Unlocking High Value Xylenes From Light Cycle Oil

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AIChE Chicago Section Meeting
Chicago, IL
September 22, 2008

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The LCO-X™ Process – Value from LCO

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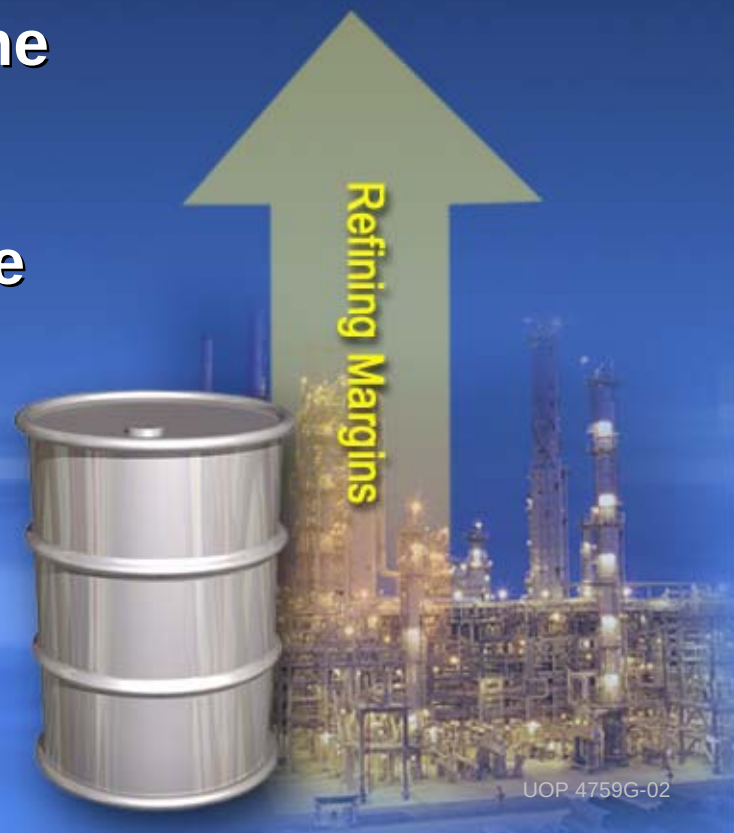
- Achieves Synergy Between Refining and Petrochemicals
- Converts LCO into Petrochemical Grade Aromatics
- Reduces Fuel Oil Production
- Provides High Quality Feeds to the Petrochemical Industry
- Can Boost Refining Margin by as Much as $0.75 per Barrel of Crude



LCO to BTX Petrochemicals Makes Money

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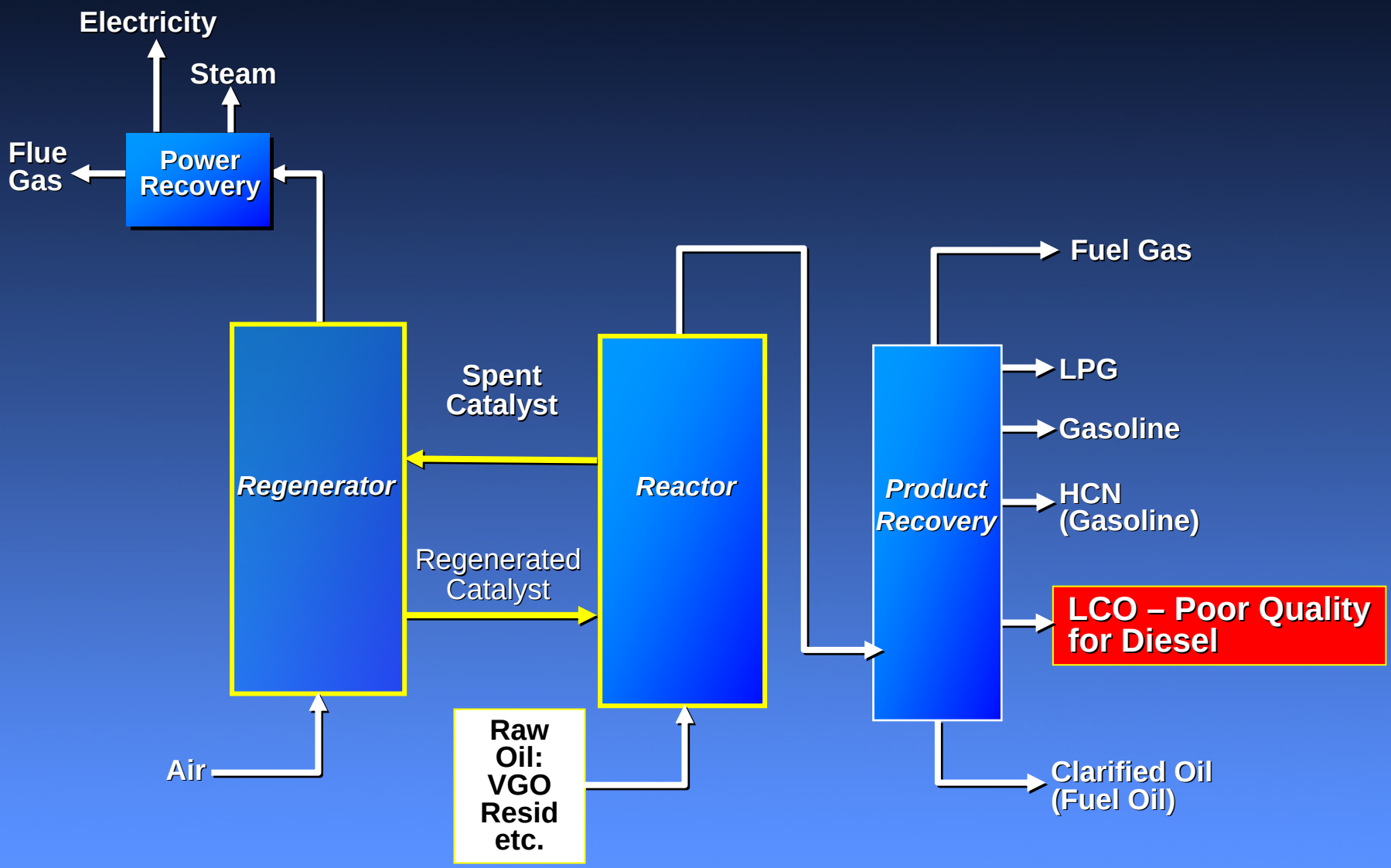
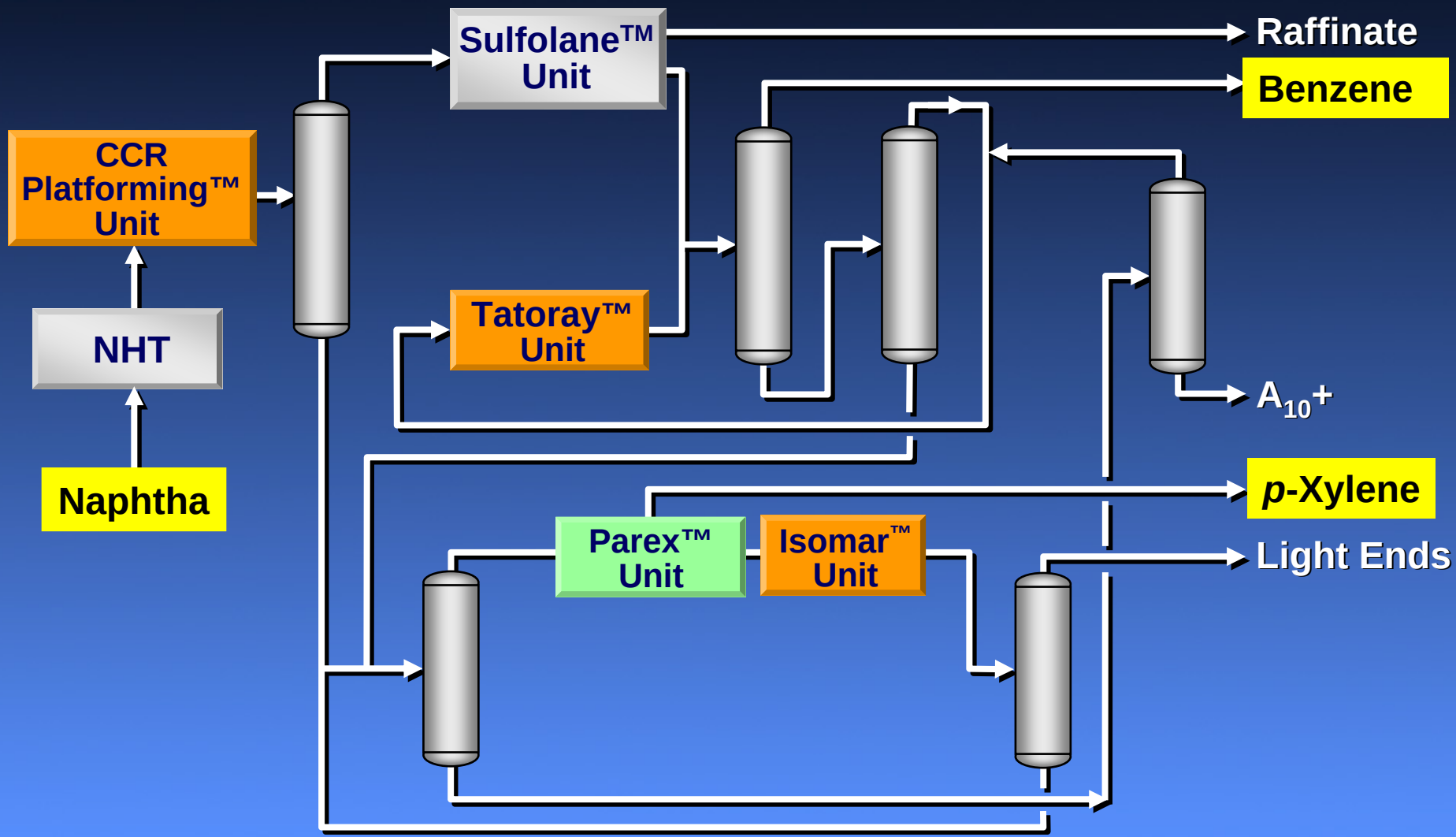
What Do You Need to Know?

- Petrochemical Aromatics Demand Growth
- Production Volume from LCO-X Process
- LCO Properties Point to Aromatics Production
- LCO-X Process Details
- Economic Considerations

All FCC and RCC Units Make LCO



Naphtha is the Dominant Feed Source for *p*-Xylene



Xylenes From the LCO-X Process Are An Ideal Feed for *p*-Xylene With Minimum By-products

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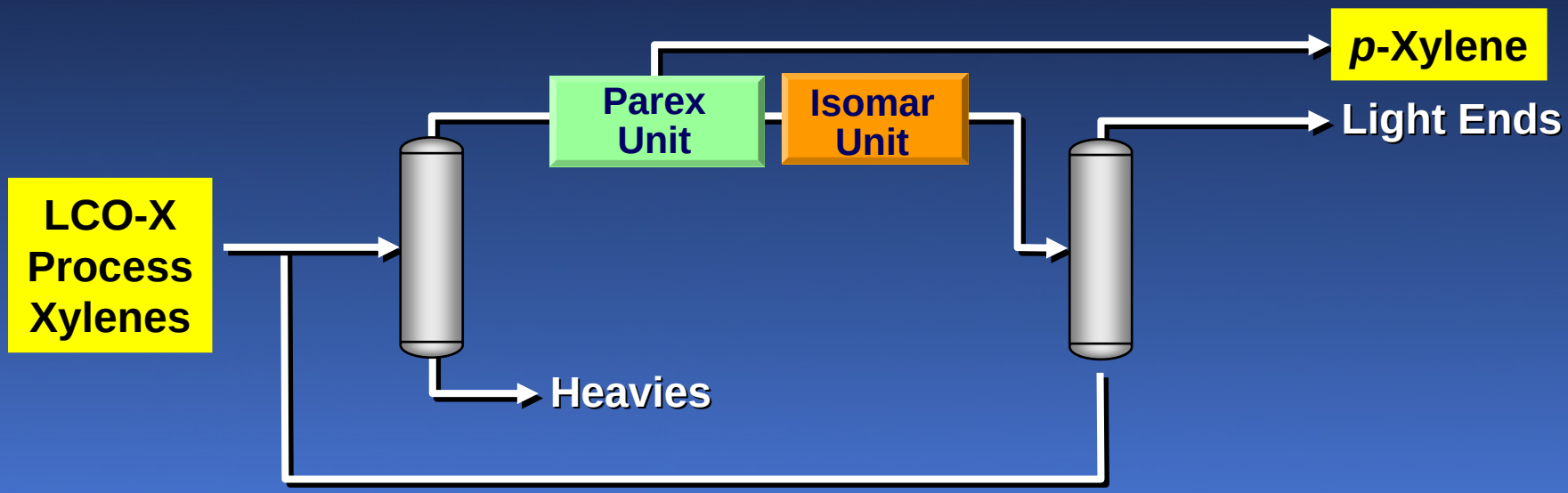

Xylenes from The LCO-X Process Can Supplement Xylenes Made from Naphtha

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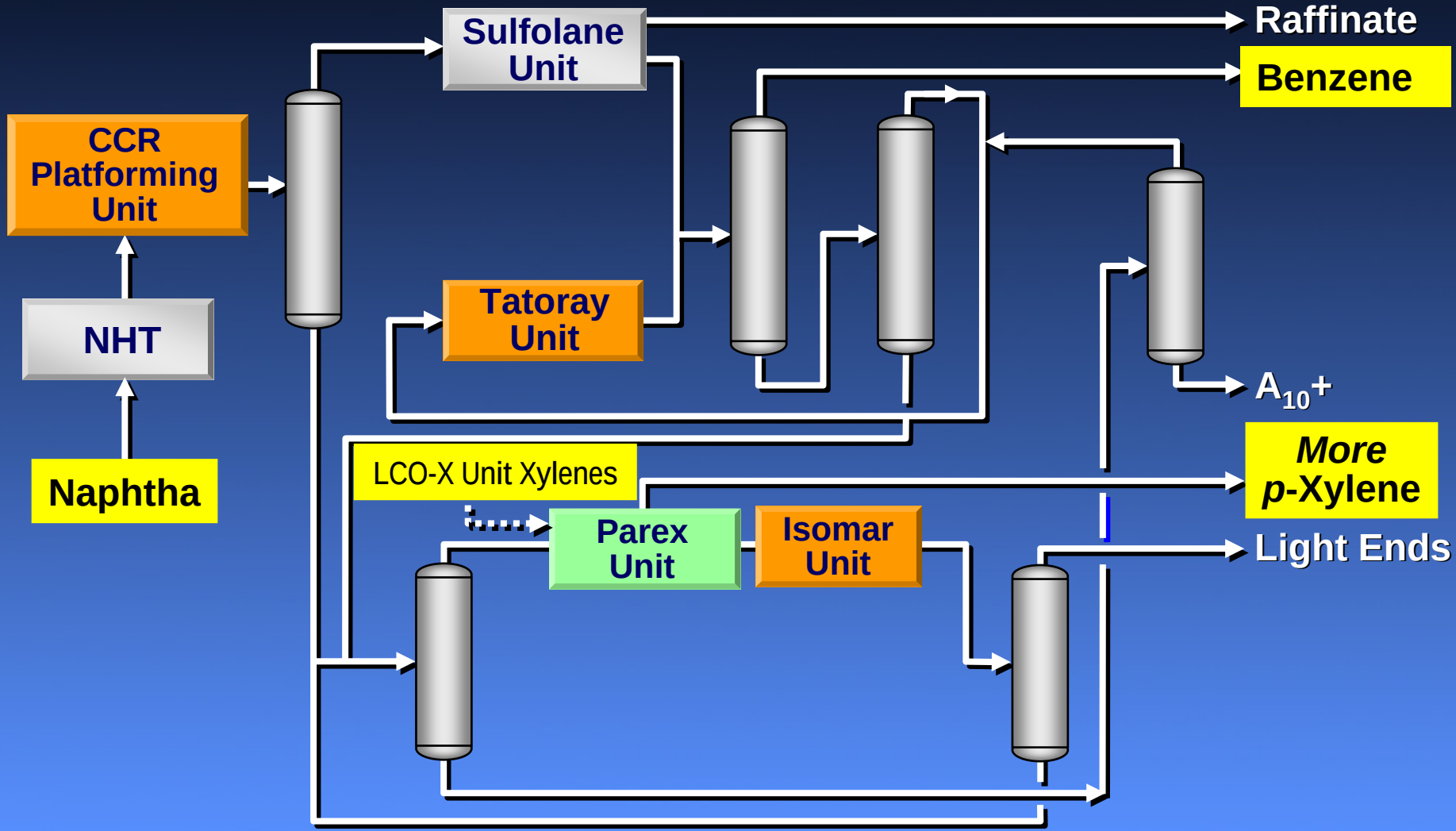

The LCO-X Unit Will Also Give Additional Benzene

Feedstock Dominates the Cost of *p*-Xylene

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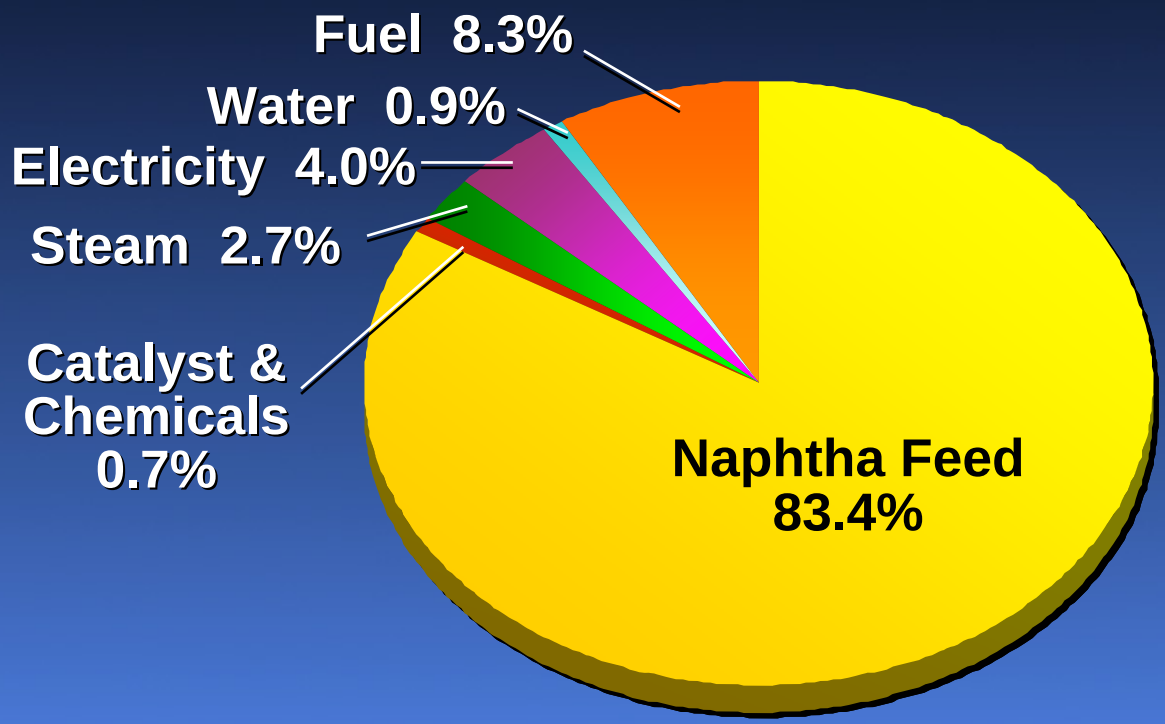

The LCO-X Process Can Reduce Feedstock Costs

Steady Worldwide Growth in Demand For *p*-Xylene: Fiber & Resins

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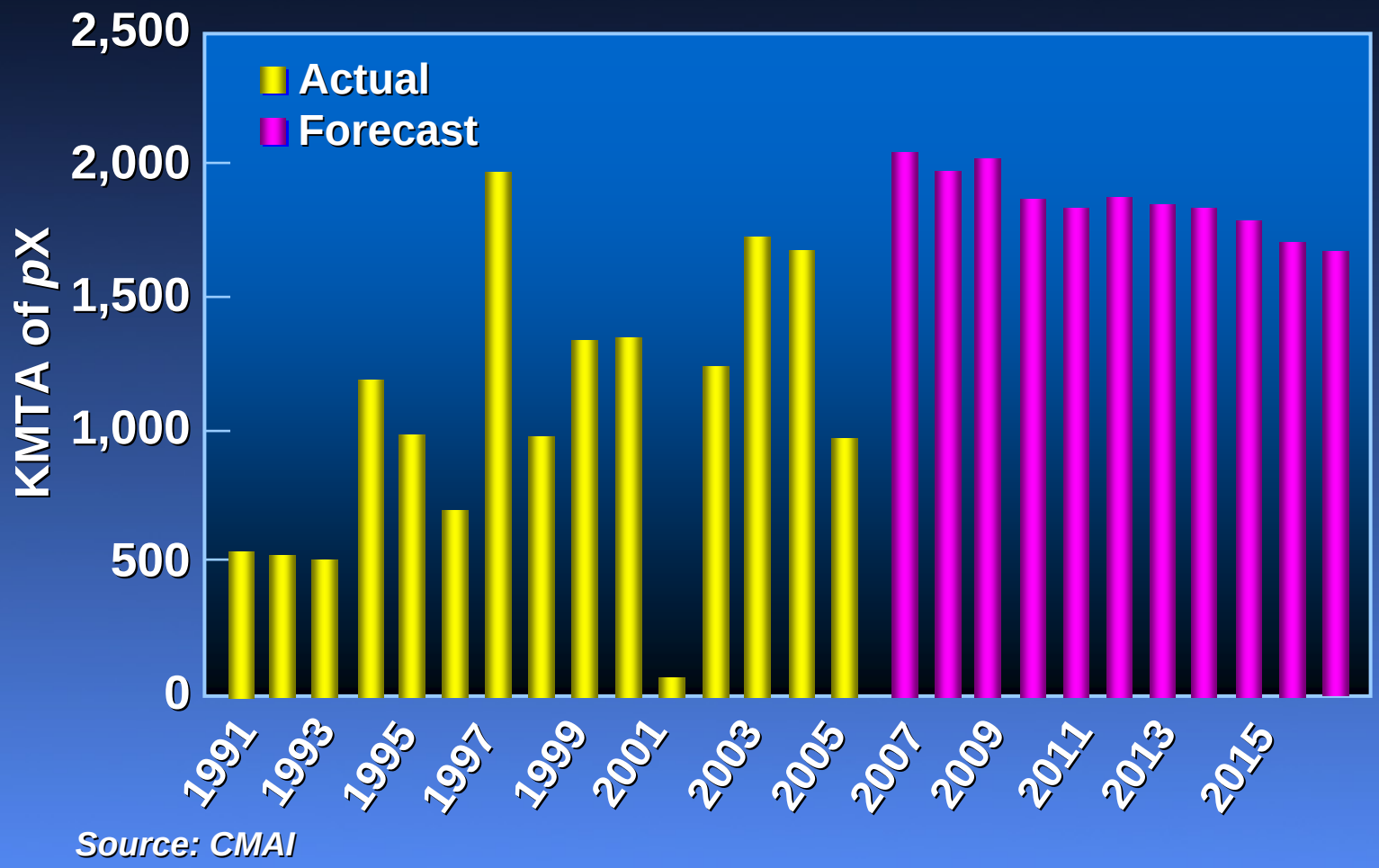
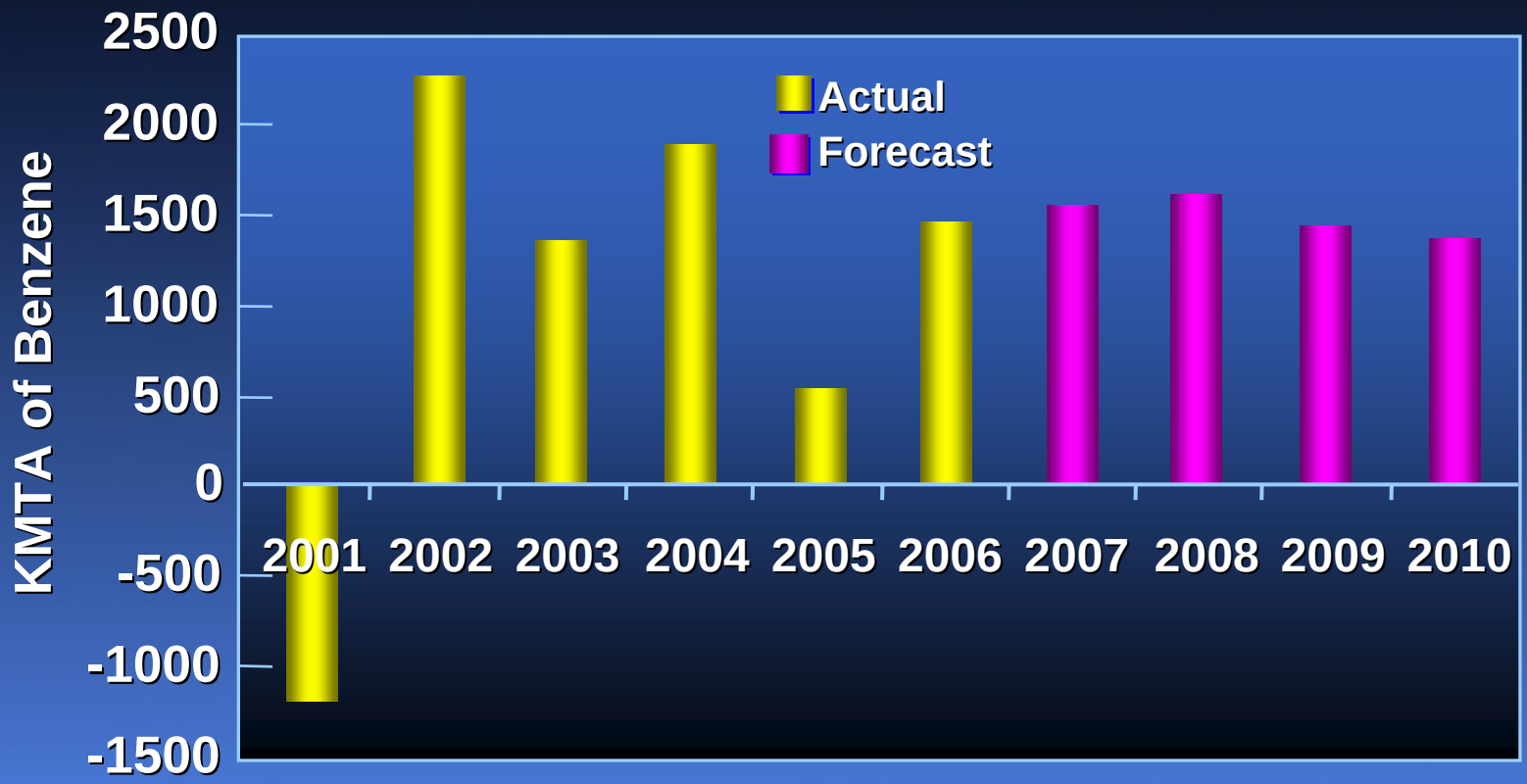


Source: CMAI

Future demand growth steady at about 1.5 MM MT/yr

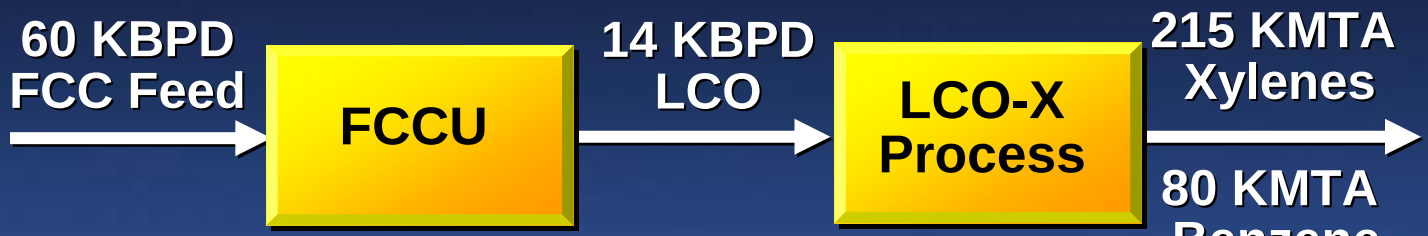
Steady Demand Growth For Benzene Styrenics, Phenolics



Source: CMAI

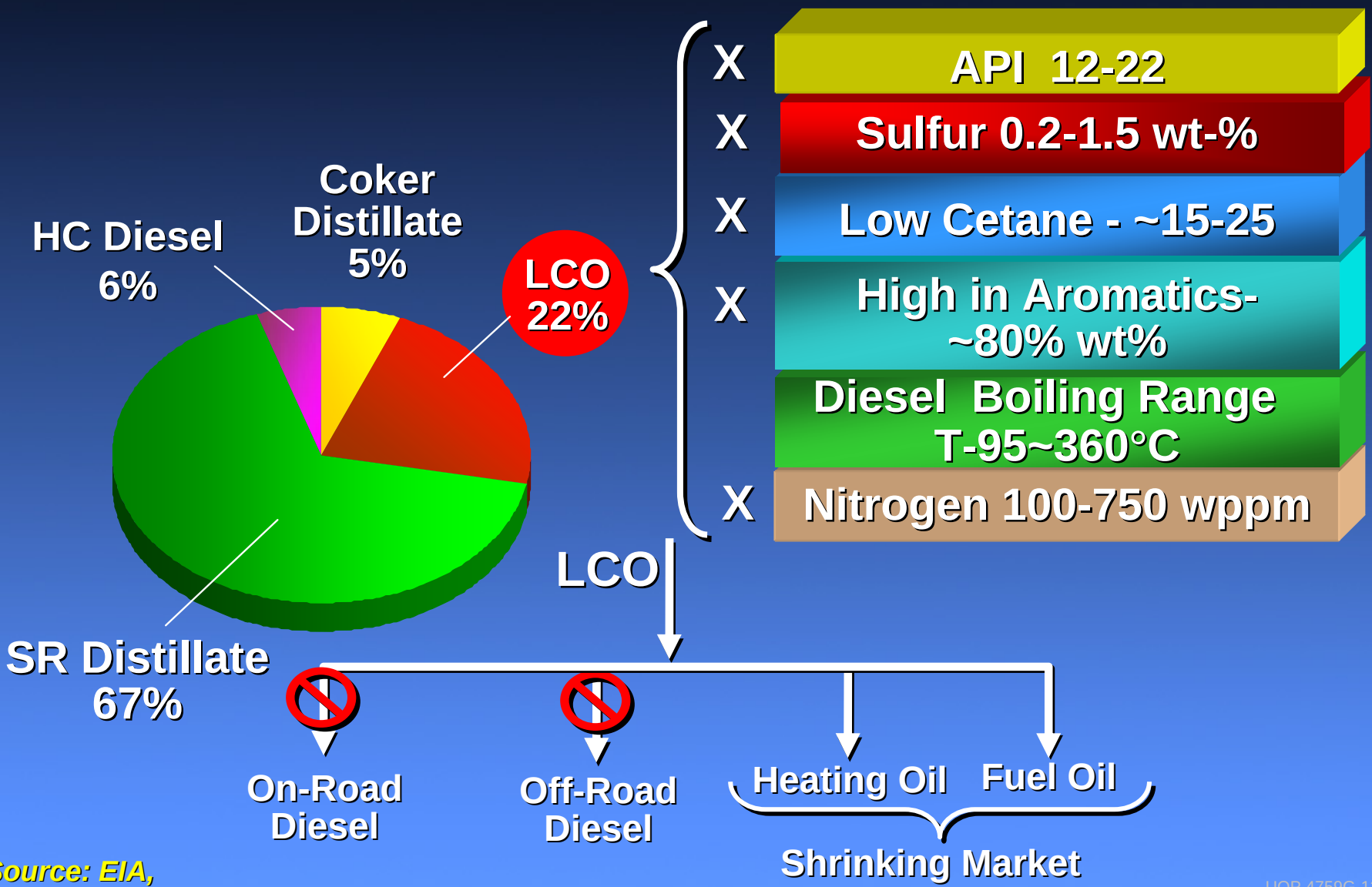
Future demand growth steady at about 1.3 MM MT/yr

There Will Be Ample Market Opportunities for Xylenes Produced From the LCO-X Process



- *pX Market Growth 6000 MTA in next 4 Years*
- *Market Can Easily Absorb Xylenes from the LCO-X Process*

LCO is High Volume, *But Poor Quality For US Diesel Pool*

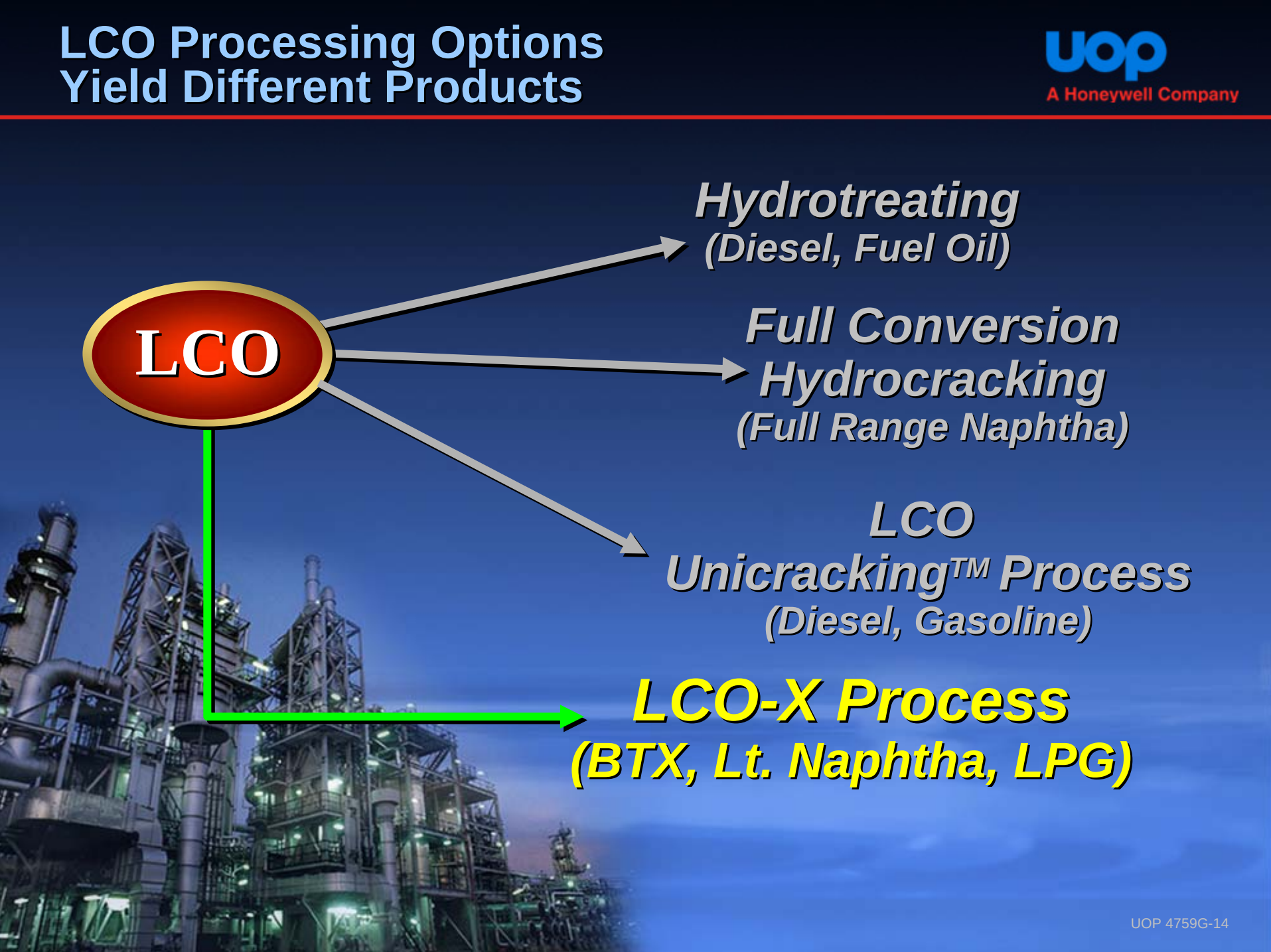


Source: EIA,

Diesel Specifications More Stringent – Bad News for LCO

	US	*CARB 2006*	*Europe 2006*	*LCO*
Cetane	40	55-59	51	15-25
API Gravity	---		36	12-22
Aromatics Vol%	35	10-20	11% PAHs	80
Sulfur, wt ppm	15	15	10	2000-15,000

LCO Processing Options Yield Different Products



LCO Is Uniquely Rich in Aromatics
Coker Gas Oil – Not So Much

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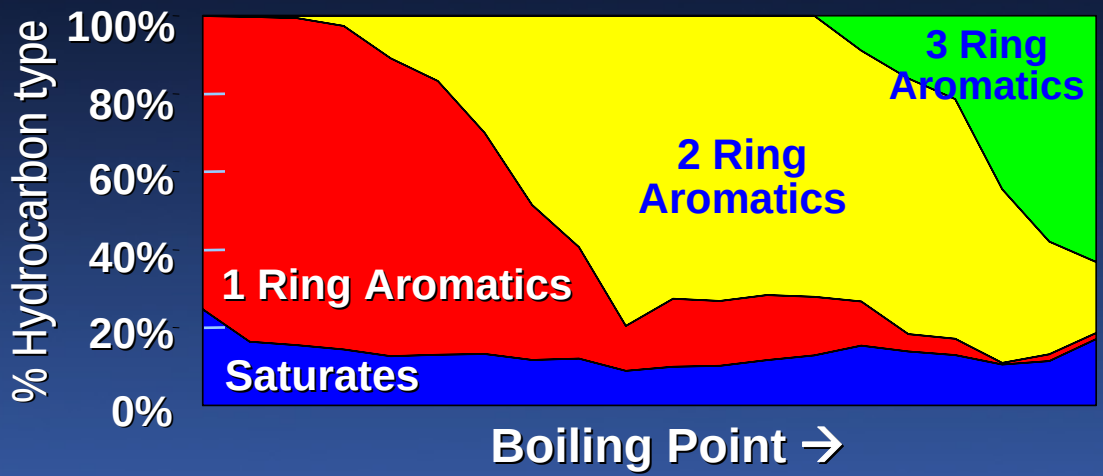
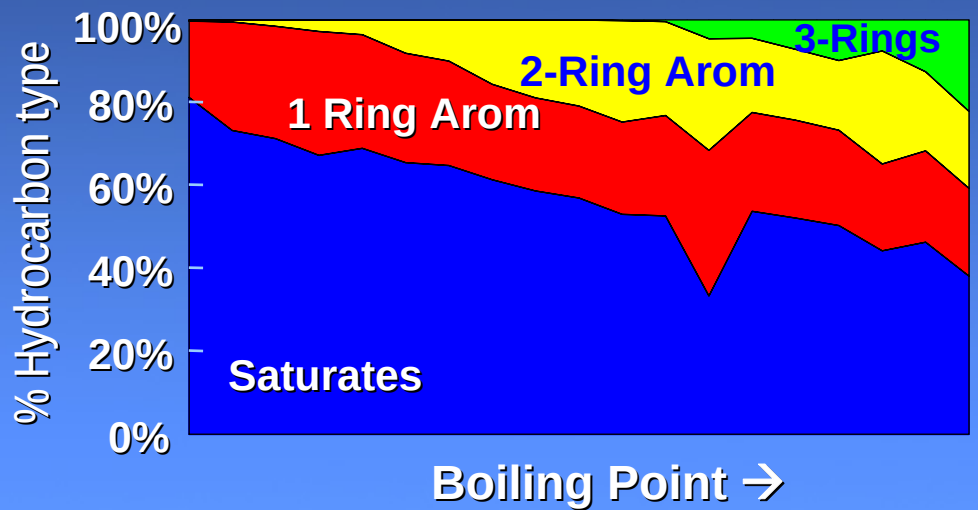
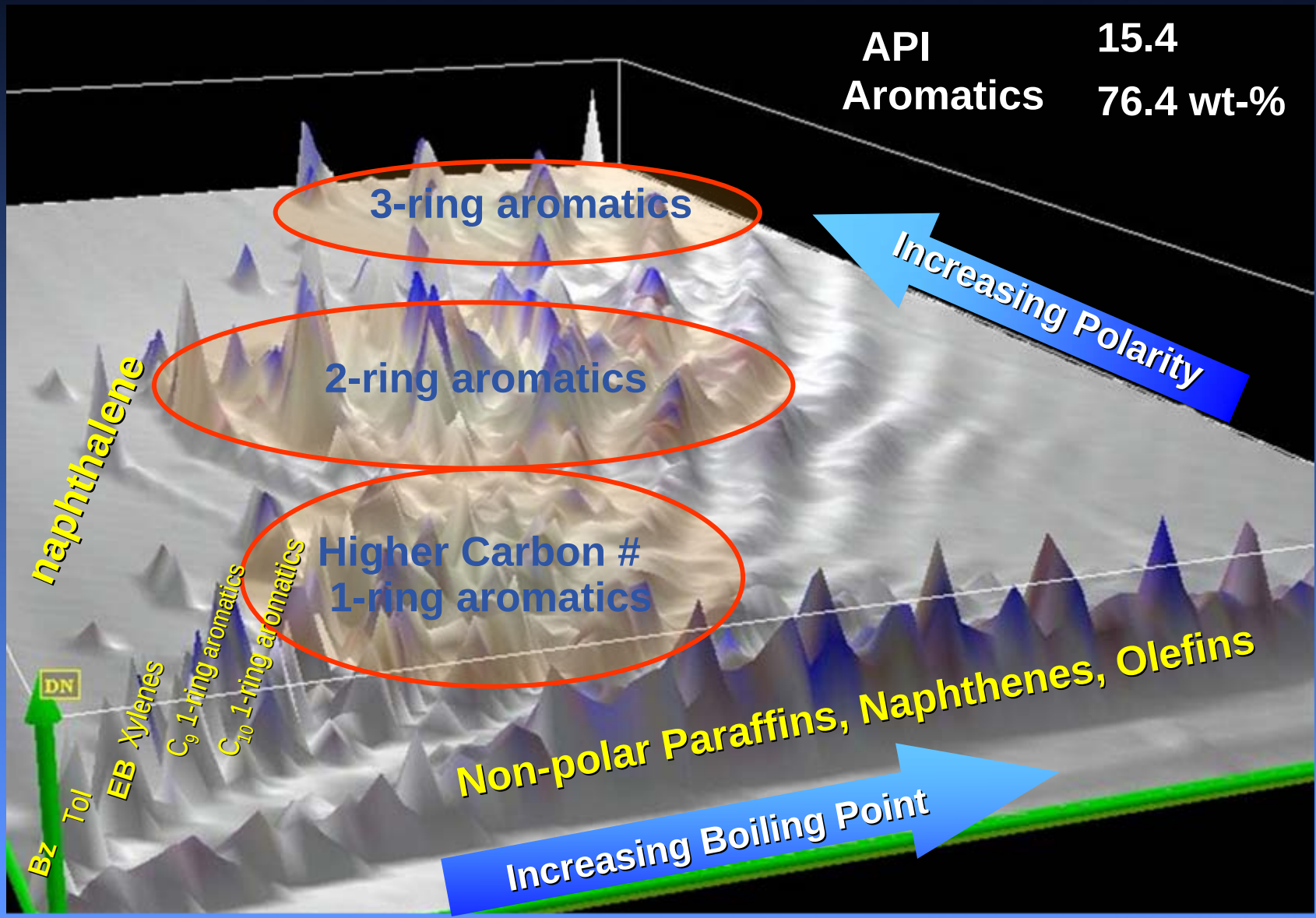
LCO Hydrocarbon Distribution by Cuts



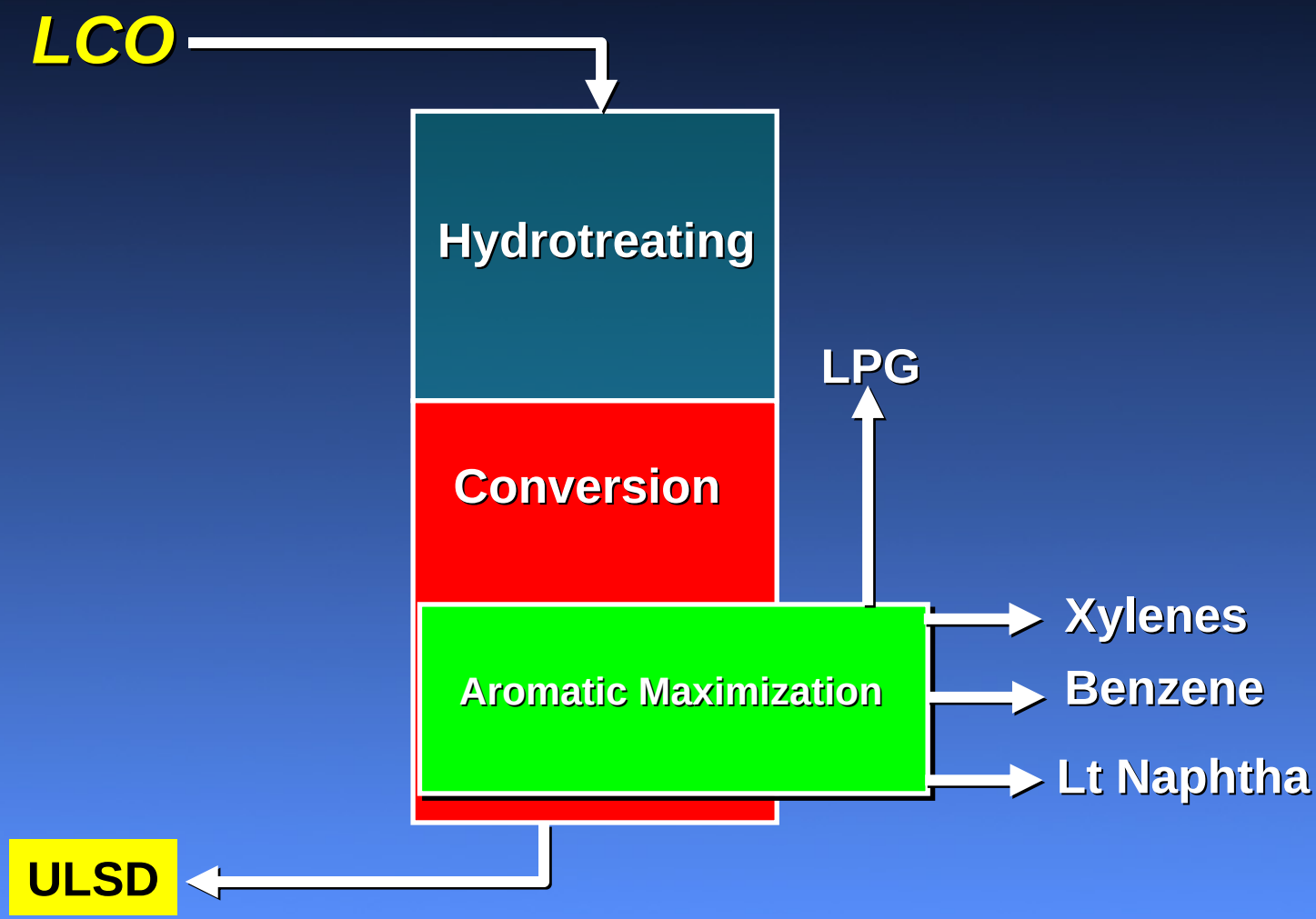
Coker Gas Oil Hydrocarbon Distribution by Cuts



What Does LCO *Really* Look Like?



Aromatics Maximization Drives the LCO to the Highest Value Products



The LCO-X Process Chemistry Is Driven to the Highest Value Products

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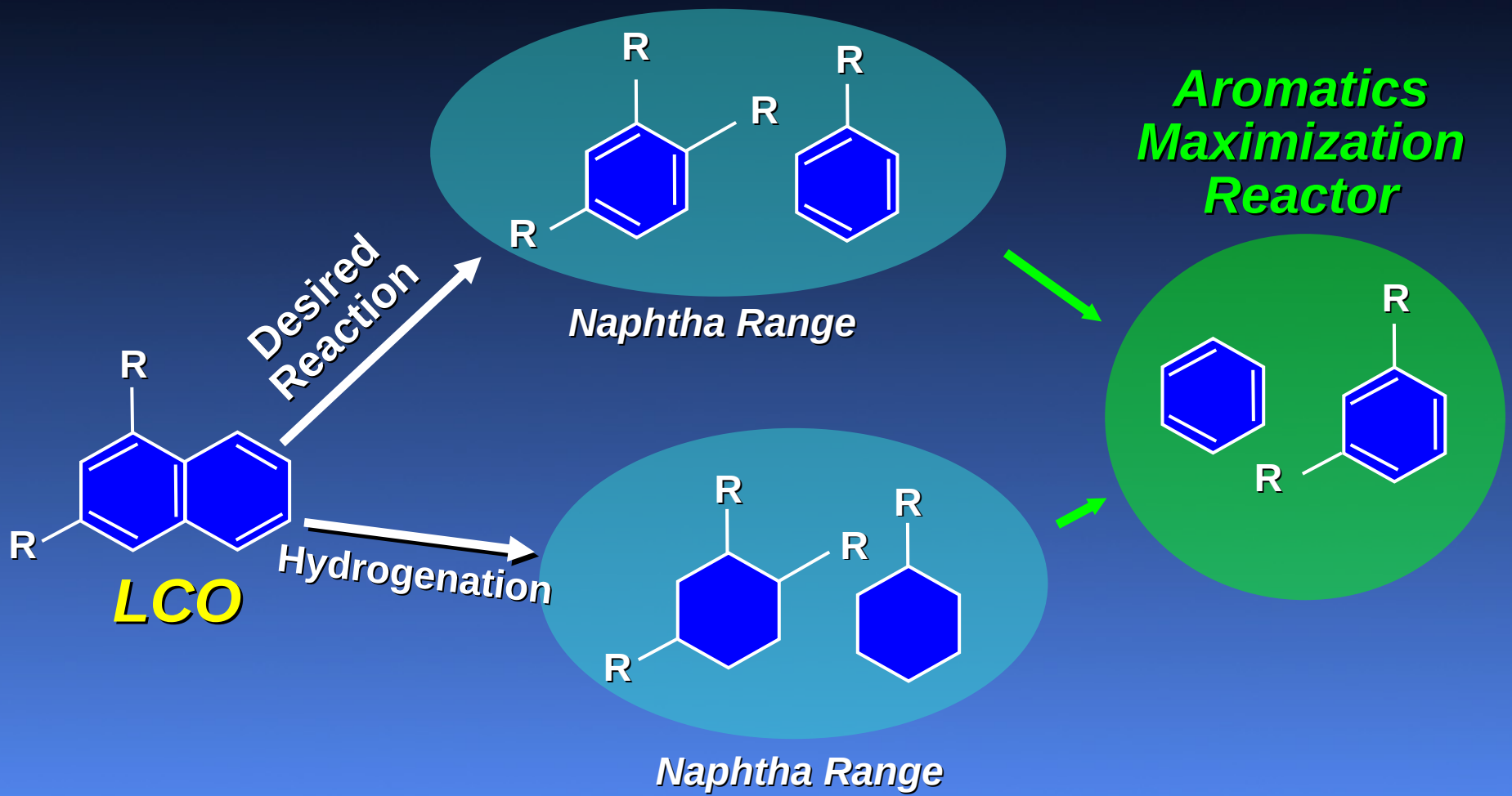
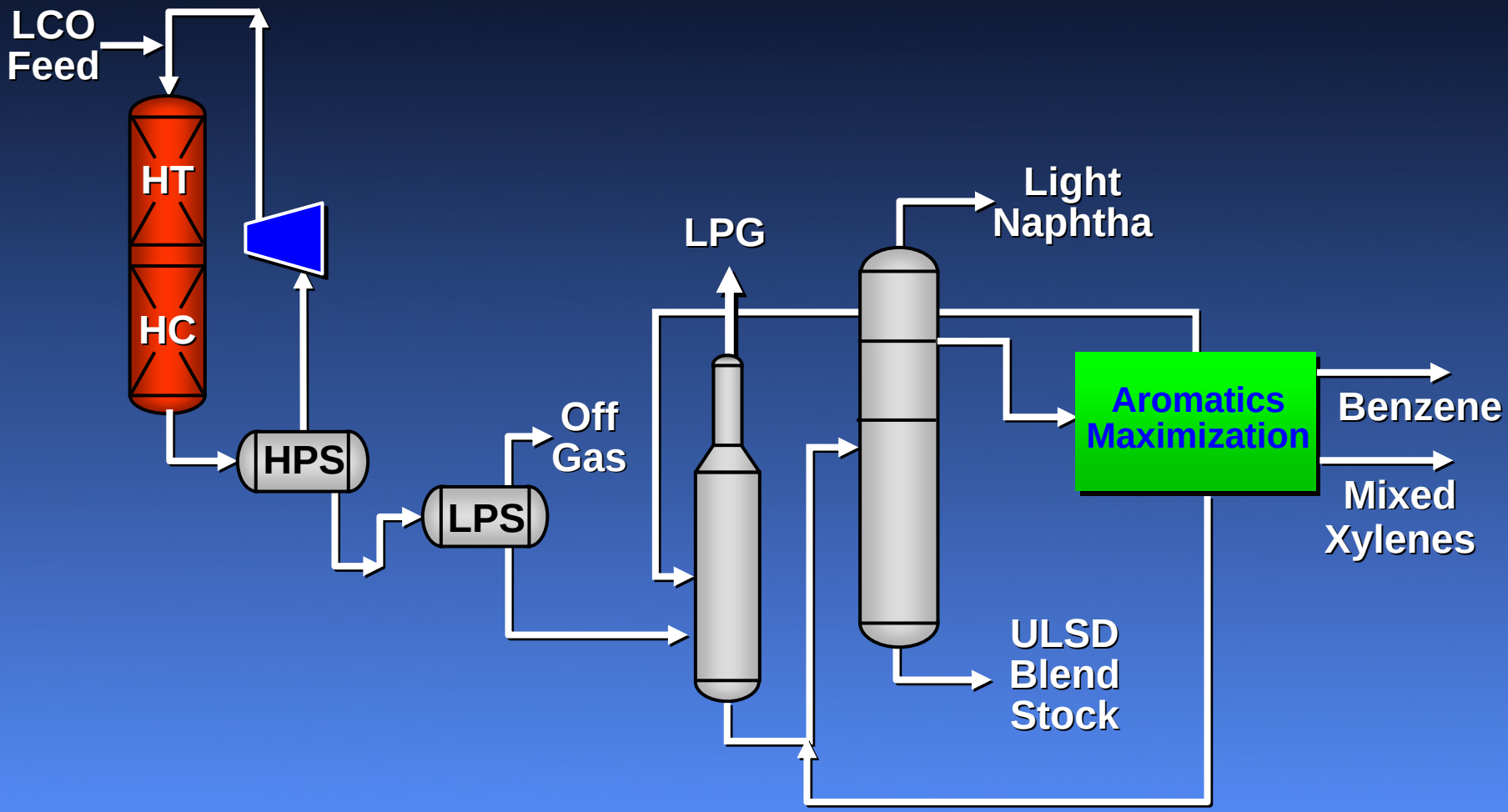


Aromatic Maximization Reactor Directly Makes Petrochemical Products

The LCO-X Process Flowscheme Assures High Quality, High Value Products from LCO



UOP Has Worked to Reduce Capex and Opex of the LCO-X Process

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- Highly Integrated Conversion & Aromatic Maximization
  - Reaction Sections
  - Fractionation Section
  - Single Compressor Section
- Low pressure hydrocracking reactor

The LCO-X Process Gives Superior Aromatic Product Qualities

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- **Mixed Xylenes**
  - Suitable for Parex unit feed for *p*-xylene
  - Exceeds ASTM D-5211 specification
  - ~1% ethylbenzene
- **Benzene Purity**
  - 99.9%
- **Lt. Naphtha**
  - 80-90% C_5-C_7 paraffins, 10-20% naphthenes
  - 82-76 RON, high Iso content
- **LPG**
  - <0.5% olefin
  - 60% C_4, 40% C_3
- **Diesel**
  - <10 ppm sulfur
  - 10-15 Cetane Increase over the LCO

Premium Quality Xylenes Are Made By the LCO-X Process – Ideal for *p*-Xylene Production

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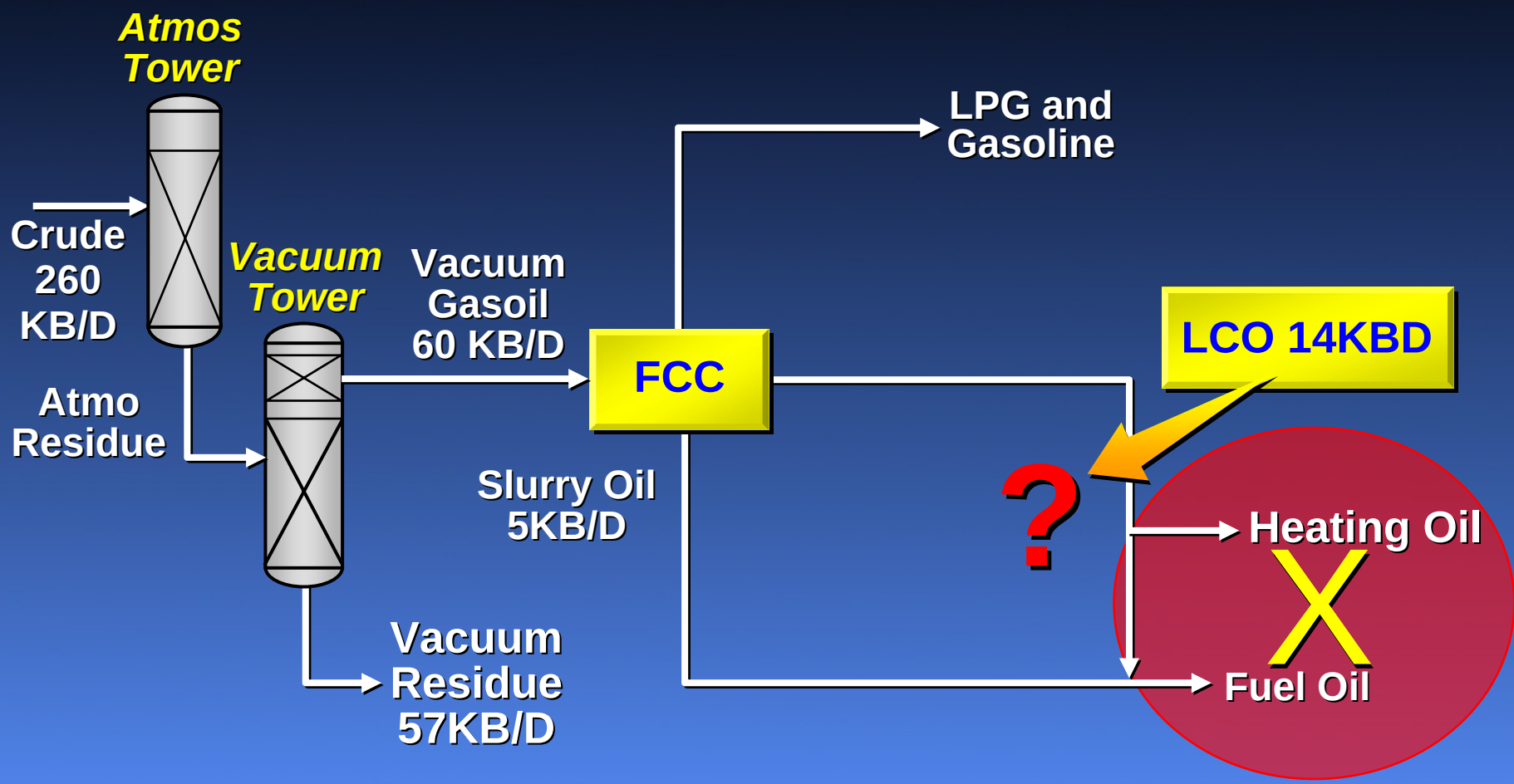
	LCO-X Xylenes	*Reformate Xylenes*
Ethylbenzene	1.0	15.6
*Para*xylene	23.2	17.9
*Meta*xylene	51.4	41.2
*Ortho*xylene	24.2	24.7
Non-aromatics	0.2	0.6

Source: UOP

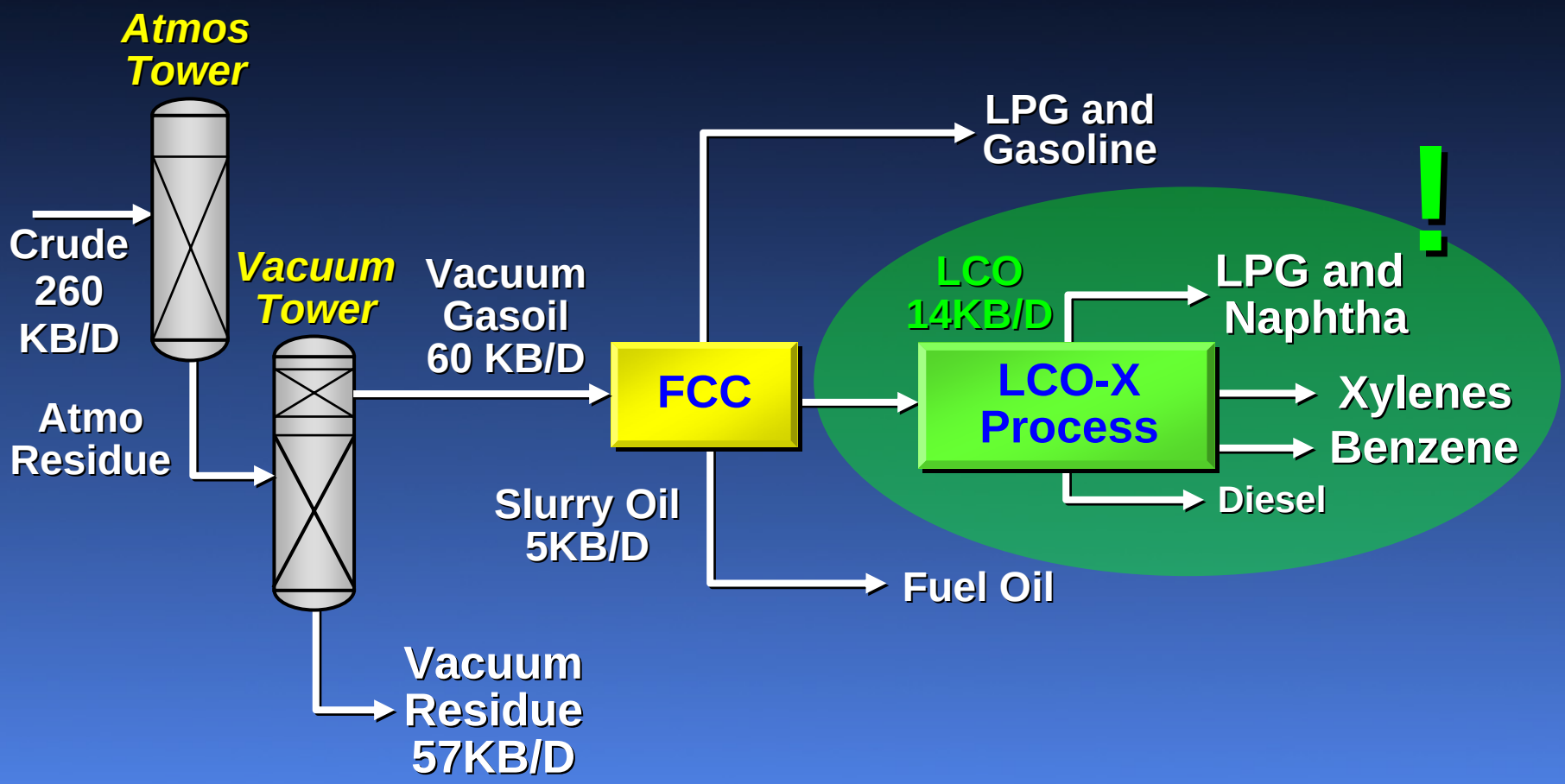
The Xylenes from The LCO-X Process Offer Many Advantages for p-Xylene Production

- Low Cost Feed Source
- Low EB Concentration – Minimum Ethane By-product
- High *p*X Concentration – Boosts Parex Efficiency
- High Xylenes Content – Maximum Yield of *p*-Xylene
- Low Non-aromatics Content – Minimizes Fuel Gas & H_2 consumption

There Is An Alternative to Get Higher Value Out of LCO



Take the LCO Through the LCO-X Process to Make High Value Aromatics



Major Refinery-Wide Benefits

- Reduce Fuel Oil production
- Produce high-value petrochemical feed stocks
- Increase Net Refining Margin by $0.75

Refining and Petrochemical Synergy Pays Off Quickly

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- Approximately $155 million total investment cost
- 15 year NPV ~ $188 million
- IRR 30%
- Break-even 2 years from start-up

LCO and LSFO are Historically Lower Cost Than Naphtha and That Differential Is Increasing

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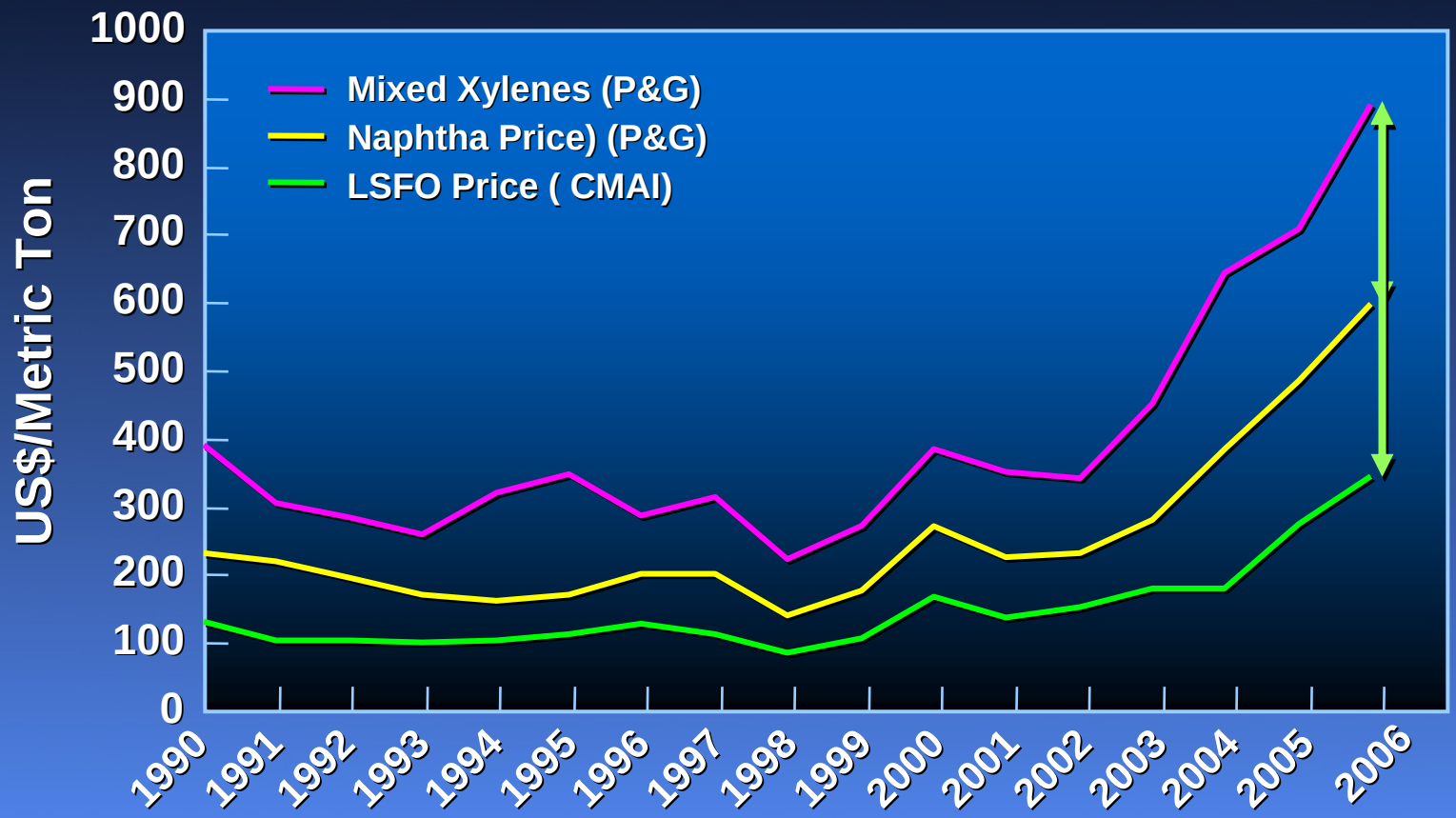
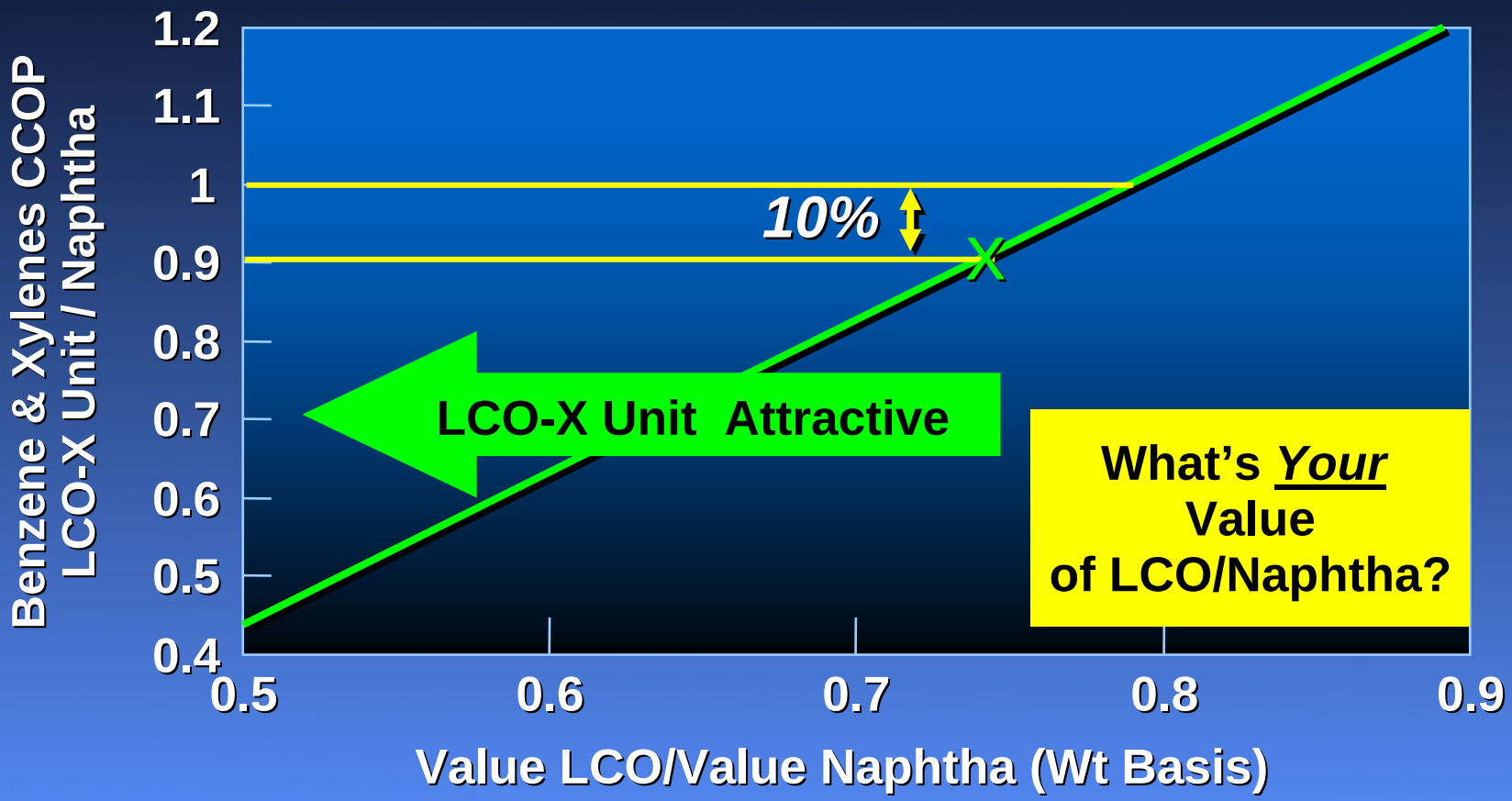


Cash Cost of Production Advantage
LCO-X Process vs Naphtha Reforming



Capture Maximum Value From LCO Through the LCO-X Process

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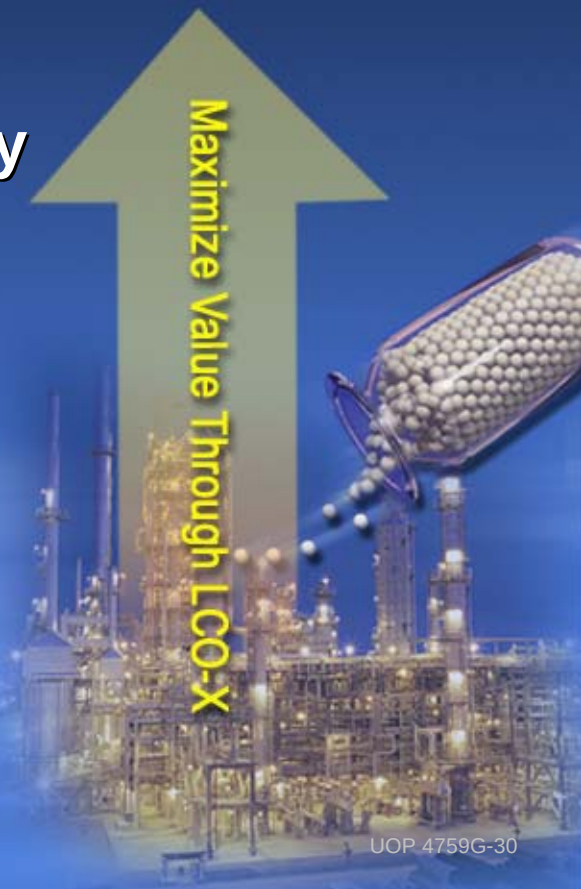
- Capture Refining and Petrochemical Synergy
- Get Margin Increase up to $0.75/BBL
- Produce and Sell High Quality Xylenes and Benzene
- Minimize Fuel Oil Production
- Meet Diesel Specifications More Easily
- Capture A Sustainable Competitive Advantage



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Q&A