How Air Liquide Leverages on PI Technologies to Optimize its Operations - SIO.Optim program

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Agenda

• Introduction to Air Liquide
• The Smart Innovative Operations initiative
• ALIZENT, a key partner
• The Smart Innovative Operations Centre in Kuala Lumpur
• Business Challenge
• Method and Results
• Conclusion
Conference Theme & Keywords

Keywords: Optimization, Data Analytics, ASU, Smart, Decisions, Airlaque, Accessible, Mathematical Modeling, Share, Digital Transformation, Deployment.
Air Liquide Key Figures

- **66,000 Employees**
- **Present in 80 Countries**
- **Revenue €21 Billion**
- **Net profit €2.1 Billion**
- **More than 3.6 Million Customers & Patients**
Air Liquide Large Industries Operations

- **365** Large Air Separation Units
  Oxygen, Nitrogen, Argon

- **50** Steam Methane Reformer Units
  Hydrogen, CO, Syngas

- **18** Cogeneration Units
  Steam & Power

- **Oil & Gas, Petrochemicals & Metals customers**

- **Best in class performance in safety and availability.**

- **We improve the efficiency of our customer processes and help them preserve the environment.**

- **Present in every key industrial basin worldwide**
Air Liquide Large Industries Ambition

**Leading Approach**
- proactive handling of operational drifts (“detect incidents before they happen”)

**Industrial Sustainability**
- make sure what we work on will improve and continue

**Double the efficiency gain**

**Zero unplanned shutdowns**

**2020**

**Connecting**
- Industrial expertise socialization
- Fleet and data socialization

**Digitalization**
- is key to enable all 3 above initiatives
Air Liquide Large Industries
Smart Innovative Operations Initiative
The Smart Innovative Operations Initiative

DRIVE = PREDICT = OPTIM = PERFORM

Evolution of OCC
- Automation and infrastructure for high level and safe remote operation

Predictive Analytics Monitoring
- Early detection of potential failure

Business Analytics Monitoring
- Operation decisions based on real time margin

Best Economical Performance
- How to use data to improve economic performance of our assets
Alizent, an End to End Key Partner

Created by Air Liquide
to connect industrial assets
and being digital technology experts
enablers for industries
to improve their operating model
by combining deep data know-how with
skilled proficiency in industrial processes.
Alizent, a Global Reach for the SIO Initiative

- **People**
  - 3 continents
  - Data Scientists
  - IT Architects
  - PI Experts

- **Processes**
  - Agile
  - Iterative
  - Collaborative
  - Customer focused

- **Phases**
  - Proof of Concept
  - Pilot
  - Industrialize
  - Operate

8 Offices to serve clients
4 Networked Technology Centers (Houston - Paris - Madrid - Montreal)

- 5 PI system accreditation
- 250+ employees
- 12 nationalities

- 12 nationalities
PI Suite Operated by Alizent

Plant 1
DCS station

Plant 2
DCS station

Plant n
DCS station

Plants Local server
interfaces / connectors

Plants Local server
 Pi Data Archive

Plants Local server
interfaces / connectors

User access

Zone Central server
PI-to-PI & APS

Central PI Data Archive + PI AF

External Data sources

Technical information
- + 250 plants

PI Data Archive
- 2 central servers
- 20 TB of Data
- + 600 000 tags
- + 1 B Data collected everyday

PI Assets Framework
- 2 central servers
- + 40 databases
OSIsoft-Air Liquide Enterprise Agreement: a Key Enabler

**Before**

- Open license limiting;
  - number of tags
  - types of interface
  - upgrades

**With Enterprise Agreement**

- 1 unlimited license with NO LIMIT on
  - tag
  - user tools
  - Access to Osisoft tool
  - Training

**Boost the SIO Projects**

**Interconnect the solutions**

**Collect more data from the field**

**Visualize the data**
Air Liquide Business Services in Malaysia
The Smart Innovative Operations Centre (SIOC)
The Remote Operations Control Centres (ROCCs)
Remote Operations Control Centre

The ROCC missions:
- control and drive production 24/7
- in parallel, operate at the best economical points in real time
- conduct predictive maintenance actions
- optimize the networks

Data is the raw material:
- leveraging up to 10 years history
- and PI technologies
  - 700 daily users accessing PI data
  - More than 1000 pages shared among the community
- Deploying PI Vision pages
Air Liquide Singapore Pipeline Network

Air Liquide Singapore pipeline network:
- ~200 km long
- 5 production plants
- **Dozens** of rotating equipment
- Serving Large Industries **major customers**

Challenges:
- **Machines** with different technologies and generations
- In such complex system, a decision-support tool is required to ensure the **optimal combination** of equipment and **plant load** to serve at best our customers
SIO.Optim: Data Analytics and Optimization for Large Industries

- Using operating data, a generic model is trained to mimic the system behaviour.

- This **Digital Twin** of the Singapore Network is used to find the optimal combination of compressors and plant loads.

- **Live for months in ROCC**

- **A collaborative work between**
  - Performance Analytics Engineers
  - Real Time Engineers
How to Build the Models?

Step #1: Template definition & creation with PI System Explorer
Step #2: Deployment Using PI AF

ROCC + Plant = Validated tag

Quick deployment

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</table>
Step #3: Analytics Definition Using PI System Explorer

- **Asset Analytics**
- **Asset Framework**
- **Data Archive**

**Easy management**

**Testing before deployment**

**Power Model** (Template analysis)
Step #4: Connecting with Ecosystems: Internal Expertise

Air Liquide experts core models

**Why develop a general optimization engine?**

- Standardization
- Share Experience
- Build and preserve know-how
- Sustainability of solution
- Reduce technical risk
- Capitalize on past experience
- Increase collaboration
- Fast deployment
- State-of-the-art optimization technology
Step #4: Connecting with Ecosystems: PRiSM

- Preferred predictive maintenance platform at Air Liquide
- User-friendly tool for data cleaning
- Linked with high fidelity, rich PI data
Step #4: Connecting with Ecosystems: Seeq

Solution -- Seeq empowers to deal with time series data in their day-to-day work, with advanced analytics

Usage:

- Search for historical periods of similar behaviour,
- Look for correlations among trends taking into account time delays,
- Develop monitors and alerts based on predictive models, etc.

Technology:

- High speed search engines,
- Advanced filter options and pattern recognition technology,
- Naturally connected to PI System and PI AF
Step #4: Connecting with Ecosystems: Seeq

1) **Data Source**
   Direct connection to PI

2) **Build in Data**
   - Cleaning
   - Formula function

3) **Regression**
   - Expanded basis, multi-variable to predict one parameter.
   - Easy training window selection
Step #4: Connecting with Ecosystems: Seeq

4) Instant display of regression result

- Select regression methods, Scale, Training window until satisfactory regression is obtained.

- Instant Display of calculated variable with regression and comparison with actual data
Step #4: Connecting with Ecosystems: AIMMS

**AIMMS Platform**

- Preferred modeling and optimization platform at Air Liquide
- User-friendly tool for non optimization experts
- Modularity and flexible user interface design
- Linked with an home made configuration wizard
- Linked with high fidelity, rich PI data
- Allows closed or open loops optimization
The Smart Innovative Operations Centre

Air Liquide
Operational data integration, applications, and analytics infrastructure

Plant process data
External informations: energy price, ...
Pipelines informations, metering and billing ...
Air Liquide

The Journey of the PI System at Air Liquide Operations in the 21st Century

**CHALLENGE**
Leverage the millions of data collected at SIO KL to improve operations in pipeline networks

**SOLUTION**
AF implementation & leverage:
- PI tools to model assets
- SIO.Optim tool developed by AL experts
- connecting with partners like AIMMS, PRiSM and Seeq

**RESULTS**
- Leading
- Optimization
- Customer satisfaction
- Collaboration with plant operations teams, external partners
- Unnecessary energy consumption
- CO2 emissions
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Questions?

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