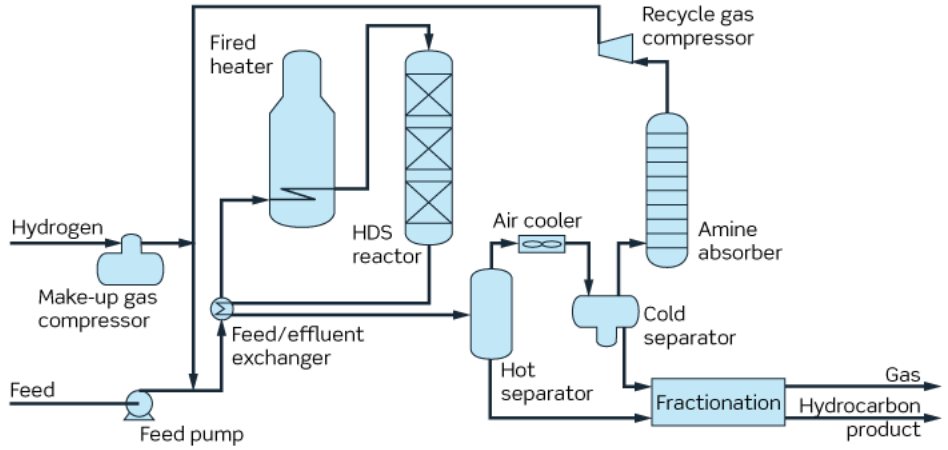
CATALYST INTELLIGENCE Sarl

Hydrotreater Optimization

Catalyst performance prediction model

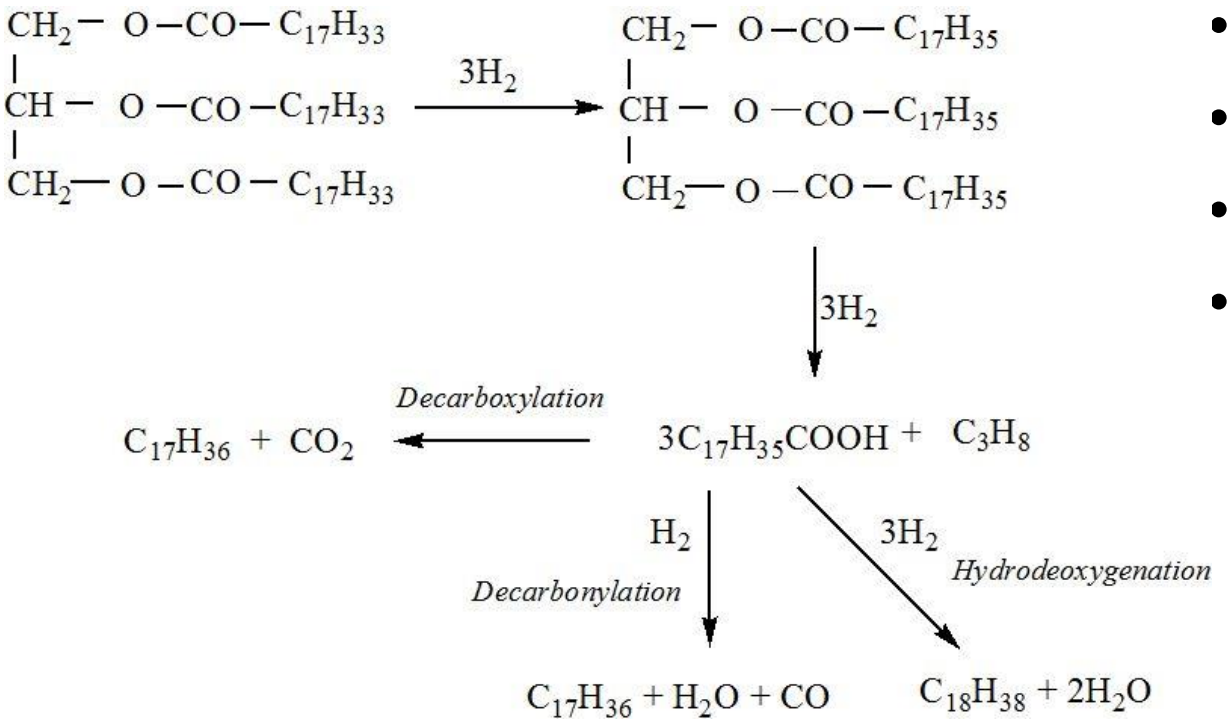
October 2020



Achieve maximum performance

- Monitoring in general: know how healthy the unit is
- Evaluate effect of alternative feedstocks (cracked, VO, …)
- Optimize performance within constraints (like cycle length)
  - Process worse feeds
  - Increase capacity
  - Reduce H_2 purge (when processing VO)
  - Reduce energy consumption (H_2/oil, P, …)
- Support Troubleshooting activities
- Predict remaining cycle length
  - Evaluate Options to extend cycle length

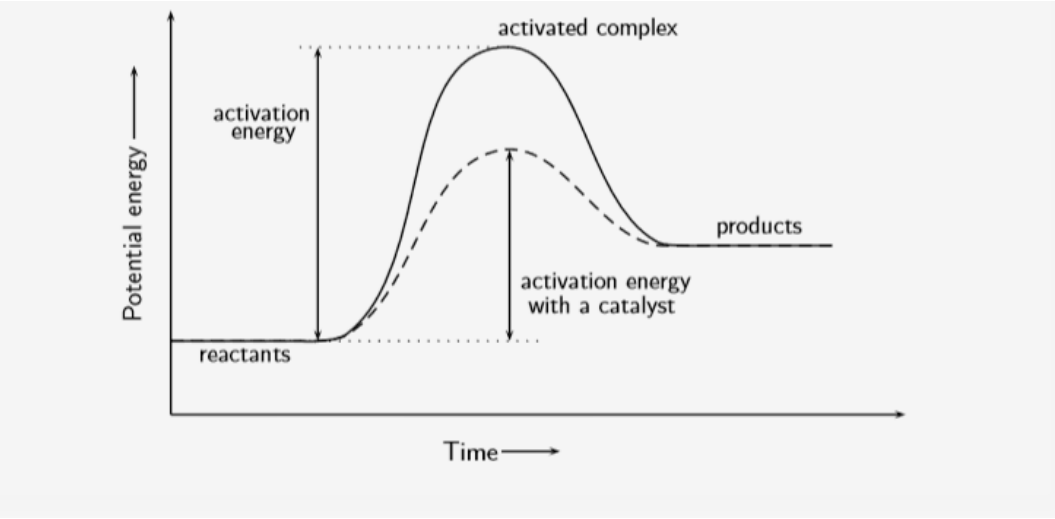
Co-processing vegetable oil



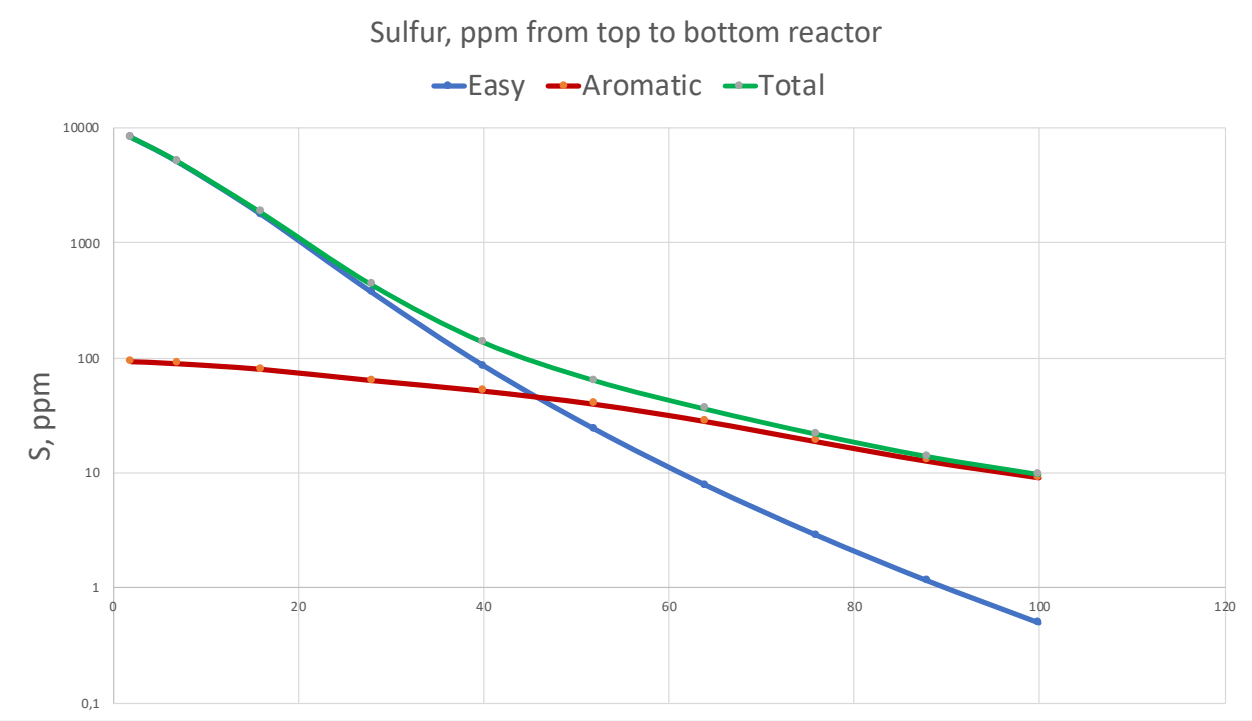
- CO & CO_2 formed
- Purge required to remove CO & CO_2
- Valuable H_2 lost
- Optimization required
  - Maximize HDO over decarb
  - Vary %VO in campaigns
  - Optimize within constraints

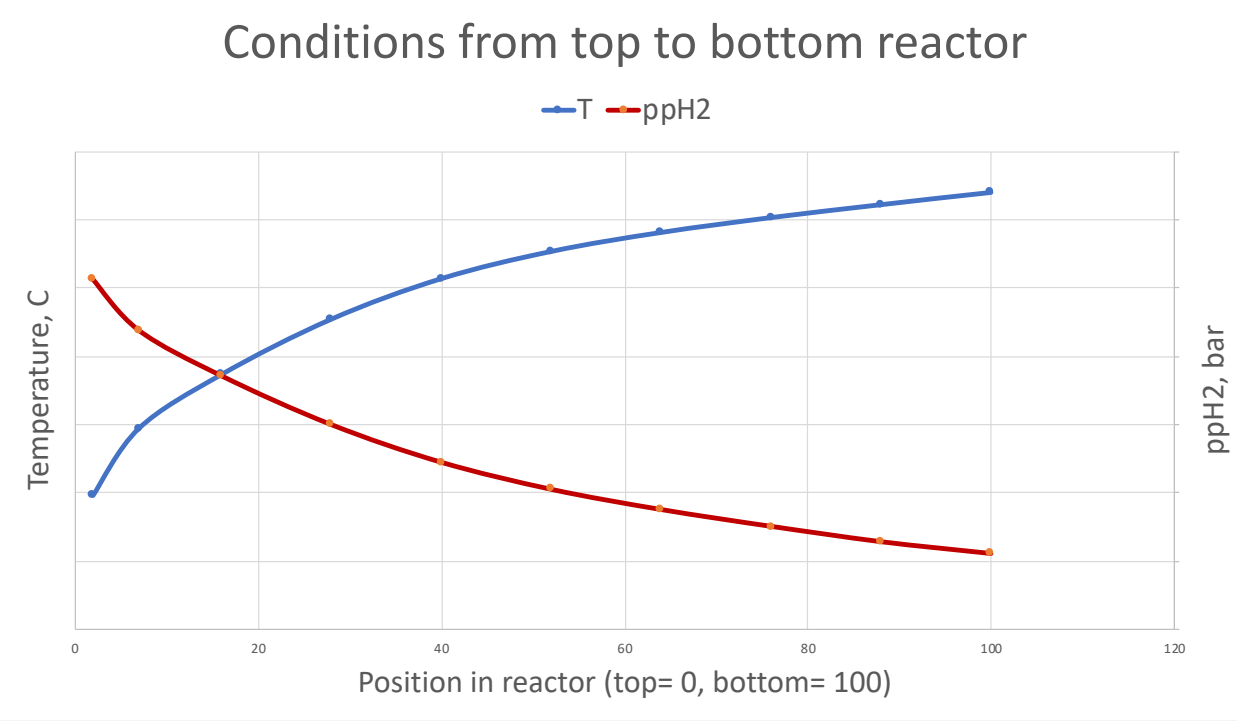
Modeling capabilities

- Kinetic model for HDS, HDN, HDO
  - Separate model for conversion of sterically hindered sulfur species
  - N, CO and H_2S inhibition considered
  - Conditions simulated from top to bottom reactor (see next slide)
  - Distinction between hydrogenation and decarboxylation of vegetable oil and animal fat
- Strong deactivation model
  - Coke deposition
  - Metal contamination
- Model to be tuned on unit data



Trend from top to bottom RX

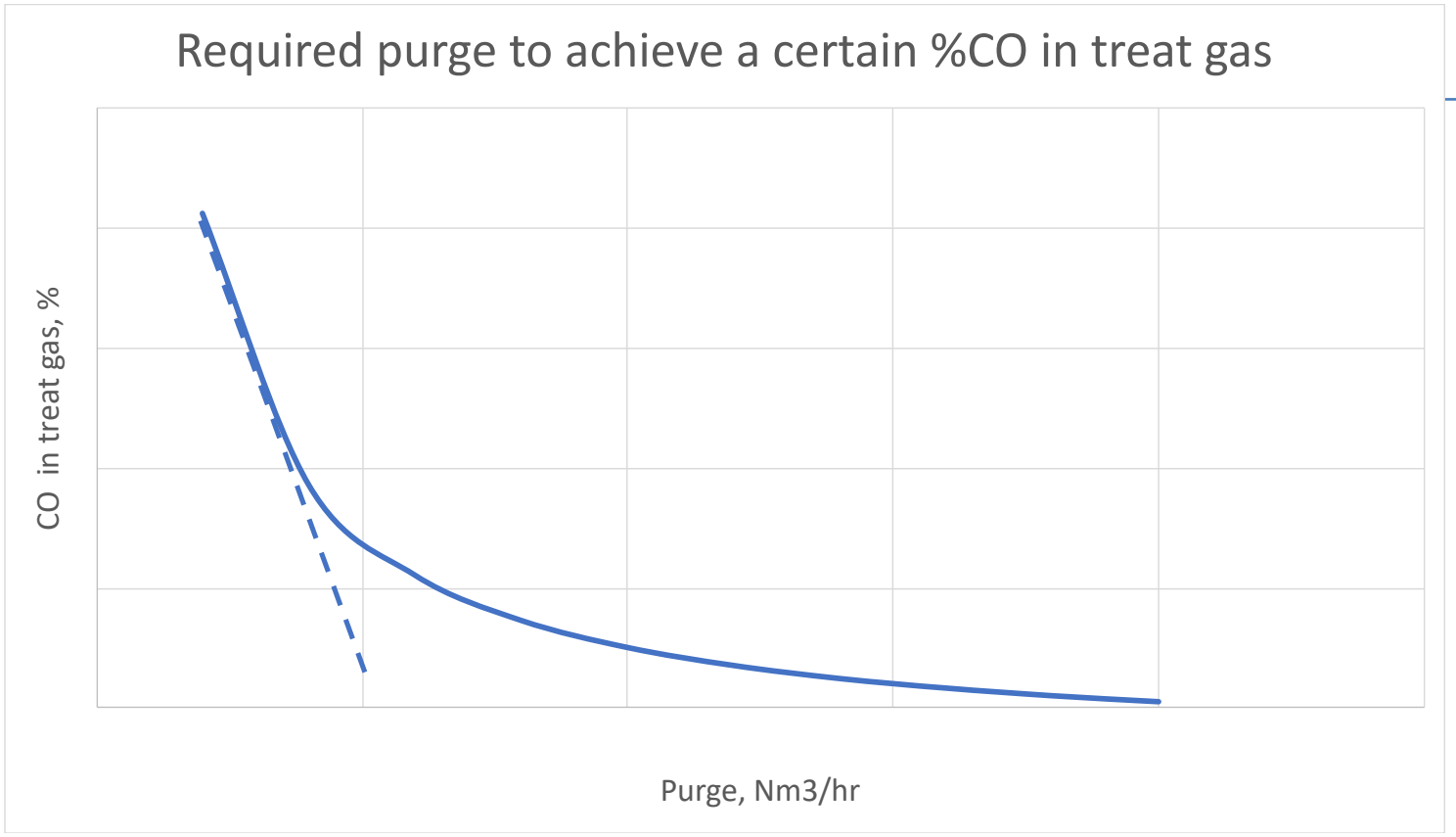




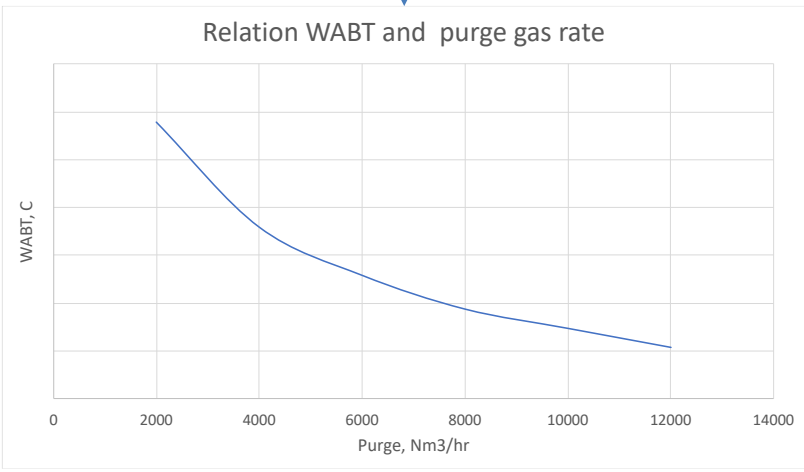
Predictive power

- Alternative feeds, for instance:
  - More cracked feed with high % aromatic sulfur or high nitrogen
  - Contaminated feeds
  - Vegetable oil:
    - Impact on H_2 consumption, ppH_2 and CO inhibition of HDS reactions
    - Check on optimization H_2 purge (see next slide)
  - Maximize profitability within constraints

Minimize purge when processing VO



Correlate purge → CO in gas →
Performance & cycle length →
Define optimal approach



Conclusions

- Model allows optimization of:
  - Economics: %cheap feeds
  - Vegetable oil operation
- Prediction of effect of processing vegetable oil or animal fat
- Strong deactivation model allowing the evaluation of alternative operating modes
- Contact Catalyst-Intelligence for more information

Working method

- Tune model on complete cycle from the past
  - With enough variation in feed quality & operating modes
  - Input from pilot plant data is an option
- Model current cycle → recommendations
  - Case studies?

Deliverables

- Refinery provides tuning data for HP unit and Catalyst Intelligence tunes the model.
- Refinery asks specific questions about unit optimization (options they have) and Catalyst Intelligence checks what the model predicts
- Catalyst Intelligence issues a report with recommendations and schedules call to discuss
- Evaluation independent of catalyst suppliers
- Data may also be used to write ItB for new load or to evaluate future catalyst offers.

Contact for free quote

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