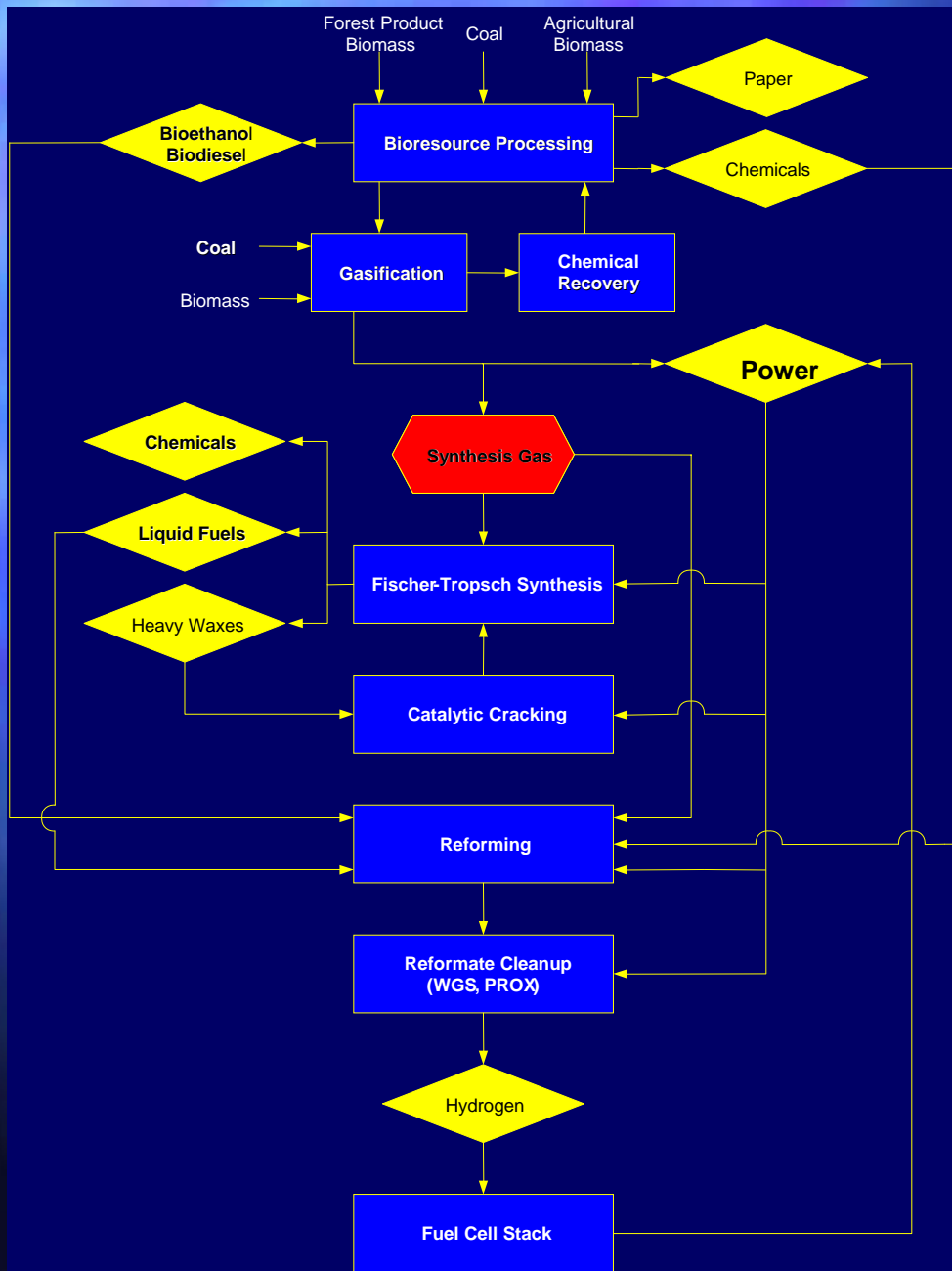


Biorefinery System Integration and Value Proposition Issues



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Challenges

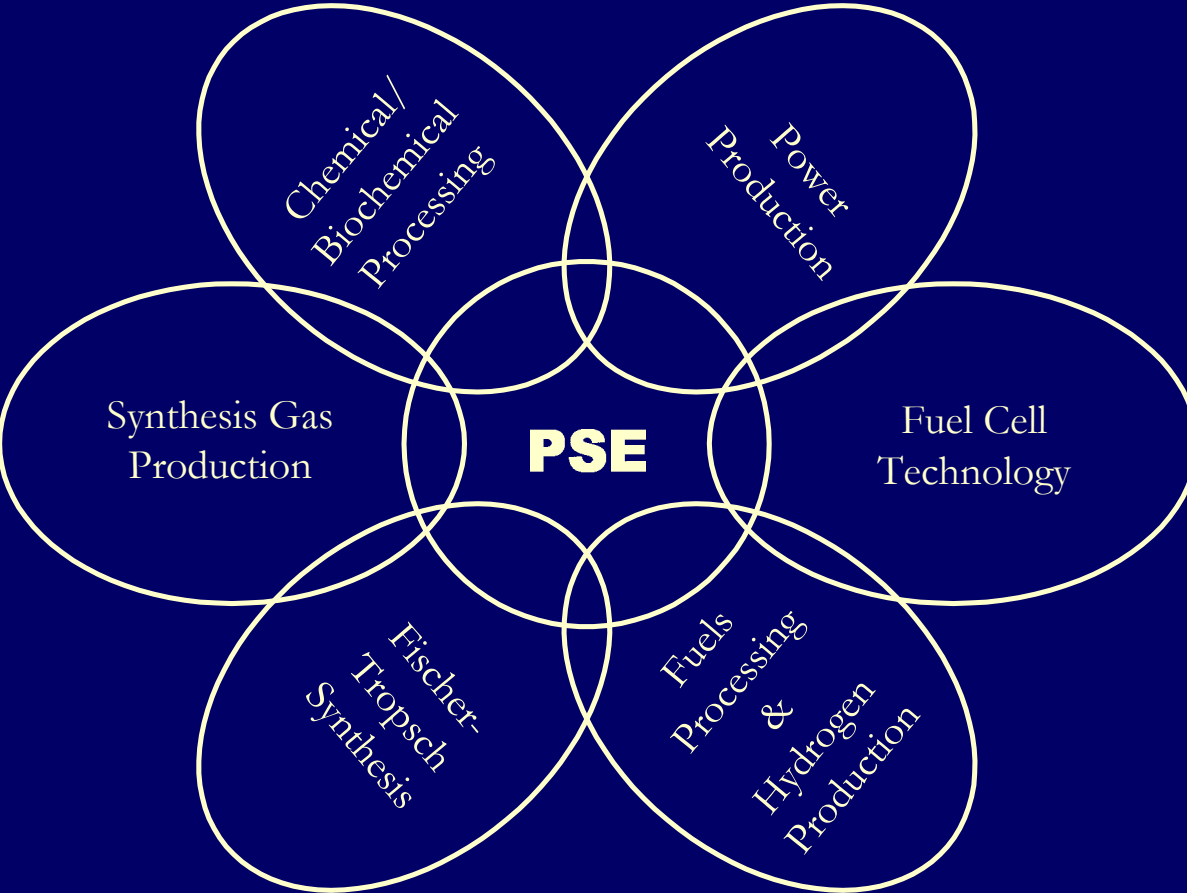
1. Multiple products and production routes.
2. Process structure depends highly on market prices, trends and feedstock availability.
3. Need to determine optimum product distributions for different price and availability scenarios.
4. Pareto-optimal values to serve as decision-making indicators.

■ The Need for a Systems Approach

- ✓ *Highly complex systems with large integration potential*
- ✓ *Changes to one section may adversely affect others*
- ✓ *Necessary to evaluate effects on overall efficiency*
- ✓ *Holistic methodology required to ensure optimality*

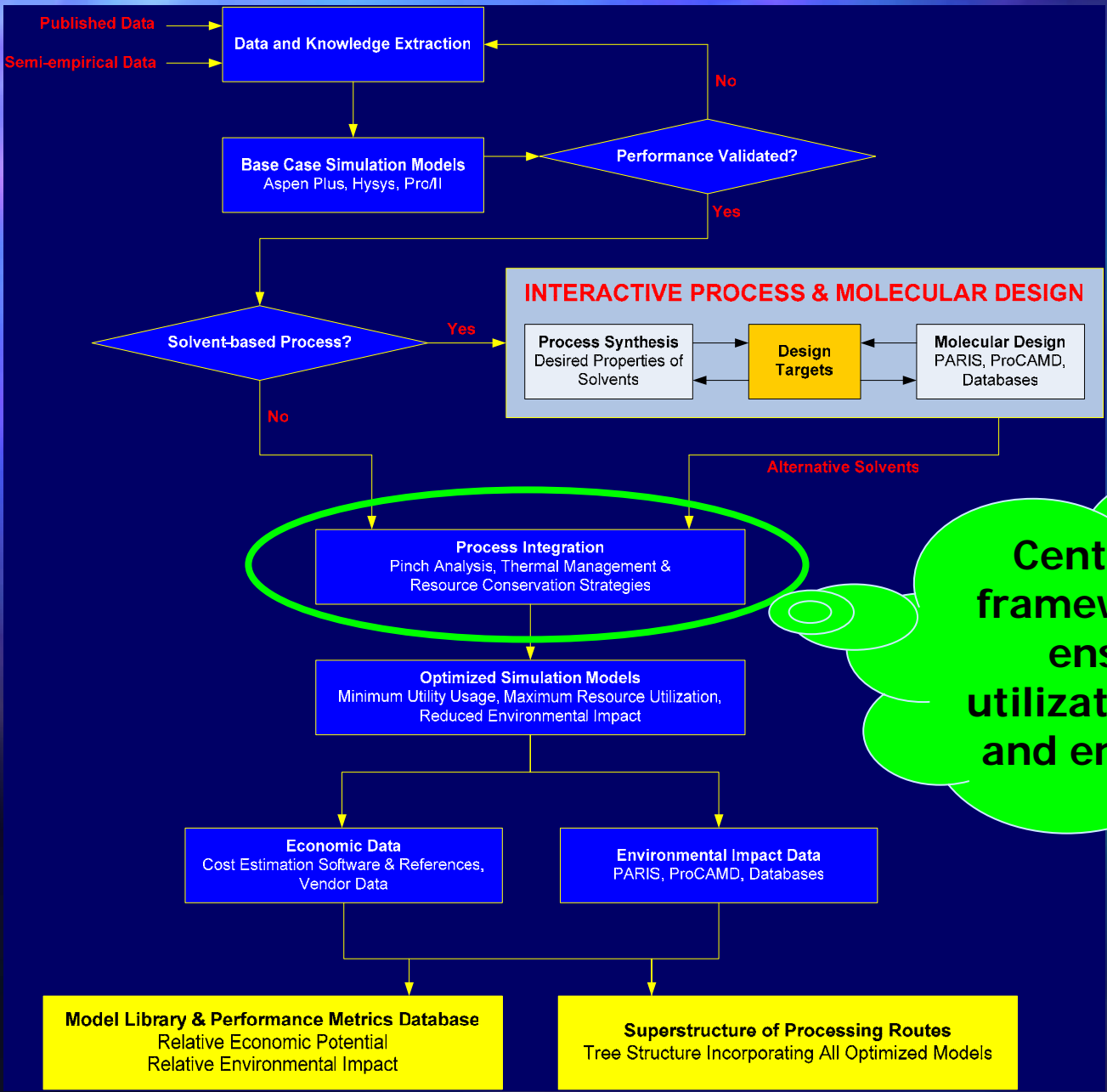
■ Potential Benefits to be Achieved

- ✓ *Development of reliable models allows for fast evaluation of changing process parameters/structure*
- ✓ *Increased utilization of available resources*
- ✓ *Imperative for increasing economic and environmental sustainability*

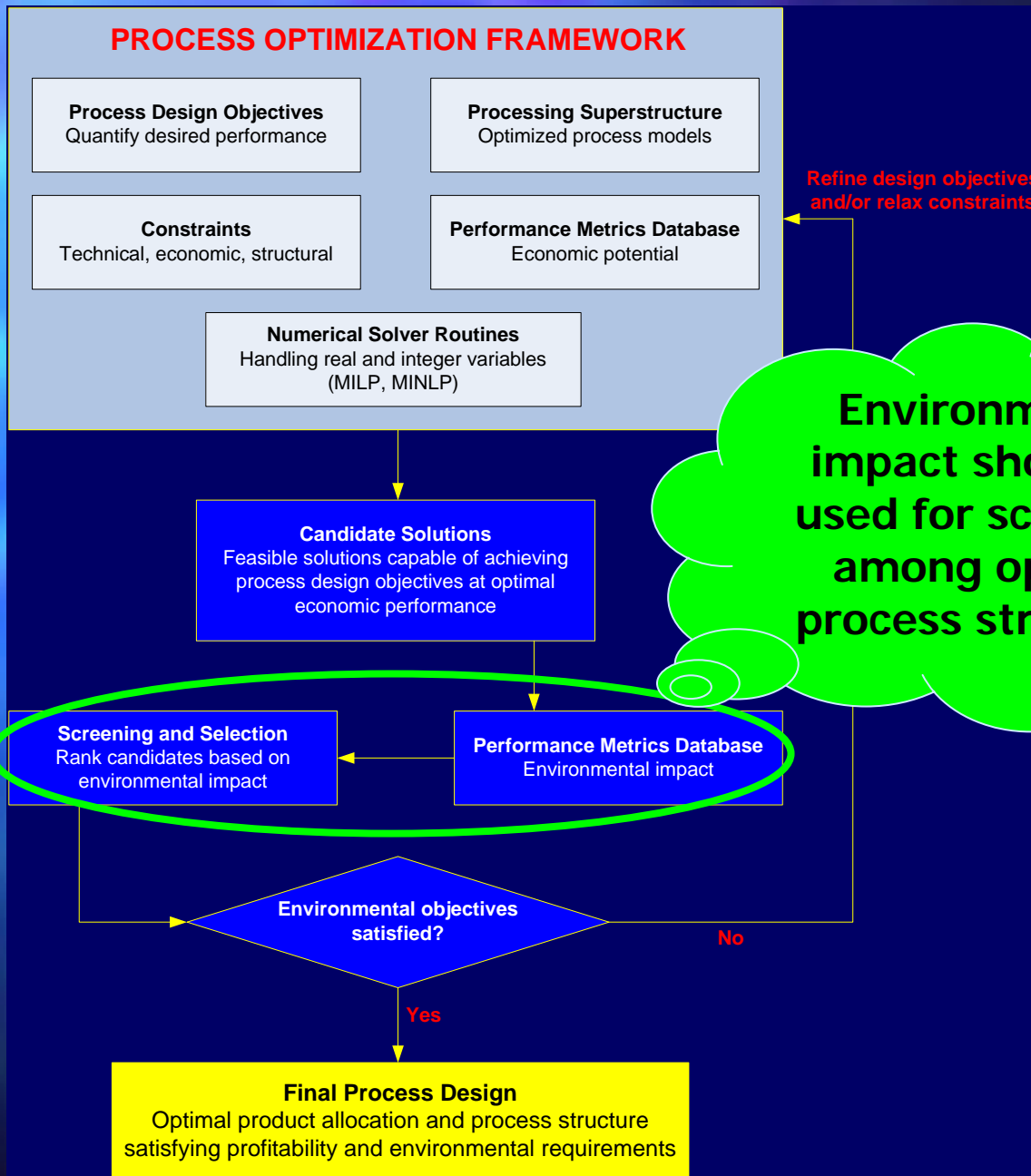


Process Systems
Engineering Tasks

Process Simulation
Mass and Energy Integration
Process Optimization
Production Optimization
Process Switchability
Process Economics



Central part of the framework in order to ensure optimal utilization of feedstock and energy resources



■ Approach to Directing Research

- ✓ *Flexible framework enabling inclusion of emerging technologies*
- ✓ *Suitable for interfacing and evaluating experimental and modeling efforts*
- ✓ *Optimization framework enables the identification of solutions providing the highest potential.*
- ✓ *More research efforts should be devoted to such solutions, while suboptimal processes are screened out*