Slovnaft`s FCC contribution to the MOL Group`s 2030 strategy

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MOL Group`s 2030 strategy and position of Slovnaft FCC in it

Slovnaft FCC steps and measures on the way

Future Development and Plans
MOL Group strategy 2030 sets a direction towards more petrochemical feedstock and less fuel

- **Propylene** is an attractive direction for the future.

- Additional elements of 2030 strategy:
  - increase **flexibility** and **efficiency**
  - maximizing petchem feedstock and reducing fuel output
Slovnaft refinery plays important role in the strategy

Slovnaft is a complex refinery in the Slovak Republic
- 6.1 million toness per year capacity
- Nelson index: 11.5
- Production units included:
  • Reformer
  • Hydrocracker
  • LC finer
  • Vacuum gasoil hydrotreater
  • Fluid Catalytic Cracking
Also petrochemical plants:
  • Steam cracker
  • Polyethylene
  • Polypropylene
Slovnaft FCC unit is a key component in the propylene balance

FCC is the second biggest propylene producer and the second biggest gasoline producer in Slovnaft

- Unit commissioned 1999
- 22 000 BPD throughput
- (Originally 17 500 BPD)
- UOP side-by-side design
- Hydrotreated VGO feed
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Slovnaft FCC steps and measures on the way

Future Development and Plans
Standard feedstock configuration and yield structure

Crude → ADU5 → VDU5 → Vacuum res. → VGH → Hydrogen → FCC
Crude → AVD6 → Vacuum res. → RHC → HS-VGO → VGH

Imports (LS-VGO, UCO) → Tank → UCO

Yield Structure:
- Fuel gas: 3.8%
- Propane: 1.3%
- Propylene: 5.9%
- C4 fr.: 12.9%
- Gasoline: 48.9%
- LCO: 12.9%
- HCO: 1.9%
- MCB: 6.9%
- Coke: 5.5%
Optimisation towards max. C3= 

**Increase conversion** through operation severity 
- Reactor outlet temperature 
- Cat/oil ratio increase 
- Increase Ecat activity 
- Improve feed quality 

Minimise hydrocarbon partial pressure 

Naphtha / butylene recycle
ZSM5 test run

Propylene Yield

ZSM5 starts
ZSM5 ends
Unit Bottlenecks

Already known:
• Propane/propylene splitting capacity
• LPG merox capacity (Caustic carryover)

Revealed during test run:
• Debutanizer delta p increase
• Primary absorber washing capacity – higher C3= losses
MOL Group 2030 strategy and position of Slovnaft FCC in it

Slovnaft FCC steps and measures on the way

Future Development and Plans
There are more alternatives for FCC development

Slovnaft has realized **revamp feasibility study** with licensor UOP for increased propylene yield up to 20% with maximum throughput.

<table>
<thead>
<tr>
<th></th>
<th>CASE</th>
<th>wt% of Feed</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Case-1</td>
<td>Case-2</td>
<td></td>
</tr>
<tr>
<td>Yield Estimate</td>
<td></td>
<td>3566</td>
<td>3509</td>
<td></td>
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<tr>
<td>H₂S</td>
<td></td>
<td>0.01</td>
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<tr>
<td>C₂ Minus</td>
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<td>4.25</td>
<td>5.66</td>
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<tr>
<td>C₃=</td>
<td></td>
<td>10.03</td>
<td>20.25</td>
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<tr>
<td>C₃</td>
<td></td>
<td>1.90</td>
<td>3.53</td>
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<tr>
<td>Total C₄</td>
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<td>14.88</td>
<td>7.58</td>
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<tr>
<td>Gasoline (90% @ 175 °C)</td>
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<td>44.54</td>
<td>39.17</td>
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<tr>
<td>LCO (90% @ 316 °C)</td>
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<td>10.79</td>
<td>10.89</td>
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<tr>
<td>MCB</td>
<td></td>
<td>7.72</td>
<td>5.94</td>
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<tr>
<td>Coke</td>
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<td>5.87</td>
<td>6.98</td>
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<tr>
<td>Conversion Vol % (90% @ ~ 175 °C)</td>
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<td>88.19</td>
<td>84.86</td>
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</tr>
</tbody>
</table>

- Evaluation and decision based on MOL Group balance
Phase 1: Addressing major bottlenecks

In the first phase we would like to tackle and shift major bottlenecks.

Propan propylene splitter
- Retrayment of the column

LPG Merex
- New sand filter
- Modification of existing caustic prewash
- Modification of existing extractor

Target: 7% propylene yield with maximum throughput
Phase 1: Other Improvements

We would like to implement other improvements.

Spent CatalystStripper
➢ Packing solution

5. Feed distributor
➢ New design (Pyrooil injection)
FCC is key unit in the **strategy** ...

... Unit is **working today** to follow it ...

.... And we **think and create** to make it happen **in the future** ...

Thank you for attention ....