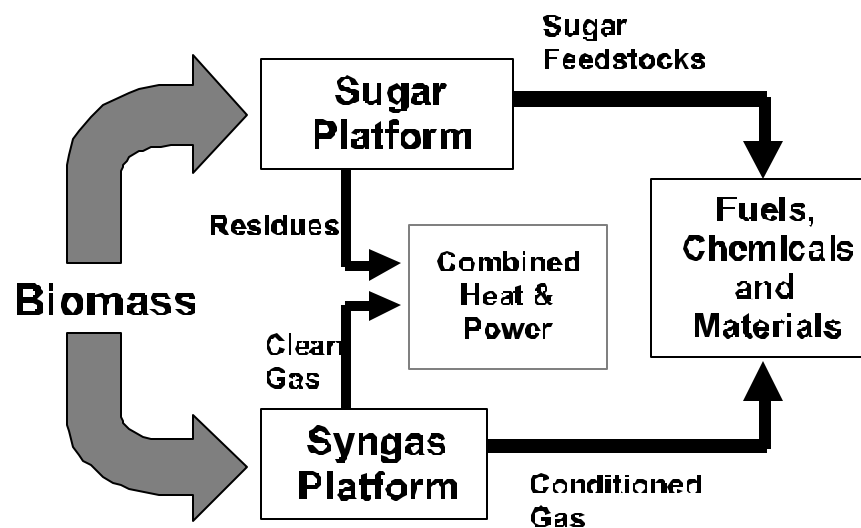


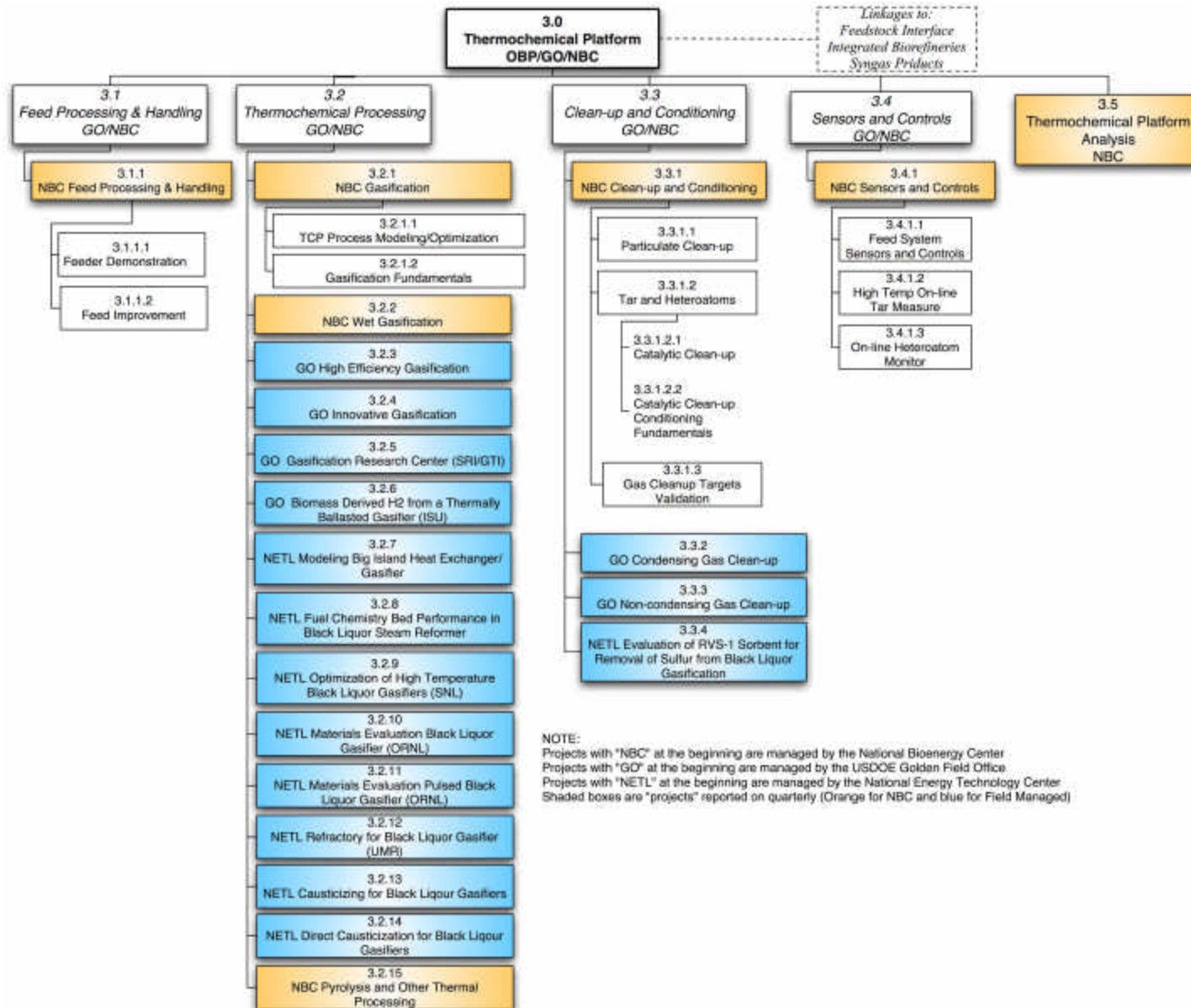
Thermochemical Platform Overview



Kevin Craig
Second Meeting of S-1007
November 7, 2003
Washington, D.C.



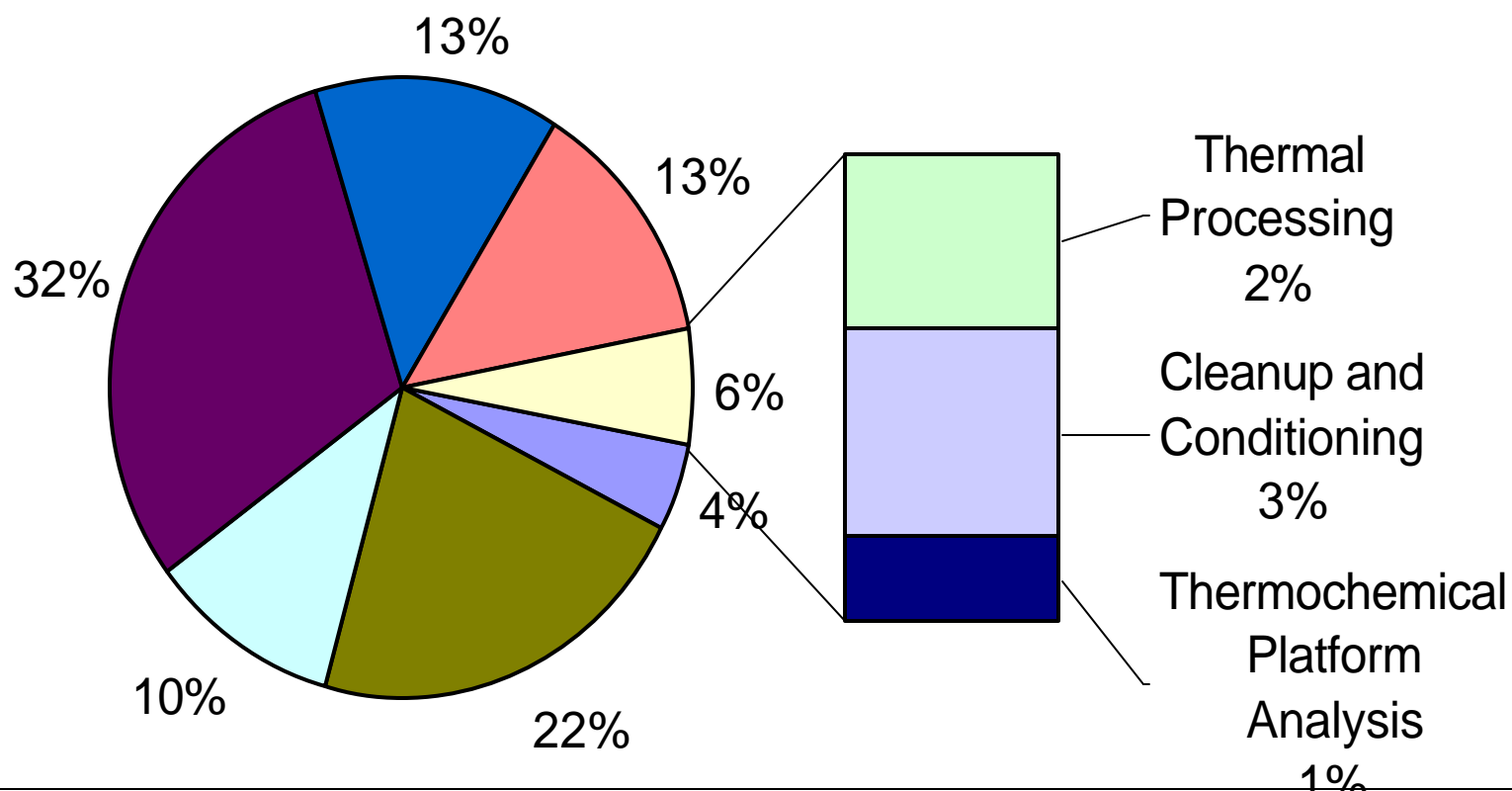
3.0 Thermochemical Platform









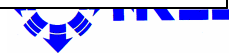
NOTE:
 Projects with "NBC" at the beginning are managed by the National Bioenergy Center
 Projects with "GO" at the beginning are managed by the USDOE Golden Field Office
 Projects with "NETL" at the beginning are managed by the National Energy Technology Center
 Shaded boxes are "projects" reported on quarterly (Orange for NBC and blue for Field Managed)

Breakout of FY04 Thermochemical Platform Budget

Total Budget Request: \$78.56M



 Feedstocks	 Sugar Platform	 Products
 Integrated Biorefineries	 Program Management	 Reserve and New Solicitaions



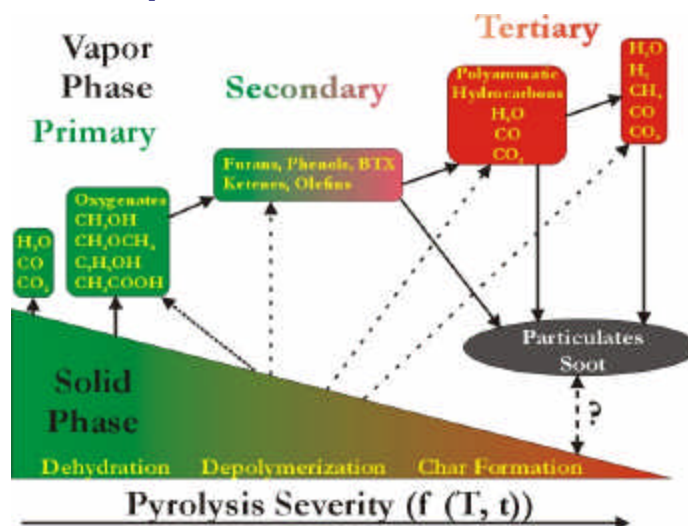
Basic Definitions

Pyrolysis

- Thermal conversion (destruction) of organics in the absence of oxygen
- In the biomass community, this commonly refers to lower temperature thermal processes producing liquids as the primary product
- Possibility of chemical and food byproducts

Gasification

- Thermal conversion of organic materials at elevated temperature and reducing conditions to produce primarily permanent gases, with char, water, and condensibles as minor products
- Primary categories are partial oxidation and indirect heating



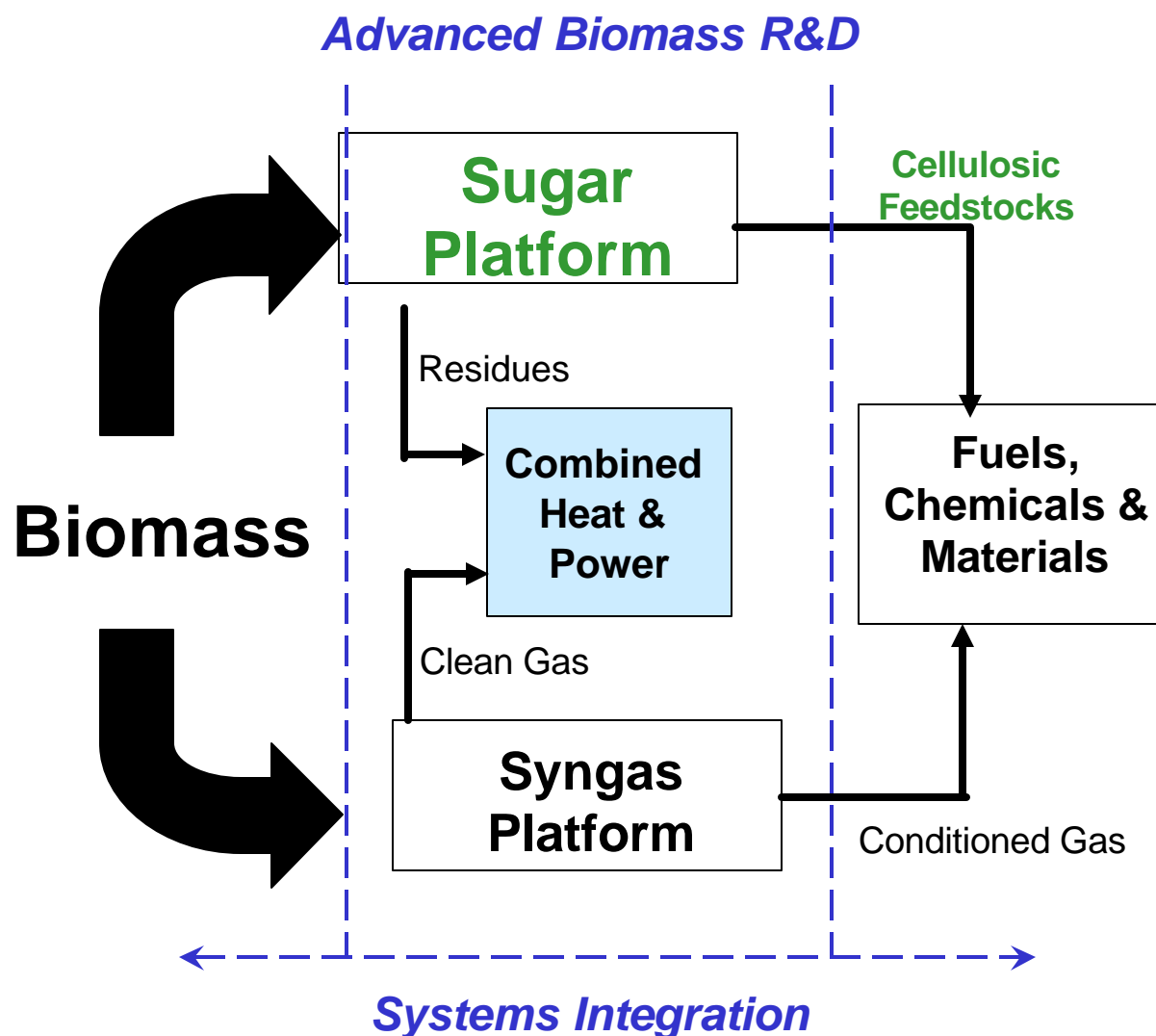
OBP Program Objectives

Draft MYPP milestones

2005: Demonstrate an integrated process for fuels production from biomass

2007: Complete technology development needed to enable start-up demonstration of a biorefinery producing fuels, chemicals and power

2010: Help U.S. industry to establish the first large-scale biorefinery based on agricultural residues



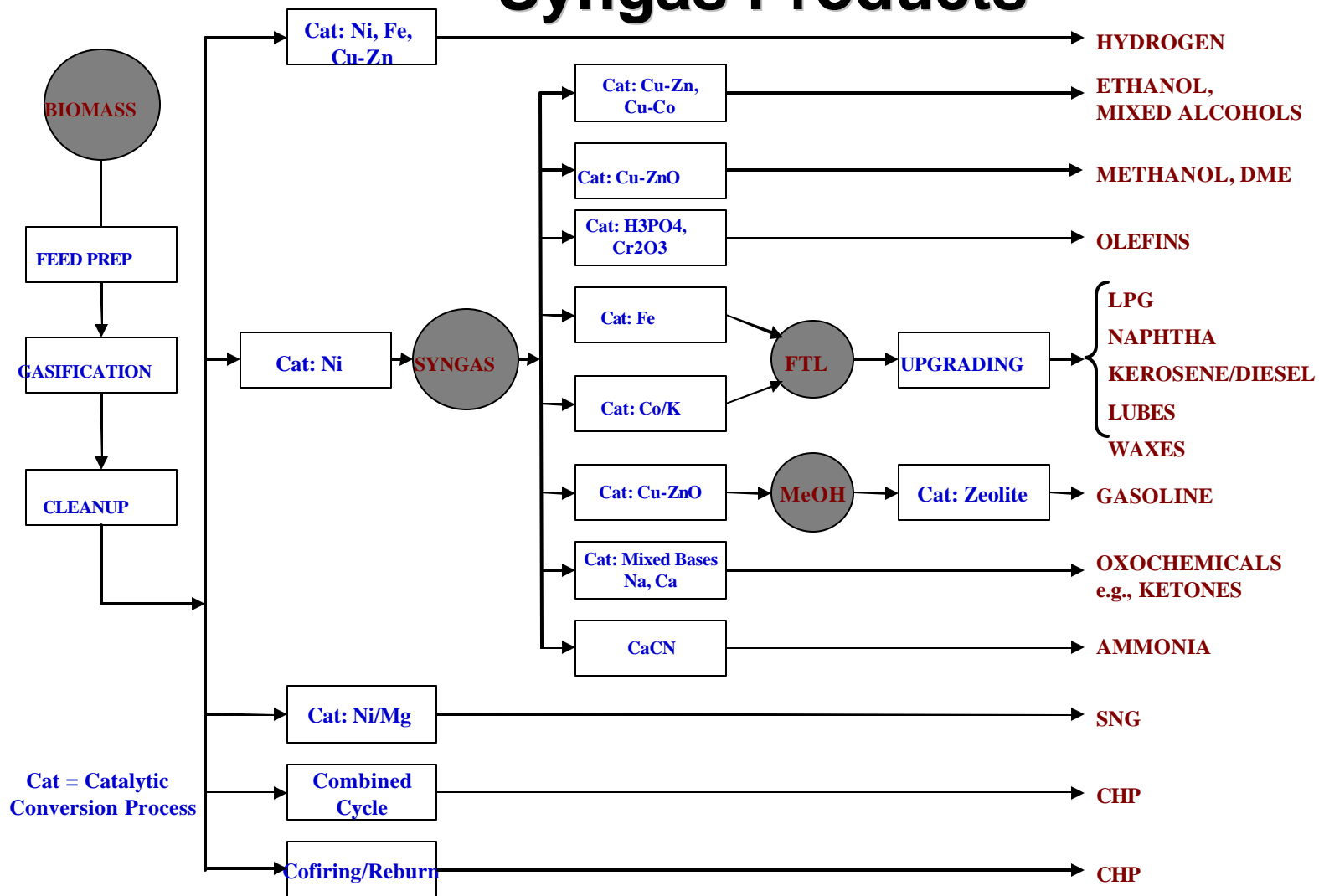
Objective – Syngas Platform



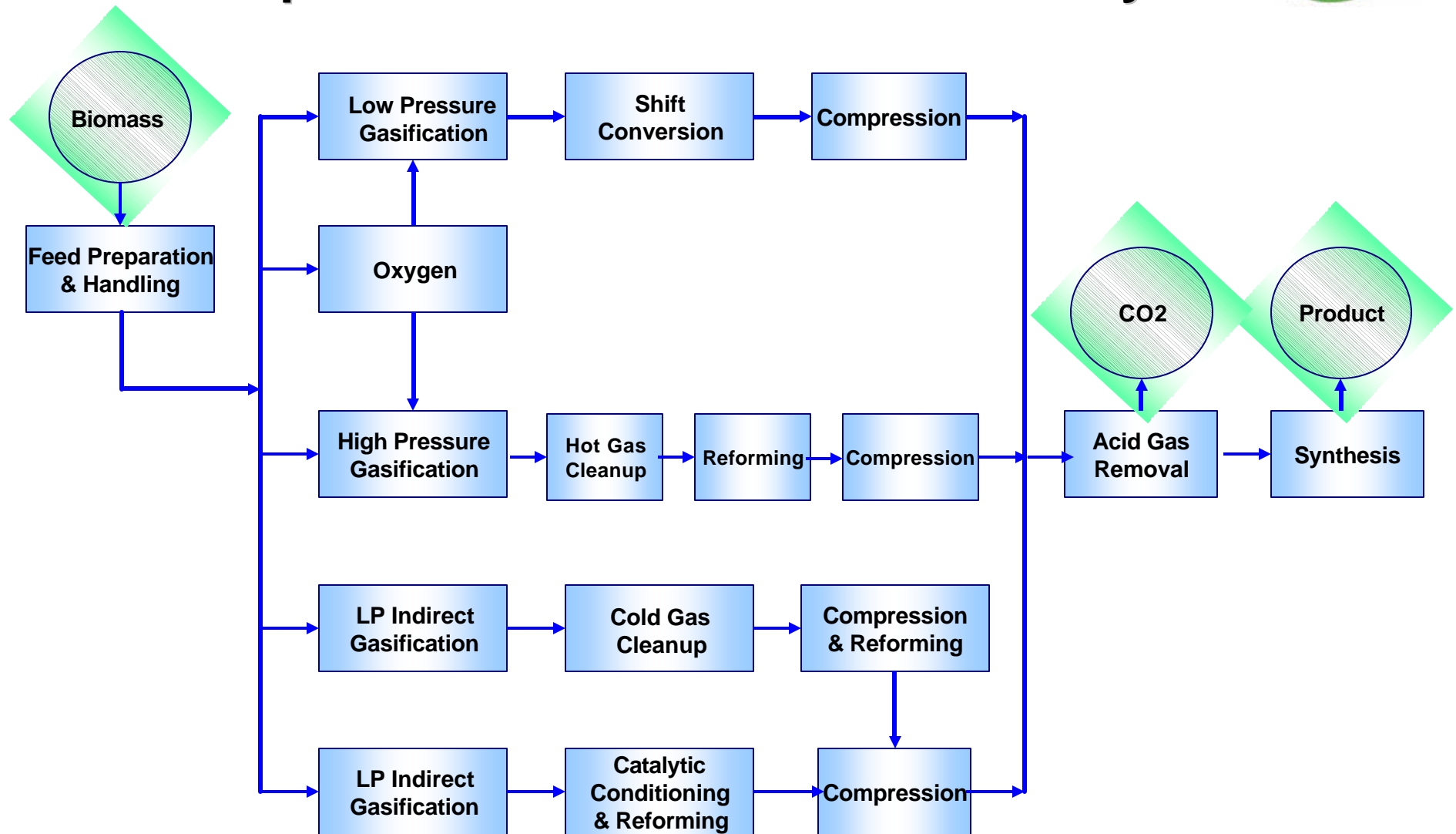
To produce an inexpensive, clean syngas from biomass that is compatible with existing and advanced processes for the production of fuels, chemicals, and power

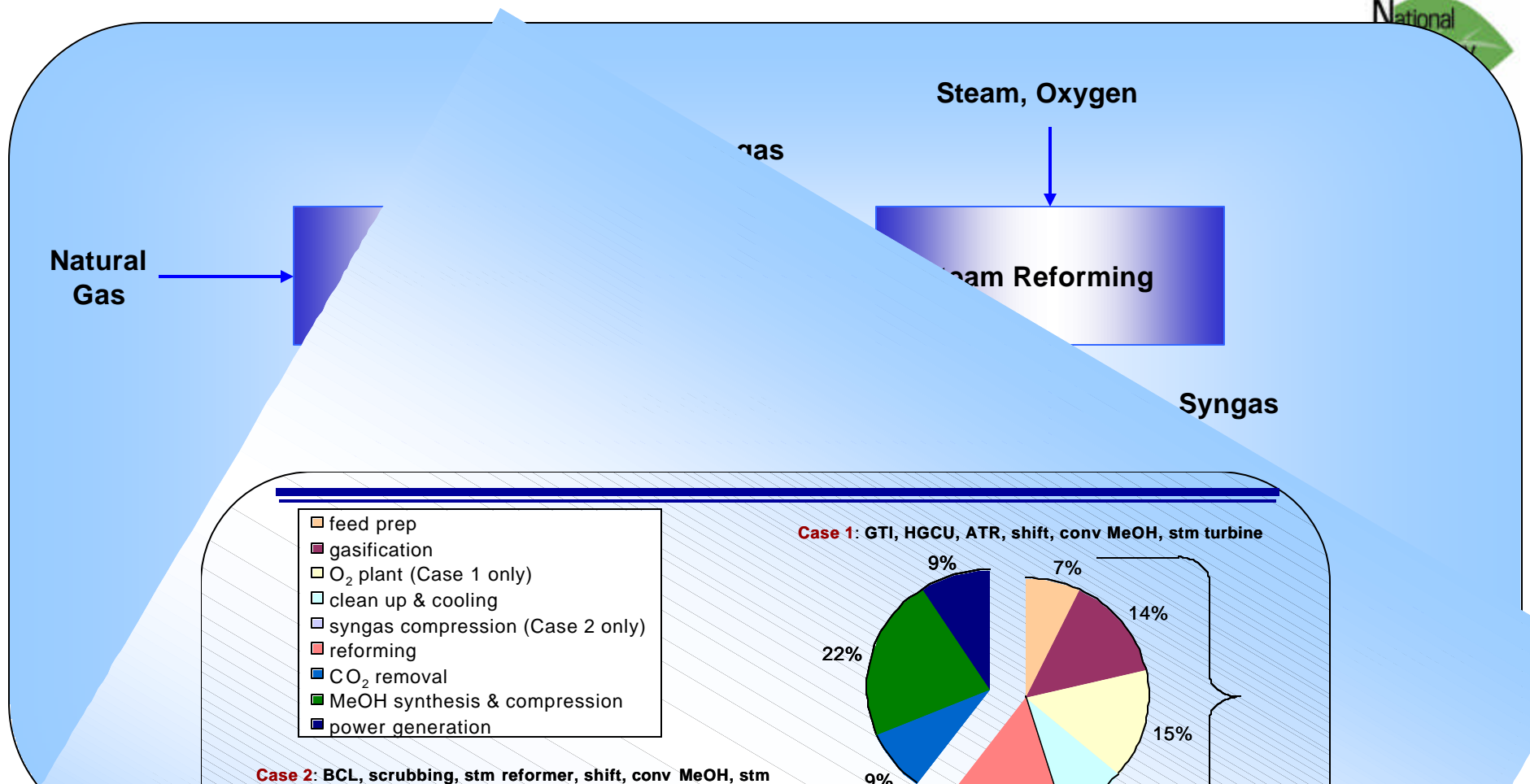


Syngas Products



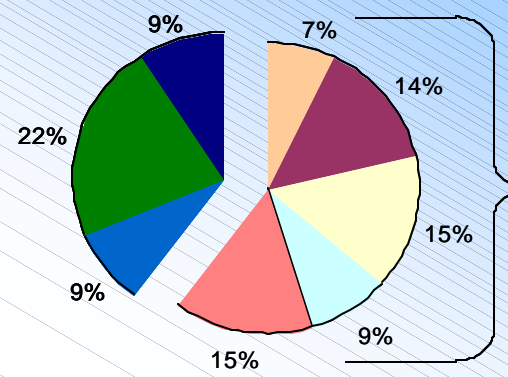
Representative Gasification Pathways



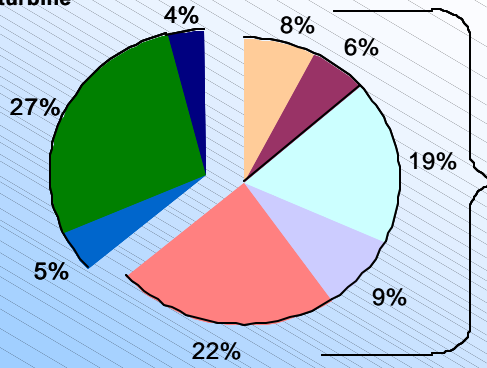


- feed prep
- gasification
- O₂ plant (Case 1 only)
- clean up & cooling
- syngas compression (Case 2 only)
- reforming
- CO₂ removal
- MeOH synthesis & compression
- power generation

Case 1: GTI, HGCU, ATR, shift, conv MeOH, stm turbine



Case 2: BCL, scrubbing, stm reformer, shift, conv MeOH, stm turbine



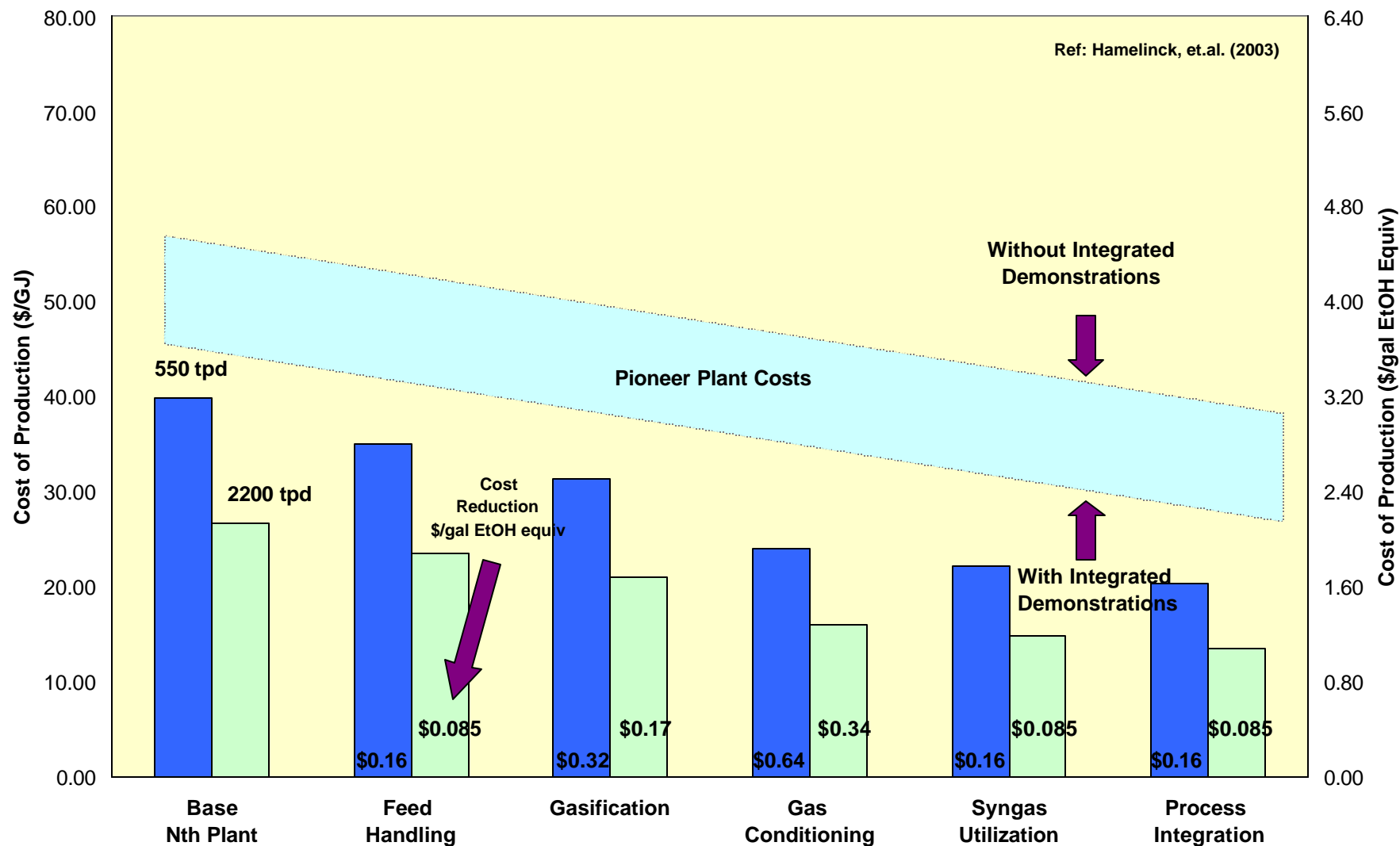
Feed prep, gasification, O₂, & syngas compression = 34-38% of total capital

Clean syngas generation = 60-64% of total capital

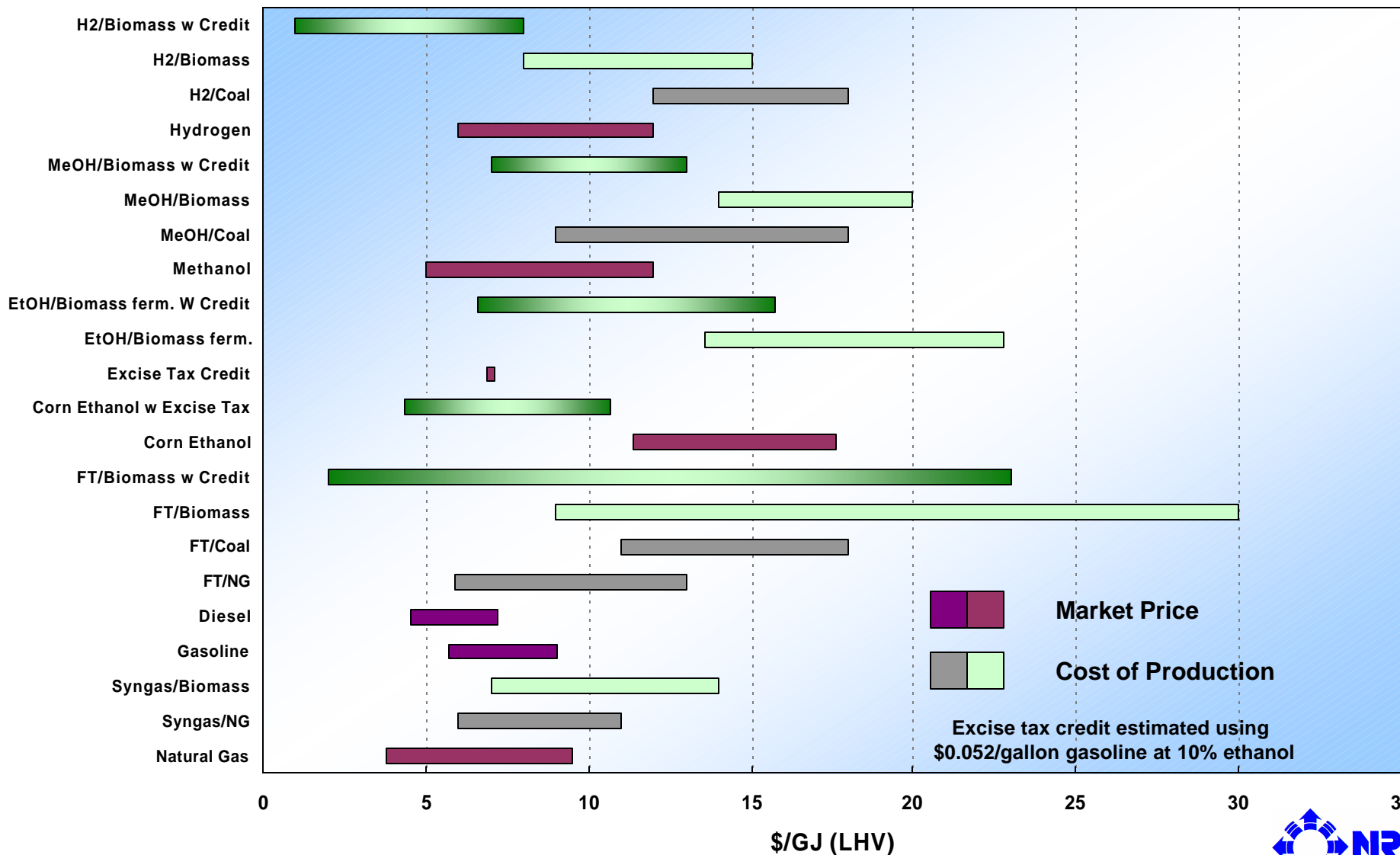
Potential Impact of Overcoming Barriers

Barrier	Priority	Potential Cost Reduction, %
Cleanup & Conditioning	High	15 - 25
Syngas Utilization (Products)	High	10 - 15
Process Integration	High	5 - 10
Thermal Processing	Medium	5 - 10
Feed Processing & Handling	Low	5 - 10
Sensors & Controls	Low	5 - 10

Syngas Platform Cost Curve for Fischer Tropsch Liquids



Renewable Fuels: Estimated Cost of Production and Impact of Renewable Fuels Excise Tax Credit



Objectives By Barrier Areas

- **Feed Processing & Handling:**
 - Improve feeder reliability
 - Improve biomass properties

- **Gasification / Conversion:**
 - Investigate gasification and tar formation/destruction fundamentals
 - Gasify biorefinery lignin residues
 - Pilot test high-efficiency and novel gasifiers
 - Develop wet gasification

- **Syngas Cleanup & Conditioning:**
 - Develop tar cracking and methane reforming catalysis
 - Develop improved particulate removal techniques
 - Test improved pilot scale non-condensing & condensing gas cleanup

Objectives By Barrier Areas

■ Syngas Utilization:

- Demonstrate viability of syngas as a feed for C1 synthesis
- Demonstrate syngas utilization for biorefinery utilities
- Investigate the catalytic upgrading of pyrolysis oils
- Complete an assessment of distributed systems

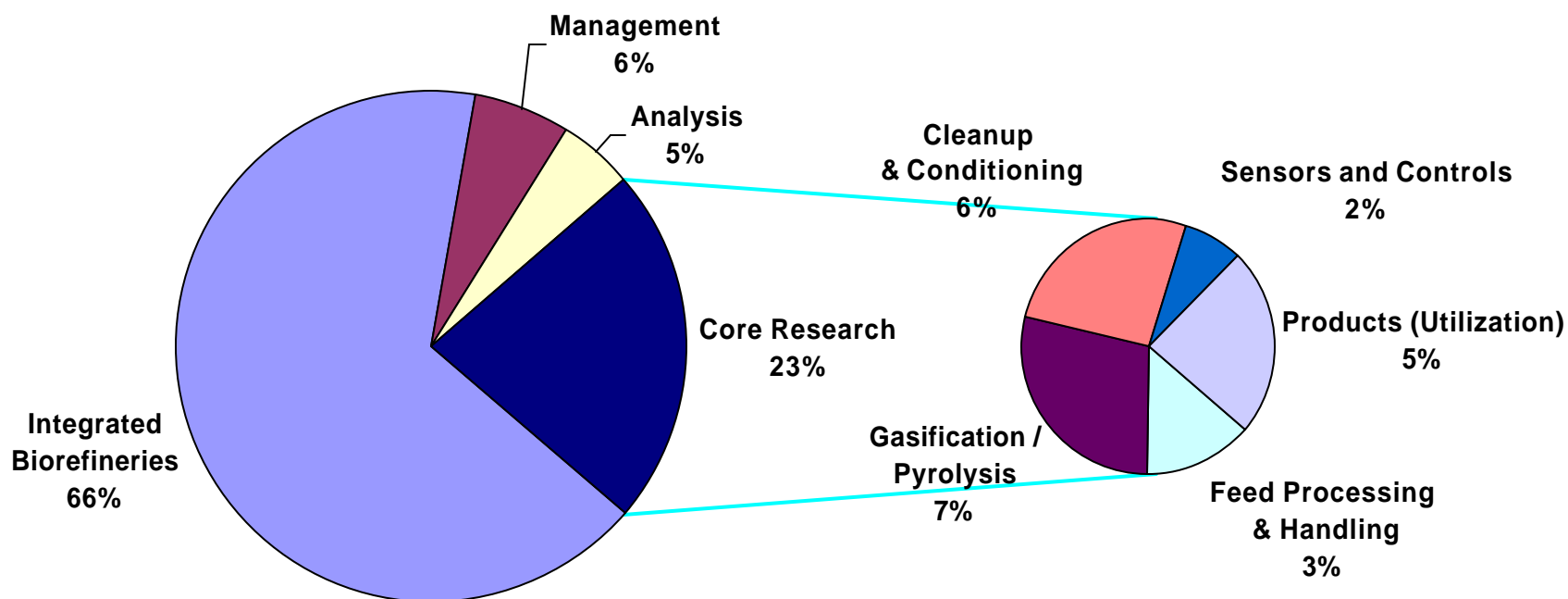
■ Process Integration:

- Demonstrate at precommercial scale integrated syngas-based hydrogen, fuels, and chemicals synthesis processes

■ Sensors and Controls:

- Develop on-line cost-effective sensors for process control applications. Sensors will be developed or adapted for feed, tars, alkalis, heteroatoms, and nitrogen compounds

Proposed Biomass Syngas Platform Funding FY2004 - 2015



Total Proposed Funding, \$300 million

Proposed SynGas Pathway

End Result and Projected Completion Date

- The end result for the SynGas Platform is to have completed the RD&D necessary to begin 1st generation commercial projects
- Development will draw on experience of coal gasification (e.g. Clean Coal) and commercial syngas conversion processes
- The Platform plan does not include new-generation technologies that may come into the pipeline

