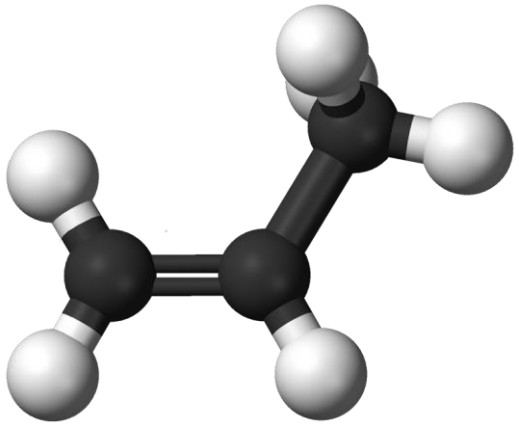
Slovnaft`s FCC contribution to the MOL Group`s 2030 strategy



Norbert Kováč – Process Engineer, Slovnaft
Dominik Gibala – Technology Development Engineer, Slovnaft

RefComm, Budapest, October 2017

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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

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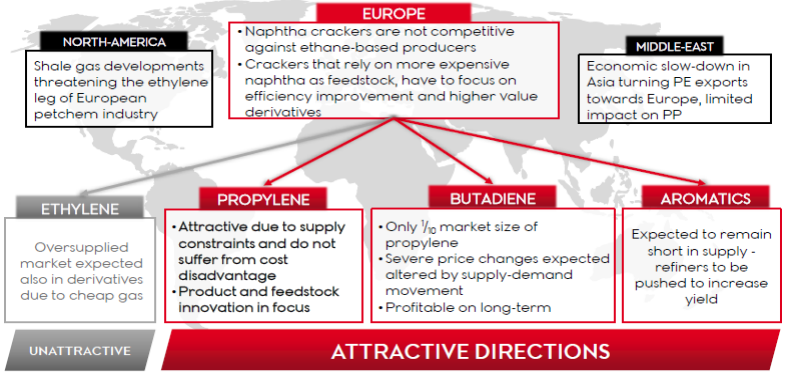
MOL Group strategy 2030 sets a direction towards more petrochemical feedstock and less fuel

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



- Additional elements of 2030 **strategy**:
  - increase **flexibility** and **efficiency**
  - **maximizing petchem** feedstock and **reducing fuel** output

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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
  - Vaccuum gasoil hydrotreater
  - Fluid Catalytic Cracking

Also petrochemical plants:

  - Steam cracker
  - Polyethylene
  - Polyproplylene

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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 commisioned 1999
- 22 000 BPD throughput
- (Oiginally 17 500 BPD)
- UOP side-by-side design
- Hydrotreated VGO feed

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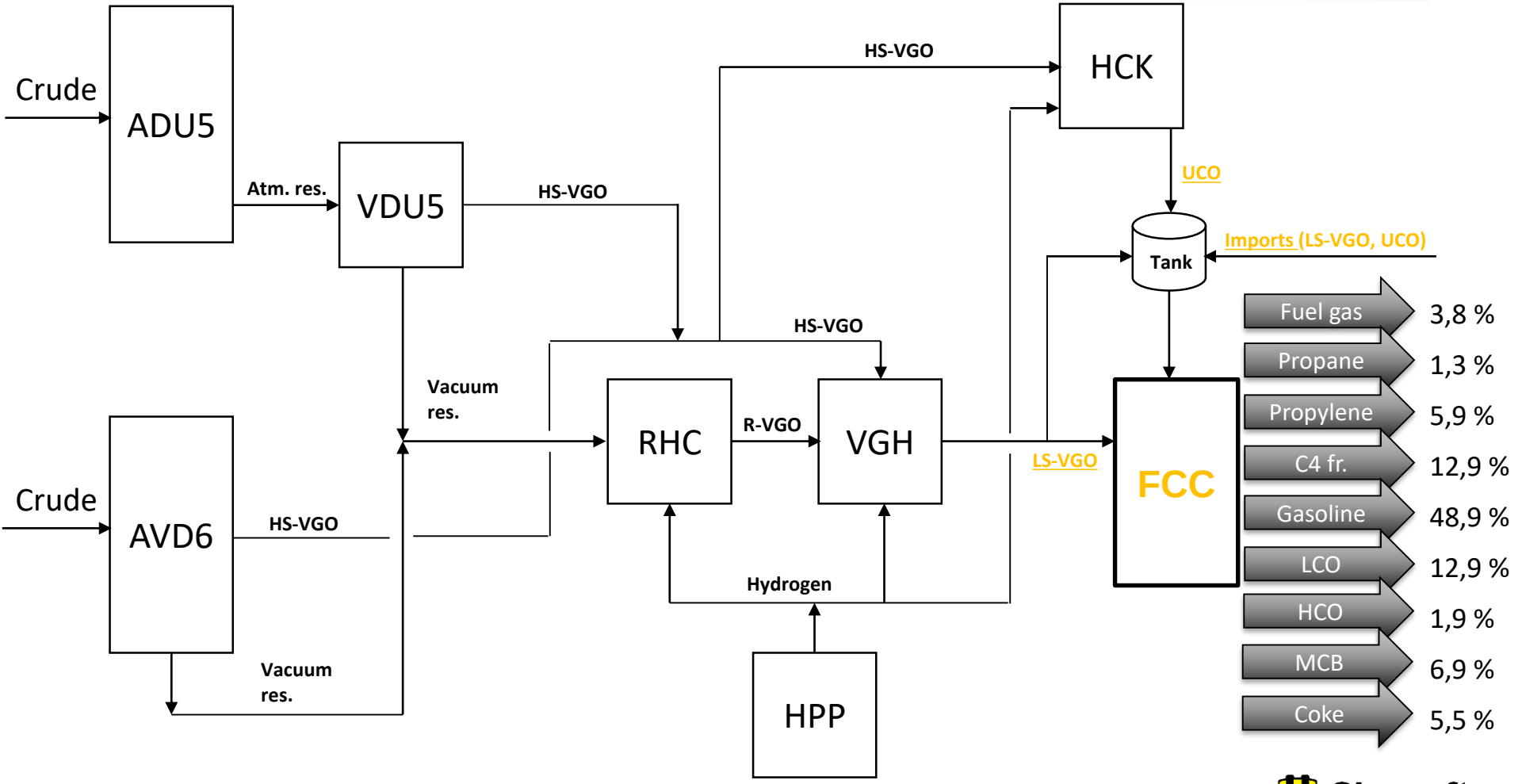
Standard feedstock configuration and yield structure



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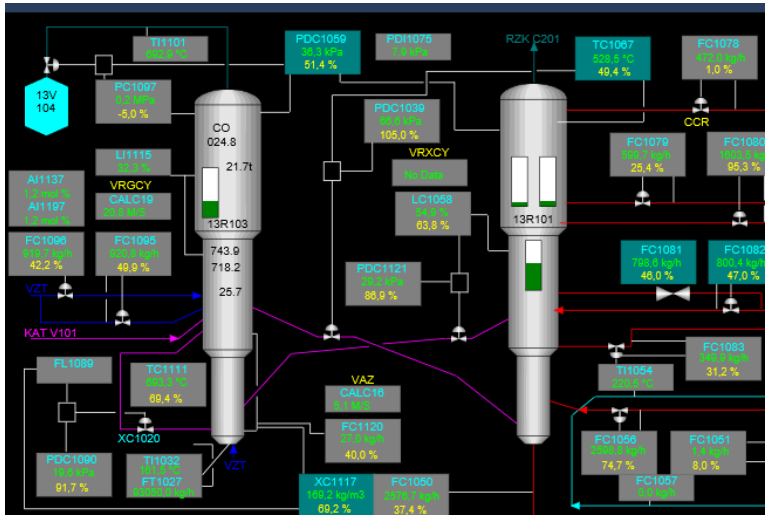
Optimisation towards max. C3=

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

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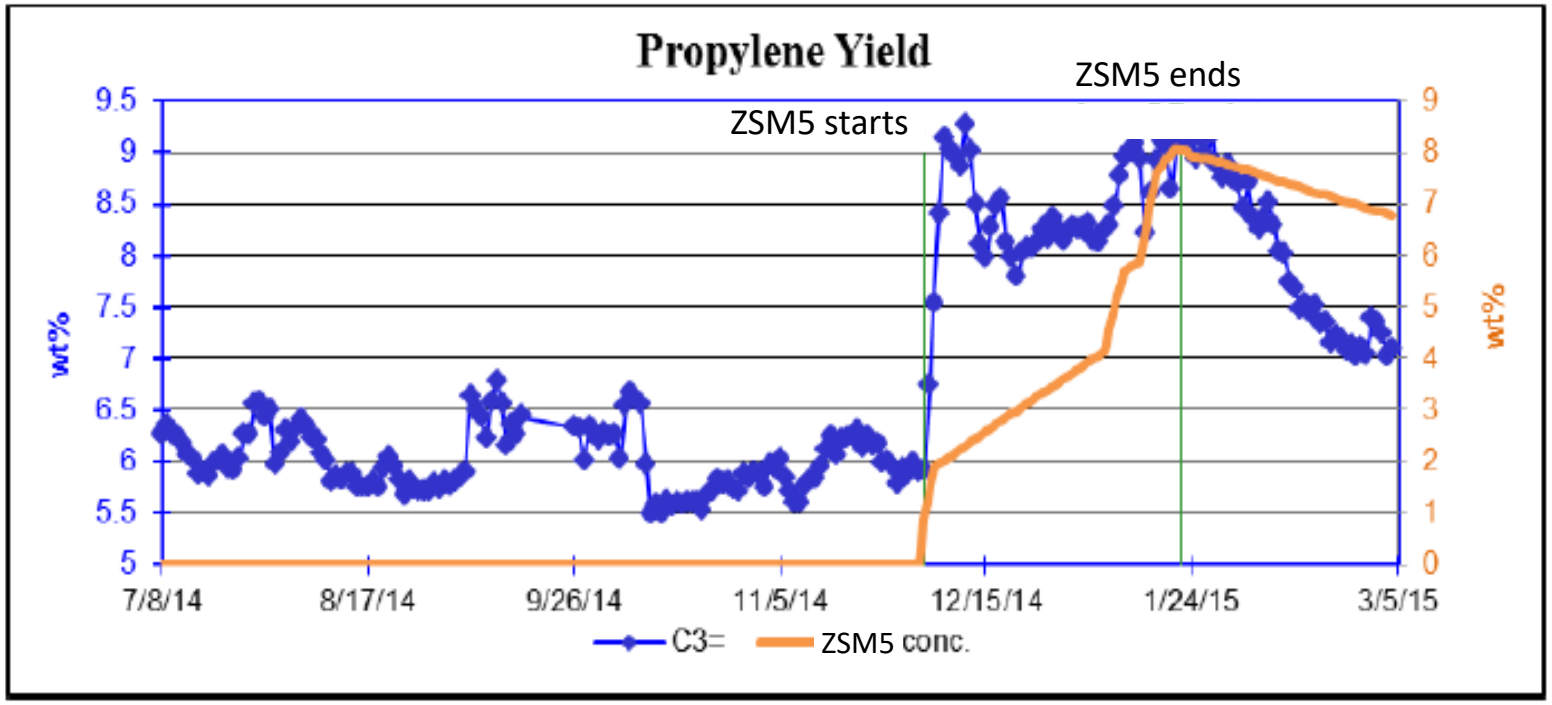
ZSM5 test run



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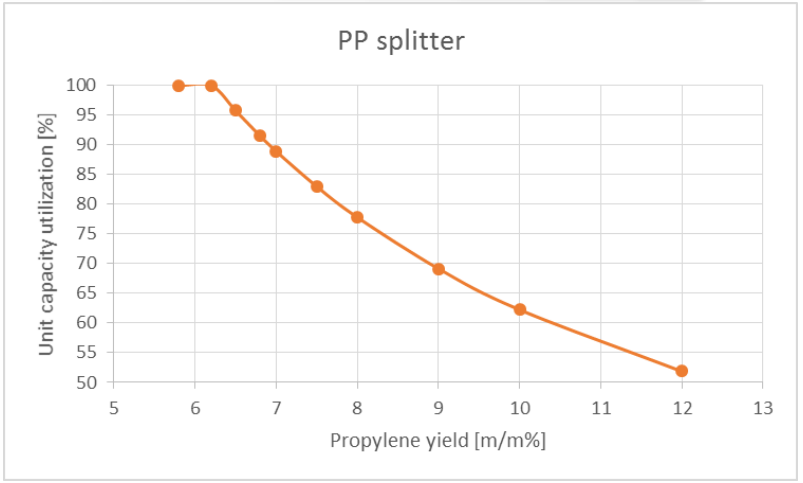
Unit Bottlenecks

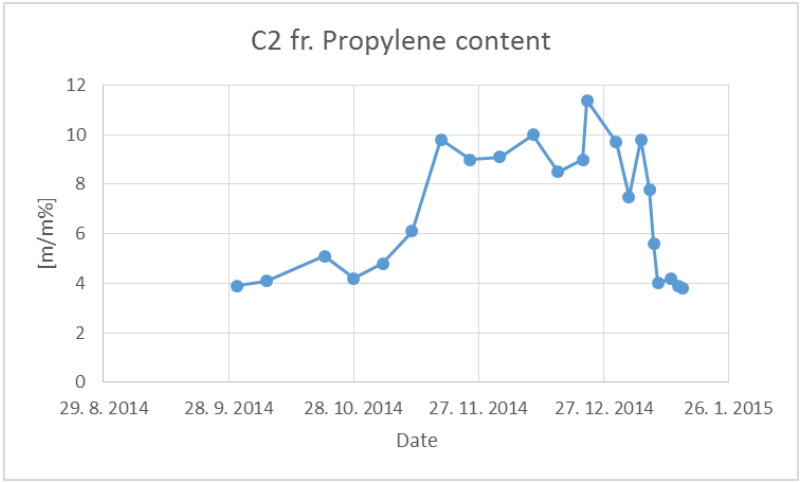
Already known:

- Propane/propylene splitting capacity
- LPG merox capacity (Caustic carryover)

Revealed during test run:

- Debutanizer delta p increase
- Primary absorber washing capacity – higher C3= losses





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There are more alternatives for FCC development

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

wt% of Feed		
CASE	**Case-1**	**Case-2**
Yield Estimate	3566	3509
H_2S	0.01	0.01
C_2 Minus	4.25	5.66
C_3=	10.03	20.25
C_3	1.90	3.53
Total C_4	14.88	7.58
Gasoline (90% @ 175 °C)	44.54	39.17
LCO (90% @ 316 °C)	10.79	10.89
MCB	7.72	5.94
Coke	5.87	6.98
Conversion Vol % (90% @ ~ 175 °C)	83.19	84.86

- Evaluation and decision based on MOL Group balance

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Phase 1: Adressing major bottlenecks

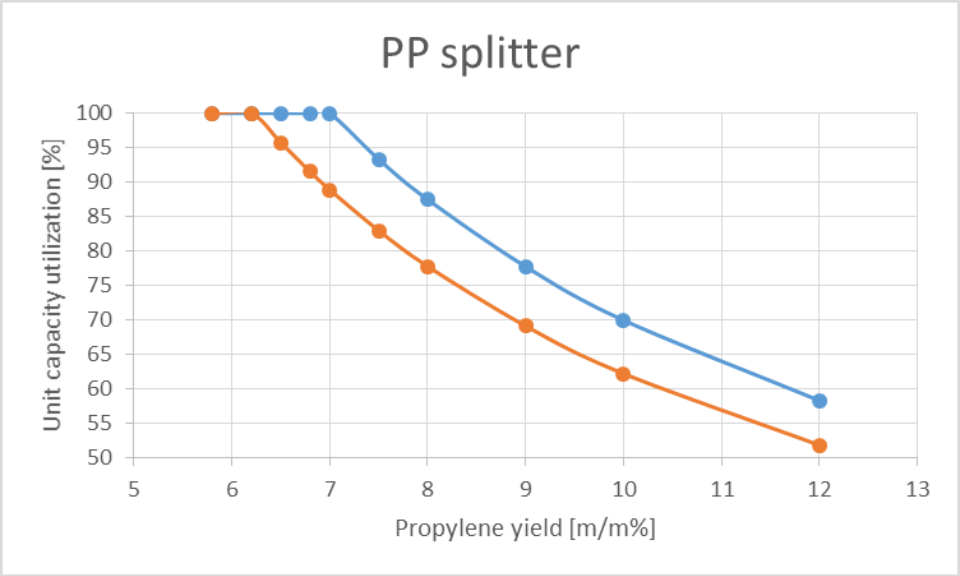
In the **first phase** we would like to **tackle and shift major bottlenecks**.

Propan propylene splitter

- Retrayment of the column

LPG Merox

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



Target: 7% propylene yield with maximum throughput

Timeline: Basic Design 2018, MC during General Turnaround 2019/2020

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Phase 1: Other Improvements

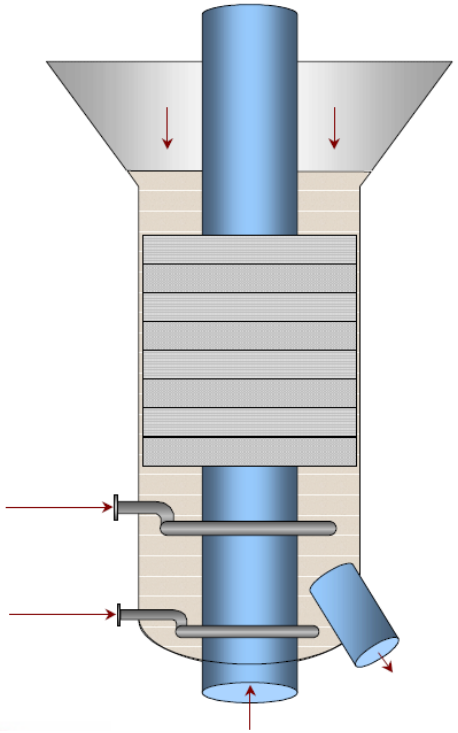
We would like to implement other improvements.

Spent Catalyst Stripper

- Packing solution

5. Feed distributor

- New design (Pyrooil injection)



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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 ….

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