

## **Floating membrane roofs for large zootechnic and industrial storage tanks**

**P. Beccarelli<sup>\*</sup>, R. Maffei<sup>†</sup>, A. Giordano<sup>††</sup> and F. Natta<sup>††</sup>**

<sup>\*</sup> Department of Architecture & Built Environment  
University of Nottingham  
University Park, Nottingham NG7 2RD, United Kingdom  
e-mail: [paolo.beccarelli@nottingham.ac.uk](mailto:paolo.beccarelli@nottingham.ac.uk), web page: <https://www.nottingham.ac.uk>

<sup>†</sup> Maco Technology srl  
Via U. La Malfa 86/88, 25050 Provaglio d'Iseo (BS), Italy  
Email: [design@macotechnology.com](mailto:design@macotechnology.com), web page: <http://www.macotechnology.com/>

<sup>††</sup> Acqua & Sole s.r.l.  
Via Giulio Natta, 27010 Vellezzo Bellini (PV), Italy  
Email: [andrea.giordano@neorisorse.net](mailto:andrea.giordano@neorisorse.net) - Web page: <https://neorisorse.net/>

### **ABSTRACT**

The biogas sector had a rapid development in the last decade with several new industrial plants realized all over Europe and Worldwide. The intrinsic efficiency of membrane structures provided a cost-effective solution to cover digesters, bio-filters, lagoons and gas holders through different concepts such as floating membranes, anticlastic geometries and pneumatic structures. The most challenging applications for biogas plants are the membrane roof for large lagoons and storage tanks designed to store the sewage after it has been treated. The most common shape is circular but elliptical and rectangular plans are also adopted in specific situations. For this application, the membrane roof protects the tank from rainwater and prevents the release of gas and smell in the atmosphere. In recent years, local environmental regulations became more stringent regarding the emissions released into the atmosphere and the current membrane structures do not always meet the new criteria.

The paper presents the development of a prototype able to address the limits of the current products and investigates the technical and financial viability of a new type of roof for zootechnic and industrial large storage tanks. The pilot project was installed in the North of Italy in a circular metal storage tank 64m in diameter and 18m high.

The study validated the new concept which provides a safe and effective way to prevent the release of gas into the atmosphere and a 10% increase in the total gas output of the biogas plant. The structure has been successfully monitored for 12 months, the level of purity of the methane gas is over 90% and the air infiltrations are negligible despite the size of the membrane roof. The positive results achieved confirmed the technical and financial viability of the idea and lead to the commercialisation of the new, patent-pending, product on the market.