Emission Trends in Petroleum Refineries

Refineries sector emissions reported to the Greenhouse Gas Reporting Program (GHGRP) remained relatively constant from 2011 to 2019, followed by a significant drop of nearly 10% in reported emissions in 2020 due to reduced demand during the COVID-19 pandemic. A rebound in production and associated emissions began in 2021, with emissions increasing by roughly 2% to 164.4 MMT CO_2e from the record low emissions reported to the GHGRP in 2020. In 2022, emissions from refineries decreased by 0.5% compared to 2021 levels, to a total of 163.4 MMT CO_2e from 164.4 MMT CO_2e.

Historically, refinery emissions trends are influenced by three key factors: the number of operating refineries, the operable capacity, and the production slate. With respect to the number of reporting facilities, the count has decreased from 150 to 135 over the last decade. This is the result of refinery closures and the fact that several small refineries are no longer required to report. [1] Notably, a large refinery in Belle Chase, Louisiana operated by Phillips 66 closed in 2021 due to Hurricane Ida, while two new smaller refineries in Texas and California came online. [2] With several announced closures schedule to take effect in the coming years, the number of refineries reporting to the GHGRP is expected to continue to decrease. [2]

With respect to operable capacity (measured in thousand barrels per calendar day), overall levels have increased by almost 2% over the last decade. [3] From 2019 to 2022, however, there has been a decrease in operable capacity of more than 4%. While the decades-long trend demonstrates that the expanded production capacity at existing and new refineries more than offsets production declines from refinery closures, the trend may be turning toward a sustained nationwide decline in operating capacity due to factors driving refinery closures, such as the expected shift toward electric vehicles and the increasing use of renewable fuels.

Finally, finished motor gasoline, distillate fuel oil, and jet fuel are the predominant fuels produced by refineries. During 2020, changes to refinery production slates were observed that were likely due to the COVID-19 pandemic. Notably, the demand for transportation fuels—specifically finished motor gasoline and jet fuel—decreased significantly in 2020. As a result, normalized emissions increased in 2020 (i.e., metric tons CO_2e per gross input to refineries in thousand barrels per day) demonstrating production inefficiencies. [3] From 2021 to 2022, the production of finished motor gasoline (including motor gasoline blend components) and kerosene jet fuel increased by 7% and 23.2%, respectively. [4, 5] In addition, distillate oil production increased 7% over the period 2021-2022. [4] These overall changes in demand resulted in a net 5% increase in refinery throughput in 2022 compared to 2021 (measured as gross input to refineries in thousand barrels per day). [3] The normalized emissions observed in 2022 are consistent with pre-pandemic values, indicating adjustment and stabilization of production processes in response to market conditions.

[1] 40 CFR §98.2(i)(1) and (2) describe provisions under which a facility may discontinue reporting.

[2] U.S. Energy Information Administration, *U.S. refinery capacity decreased during 2021 for second consecutive year* (accessed September 26, 2023) at: https://www.eia.gov/todayinenergy/detail.php?id=52939.

[3] U.S. Energy Information Administration, *Refinery Utilization and Capacity* (accessed September 26, 2023) at: http://www.eia.gov/dnav/pet/pet_pnp_unc_dcu_nus_a.htm.

[4] U.S. Energy Information Administration, *U.S. Refinery Net Production* (accessed September 26, 2023) at: http://www.eia.gov/dnav/pet/pet_pnp_refp2_dc_nus_mbbl_a.htm.

[5] U.S. Energy Information Administration, *U.S. Refinery Net Inputs* (accessed September 26, 2023) at: https://www.eia.gov/dnav/pet/pet_pnp_inpt2_dc_nus_mbbl_a.htm.

Updated on Nov 14, 2023 14:57