SUMMARY

1. Big Data in a Petroleum Refinery
2. Treatment of Plant Data
3. Digital Twin of the Plant
4. SRU Prototype
5. Conclusions & Action Plan
MAIRE TECNIMONT GROUP: TECHNOLOGY DRIVEN EPC CONTRACTOR

BUSINESS STRUCTURE

We are an industrial Group able to manage end-to-end the value chain in all its phases, offering a range of services with a high degree of flexibility.

Hydrocarbon Processing
- Tecnimont
- KT - Kinetics Technology
- Stamicarbon
- Met Gas Processing Technologies

Renewable & Green
- Neosia Renewables
- NextChem

New Business Model
- Met Development
TECHNOLOGICAL LEADERSHIP

**PETROCHEMICALS**
- Well rooted technology orientation: Market leader (#1) for installed capacity (last 10yrs)
  - 30% market share in polyolefin plants
  - 50% market share in LDPE plants

Since 1970
- More than 200 polyethylene and polypropylene plants completed

**FERTILIZERS**
- Market share in licensing urea plants technology (#1 worldwide)*
- 54%

Since 1924
- 172 ammonia and urea plants completed

**OIL & GAS REFINING**
- Well recognized leadership in licensing hydrogen technology and in licensing sulphur recovery and tail gas treatment technology
- World class track record in large gas treatment plants and refinery process units

Since 1971
- More than 250 hydrogen and sulphur recovery unit projects completed

**INVESTED IN INNOVATION**
- €50 MLN

**R&D PROJECTS**
- 70

**In Green Acceleration**
- (last 5yrs)

**Strong commitment to technology development**
- ~1,300 cumulated patents
In this era of low oil & gas commodity prices, improvements to process and technology efficiencies begin to emerge as a critical success factor. Aging assets across application areas that were economically viable when oil prices were high, are now too inefficient to compete in a low-commodity-price economy.
Plant Data are utilised by Operator to take a decision in all operating scenarios:
KT WAY TO UNLOCK THE VALUE OF BIG DATA

KT Digital Platform

NEW SMART “APP” for the Management of Plant Data

KT “APP” is capable to support 24h/day Operator in achievement of Plant Operation Excellence and Full Plant Profitability

KEY WORDS:
Plant Model, Data Validation, Data Reconciliation, Reliable Data, Monitoring Plant Performances, Plant Optimization, Maintenance, Safety, Training
KT “DIGITAL PLATFORM”

- KT “Digital Platform” is an Engineering Tool that works like an “APP” based on our customised and proprietary Plant Model developed on top of SYMMETRY Process modelling solution.

- What you can do with our App:
  - Model the real behaviour of the Process Unit
  - Perform Data Classification, Validation and Reconciliation of Plant Data through mathematical algorithms, returning reliable consolidated results
  - Analyse the results of a change of one or more operating parameters “off-line” for and easy and smoother Plant Optimization

**Our way to “bring our expertise closer to operation”**
MEASURED PLANT DATA

\[ Y = X \pm e \]

- Error
- True Value
- Measured Value

INSTRUMENT TYPES
OF FAULTS

- Bias
- Complete Failure
- Drifting
- Precision Degradation

- Corrupted Data
- Correct Data
In a “Real Plant”:

\[ F_1 - F_2 - F_3 \neq 0 \]

because INSTRUMENT ERROR

How to solve the problem?

It is necessary to “refine” the Plant Data utilizing a mathematical technique:

\[
\Phi_{\text{MIN}} = (F_1 - X_1)^2 + (F_2 - X_2)^2 + (F_3 - X_3)^2
\]

<table>
<thead>
<tr>
<th>( X_i )</th>
<th>( X_1 )</th>
<th>( X_2 )</th>
<th>( X_3 )</th>
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<td>46.67</td>
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This technique is called DATA RECONCILIATION

“PLANT DATA REFINING” \( \rightarrow \) RELIABLE DATA
THE IMPORTANCE OF RELIABLE DATA - CASE STUDY

When the Flame Temperature in Thermal Reactor is too high...

Our proprietary Data Processing Technique can be utilised by industry to reduce and/or completely eliminate the effects of Random Errors
KT DIGITAL TWIN - DATA RECONCILIATION

Three ingredients are required:

- Measurements Data (DCS DATA)
- Plant Model (Rigorous PROCESS SIMULATOR - SYMMETRY)
- Mathematic Optimizer (Solver for $\Phi_{MIN}$)

DATA Reconciliation is the adjustment of DCS Data...

Plant Model has to “mirror” the behaviour of Real Plant...
Efficient use of ALL Plant Data to support Operator in achieving Operation Excellence and Full Plant Profitability
KT DIGITAL TWIN - HOW IT WORKS

AAG

Thermal Reactor train 1

Claus Reactors train 1

S. Degassing train 1

RAR Section

SWSAG

Thermal Reactor train 2

Claus Reactors train 2

S. Degassing train 2

INC Section

AMB. AIR

O2

AAG

SWSAG

AMB. AIR

O2

THERMAL REACTOR

- Flame temperature: 1365 °C
- Refractory temper.: 238 °C
- WHB temperature: 287 °C
KT DIGITAL TWIN - HOW IT WORKS

- DASHBOARDS
- ADDITIONAL INFO
- DCS GRAPHIC PAGES
- TRENDS
- MESSAGES
- HELP
- ABOUT
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KT DIGITAL TWIN - HOW IT WORKS

DASHBOARDS

ADDITIONAL INFO

DCS GRAPHIC PAGES

TRENDS

MESSAGES

HELP

ABOUT
CONNECT PEOPLE...

SA-SRU:
- Connect to Real-Time Plant Data
- Process the Data through engines: algorithms and models (Symmetry)
- Provide Engineering Information to Operators through Dashboards
- Off-line usage for Engineering What-If Analyses
- Promote collaboration between disciplines and specialists

SA-SRU:
- Manage Field Tasks
- Visualize Work Instructions/Reports from one shift to another
  - Provide Real-Time Information on Equipment Status
  - Monitor Equipment Performance
  - Predict Equipment Service Run-time
  - Plan BETTER the Maintenance

SA-SRU:
- Give assessment on Full Plant Profitability by increasing valuable products, reducing by-products, minimizing energy consumption
- Optimization takes into account Plant Constraints (Equipment/Utilities/Emissions)
- Allow direct connection to Experts to improve economics/debottleneck

PLANT DIGITAL TWIN

PLANT MANAGEMENT

HSE EXCELLENCE

MAXIMIZE REVENUES

Supervisory Analytics for SRU
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