Energy conservation for the compressible Euler equations with vacuum

In this talk we will consider the compressible isentropic Euler equations on $T^d \times [0, T]$, where the pressure $p$ is a function of the density and in most practical applications is of the form $p(\rho) := C\rho^\gamma$ where $1 \leq \gamma < 2$. It has been show that for weak regularity of $u$ and $\rho$ a local energy equation can be formulated if $p \in C^2$. However, for practical applications this means that we must exclude the vacuum case. Here we will improve these results, firstly, by assuming $u$ to be a divergence-measure field, secondly, imposing extra integrability on $1/\rho$ near a vacuum, also assuming $\rho$ to be quasi-nearly subharmonic near a vacuum and finally, by assuming that $u$ and $\rho$ are Hölder continuous. We then extend these results to show global energy conservation for the domain $\Omega \times [0, T]$ where $\Omega$ is bounded with a sufficiently smooth boundary. If time allows we will discuss the similarities and differences between these methods and the ones used on the incompressible Euler equations.