THERMOMECHANICAL TREATMENT: A Comparison to Coal

Opponents of Thermomechanical Treatment Facilities (TTF) facilities (also known as Waste-To Energy, WTE) sometimes claim that TTFs are "worse than coal." This comparison ignores a critical point: TTFs are first and foremost solid waste management facilities. While their primary function is to safely manage waste remaining after recycling, they generate beneficial products from waste, including steam and/or electricity and metals for recycling. TTFs are an important tool in reducing overall greenhouse gas (GHG) and other emissions by avoiding landfills - serving as an important source of GHG mitigation in the process and are cleaner than coal on a lifecycle basis.[1-4]

TTFs are a source of GHG mitigation.

In 2022, coal generation alone accounted for 17.8 percent of our nation's total CO_2 emissions.[5] In stark contrast to coal plants, TTFs are widely recognized as a source of GHG mitigation. U.S. EPA scientists have reported GHG emissions from TTFs to be significantly less than landfills, concluding "if the goal is greenhouse gas reduction, then WTE should be considered as an option under U.S. renewable energy policies."[4]

In addition, many other governmental and nongovernmental organizations have formally recognized TTFs for their role in reducing GHG emissions, including the World Economic Forum (WEF)[6], the European Union,[7,8] the Center for American Progress,[9] Columbia University scientists,[10] CalRecycle,[11] California Air Resources Board,[12] and the Joint Institute for Strategic Energy Analysis (NREL).[13] The Intergovernmental Panel on Climate Change (IPCC) called TTF a "key GHG mitigation technology."[14] TTFs are recognized as a source of credits under the United Nations' Clean Development Mechanism (CDM) where over 50 projects have been registered with a combined annual GHG reduction of 6 million metric tonnes of CO_2e a year.[15] Domestically, two Florida facility expansions in Lee and Hillsborough Counties have been credited since 2017 and 2019 respectively to sell carbon offsets into the voluntary market.[16]

Those who claim that TTFs are worse than coal typically only look at total stack CO_2 emissions

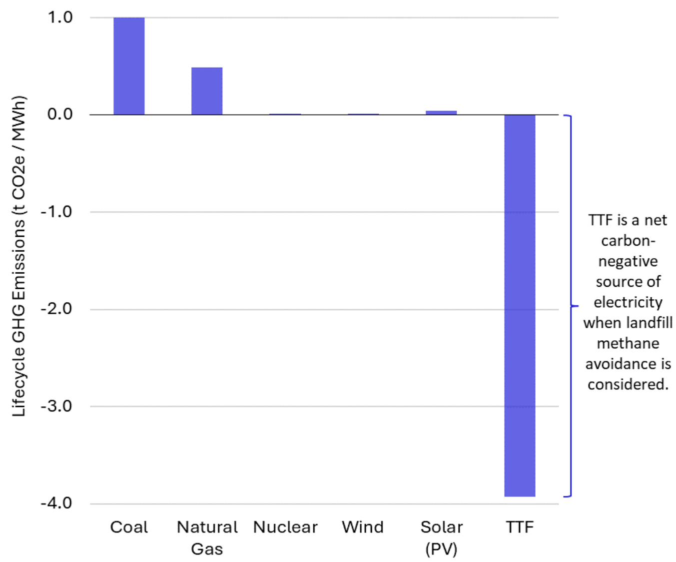

Figure 1. *Lifecycle GHG emissions – electricity sources*[18,19]

divided by the MWh of electricity exported to the grid. This approach doesn't consider the difference between biogenic and fossil CO_2 and fails to recognize that TTFs are multi-purpose, supplying both electricity and fulfilling a need for soil waste management.

By managing solid waste while concurrently generating energy and recovering metal for recycling, TTFs avoid significant landfill emissions of methane, a potent GHG 81 times more potent than carbon dioxide over 20 years.[17] Landfills are the 3rd largest source of anthropogenic methane, a short-lived climate pollutant under increasing scrutiny. In contrast, coal plants and other fossil fuel-fired electricity generation facilities, accomplish one thing, and one thing only: combustion of fossil fuel for electricity generation.

While there is growing recognition that the use of biogenic sources of carbon should not be universally considered carbon neutral, waste sources of biomass used for energy are widely recognized as being low to zero carbon. The majority of the carbon in MSW managed in TTFs is biogenic.[19] Most significantly, the U.S. EPA outlined its clear intent to recognize the "biogenic CO_2 and climate policy benefits" of waste-derived feedstocks.[18]

When a more balanced lifecycle perspective is taken, the benefits of avoided landfill methane and metal recovery outweigh the stack emissions. For every MWh) of electricity produced by a TTF, 3.9 metric tons of expected CO_2 is avoided, when the GHG benefits of diversion from landfills is considered.[19]

TTFs are the only major source of net carbon-negative energy. When we compare the net lifecycle GHG footprint on a per MWh basis, TTFs are **over 10X times better than wind and solar** at achieving GHG reductions relative to a natural gas-fired power plant (Figure 1).

Other emissions

TTFs outperform coal on other emissions as well, according to data published in peer-reviewed journals and regulatory agency documents. EPA scientists found lifecycle emissions of TTFs per MWh to be lower on average than those for coal-fired facilities for sulfur dioxide, nitrous oxides, and particulate matter, even before the benefits of avoided landfill emissions were considered.[4]

Regarding hazardous air pollutants, TTFs are a minor source of overall exposure of these pollutants compared with other anthropogenic and even natural sources. For example, mercury emissions from U.S. TTFs are a fraction of those from coal plants. Over the period from 1990 to 2005, TTFs reduced their mercury emissions by 99 percent.[20] Mercury emissions have continued to drop as a result of better air pollution control performance and lower levels of mercury in waste driven by restrictions on mercury use in products. A 2019 study revealed TTFs represent only 0.8 percent of total U.S. anthropogenic mercury emissions (See Figure 2).[21]

In addition, advancements in boiler design, operations, and air pollution control equipment have drastically reduced dioxin emissions in the TTF industry. At one time, waste combustors were a leading source of dioxin emissions. However, in 2012 peer-reviewed research by Columbia University scientists published that the total dioxin emissions of all U.S. TTFs represented less than one-tenth of one percent (0.09%) of total dioxin sources in the U.S. (See Figure 3).[22]

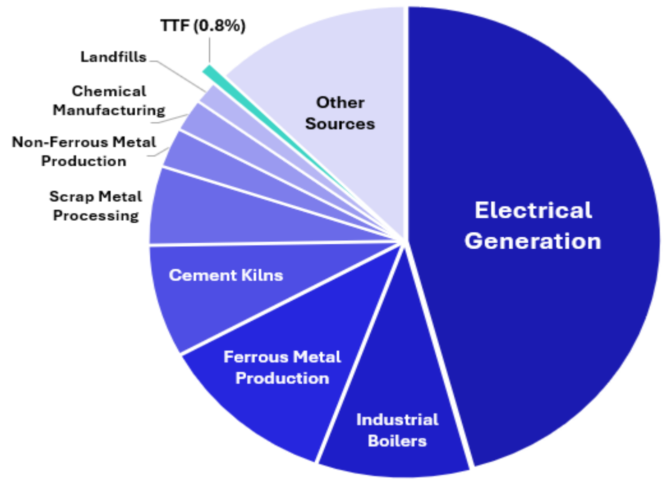

Figure 2. *U.S. anthropogenic mercury emissions*

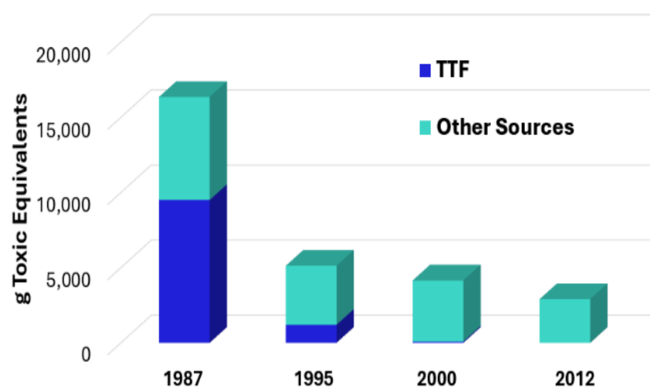

Figure 3. *U.S. total dioxin and furan emissions over time*

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