

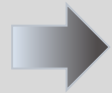
# Closed Coke Slurry System

*An Advanced Coke Handling Process*

- *Environment-Friendly*
- *Economical*
- *Safe*

**REFCOMM<sup>®</sup>**  
MUMBAI  
17-20 Oct 2016

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Germany



Topic	
<b>A</b>	<b>Introduction</b>
<b>B</b>	Coke Handling Systems
<b>C</b>	Process & Operating Features of CCS System
<b>D</b>	Special Design of Selected Components
<b>E</b>	Advantages of CCS System
<b>F</b>	CCS System Implementation
<b>G</b>	Conclusion

## G Conclusion

### CCSS at a Glance - Features of CCSS vs. Conventional Systems

Items	CCSS	Conventional Systems
Emission of Coke Fines & VOC	very low	very high
Dewatering Efficiency	very high	poor
Water Consumption	Very low	high
Level of Automation	high	very low
Operational Safety	very high	low
Reliability	very high	low
Plot Requirement	moderate	high
Total Investment (CAPEX)	equal	equal
Operating Costs (OPEX)	low	high

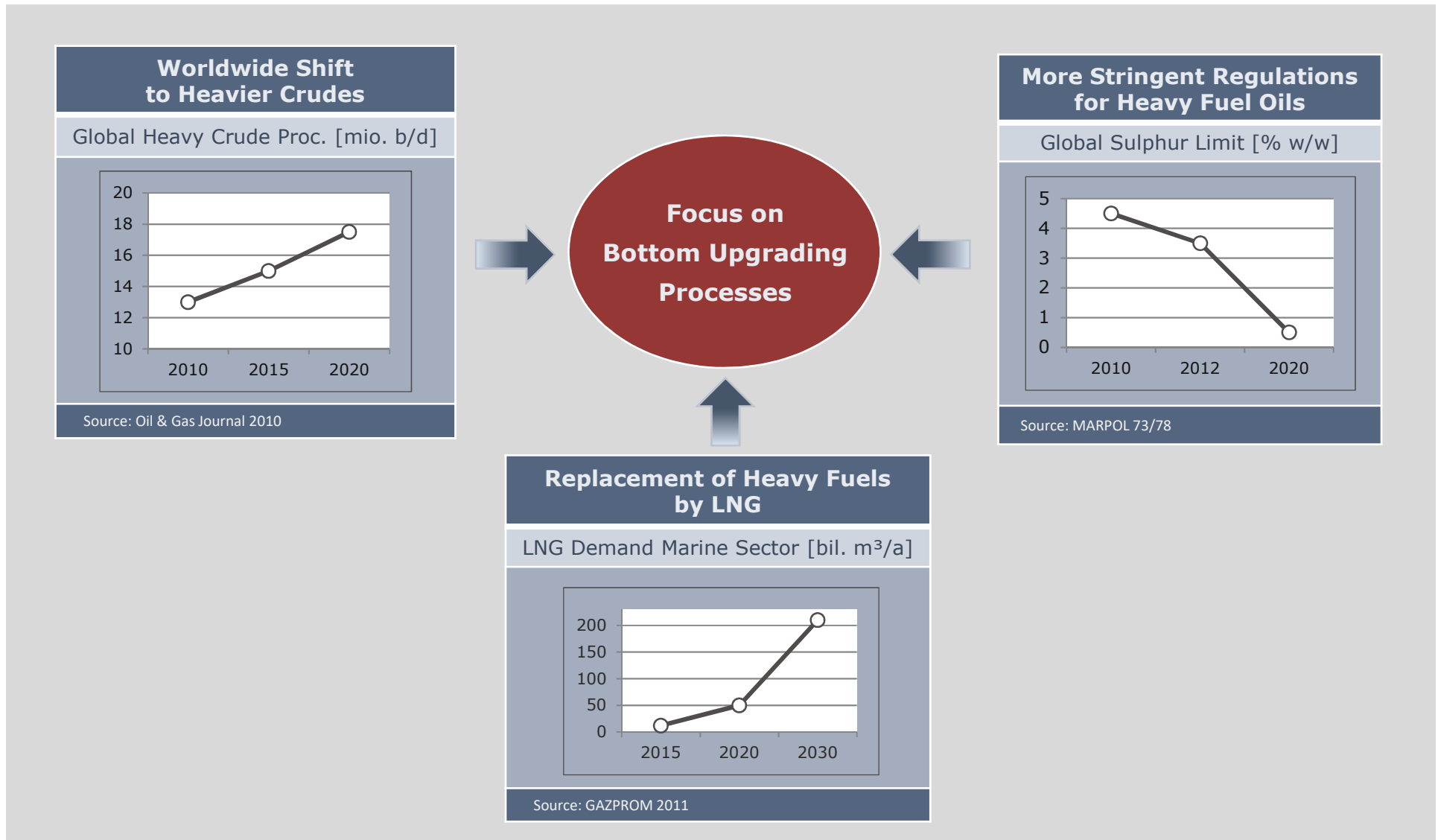
*Get rid of the coal mine in your refinery !*

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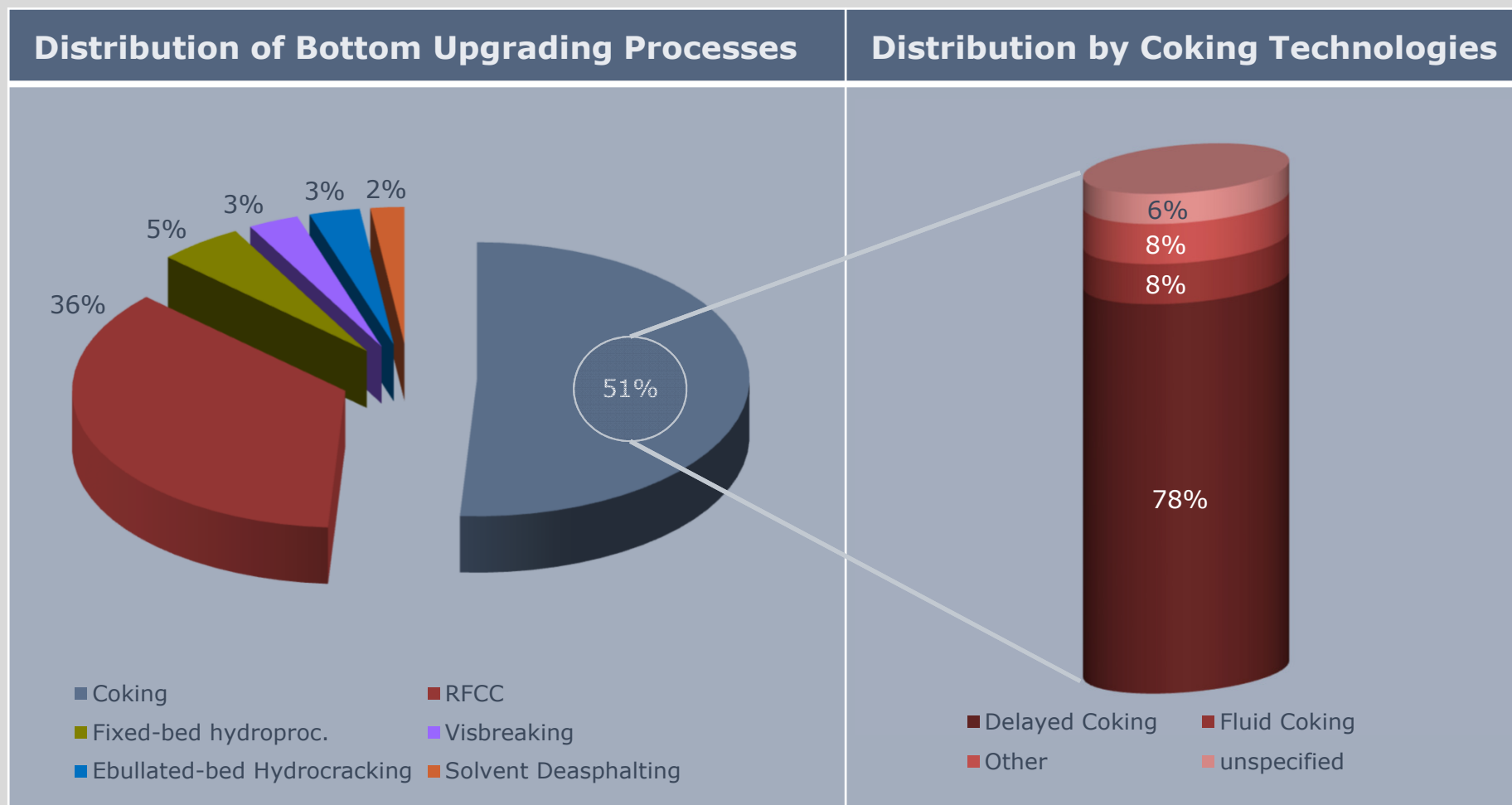
# Technology for Future, For a cleaner environment



## A Introduction – Global Situation in Crude Refining



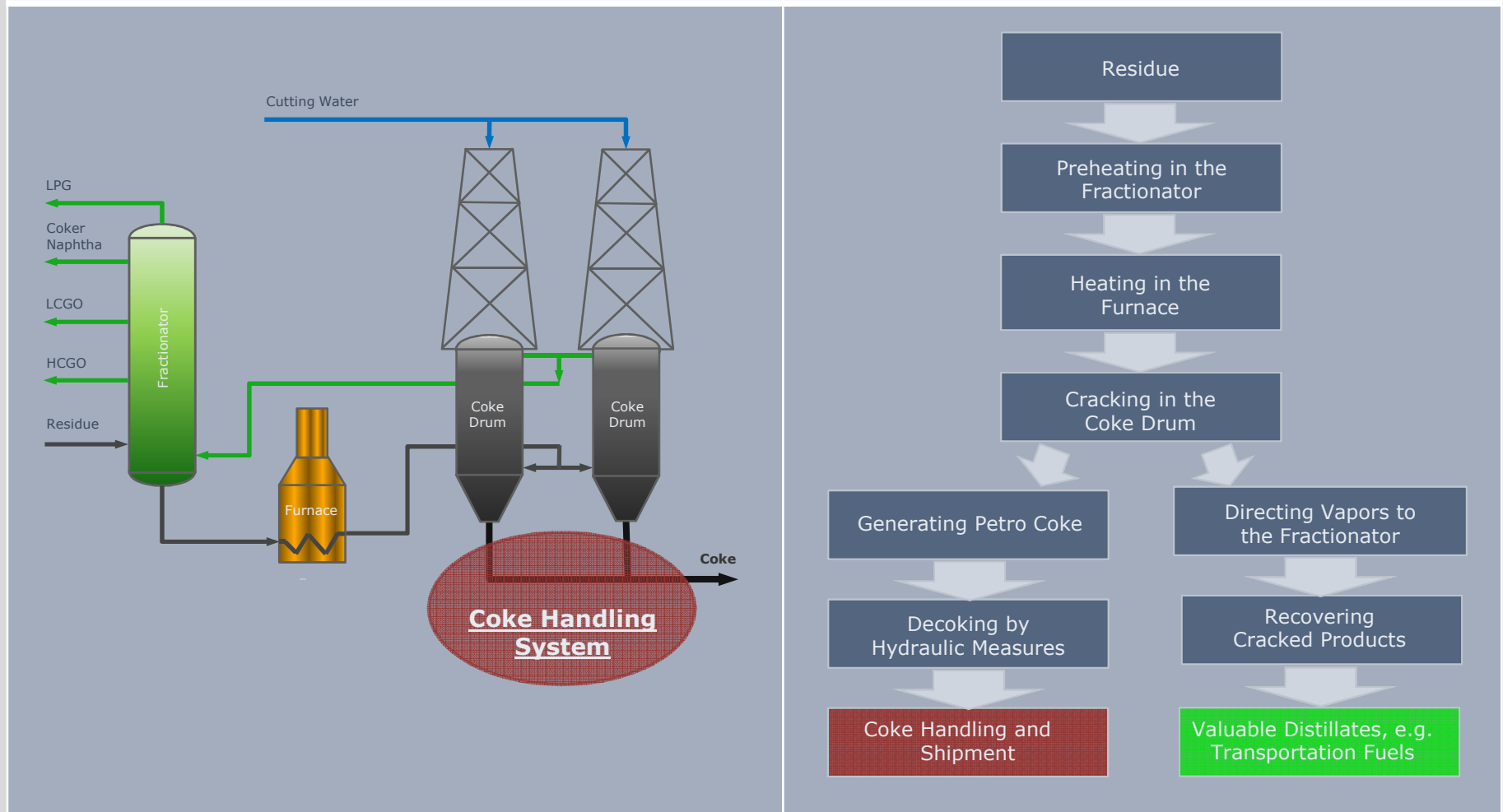
## A Introduction – Bottom Upgrading



Source: Hydrocarbon Publishing 3Q, 2010

## A Introduction – Key Process Steps Delayed Coking

### Delayed Coking Processing (Schematic)

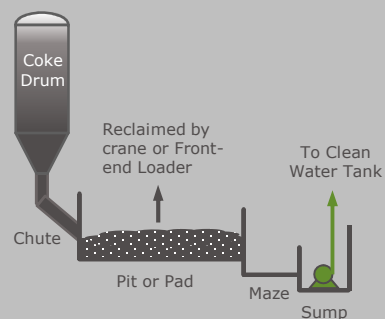




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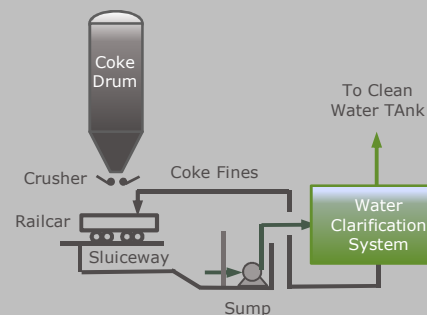
## B Coke Handling Systems – Different Setups

### Pit or Pad System (95% Coker Units)



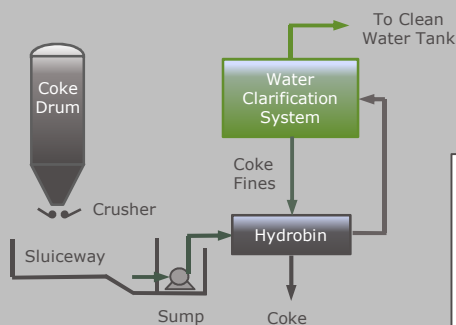
- **Open System**
- No In-line Crusher
- Cran or Front-End Loader for Coke Transport
- No Further Water Treatment

### Railcar Loading System



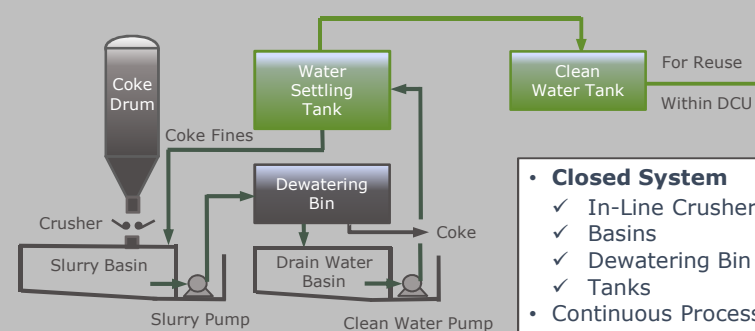
- **Open System**
- Just-In-Time Unloading
- Water Separation by Overflowing & through Holes in the Car

### Allen-Sherman-Hoff Hydrobin System



- **Open System**
- ✓ Crusher
- ✓ Slurry Sump
- ✓ Hydrobin
- ✓ Tanks
- Continuous Process

### TRIPLAN's Proprietary CCSS



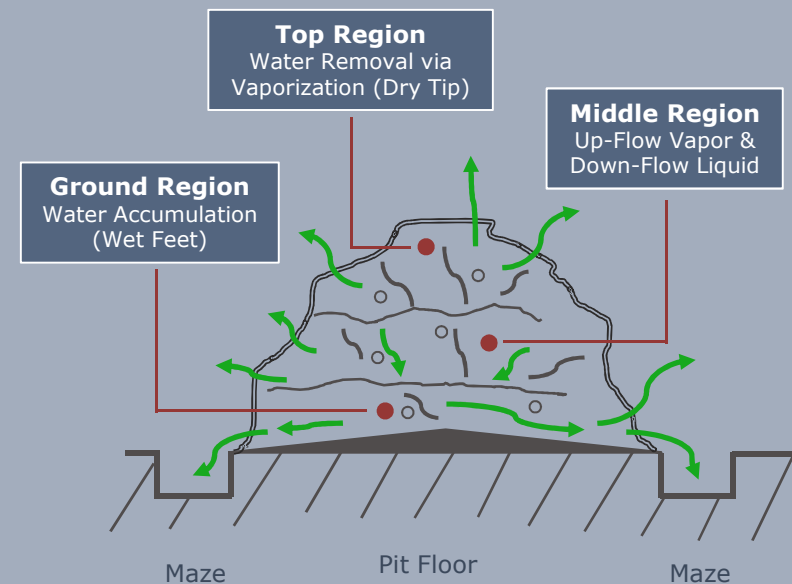
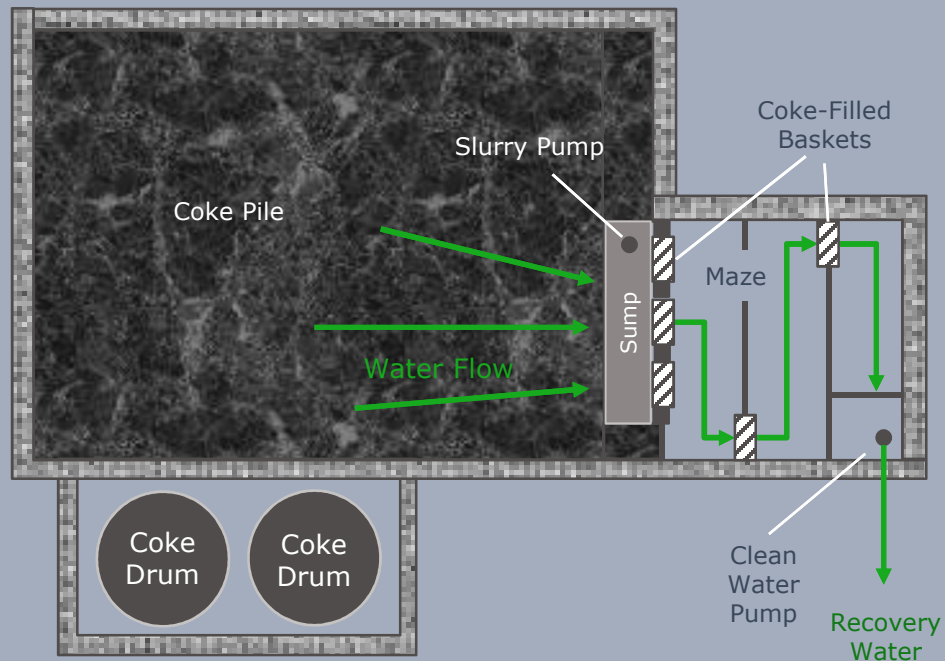
- **Closed System**
- ✓ In-Line Crusher
- ✓ Basins
- ✓ Dewatering Bin
- ✓ Tanks
- Continuous Process

## B Coke Handling Systems – Different Setups

Open System and Its Main Disadvantage	
System	Disadvantage
Open Pit / Pad (Conventional)	<b>1. High Emission of Coke Fines and VOC</b> to the Atmosphere with Exhaust Steam from Pit, Slurry Sump etc.  <b>2. High Water Loss</b> Due to the Exhaust Steam from Open System
Railcar Loading	
Allen-Sherman-Hoff Hydrobin	

## B Coke Handling Systems – Conventional Pit/Pad System

### Having a look at Conventional Open Pit/Pad System



### Disadvantages of Conventional Open Pit/Pad System

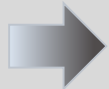
- **High Emission**
  - Coke Fines & 20% VOC to the Atmosphere with Exhaust Steam from Open Pit
- **Separate Coke Crushing Step**
  - Coke Fines to the Atmosphere
- **Poor Dewatering**
  - Unhomogeneous in Different Coke Pile Regions
  - Post-Drainage within Load Area / Railcars / Trucks Required
- **High Water Loss due to the Exhaust Steam from Open Pit**
  - High Quantity of Make-Up Water
- **Maze Clogging**
  - Repeatedly Manual Sludge Disposal
- **Low Efficiency of Water Clarification System**
  - Fines in the Cutting Water
- **Poor Reliability and High Maintenance Cost**
  - e.g. Bridge Crane & Pumps

## B Coke Handling Systems – Conventional Pit/Pad System

### Disadvantages of Conventional Open Pit/Pad System - High Emission, Maze Clogging



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## C Process & Operating Features of CCSS

What can be expected from the

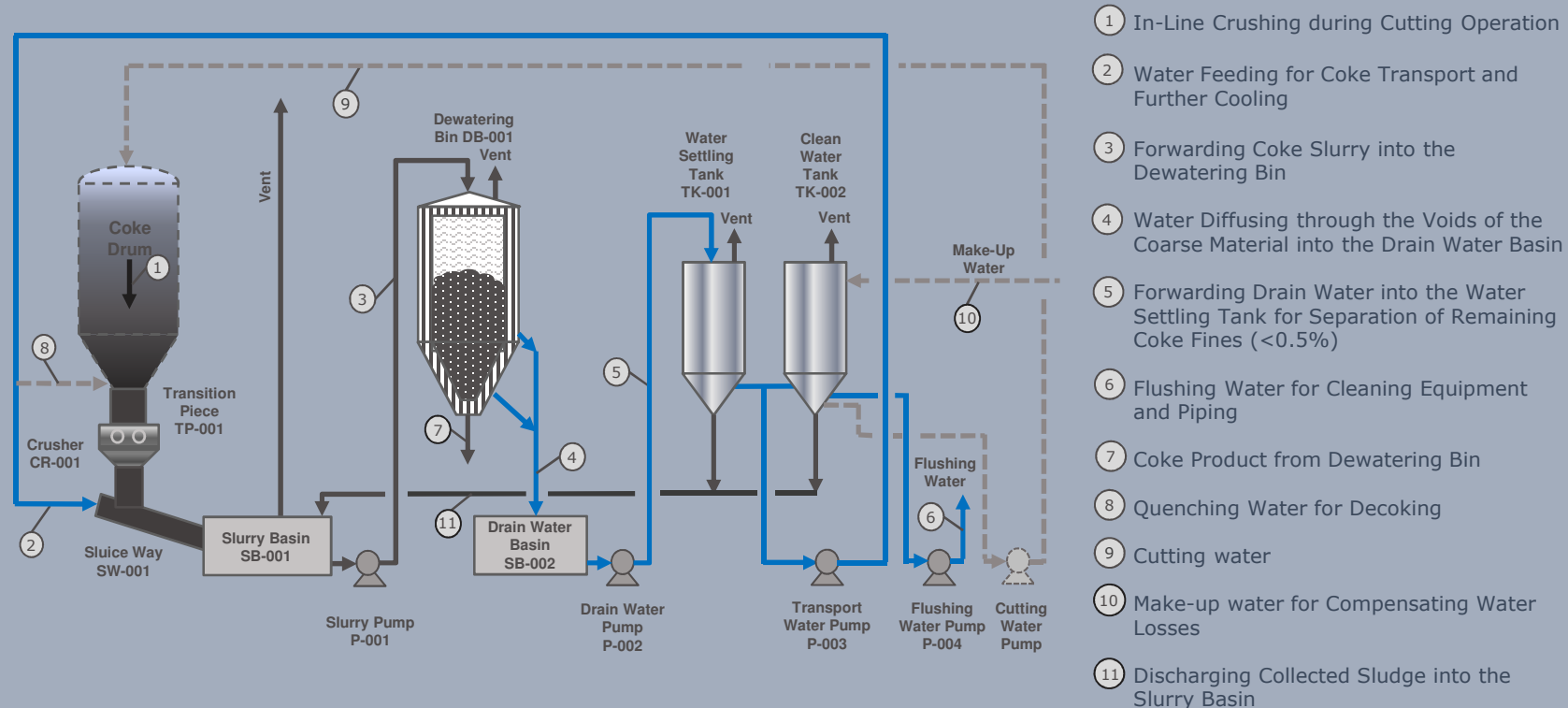
### Closed Coke Slurry System...?

#### Measures to Improve Coke Handling Operation

Low Emission		<i>Closed System to "cover" Processing</i>
Continuous Operation		<i>In-line Crusher</i>
Efficient Dewatering		<i>Special Dewatering Bin (Water Content <math>\leq 10\%</math>)</i>
Low Make-Up Water Consumption		<i>Water Cooling -&gt; Less Exhaust Steam Losses</i>
Low Manpower Requirement		<i>High Level of Automation</i>
Effective Water Clarification		<i>Water Filtering and Internal Sludge Recycle</i>
Higher System Reliability		<i>Unique Design &amp; Construction</i>

## C Process & Operating Features of CCS System

### How the Closed Coke Slurry System works?



### How the Closed Coke Slurry System works?


#### ***Dedicated Crushing Principle...***

- Holding the Full Coke Drum Inventory Positively Back – No Avalance Outlet
- Handling any Type of Coke from Premium Calciate Grade to Shot Coke
- In-line Grinding from 40"/1,000 mm to 4"/100 mm in One Single Step

### How the Closed Coke Slurry System works?

#### ***Dedicated Dewatering Principle...***

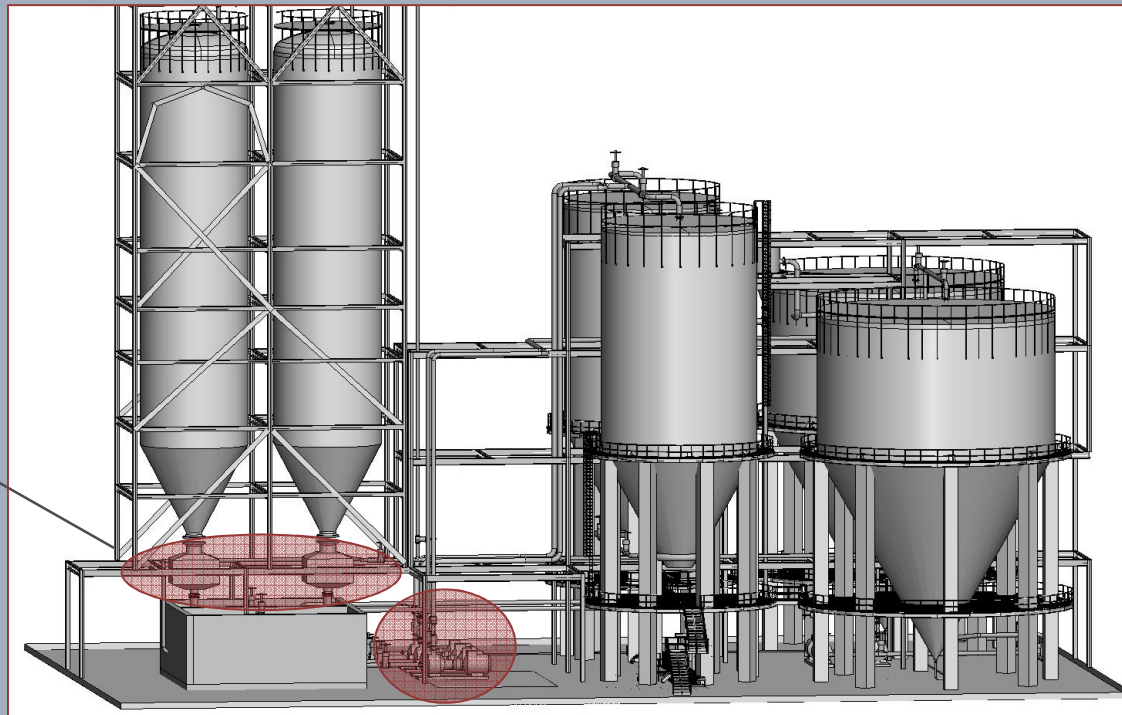
- Hydrostatic Pressure enhances Drain Water Velocity
- Coarse Material of Coke serves as Filter for Trapping and Retaining Coke Fines
- Maximum Fines Retention (Sludge Retention Rate in Dewatering Bin >99,5 %)

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## D Special Design of Selected Components

### Proprietary Design

Transition Piece  
& Crusher



Slurry & Drain  
Water Pump

## D Special Design of Selected Components

### Double Roll Crusher

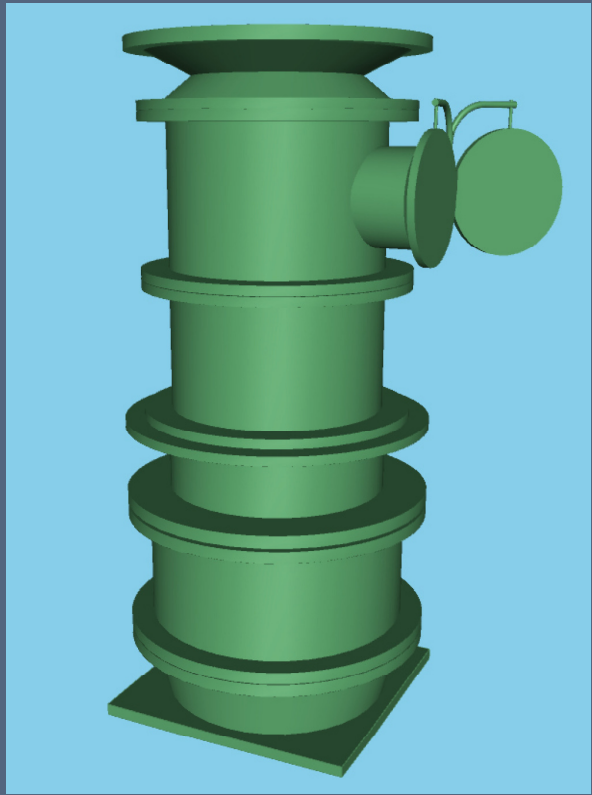


#### Proprietary Design

- |   |   |
|---|---|
| ✓ | 80 Tons of Special Material                           |
| ✓ | Unique Design & Construction Features                 |
| ✓ | 50 mm / 2" Wall Casing Thickness                      |
| ✓ | German Craftsmanship, under 100 % TRIPLAN Supervision |
| ✓ | High Torque Direct Drive Each Roll                    |
| ✓ | Crushing Ratio till 10:1; 40" --> 4"                  |
| ✓ | Safe & Remote Operation                               |

## D Special Design of Selected Components

### Transition Piece



#### Proprietary Design

✓

Compensation of axial and radial Expansions caused by the huge Temperature Differences in Coke Drum

✓

Closed System

✓

Cladded Surface which has Contact with abrasive Medium - Coke/Water Mixing

## D Special Design of Selected Components

### Slurry Pump - Proprietary Design



No Fines Generation at Low Speed 600 rpm

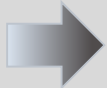


Design, Construction and Materials Selection for Long Life Cycle



Cavitation Protection by Impeller Design and Material Selection

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## E Advantages of CCS System

### Environment-Friendly, Safe, Efficient & Economical

**EF**

No Emission of Coke Fines & VOC to the Atmosphere

No Effluent

Minimum Steam Exhaust

**S**

Safe & Healthy Environment für Fellow Worker

Minimization of Occupational Accidents & Fire Hazard within the DCU

**EE**

Effective Water Clarification

Extensively Automation / Low Manpower

High Overall System Reliability ( $\geq 99.5\%$ )

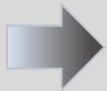
Less Footprint

Omission of Open Pit/Pad with 17 Meter Walls

Low Make-Up Water Consumption

Low Operation & Maintenance Cost

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## F CCS System Implementation

### Retrofit e.g. Replacement for Open PIT/PAD

✓

Suitable for Multi-Drum Coker

✓

Footprint fits into any Existing Coker Units, Maximum Layout Flexibility

✓

System Flexibility - Slurry Transport via Pipeline (e.g. 4 Kilometers) for Supplying remote Power Stations / Gasification Plants / Calciner Plants with Petcoke directly

✓

Basin Construction in Concrete (above-/underground) or Steel Work (aboveground)

## F CCS System Implementation

Greenfield Installation	
✓	Ease Permission regarding Environmental Concern
✓	Early Involvement for Optimum Project Embedding & Cost Savings
✓	Suitable for Multi Drum Coker
✓	System Flexibility - Slurry Transport via Pipeline for Feeding remote Power Stations / Gasification Plants / Calciner Plants Petcoke directly

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## Operating Experience with CCSS



**25 Years+**  
at a German Refinery  
**10 Years Operation**  
in current configuration

### Best Available Technology (BAT)

✓	No Dedicated Field Operators Required; Less Operators per Shift for the Entire Delayed Coker Unit.
✓	Maintenance Free; Reliability Factor $\geq 99,5\%$
✓	Uninterrupted Operation, Equivalent to 5.000 Cycles
✓	No Deterioration of the Slurry Pump Performances
✓	No Corrosion and Erosion in the Total CCS System
✓	No Fire, No Accidents, No 'Near Miss' Incidents
✓	Free Water Content of Commercially Dry Coke $\leq 10\%$

*Get rid of the coal mine in your refinery !*

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# Technology for Future, For a cleaner environment



# Thanks for Your Attention

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