With the growing population and constraints on water and energy resources, greenhouse agriculture has emerged as an essential strategy for ensuring food security. However, conventional cooling systems such as fan-pad systems face challenges including high water and energy consumption and temperature non-uniformity within the greenhouse environment. Therefore, the development of efficient and sustainable cooling systems aimed at reducing resource consumption and improving temperature uniformity is an undeniable necessity. In this research, the Computational Fluid Dynamics (CFD) method was employed to simulate the greenhouse environment and evaluate the performance of cooling systems, including the fan-pad system and the Earth-to-Air Heat Exchanger (EAHE). The modeling was conducted using ANSYS Fluent software, taking into account specific features such as plant canopy porosity, plant transpiration, and radiative effects. Furthermore, an analytical model was utilized to predict the performance of the EAHE system and determine its optimal parameters. The results demonstrated that the EAHE system, compared to the fan-pad system, provides superior temperature uniformity (ΔT < ٢°C) and significantly reduces water and energy consumption. Additionally, the optimal greenhouse height was determined to be ٦٫٥ meters, which offers the best balance between temperature uniformity (with a temperature variation coefficient of ٢٫٩٦٪) and economic considerations. A hybrid system combining fan-pad and EAHE was proposed as a comprehensive solution for large greenhouses in hot and arid climates. This study confirms that the developed CFD model is a reliable tool for optimizing the design and energy management of greenhouses.