This paper reports preliminary experimental and numerical efforts towards obtaining steam-water relative, permeability and capillary pressure functions under steady-state and adiabatic conditions. In the experimental direction, steady-state nitrogen-water relative permeability experiments were conducted in a Berea sandstone core as a first step. Results obtained from this type of experiment will be compared to those from steam-water relative permeability experiments in order to explore the importance of phase change and heat transfer. Using a high resolution X-ray computer tomography (CT) equipment, saturation distributions along the core were obtained and relative permeabilities for both nitrogen and water were calculated. Preliminary results showed strong end effects for the core length and total flow rate used in the experiment, which therefore suggested either to use of a longer core or to work at a higher total flow rate. Along with the experiment, numerical simulations of simultaneous injection of steam and water into a core were also carried out by using a commercial thermal simulator. At steady-state flow conditions, effects of steam quality and total injection rate on saturation profiles were investigated. Numerical simulation results suggested a core length of 38.10 cm for a flat saturation profile region to exist under typical experimental conditions.