Manufacturing operations generate revenue by adding value to material through machine work and the cost associated with part production hinders the maximum profit available. In order to remain competitive, companies invest in research to maximize profit and reduce waste of manufacturing operations. This results in cheaper products for the customer without sacrificing quality. The purpose of the project presented in this thesis was to identify machine settings of an Okuma LC 40 Turning Center which will optimize the cost of machining in terms of tool cost and energy consumption while maintaining part quality at a productive cycle time. Studying the relationship between energy consumption, tool life, and cycle time with the speed and feed settings through statistical analysis of variance (ANOVA) method will allow the production plant to make profitable financial decisions concerning simultaneous turning operation of forged chrome-alloy steel. The project was divided into three phases; the first phase began with a literature survey of sensors used in current manufacturing research and the adaptation of our sensors to the Okuma LC 40 turning center. Then, phase II used design of experiments to identify spindle speed and feedrate settings which will optimize multiple responses related to the turning process. The result was a saving in energy consumption (kWh) by 11.8%, a saving in cutting time by 13.2% for a total cost reduction from $1.15 per tool pass to $1.075 per tool pass. Furthermore, this work provides the foundation for phase III to develop an intelligent monitoring system to provide real-time information about the state of the machine and tool.