Myocardial perfusion imaging is a widely used approach to noninvasively identify myocardial ischemia and guide therapies. It is typically performed using single photon emission computed tomography. The competing technology positron emission tomography (PET) offers higher diagnostic accuracies but suffers from logistical limitations due to the use of short-lived radioisotopes. New (18)F-labeled perfusion markers were introduced in the past years and offer simplified supply approaches, as known from oncologic PET imaging. This review summarizes the available literature especially from preclinical studies, but also very recent findings from early clinical trials. We discuss the consequences of long-lived radioisotopes in myocardial PET and the potential role of absolute blood flow quantification to establish efficient clinical protocols.