

# **INTEGRATED ASSET INTEGRITY MANAGEMENT AND RBI IN CHEMICAL AND PETROCHEMICAL PLANTS**



**IPAMC 2016**  
**SPEAKER: Alberto Mura**  
**COMPANY: Antea**  
**Part 2**

## ➤ Cost Saving for Integration and RBI



- ❑ Case Study 1: Onshore Implementation
- ❑ Case Study 2: Offshore Implementation
- ❑ Case Study 3: RBI Implementation (Refinery)

**Savings** resulting from the **Integration** are **multiple** and are summarized in this presentation; when possible estimates are carried out based on information or percentages coming from research, others are estimates coming from current customers.



In order to simplify, the following comparisons refer to plants made of approximately 1.000 pieces of equipment and/or employing about 200 employees.

The result refers to annual savings of a system complete of data and documents. This value should be compared to the cost estimates required to take the **system to a running state**, distribute it and maintain it updated.

- Insurance
- Documents and data searching
- Management of P&IDs and maps
- Distribution of reports and data
- Optimizations using 3D Model
- Data entry from contractors
- Benefit link with Palladio, SAP, Maximo, ...
- Operators' quality of life
- Loss of production for delayed info
- Reduction of unwanted shutdowns
- Documentation rebuilding
- RBI cost saving



International brokers claim that a facility with 1.000 pieces of equipment has an annual insurance premium of about 1-1.5 million Euro and that the savings on insurance can vary **from 2% to 5%** if the submitted documentation:

- is **immediately accessible** (cost saving during audits and reinsurance),
- enables the **continuous** monitoring of the **risk indicators**.



The considered components are two:

- according to a Nielsen research [1], an employee spends an average 50 hours per year to **search for documents**. The 50 hours per year spent in document search, rated at 25 €/hour for 200 employees have a cost of 250.000 €/year.
- According to an Accenture survey [2], 42% of employees **use wrong information at least once a week**. The cost for using incorrect information according to our estimates is € 100 for each incorrect use (meetings and/or corrective actions). The estimated damage is approximately € 369.600 per year (200 employees x 42% x 44 working weeks x € 100 per event).



Costs for finding documents that eventually will be untraceable and replication costs have not be considered.

(1) Nielsen, research on big organizations, mentioned in G.B. Knowledge Box Spring 2013, (Accessed: February 2016)

(2) Accenture, research quoted da G.B. Knowledge Box Spring 2013, (Accessed: February 2016)

If the technical documents can be **viewed and annotated by everyone**, the possibility that they are reliable is very high.

No researches were found to support the economic value of this capacity, but it is apparent and has been acknowledged by all the interviewed operators, who emphasized two main sources of savings:

- hours saved during the **search for the an asset**, sometimes not found;
- use of **annotations on the drawings** directly made by the operators as unofficial update (no one knows the plant better than those who works in it every day).

The estimate of € 100.000 per year takes into consideration the direct costs of employees, the costs for activities that may be carried out by engineering companies and costs for modifications or revamping.



Many **reports** are created during inspection, maintenance and monitoring activities.

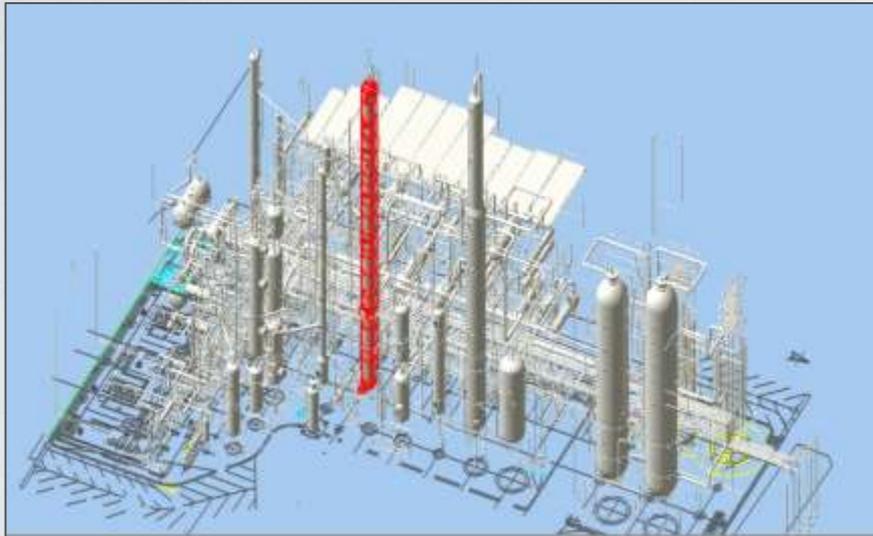
Their **distribution** to entitled users **takes time** and is a waste of space because almost everybody keeps a copy of the documents.

The same situation regards **data sharing**, as data is often contained in **spreadsheets** to be distributed in copies that will be duplicated and will probably lose reliability, as it is difficult to check the **most current version**.

Distribution of reports and data to entitled users, just by simply **sending notice of their availability** and asking for direct acknowledgement, is an undeniable source of saving, even if difficult to measure analytically.

The estimated value of € 100.000 per year is an average resulting from the perceived value of interviewed operators.





The availability of **3D models** or 3D renderings coming from **Laser Scanning** and the possibility to link the items in the browser to their exact position in the 3D models is a **great advantage to the inspection and maintenance activities.**

Access evaluation, planning and dimensioning of scaffolding, identification of inspection routes can be largely performed without the need for preventive site survey. As a result, planning and optimization activities are easier and quicker to be made.

No researches were found to support the economic value of this capacity, but it is apparent and has been recognized by all operators interviewed.

The estimated value of € 100.000 is considered an underestimate by the interviewed operators.

Inspection reports, maintenance reports, etc. are usually provided on paper or on external files: the operator is forced to manually insert their contents with all their requirements, suggestions, expiration dates, etc.

It is possible to **use standard templates** for reports and set up **automatic data loading** of reports filled in directly by external companies.



An underestimate foresees a saving of at least 2 employees, amounting to a total cost of € 90.000 per year.

In the estimate, we did not consider the benefits coming from the savings due to immediate availability of information.



**Links** between different **installed systems**, enable the systems to take advantages each other.

Considerable benefits regard:

- **budget** management of inspection and maintenance activities
- issues of **work orders**
- quicker **scheduling** of maintenance activities
- cross check of the **compliance** of the items to the **P&IDs** (approximately 90% of the items are reported in the P&IDs)

No researches were found to support the economic value of this capacity, but it is apparent and has been recognized by all interviewed operators.

The estimate of € 100.000 is considered by the interviewed operators an underestimate as it does not consider costs regarding unexpected inefficiencies, list misalignments or remakes.

Managers frequently ask for documents or information urgently; as they cannot directly consult them, they ask to trusted staff, who often has great difficulty finding the requested information.

The possibility to **directly consult** and **obtain information easily** contributes in maintaining **peaceful and profitable work relations**.

Estimated amount:

It is not possible to estimate the economic impact; the benefit value in our table is zero, leaving to auditors a possible estimate.





During the operating of a plant, a **change of operating conditions** or an **increase of the production capacity** can be required for short periods of time; typically, this can be done only if it is possible to **consult the current state** of the facility and its technical information, for evaluation.

When this is not possible, this opportunity has to be given up, as the decision making without the necessary information is too risky.

Estimated amount:

It is not possible to estimate the economic impact; the benefit value in our table is zero, leaving to the reader a possible estimate.

Sometimes the lack of **immediate availability of information** may lead to **reduced** production capacity or unexpected **temporary shutdown**. It is statistically impossible to quantify the economic impact without access to analytical production data of the various companies, often jealously guarded. We can only make assumptions.



If delays or unwanted stops can be globally summarized in 2-3 days of non-production of one unit (each plant has various units) and if the availability of data could avoid one day of production loss, the economic impact is huge. Some interviewed operators confirm this assumption, and consider the estimate prudential.

One day of production loss of a unit amounts to several hundreds of thousands of Euro.

Estimated amount:

The estimated amount in our table is € 200.000

Research and case studies claim that many business **documents** are **not** systematically **consulted** (81%) and if not properly stored, they can even be considered **not existent**; often, as they are not available and are required by law or for technical reasons, **they are recreated**.

The document reconstruction requires site surveys and technical inquiries (identification of the materials adopted, remake of the layout, etc.).



Estimated amount:

No researches were found to support the economic value of this capacity, but it is apparent and has been recognized by all operators interviewed.

The estimate of € 50.000 is considered by the interviewed an underestimate as the document reconstruction is more frequent than **expected**.

# RBI cost saving

RBI permits to **optimize inspection intervals** based on site-acceptable risk levels and operating limits, while mitigating risk as appropriate.

It permits also to **individuate the real damage mechanisms** so to provide correct **inspection methods** and **inspection locations** to individuate if the damage mechanisms are really existing, avoiding not useful inspection and maintenance activities.



## Upstream Project

## Onshore



### DETAIL OF THE PROJECT:

**NR of Static Equipment: 101**

**NR of Lines: 755**

**NR of PSVs: 82**

**NR of P&IDs: 89**

**LOCATION:** Kurdistan Region of Northern Iraq

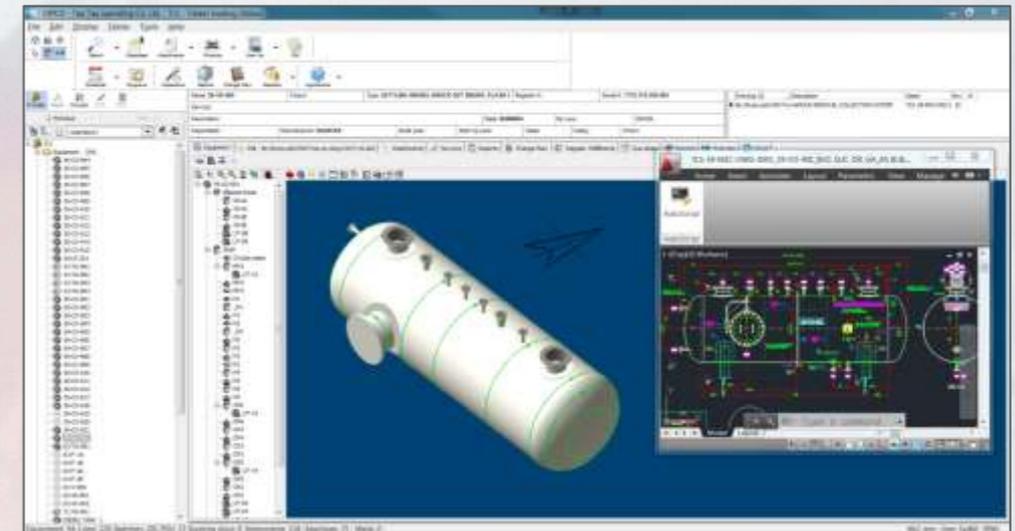
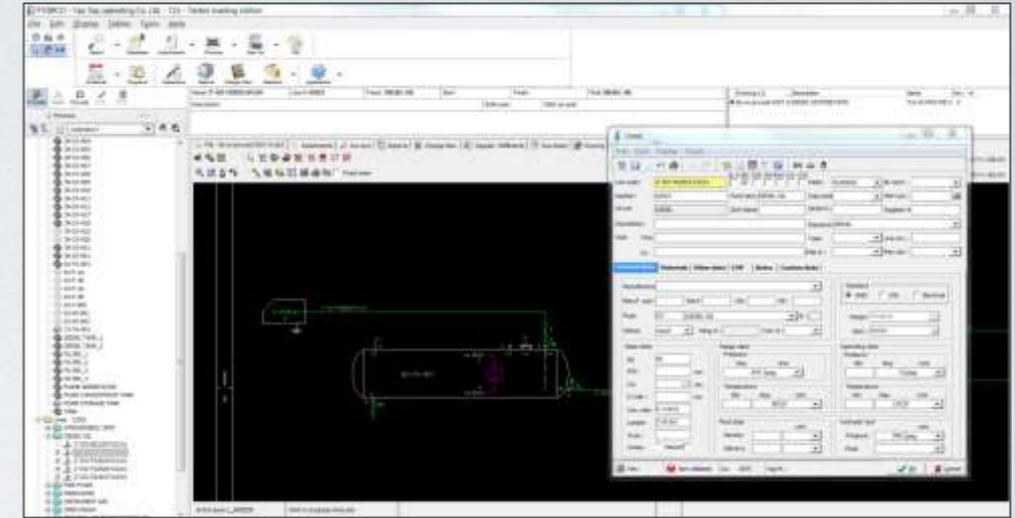
**PRODUCTION:** 105,000 SBOPD

**WELLS NUMBER:** 23

**PURPOSE:** Implementation of an Integrated Asset Integrity tool for continuous Inspection and Maintenance Management using RBI.

## Implementation

- **features:**
- Creation of existing item lists linking the official lists and the P&IDs representation (direct link).
- Loading of all technical data.
- Loading of technical documentation for each equipment and line.
- Laser Scanning of the area.
- 3D technical representation of the plant.
- RBI assessment.
- Inspection Plan implementation.
- Test point location in 3D model.
- Preparation of the database inspection and maintenance history management in a shared server.



## Cost/Benefit of Integration

Activity List	Value
1) Analysis and documentation cataloging	\$342
2) Extraction of lists from P&ID	\$5.383
3) Link with the official lists	\$1.800
4) Import data from Excel files	\$12.000
5) Entering the technical and inspection annexes	\$2.727
6) Creating 3D model	\$46.460
7) Inspection points on 3D Positioning	\$4.444
8) Entering historical inspection data	\$0
9) Connect to MMS or document manager	\$0
10) 3D Laser scanning	\$80.800
11) Entering laser scanning	\$15.487
<b>TOTAL</b>	<b>\$169.443</b>

Cost Saving List	Value
A: Insurance	\$2.251
B: Documents and data searching	\$67.527
C: Management of P&IDs and maps	\$11.254
D: Distribution of reports and data	\$0
E: Optimizations using 3D Model	\$22.509
F: Data entry from contractors	\$6.685
G: Benefit link with SAP, Maximo, ...	\$0
H: Operators' quality of life	\$9.004
I: Loss of production for delayed info	\$9.004
L: Reduction of unwanted shutdowns	\$18.007
M: Documentation rebuilding	\$5.627
<b>TOTAL</b>	<b>\$151.867</b>

**ROI = 1,2**  
**years**

\*Only the integrated usage of the Asset Management System is considered.

The cost and the benefit of performing RBI analysis and the cost and benefit of performing Inspection and Maintenance Activity are

## Upstream Project

## Offshore



**LOCATION:** Barents Sea, 100 km off the coast of Norway

**PRODUCTION:** 100,000 SBOPD

**WELLS NUMBER:** 22

**PURPOSE:** Implementation of an Integrated Asset Integrity tool for continuous Inspection and Maintenance Management using RBI both for topside and subsea.

### **DETAIL OF THE PROJECT:**

**NR of Static Equipment:** 668

**NR of Lines:** 11576

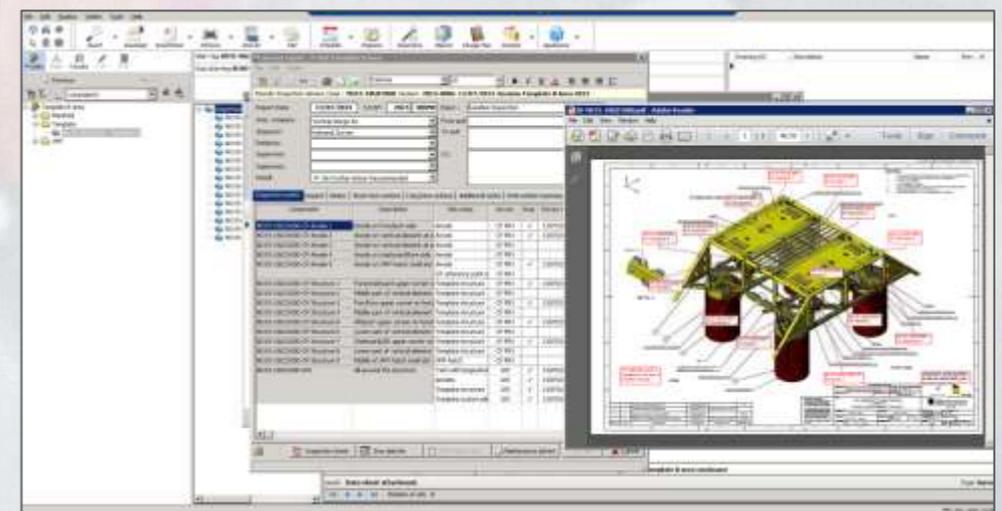
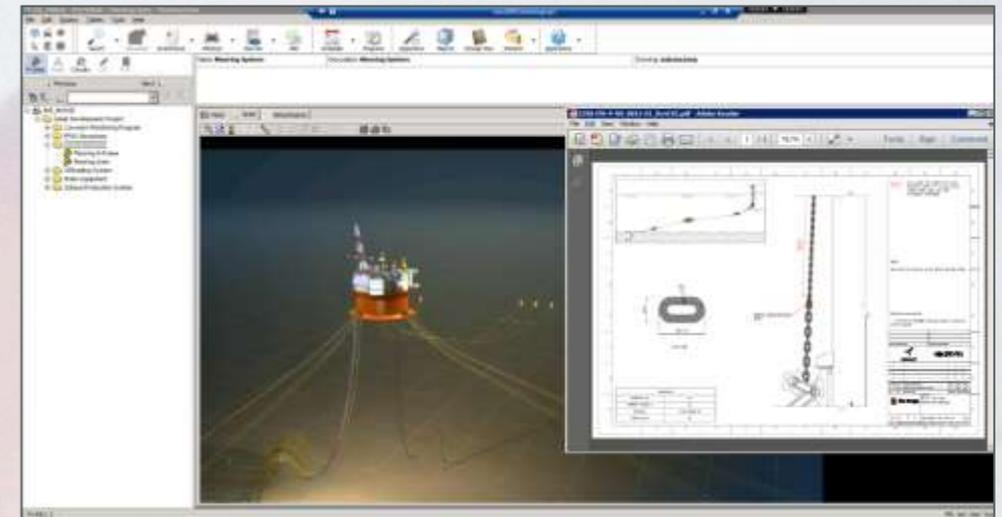
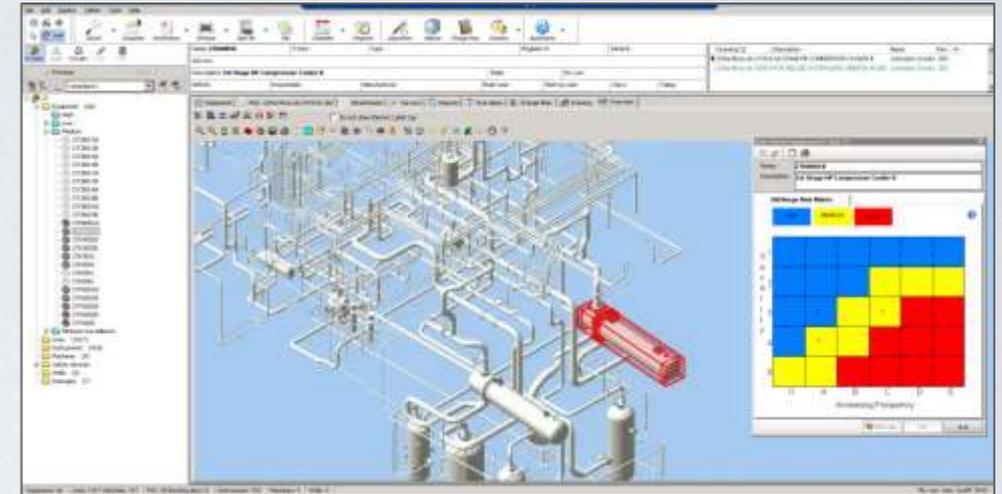
**NR of PSVs:** 357

**NR of P&IDs:** 485

## Implementation

### features

- Creation of existing item lists linking the official lists and the P&IDs representation (direct link).
- Loading of all technical data both for Topside and Subsea.
- Loading of technical documentation for each equipment and line.
- 3D technical representation of the plant.
- RBI assessment integration.
- Inspection Plan implementation.
- Test point location in 3D model.
- Preparation of the database inspection and maintenance history management in a shared server.



## Cost/Benefit of Integration

Activity List	Value
1) Analysis and documentation cataloging	\$1.897
2) Extraction of lists from P&ID	\$36.885
3) Link with the official lists	\$2.004
4) Import data from Excel files	\$13.362
5) Entering the technical and inspection annexes	\$20.083
6) Creating 3D model	\$81.820
7) Inspection points on 3D Positioning	\$0
8) Entering historical inspection data	\$0
9) Connect to MMS or document manager	\$0
10) 3D Laser scanning	\$0
11) Entering laser scanning	\$0
<b>TOTAL</b>	<b>\$156.051</b>

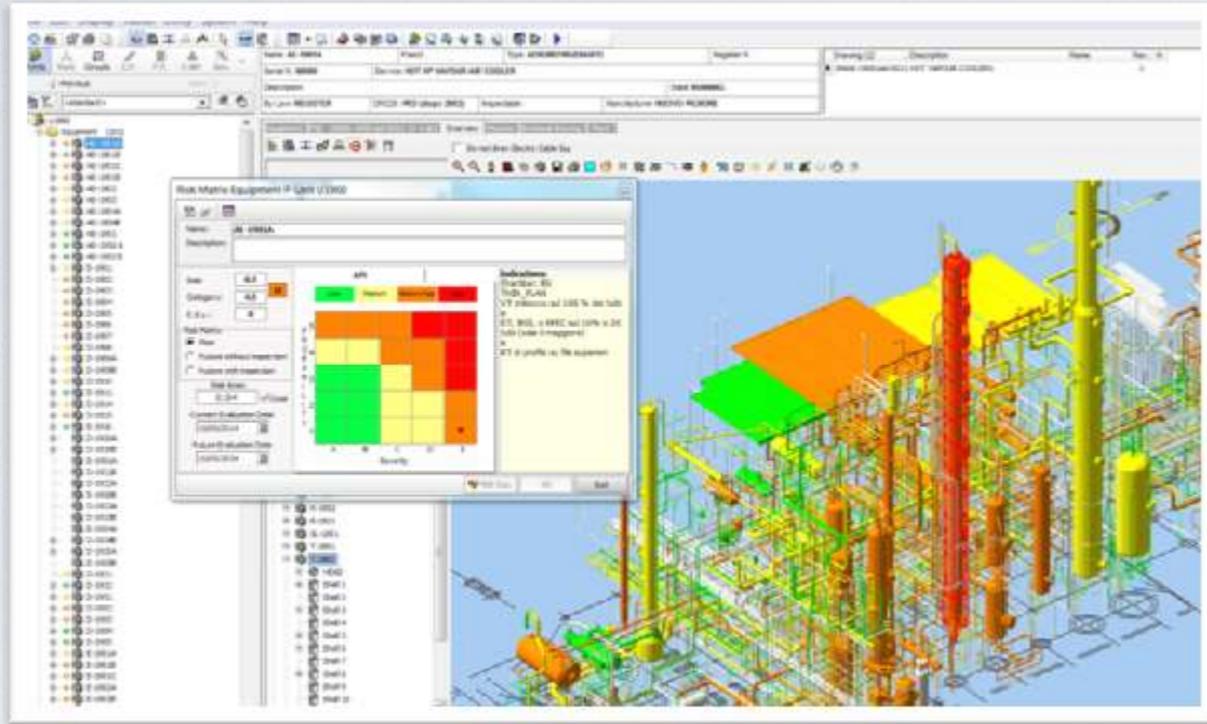
Cost Saving List	Value
A: Insurance	\$14.876
B: Documents and data searching	\$446.291
C: Management of P&IDs and maps	\$74.382
D: Distribution of reports and data	\$0
E: Optimizations using 3D Model	\$74.382
F: Data entry from contractors	\$22.091
G: Benefit link with SAP, Maximo, ...	\$0
H: Operators' quality of life	\$37.191
I: Loss of production for delayed info	\$37.191
L: Reduction of unwanted shutdowns	\$74.382
M: Documentation rebuilding	\$37.191
<b>TOTAL</b>	<b>\$817.977</b>

**ROI = 0,2**  
**years**

\*Only the integrated usage of the Asset Management System is considered.

The cost and the benefit of performing RBI analysis and the cost and benefit of performing Inspection and Maintenance Activity are

## RBI Implementation



**LOCATION:** North Italy

**Plant Type:** Oil Refinery

**Plant Unit Type :** Hydroconversion Unit

**PURPOSE:** RBI study and Implementation of an inspection plan based on risk.

### DETAIL OF THE PROJECT:

**NR of Static Equipment:** 99

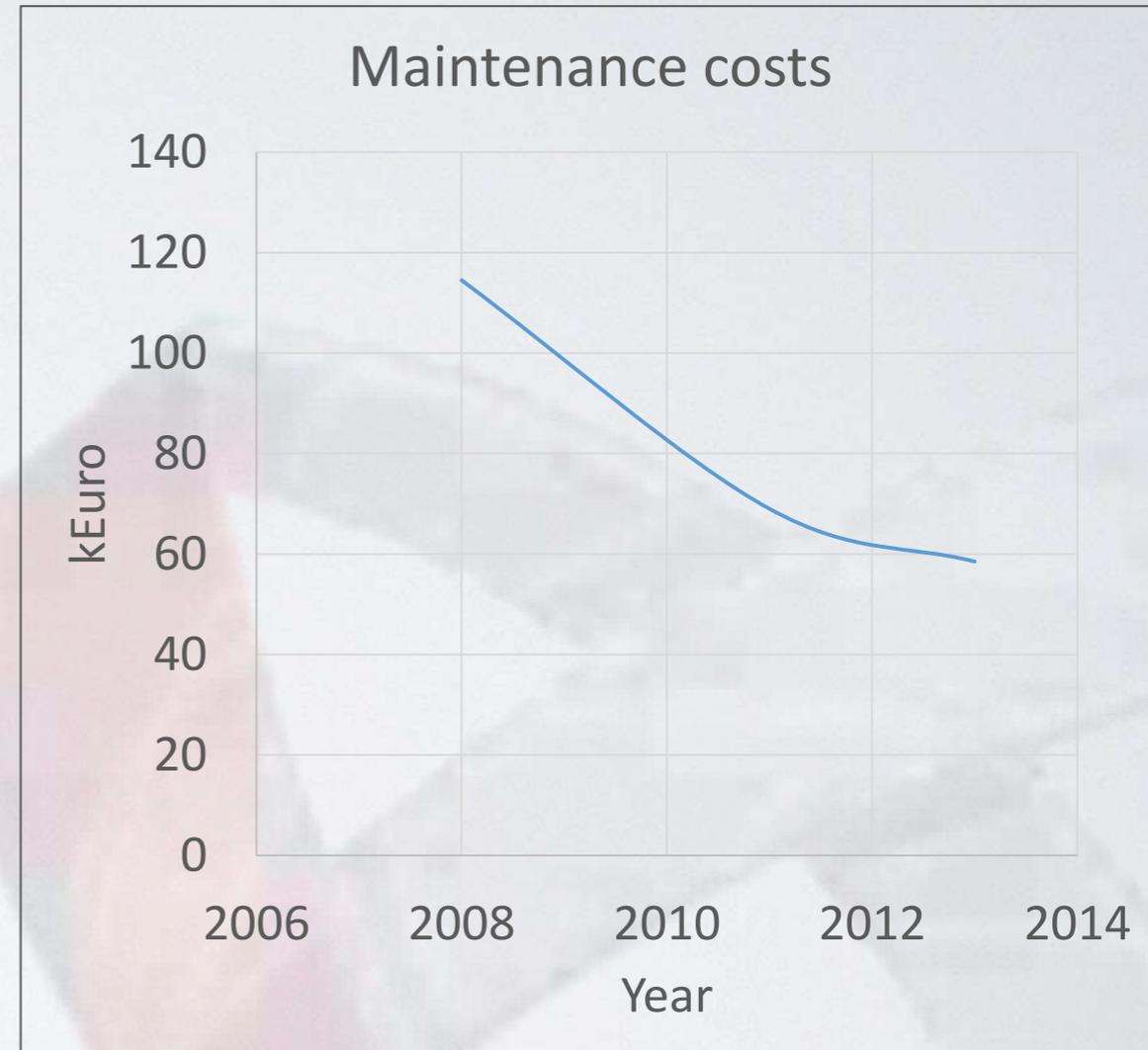
**NR of Lines:** 1363

**NR of PSVs:** 57

**NR of P&IDs:** 65

## Benefits of RBI

Turn Around Year	2008	2011	2013
<b>Equipment inspected</b>			
Heat Exchangers	10	5	10
Columns	5	2	3
Vessels	8	5	0
Reactors	2	1	0
Air Coolers	0	1	1
Heaters	1	1	
<b>Total</b>	<b>26</b>	<b>15</b>	<b>14</b>
<b>Maintenance costs (kEuro)</b>	<b>114,5</b>	<b>69</b>	<b>58,5</b>



RBI costs are **included** inside maintenance costs.  
 About 30 kEuro First Assessment, 10 kEuro for Reassessment

The **impact of integration** between inspection and maintenance activities with RBI techniques could be **really massive** in the final economical balance of Asset Integrity.

The use of **appropriate tools** and their **integration** is very important for planning and accomplishing an effective asset integrity management.



**THANKS FOR  
YOUR  
ATTENTION**





**Antea**  
our eyes, your security

Antea S.r.l.

Via San Crispino 82, 35129, Padova, ITALY

 +39 049 7808312

 +39 049 8089516

 [antea@anteash.com](mailto:antea@anteash.com)

[www.anteash.com](http://www.anteash.com)

**Accountable****Alberto Mura**

File Name

PAM Iran abstract Mura

Revisions

R01 07/10/2016 Alberto Mura

R02 22/10/2016 Alberto Mura

This document is © 2016 Antea s.r.l.