RENEWABLE THERMAL COLLABORATIVE

DIAGEO

CASE STUDY
Diageo Lebanon Distillery

Diageo's new all-electric distillery in Lebanon, Kentucky.

LOCATION
Lebanon, Kentucky

INDUSTRY TYPE
Food and beverage

FACILITY TYPE
Distillery

TECHNOLOGY DEPLOYED
Electric boilers (jet electrode)

EMISSIONS IMPACT
Avoids approximately 117,000 metric tons of CO_2 emissions annually

Project Overview

When constructing a new distillery in Kentucky, Diageo decided to use electric boilers powered by a mix of 100% renewable wind and solar energy sources rather than conventional thermal processes. This choice — in addition to several sustainability features — resulted in significant avoided emissions and furthers Diageo's commitment to reach to net-zero carbon across its direct operations, as part of its **'Society 2030:Spirit of Progress'** action plan to help build a more sustainable world.

Project Description

The Distillation Process

As is the case for many kinds of food and beverage production, distilling has multiple thermal processes requirements. The distilling process has three large heat requirements: cooking the grain into mash, generating steam to capture the ethanol in a distillation column, drying the leftover grain for alternative uses, such as animal feed. Cookers use steam through a heat exchanger to cook the grain while steam is directly injected into the distillation column during the distillation process. While previous generations of dry houses have direct fire natural gas dryers, this facility utilizes steam for an evaporation process as well as a steam-fired rotary dryer.

Electric Boilers

Product consistency is critical to Diageo; the company needed to maintain the integrity of the traditional processes like milling grain, cooking, fermentation, distillation, and maturing while still avoiding emissions. Instead of natural gas fired equipment, the new distillery uses 22-foot tall high voltage jet electrode boilers. These equipment can rise to the desired heat level almost immediately, making them much more precise than traditional heat sources and nearly 100% efficient. The electrode boiler system pumps water out of the header jets to an electrode that conducts the electric current, heating the water to generate steam. The boiler pressure control system modulates the pump speed and allows the boiler system to maintain constant steam pressure.

Rendering of electrode boilers

Courtesy of Precision Boilers

Modulation of the steam output is based on water circulation from the variable speed circulation pump. The boiler pressure control system modulates the pump speed and allows the boiler system to maintain constant steam pressure.

Sourcing Renewable Electricity

The electricity used to power the electrode boilers and the facilities electrical needs is sourced from 100% renewable sources through a fifteen-year agreement with the two local energy cooperatives.

Diageo chose to prioritize sourcing the renewable electricity as close to the facility as possible. The company worked closely with the energy cooperatives in preparation for the higher electricity demand required to operate the electrode boiler system, including work on electrical system requirements and identifying renewable electricity projects.

The 15-year power agreement is structured to provide validated renewable energy supported with renewable energy certificates. The site will only require small residual amounts of carbon offsets to be purchased, associated with refrigeration and emergency back-up power. Carbon offsets are expected to account for less than 165 MT CO_2-eq, which is approximately 0.1% of the total calculated GHG emissions being avoided through the electrification of the site.

Meeting Diageo's Goals

This project is part of Diageo's journey towards meeting the approved Science Based Targets in its Society 2030 action plan, as it seeks to realize a 100% reduction of Scope 1 and Scope 2 greenhouse gas (GHG) emissions across its direct operations by 2030, harnessing 100% renewable energy.

After deciding to move to electric boilers, Diageo opted to electrify its operations in the new facility, using LED lighting and electric vehicles on site. Diageo also designed the overall size of the facility to maximize operational efficiency, including minimizing air heating and cooling facilities.

While Scope 3 emissions are not included in the Lebanon site-specific carbon neutrality commitment at this time, Diageo has committed to reduce absolute Scope 3 emissions across its operations by half by 2030. However, the company has incorporated efforts to minimize Scope 3 emissions into the Lebanon facility's site selection and design. Diageo uses locally-grown corn and sources maturation barrels from Kentucky and the surrounding states, there is zero waste to landfill for operations, and minimizing empty load miles reduces third-party logistics miles.

Outcomes

The electrification of operations and sourcing of 100% renewable electricity allows the site to demonstrate carbon neutrality with only residual amounts of carbon offsets to be purchased.

Using electric boilers powered with renewable electricity instead of natural gas boilers at this facility, Diageo avoids approximately 117,000 metric tons of CO_2 emissions annually, equivalent to taking more than 25,000 passenger vehicles off the road for a year.

Electric boilers require less maintenance than conventional equipment, saving money on maintenance costs and requiring less downtime for maintenance. Electric boilers are also quieter, reducing the need for hearing-related worker safety equipment.

In addition, these electric boilers do not require air permits, reducing time and money spent on required reporting and associated permit fees.

Lessons Learned

This new distillery was built from the ground up, offering Diageo the opportunity to implement these new methods and operational choices at the project's inception. Existing facilities switching to electrified processes may require additional electrical or utility upgrades to serve their increased electric demand.

Whether building a new facility or modifying an existing plant, it is imperative to engage with the electric utility early in the process and continue conversations throughout project development and deployment. The utility may need to install additional equipment to accommodate an increased load, but, with sufficient notice, may be able to incorporate these needs into its infrastructure planning.

Those seeking to reduce their emissions through electrification will also need to ensure that their electric supply is renewable. In this case, local energy cooperatives were able to provide renewable electricity and Diageo chose to prioritize sourcing the renewable electricity as close to the facility as possible. Early engagement with the electric utility to determine renewable electricity procurement options will help to ensure that electrified facilities are renewably-powered.

Additional Links

https://www.greenbiz.com/article/electric-boilers-fuel-diageos-carbon-neutral-whiskey-distillery-dream

https://www.diageo.com/en/news-and-media/features/diageo-opens-its-first-carbon-neutral-whiskey-distillery-in-north-america/

https://www.diageo.com/PR1346/aws/media/10988/pas-2060-diageo-qualifying-explanatory-statement-final-with-verification-letter-june-2020.pdf