



Technical & Catalytic Solution for Optimizing Reformers

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Trends impacting Catalytic Reforming

- **Higher demand in unleaded gasoline**
- **Increase in aromatics market**
- **Tighter H₂ balance in the refineries**

Cost-effective solutions enable improved productivity for fixed bed reformers

Three Ways to Improved Performance

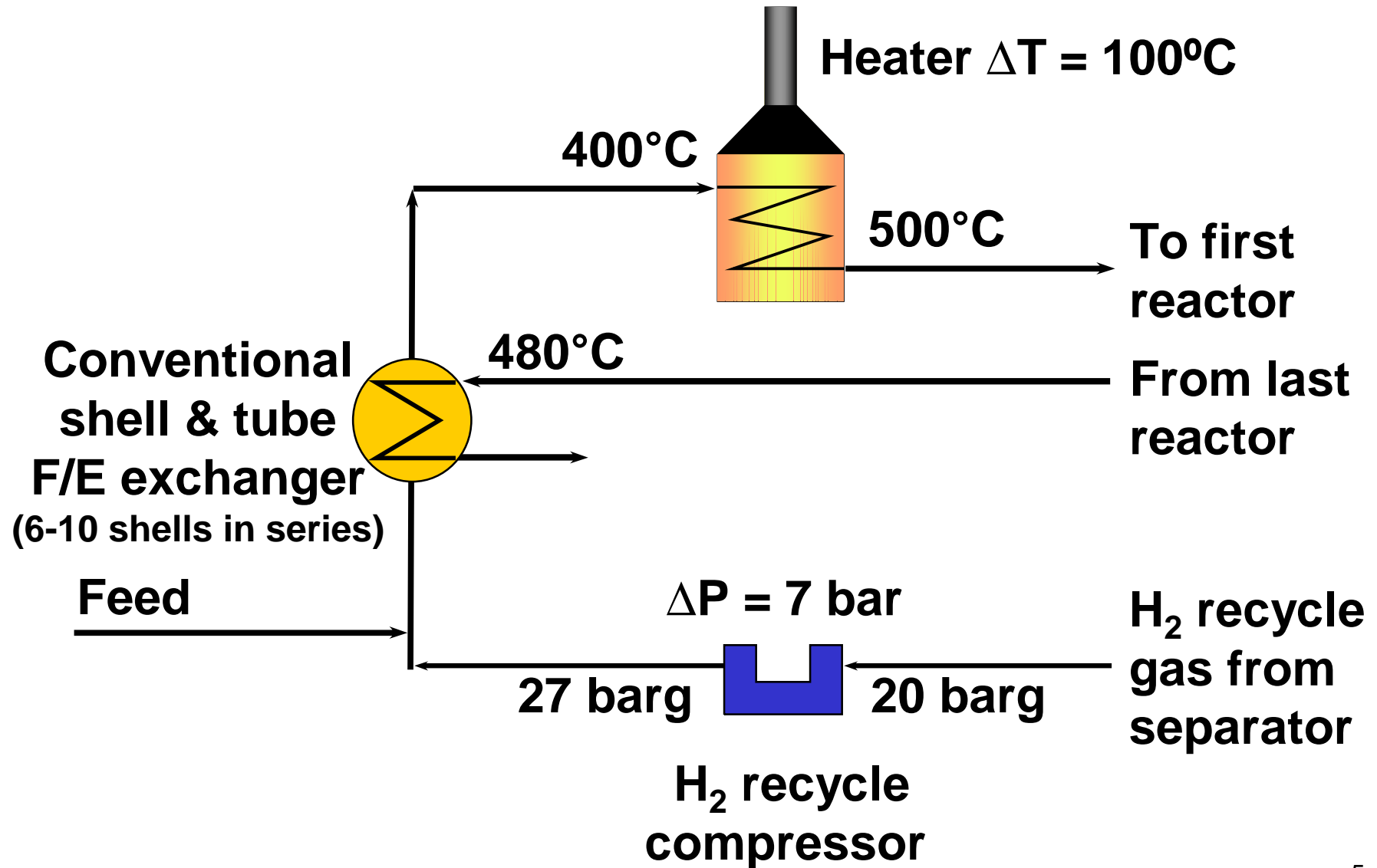
- **Install high efficiency feed/effluent exchanger**
- **Increase active catalyst volume in radial reactors**
- **Optimize efficiency of the catalytic system**



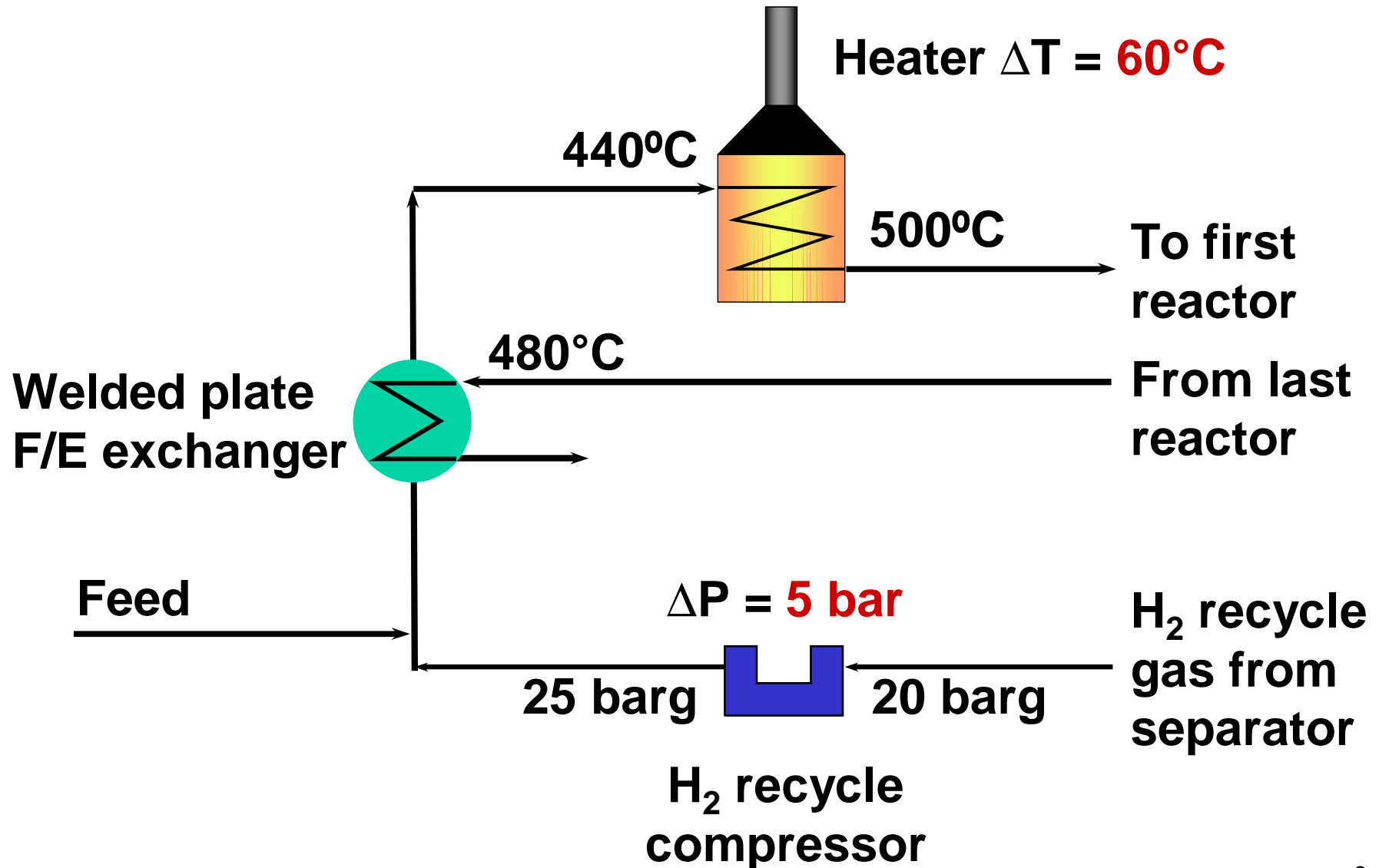
Three Ways to Improved Performance

- **Install high efficiency feed/effluent exchanger**

Use of Conventional Feed/Effluent Heat Exchanger



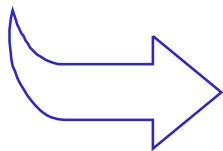
Replacement by Welded Plate Feed/Effluent Heat Exchanger



Situation After Packinox Installation

Unused capacity is now available on

- Recycle gas compressor**
- First heater**
- Reactor effluent air cooler**



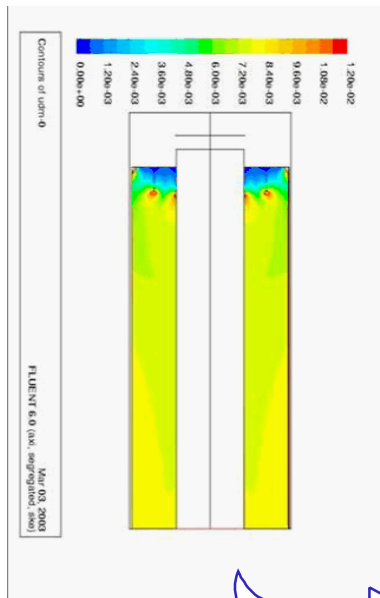
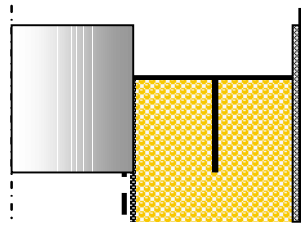
**Increased reformer throughput
or severity is now possible**

Three Ways to Improved Performance

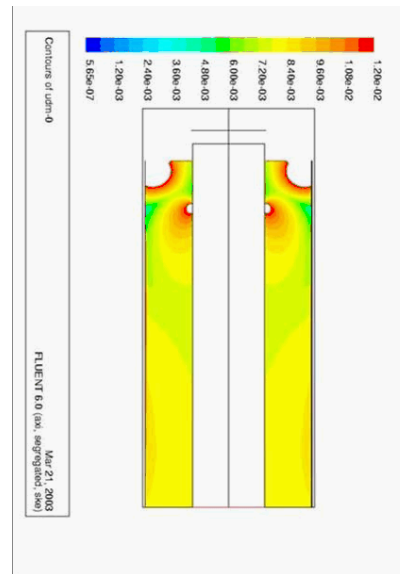
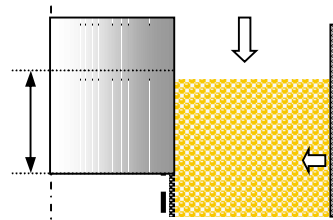
- Install high efficiency feed/effluent exchanger
- **Increase active catalyst volume in radial reactors**

Various configurations have been analyzed

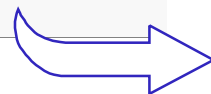
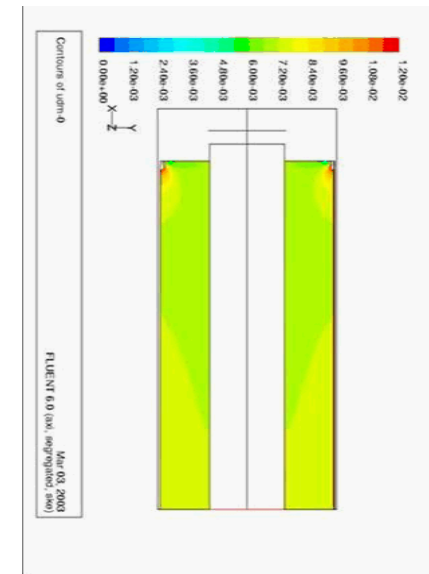
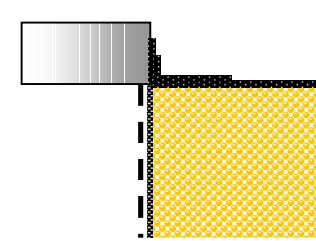
Cover plate & hat at the top of the Center pipe



No cover plate & hat at the top of the Center pipe

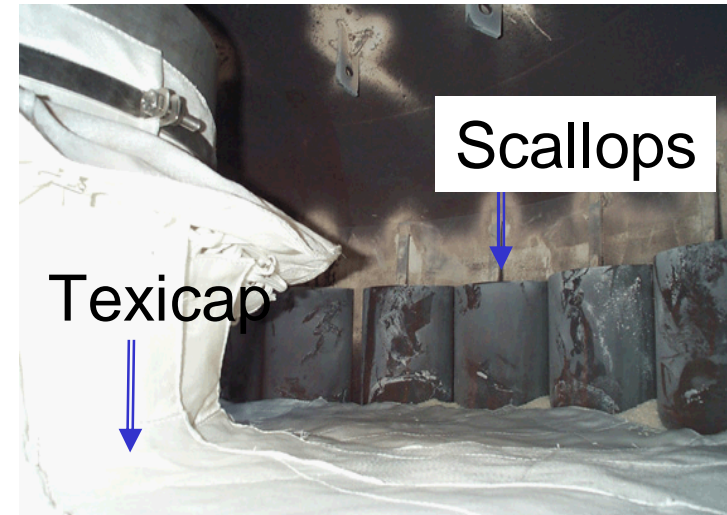
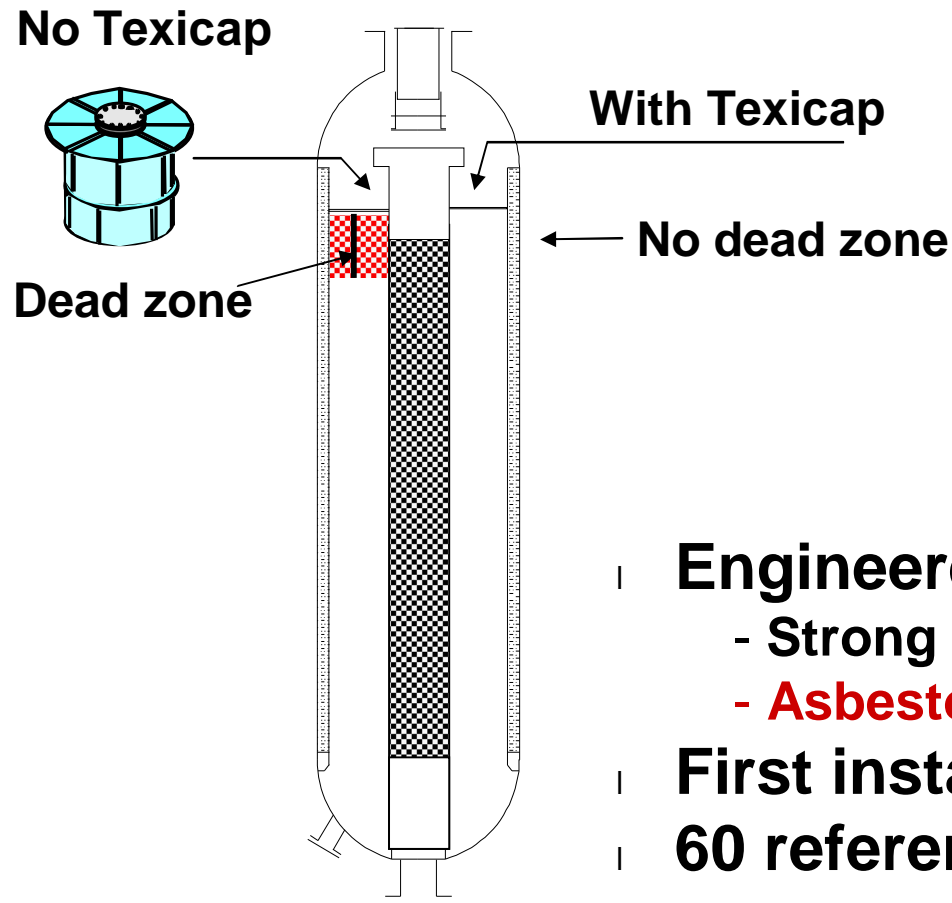


Texicap™



Texicap provides the best distribution

Texicap How it looks, how it works



- | **Engineered refractory composite**
 - Strong & Impermeable
 - **Asbestos-free**
- | **First installation operating since 1992**
- | **60 references in 2003**

- **Optimum gas distribution**

- **Increased bed activity**

 **Potential for capacity/RON/cycle increase**

- **No dead zones**

 **No risks of runaway during regeneration**

- **Very easy installation**

 **Reduced shut-down for catalyst loading**

Three Ways to Improved Performance

- Install high efficiency feed/effluent exchanger
- Increase active catalyst volume in radial reactors
- **Optimize the efficiency of the catalytic system**

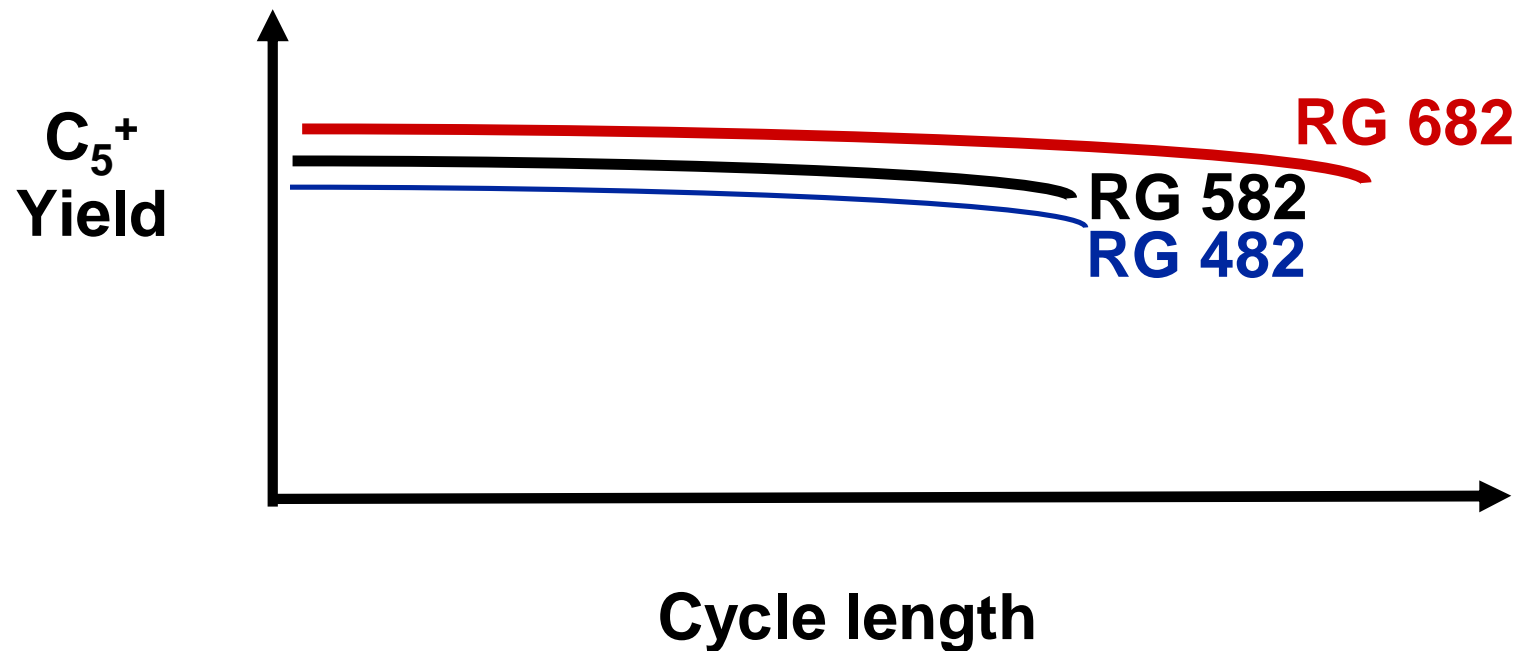
RG 682

A new catalyst launched in 2001 to replace the successful RG 582:

- **Higher activity**
- **Better selectivity (higher yields)**
- **Better stability**

Promoted Bimetallic RG 682

Yield and stability benefit with new RG 682



RG 682 Advantages

	RG 582	RG 682
H₂ yield, wt%	base	base + 0.1
C₅₊ yield, wt%	base	base + 0.6
WAIT, °C	base	base - 3
Relative stability	1	1.35
Number of references	> 50	9

Three Ways to Improved Performance

- Install high efficiency feed/effluent exchanger
- Increase active catalyst volume in radial reactors
- Optimize the efficiency of the catalytic system
- **Combination of all 3 options**

Conventional Reformer running at 100% capacity	20 000 BPSD
Severity	RON 98
Feed quality	Arabian Light
Separator Pressure	20 barg
H₂/HC	5
Space velocity	1.5
On-stream factor	350 days/year (12-month cycles)

After Complete Revamp

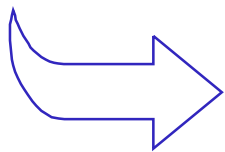
	Base Case	Welded Plate Texicap RG 682
Reformer Feed, BPSD	20 000	22 000
On-stream factor, days/year	350	357
Cycle length, months	12	24
Economics, million \$/year		
Product Revenue	base	base + 6.1
Utility Cost	base	base - 0.2
Operating Margin	base	base + 6.3

Payout for Complete Revamp

Equipment and Catalyst Cost, million\$	3.5
Payout Time, Months	7

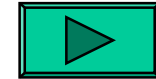
Simple solutions are available to improve fixed-bed reactor performance each featuring

- **Short installation period avoiding production loss**
- **Low investment cost**
- **Improved operating cost**
- **Short payout time**



Allow rapid adaptation of existing unit to market demand

For deeper Reformer revamp, Axens offers well proven **Dualforming** technology



- Five units in operation, one under engineering
- First unit in operation since 1989
- Two units in operation in CIS
 - Mozyr - Bielorussia S/U in 1996
 - Ufa - Russia S/U in 1997

Dualforming Process

