Smart Performance Management, Improvement and Reinvention

Presented by
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Summary

- Large Metallurgical Complexes are substantial users of energy, water and assets. To improve the effectiveness of energy and assets the quality of the data and events becomes paramount for real time operational management. A lack of resources at the local operations and at the enterprise makes it impossible to process the sea of information and many projects have failed. As such, a novel approach for implementation of continuous improvements at the local level and innovations at the strategic level was implemented at all operating plants at Anglo American Platinum. Sixteen concentrators, three smelters and two refineries process systems were integrated to scale the information for manufacturing services at the local and enterprise level. The new capability of an enterprise real time monitoring and diagnosis software infrastructure was available to implement many business strategies in tandem. Mineral and metallurgical processing knowledge is used to simplify the implementation of the data model. As such, asset monitoring, energy, production and process control management was implemented in an integrated approach reusing the same data but with different context and time horizons to have a standard methodology for local root cause analysis. This paper will highlight a sustainability management approach to change and empower the local and strategic team to collaborate using a new approach for adaptive reporting, condition based event management and notifications. The results based on the integrated and collaborative team efforts will be presented. OSIsoft PI System was installed and configured to achieve a targeted reduction in energy consumption of 15% by 2015.
Challenges for Metals and Mining

Sustainable Process Productivity

- Volatile Global commodity prices
- Lower ore grades means more rock has to be mined to produce the same amount of metal
- Lack of information to understand the current process productivity
- Loss of knowledge from aging workforce as they retire
- Production optimization (better use of resources, and maximizing returns)

Energy and Water Management

- More energy consumption for blasting, mobile equipment, crushing and grinding
- Water treatment and reuse
- Data silos and lack of integration throughout the value chain (mine to mill)
- Higher cost of energy and raw materials
- ISO 50001

Asset Performance and Reliability

- Extending asset life of critical assets
- Unscheduled equipment downtime
- Improve equipment uptime and availability
- Lack of insight into asset performance and benchmarking

Environmental, Health and Safety Compliance

- Lack of automation and communication
- Monitoring venting operations
- Monitoring underground and above ground equipment.
- Disparate sources of information for compliance reporting and audits
- Compliance risk management for regulations and standards like ISO 140001 and ISO 9001

Quality Assurance

- Lack of real-time notifications for product quality deviation
- Track of product genealogy
- Compliance with regulations such as ISO 17025
Sustainability, Process Manufacturing Excellence and Information

- What is Sustainability?

- Process Manufacturing Excellence – The Heart of a Sustainability Program

Information is Recognized as a Key Enabler for 21st Century Manufacturing Excellence.
Sustainable Mining

• Sustainability of the Company
  ▪ Production and Ore Grade Control (revenue)
  ▪ Work Index Control (energy use)
  ▪ Operating Cost Control (costs)

• Sustainability of the Environment
  ▪ Monitoring and Control of Emissions
  ▪ Monitoring and Control of Contaminants
  ▪ Prevention/Mitigation of Emissions

• Sustainability of Local Communities
  ▪ Employment Opportunities
  ▪ Occupational and Community Health and Safety
  ▪ Cultural Issues (First Nations)
OSIsoft Vision on Sustainability

- **Sustainability**
  - … is NOT a project
  - … is NOT a product
  - … is NOT achieved (in the long term) with disjointed efforts

**Sustainability:**

1. Is an opportunity for innovation

2. Requires data (timely & accurate) plus a common decision making infrastructure

3. Is best approached as a continuous improvement process (will emphasize this practice!!!!!)

4. Just good business for today and tomorrow!
What Could Manufacturers Achieve with Better ‘Information’?

• Financial Value (EBITDA / Working Capital)
  – Process Productivity / OEE
  – Quality Tracking / Product Genealogy
  – Asset Management / Condition Based Monitoring
  – Energy / Raw Material Management

• Improved Environmental, Health and Safety Performance

• Reduced / Eliminated Excursions – Maintain Expected Performance through Early Problem Detection and Recovery
PI System: An Infrastructure for Sustainability

- OSIsoft (in brief):
  - helping industrial, utility & public sector customers better manage resources, assets, and costs for 30 years
  - addressing Energy Efficiency, Energy Demand, Water Usage, Green House Gas Accounting and Waste Minimization for its customers.

- Observations:
  1. Opportunities for impact exist both on the Demand side and on the Supply side for water & for energy. These are even GREATER at the nexus
  2. Organizations that tackle sustainability driving innovation and capitalizing on a culture of continuous improvement can simultaneously and pre-emptively address profitability, compliance, and public mandate.
  3. Innovation & Continuous Improvement each require an Infrastructure; Data-driven decision-making is the key
  4. Collaboration and payback require a policy environment that support, encourage and reward sharing information & gains across “borders”
  5. It’s about Green (Energy, Water, GHG) and it’s about GREEN ($$)!
Overall Integrated Industrial Effectiveness

Results

Opportunities $

Shared VALUE
Strategy for
SUSTAINABILITY

Big Data Convergence
Advanced Analytics
Smart Manufacturing

- Systems
- Standards
  - ISO50001
  - S95

Long term PROFITS With Sustainability

Real Time Integrated Plant Systems
2. Power Generation to the rescue
Endesa LATAM. Power Generation

Total Capacity
14,881 MW (2012)

Total Generation
57,296 GWh
Endesa Latam Enterprise Strategy

Endesa Chile

Negocio de Generación en LATAM

COLOMBIA
- 2,914 MW inst. capacity
  - Hydro: 2,470 MW
  - Thermal: 444 MW
- 20% market share

PERU
- 1,657 MW inst. capacity
  - Hydro: 740 MW
  - Thermal: 917 MW
- 28% market share

CHILE
- 5,071 MW inst. capacity
  - Hydro: 3,406 MW
  - Thermal: 1,665 MW
- 30% market share

BRAZIL
- 987 MW inst. capacity
  - Hydro: 605 MW
  - Thermal: 382 MW
- 1% market share

ARGENTINA
- 3,652 MW inst. capacity
  - Hydro: 1,328 MW
  - Thermal: 2,324 MW
- 12% market share

Consolidated installed capacity: 13,794 MW
Capacity including Brazil: 14,761 MW
Consolidated energy sales 2012: 59,020 GWh
Consolidated energy sales 1H13: 27,237 GWh

Total installed capacity: 13,794 MW
Total generation (TTM): 57,286 GWh

1 Excludes the proportional assets from GasAtacama (390 MW).
Sustainable Value Added to the Enterprise
Data Transformation into Actionable Information

Elementos

PI-PERFORMANCE EQUATION
PI-ACE: Advanced Computing Engine
PI-AF: Analysis Framework
SOLCEP (Modulo de Validación de Datos)

DATOS CRUDOS

DATOS VALIDADOS Y CONCILIADOS
Leveraging Enterprise Smart Process Management
Anglo American Platinum

• Anglo American Platinum is the world’s premier PGM producer, supplying approximately 40% of the world’s newly refined Platinum.

• Process Division:
  – 14 Concentrators
  – 3 Smelters
  – 2 Refineries
  – 9 geographic operating areas
Business Challenge

Multiple Energy Sources: Electrical, Diesel, Steam from Coal Fired Boilers
Electrical energy is key focus
Anglo Platinum is a large consumer of electricity
Platinum Process

- Long value chain in comparison to most minerals
- Technically complex
- Comparatively low volumes but high value
- A significant material pipe line
- Energy and water intensive
Enterprise Real Time Dynamic Continuous Improvement and Innovation strategy

- Calculations are performed primarily on the sites
- The central PI System is used for:
  - Group wide analyses
  - Maintain Knowledge and Strategic BI Analysis
  - Maintain Models and Plan Targets
Establishing a Value Framework

By Driving Competitive Advantage through Reduction of Controllable Cost or Delivery of Additional Revenue Opportunities

Specific Process / Project Value Categories Include:

- Process Productivity / OEE
- Optimize Asset Life / Reduce Maintenance Cost
- Reduce Energy / Raw Material / Natural Resource Consumption
- Environmental, Health, and Safety
- Product Genealogy / Quality
- Compliance and Reporting
Integrated Concentrator Model

Ore Type

Crushing

Energy Ore Water

Grinding

Energy Flow Water

Flotation

Energy Flow Water

Thickening

Energy Flow Water

Tailings

Energy Flow Water

POWER

WATER

Concentrate
Event Driven Process Diary

Started out with condition based maintenance in mind. The resulting “Process Diary” can be used for Downtime, Slowtime, KPI’s, basically anything that can be configured.”

Michael Halhead
Lead Process Control Engineer

Challenge

Escalating Energy Costs
Electrical System Constraints
Integration with Energy SCADA
Non Standards methods
Replace Excel solution
Provide Enterprise easily configurable solution

Solution

• PI Event Frames and PI AF
• PI EV to sense and capture the events
• Custom Silverlight screens using PI AF controls to capture manual events
• Integration with SAP

Results

Increased overall equipment utilization
Time savings
Enterprise-wide standardization
Flexibility – not just CBM
Target 15% Energy Reductions 2015
Compare years of data
User configurable
Energy Monitoring

• AngloAmerican Platinum

  “Implementing high level metrics and analyses linked to production clearly shows were the power is used allowing focused energy reduction initiatives. A roll out to the concentrators is in the planning stages. Due to the scale of the concentrator operations the potential benefits are enormous.”

• Thobile Mukuna, Energy Process Engineer

Challenges

• Large electricity consumption - 450 GWh/month
• Target 15% reduction in electricity consumption 2008 to 2015
• Company-wide integrated approach to energy saving is required

Solution

• Use PI AF - granularity and roll-up
• Visibility - power use at every level
  • PI WebParts and SharePoint, Silverlight
• High level metrics - KPIs
• Provided ability for users to drill down to every level of granularity

Results

• Enterprise visibility of all electrical consumption
• Significant time reduction for analysis
• Easy construction of BI cubes
• Just making the data visible resulted in a 1% reduction in electrical power use.
• Target a 15% reduction by 2015
Microsoft BI with PI System - Architecture

Design of PI AF for Data Mining.

- PI Real-Time Data
- OLAP Cubes
- Data Warehouse
- PI System
- Microsoft PerformancePoint
- Excel Services & DLES
- Reporting Services
- OSIsoft PI WebParts & other Web Parts
**Going BI with KPIs**

“KPI building and maintenance was a nightmare, creating a lot of frustration due to long lead times”

Warren Armstrong, Process Control Support

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<th>Challenge</th>
<th>Solution</th>
<th>Results</th>
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<td>KPI were onerous to create and troubleshoot</td>
<td>• PI system for daily/shiftily totals&lt;br&gt;• PI Asset Framework for KPIs and hierarchy configuration and data extraction&lt;br&gt;• Microsoft Analysis Service tabular model to aggregate up&lt;br&gt;• Excel Pivot table for Reporting</td>
<td>KPIs creation from 6 to 3 steps&lt;br&gt;One Report&lt;br&gt;Quick rollout&lt;br&gt;More user control&lt;br&gt;Flexible reporting</td>
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Leveraging External Community for Smart Process Management
New Tools and Technologies in the 21\textsuperscript{st} Century

- Modern Design Tools
- Smart Sensors
- Robotics
- Remote Sensors
- Process Analytics
- Big Data
- Continuous Video Monitoring
- Advanced Process Control
- Cloud Based and Collaborative Technologies
- Offline Decision Making
- Mobile Apps
- Learning On-demand
Future: Moving into Interconnected Systems

- Mobile Equipment Manufacturer
- Equipment Manufacturer
- Chemical Manufacturer
- Power Generation
- Government
- Universities
- External Engineering Support
- Outotec Finland
- Chris Mining Video
- Mining and Metallurgical Enterprise
PI Cloud Connect – Amplats Architecture
AF Accessible from the Cloud

The AF Models are “replicated” by PI Cloud Connect
Large Metallurgical are large cities

- Process Productivity / OEE
- Optimize Asset Life / Reduce Maintenance Cost
- Reduce Energy / Raw Material / Natural Resource Consumption
- Environmental, Health, and Safety
- Product Genealogy / Quality
- Compliance and Reporting

- Gas and Electric
- Equipment Assets
- Metallurgical Complexes
- Water and Wastewater
- Raw Materials
- Process Systems
- Material Inventories
Conclusions

• Real Time Data and Events transform data into Actionable information

• Data Validation- Event Classification- Predictive Analytics - Collaboration

• Real time predictive event framing (analytics) is crucial to increase equipment availability to reduce specific fuel, electricity and water consumption.

• Integration and standardization of systems for local and enterprise collaboration are essential strategies to transform the organization using new proactive analytics and data analysis tools

• Drastic reduction in operating costs, increase productivity and add sustainable value to the enterprise.

• Competence Centers are Knowledge Centers to promote change via people collaboration at the local and enterprise business levels.
Questions?
Thanks for your attention

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THANK YOU
PI System Infrastructure

PI Interfaces

- PI Notications
- PI Event Frames
- PI Analytics
- PI AF
- PI Data Archive

PI Visualization Suite

- PI System Access
- Business Systems

- PI Coresight
- PI ProcessBook
- PI DataLink
- PI WebParts