

*Presentation submitted to 8<sup>th</sup> Sustainable Waste Management Conference,  
Thessaloniki, June 17-20, 2020*

**The answer to the global problem of plastic wastes:  
Plastics to Energy (PTE) and Pyrolysis to Oil (PTO)**

Nickolas J. Themelis, Global WtERT Council; Columbia University

*Corresponding author: njt1@columbia.edu*

The invention of plastics resulted in the creation of a very useful family of materials for humanity. By now there are thousands of different plastic compounds which are used for clothing, food preservation, furniture, appliances, automobiles, airplanes, wind turbines, and hundreds of other uses. However, there is a persistent environmental problem with plastics: What to do with them at their end of useful life? For technical and economic reasons, less than 10% of the global plastic wastes are recycled as materials and another 10% are combusted with energy recovery in waste-to-energy power plants (WTE). Over 200 million tons of plastic wastes are landfilled or become a major pollutant of land and water. For example, an enormous “garbage patch” has been formed on the surface of the Pacific Ocean. Efforts are under way to collect some of the millions of tons of plastics floating on the oceans but what will be done with them once they are brought to shore? The same question applies to the million of tons of baled “recycled” plastics that the recent environmental policy of China has sent back to their origins in the west. A multiyear study by Columbia University has identified two sustainable ways for dealing with mixed plastic wastes:

**- Use mixed plastic wastes as fuel in dedicated Plastics to Energy power plants (PTE).**

There are more than one thousand WTE plants that combust over 200 million tons of municipal solid waste of calorific value 7 - 12 MJ/kg and produce up to 600 kWh of electricity. PTE power plants will be designed to use a fuel of 30-35 MJ/kg and produce over 2,000 kWh per ton of fuel. -

**-Use mixed plastic wastes as feedstock to pyrolysis plants that transform them to synthetic oils (PTO)**

Both of the above technologies will ensure that the crude oil now used to make plastics will not be wasted in landfills. Also, both methods will be in accord with the concept of circular economy. This paper will discuss the findings of the Columbia study as to the remaining technical challenges, the economic aspects, and the environmental benefits of the above two technologies. Industrial implementation will require source separation and transportation to PTE or the pyrolysis plants where the plastic wastes will be shredded and used as fuel or feedstock. Source separation is already practiced in many developed cities.

Submitted to Prof. Moustakas,, March 2, 2020