

Green Olefins: Process Development for Energy-Efficient Olefins Recovery

Mike Foral

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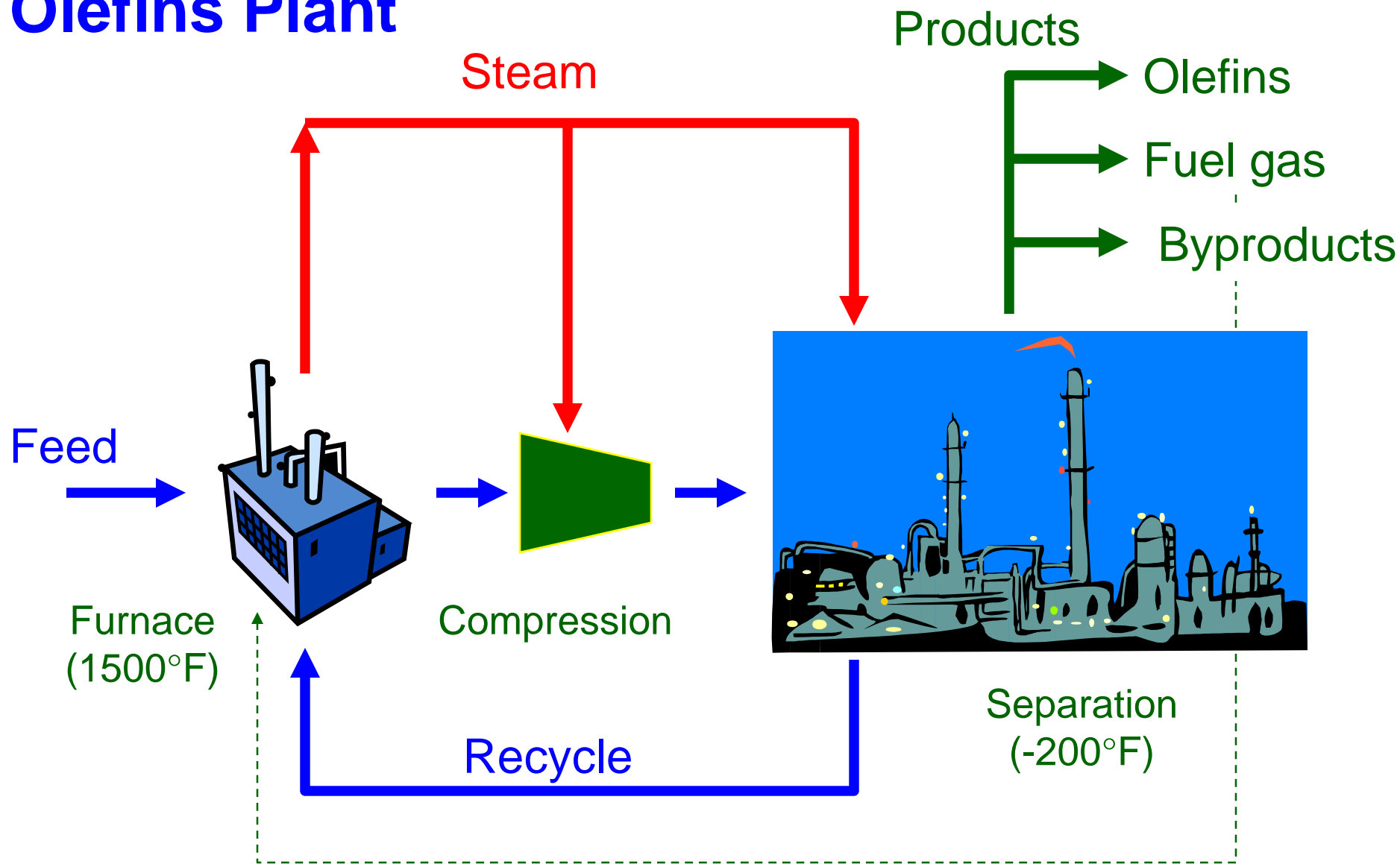
aspentech

Outline

- > Background: Energy Use in Ethylene Production
- > Project Goals and Methodology
- > Optimized Advanced Distillation Concept
- > Current Status
- > Next Steps



Olefins Plant



Project Goals

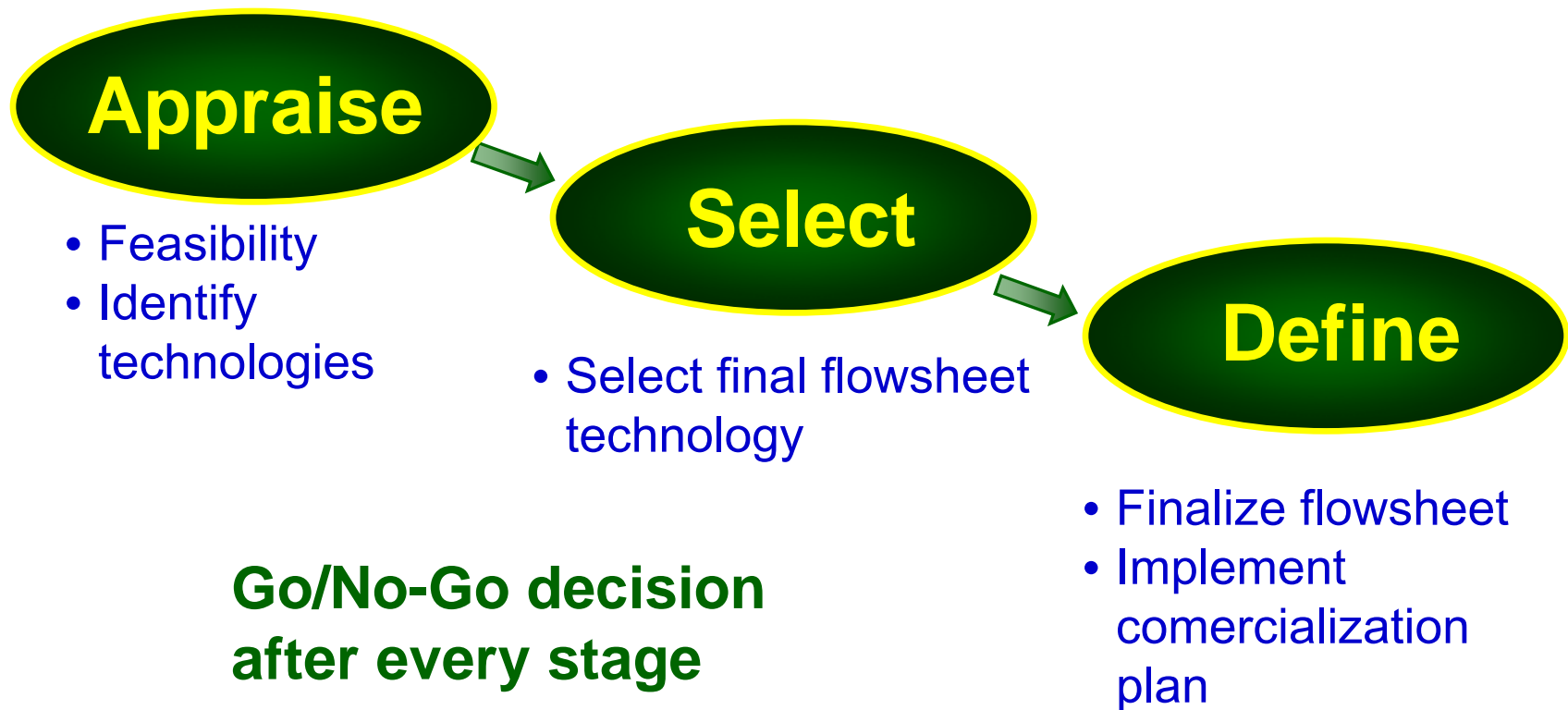
> Our key technical goals are:

- Produce a new olefins plant separation system that will:
 - Reduce separation energy by 15%
 - Reduce GHG derived from separation section by at least 15%
 - Be at least capital-neutral
 - Utilize only commercially proven technologies

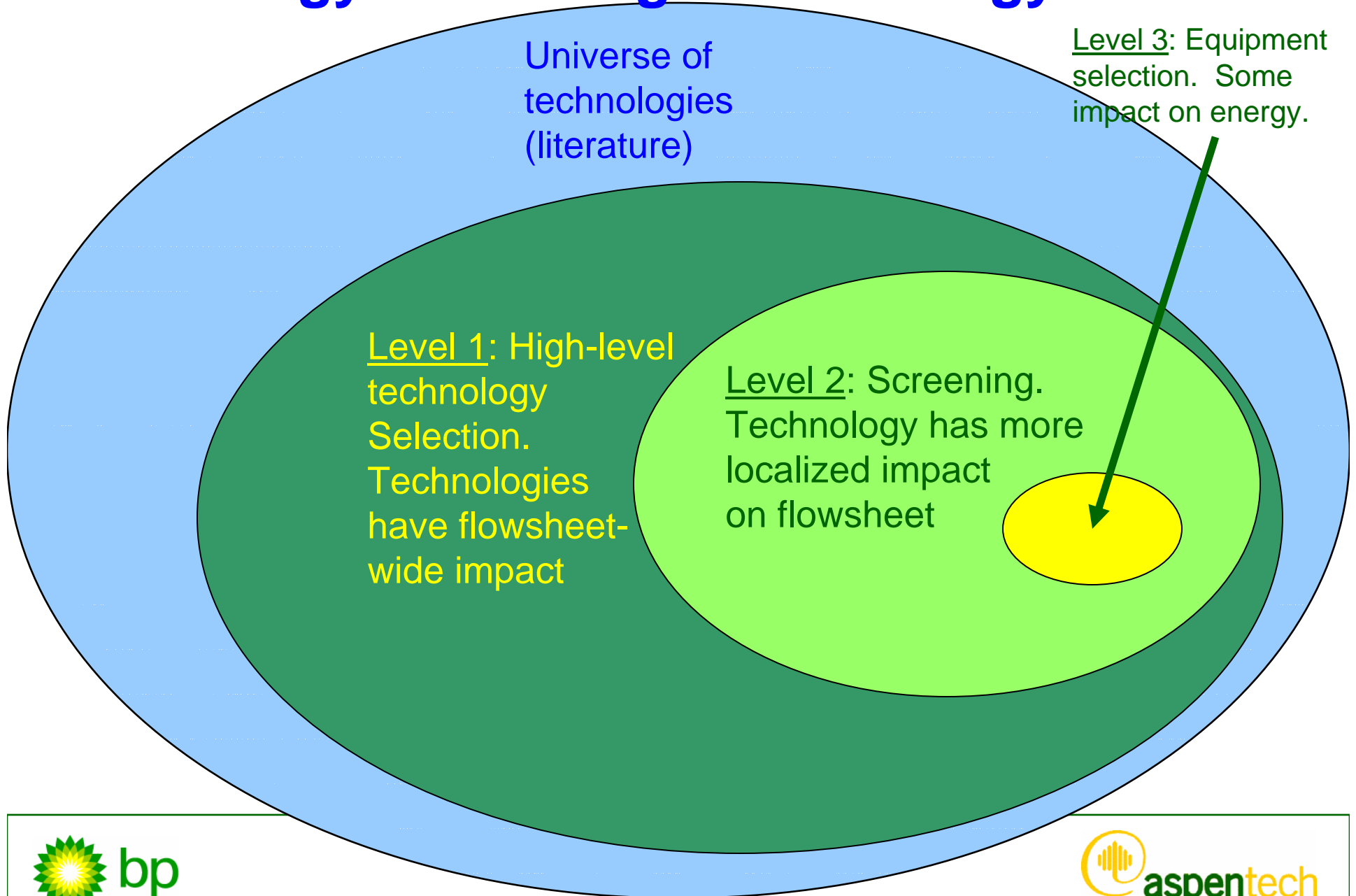


Project Management

- > Collaborative project with Aspen Technology, support from U.S. Department of Energy
- > Project being managed using a stage-gate approach



Technology Screening Methodology



Level 1 Technologies

- > Some of the Level 1 Technologies that were evaluated:
 - Absorption
 - Distillation (conventional and advanced)
 - Hydrogen Membranes
 - Mixed Refrigeration Systems



A Complex Optimization Problem

- > Multiple optimization parameters
 - Many column sequencing options: distribution of components and groups of components are possible
 - Sets of columns can be thermally coupled
 - Any column can operate at nearly any pressure
 - Multiple utility (steam and refrigeration) systems are possible
- > Problem requires an efficient approach and the right tools.



Green Olefins Advanced Distillation System

- > Comprehensive analysis of all feasible column thermal coupling and component distribution options.
- > Extensive use of Optimization tools
 - Energy pinch analysis – process, utility integration
 - Column thermal analysis – column operating conditions and design, feed conditioning



Green Olefins Advanced Distillation System

- > Careful study of energy/hydrogen production trade-off
 - Determine trade-offs for various flowsheet options
 - Led to novel high-recovery flowsheet design
- > ADS flowsheet selected based on energy, flowsheet complexity, capital cost
- > Developed simple yet flexible refrigeration system that complements flowsheet design



Current Status

- > ADS separation train design with very low energy. 20-25% lower total separation energy than conventional designs
- > Preliminary estimate shows capital savings of more than 10% for major separation equipment (columns, compressors, exchangers)
- > Column and compressor count are similar to conventional designs. No new or unproven technology is employed.



Current Status (continued)

> ADS Design flexibility

- Different feedstocks – feasible designs for pure ethane to pure naphtha feeds
- Different furnace technologies
- Hydrogen production – high hydrogen recovery to product without impacting ethylene loss
- Potential to apply technology to expansions of existing olefins plants. Unique high-capacity debottlenecking options may be possible



There's Still Some Work to be Done:

- > Patent protection
- > Controllability/operability studies
- > Ensure design feasibility of key equipment
- > Confirm and implement a commercialization strategy



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