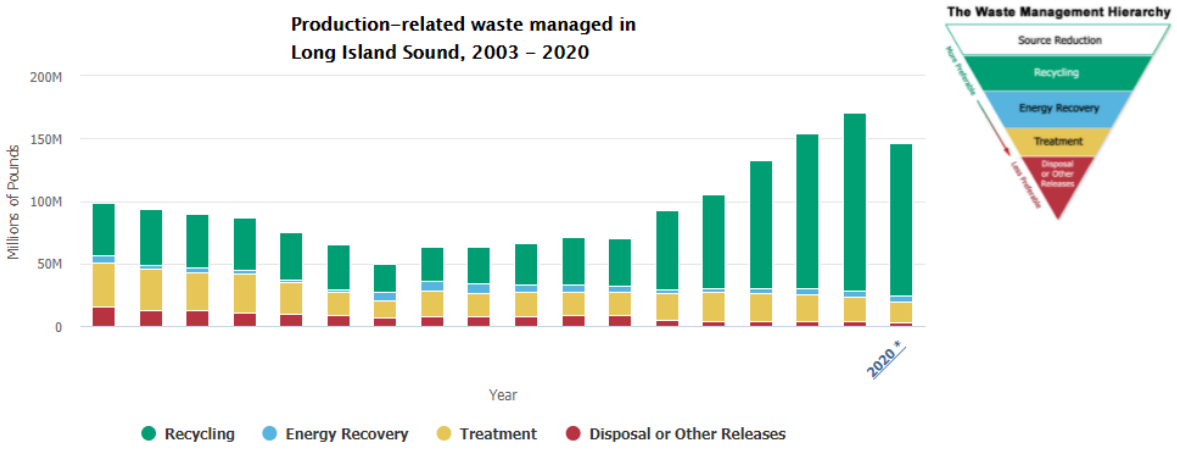
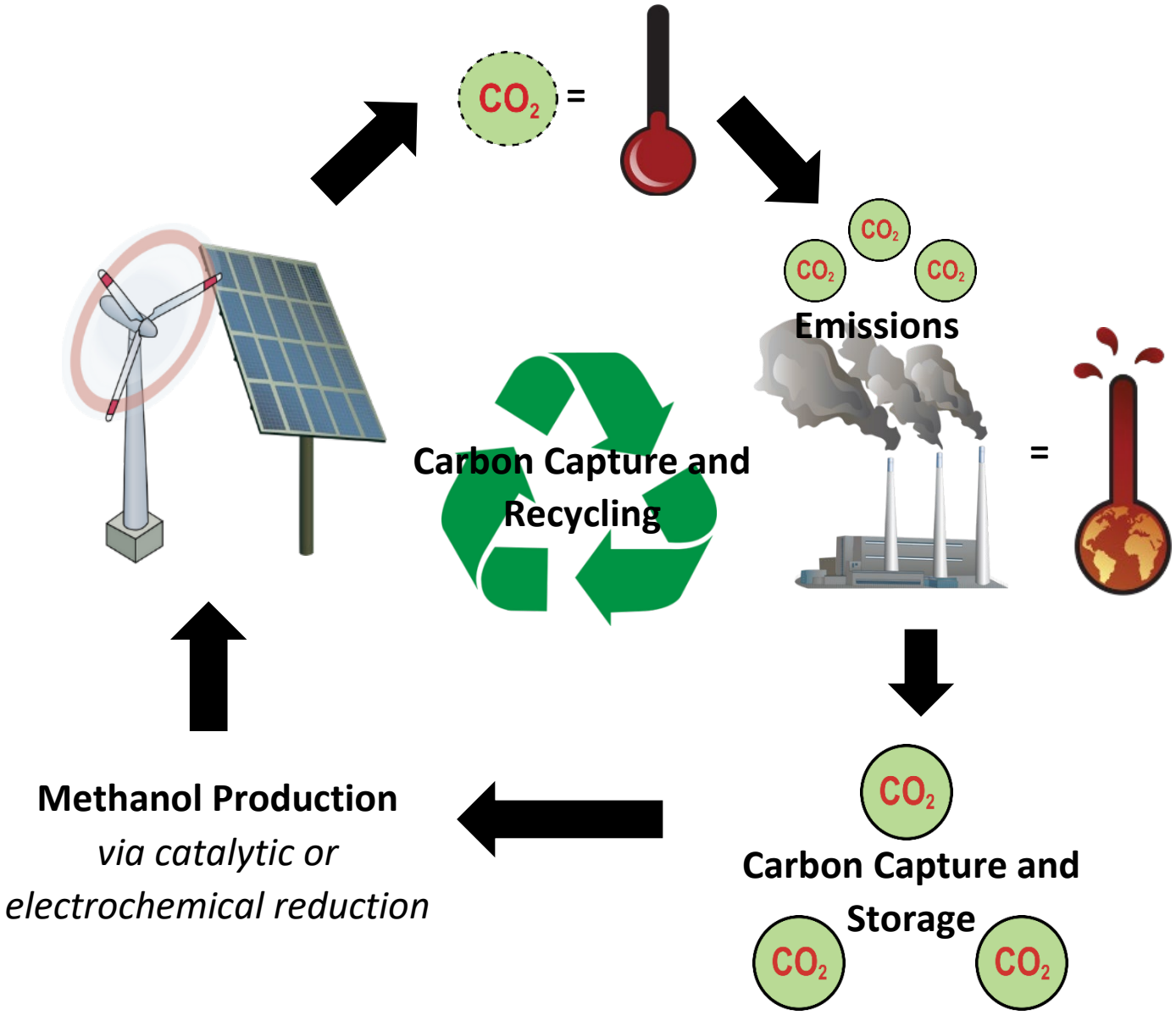
Methanol Recycling

The US Environmental Protection Agency (EPA) tracks the management of various toxic chemicals released and used from facilities through the Toxic Release Inventory (TRI) Program. By inventorying these facilities, the Program reports annually, by large aquatic ecosystem, on the how production-related wastes are managed, and the amount of total on-site (seperated by air, water, and land) and off-site disposals or other releases. The LISS uses this data to track the Industrial Chemical Discharges Indicator within the Long Island Sound, in which we report on the total on-site toxic contaminant releases within the watershed. Since 2003, total toxic contaminants from facilities has decreased dramatically.

There are many different techniques used to mitigate toxic chemical production including, recycling, energy recovery, treatment, and disposal (i.e., releases). The most preferred way is recycling, in which, within the Long Island Sound watershed has increased substantially. Furthermore, the large increase in recycling starting in 2015 was predominantly from a facility located in New Haven, Connecticut, which utilized methanol recycling. Methanol recycling is the process of converting, or reducing, CO_2 emissions from these facilities into methanol through the use solar or wind energy (Goeppert et al. 2014). Methanol is a renewable fuel meaning it can be used to power other applications, including, internal combustion engines, fuel cells, and stoves; or it can be further transformed into ethylene and propylene. Methanol recycling is an important method to help combat climate change and fossil fuel depletion.



Source: EPA 2020



The conceptual model above shows the methanol recycling process (adapted from Goeppert et al. 2014). High carbon dioxide (CO_2) emissions, indicated by the solid line circle, are produced from facilities which create high temperature conditions, also known as global warming. Rather than disposal or another release mechanism into the environment, the facilities capture and store these CO_2 emissions to later produce methanol via catalytic or electrochemical reduction. Electrochemical and catalytic reduction involves using an electrical energy or catalyst to convert CO_2 to more reduced forms of carbon. These reduced forms, like methanol, are then used to power other technologies – for example, wind and solar energy. This recycling process reduces fossil fuel emissions (CO_2), indicated by the dashed line circle, and therefore can help lessen global warming impacts.