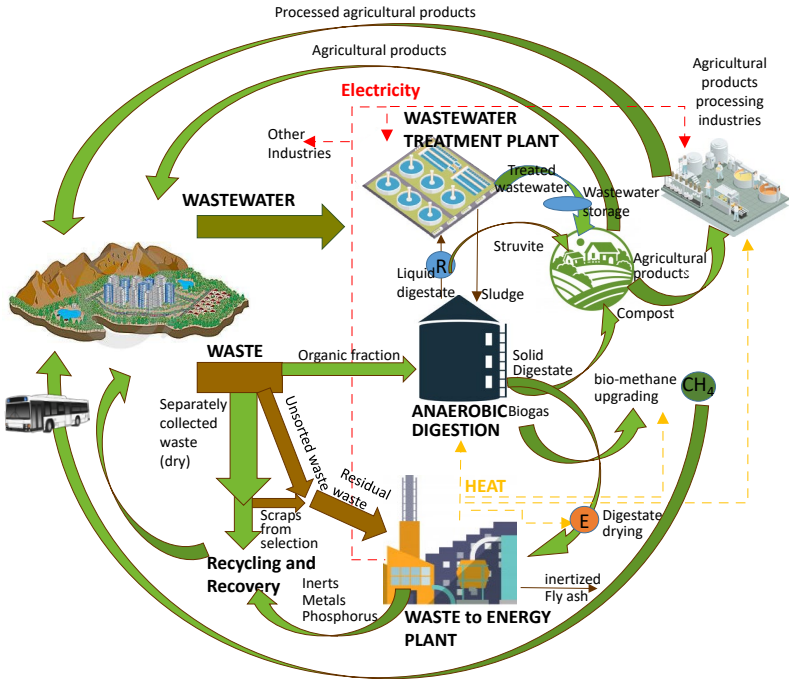
MAXIMIZING MATERIAL AND ENERGY RECOVERY PROCESSES THROUGH INDUSTRIAL SYMBIOSIS WITHIN THE WASTE-WASTEWATER–ENERGY NEXUS

Antonella Luciano [a] Giuseppe Mancini [b] & Debora Fino [c]

[b] ENEA, Department for sustainability, Rome, Italy
[a] University of Catania, Catania, Italy
[c] Polytechnic of Turin, Turin, Italy
E-mail: antonella.luciano@enea.it

A new approach is here proposed, within the "waste-wastewater–energy nexus" aimed at simultaneously maximizing material and energy recovery through Industrial Symbiosis (IS). The symbiosis is performed through the integration of: 1) a wastewater treatment plant, 2) an enhanced anaerobic digestion plant for OFMSW and sludge, 3) a new Waste-to-Energy (WtE) plant to fully recover the energy value of the residual waste and scraps from selection. More than seventeen mutual symbiosis relationships are, for the first time, explored and assessed between the three systems and outside their boundaries involving the urban, agriculture, food production and transport sectors.

The proposed IS scenario is deeply explored, in terms of mass balance and resources flows exchanges and compared, also through LCA methodology, to other two scenarios where WtE plant is not included and IS not applied. The comparison is performed on a large metropolitan area case study. The proposed approach is also investigated in terms of its huge potential for residual heat exploitation for further industrial activities (e.g. food industry) with a view to more holistic IS application able to boost the industrial district attraction for new companies.



The proposed integration is particularly suitable to bridge the sustainability gap in Southern and Eastern European regions which continue to have disjointed and unsustainable management of waste, wastewater and sludge, unacceptable levels of material recovery, waste of potentially exploitable energy and significant environmental burdens, so helping in preventing unjustified opposition to WtE plants in these regions.

Keywords: *Industrial Symbiosis, Biorefinery, Life cycle assessment (LCA), material and energy recovery*