



An integrated system for the energy production and accumulation from renewable sources: a rural tower prototype

Silvia Di Francesco (1), Alessandro Petrozzi (2), and Valeria Montesarchio (3)

(1) Niccolò Cusano, Rome, Italy (silvia.difrancesco@unicusano.it), (2) Interuniversity Centre of Research on Environment and Pollution Felli, Perugia, Italy (petrozzi@crbnet.it), (3) Niccolò Cusano, Rome, Italy (valeria.montesarchio@unicusano.it)

This research work presents the implementation of an architectural prototype aiming at the complete energy self-sufficiency through an integrated system based on renewable energy. It is suitable for historical buildings in rural areas, isolated but important from natural and architectural point of view. In addition to the energy aspects, it is important to protect the impact in terms of land-use and environment.

This idea is also especially powerful because in the rural countries there are many little building centers abandoned because they are devoid of a connection to the electric energy grid and methane piping.

Thus, taking inspiration from dove towers, architectural typology widespread in central Italy, a virtual model has been developed as an integrated system for renewable energy production, storage and supply.

While recovering the ancient tower, it is possible to design and assemble an integrated intelligent system, able to combine energy supply and demand: a new tower that should be flexible, efficient and replicable in other contexts as manufacturing, commercial and residential ones.

The prototype has been applied to a real case of study, an ancient complex located in Umbria Region.

The sources for electric production installed on the tower are photovoltaics, on the head and shaft of the tower, hydropower and a biomass gasifier providing thermal too. A tank at the head of the tower allows an available hydraulic potential energy, for the turbine at any time, to cover photovoltaic lacks, caused by sudden loss of production, for environmental causes. Conversely, photovoltaic peaks, otherwise unusable, can be used to reload the water from the receiving tank at the foot of the tower, up to the tank in the head. The same underground tank acts as a thermal flywheel to optimize the geothermal heat pumps for the heat and cold production.

Keywords: hydropower, photovoltaics, dove tower.