

Project Summary

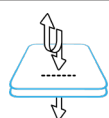
BIOVALUE concept focuses on the design, building up, validation in real environment of an **innovative integrated membrane process based on advanced membrane operations for the treatment of gaseous bio-digester downstream aiming at bio-methane purification and recovery of high added value compounds**. Bio-methane is currently separated/purified from CO₂ using various technologies also including membranes. However, various are the pre-treatment stages that precede the membrane gas separation units, for preserving the membranes and meeting the specifications of grid injection. The presence of contaminants such as H₂S, NH₃, siloxanes and water can, in fact, affect membranes performance or even damage them. These pre-treatments are usually based on chillers or condensers for water vapor condensation, scrubber for H₂S absorption with Fe₂O₃, activated carbons for siloxanes, mercaptans, etc.

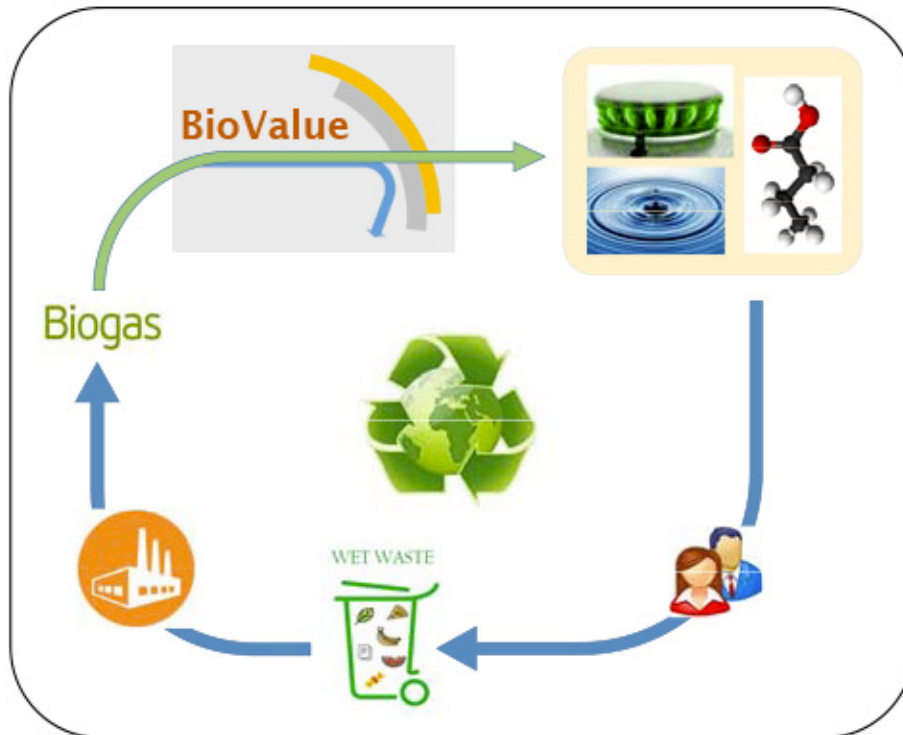
The BIOVALUE project deals with these relevant issues still open in bio-methane upgrading process aspiring to pave the way towards the development of an innovative technology where membranes, used for separations, pre-treatments etc. will be the key in redesigning the whole upgrading process. To pursue these objectives, the proposal aims at the use of advanced functional materials for membrane gas separation architecture so to improve separation properties and tolerance towards contaminants. Membranes will be based on the polymer blends and semi-interpenetrating network – SIPN of materials belonging to the groups of specialty glassy polymers like polyetherimide, polysulfones, polyethersulfones and others; on the other hand, at the development of advanced membrane technologies as pre-treatment units able to reduce or remove the number and/or the size of conventional pre-treatment stage. Membrane condenser will allow separating water vapor and contaminants, VFA, VOCs, etc., from gaseous stream, whereas pervaporation will concentrate VFA and/or VOCs, producing in the meantime, high quality water.

The pre-treatment loads reduction traduces in less solvent use, lower environmental impact, and improvement in air quality. Moreover, membrane condensers and pervaporation units used as novel highly selective and energy-efficient separation (pre-treatment) technologies will enhance the recovery of further resources from bio-digester downstream, which can be then further purified and reused.

BIOVALUE engages in a waste recycling loop for their valorization and reuse as circular economy dictates.

BIOVALUE is a 3-year project, splits up in 7 WPs, where both industrial research and





experimental development are linked to promote the cooperation of partners for achieving the project target objectives. BIOVALUE starts from TRL3 for what concerns materials and membrane development, TRL3/4 for membrane technologies, already validated at lab scale, but not for this specific process. The scope of this proposal is to bring the whole technology to TRL6, designing, building up and validating an integrated membrane prototype in real environment.

The prototype will be built up and validated in industrially relevant environment by connecting it to a bio-digester producing 1 m³/h of raw biogas. The variability of bio-digester composition will be considered as a fundamental parameter not only to maximize the bio-methane recovery and purity, but also regarding the effect of eventual residual contaminants, water vapor, etc. on membrane performance, lifetime, etc. After the exposure under real stream, a post-mortem analysis on the membranes will provide important information to membrane producers and for improving the integrated plant operation. BIOVALUE is a concrete initiative of innovating the separation/purification process in biogas upgrading and waste recycle with positive impact on environment and air quality, reducing, recovering and reusing wastes, thus, pushing toward a circular economy in EU for this specific sector.

