GENERAL OVERVIEW

COQA Meeting

Minneapolis

11th June 2015

TOPNIR SYSTEMS

Crude Oil Identification and Characterization

A unique approach by Topnir

CONFIDENTIAL

This document contains proprietary information of Topnir Systems. No use may be made of information herein without the express written consent of Topnir Systems.
TOPNIR SYSTEMS

Delivering Solutions since 1993

A Company which delivers Turn Key Projects Worldwide for On-line Process Analysis in Oil & Gas

- TOPNIR Technology and Know-how initially developed in BP
- Field proven technology over 20 years, More than 150 References over the 5 continents
- Advanced Technology delivered to all Major Oil Companies
- Unique experience in NIR Process Analysis Projects
- Proprietary Technology, more than 30 Patents and Trade Marks owned by TS

Topnir solutions measure Hydrocarbon Properties in less than 1 minute, off-line / on-line
TOPNIR, WHAT IS IT MADE FOR?

- A turn-key system to measure Hydrocarbons Properties in less than 1 minute, off-line or/and on-line

<table>
<thead>
<tr>
<th>Gasoline</th>
<th>Diesel</th>
<th>Naphtha Cracker Feed</th>
</tr>
</thead>
<tbody>
<tr>
<td>MON</td>
<td>Cloud point</td>
<td>Distillation</td>
</tr>
<tr>
<td>RON</td>
<td>Cetane number</td>
<td>Detailed Hydrocarbon Analysis</td>
</tr>
<tr>
<td>Distillation curve</td>
<td>Cetane index</td>
<td></td>
</tr>
<tr>
<td>RVP</td>
<td>CFPP (with/without additive)</td>
<td></td>
</tr>
<tr>
<td>Benzene</td>
<td>Flash Point</td>
<td></td>
</tr>
<tr>
<td>Oxygenates</td>
<td>FAME</td>
<td></td>
</tr>
<tr>
<td>PIONA</td>
<td>Distillation curve</td>
<td></td>
</tr>
<tr>
<td>Bio components</td>
<td></td>
<td></td>
</tr>
<tr>
<td>...</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Base Oils & Heavy streams**

- VI, Pour Point, Noack, ...
- Conradson Carbon
- Distillation
- Aromatics, PAH (PCA)

**Crude Oils**

- API, TAN, Sulphur
- TBP Distillation Curve
- Yields
- Crude Assay, ...
NIR SPECTROSCOPY – BASIC PRINCIPLES

Intensity = Io

NIR Source

Intensity = I

Measurement Cell

Fourier Transform

Detector

NIR Spectrum

→ Each NIR Spectrum is unique for each Product
→ It is the fingerprint of the sample

KEY ISSUE in NIR is MODELING!
**Pattern Recognition Approach - Basic Postulate**

---

**Same spectra ↔ Same sample**

**Same sample ↔ Same properties**

**Modeling achieved from Reference Database**
DATABASE FOR MODELLING

- 20 samples required for calibration per grade
- Densification methodology to maintain the accuracy
  - Creation of virtual samples using linear mixing rules for Spectra and non-linear mixing rules for Properties

<table>
<thead>
<tr>
<th>Sample 1</th>
<th>Spectra 1</th>
<th>Prop 1</th>
<th>Prop 2</th>
<th>Prop 3</th>
<th>Prop 4</th>
<th>Prop 5</th>
<th>Prop 6</th>
<th>Prop n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample 2</td>
<td>Spectra 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sample 3</td>
<td>Spectra 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sample 4</td>
<td>Spectra 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sample 5</td>
<td>Spectra 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sample 6</td>
<td>Spectra 6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sample n</td>
<td>Spectra n</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

REFERENCE DATABASE USED FOR NIR PREDICTIONS
Properties $X = f \left( \text{Prop}[S1, S2, S3, S4, S5, S6] \right)$
TOPNIR™ SUMMARY

- Only a few number of samples required to build the database (densification process)
- Uses only a reference database to predict and calculate sample properties (no models to be built & updated)
- Update is easily done only by adding new sample in the database, with both NIR Spectra and conventional analysis
- Self-learning method without necessity of remodelling
- Outlier prediction
- When new sample is added, it is taken into account by Topnir™
- Patented technology
CRUDE UNIT ONLINE OPTIMIZATION

FTIR / TOPNIR On-line Analyzer

Process Control Advanced Process Control

1 stream analyzed every minute

Cut 1 Properties
Cut 2 Properties
Cut 3 Properties
Cut x Properties
Cut n Properties

CDU

Crude Feed Properties

Atmospheric Residue
TOPNIR CRUDE CDU PROJECT – GERMAN REFINERY
140,000 BBL/D
TOPNIR CRUDE CDU PROJECT – FEED ONLINE ANALYSIS

Real time Monitoring of Crude transition

Values Lab vs Nir for property %D140°C Feed
## TOPNIR CRUDE CDU PROJECT – PRODUCTS ONLINE ANALYSIS

<table>
<thead>
<tr>
<th>Property</th>
<th>Feed</th>
<th>HSRN</th>
<th>Kero</th>
<th>Mid</th>
<th>LVGO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dens@15°C</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>T5%</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>T95%</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Cloud</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flash</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Freeze</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%P</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>%I</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>%N</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>%A</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Visco@20°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>11 TBP cut points</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Properties estimation**

<table>
<thead>
<tr>
<th>Property Status</th>
<th>Property</th>
<th>Calculated</th>
</tr>
</thead>
<tbody>
<tr>
<td>DENS</td>
<td>026.6</td>
<td>H-BENZ</td>
</tr>
<tr>
<td>4D125°C</td>
<td>19.4</td>
<td>KERO</td>
</tr>
<tr>
<td>4D149°C</td>
<td>23.8</td>
<td>LUX</td>
</tr>
<tr>
<td>4D159°C</td>
<td>26.9</td>
<td>HGO</td>
</tr>
<tr>
<td>4D170°C</td>
<td>29.8</td>
<td>ATRES</td>
</tr>
<tr>
<td>4D193°C</td>
<td>32.9</td>
<td>KERO 5%</td>
</tr>
<tr>
<td>4D240°C</td>
<td>43.0</td>
<td>KERO 95%</td>
</tr>
<tr>
<td>4D250°C</td>
<td>46.9</td>
<td>KERO N+2A</td>
</tr>
<tr>
<td>4D290°C</td>
<td>50.8</td>
<td>KERO 95%</td>
</tr>
<tr>
<td>4D313°C</td>
<td>57.6</td>
<td>KERO 95%</td>
</tr>
<tr>
<td>4D340°C</td>
<td>61.8</td>
<td>K-FLASH</td>
</tr>
<tr>
<td>4D363°C</td>
<td>63.9</td>
<td>K-FREEZE</td>
</tr>
<tr>
<td>4S</td>
<td>0.30</td>
<td>LGO 5%</td>
</tr>
<tr>
<td>C5/C4</td>
<td>1.6</td>
<td>LGO CLOUD</td>
</tr>
<tr>
<td>C3</td>
<td>3.0</td>
<td>LGO 4%</td>
</tr>
<tr>
<td>GOSOLINE</td>
<td>10.3</td>
<td>HGO 95%</td>
</tr>
<tr>
<td>L-BENZ</td>
<td>13.1</td>
<td></td>
</tr>
</tbody>
</table>

**11 TBP cut points**

- BZ 5%: 126.8
- BZ 95%: 172.7
- BZ N+2A: 68.2
- KERO 3%: 177.1
- KERO 95%: 240.9
- K-FLASH: 41.9
- K-FREEZE: -45.7
- LGO 5%: 228.7
- LGO CLOUD: 1.6
- LGO 4%: 0.25
- HGO 95%: 363.2

**Sample Status**

- gennes dex EV-UF
## Properties of Crude Oil

<table>
<thead>
<tr>
<th>Property</th>
<th>Accuracy accord. to ASTM</th>
</tr>
</thead>
<tbody>
<tr>
<td>TBP curve</td>
<td>+</td>
</tr>
<tr>
<td>API</td>
<td>+</td>
</tr>
<tr>
<td>Sulphur, %</td>
<td>+</td>
</tr>
<tr>
<td>Assays Yield, %</td>
<td>+</td>
</tr>
<tr>
<td>TAN</td>
<td>+</td>
</tr>
<tr>
<td>Crude Assays</td>
<td>+</td>
</tr>
<tr>
<td>GOR</td>
<td>+</td>
</tr>
<tr>
<td>Carbon-Hydrogen ratio</td>
<td>+</td>
</tr>
<tr>
<td>Asphaltenes</td>
<td>+</td>
</tr>
<tr>
<td>RVP</td>
<td>+</td>
</tr>
<tr>
<td>others</td>
<td></td>
</tr>
</tbody>
</table>
TOPNIR RAW CRUDE PIPELINE

Raw Crude Pipelines
   Pipelines with Synthetic Crude and Conventional Crude
Two Phases Project
   Phase 1 in Lab successfully completed to prove feasibility
   Phase 2 for Online Application

More than 70 different Crude Oils
RAW CRUDE PROJECT
NIR SPECTRA DATA FOR RAW CRUDES
BEFORE AND AFTER SPECTRA TREATMENT

Absorbance vs Wavenumber (cm$^{-1}$)
Region of interest, 4,000 – 4,800 cm$^{-1}$

Before

After
EXAMPLE RESULTS: RAW CRUDE CHARACTERIZATION

1. IDENTIFICATION OF ALL CRUDE FAMILIES:
   - High / Low Density
   - High / Low Sulphur
   - High / Low TAN
   - High / Low MCR
   and so on…
EXAMPLE RESULTS:
RAW CRUDE CHARACTERIZATION

2. PREDICTION OF CRUDE PROPERTIES INCLUDING CRUDE ASSAY:

<table>
<thead>
<tr>
<th>Property</th>
<th>Min</th>
<th>Max</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAN</td>
<td>0.1</td>
<td>3.9</td>
<td>mg KOH/g</td>
</tr>
<tr>
<td>Total Sulfur</td>
<td>0.01</td>
<td>5.1</td>
<td>wt</td>
</tr>
<tr>
<td>Gravity, API</td>
<td>18.1</td>
<td>67.5</td>
<td>deg</td>
</tr>
<tr>
<td>MCR</td>
<td>0</td>
<td>13</td>
<td>(m/m) %</td>
</tr>
</tbody>
</table>

TBP CRUDE PREDICTION

CRUDE ASSAY
TOPNIR™ CRUDE OIL ECOPETROL, COLOMBIA

- Crude Pipeline Transportation Optimization
  - >140 Crude; Blend in Pipeline 3 to 40 Crudes
  - Crude Composition Known
  - Blend Ratio Unknown
  - Five Pumping Stations; Two Refineries - Barrancabermeja & Cartagena

- Scope
  - Crude Identification and Characterization

- Project Completed in 9 months

- ROI less than 6 Months
**ECOPETROL**

**CRUDE OIL MANAGEMENT PROJECT**

At-line Automatic Topnir Analyzer installed in Pumping Stations for Crude analyses by shift Operators
ECOPETROL CRUDE PROJECT - IDENTIFICATION
Plot of Crude Oil Mixtures

Application for End-members in Commingled oils
ECOPETROL CRUDE PROJECT - CHARACTERIZATION

Crude Properties: Distillation Curve (TBP), Rundown Yields, TAN, API, Sulphur, Density
Crude Assay delivered from Topnir

- A Fast Crude Assay giving TBP curve with Distillation cut yields, TAN, API Gravity, Pour Point, Viscosity @ 40°C and Sulphur

- A Full Assay Property Table including standard Distillation Cuts properties.
### Crude properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Unit</th>
<th>Description</th>
<th>TBP cut temp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density D15</td>
<td>kg/m³</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulphur</td>
<td>%wt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TAN</td>
<td>mg KOH/g</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pour Point</td>
<td>°C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viscosity 50°C</td>
<td>cSt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viscosity 40°C</td>
<td>cSt</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TBP Curve(IBP to FBP)</td>
<td>°C or °F</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Distillation Cut Yields</td>
<td>%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**GASES**
- C2-C5 LIGHT ENDS
- NAPHTHA
- LIGHT KERO
- HEAVY KERO
- LIGHT GASOIL
- HEAVY GASOIL
- LVGO
- VGO
- VACUUM RESIDUE

**TBP cut temp**
- IBP-15
- 75
- 160
- 230
- 270
- 330
- 390
- 430
- 540
- 540-FBP

**Distillation cut points are Standard or can be tuned to End User cut points request**
### TOPNIR CRUDE ASSAY ANALYZER

#### Crude Composition if Crude mixture (accuracy of +/- 3%)

<table>
<thead>
<tr>
<th>PRODUCT PROPERTIES</th>
<th>Units</th>
<th>GASES</th>
<th>C2-C5 LIGHT ENDS</th>
<th>NAPHTHA</th>
<th>LIGHT KERO</th>
<th>HEAVY KERO</th>
<th>LIGHT GASOIL</th>
<th>HEAVY GASOIL</th>
<th>LVGO</th>
<th>VGO</th>
<th>VACUUM RESIDUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density @15°C</td>
<td>(kg/m³)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Sulphur</td>
<td>(%wt)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Naphtene</td>
<td>(%wt)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Aromatic</td>
<td>(%wt)</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TAN</td>
<td>(mg KOH/g)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Freezing point</td>
<td>(°C)</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cloud point</td>
<td>(°C)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>CFPP</td>
<td>(°C)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Pour point</td>
<td>(°C)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Flash point</td>
<td>(°C)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Cetane index</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Viscosity @40C</td>
<td>(cSt)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Viscosity @50C</td>
<td>(cSt)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Distillation Curve</td>
<td>(%)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Total nitrogen</td>
<td>(%)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Basic nitrogen</td>
<td>(%)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Conradson Carbon</td>
<td>(%wt)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Any other Properties can be added on request
LABORATORY - FTIR + TOPNIR
ON-LINE: FTIR + TOPNIR HARDWARE

TOPNIR installation inside Shelter
ON-LINE : FTIR + TOPNIR CRUDE SAMPLING

TOPNIR SCS for Crude Oil
TOPNIR CRUDE DISTILLATION
ARAMCO, YANBU, ARABIE SAOUDITE

200,000 BPD refinery
9 Streams – Crude, LSRN, HSRN, CDU HSRN, KERO, LDO, ADO, HDO, RCO

Advanced features
- On-line analysis based on optic fibers
- Analyzer integrated in a shelter
- On-line analysis 117 Properties
- Turn-key system

The Biggest NIR Project of the World!
ON-LINE: FTIR + TOPNIR FOR CRUDE OILS

TOPNIR SCS wall on Shelter
ON-LINE: FTIR + TOPNIR FOR CRUDE OILS

TOPNIR installation inside Shelter
FTIR + TOPNIR™: On-line Crude Solution

- Better Crude Allocation and Segregation
- Crude Blending Optimization
- Crude Switch Optimization
- Distillation Curve (TBP) always available
- Crude Assay
- Crude Stability Index
- Feed Preparation Giving Greater Stability
- Feed Optimized for Different CDU Modes
- Crude Throughput Increase

Benefits: $3-10 Million/year
TOPNIR SYSTEMS CONTACT POINTS

Julie WILLIAMS, Sales & Marketing Director, North America
Cell:  (1) 508-736-2696
Email: julie.williams@topnir.com

Didier LAMBERT, President
Phone:  +33 442 507 340, Cell:  +33 677 039 657
Email: didier.lambert@topnir.com
Topnir Systems
**Local Densification (outlier)**

- with database samples
- with extreme samples (components or untypical Crude)

**Calibration Database**

**OUTLIER PREDICTION WITHIN ASTM**

Component A

Component B

Component C

New Sample
**Benefits with Topnir on Crude Distillation Unit**

**Crude Throughput Transition Losses**

- Estimated Throughput Gain = 3000 - 4000 t / Transition
- 3 Transitions / week = 150,000 - 200,000 t / year

Without Topnir, Change is anticipated
- TO AVOID COLUMNS FLOODING
- TO AVOID HEAT SHOCKS ON EXCHANGER TRAIN
- FEEDBACK CONTROL.
Atmospheric Residue (ATRES) Yield Monitoring

4% Yield difference

Saving: $300,000

Achieved
NIR
LP

30  60
TIME (h)
35  40  45  50  55  60

60 hrs
TOPNIR & Asphaltene Stability Index (ASI) for Crude Oils

Crude Asphaltene Stability Index (or Crude Compatibility Index) is a function of:
- Asphaltene / Resin ratio
- Saturates / Aromatics ratio
- Light Fraction yield
- API Gravity
- Viscosity
**CRUDE BLENDING SIMCRUDE**

**Simcrude interface**
CRUDE BLENDING SIMCRUDE

Simcrude calculation
TOPNIR REFINERY PERFORMANCE

For typical 100,000 bpd Refinery

- Crude Unit
  - Tank Farm
    - $0.5-1M
  - $1.5-5M
  - $2-5M

- Saturate Gas Plant
  - $0.5-1M
  - $1.5-2.5M

- Hydrotreating
  - $0.5-1M

- Isomerization
  - $1.5-2.5M

- Reformers
  - $0.5-1.5M

- Hydrocracker
  - $2-5M

- Cat Cracker
  - $1.5-3M

- Alkylation
  - $1.5-3M

- Blending
  - $1.5-4.5M

- Vacuum
  - $2-3M

- Coker
  - $2-3M

- Utilities
TOPNIR SYSTEMS

Patents and IPR

- More than 30 Patents covering all applications
- Key Technology Patents renewed on 2013 – 2014
  - Technology protected for the next 20 years
  - Patents cover some Upstream applications
  - Other Patents pending
- Topnir Trade Mark in France, GB, USA and China
- Strong Patent policy with regular patent filling
- Freedom To Operate
**TOPNIR APPLICATIONS WORLD-WIDE (1)**

- **Gasoline Blending**
  - BPO Lavera
  - BPO Grangemouth
  - BPO Castellon
  - Shell DEA Germany
  - Shell Thaï Oil Sriracha
  - Shell CRC Litvinov
  - Shell NZRC New Zealand
  - Shell Sapref Durban
  - Sasol South Africa
  - SIR Abidjan
  - Adnoc UAN / Ruwais
  - Aramco Yanbu
  - MOL Hungary
  - Bapco
  - Parco
  - CPC Kaohsiung
  - KOA Osaka
  - KOA Marif
  - Aramco Ras Tanura
  - Petronor Repsol Spain
  - Slovnaft Slovakia
  - Aramco Riyadh
  - Ineos Lavera
  - Naftec Arzew
  - ENAP Conception Chile
  - Petrovietnam Dung Quat
  - ConocoPhillips Ireland
  - ConocoPhillips USA, Alliance
  - Ineos Grangemouth

- **Gasoline Blending (Cont’d)**
  - CRC Kralupy
  - Sonatrach Algiers
  - Petron Bataan Philippines
  - Pemex, Tula, Mexico
  - Ancap, Montevideo, Uruguay

- **Gasoil Blending**
  - BPO Grangemouth
  - BPO Lavera (Lab)
  - Sasol South Africa
  - Adnoc UAN
  - ADNOC Ruwais
  - Bapco
  - Aramco Ras Tanura
  - Shell DEA Wesseling
  - Repsol Bilbao
  - Slovnaft
  - MOL Hungary
  - French Army Laboratory
  - Reliance India
  - Ecopetrol Barranca
  - Petrovietnam Dung Quat
  - Petrobras Replan Brazil
  - Petroplus Cressier, Switzerland
  - ConocoPhillips USA, Alliance
  - Petrochina Dushanzi
  - CRC Kralupy
  - Zeeland Refinery, Vlissingen

- **Clean Fuels & Bio Fuels**
  - Innoven Lavera
  - MOL Hungary
  - Slovnaft Slovakia
  - Petronor Repsol Spain
  - Shell Wesseling Germany
  - CRC Litvinov Czech Republic
  - BP Castellon Spain
  - Ineos France
  - Ineos Grangemouth
  - Eneos, Osaka, Japan
  - Thai Oil Sriracha, Thailand

- **Reformer**
  - BPO Lavera
  - Aramco PP Dhahran
  - MOL Hungary
  - BP Castellon
  - Ineos Grangemouth
  - Ineos Grangemouth
  - Shell Wesseling
TOPNIR APPLICATIONS WORLD-WIDE (2)

- **Crude Oil Production & Optimization**
  - BP Forties Pipe Line, UK
  - Ecopetrol Colombia
  - Marathon, Catlettsburg, USA
  - BP Whiting, IN, USA
  - Crude Quality Inc, Edmonton, Canada
  - Shell E&P, Houston, USA

- **Crude Oil Distillation**
  - BPO Lavera, France
  - Takreer Adnoc, UAN
  - Shell DEA, Germany
  - Aramco Yanbu, KSA
  - Ecopetrol, Colombia
  - Galp Porto, Portugal (Rundowns)
  - Marathon Catlettsburg, USA
  - BP Whiting, IN, USA

- **Heavy Feed (FCC and other Plants)**
  - BPO Lavera (Lab), France
  - BPO Castellon, Spain
  - Shell Petit Couronne, France
  - Petroplus, France
  - Petroplus Cressier, Switzerland

- **Naphtha Cracker**
  - Total / Ineos Lavera
  - BPC Grangemouth
  - Braskem Copene Brazil
  - Erdolchemie
  - Petrochina Dushanzi
  - ExxonMobil Singapore
  - Gazprom Salavat, Russia

- **Base Oils**
  - BP / Elf Dunkirk
  - Shell Petit Couronne

- **Solvent & Chemicals**
  - Total Fluides Oudalle
  - BP Chemicals Lavera
  - Polymers PE, PP, PIB, Polyols

- **Terminals**
  - BP France Frontignan
THE IMPLEMENTATION PROCESS: TURNKEY PROJECT

TOPNIR DELIVERABLES

- Hardware (Topnir Analyzers, sampling systems, ancillaries)
- TOPNIR Software
- TOPNIR reference database
- Sites Services
  - KOM & Site Survey
  - One Progress Meeting
  - FAT
  - Commissioning & Start Up
  - System validation & SAT
- Topnir License and Patents Immunity
- One year warranty on
  - Hardware
  - Software
  - Topnir results
- Maintenance
  - Local Support
  - Remote maintenance
  - Long term support

Typical Schedule is 8 – 10 months from PO to Site Acceptance Test (SAT)