield, they reasoned, it would be recycled, offsetting a portion of the emissions generated. In fact, they discovered that the more plastic waste they added, the greater the yield of BTX.

Faced with this surprising result, Encina reconsidered its plans, says Schwedel. As originally configured, the plant would have processed about 4.2 million metric tons of coal per year, or about 480 metric tons per hour, to produce about 100,000-metric tons/year of BTX, for a yield of 6–8%. By comparison, completely replacing coal with plastic waste pushed the yield to 55% while eliminating the production of activated carbon and steeply lowering the capital cost.

"It costs you $550 million to build the [coal-based] plant," notes Schwedel. "With plastics, you can build a 20-ton-per-hour facility at about half the cost and in three-quarters of the time but get the same [volume] of BTX. So that was it, we had to go in this direction."

SCHWEDEL: Planning five or more plants globally and an IPO.

Encina negotiated an exit from its lease on the site in Wyoming, which had been chosen for its proximity to the coal deposits of the Powder River Basin. A new location along the Mississippi River was identified, the idea being to receive plastic waste by water and likewise to deliver BTX to the markets of Texas and Louisiana. However, the company broadened its search after hiring PLG Consulting. "You want to be as close to the feedstock as possible," notes Schwedel. "Most of the [plastic waste] feedstock in the US tends to be in the northeast part of the country, so we're looking strongly in that area now."

The US Northeast already shows signs of becoming a petrochemical hub, owing to low-cost feedstock ethane supplies in the region. Shell is building a $6-billion ethylene project in Monaca, Pennsylvania; PTT Global is mulling a similar project in Ohio; and local business development groups are actively pursuing related investments. A plastics-to-BTX facility would neatly complement these projects by producing the aromatics that steam crackers consuming ethane cannot.

Securing a reliable, economical supply of suitable feedstock is one of the greatest hurdles to widespread plastics recycling. The volume of plastic waste produced is enormous, but it must be aggregated from a myriad of sources as small as the bins set out by individual households. This fragmentation compounds the fundamental problem of quality, which varies widely with respect to both resin type and purity, so that sorting and cleaning requirements become important contributors to cost. The result is that very little plastic is currently recycled, and most of that is polyethylene terephthalate (PET) or high-density polyethylene (HDPE), the more easily recycled plastics bearing codes 1 and 2.

"Plastics 1 and 2 get all the love, while plastics 3–7 go to the landfill," Schwedel observes. "Fortunately for us, our process works best on plastics 3–7." That's because pyrolysis is a brute force technology that is relatively insensitive to feedstock quality. Whereas other chemical recycling technologies might dismantle a polymer, freeing the monomers, pyrolysis tears the polymer apart, producing a range of basic hydrocarbons. More of the energy consumed to produce the original polymer is lost, but this shortcoming is offset by the ability of pyrolysis to handle unsorted plastics, difficult-to-recycle plastics, and plastics contaminated with other materials.

"We have letters of intent in place with feedstock suppliers that get us today to 100% of what our current US plant expectations are, and we believe that we can double that within the next 6 to 8 months," says Schwedel. The company recently hired a veteran of the plastics recycling industry, Mylinda Jacobsen, as its global director of purchasing. "Mylinda's market expertise, industry connections, and the ability to develop strategic relationships are key to shaping the growth trajectory of Encina."

Encina is not the only company planning to recycle plastics using pyrolysis, but Schwedel says its process is uniquely flexible, owing to the catalysts used. "In our case, not only can we make BTX, but we're having conversations with companies now about polypropylene solutions, where it's a full circular loop for them." A "plug-and-play" capability allows Encina to convert about 20–30% of its end product to refinery-grade propylene he says.

"Our goal is to help solve [the] waste plastics problem," Schwedel adds. "We will continue to evolve as we look at aggregating technologies that can beneficiate plastics into a multitude of other products downstream on a global basis." ■