



Overview of the PI System in Our Factory After 15 Years of Usage

Presented by
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Solvay Chimica Italia S.p.A.

Solvay in the World

- Group founded **in Belgium in 1863** working in **sectors of chemistry and plastic materials.**
- It is active in **40 countries** with **around 300 sites and plants**
- It aims to a growing presence in **Asia, America and East Europe**
- It has a **worldwide leadership** in the market where it is present
- Some figures (year 2010):
 - Sales: **6.8 Billion €**
 - Income: **0.6 Billion €**
 - Employees: **16800**



In 2012 we will celebrate 100 years of industrial activity



Solvay in Italy

Chemistry and plastic materials

Over 2000 people

548 million euro of sales in 2010

It represents 8% of the Group's activities

9 production sites

Rosignano factory

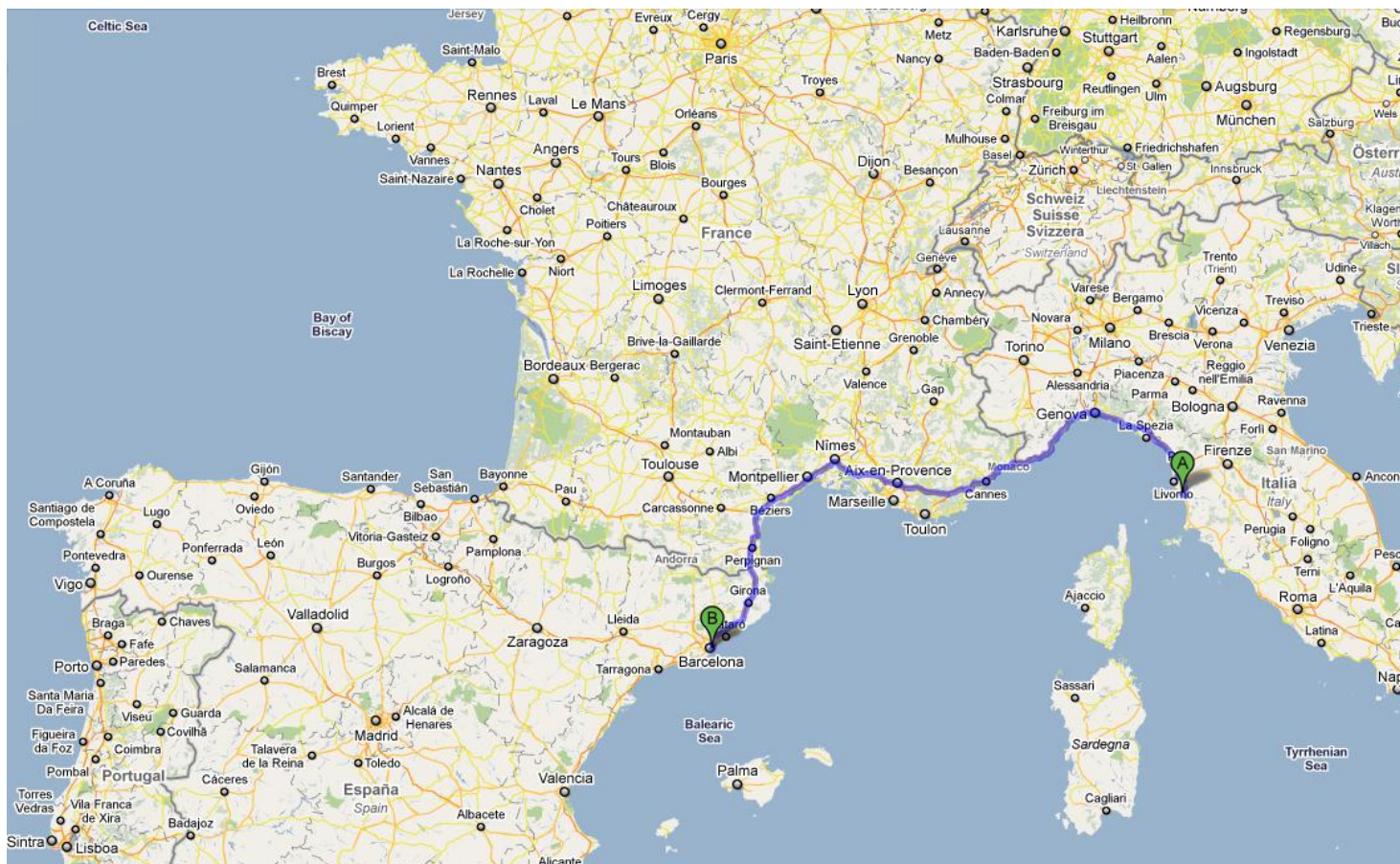
Historical notes

- **Building start 1912**
- **Production start 1917**

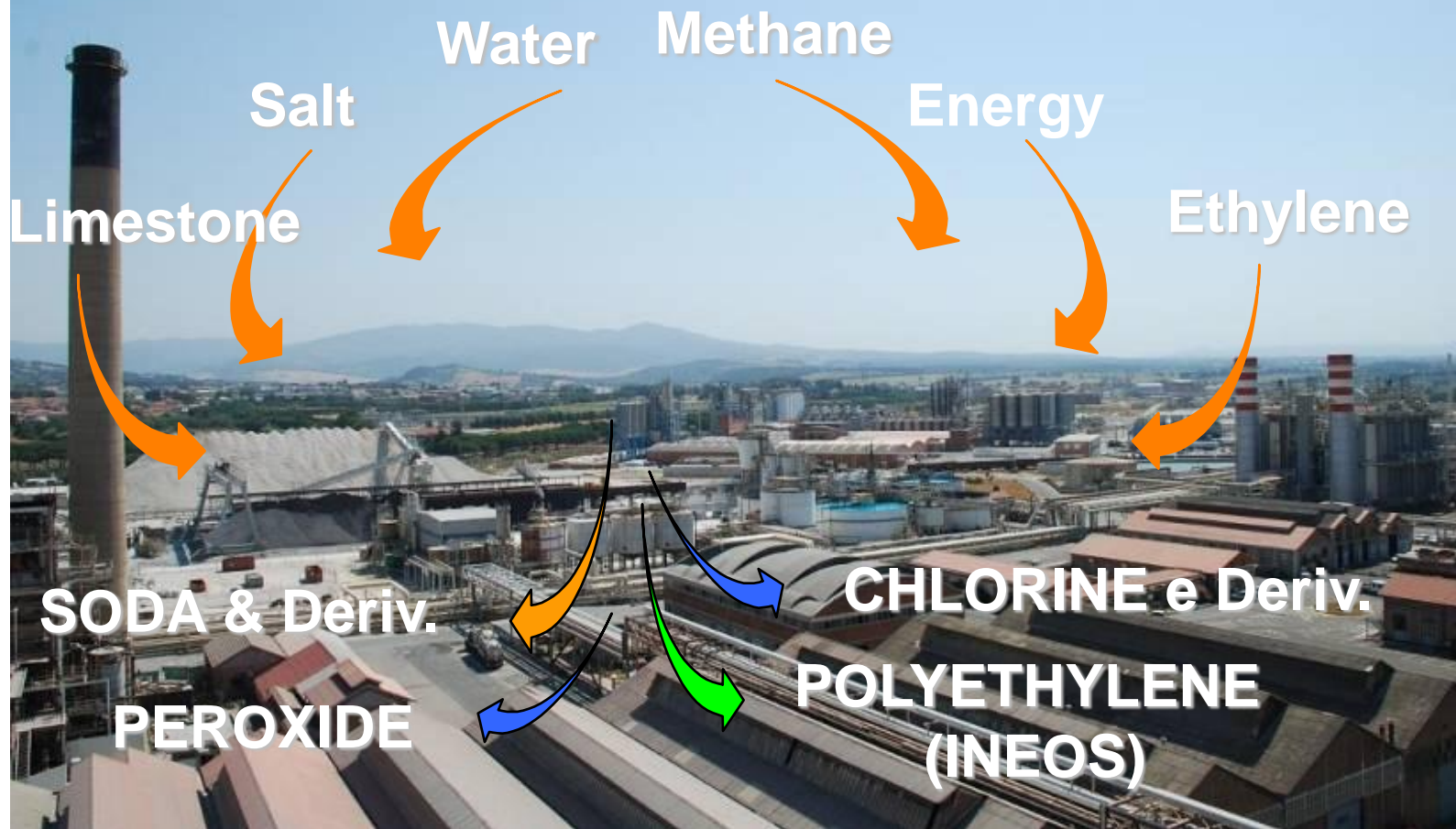
Current situation (2010)

- **The factory occupies 2.2 km²**
- **Investments almost 12 M€**
- **People: 700 directly employed**
400 indirectly “ ”

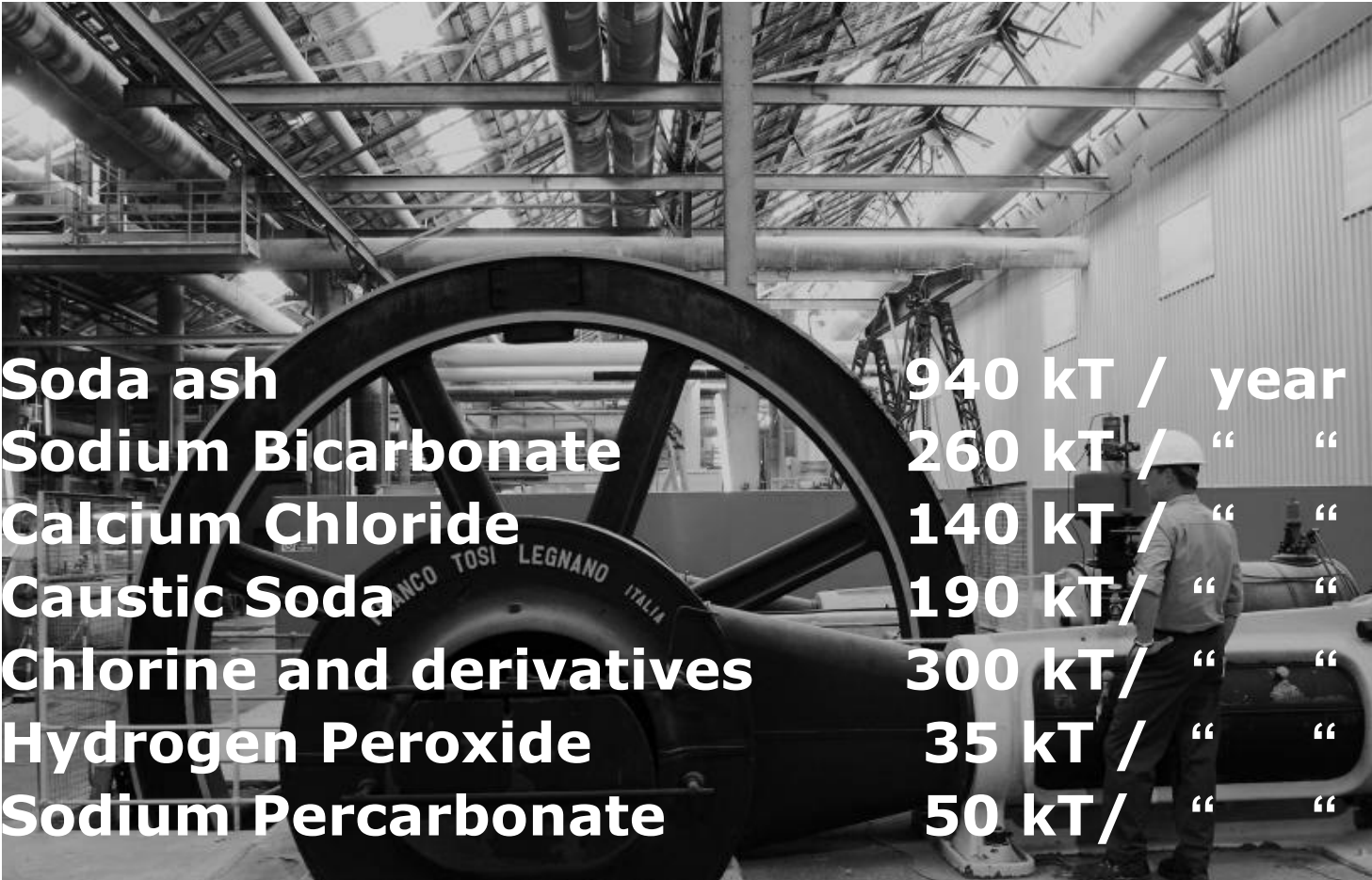
Where we are



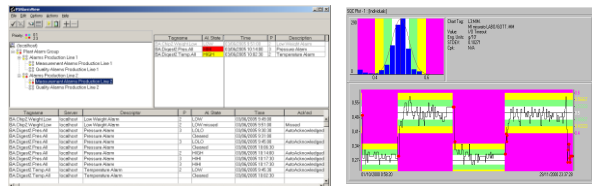
Productions



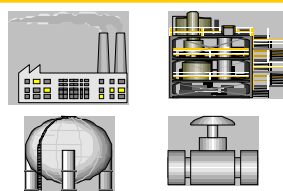
Production Capacity



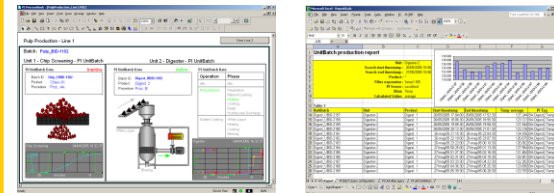
| | |
|---------------------------------|----------------------|
| Soda ash | 940 kT / year |
| Sodium Bicarbonate | 260 kT / “ “ |
| Calcium Chloride | 140 kT / “ “ |
| Caustic Soda | 190 kT / “ “ |
| Chlorine and derivatives | 300 kT / “ “ |
| Hydrogen Peroxide | 35 kT / “ “ |
| Sodium Percarbonate | 50 kT / “ “ |



Quality & Safety management



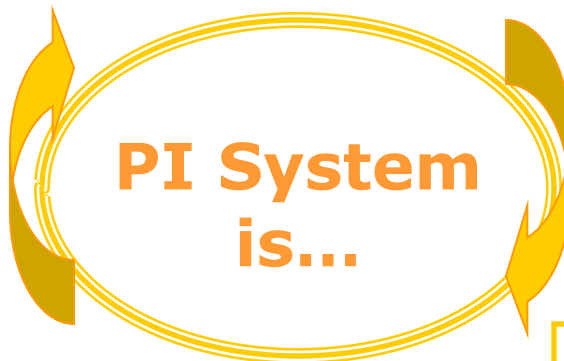
Models & Analyses



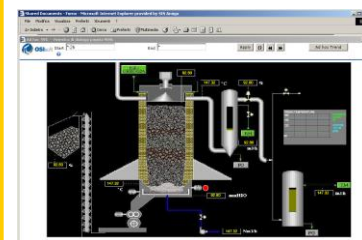
Reporting



Notification system



**PI System
is...**



Web Monitoring

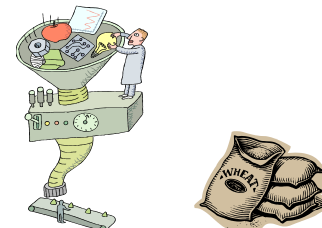
Index



LIMS

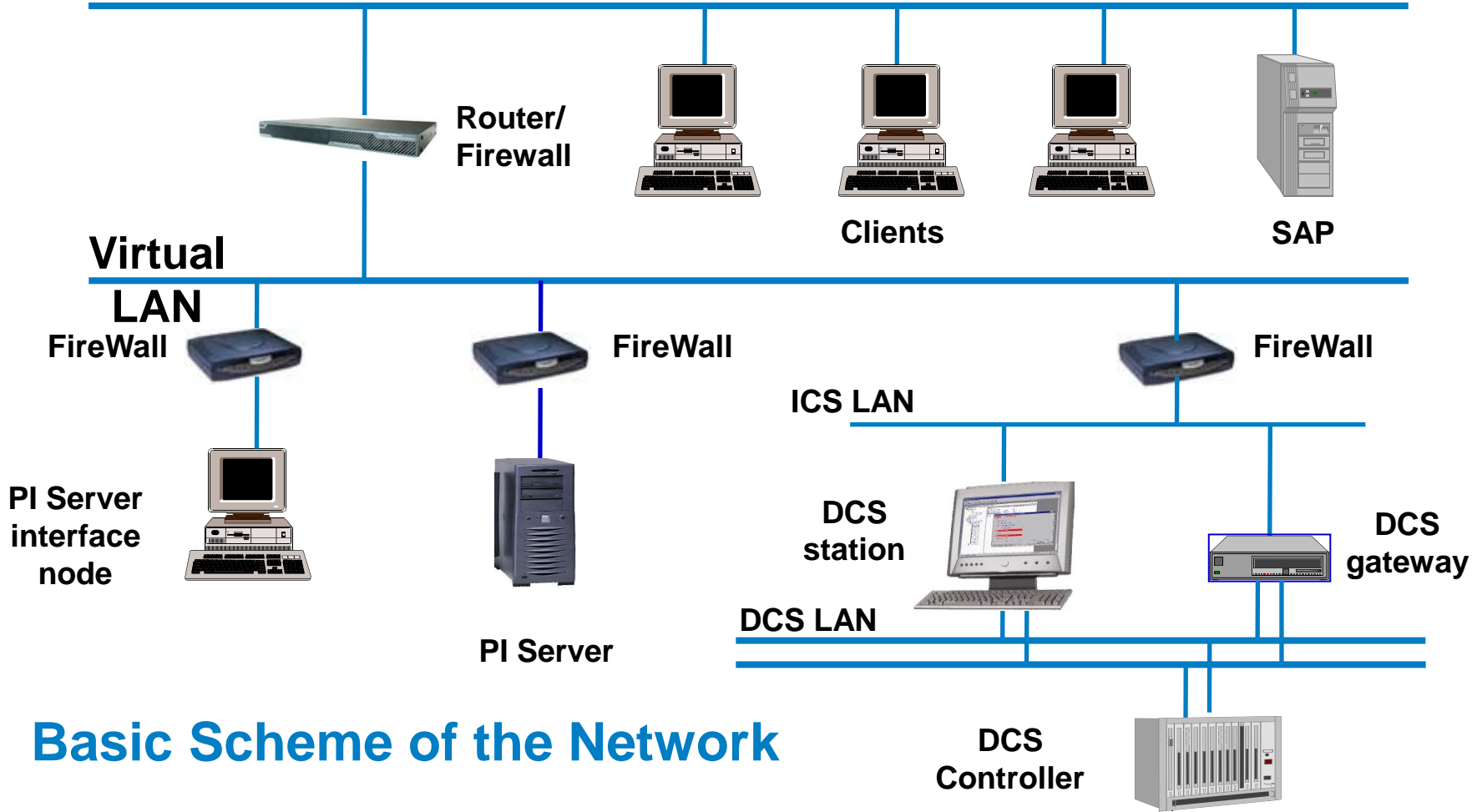


Two-ways DCS Interfacing



Batch Management

Office Automation LAN



Basic Scheme of the Network

Shift Report – Electric Dep.

Loading the specified date

Switches config. + notes to PI System

Scrolling through shifts

Arrangement registered in PI System

Data from PI System

Users' notes

Shift Report of the Electrical Department

UST - GRS
 Overia (via esteso): 4/10/10 5.15
 DATA: 03/10/2010 TURNO: 3 SQUADRA: C
 GESTIONE: Settore Energia Elettrica

UP DATE
 Send to PI
 Print Shift Report

Aspetto Rete 33FE

Dati a servizio di fine turno

| | |
|-----------------|------|
| Acquisto | |
| Acq.TSA MWh | 0.0 |
| Acq.TSB MWh | 0.0 |
| Acq.T18 MWh | 49.6 |
| Acq.T20 MWh | 18.2 |
| Acq.Totale MWh | 68.8 |

| | |
|-------------------|--------|
| Produzione | |
| VE MWh | |
| TAP | 1 0.0 |
| TAT | 44 2.7 |
| TAT | 45 2.7 |
| TOTALE | 90 6.0 |

| | |
|----------------------|-----------|
| Distribuzione | |
| TF 5 MWh | 16.1 |
| TF 6 MWh | 13.9 |
| T.S. Nord MWh | 35.5 |
| KA Elettrolisi | 58 |
| SODIERA | 2062 1337 |

RETE RETE FID V ARIE WPC CO STATO FI EMO TO FI ALCALI In use In use

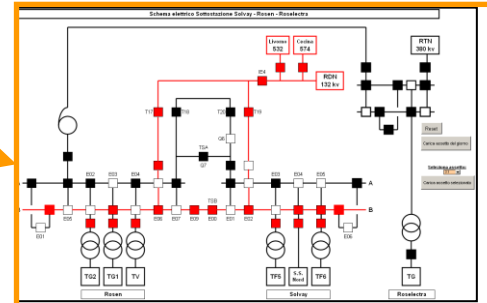
Notes for S.S.132KV

(A) Per ripristino termico pompa olio interruttore stallo E04, allarme rientrato. Da verificare nelle prossime ore se la pressione olio è al valore nominale, dal momento che in mia presenza non ha fatto cicli di reintegro pressione olio.

RETE FID: La Rosen ha comunicato che il rientro in FID è previsto per le 8.15, al momento non ci sono messaggi scritti (ore 5.06) al cambio turno avevano detto alle 7.15, si dovrebbe attendere il messaggio scritto.

V ARIE: La via di accesso all'esterno dello stabilimento presso il cancello del Mondiglio (quello che adoperiamo per entrare e uscire dallo stabilimento), è al 50% invaso dalle canine, sarebbe opportuno pensare a farle tagliare.

GRS XXX



Delete notes

E-Mail distribution list

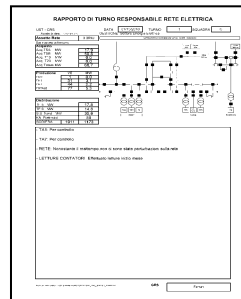
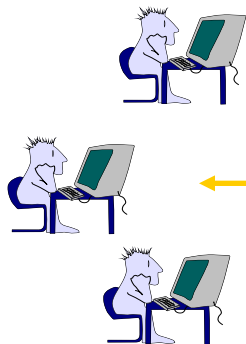
Anomaly TO: ITR-UST-CoodinatorELEC@solvas.com ITR-UST-ReperibIA_TMT@solvas.com
 Out of service CC: ITR-GRS@solvas.com

Send e-mail

People in charge enter notes and indicates anomalies or inefficiencies for each electrical room

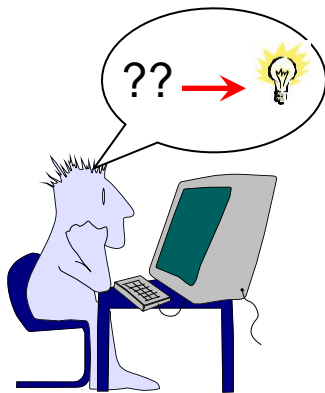
Shift Report – Electric Dep.

Every report is saved in a network folder in tif format



Main features:

1. Search of past events and how they were resolved
2. Find all notes containing a string of text



| Electrical tasks per room | | |
|---------------------------|--|--|
| Start: | 1/10/2010 | <input type="text"/> Search <input type="text"/> |
| End: | 1/11/2010 | |
| Room: | FE4 | |
| Filter: | Tutti | |
| Num of tasks : 11 | | |
| Data | Descrizione | Assetto |
| 10/10/2010 22:00 | IN SICUREZZA PER LAVORI MECCANICI F881/1/A (FL 8763) E F881/1/B (FL8764) | * 3 3RIU * |
| 14/10/2010 14:00 | tolto di sicurezza F881/1/A (FL N°8763) E F881/1/B (FL N°8764) | * 3 3RIU * |
| 19/10/2010 6:00 | In sicurezza per lavori meccanici F881/1/B (FL 8765) | * 3 3RIU * |
| 19/10/2010 14:00 | 1)-Per togliere di sicurezza F881/1/B (FL n°8765) 2)-Controllato assetto TRF. 3 + Varie per lavoro da effettuare domani | * 3 3RIU * |
| | Messo in sicurezza con terre TF3 per sostituzione (FL 9167) N.B. : RD2 110Vcc è sulle batterie in quanto prende l'alimentazione principale dall' MCC5 disalimentato al momento della fermata del TF3. Le utenze sono comunque ridondanti su RD1 110Vcc. | |
| | Messo in sicurezza F881/1/B per sostituzione VTL moduli di potenza su azionamento (FL 9168). Lavoro terminato , rimossa la sicurezza. | |
| | Successivamente , messo in sicurezza F881/1/A per sostituzione VTL moduli di potenza su azionamento (FL 9169) Lavoro terminato , rimossa la sicurezza | |
| 20/10/2010 6:00 | Di nuovo messo in sicurezza F881/1/B per smontaggio modulo di potenza su azionamento (FL 9170) | * 3 3RIU * |
| | (A) Rimosso di sicurezza TF3 dopo sostituzione TP privato gli allarmi con esito negativo (gli allarmi arrivano all'RTU ma non vengono ripetuti in sala controllo) provato gli scatti con esito positivo , verbale di consegna ricevuto in apposito registratore FL 9167 | |
| | Al TD è stata montata una recinzione provvisoria in settimana proseguiranno i lavori su riparazione recinzione + nuova tetta | |
| 30/08/2010 14:00 | Rimozione di sicurezza F881/1/B - FL 9170 | * 3 3RIU * |
| 21/10/2010 6:00 | Autorizzazione n°9276 per costruzione tettoia TRF 3 | * 3 3RIU * |
| 26/10/2010 6:00 | Messo in sicurezza F881/1/A (FL 9227) | * 3 3RIU * |
| 26/10/2010 6:00 | Messo in sicurezza F881/1/B (FL 9228) | * 3 3RIU * |
| 29/10/2010 6:00 | Messo in sicurezza TP 3 per rimozione ponteggio FL 9172 al termine dei lavori rimosso sicurezza e rimosso in servizio il TF3 | * X * |
| | Rimozione di sicurezza F881/1/B FL 9227 | |
| | Rimozione di sicurezza F881/1/A FL 9228 | |
| 30/10/2010 14:00 | | * 3 3RIU * |
| 31/10/2010 6:00 | Per sicurezza elettrica pomini F881/1/a + 1/B (@ n°9173 e 9174). A lavoro terminato tolto le sicurezze. | * 3 3RIU * |

Web monitoring

PI Module DB

Display coming from PI ProcessBook → PI WebParts

The screenshot shows a web browser window displaying a process monitoring interface. The browser title is "Sinottici - Schema Generale FCH - Windows Internet Explorer provided by SIS Amigo". The address bar shows the URL: "http://itr-piweb.r.it.solvay.com:31064/sites/itr-soda/ITR-FCH/Sinottici/Schema%20Generale%20FCH.aspx".

The interface displays the following components:

- Navigation Tree (RTTreeView):** A list of folders and files under "FCH": FCD1, FC02, FC03, FC04, FC05, FC07, FC08, FC09, FC10, FC11, FC1B, FC7B.
- Time Range:** Start Time: *-8h, End Time: *, Apply, and navigation buttons.
- Process Flow Diagram:** A central diagram showing a brick-lined furnace with various inputs and outputs. Key elements include:
 - ANALIZZATORE:** CO2: 34 %, CO: 2 %, O2: 2 %.
 - TITOLO:** CO2: 0 %, CO: 0 %, O2: 0 %.
 - Processors:** PY00B, FC03, EM, FG, SC00, ME01, ME02, ME03, ME04, ME05, ME06, PI01, TPS.
 - Flow Rates:** 167 m³/h, 25 m³/h, 10 G/min, 44 %, 66 m³/h, 5397 Nm³/h.
 - Temperatures:** T100: 167 °C, T101: 89 °C, T105: 58 °C.
 - Other Data:** FCHP101: -188 m³/h₂O, FCH01: 188 m³/h₂O.
- DATI DI MARCIA:**

| | | |
|----------------------|------|---|
| MARCIA | 249 | % |
| INTEGR. MARCIA REALE | 2143 | t |
| ORE MARCIA | 0 | |
| CARICHE GIORNALIERE | 24 | |
| INDICE COKE | 222 | |

Main Goal: Access easily your data everywhere.



Web monitoring

ADVANTAGES

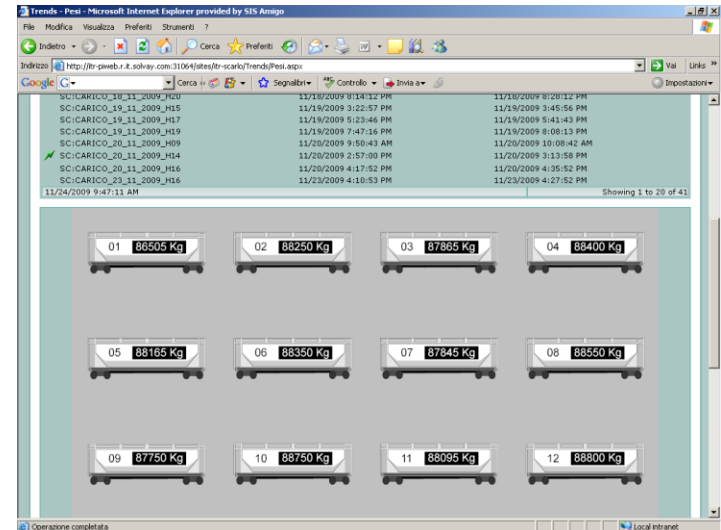
- **Simplified Client**
- **Access your data from any PC in your Company net**
- **Views restricted to the allowed web pages**
- **Multi-site usage of the same installation**
- **Concurrent license – cost reduction**

Batch Management

The PI Batch module helps to trace production or treatment phases inside the process.

What we mainly use the PI Batch module for:

- Control production loads
- Control chemical treatments
- Analyses of sensible measurements (e.g. for the respect of 2008/1/CE - “IPPC”)
- Tests for our Research facility (membrane cells for electrolysis)



Example of PI Batch Report

Production charge

Start time: 01/03/2011 6:00
End time: 01/04/2011 6:00

Unit: PIUnitNameTag
Tag flow: FlowTag
Tag tot on DeltaV: TotalTag
Tag type of charge: TypeOfChargeTag
WC tag code: WCTagCode

Current Month

Calculate

Selection

Year: 2011
Month: 3
Longer than: 2 minute

| Charge type | WC Code | Tot | Start | End | Time (dd mm hh) | Hour | Day |
|-------------|---------|---------|-------------------|-------------------|-----------------|------|-----|
| WC | 614/3 | 507,1 | 30/03/11 10:15:50 | 30/03/11 10:18:05 | 00 00 02 | 0,0 | 30 |
| WC | 614/3 | 15505,4 | 30/03/11 09:12:30 | 30/03/11 10:12:15 | 00 00 59 | 1,0 | 30 |
| WC | 614/3 | 14399,5 | 28/03/11 17:10:50 | 28/03/11 18:04:50 | 00 00 54 | 0,9 | 28 |
| WC | 614/3 | 604,0 | 28/03/11 17:07:20 | 28/03/11 17:10:35 | 00 00 03 | 0,1 | 28 |
| WC | 614/3 | 30002,5 | 26/03/11 15:28:05 | 26/03/11 17:14:50 | 00 01 46 | 1,8 | 26 |
| WC | 609/3 | 29999,6 | 23/03/11 10:29:20 | 23/03/11 11:00:00 | | | |
| WC | 609/3 | 30007,6 | 19/03/11 23:08:30 | 20/03/11 00:00:00 | | | |
| WC | 096/1 | 27004,6 | 17/03/11 22:38:40 | 18/03/11 00:00:00 | | | |
| WC | 096/1 | 30001,6 | 15/03/11 18:41:00 | 15/03/11 19:00:00 | | | |
| WC | 802/2 | 28000,4 | 13/03/11 22:50:10 | 14/03/11 00:00:00 | | | |
| WC | 802/2 | 29242,9 | 11/03/11 16:42:15 | 11/03/11 17:00:00 | | | |
| ATB | | 754,9 | 11/03/11 16:39:00 | 11/03/11 17:00:00 | | | |
| WC | 543/7 | 27700,2 | 09/03/11 23:12:30 | 10/03/11 00:00:00 | | | |
| ? | N.A. | 41,7 | 09/03/11 15:51:15 | 09/03/11 16:00:00 | | | |

| TOT | WC | ATB |
|-------------------|--------|-----|
| Number of charges | 14 | 12 |
| Hours | 16,12 | 1 |
| Tot(kg) | 263772 | |

List of load operations

| WC Code | Total monthly | Num. of charges |
|---------|---------------|-----------------|
| N.A. | 42 | 1 |
| 095/3 | 0 | 0 |
| 096/1 | 57006 | 2 |
| 114/3 | 0 | 0 |
| 330/4 | 0 | 0 |
| 537/3 | 0 | 0 |
| 543/7 | 27700 | 1 |
| 546/4 | 0 | 0 |
| 586/3 | 0 | 0 |
| 609/3 | 60007 | 2 |
| 614/3 | 61018 | 5 |
| 615/0 | 0 | 0 |
| 620/0 | 0 | 0 |
| 802/2 | 57243 | 2 |

List of loads per freight car

Total loads per day

Num of charges WC: 263017
Num of charges ATB: 755

Production charge

Year: 2011
Month: 3
Longer than: 2 minute

| Day | Num of charges | Tot(kg) | Tot (hour) |
|-----|----------------|---------|------------|
| 1 | 0 | 0 | 0,0 |
| 2 | 0 | 0 | 0,0 |
| 3 | 0 | 0 | 0,0 |
| 4 | 0 | 0 | 0,0 |
| 5 | 0 | 0 | 0,0 |
| 6 | 0 | 0 | 0,0 |
| 7 | 0 | 0 | 0,0 |
| 8 | 0 | 0 | 0,0 |
| 9 | 2 | 27742 | 1,8 |
| 10 | 0 | 0 | 0,0 |
| 11 | 2 | 29998 | 1,8 |
| 12 | 0 | 0 | 0,0 |
| 13 | 1 | 28000 | 1,7 |
| 14 | 0 | 0 | 0,0 |
| 15 | 1 | 30002 | 1,8 |
| 16 | 0 | 0 | 0,0 |
| 17 | 1 | 27005 | 1,8 |
| 18 | 0 | 0 | 0,0 |
| 19 | 1 | 30008 | 1,8 |
| 20 | 0 | 0 | 0,0 |
| 21 | 0 | 0 | 0,0 |
| 22 | 0 | 0 | 0,0 |
| 23 | 1 | 30000 | 1,9 |
| 24 | 0 | 0 | 0,0 |
| 25 | 0 | 0 | 0,0 |
| 26 | 1 | 30003 | 1,8 |
| 27 | 0 | 0 | 0,0 |
| 28 | 2 | 15004 | 1,0 |
| 29 | 0 | 0 | 0,0 |
| 30 | 2 | 16012 | 1,0 |
| 31 | 0 | 0 | 0,0 |

| Tot | WC | ATB |
|-------------------|--------|-----|
| Number of charges | 14 | 12 |
| Hours | 16,12 | 1 |
| Tot(kg) | 263772 | |

Summary Report

| WC Code | Total monthly | Num. of charges |
|---------|---------------|-----------------|
| N.A. | 42 | 1 |
| 095/3 | 0 | 0 |
| 096/1 | 57006 | 2 |
| 114/3 | 0 | 0 |
| 330/4 | 0 | 0 |
| 537/3 | 0 | 0 |
| 543/7 | 27700 | 1 |
| 546/4 | 0 | 0 |
| 586/3 | 0 | 0 |
| 609/3 | 60007 | 2 |
| 614/3 | 61018 | 5 |
| 615/0 | 0 | 0 |
| 620/0 | 0 | 0 |
| 802/2 | 57243 | 2 |



Number of charges WC: 263017



Number of charges ATB: 755

263772

Two-ways interface – set points to DCS

CONTEXT

- **Electrolytic plant → big consumer of energy**
- **Declare future energy consumptions 2 days in advance**
- **Price of energy fixed one day later**
- **Respect consumption statements or hefty fined**

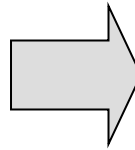
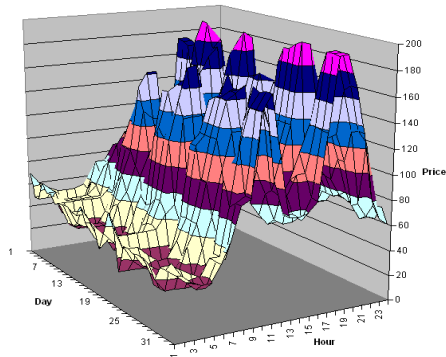


PROBLEM

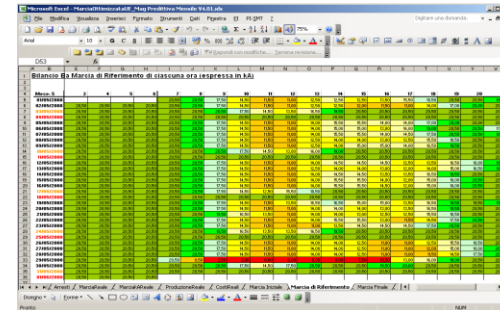
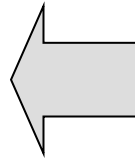
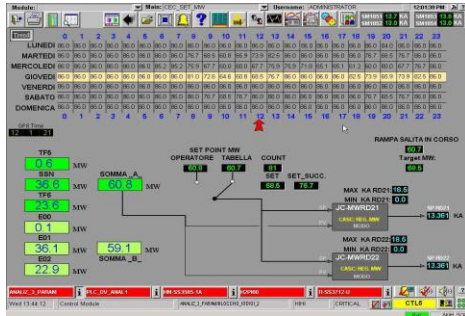
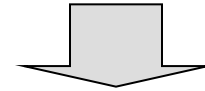
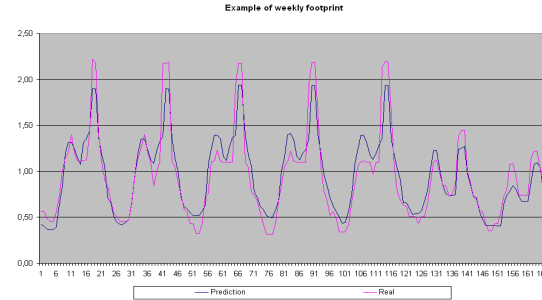
Find an optimized load shedding of the energy consumption

Two-ways interface – set points to DCS

Analysis of the past Energy price



Estimation of the future trend



Process Control

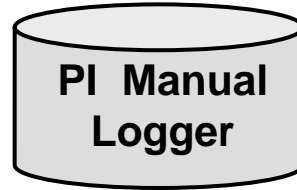
Calculation most convenient Set points

We estimate a savings of around 300 k€/year on the energy cost

PI System as a Laboratory System

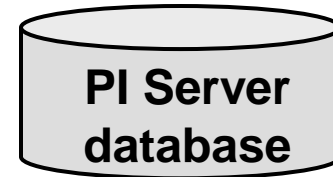
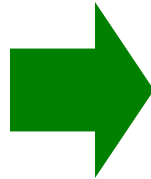


PI Manual Logger Users



Validation

PI Manual Logger and PI Users



PI Manual Logger is an utility for Data Entry Operations.

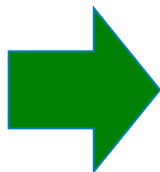
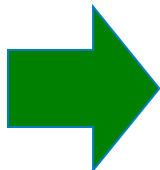
PI Manual Logger as a LIMS

PI Manual Logger is a utility for data entry operations

Our Requirements for a LIMS

Data entry sessions

Management of Low/High limits



Fulfillments with PI Manual Logger

Tour = list of tags for labo
Tour run = data entry session

Low limits
High Limits
Delta limit

} values or tags

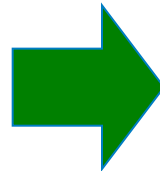
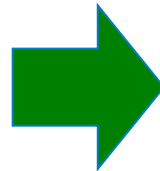
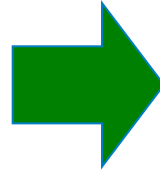
PI Manual Logger as a LIMS

Requirements

Two levels of users:
1) Operators
2) Supervisors

**Data Collection
Scheduling**

**WWW Traceability:
What, Who, When**



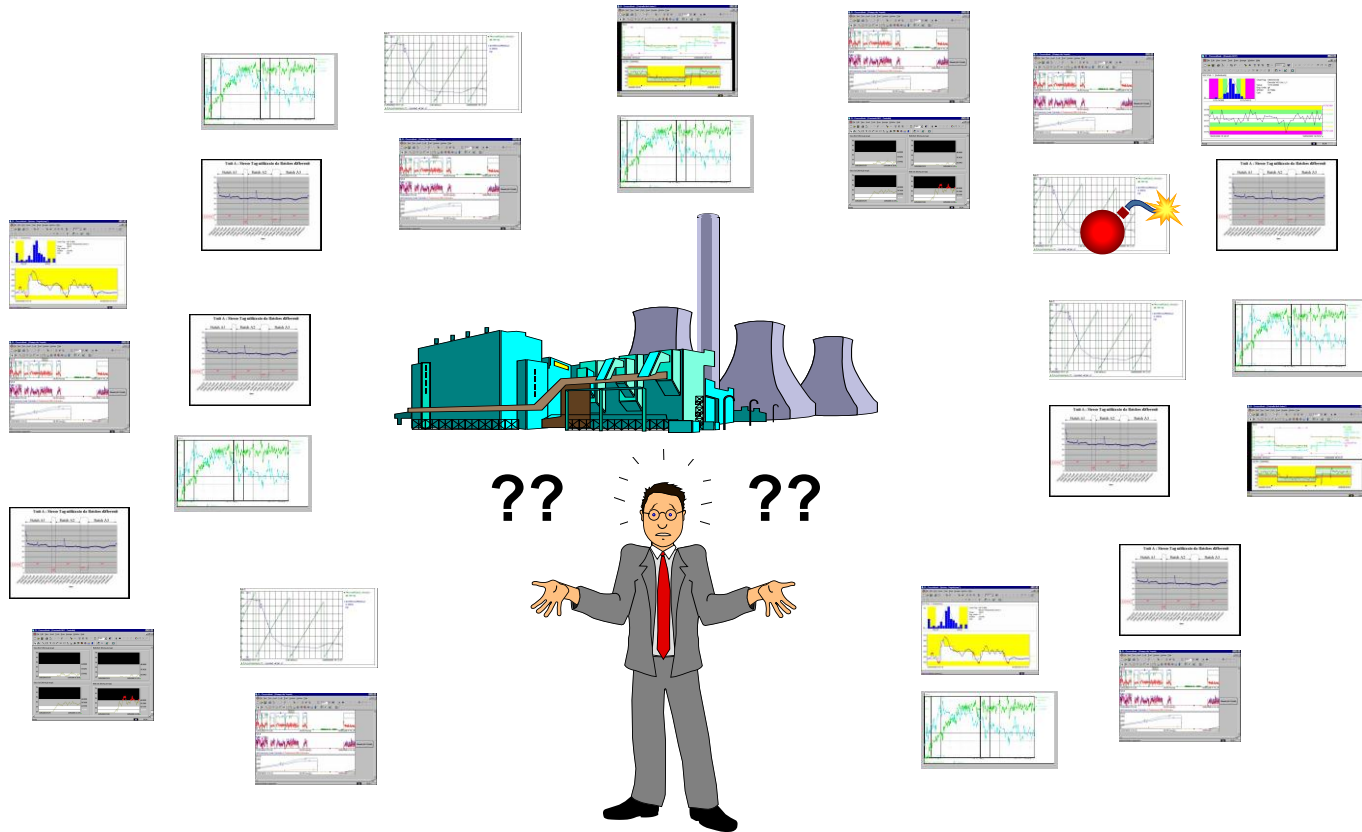
Fulfillments

Two kind of user groups:
1) Data entry group
2) Full Access group

**Scheduling based on
Recurrence clock
(hourly...yearly)**

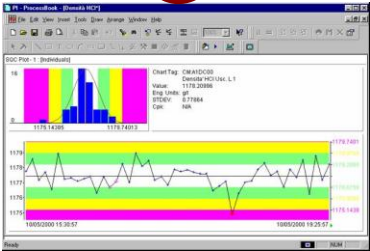
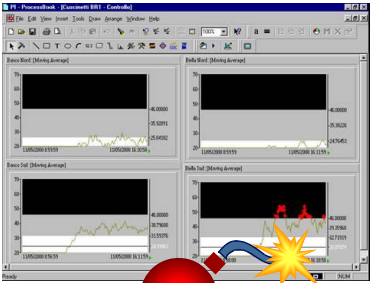
Audit Functionalities

Notification of Process Alarms

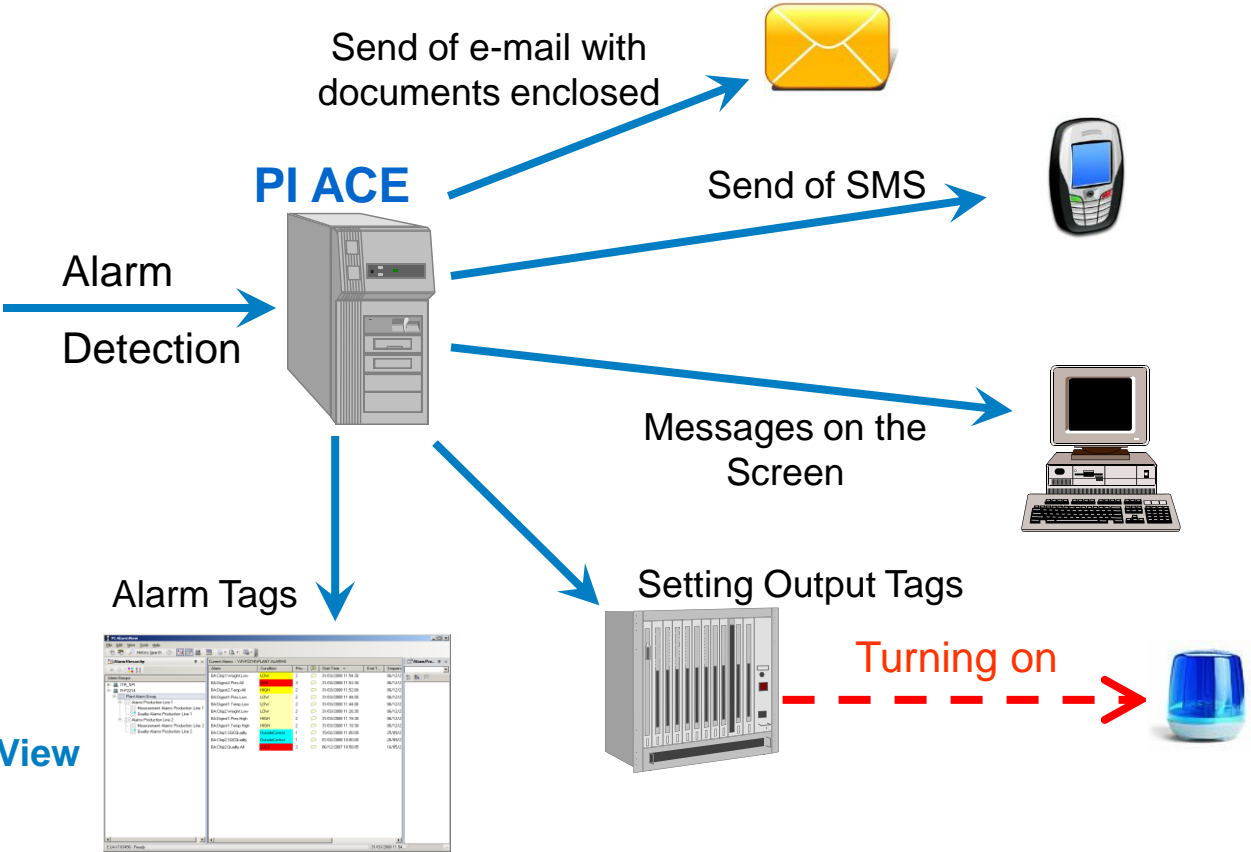


Where is a warning or danger ?

Notification means



PI AlarmView



We built our PI ACE application when PI Notifications did not exist

Quality/Safety management

PI AlarmView

Alarm Hierarchy

- ITR_SPI
 - Gruppo Allarmi di Rosignano
 - Gruppo Allarmi Clorometani
 - Gruppo Allarmi ECO
 - Gruppo Allarmi di S. Carlo
 - Gruppo Allarmi BR1
 - Gruppo Allarmi SO
 - Gruppo Allarmi UE
 - Gruppo di prova

Current Alarms - \VTR_SPINROS:ALLARMI\SC:ALLARMI\SC:BR1_ALLARMI

| Alarm | Condit... | Prio... | Start Time | Sequence Start |
|---------------|-----------|---------|---------------------|---------------------|
| SC:VICUBAS_AL | HIGH | 2 | 04/04/2011 11:00:44 | 16/03/2011 16:23:05 |
| SC:VICUBIS_AL | HIGH | 2 | 04/04/2011 10:57:00 | 16/03/2011 15:04:13 |
| SC:VICUBAN_AL | HIGH | 2 | 04/04/2011 10:54:09 | 16/03/2011 15:25:42 |
| SC:VICUBIN_AL | HIGH | 2 | 04/04/2011 10:46:02 | 16/03/2011 15:19:14 |

Events that must be checked and explained

PI AlarmView

White water

04/04/2011 9:28

Year 2011

Longer than 120

| Start time | End time | Duration (hh mm ss) | Hour | Month | Merch |
|-------------------|-------------------|---------------------|------|-------|-----------|
| 02/03/11 02:41:15 | 02/03/11 08:58:03 | 00 06 16 | 6,3 | 3 | N.events |
| 01/03/11 13:54:40 | 01/03/11 20:07:13 | 00 06 12 | 6,2 | 3 | Tot hours |
| 01/03/11 07:31:19 | 01/03/11 13:54:10 | 00 06 22 | 6,4 | 3 | |
| 28/02/11 14:07:22 | 01/03/11 07:25:19 | 00 17 17 | 17,3 | 3 | |
| 28/02/11 09:57:01 | 28/02/11 13:49:21 | 00 03 52 | 3,9 | 2 | |
| 26/02/11 16:01:12 | 28/02/11 09:55:17 | 01 17 54 | 41,9 | 2 | |
| 24/02/11 14:41:41 | 26/02/11 16:00:12 | 02 01 18 | 49,3 | 2 | |
| 16/02/11 17:36:59 | 16/02/11 20:12:24 | 00 02 35 | 2,6 | 2 | |
| 16/02/11 04:35:48 | 16/02/11 09:12:09 | 00 04 36 | 4,6 | 2 | |

Parameter: pH

Unit: UnitName

Measure TagMeasure pH

Alarm AlarmTagName

Limit 5,5 <=pH <=9,5

Filter(minutes) 120

DeadBand

Total Events 9

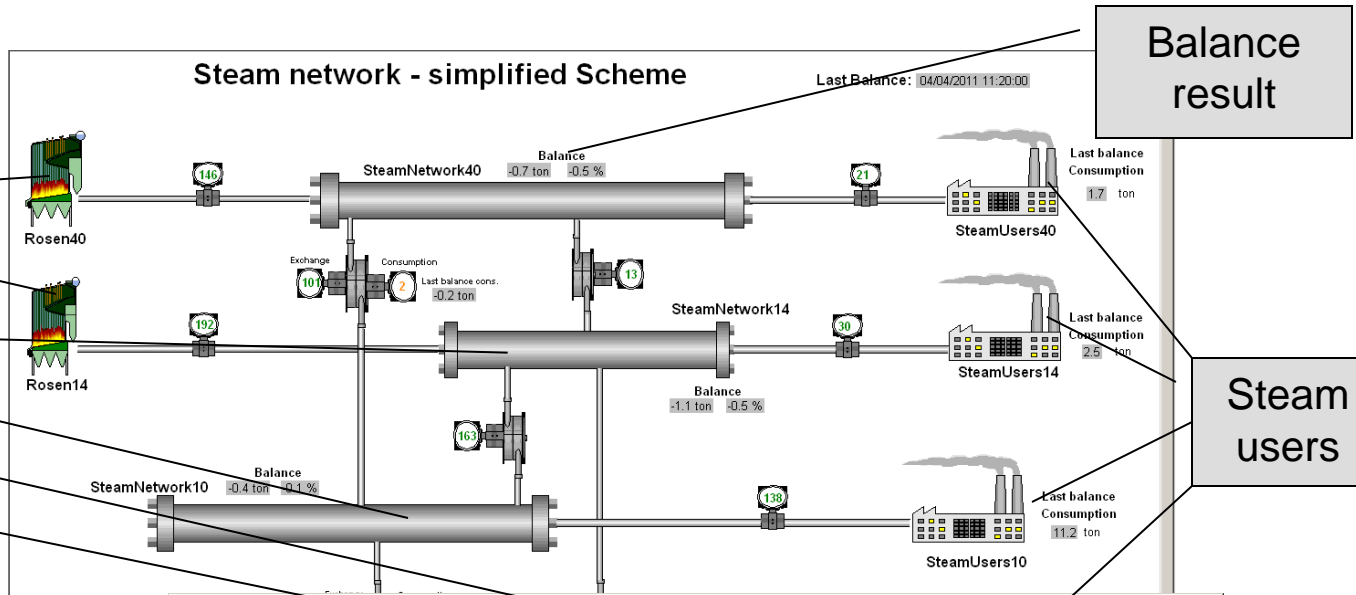
Total Hour 138

Periods of time when warning conditions happened

PI DataLink + BatchView in MS Excel

Analyses in our asset – PI AF example

Keep under control the balance values of each steam network.



Steam producers

Steam networks

Steam transfers

ACE Scheduling

Model Analysis: [玫瑰]_analysis

Description: [玫瑰]_analysis for Steam Model

Maximum Transfer Duration: 1 days

Analysis Rule: [玫瑰]_analysis

Summary: [玫瑰]_analysis

Schedule Analysis with ACE

Content: [玫瑰]_analysis

Priority: Normal

Period: 1 minutes

Offset: 0 hours

Calculation Limit: 1 minutes

Rosignano - PI System Explorer

SteamFlowNet10Net01

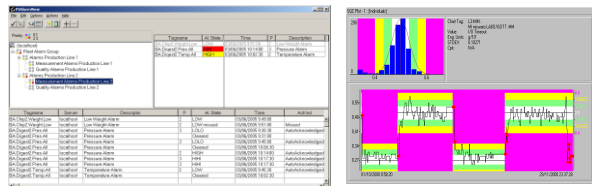
Model View

SteamNetwork10 [Decompressions] → In → SteamFlowNet10Net01 → Out → SteamNetwork01 [In]

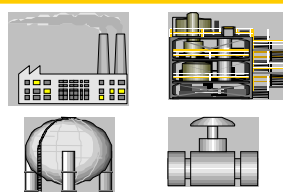
Measurement: SteamMeterNet10Net01 (Measurement)

Asset configuration

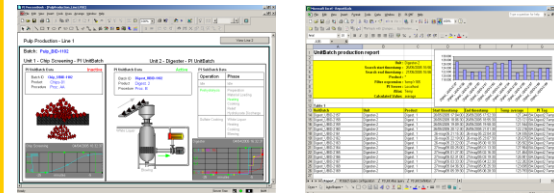
SteamFlowNet10Net01 Modified:15/12/2010 14:55:16, Version: 01/01/1970 0:00:00, Revision 1



Quality & Safety management



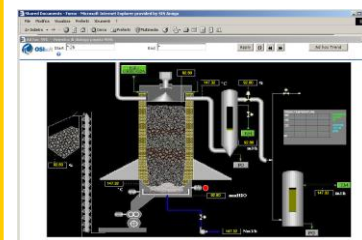
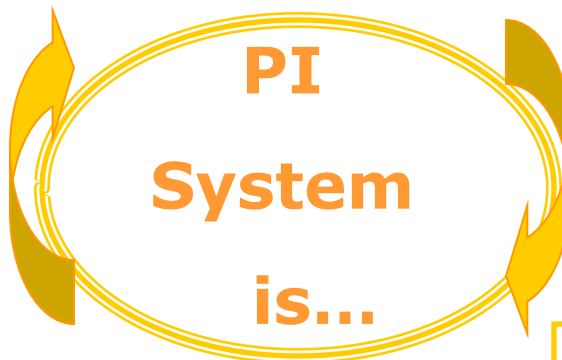
Models & Analyses



Reporting



Notification system



Web Monitoring

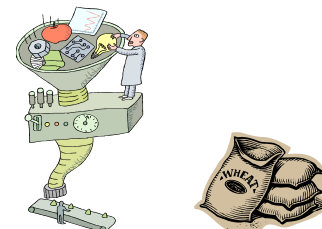
Index



LIMS



Two-ways DCS Interfacing



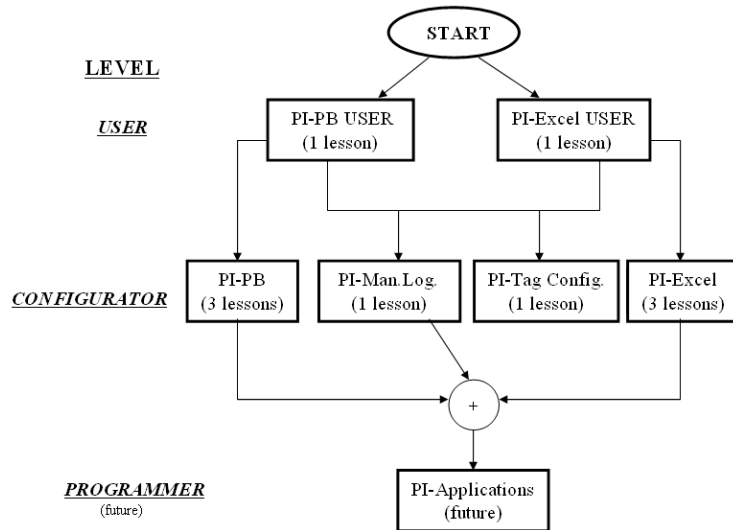
Batch Management

Benefits for our factory

- **PI System is essential for our operations**
 - **Process/Quality Management, Traceability, Labo, Notifications**
- **Communication among different systems**
 - **Customized systems, web servers, DCS to DCS**
- **Reduction of existing systems. PI System engulfed :**
 - **LIMS, ad-hoc Research, Tech. DB, critical sys alarm (future)**
- **PI System as a basic platform for new applications**
 - **Batch traceab. & SAP conn. with Pimsoft for other factories**

Implementation

- In-house installation
- Knowledge: VBA & VB/VB.Net + MS Excel & SQL Server
- We attended training courses at OSIssoft
- We prepared some internal courses for our end users





Questions?



Thank you