An integrated optimization-based framework for product and process design is proposed. The framework uses a set of methods and tools to obtain the optimal product-process design solution given a set of economic and environmental sustainability targets. The methods and tools required are property prediction through group contributions, unless supported with a database, computer-aided molecular and mixture/blend design for generation of novel as well as existing products and mathematical programming for formulating and solving multiscale integrated process-product design problems. The application of the framework is demonstrated through three case studies: (i) refrigeration cycle unit for R134a replacement, (ii) a mixed working fluid design problem for R134a replacement, and (iii) pure solvent design for water-acetic acid LLE extraction. Through the application of the framework it is demonstrated that all solutions satisfy product, process, economic, and environmental targets simultaneously. The solution is obtained through a direct deterministic mathematical optimization strategy. The framework proposed in this work is generic and can be applied to a wide range of problems where an integrated solution to process-product design is beneficial.