Project Title: Operational Planning and Design Optimization for Complex Products, Facilities, and Services

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Thrust Area: Design Optimization

Need and Industrial Relevance
1. Products, facilities, and service systems are often designed for long operating lifetimes in complex and uncertain environments
2. Plant-level engineering design decisions and short-run operating specifications determine the quantity and quality of the products
3. Coupling the design of the original systems with the optimal operation will result in stronger long-run performance for complex systems

Approach and Methods
• Use thermochemical biofuel refineries as the prototype system
• Develop a conceptual framework to understand and characterize the various components and factors in biorefinery facility operational planning and decision making
• Formulate new performance metrics for evaluating the production process efficiency
• Develop an optimization methodology to analyze the biorefinery operations design
• Develop optimal short-run operational plans and long-run plant level design
• Simulate various biorefinery operation designs to test and validate the optimization modeling approach

Objectives
• Formulate performance metrics for evaluating the impacts of operation configuration design to production.
• Build a framework to characterize the various components of bio-fuel refinery operational planning.
• Simulate various facility designs and operational plans to test and validate the optimization modeling approach

Impact
• Speed the transition to a sustainable energy system by providing guidelines for refinery design and operation
• Provide industry with analytic system analysis and optimization model with computational simulation results
• Shape future research to expand and improve design for complex systems by including optimal operational planning as an element of system design

Outcomes/Deliverables
• Recommendations on facility and operational plan design based on system optimization models and analysis
• Conference presentations (IIE, INFORMS, ASME) and presentations to industry partners and federal agencies
• Annual report with quarterly updates; Peer reviewed journal publications

Project Goals
• Initiate interdisciplinary study of operational planning and design optimization for complex products, facilities and services.
• Define, formulate, and calibrate new methods to study the emerging biofuel production facility design and optimization problems.
• Promote the development of optimization methods for minimizing total production cost and maximize the societal benefits.

Project Duration
• Two years

Proposed Budget
Annual Budget: 50K