In the face of ambitious mitigation policies of the environmental impact of the civil air transport industry, this paper proposes an integrated technique for the assessment of future aircraft technologies in order to determine the impact at fleet-wide level these technologies actually have. With the help of scenario planning methods, three different future scenarios are developed, defining alternative growth rates of the air transport market. The core of the proposed technique is a fleet system dynamics model that is able to dynamically calculate the time and market-specific fleet size, composition, and age distribution, taking the scenario-specific market growth rates as input data. Preliminary results of the study presented reveal the major future aircraft sales markets, as well as the market size for future aircraft generations such as the A320neo/B737max aircraft. In addition, fleet-level performance calculations quantify the increase in fuel efficiency that is required to reach the system-wide CO2 emission targets set by the Air Transport Action Group.