Heart failure is a serious condition with poor prognosis, which imposes an ever increasing burden on healthcare systems due to its rising prevalence. Nonetheless, physiological processes underlying heart failure remain poorly understood. In recent years, functional imaging such as gated CT has become available for routine clinical cardiology investigations. However, a maturation of nuclear imaging techniques such as PET and SPECT is now yielding new insights into the pathophysiological changes underlying heart failure, based on non-invasive measurements of myocardial blood flow, myocardial viability, sympathetic innervation, neoangiogenesis and matrix metalloproteinases activity. Investigations of these biomarkers have the potential to reveal early aspects of left ventricle remodeling; diagnosis at an earlier stage of heart failure promises to facilitate improved intervention and therapy guidance. Furthermore, nuclear imaging techniques are being developed to monitor and predict outcome of novel cell-based approaches for restorative therapy of heart failure.