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New Innovative Approach to Increase Isomerization Throughput and Octane Booster

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KBR
TECHNOLOGY

Topics

- ▶ What is MAX-ISOM?
- ▶ The Conversion Challenge
- ▶ Traditional Solutions
- ▶ The MAX-ISOM™ Solution
- ▶ Low Cost Revamp Scheme

MAX-ISOM™

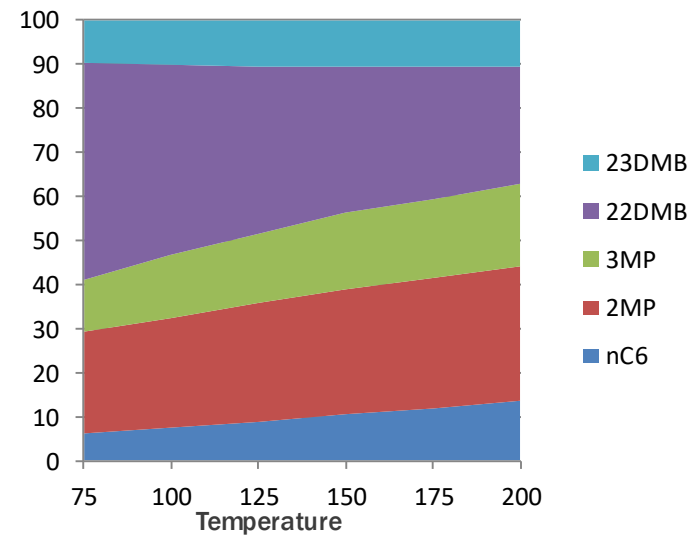
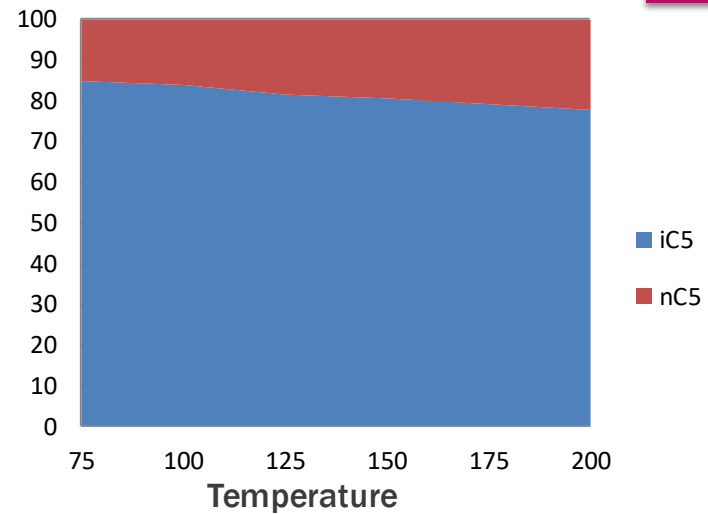
MAX-ISOM™ IS A LIGHT NAPHTHA ISOMERIZATION PROCESS THAT ENABLES REFINERS TO INCREASE GASOLINE BLENDSTOCK OCTANE BY ACHIEVING **HIGH CONVERSION IN A LOW-COST, COMPACT ONCE-THROUGH UNIT**

The Conversion Challenge

Paraffin Isomerization is an equilibrium reaction

Conversion in a fixed bed reactor is limited

83 – 84 Isomerate RON is typical for a once-through system

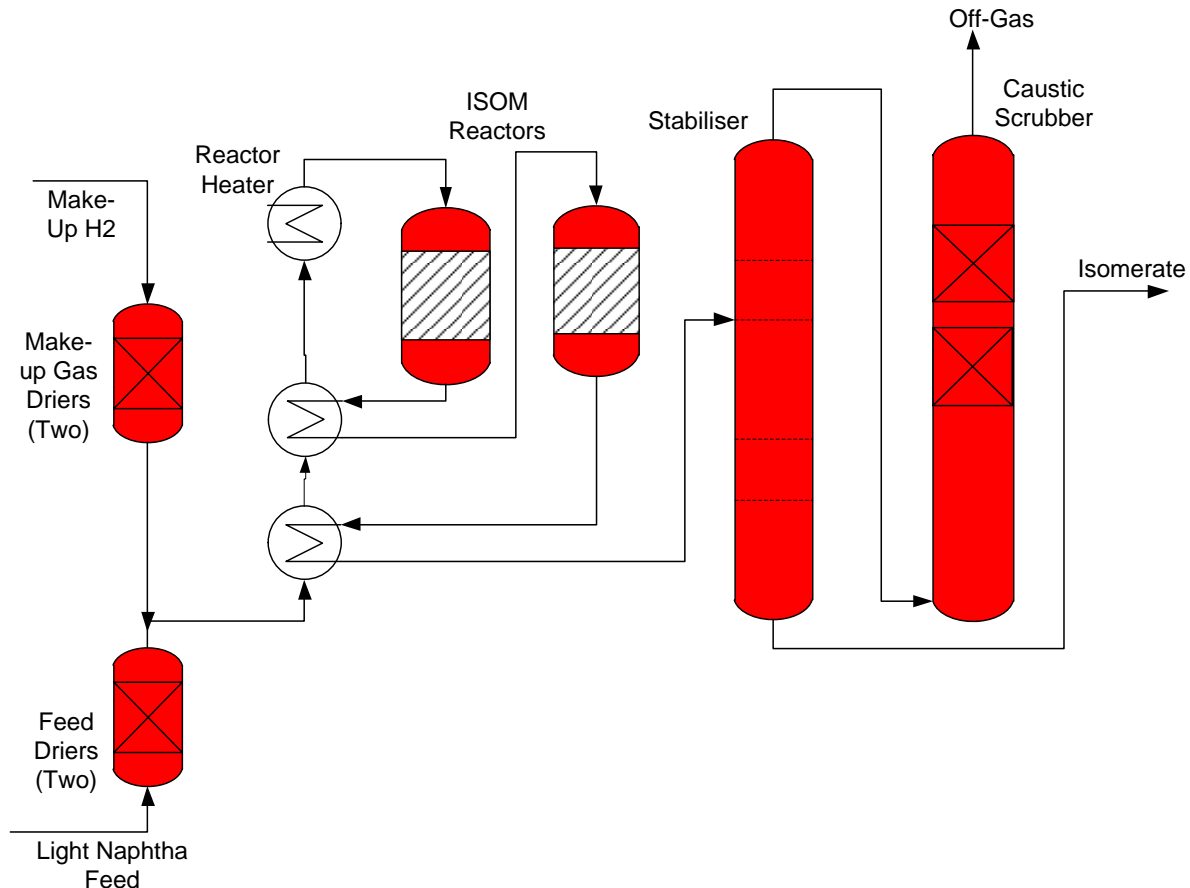


Isomerization Objective

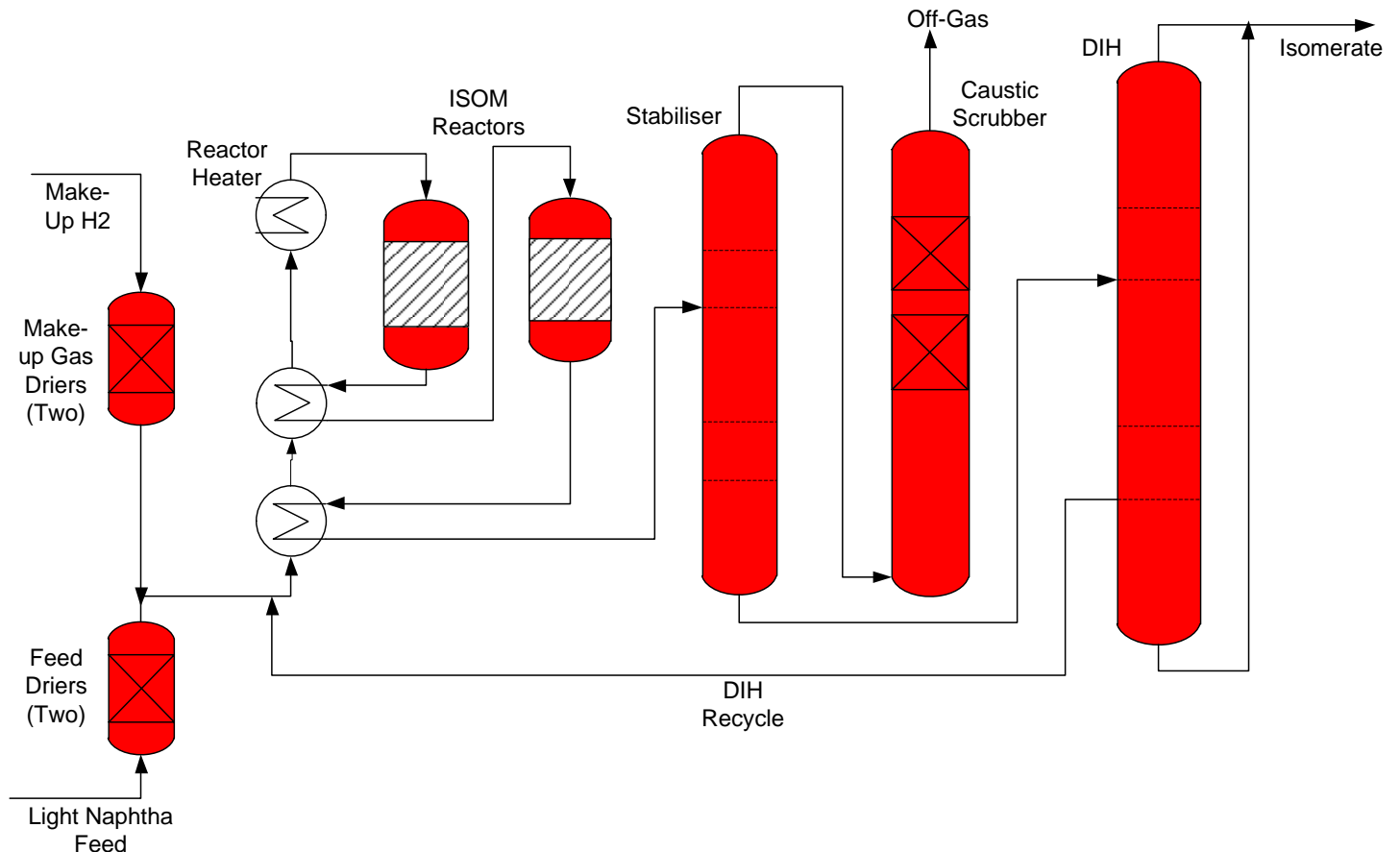
- ▶ The main objective of Isomerization is to convert low octane C5 and C6 isomers to C5 and C6 isomers with higher octane

Component	Boiling Point °C	RON	MON
iC5	27.8	93.5	89.5
nC5	36.1	61.7	61.3
2,2 DMB	48.7	93.0	93.5
CP	49.3	101.3	85.0
2,3 DMB	58.0	104.0	94.3
2 MP	60.3	73.4	72.9
3 MP	63.3	74.5	74.0
nC6	68.7	30.0	25.0
MCP	71.8	95.0	80.0
Benzene	80.0	>100	>100
CH	80.7	83.0	77.2

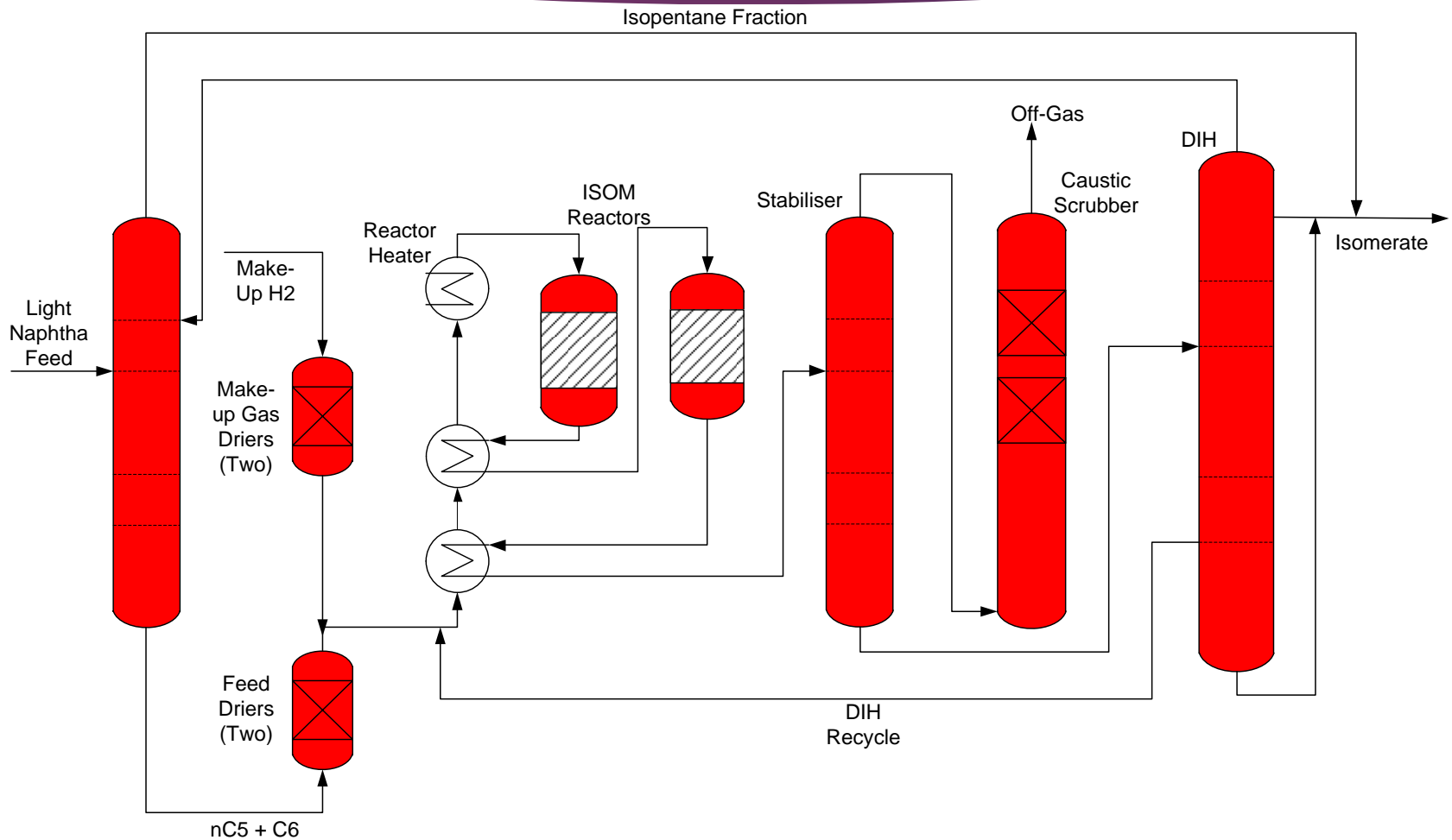
Traditional Solutions: Once-Through



Traditional Solutions: DIH Recycle



Traditional Solutions: DIP + DIH Recycle



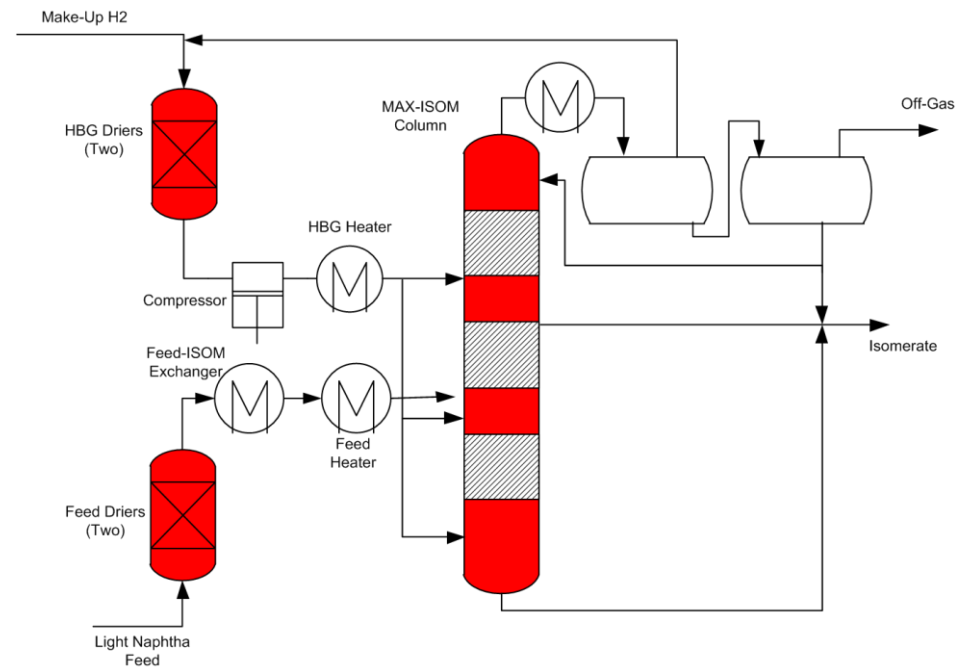
MAX-ISOM Solution

- ▶ Catalytic distillation column
 - ▶ Unique design exploits product / reactant relative volatilities
 - ▶ Internal recycles maximize conversion
 - ▶ Fractionation delivers high quality isomerate
 - ▶ Lower energy consumption



High Quality Isomerate

- ▶ Typical 90 – 91 RON
- ▶ Typical 86 – 88 MON
- ▶ Typical 96 – 98 wt% yield
- ▶ Benzene free



Compact Design

- ▶ Most compact design available
- ▶ Reaction and fractionation in a single column
- ▶ Simple process flow scheme
- ▶ Lower capital and operating cost



Feed Flexibility

- ▶ Fixed bed units typically limited to 5% feed benzene
 - ▶ Benzene in feed is saturated to cyclohexane
 - ▶ Reaction is exothermic
 - ▶ Temperature rise is detrimental to conversion

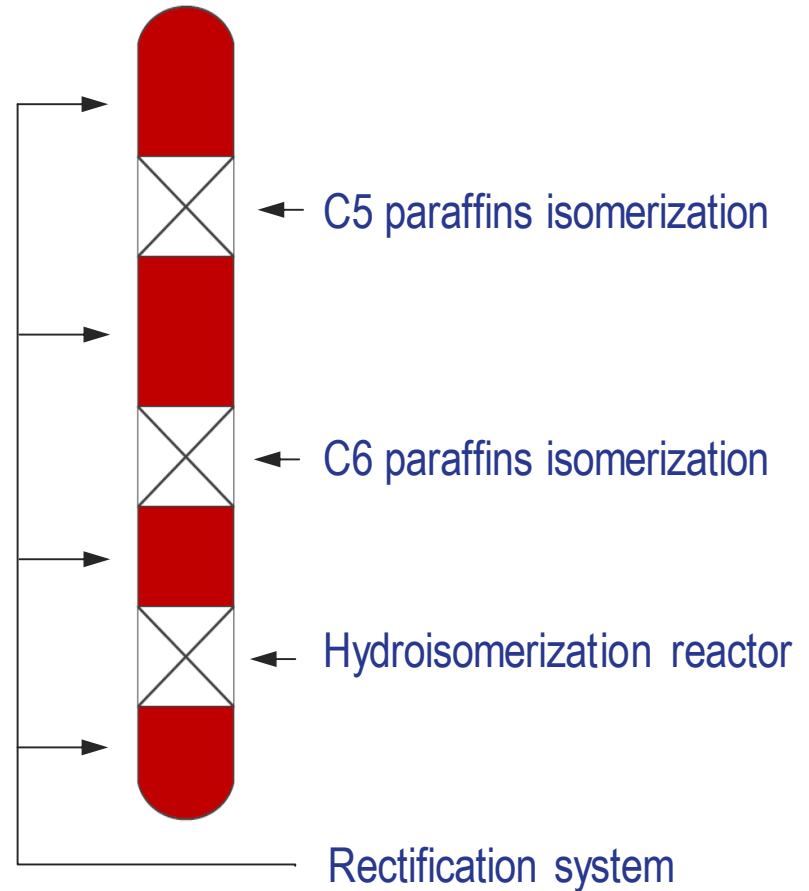
Feed Flexibility: MAX-ISOM Solution

Benzene saturated in a separate bed

Specific benzene
hydrogenation catalyst

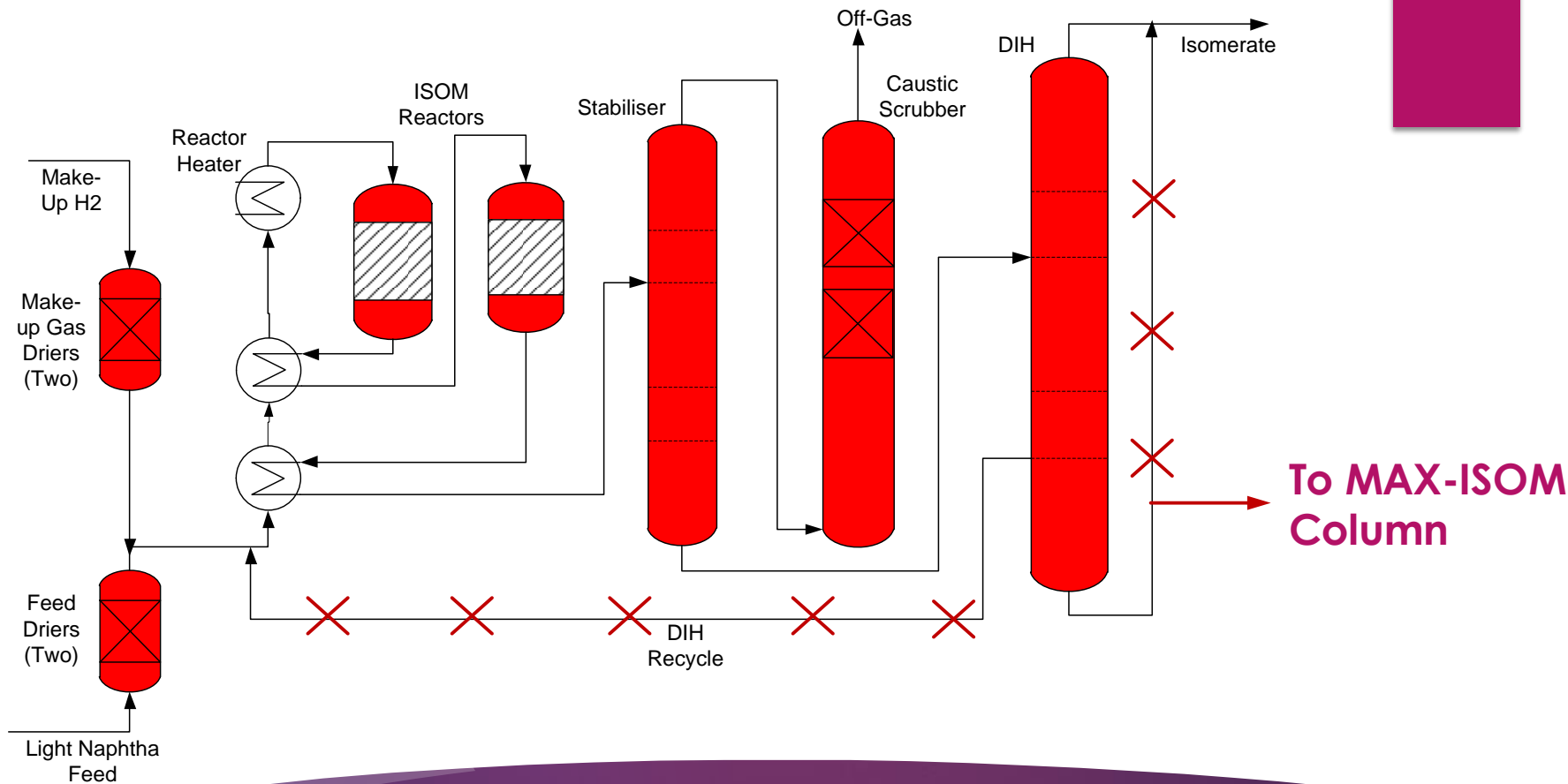
Heat of reaction displaces
column reboiler duty

**Up to 20% feed benzene
can be processed**



Low Cost Revamp

- ▶ Low cost revamp of existing units
 - ▶ Retain existing isomerization reactors
 - ▶ Recover C5s and iC6 isomerate
 - ▶ Process unconverted nC6 and methyl pentane in MAX-ISOM column
- ▶ Capacity debottleneck
- ▶ Octane improvement



2-in-1 Compact Revamp Flow Scheme

Remove / Reduce DIH Recycle

C₆+ to New MAX-ISOM Unit

Revamp Benefits

- ▶ Higher throughput
 - ▶ DIH Recycle may be 65% of Fresh Feed Rate
- ▶ Higher C6 Conversion → Higher Isomerase RON/MON
- ▶ Lower Utility Consumption (per barrel)
 - ▶ No DIH Recycle
 - ▶ Hot MAX-ISOM Feed (DIH Bottoms)

Conclusions

- ▶ Conversion limits C5/C6 Isomerization reactions
- ▶ Traditional solutions are complex and costly
- ▶ MAX-ISOM provides owners with the ultimate feed flexibility for low cost production of high quality isomerate using the most compact design available in the industry.

