The central problem in the modern electronic structure theory is the calculation of correlation energy, possibly by an approach that would account for both static and dynamic correlation in an efficient, balanced and accurate way. In this thesis, I present a collection of methods that combine the effective treatment of dynamic correlation by the coupled cluster theory with density matrix renormalization group, a well-established technique for calculations of strongly correlated systems. The connection between them is achieved via the tailored coupled clusters (TCC) ansatz, which conveniently does not impose any additional computational costs. After the successful initial assessment, we developed more efficient implementations of these methods by employing the local approaches based on pair natural orbitals. This way, we extended the range of possible applications to larger systems with thousands of basis functions. To assess the accuracy of TCC as well as its local counterparts, we performed a variety of benchmark calculations ranging from small, yet challenging systems such as the nitrogen molecule or tetramethyleneethane diradical, to larger molecules like oxo-Mn(Salen) or Fe(II)-porphyrin model.