# Remote monitoring & optimization for Air Liquide plants using AF/EF From

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# Conference Theme & Keywords

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# Air Liquide Industries
# **Smart Innovative Operations Initiative**


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# Air Liquide key figures

~65,000
EMPLOYEES

Present in
80
COUNTRIES

Revenue
€ 20.3
BILLION

Net profit
€ 2.2
BILLION

More than
3 MILLION
CUSTOMERS & PATIENTS


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# Large Industries perimeter

**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.


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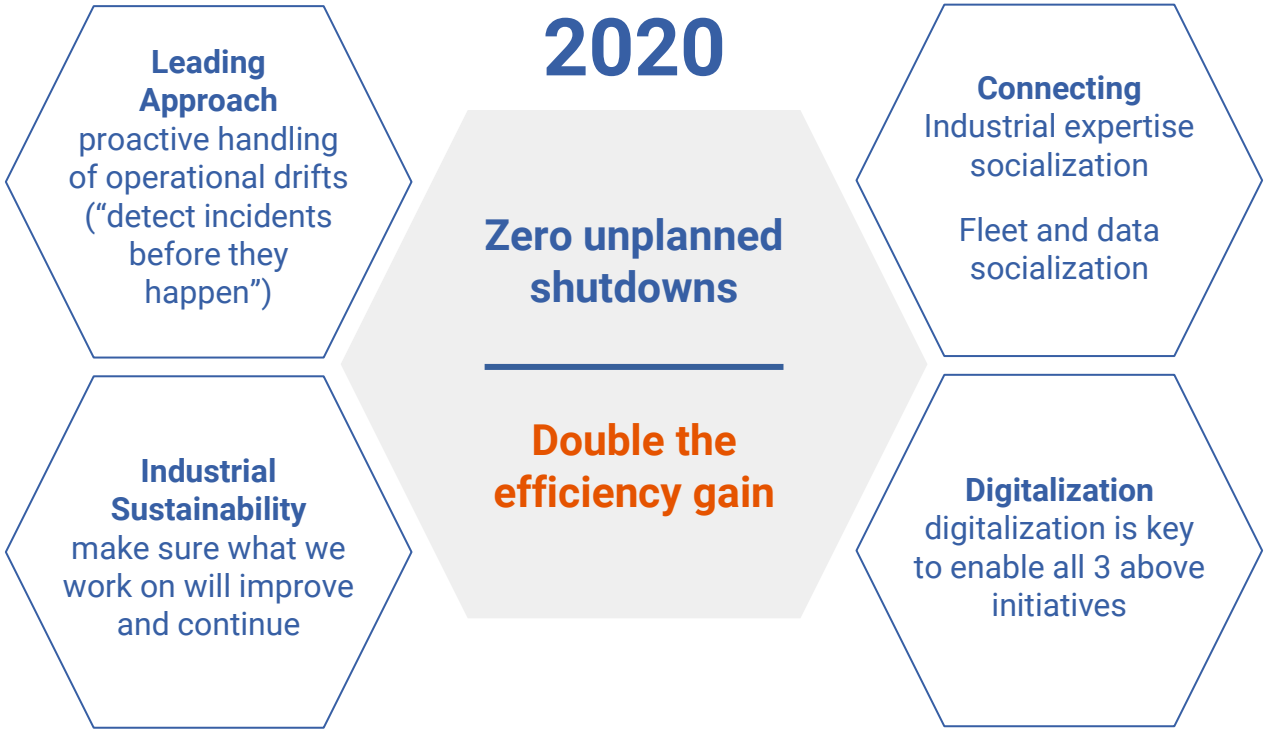
# Air Liquide Large Industries business challenge





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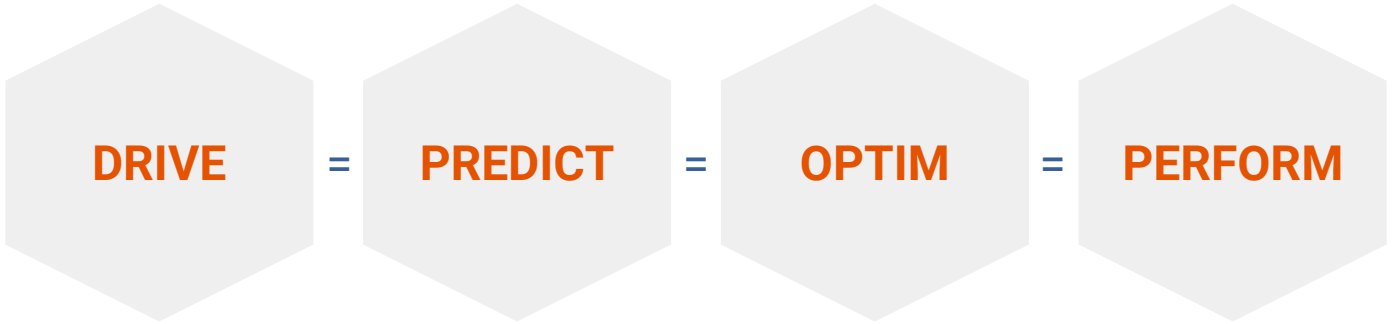
# Air Liquide Large Industries business challenge




**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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# SIO.Drive - ROCC

**2**

ROCCs

**24/7**

Providing service to customers supplied in industrial gases

**22**

Production units connected to the remote center

**20**

Million euros of investment

**8+**

Countries in Southeast Asia with units to be progressively connected

**18+**

Production units will be progressively connected to the remote center

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a Key Partner


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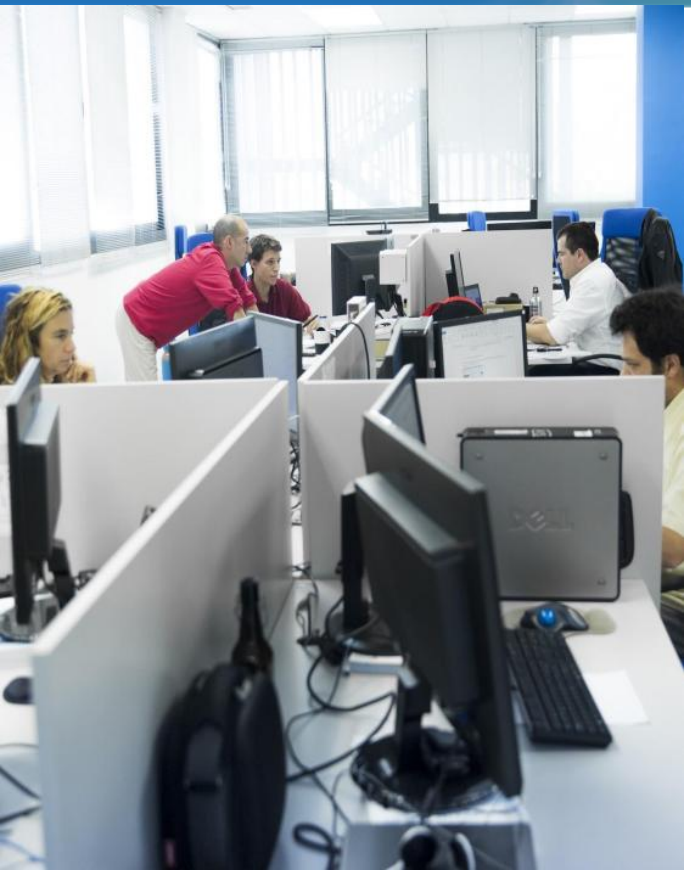

# Alizent purpose

Alizent is a fully owned subsidiary of Air Liquide, dedicated to **Industrial Internet of Things.** We **design** and **operate** solutions that **connect assets** to provide data and enhance performance to:

- deliver Air Liquide Digital Transformation for asset management and production & logistics optimization
- **serve non competing 3rd party clients** facing similar challenges as AL in their Digital transformation. Ex: LPG Industry - Beer Industry - Aluminum Industry - Health & Wellbeing Industry - Food Industry


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# Alizent - local presence and global reach

- **7 Offices to serve clients from**
- **3 Networked Technology Centers**
  (Paris - Madrid - Montreal)

- 250+ employees
- 20+ years of experience
- ISO 9001
- Digital Studio facilities in Paris

Digital Studio - Paris


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# Alizent augments industrial & medical assets with data

**Returnable Assets:** *22M assets tracked today*

**Remote Assets :** *205k connected assets today*:

**Production Assets :** *200+ plants supervised today*

## Alizent Value Proposition

Accelerate rotation
Anticipate demand
Inventory & working capital optimization
Avoid losses / detect theft
Attach info to the asset
Enable new distribution & business model

Optimize service costs (refill, maintenance…)
Collect & share information with client / users / patients
Enable new distribution & business model

Improve plant performance
Traceability of production / regulation compliance
Pool operation teams across several assets
Enable new distribution & business model


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# SIO Program and Alizent

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

**Processes**
- Agile
- Iterative
- Collaborative
- Customer Experience

**Phases**
- Proof of Concept
- Pilot
- Industrialization
- Operation


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# Air Liquide Industries France
# **New Remote Operation Control Center (ROCC)**


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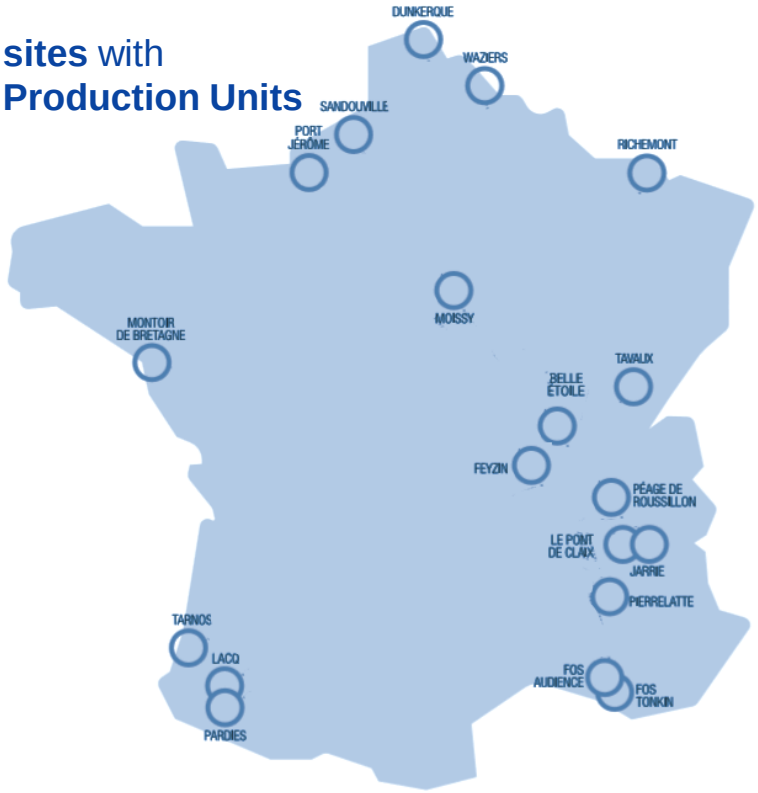
# ALFI before ROCC

**19 sites** with
**22 Production Units**



- Plant manager
- Production supervisor
- Technicians

- Safety
- Production optimization
- Maintenance
- Local customer service
- Regulatory compliances
- Billing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# Old habits with PI System

PI ProcessBook

**Ownership and update**

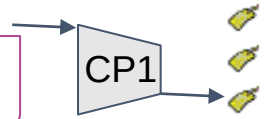
- Creation numerous displays incorrectly shared, updated and/ or questioned

**Files multiplicity**

- For x same equipment x views meaning x files to maintain

Data Archive

PI DataLink




**Time consuming**

- Numerous tags and tag naming across AL not homogeneous
- => spend time searching/asking

**1 expression 5 experts 5 results**

- For 1 measure on 1 equipment 5 tags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# ALFI with ROCC

## A unique remote operation center connected to production units in France

Based in Saint-Priest, the remote operation and optimization center is gradually being connected to 22 units producing gases for industry and health in France.

In the production units, the teams are able to focus on equipment safety and performance.

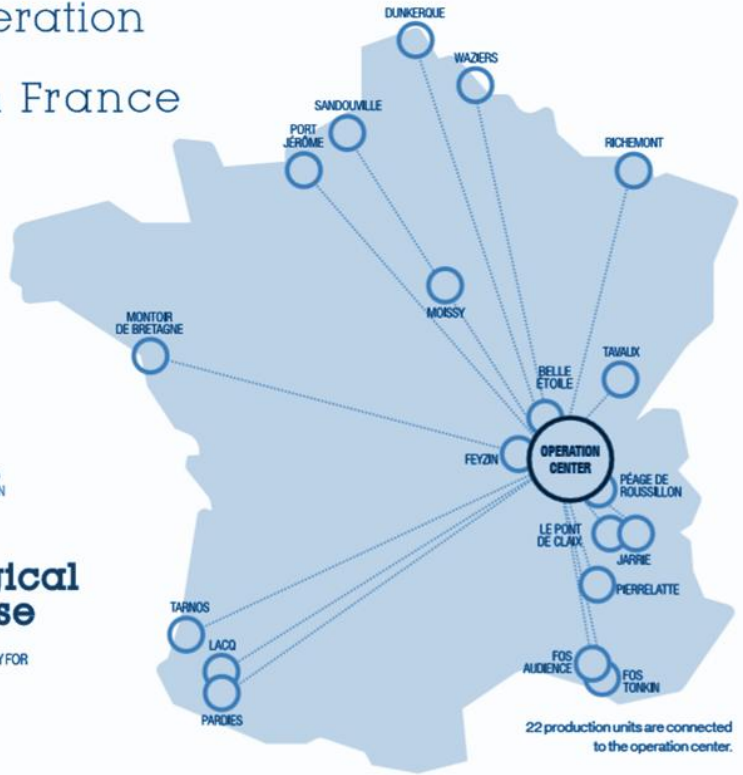
**1**
REMOTE OPERATION AND OPTIMIZATION CENTER

**20**
MILLION EUROS OF INVESTMENTS

**22**
PRODUCTION UNITS CONNECTED TO ONE REMOTE OPERATION AND OPTIMIZATION CENTER

**24/7**
PROVIDING SERVICE TO CUSTOMERS SUPPLIED IN INDUSTRIAL GASES

**Technological showcase**
CERTIFIED BY THE INDUSTRY FOR FUTURE ALLIANCE[1]




22 production units are connected to the operation center.

1. *Alliance Industrie du Futur*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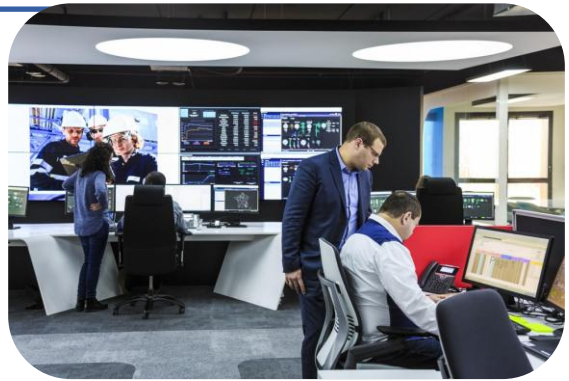
# New roles and challenges



Real time pilot

Analyst

- Production optimization
- Predictive maintenance
- Customer service
- Automatic billing

Plant manager

Foreman

Technicians

- Safety
- Equipment availability
- Maintenance
- Regulatory compliances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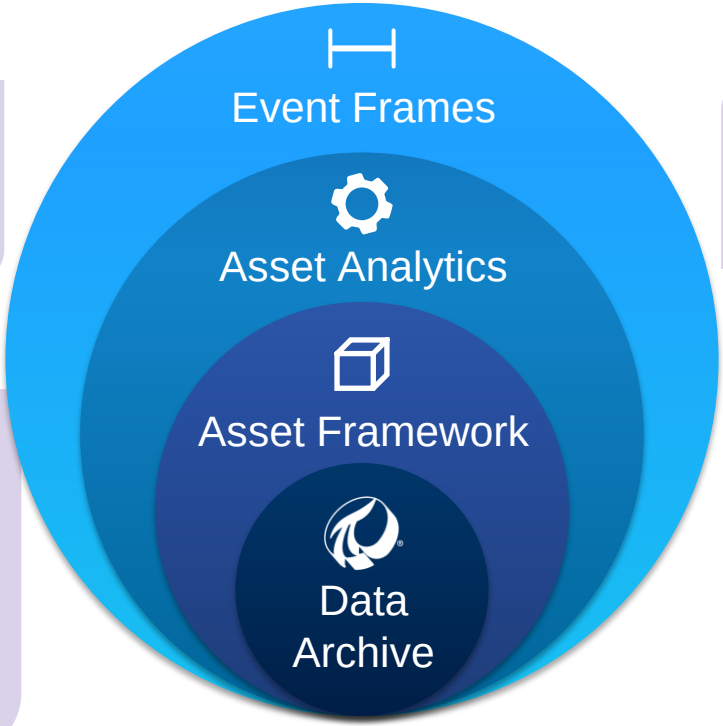
# Product impact for real time monitoring and optimization

## PI ProcessBook

- Less file using Element relatives display
- information access facilitated

## PI Vision

- Easy share of displays and EF
- Clear ownership / display update ++
- Possibility to import ProcessBook display/share easily




## PI DataLink

- Retrieval of data from analytics
- EF frequency and relevance easy to assess

## PI System Explorer

- User friendly access to database management & testing

## PI AFBuilder

- Quick deployment of data in AF databases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# Implementation - Template definition & creation with PI System Explorer

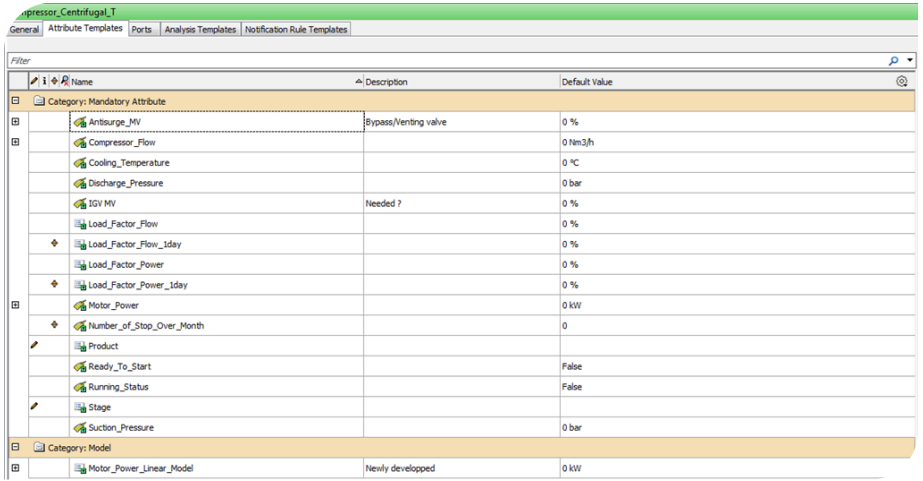
**PI System Explorer**

**Asset Framework**

Data Archive

ROCC
+
Plant
+
Business expert
=
X templates

Template





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# Deployment using PI AFBuilder

PI AFBuilder

Asset Framework

Data Archive

ROCC
+
Plant
=
Validated tag

**Quick deployment**

T

1 Inlet Flow Power

2 Inlet Flow Power

3 Inlet Flow Power

4 Inlet Flow Power

| Attribute →<br>Element ↓ | Inlet Flow | Power |
|---|---|---|
| 1 | FI45 | P451 |
| 2 | FI678 | P589 |
| 3 | FI986 | P325 |
| 4 | FI879 | P598 |


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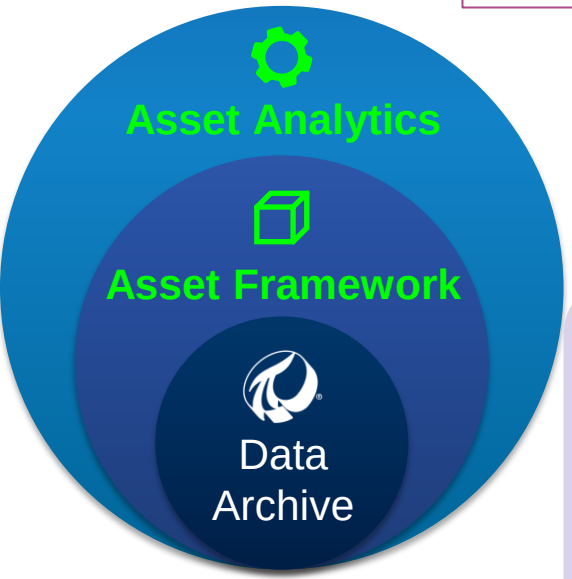
# Analytics definition using PI System Explorer

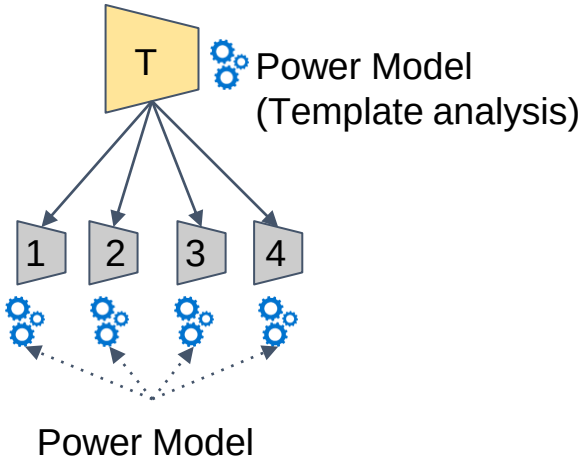



PI System Explorer

Easy management

Testing before deployment

| Name | Expression | Value at Eval |
|---|---|---|
| flow | If BadVal('Motor_Power_Linear_Model|Power_Model|Flow') then 0 else 'Motor_Power_Linear_Model|Power_Model|Flow' | |
| temperatureCooling | If BadVal('Motor_Power_Linear_Model|Power_Model|Temperature_Cooling') then 0 else TagAvg('Motor_Power_Linear_Mo | |
| pressureDischarge | If BadVal('Motor_Power_Linear_Model|Power_Model|Pressure_Discharge') then 0 else 'Motor_Power_Linear_Model|Powe | |
| pressureSuction | If badval('Motor_Power_Linear_Model|Power_Model|Pressure_Suction') then 1.013 else 'Motor_Power_Linear_Model|Po | |
| pFlow | 'Motor_Power_Linear_Model|Power_Model|Coefficients|Coef_Flow'*flow | |
| pTemp | 'Motor_Power_Linear_Model|Power_Model|Coefficients|Coef_Temperature_Cooling'*temperatureCooling | |
| pDischargeP | 'Motor_Power_Linear_Model|Power_Model|Coefficients|Coef_Pressure_Discharge'*pressureDischarge | |
| pSuctionP | 'Motor_Power_Linear_Model|Power_Model|Coefficients|Coef_Pressure_Suction'*pressureSuction | |
| pConstant | 'Motor_Power_Linear_Model|Power_Model|Coefficients|Coef_Constant' | |
| powerReal | If badval('Motor_Power_Linear_Model|Power_Real|Power_PV') then 0 else Round('Motor_Power_Linear_Model|Power_Rea | |
| efficiencyReal | If 'Motor_Power_Linear_Model|Power_Model|Inhibitor'="True" or flow=0 or temperatureCooling=0 or pressureDischar then 0 else Round(1000*(0.000103137*temperatureCooling*flow*Log(pressureDischarge/pressureSuction))/powerReal)/10 | |
| powerModel | If 'Motor_Power_Linear_Model|Power_Model|Inhibitor'="True" or flow=0 or temperatureCooling=0 or pressureDischa then 0 else Round(pFlow+pTemp+pDischargeP+pSuctionP+pConstant) | |
| efficiencyModel | If 'Motor_Power_Linear_Model|Power_Model|Inhibitor'="True" or flow=0 or temperatureCooling=0 or pressureDischa then 0 else Round(1000*(0.000103137*temperatureCooling*flow*Log(pressureDischarge/pressureSuction))/powerModel)/10 | |
| deltaPower | If 'Motor_Power_Linear_Model|Power_Model|Inhibitor'="True" or flow=0 or temperatureCooling=0 or pressureDischa then 0 else powerReal-powerModel | |




Power Model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# Data exploitation using PI DataLink

PI DataLink

Asset Analytics

Asset Framework

Data Archive

New database
- Contextualized
- Validated data
- Accessible by all

T

1

2

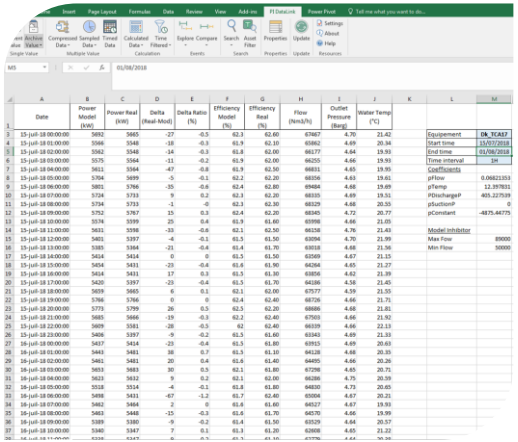
3

4

Power Real

Power Model

Gap

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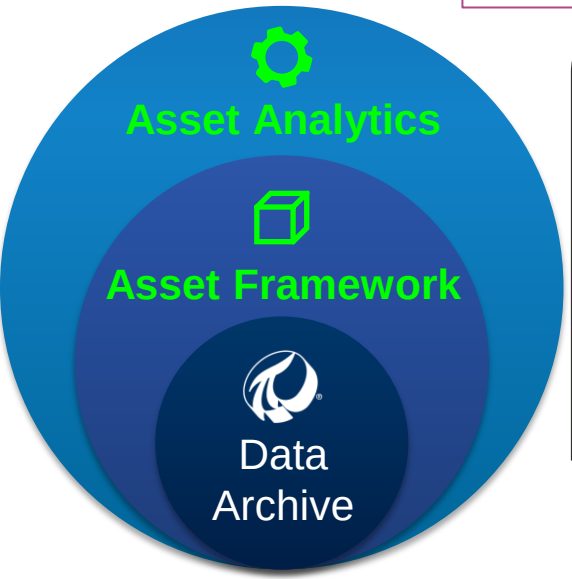
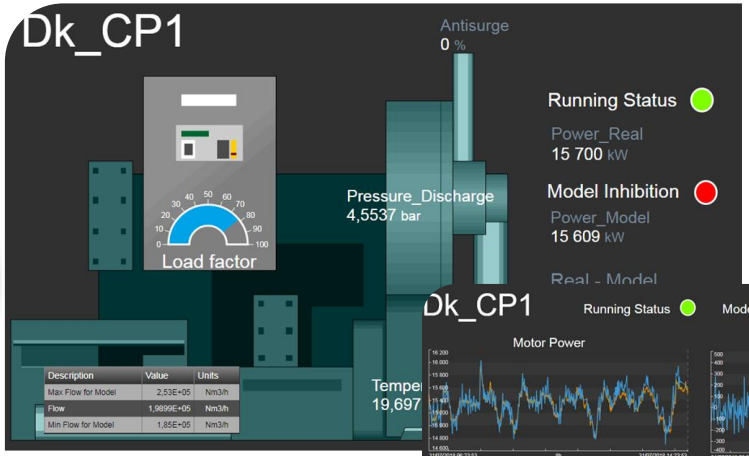
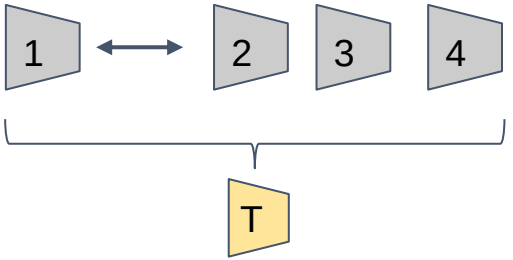
# Visualization using PI Vision




**PI Vision**







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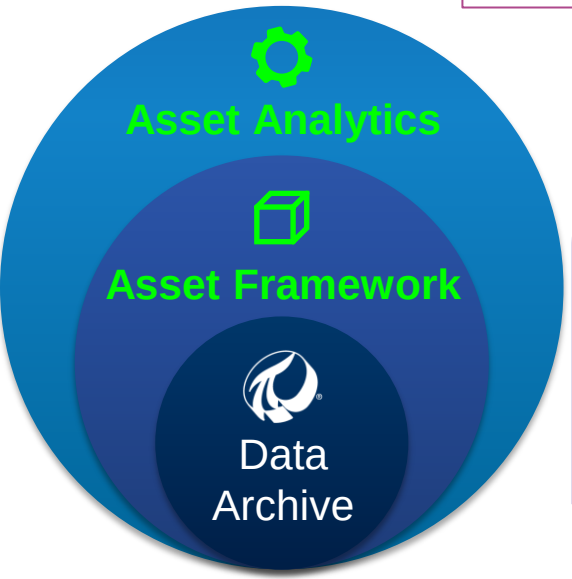
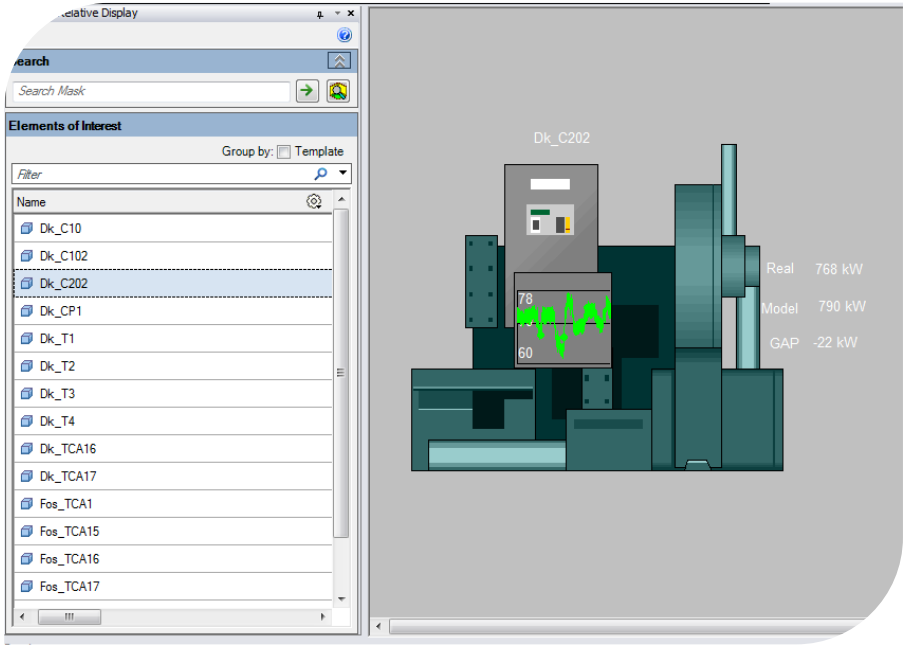
# Visualization using PI ProcessBook

**PI ProcessBook**




Less files

Smooth transition to AF





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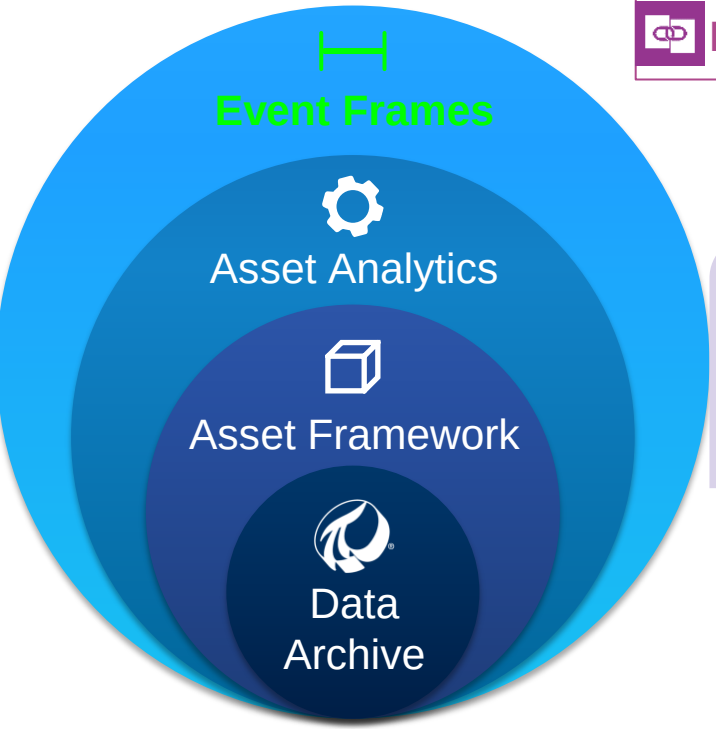
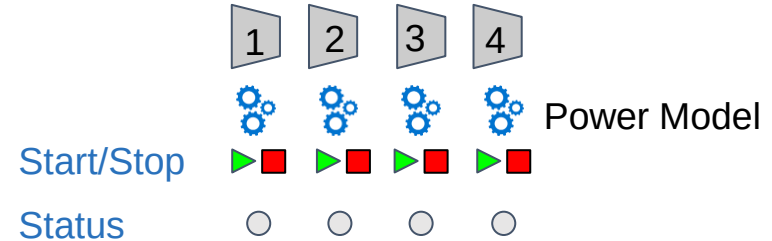
# Event Frames deployment and management with PI SE

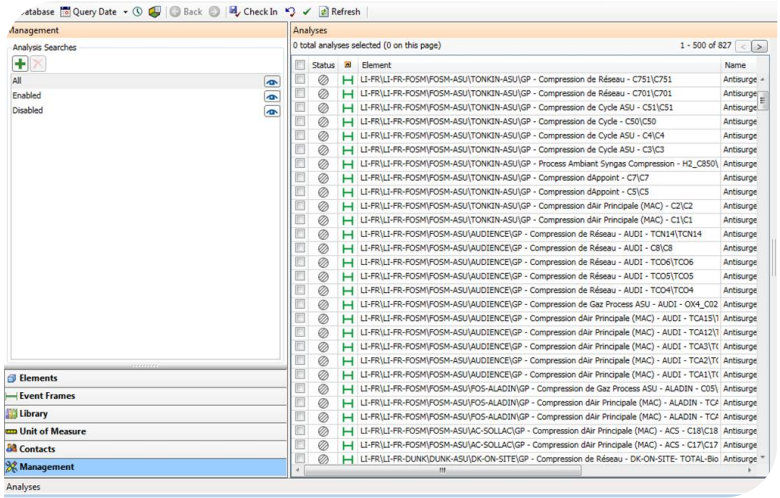



PI System Explorer

Quick deployment

Easy management





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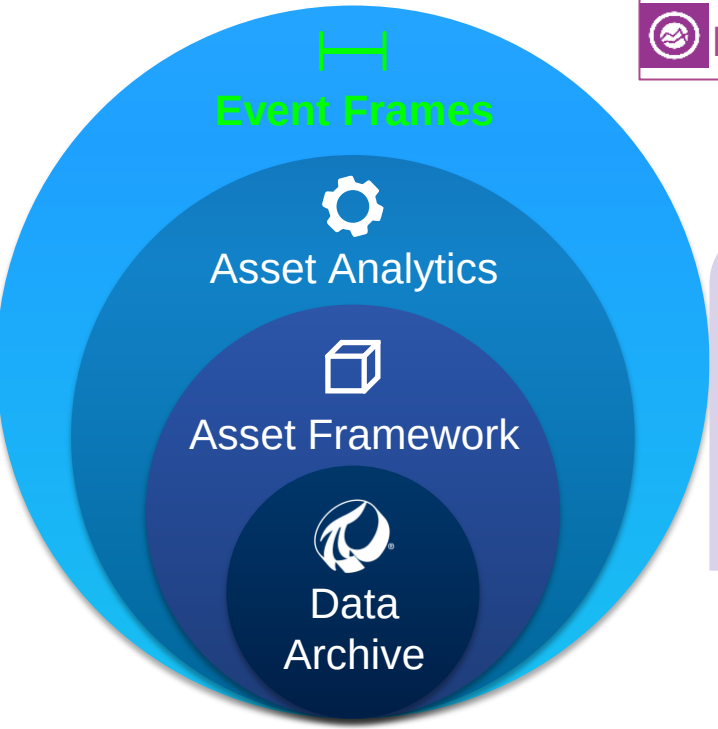
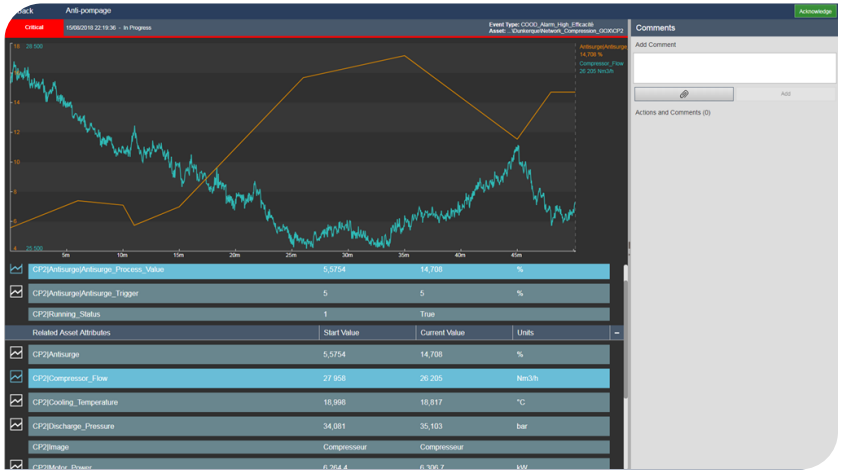
# Event Frames analysis and sharing with PI Vision




**PI Vision**

Contextualized and custom viz

Weblink for sharing





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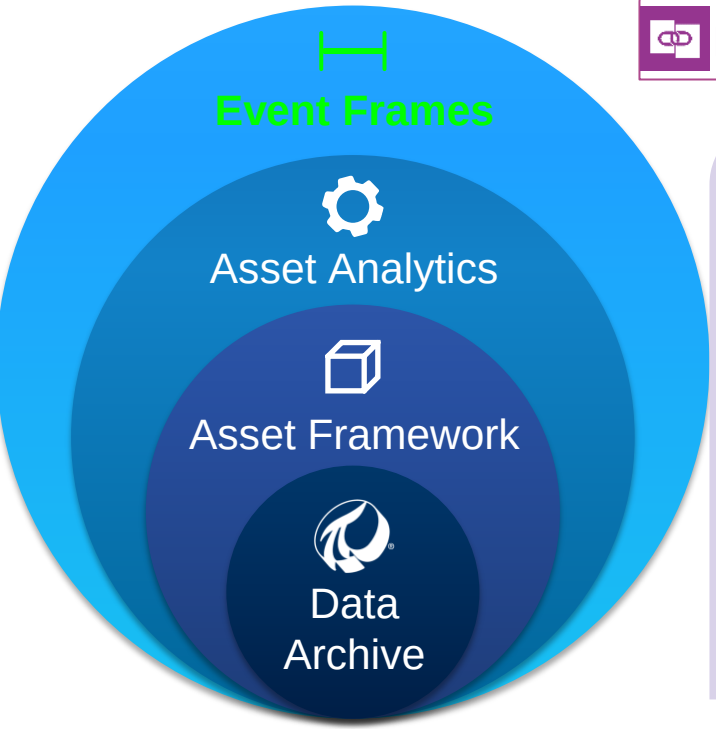
# Event Frames quantitative analysis with PI DataLink




PI DataLink

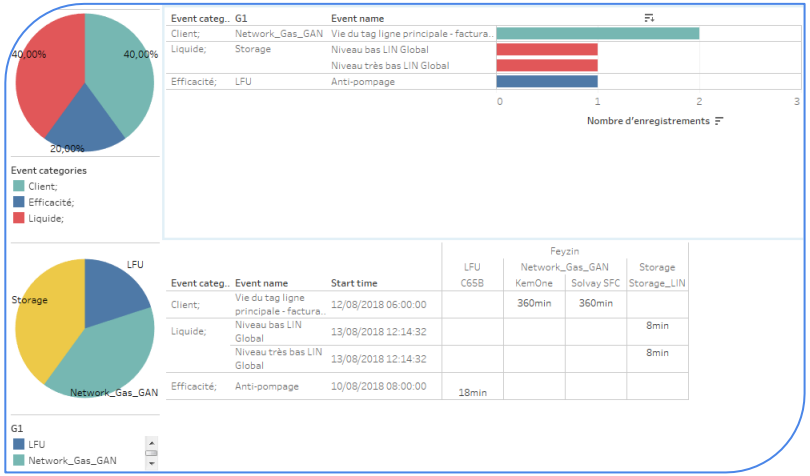
Extraction of EF

↓

Trigger tuning

Specific expression

EF killing





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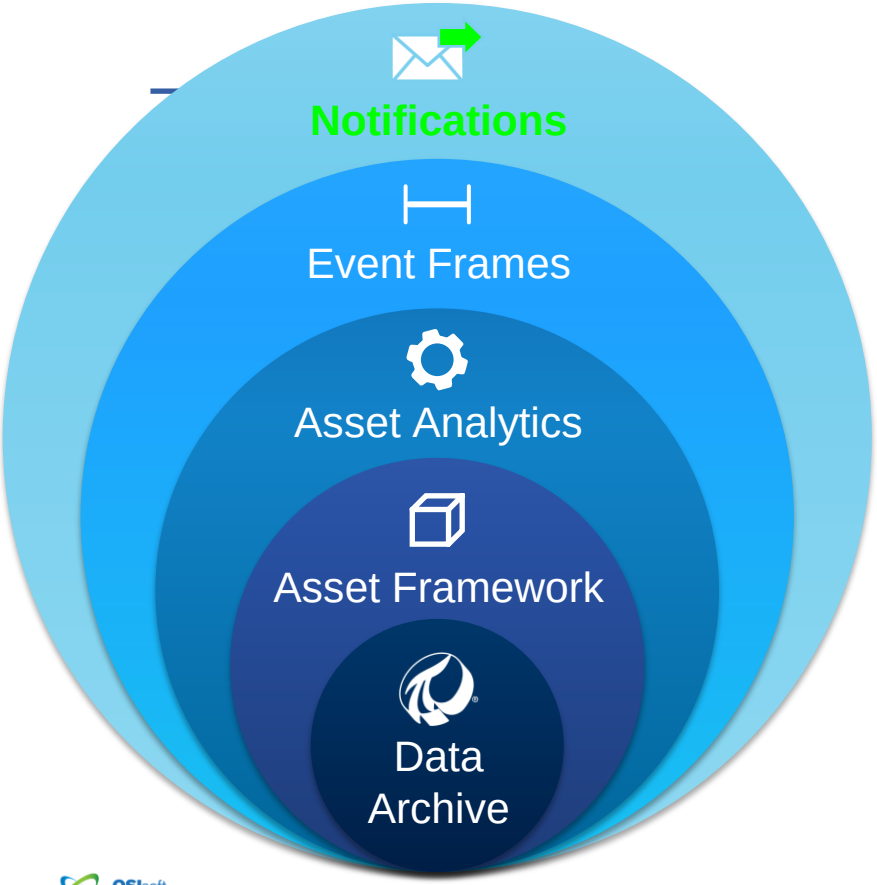
# Next step - PI Notification implementation



Short term notification to Real time pilot for Quick action

Short and mid term notification to Analyst for Sustainable solution

Warning notification to Everyone for Crisis case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# Next step - Central Asset Framework Management (CAFM)

**What ?**

- **A project launch by the Historian Worldwide Users Committee to create a base template library for Asset Framework for operation.**

**Why ?**

- **To define templates and architecture to:**
  - Reduce time to deployment
  - Facilitate asset management and base KPI deployment
  - Reuse visualization screens and reports

- **To define an architecture philosophy consistent with our business and other data project being developed in parallel**


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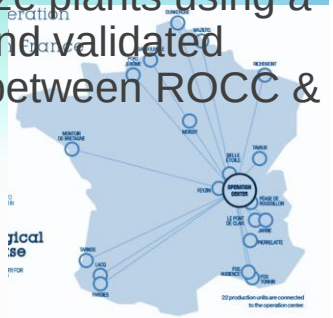
# Air Liquide

Remote monitoring & optimization for Air Liquide plants using AF/EF

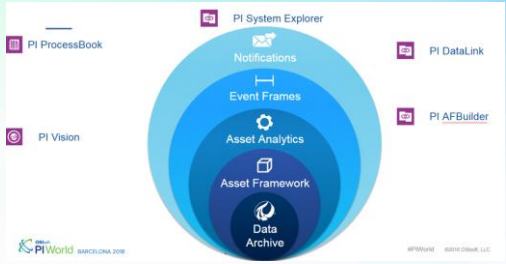
## CHALLENGE

Change old habits with PI system to remotely monitor and optimize plants using a common and validated database between ROCC & plants



## SOLUTION

AF implementation and leverage of data using more tools within the PI System




## RESULTS

Reactivity
Optimization
Customer satisfaction

Production shortage
Gas venting
Liquid Overflow

Trust ∩ ROCC & plants
Excellent savings
Global deployment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# Questions?

Please wait for the **microphone**

State your **name & company**

# Please rate this session in the mobile app!

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