



**“Gheorghe Asachi” Technical University of Iasi, Romania**



---

**PROJECT *GREEN SYMBIOSIS* 2014 - II PHASE.  
RESULTS FROM AN INDUSTRIAL SYMBIOSIS PILOT PROJECT  
IN EMILIA ROMAGNA REGION (ITALY)**

**Laura Cutaia<sup>1\*</sup>, Claudia Scagliarino<sup>2</sup>, Ugo Mencherini<sup>3</sup>, Marco La Monica<sup>4</sup>**

<sup>1</sup>*ENEA, Centro Ricerche Casaccia - Via Anguillarese 301, Roma, Italy*

<sup>2</sup>*Free-lance environmental engineer – Via G. Molteni 141, Roma, Italy*

<sup>3</sup>*ASTER - Via Pietro Gobetti 101, 40129, Bologna, Italy*

<sup>4</sup>*Tuscia University, - Via S.M. in Gradi 4, 01100, Viterbo, Italy*

---

**Abstract**

The Project “Green - Industrial Symbiosis” (G-IS), in Emilia Romagna region (IT), took place in two phases: phase I, 05.2013 – 03.2014; phase II, 10. 2014 – 10.2015. During the first phase, it was completed the first part of the pilot project of industrial symbiosis (IS) in Emilia-Romagna, which involved 13 companies in the agro-industrial sector, 7 laboratories of the High Technology Network, with Unioncamere and Aster (promoters) and ENEA (technical and scientific coordinator). The first phase generated 90 potential synergies among the 10 companies that shared their input-output resources. During the second phase, promoted by ASTER and organized with the technical and scientific coordination of ENEA, some of the most interesting synergies of the first phase were selected, in order to go from the identification of potential synergies to its actual implementation. In particular, 3 pathways of industrial symbiosis were chosen, in which waste food industry outputs were destined to three different types of exploitation (production of biopolymers, nutraceuticals, energy recovery). The pathway that a resource must take to shift from being a company's output to another company's input, involves several steps that require compliance and verification of regulatory, technical, logistical and economic issues. All these factors have been examined and reported in 3 Operative Manuals for the companies involved, each one arranged for a different symbiosis' pathway. The manuals consist of two sections: an operative and a documental part (technical dossier). The operative part describes the transformation path of resources, with a layout in which each block and intermediate vector represent a passage of the resource (e.g. exit from the producing company, transport, valorisation). Under the layout, a synthesis table refers, for each stage, to the necessary requirements, reported in full in the technical dossier. Links on the synthesis table refer, for example, to laws or techniques that the specific flow, in each step, must comply with. These links also define, with a predefined color, if that aspect can be considered as an obstacle to the progress of the symbiosis.

*Key words:* circular economy, enhancement, restoration, symbiosis, synergy

*Received: January, 2016; Revised final: August, 2016; Accepted: September, 2016*

---

\* Author to whom all correspondence should be addressed: e-mail: [laura.cutaia@enea.it](mailto:laura.cutaia@enea.it); Phone: +39 6 30483306