




Manufacturing: The Black Box

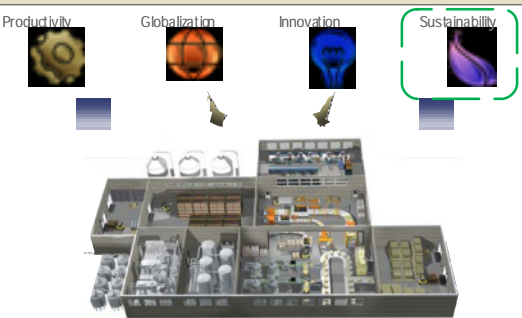


- Energy and raw materials are seen as variable costs
- Environmental responsibility is labeled a "feel-good" initiative
- How do you measure & manage green?

Characteristics of Minerals Processing

- Mined materials are inherently variable in terms of
 - Chemical composition
 - Moisture
 - Size, size distribution
 - Hardness
 - Disproportionate effect of trace compounds
 - On grinding efficiency, on pyro-processing and flotation etc.
- Very large mass flows involved
 - Inefficiencies in control and material tracking lead to large \$ errors
- Complex chemical and physical interactions
- Non-linearities in chemical and thermal processes
- Inferred process information from sensors due to harsh environment
- Noisy data, sensor reliability issues

Manufacturing Drivers... Today




Complex Environment ... Multiple Priorities


Market Drivers

Sustainability


Cleaner, safer and more efficient



Sustainability has emerged as an additional business



Market Drivers



Do these sustainability drivers simply add cost and complexity to your operation...or are you beginning to see the "green" lining in this dark cloud?

Market Drivers

So here we stand with
Too many priorities

Too much to do before
you can get to
Sustainability?

How do we break out
of this strategic paralysis?

The right thing to do for your business..

Have you discovered:

How energy costs can become a managed variable within your process control strategy?

How to measure and manage your carbon footprint and your process emissions?

Two-pronged approach to Clean Energy...

Accelerate Alternative Energy Adoption

Strategy for Responsible Use of Energy

Sustainable Production

- Smart grid
- Integrated smart plant
- Energy Visualization
- Energy Profiling
- Intelligent Power Control
- Predictive Emission Monitoring

REALIZING THESE STRATEGIES

SOME CONCEPTS & CASE STUDIES

Sustainable Production: Industrial Energy Management

Generation

Conventional: Coal, Nuclear, Oil / Gas, Hydro

Smart Grid

Wind

Transmission

Distribution

Substation

Utilization

Residential/Commercial

• Economic models

• Low-cost "embedded" communications

• Standards for process equipment energy

• Integrated control & energy mgmt.

• Machine / process level energy sensing, measurement, analysis, optimization, control

Transform factories from passive to active energy management


Production Energy Profiling

- Metering monitors energy consumption and quality from the point of use in a production process (KWh per product, per line)
- Collects data to establish process baselines, 'golden batch'
- Establishes equipment performance baselines for energy and asset management
- Presents production data against established process standards for deviation analysis

5 batches consumed 38% of the energy to produce this production this day. Any data quality issue such as equipment out of calibration.

Baseline constant 247 but increases as temperature exceeds 30 deg F - flag indicate cooling capacity issue in production.

Power Solutions



Drive Energy Savings –
Build a Competitive Advantage:

- Adjust flow efficiently
- Improve power factors
- Eliminate energy surcharges
- Utilize motor control data to create a power usage profile

The new drive and motor set uses 66% less steam to create the equivalent power... The investment payback on the drive and motor was realized in a six-month season of mill operation.

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Case Study: Energy Visualization

Production Energy Profiling

• User Situation


- Excessive energy use needed to reduce overall consumption by 4%, plant dead load by 25%
- Needed visibility of daily utilities usage, air and steam leak audits, plant dead load

• Solution

- Metered utilities, flow meters for real-time data, tracking of natural gas, nitrogen, electricity, compressed air and steam
- Established a baseline of energy use – determined efficiencies for each operational center, implemented energy action plans

• Results

- Saved \$136,000/mo in peak fees - \$1,632,000/year
- Reduced lost energy BTU/lb metric by 14% over 3 years
- Electricity reduce by 1.12%, nitrogen reduce by 1.88%, natural gas reduced by 13%



Sustainable benefit: Less energy use, business intelligence to continuously improve.


Raw Mill Proportioning Control Application

- Capabilities
 - Calculate raw mix proportions from material analyses and feed rates
 - Provide optimal feed rates to individual weighers
 - Maintain consistent kiln feed
- Benefits
 - Improve kiln stability
 - Reduce raw mix costs
 - Reduce product variability
 - Optimize raw material reserves




Raw Material Preparation Application

- Capabilities
 - Process Control
 - Vertical or Ball Mill Circuits
 - Wet AND Dry Ball Mills
 - Raw Mix Proportioning
 - Manipulate feed rate and separator speed to meet throughput and specification objectives
 - Optimize circuit loading
 - Fineness prediction to provide closed loop control on quality target
- Benefits
 - Increase throughput up to 10%
 - Reduce fineness variation up to 50%
 - Improve stability – VRM
 - Reduce specific energy consumption
 - Reduce chemical variability
 - Raw materials cost optimization




Pyroprocessing Application

- Capabilities
 - Maximize throughput to produce clinker to specification
 - Optimize complex fuel systems on a kiln and pre-caliner systems
 - Minimize excess combustion air to optimize fuel economy and ID fan capacity utilization
 - Reduce system thermal load variability
 - Control clinker cooler to optimize cooling efficiency and heat recovery
 - Provide active compliance within environmental limits
- Benefits
 - Increase clinker production up to 6%
 - Reduce free lime variability up to 30%
 - Reduce NOx emissions up to 8%
 - Reduce NOx variability up to 40%
 - Decrease total fuel consumption
 - Maximize use of waste fuels
 - Increase refractory life by up to 10%



Cement Grinding Application

- Capabilities
 - Process Control
 - Vertical or Ball Mill Circuits
 - Closed AND Open Circuit Mills
 - Manipulate feed rate and separator speed to meet throughput and specification objectives
 - Optimize circuit loading
 - Fineness prediction to provide closed loop control on quality target
- Benefits
 - Increase production up to 10%
 - Reduce product variability up to 30%
 - Reduce specific power consumption up to 10%
 - Improve type transition accuracy



Environmental - Active Monitoring, Compliance, Reporting

Soft Sensor® Measurements

- NOx and CO2 PEMS
- Foundation for real-time environmental optimization

Real-time Compliance Assurance

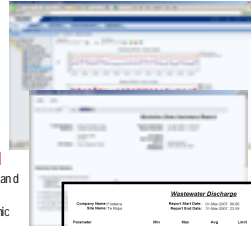
- Active assessment of environmental performance
- Proactively implement process improvement measures

Verifiable and Auditable System of Record

- Quality assurance of input data, reducing reporting errors and rework
- Minimize unauthorized manipulation of results for economic gains
- Provide single version of the truth

Scalable Foundation for Emissions Trading Programs

- Essential information for buying/selling of emissions credits
- Scalable to thousands of data sources and calculations

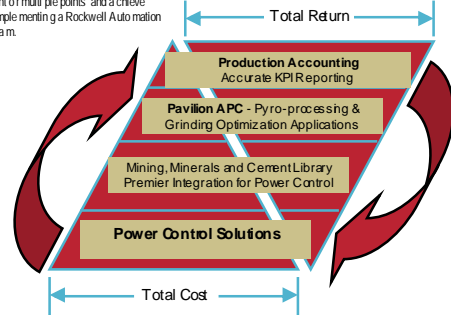


Parameter	Wastewater Discharge			
	Min	Max	Avg	Limit
Flowrate (MGD)	0.000	20.000	14.000	30.000
BOD Average (mg/L)	1.00	5.00	3.00	5.00
BOD Max (mg/L)	1.00	5.00	3.00	5.00
BOD5 (mg/L)	1.00	5.00	3.00	5.00
Total Suspended Solids (mg/L)	1.00	5.00	3.00	5.00
Total Solids (mg/L)	1.00	5.00	3.00	5.00
Total Phosphorus (mg/L)	1.00	5.00	3.00	5.00
Total Nitrogen (mg/L)	1.00	5.00	3.00	5.00
Temperature (°C)	10.00	20.00	15.00	20.00

Rockwell Automation Delivers Value

Automation is core to operational excellence.

Start at any point or multiple points and achieve your goals by implementing a Rockwell Automation managed program.



Thank You