

**DIPARTIMENTO DI INGEGNERIA – UNIVERSITY OF PERUGIA
PHD COURSE IN INDUSTRIAL AND INFORMATION ENGINEERING -
38TH CYCLE**

Title of the research activity:	Advanced industrial solutions for waste recycling and recovery and related sustainability assessment
State of the Art:	<p>The implementation of the so called waste management hierarchy is a fundamental step for the implementation of the circular use of resources. Of particular importance in this sector is the development of advanced industrial solution able to maximize the effectiveness and efficiency of this goal.</p> <p>Nowadays most diffused solutions are based on the separation at source of the different recyclable streams for their delivery to the recycling industry. By the way several shortcomings are associated to this approach as: costs; quality of the materials collected; environmental impact; social acceptance; etc.</p> <p>Furthermore there is another relevant amount of waste stream that cannot be managed without the adoption of complex and integrated plants as the bio-waste and the residual waste.</p> <p>Nowadays such plants are mainly based on incineration, anaerobic digestion, composting, mechanical biological treatment and similar facilities.</p> <p>By the way it is clear that an increase in their sustainability, in the broader sense of this word, including also their efficiency, cannot be maximized without an integrated approach.</p> <p>Integrating biological processes with thermal and mechanical is a key factor for maximizing the implementation the waste hierarchy and related effectiveness in the best use of waste materials.</p> <p>Above the identification of most effective integrated plant treatment schemes another important aspect is the assessment of their sustainability. Sustainability is a broader concept involving at least three main issues: social, environmental and economic.</p> <p>How to asses this is another challenging issue. Many solutions have been proposed as those based on Multi-criteria analysis; cost benefit analysis; risk assessment; etc. etc.</p> <p>But still remain the need of the implementation of a ore objective approach</p>
Short description and objectives of the research activity:	<p>The research activity will be focused on innovative and advanced integrated industrial waste treatment, recycling and recovery facility. The integration will be based on the coupling of thermal, biological, physical and mechanical treatments able to maximize the extraction of recyclables and energy and fuels from bio-waste and residual waste. Together with this main issue the development of advanced sustainability assessment methods will be also investigated.</p>
Bibliography:	<p>Di Maria F, Sisani F, Lasagni M, Borges MS, Gonzales TH. 2018. Replacement of energy crops with bio-waste in existing anaerobic digestion plants: An energetic and environmental analysis. Energy 152;202-213.</p> <p>Di Maria F, Sisani F. 2018. Incidence of human labour on waste collection: a full-scale life cycle analysis. 33rd International Conference on Solid Waste Technology and</p>

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