Modernization of Romanian Cokers, Executed in a Major Revamp at OMV Petrom Petrobrazi Refinery

Improve Safety Operation in Coker Unit

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We are the leading industrial company in Romania

One of the largest private employers
- c.15,000 direct employees and more than 45,000 indirect jobs

#1 energy supplier
- Accounts for ~40% of oil, gas and fuel supply, and can cover up to 10% of power generation in Romania

Substantial investor
- Over EUR 1bn Capex spent per year since privatization

Largest contributor to state budget
- EUR 2.2 bn

All data refers to 2016

1 Source: internal data and analysis; 2 Includes: profit tax, royalties, employer social contributions, excises incl. custom duties, VAT, employee related taxes, other direct and indirect taxes paid to Romanian State

V. Predescu, Improve safety operation in Coker Unit, 4&5 October, 2017
Operating in the integrated oil and gas sector

**Upstream**
- **Romania**
  - 3.66 mn toe/yr crude oil and NGL
  - 5.25 bcm/yr gas
  - 582 mn boe proven reserves (~10 yrs of current production)
- **Kazakhstan**
  - 0.36 mn toe/yr crude oil and NGL
  - 0.05 bcm/yr gas
  - 24 mn boe proven reserves

**Downstream Oil**
- **Petrobrazi** refinery, 4.5 mn t/yr capacity
- 783 filling stations, operated via 2 brands: Petrom (479, Romania, Moldova) and OMV (304, Romania, Bulgaria, Serbia)
- 2.6 mn t retail sales

**Downstream Gas**
- Gas sales 4.6 bcm/yr, meeting up to ~40% of Romania’s demand
- Brazi gas-fired power plant (860 MW)

All data refers to 2016
Summary of Delayed Coker Unit

➢ Actual DCU Petrobrazi is in operation since 1989.

➢ Passed through certain modernization programs as:
  - Install low NOx Burners & Burner Management System in 2010.
  - Energy improvements (reduce EII with 1%) and Increase unit capacity with 18 % in 2012.
  - Implement DCS/ESD and APC in Coker unit in 2014.
DCU Petrobrazi model: 4 drums 1 heater, 1 fractionator

➢ Also, during 2014 and 2016 has been executed a big project focused mainly on safety operation during decoking time, triggered by the necessity of safety increasing around coke drums executed by Ruhrpumpen Company

➢ Project implemented in 2 phases:
  ❖ **Phase 1- 2014-** Bottom side- Ruhrpumpen bottom chute system and increased drainage line diameter
  ❖ **Phase 2- 2016-** Top side- slide valves, new crane and guide frame
Selection of the right solution was a real challenge

<table>
<thead>
<tr>
<th>Find the most appropriate solution</th>
<th>Top/ bottom fully automatic systems (e.g slide valves)</th>
<th>Top-fully automatic Bottom –semiautomatic system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safe conditions</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Fit into existing system</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Existing structure is able/ not able to sustain additional overload</td>
<td><strong>No</strong> High Capex</td>
<td>Yes Reasonable Capex</td>
</tr>
<tr>
<td>Bring benefits</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Decision</td>
<td><strong>No Go</strong></td>
<td><strong>GO</strong></td>
</tr>
</tbody>
</table>
Decoking steps “touched” by automatic system

Decoking steps

Switch + Steam out to F → Steam out to BD → Water Quenching

Coke cutting → Un/heading

Re/heading → Testing → Preheating

Batch schedule of DCU

V. Predescu, Improve safety operation in Coker Unit, 4&5 October, 2017
Expected versus achieved reduction time*

- **Drainage**
  - Expected: 25%
  - Achieved: over 50%

- **Un/Heading**
  - Expected: 25%
  - Achieved: 25%

- **Re/Heading**
  - Expected: 25%
  - Achieved: over 50%

This overall reduction of cycle time led to increasing of amount processed in DCU with 10% and it improved unit efficiency.

* - reported to baseline

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Old system: Manually open/close the bolts, lift up the top cover with local crane.

New slide valve takes few minutes to open or close.
Bottom heading/un-heading operation

Before

Metal fence protects the coke to be spread around coke drum platform

After

New bottom chute system, movable on rail way
Feedback operators & Coker Unit manager

1. “Safety”
2. “Easier and faster”
3. “Cleaner”
   - ranking made by Coke drums operational staff after Project realization.

“The people works now in safety conditions and the Coker unit gained a plus in processed feedstock”.

Coker Unit manager
Thank you for your attention!

Questions?
Modernization of Romanian Cokers, Executed in a Major Revamp at OMV Petrom Petrobrazi Refinery

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Introduction

Location: RuhRPumpen Witten, Germany

1950 Founded in Witten / Germany
Specialist for: API Process pumps
API Pipeline pumps for Crude Oil, Products, Water

1963 Part of THYSSEN AG
THYSSEN RUHRPUMPEN

1997 Part of Cooperation EG, Monterrey, Mexico

Our Mission: Become a worldwide company

2000 Start with Hydraulic Decoking System

2001 First Order: Petroleras Ameriven
/04 ConocoPhillips, PdVSA, Chevron Texaco

Since that time orders for revamps, new Units and Components
Ruhrpumpen Business Units

**Witten, Germany**
Area: 48,000 m²  
Testing: 8,850 HP

**Tulsa, USA**
Area: 28,000 m²  
Testing: 2,000 HP

**Monterrey, Mexico**
Area: 14,370 m²  
Testing: 7,500 HP

**Changzhou, China**
Area: 7,500 m²  
Testing: 6,000 HP

**Chennai, India**
Area: 7,500 m²  
Testing: 6,000 HP

**Rio de Janeiro, Brazil**
Area: 7,500 m²  
Testing: 6,000 HP

**Buenos Aires, Argentina**
Area: 7,500 m²  
Testing: 1,500 HP

**Orland, California**
Area: 2,500 m²

**Suez, Egypt**
Area: 2,280 m²  
Testing: 2,680 HP
Overview

- Delayed Coking units in Romania and CIS
  - built between 1960’s and 1990’s
  - built acc. GOST and Romanian standard

- Upgrades and modernisation
  - for higher throughput
  - for higher safety standards
  - to meet international standards

- Requirements
  - Ambient conditions, warm and cold
  - Refinery conditions
  - Company and Licensor specifications
  - Local codes and standards
Basic design of Decoking System

- Design
  - does not depend on process
    (mostly production of anode grade / fuel grade coke, no shot coke)
  - derrick design to accommodate cutting system only,

- Soviet Union, Romania
  - Open derrick, torque will not be transferred into derrick
  - Double deck system, process deck and cutting deck
  - Turn Table arrangement with square drill stems
  - Electrical hoists and Turn Table

- Western countries
  - Drill Stem Drive with round Drill Stems
  - Hoists and DSD’s are driven pneumatically, hydraulically, electrically
  - Derrick with main beams, Torque will be transferred in the derrick
  - Single deck design
References for Revamp Coker Projects Top and Bottom

• 2003 BP-Gelsenkirchen
  Top semiautomatic MOTICAR
  Bottom semiautomatic
    Car version with 100t lift power

• 2004 BP-Lingen
  Top automatic 36" Z&J electric driven top valve
  Bottom semiautomatic
    clamp-version with 80t clamp force

• 2006 BP-Lingen
  Top automatic 30" Z&J electric driven top valve
  Bottom semiautomatic
    clamp-version with 80t clamp force
References for Revamp Coker Projects Top and Bottom

- 2013  Rompetrol, Romania
  Bottom  semiautomatic chute system, hydraulic operated

- 2015  OMV, Ploest, Romania
  Top    automatic  30“ Z&J electric driven top valve
  Bottom semiautomatic chute system, remote-hydraulic operated
Coker in Romania

- OMV
- Rompetrol
- Lukoil
Coker in Romania

Cutting deck

Petrom
- Hoist
- Turn table
- Square Drill Stem
Coker in Romania

• Design
  • Derrick design for Zero torque due to Square Drill Stem and Turn Table
Coker in Romania

- Derrick Design
  - Swivel
  - free hanging
  - no torque
OMV Petrom Modernization

Project: Deheading System 2012-2015

• Target
  • Increase of safety
  • Reduction of cycle time
  • Increase of reliability
    To be more profitable

• Steps
  • Revamping of Bottom Unheading System
  • Modernisation of Top Unheading System
  • Improvement of cutting cycle (optional)
Situation 2012

4 Drums

- V approx 700 m³
- m coke 450,000 kg
- m drum, approx 90,000 kg
- m function 656,000 kg
Bottom

• Situation 2012
  • open chute
  • Manual operation
    • Without safety system
• up to 2013
• open chute
• Manual operation
• Without safety system
OMV Petrom-Solution

**Bottom**

**Plan**

Chute System
  • Remote operated

Safety System
  • Safety Clamp
  • Manual operation
  • BUT SAFE

Chute Holes
  • Cover Plates
Switch deck

Chute System
- Ruhrpumpen

Safety Clamping Device
- Reinforced hydraulic cy

Auxiliaries
- HPU
- Operator Shelter
- MCC
- PLC Cabinet
OMV Petrom

Switch deck

Chute System
- Ruhrpumpen

Safety Clamping Device
- Reinforced hydraulic cy

Auxiliaries
- HPU
- Operator Shelter
- MCC
- PLC Cabinet
Switch deck

- Chute System
  - Ruhrpumpen

- Safety Clamping Device
  - Reinforced hydraulic cylinder

- Auxiliaries
  - HPU
  - Operator Shelter
  - MCC
  - PLC Cabinet
OMV-Petrom

Bottom

Actual Situation:

- Safety Clamping Device

Increased safety system
OMV-Petrom Romania

Actual Situation:
- Safety Clamping Device

Increased safety system
Solutions

• Proposal A: Semiautomatic
  manual operated, but closed by automatic operated device
  • Swingversion
  • Plate version
  • Moticar version

• Proposal B: Automatic (recommended when possible)
  automatic valve version, remote operated
  • Z&J Double Disk Valves
  • DV Single Disk Valves
Germany

Top Valve
- ZJ 30"
- Adapter drum
- Adapter Top

Derrick
- Guide device

Weight
- Valve 8.000 kg
- Adapter 1x500 kg
Germany

Top Valve
- ZJ 30"
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Weight
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Top

- **Weight comparison**

- **Semiautomatic**
  - Swingversion (MIRO) 30“ 750 mm 1.000 kg
  - Plate version (OMV-Bgh) 24“ 600 mm(?) 5.000 kg
  - Moticar version (BP-Ge) 22“ 550 mm 2.000 kg

  Additonal HPU required

- **Automatic**
  - Valve 1 30“ 750 mm 5.000 kg
  - Valve 2a 26“ 660 mm 5.500 kg
  - Valve 2b 30“ 750 mm 7.900 kg

- **RP Tool**
  - Tool 13,5“ 330 mm
Structure

- Calculation of an existing coker,
- with similar design
- with similar drum size
- with similar arrangement
Realisation top, phase II

- Top Deheading
  - 30" Top Deheading System
    - 30" Top Valves
    - Steam Purge system

- Details
  - Operator Shelter
  - adapter between drum and top valve
  - Guide device above top valve

- Auxiliaries
  - new 10t crane for installation and maintenance
OMV Petrom-realisation

Flange deck
OMV Petrom-realisation

Top valve assembly

Adapter
Top valve
Guide device
OMV Petrom-realisation

Top valve assembly

- Adapter
- Top valve
- Guide device
- Tool
**Summary and Conclusion**

**Target:**
Increase of safety and reliability of top- and bottom deheading systems.
Installation of a system without modification of existing drums and structure.

**RUHRPUMPEN and OMV Petrom:**
OMV provided to Ruhrpumpen a turn key project.
A successful project has been executed to increase safety and reliability for the drum deheading process.
Cycle time has been reduced. Coker works more profitable.
THANKS FOR YOUR ATTENTION

Questions?