

Sistemi di supporto decisionale per le operazioni e la diagnostica.

Il caso Energhe SpA, le soluzioni software
e gli scenari applicativi

Fulvio Roveta – Integration Objects

About Integration Objects



- Integration Objects is a leading system integrator and solutions provider of **automation, plant performance management, decision support, knowledge management, and systems connectivity** for process, power, and utilities industries.

About Integration Objects

Partners

- Emerson
- GE
- Rockwell
- Invensys
- OSIsoft
- Aspentech
- Belsim
- Yokogawa



NTT DATA

References

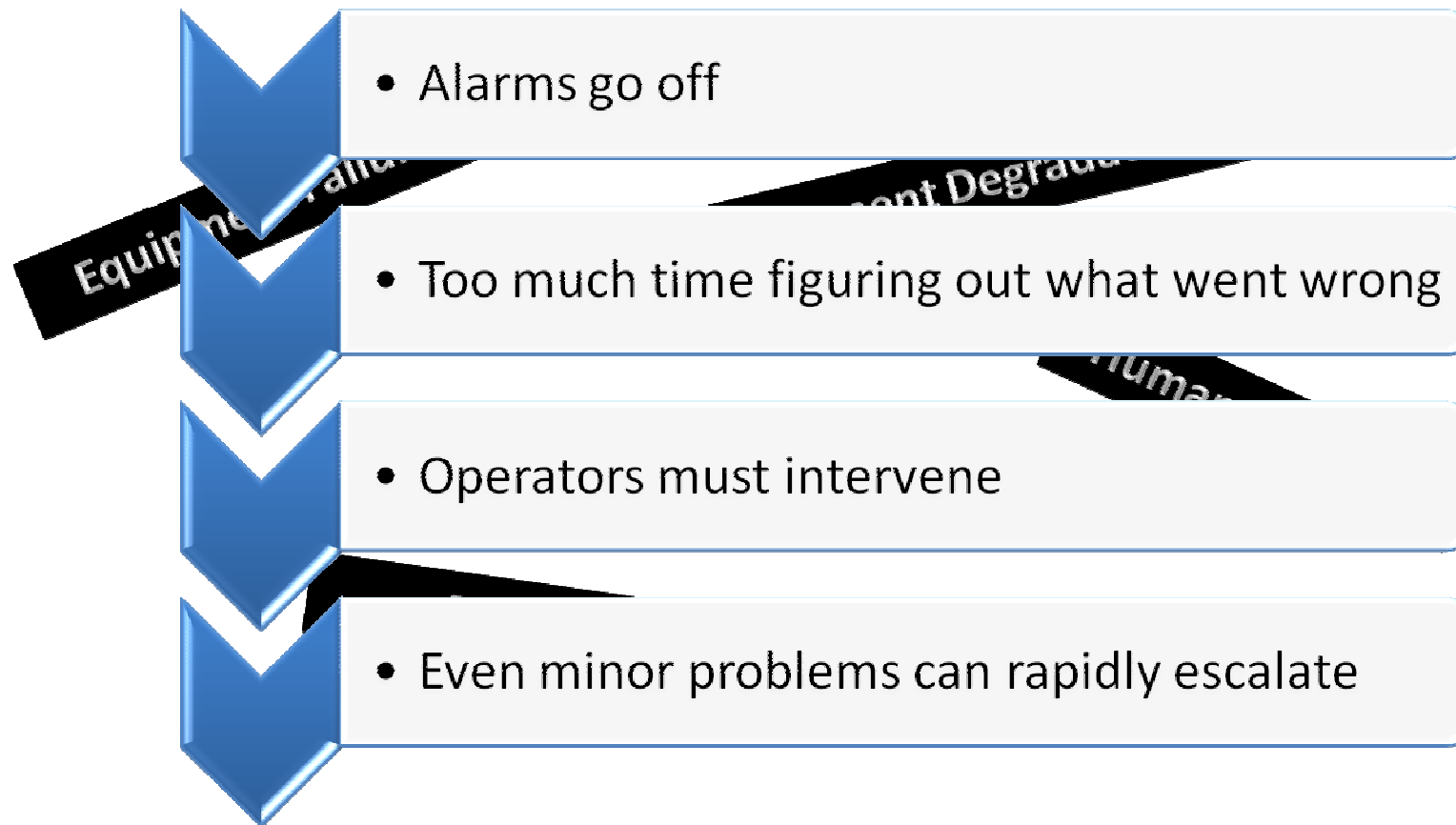


Today's Environment

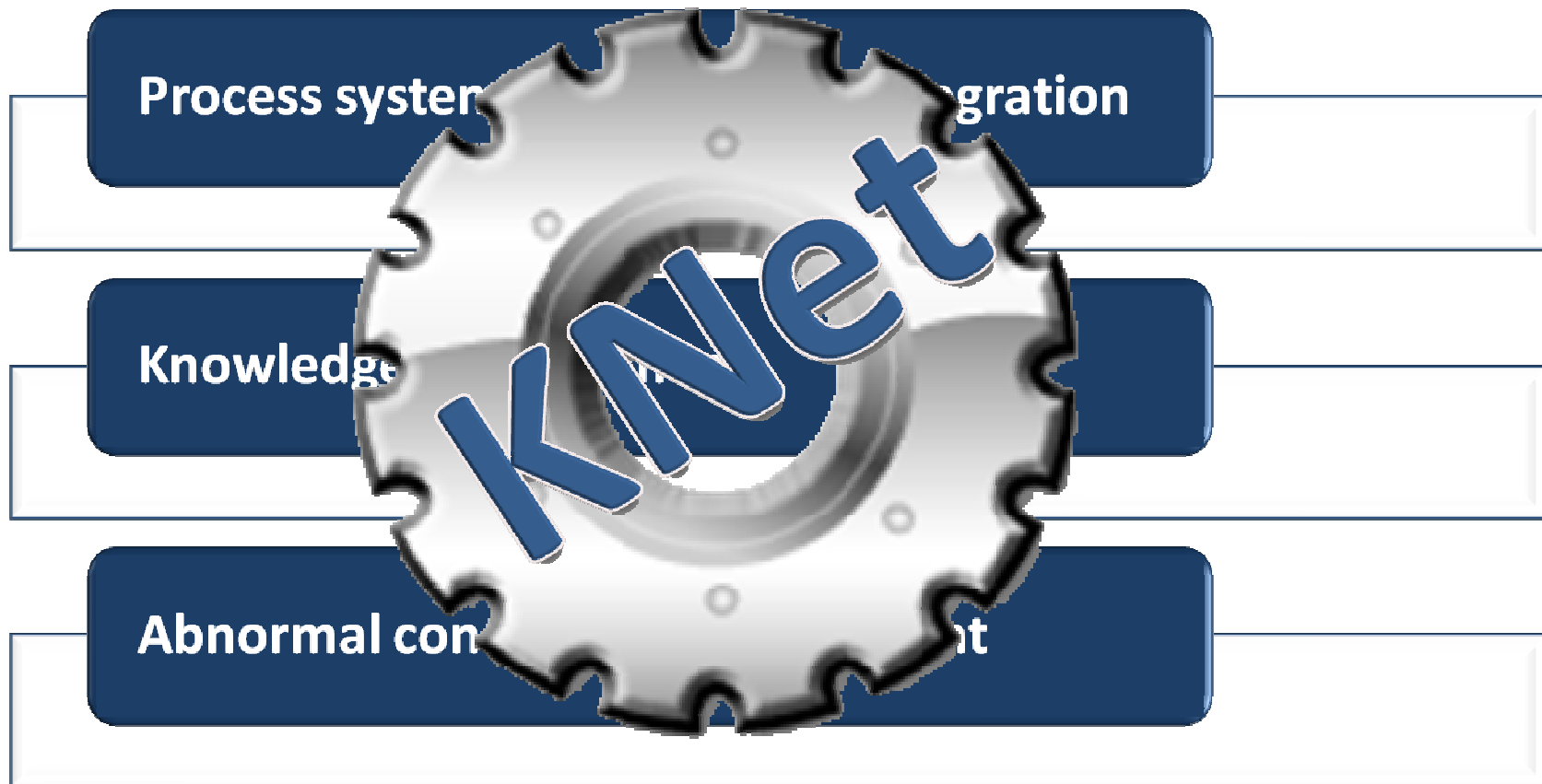


- Increased operations complexity
- Increased amount of data to manage
- Operating plants closer to their limits
- Lack of trained personnel with long experience
- Higher environmental awareness
- Increase in regulatory requirements

Typical Scenario



Integration Objects' Solution



Traditional Control Room



Noticing the Alarm
Correlating information
Identifying the scenario
Comparing with past experiences
Finding the proper solution
Reacting in the best way

Alarm
Printer



Alarm
Screen



Operator
Screen



Trends



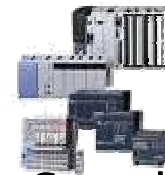
Acoustic
Warning



Burden is on operators



Data



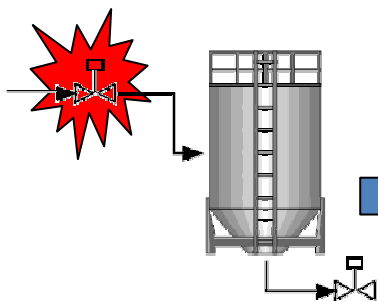
Control
Systems

Plant
Historians

Databases

Legacy
Applications

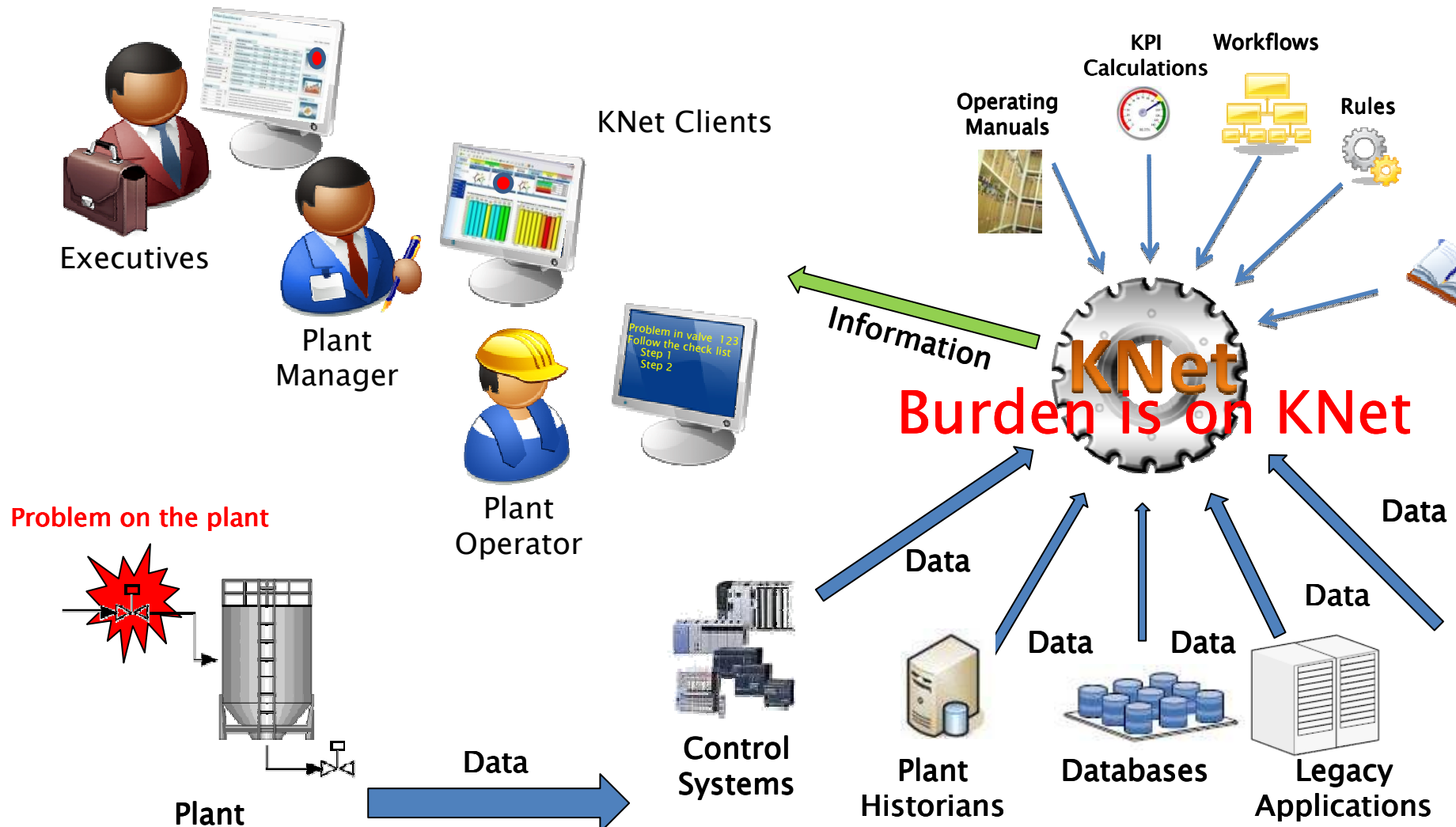
LIMS



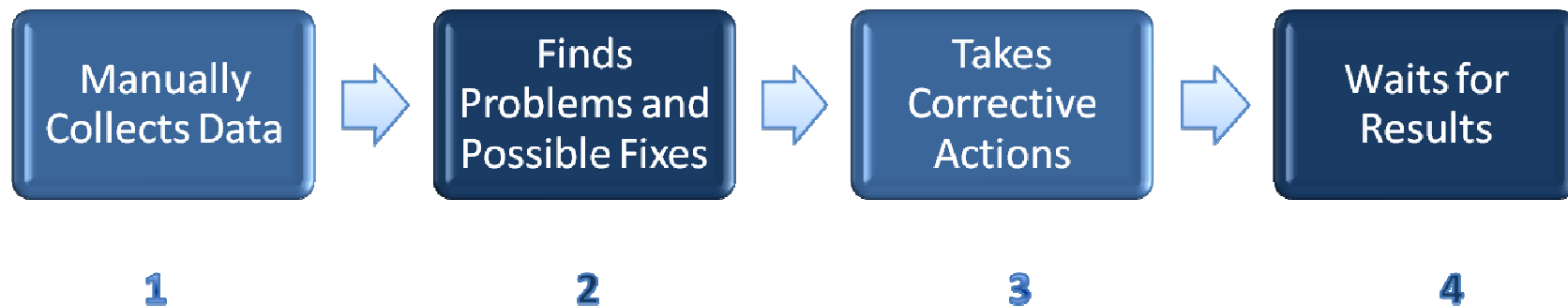
Data



KNet Approach



Traditional Problem Solving



KNet Solves Problems

Tree View

- SC4: Recycle gas moisture high
 - Moisture Analyzer 13AR1A sample lines plugged (or other analyzer fault leading to "flat line") (RC4_4)
 - Other Analyzer 13AR1A fault (RC4_5)**
 - High temperature leading to high moisture (RC4_6)
 - O2 leak from regenerator into reduction zone instead. Note: This Root Cause will be discussed during Pro...
 - Not enough N2 purging before unloading (RC4_2)
- SC13: High moisture in reformer feed
 - Stripper tower (1201E) bottom temperature low, not removing moisture. (RC13_1)
 - (Startup/cold feed case) Low bottoms temperature of Splitter 1202E. (In normal operation, Stripper removes...
 - (Startup/cold feed case) During cold feed, water escaping from cold feed filter (c.f.f.) (RC13_3)
 - 1202F (separator) boot water level high (RC13_4)

Impact: inability to quickly see moisture changes, so that moisture can drift out of target range, leading to high moisture in reactors, which removes chloride from catalyst, making it less effective, and reactor delta T and octane will go down

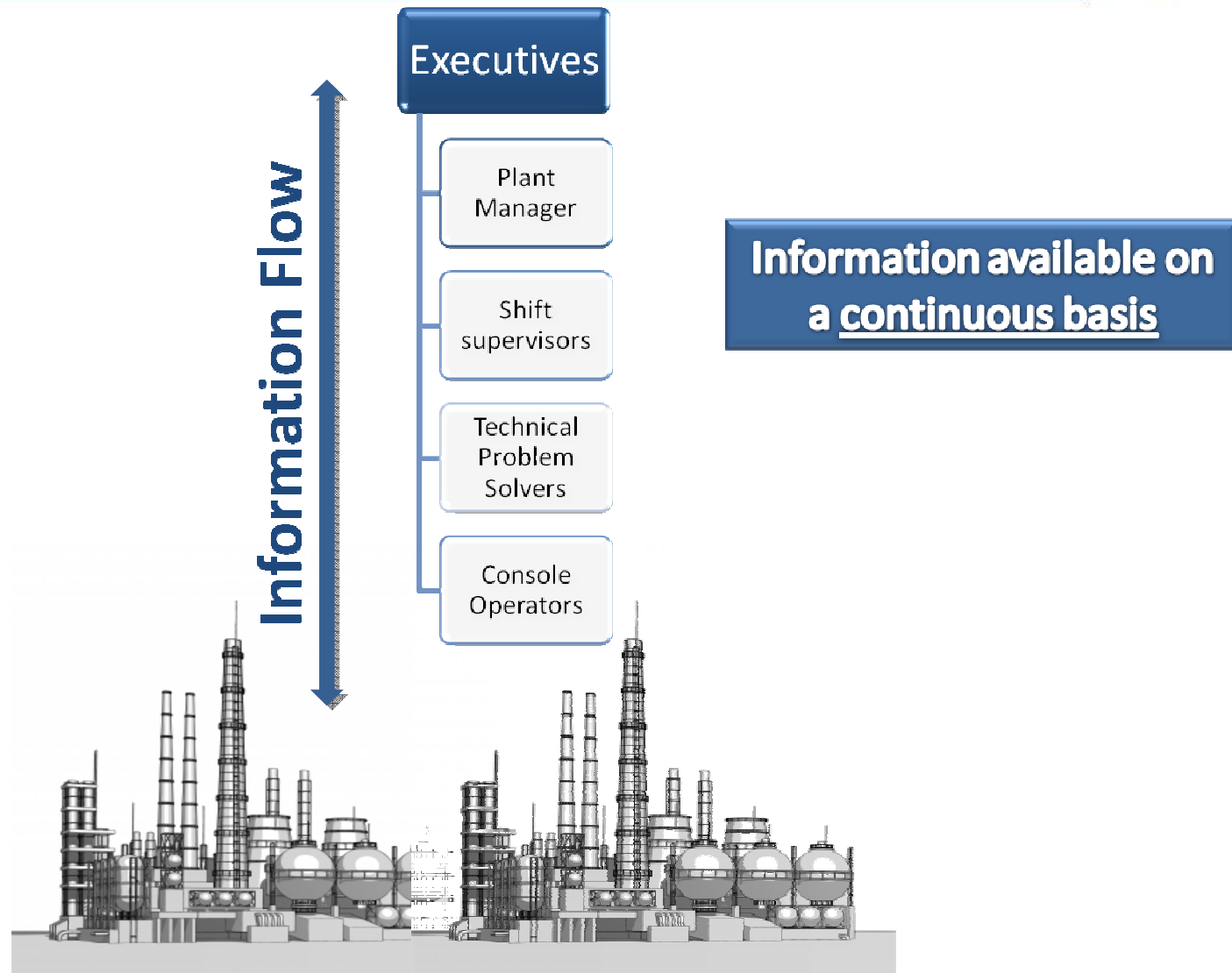
Action: Notify maintenance to fix analyzer and use the portable analyzer in the meantime (field check every hour if abnormal)

Check 13AR1A against portable analyzer. Is it significantly different (field check)?

Confirmed
Not Confirmed
Not Verified

Last performed action: Confirmed at 2011/03/30 10:02:29

KNet Information Flow

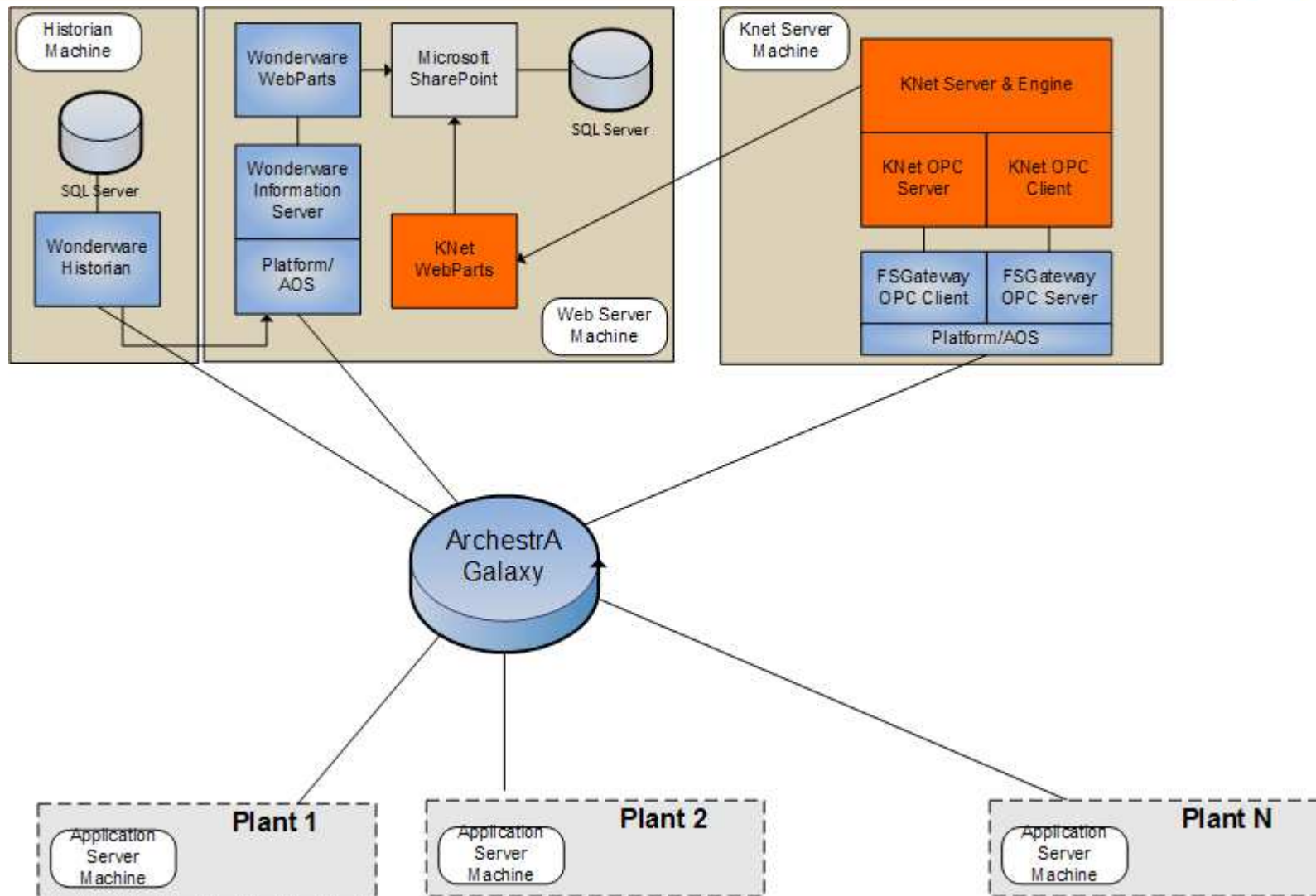


Energhe Case Study



- Scenario:
 - Distributed cogeneration and tri-generation power plants
 - Different technologies and control systems
 - Missing a real-time data infrastructure
- Target:
 - Real time monitoring of process performance
 - Support to remote diagnostic
 - Online operation support

Architecture Overview



KNet main modules



KRules enables the implementation of complex real-time calculations in a graphical language.



KRules

KWorkflow enables the creation of workflows to describe sequential and parallel set of operations.



KWorkflow

KRCA enables the implementation of
-decision support systems.
-graphical diagnosis applications
-abnormal condition management systems



KRCA

KMap enables
- the representation of plant objects, equipment, and unit hierarchy.
- the creation of several types of HMI graphics.



KMap

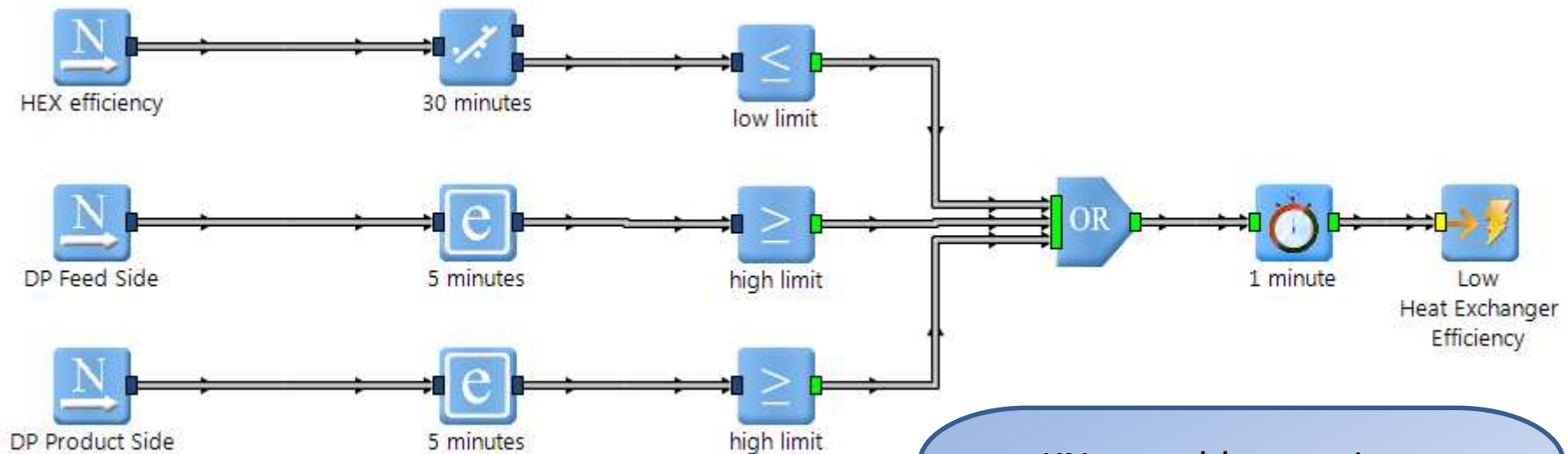
KRules

KNet detects fluctuations in the input flow rates by calculating the standard deviation of reflux pump flow rate or rate of change of the product pump flow rate

KNet main modules

KRules

Low heat exchanger performance

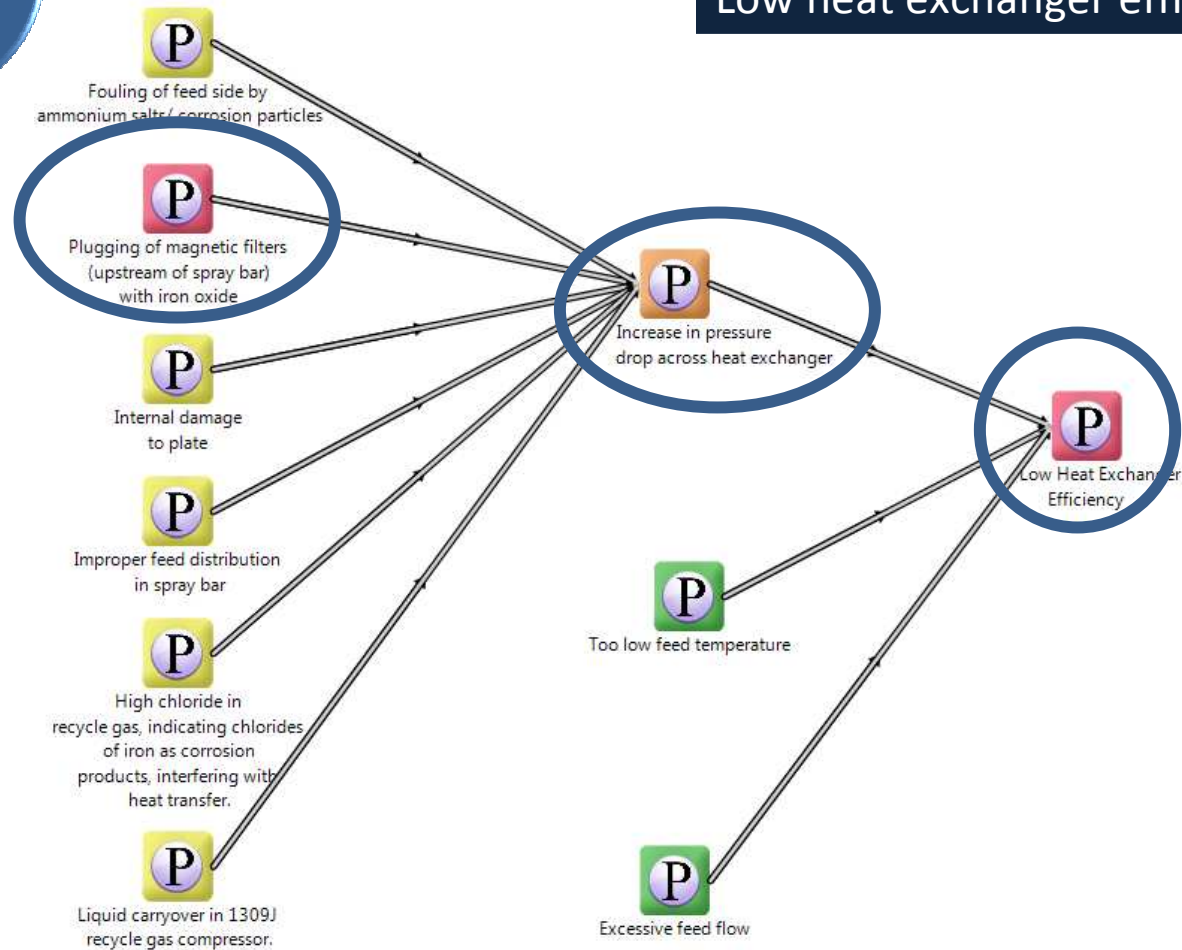


KNet enables continuous monitoring of the heat exchanger efficiency with predictive technology based on time series algorithm.

KNet main modules

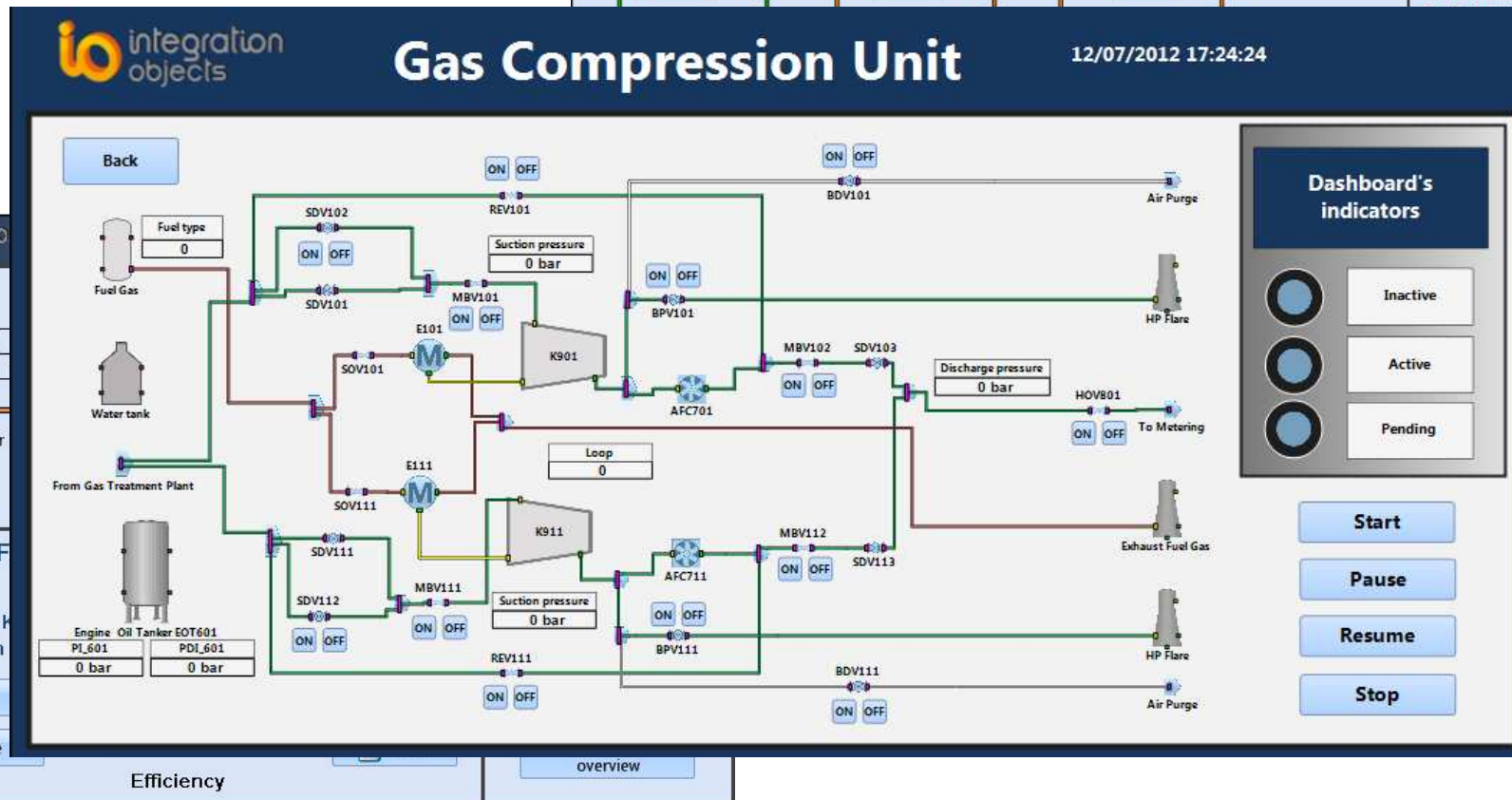
KRCA

Low heat exchanger efficiency fault model



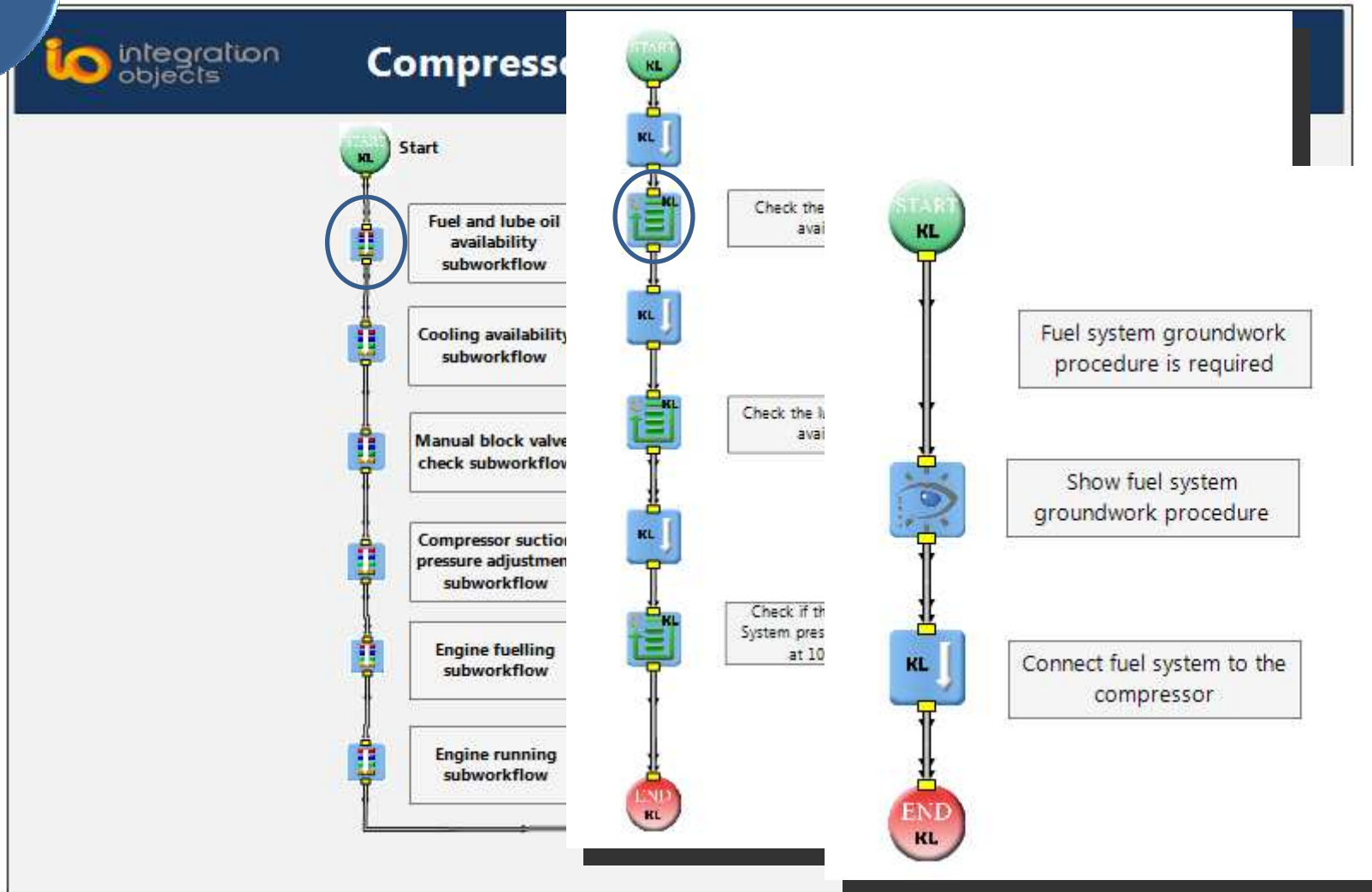
KNet main modules

KMap



KNet main modules

KWork-
flow



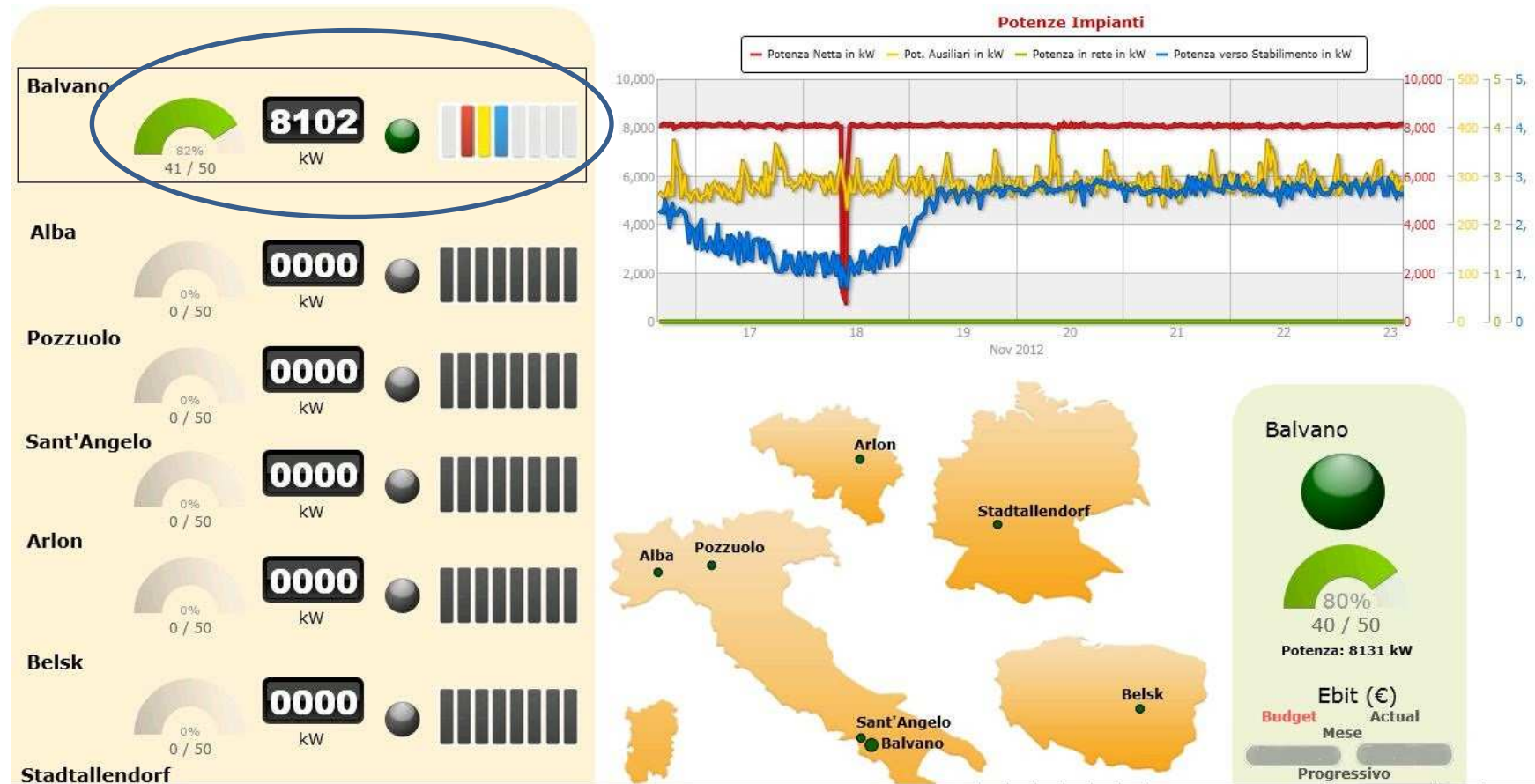
KNet Main Features



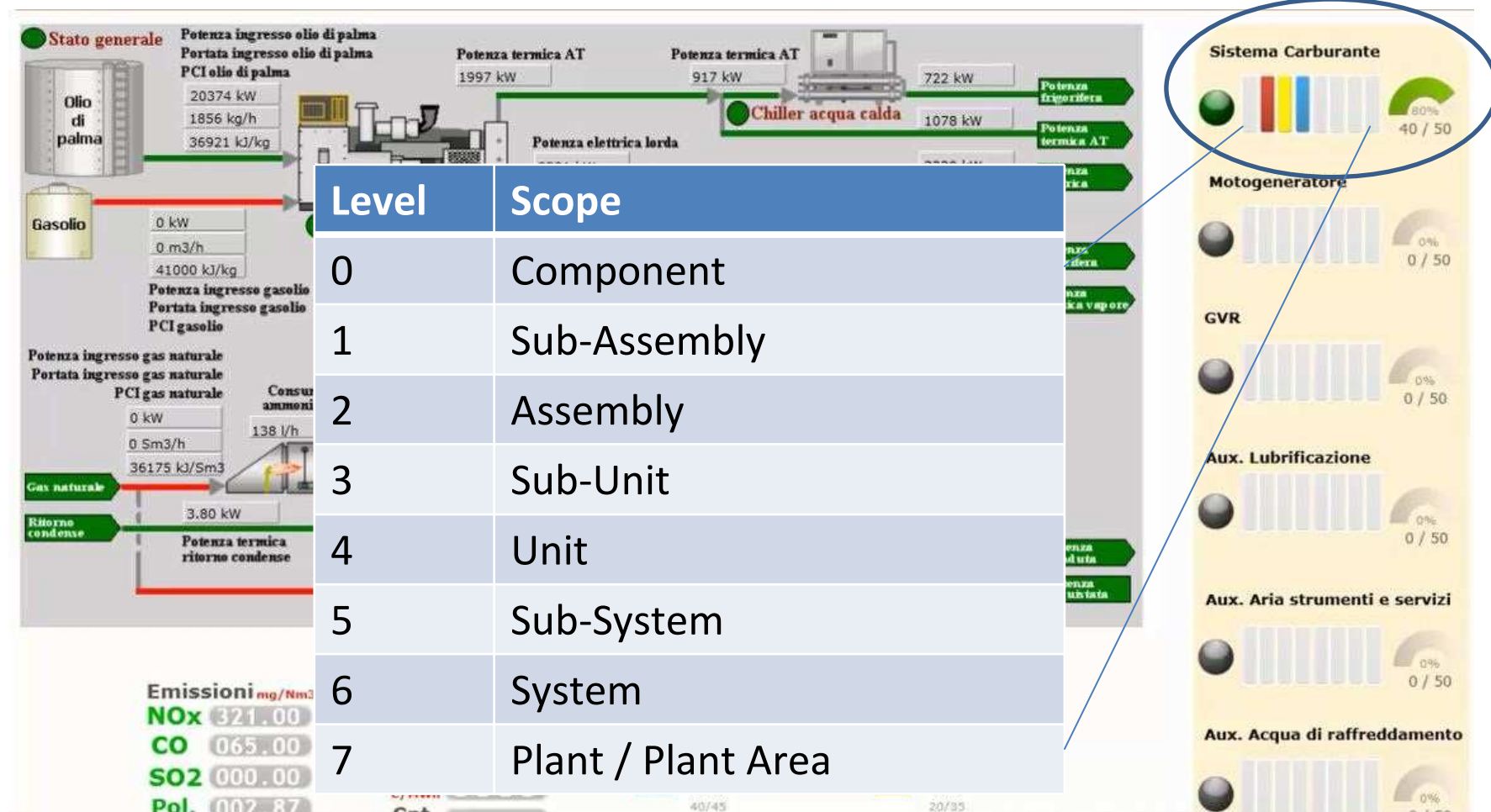
In Ferrero Energhe project KNet is used for:

- Real-time calculation of process KPI's
- Collection and aggregation of plant alarms
- Generation of status signals
- Root Cause Analysis
- User's guidance

Diagnostic for Energhe VCR



Diagnostic for Energhe VCR



KNet Diagnostic Tree

Alimentazione e Stoccaggio

BA_AES_04_NN value: Early warning



Legenda

Codice a colori:

Grigio: nessun problema

Azzurro: early warning. L'unità funzionale considerata si trova in uno **stato anomalo**, sono presenti guasti, malfunzionamenti e/o deviazioni delle variabili di processo negli item d'impianto che la realizzano.

Giallo: warning. L'unità funzionale considerata si trova in uno **stato degradato**, sono presenti guasti, malfunzionamenti e/o deviazioni delle variabili di processo negli item d'impianto che la realizzano.

Arancione: final warning. L'unità funzionale considerata si trova in uno **stato critico**, sono presenti guasti, malfunzionamenti e/o deviazioni delle variabili di processo negli item d'impianto che la realizzano.

Rosso: post trip. L'unità funzionale considerata non svolge la funzione attesa e/o si trova in uno **stato non accettabile**, sono, cioè, presenti guasti e/o malfunzionamenti e/o deviazioni delle variabili di processo tali da determinare l'intervento automatico dei sistemi di protezione e/o interventi immediati, diretti e non evitabili degli Operatori dei siti produttivi

Viola: unsafe. L'unità funzionale considerata non svolge la funzione attesa e/o si trova in uno **stato non accettabile**, sono, inoltre, presenti segnali che indicano la **mancata attuazione dei comandi** dei sistemi di controllo e/o di quelli di protezione automatici.

Impact Message:

Il messaggio è strutturato in tre componenti:

LOCATION: indicazione del sistema associato alla funzione di livello gerarchico superiore ed indicazione di quello cui è riferito il messaggio;

CONSEQUENCES: indicazione delle possibili conseguenze in relazione alla funzione svolta;

CAUSES: indicazione delle possibili cause che possono determinarlo.

Analisi dell'Albero di Guasto

Root Cause Analysis

Funzioni composte area Alimentazione e Stoccaggio

Sistema stoccaggio LBF

Carico LBF

Problema alla Pompa P-0401

Problema alla Pompa P-0402

> Sistema Buffer Tank

> Sistema Daily Tank

Problema alla Pompa P-0401

Cause name: Problema alla Pompa P-0401

Status: True

Impact message:

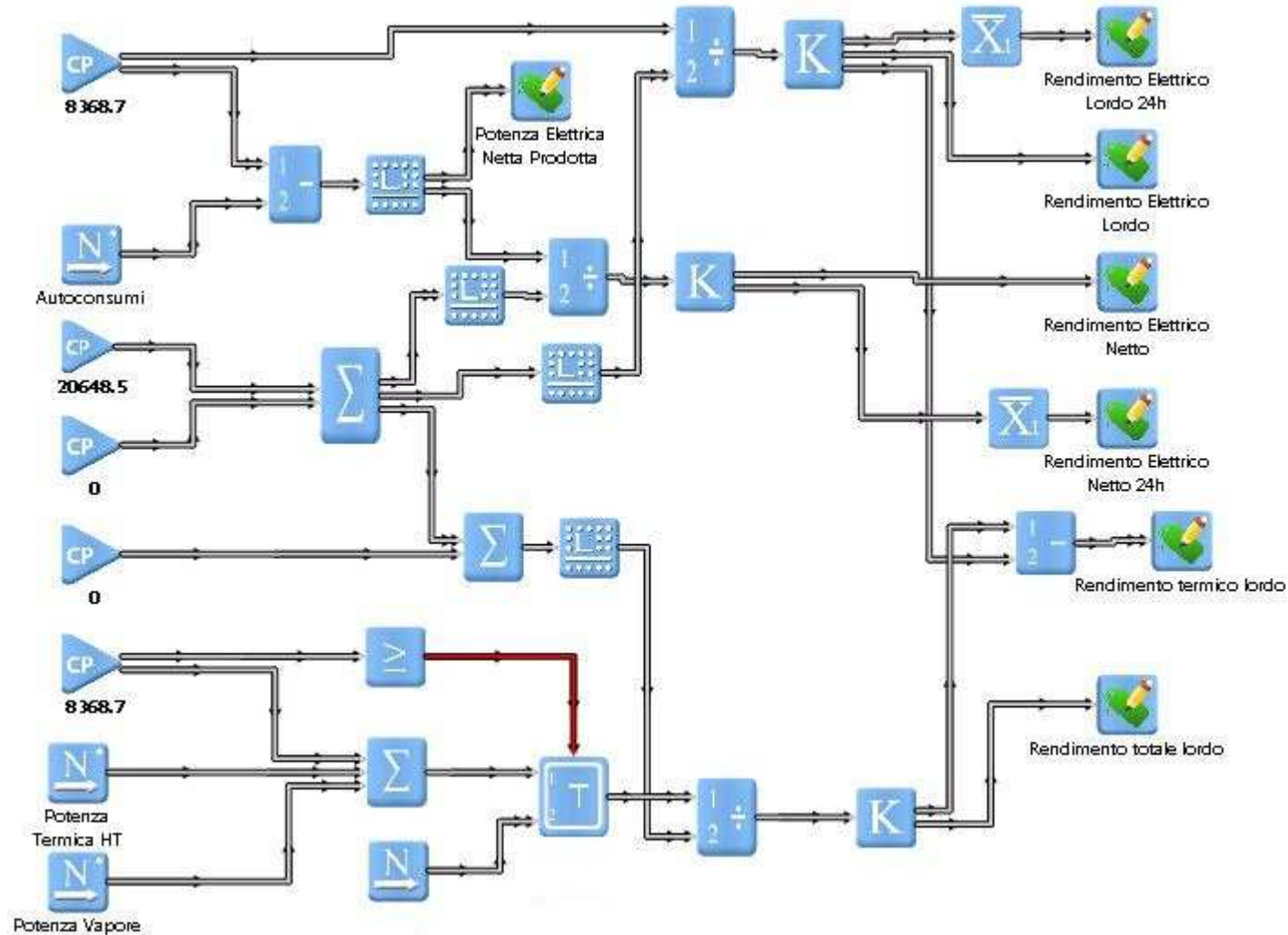
Carico LBF, Pompa P-0401.

Mancato funzionamento e/o anomalie pompaggio.

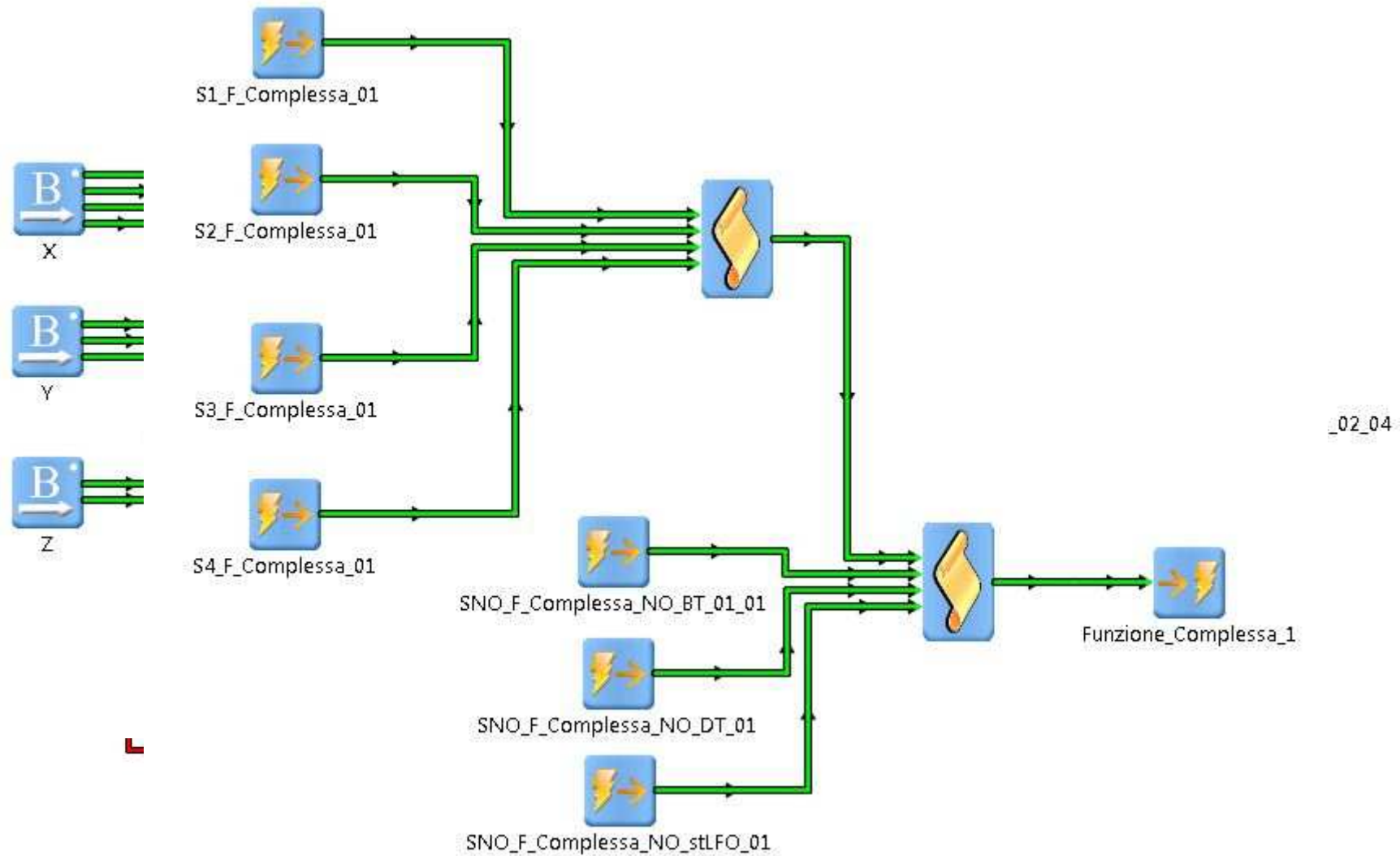
Pompa ferma e/o mancata corrispondenza comando/stato della pompa

Advice message:

KPI calculation



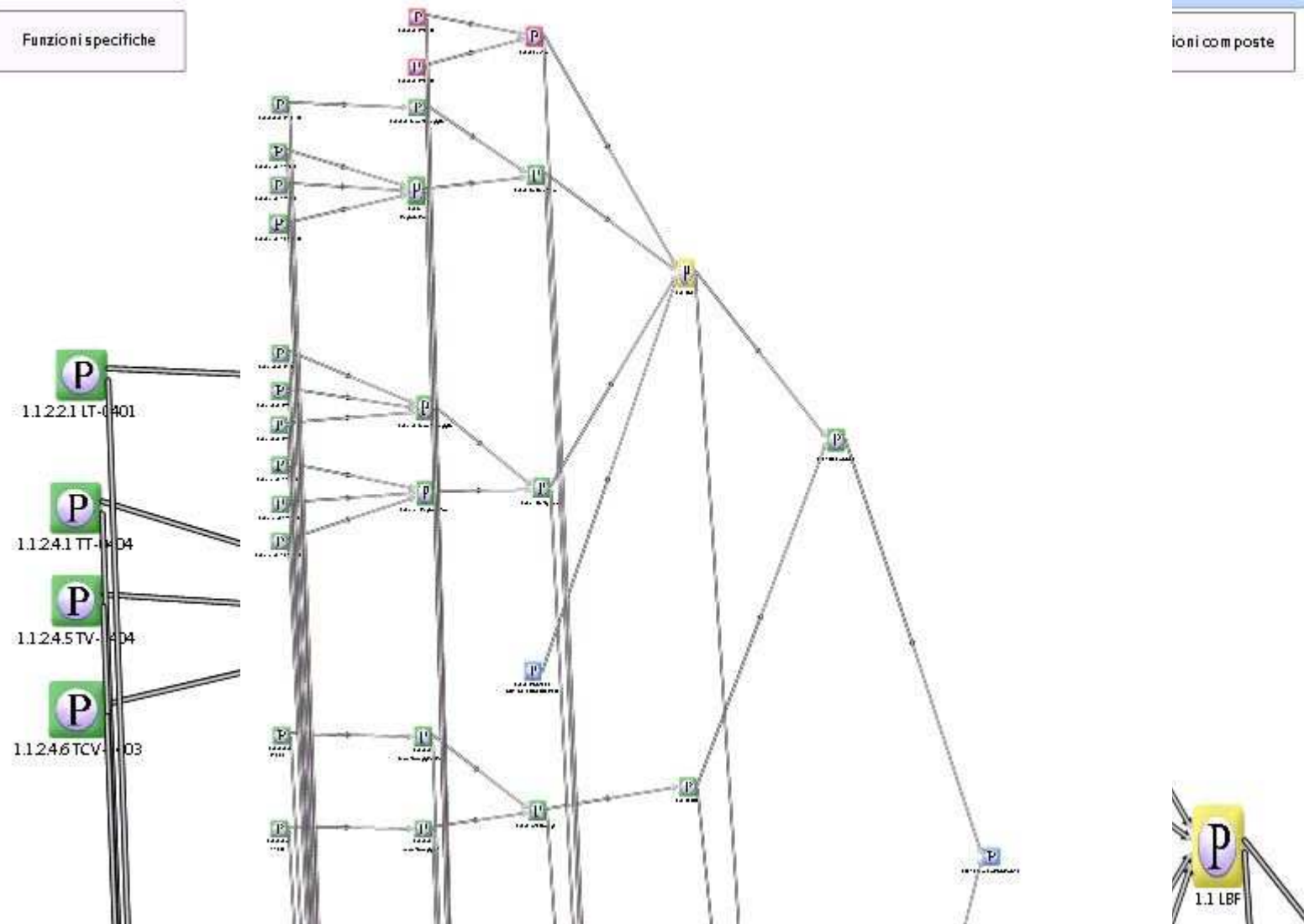
Status Rules



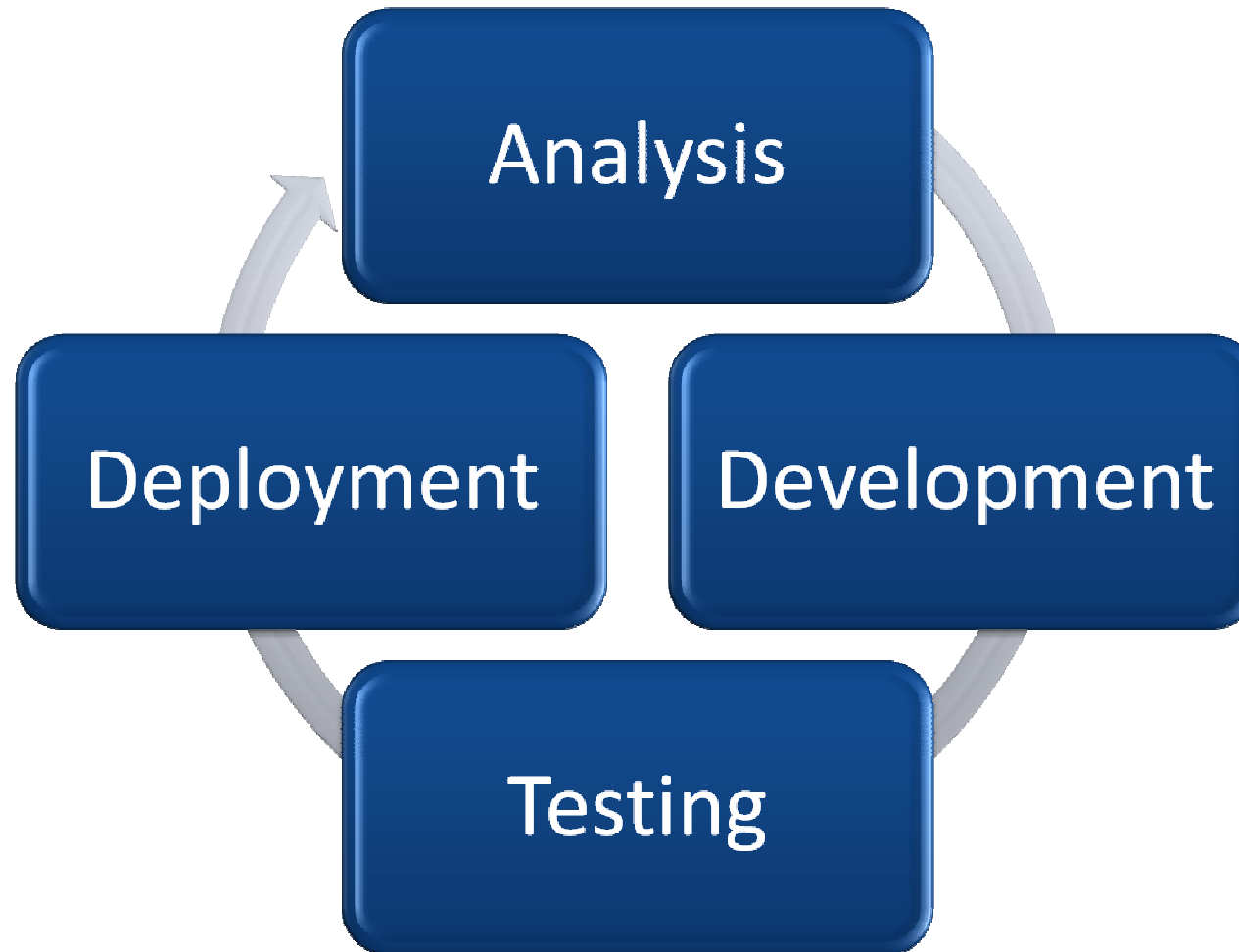
RCA

Funzioni specifiche

Funzioni composte



Project Execution



Abnormal Condition Management



Normal

Abnormal

Out of Control

Accident

Disaster

**Operational
Goal**

Keep Normal

Return to Normal

Bring to Safe State

Minimize the Impact

Control Systems vs. ACM



Function	Control System	ACM
Alarm Detection	Reactive	Predictive
Alarm Management	Non-deductive notification	Deductive Notification
Personnel Guidance	Little	Significant
Inputs	Largely from sensors	Sensors & Expert Knowledge
Corrective Actions	Automatic	Operator Initiated (can be automated)

ACM Functions



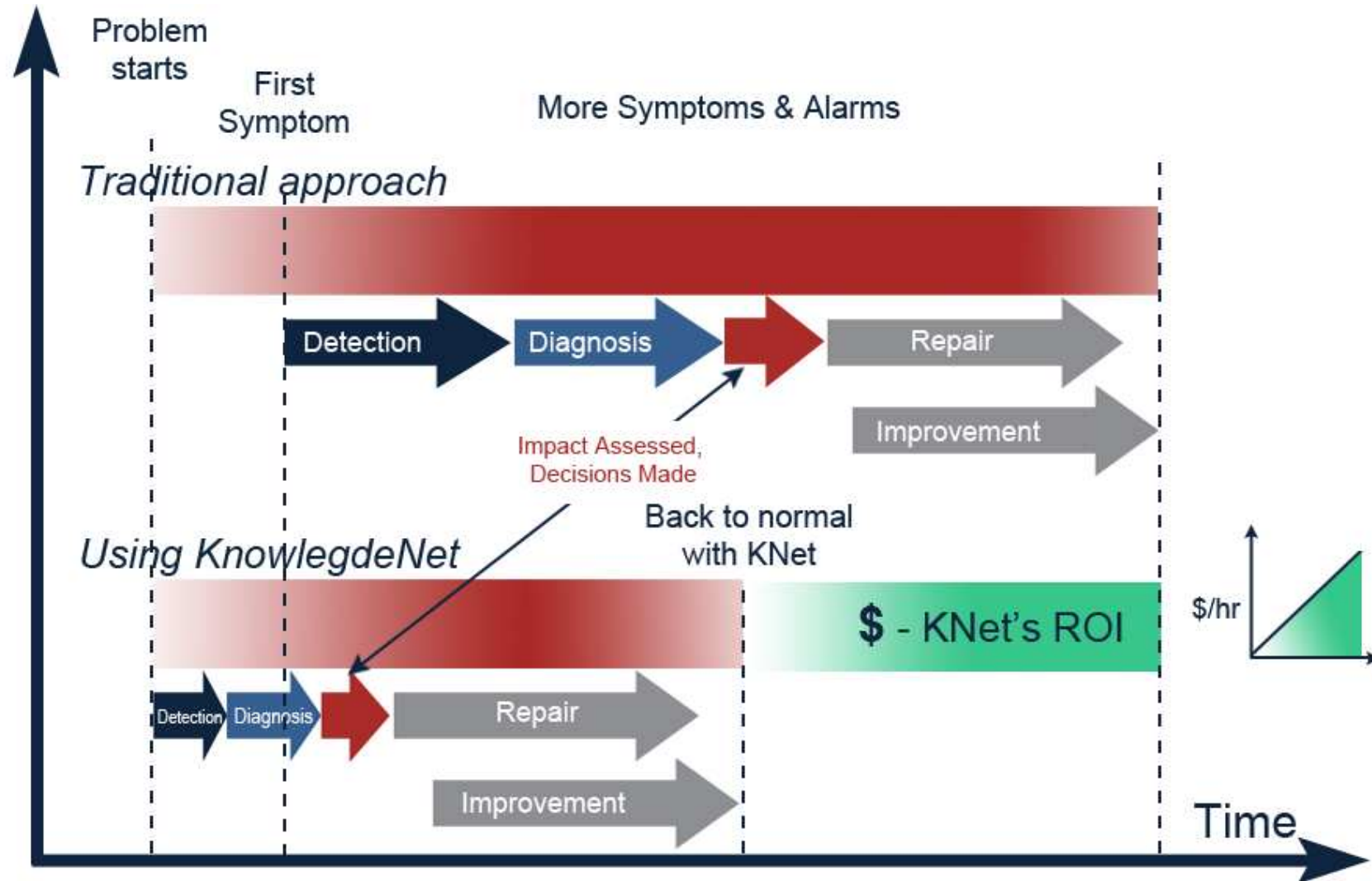
- Automatic testing and fault isolation
- Deductive alarm notification
- Root cause analysis
- Reasoned decision support for corrective response
- Analysis on the consequences of a problem
- Continuous improvements using cognitive technologies

Benefits of ACM



- Safer plant
- Better performances
- Increased plant availability
- Reduced unplanned shutdowns
- Smoother operation

Return on investment



Economic Benefits



- Plant managers can gain more from abnormal condition management than by applying advanced process optimization:
“Typical gain from advanced process optimization in a large continuous process is around 3 percent, whereas an ACM application can add 5 percent or more to the profits.”

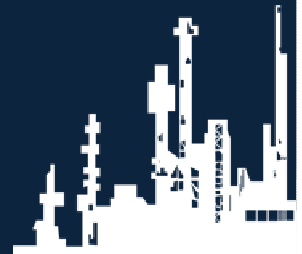
❶ “Abnormal Condition Management”, ARC Advisory Group, March 2001, page 7

Who can use ACM



Manufacturing operations where abnormal condition would cause unacceptable consequences:

- Large and complex process plants
- Unmanned operations
- Manufacturers of high value products
- Operations that require frequent start-ups and shutdowns



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Thank you for your attention