Laminar flow and heat transfer of three different types of nanofluids; Al_2O_3, CuO, and SiO_2 suspended in ethylene glycol, in a triangular duct using delta-winglet pair of vortex generator are numerically simulated in three dimensions. The governing equations of mass, momentum and energy are solved using the finite volume method. The effects of types, concentrations, and diameter of solid nanoparticles and Reynolds number on thermal and hydraulic performance of triangular duct are examined. The range of Reynolds number, volume fraction and nanoparticles diameters is 100–1200, 1–4%, and 25–85 nm, respectively. The results indicate that the average Nusselt number increases with the particles volume fraction and Reynolds number associated with an increase in the pressure drop. The heat transfer enhancement and pressure drop penalty reduce with increasing the particles diameters. However, a reduction in the pumping power required is observed to force the nanofluids when the volume fraction increases, assuming the heat transfer coefficient remains constant.