CBCi
7º CONGRESSO BRASILEIRO DO CIMENTO

20 a 22 de Junho de 2016 - São Paulo/SP

Technology and solutions to optimize energy consumption and to increase production transparency

Schneider Electric

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Realização

Associação Brasileira de Cimento Portland

SNIC
SINDICATO NACIONAL DA INDÚSTRIA DO CIMENTO

Introduction to Schneider Electric

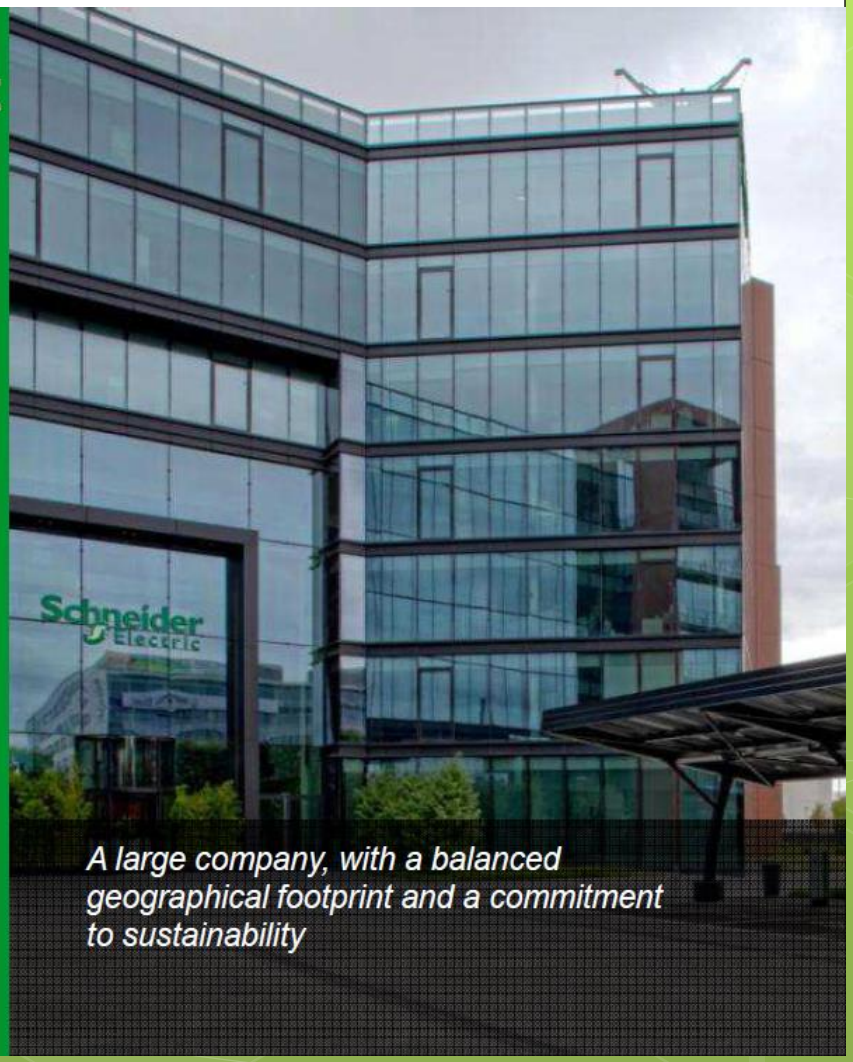
We are the Global Specialist in Energy Management ™

26.6
billion € revenue (FY 2015)

43%
of revenue in new economies (FY 2015)

160 000+
employees in 100+ countries

c.5%
of sales dedicated to R&D



A large company, with a balanced geographical footprint and a commitment to sustainability

Solutions for Cement

We help cement producers grow in a sustainable way by helping them maximize their production resources and optimize industrial operations, while improving overall efficiency and asset utilization.

Addressing critical Cement Industry challenges

- Delivering a safe work environment
- Improving energy efficiency and reducing carbon emissions and environmental footprint
- Managing a sustainable production able to address volatile market demands
- Maximizing asset utilization, uptime, and reliability
- Balancing talent needs

Safety and Security

Protect people, assets, and machines with flexible, integrated solutions.

Energy and Sustainability

Improve energy availability, mix, use, and transparency to reduce costs and emissions throughout the entire energy management life cycle.

Operational Efficiency

Best-in-class system for controlling and optimizing cement processes that connects the shop floor to the top floor and seamlessly integrates control and electrical systems.

Solutions for Cement


4


5


6

Asset Performance Improvement

Extend the useful life of assets, decrease downtime, and improve overall equipment efficiency.

Workforce Efficiency

Improve labor productivity through mobile workforce and decision support, workflow, and mobility solutions.

Value Chain Optimization

Drive profitability across the value chain and get the most of your resources.

Why Cement companies choose Schneider Electric

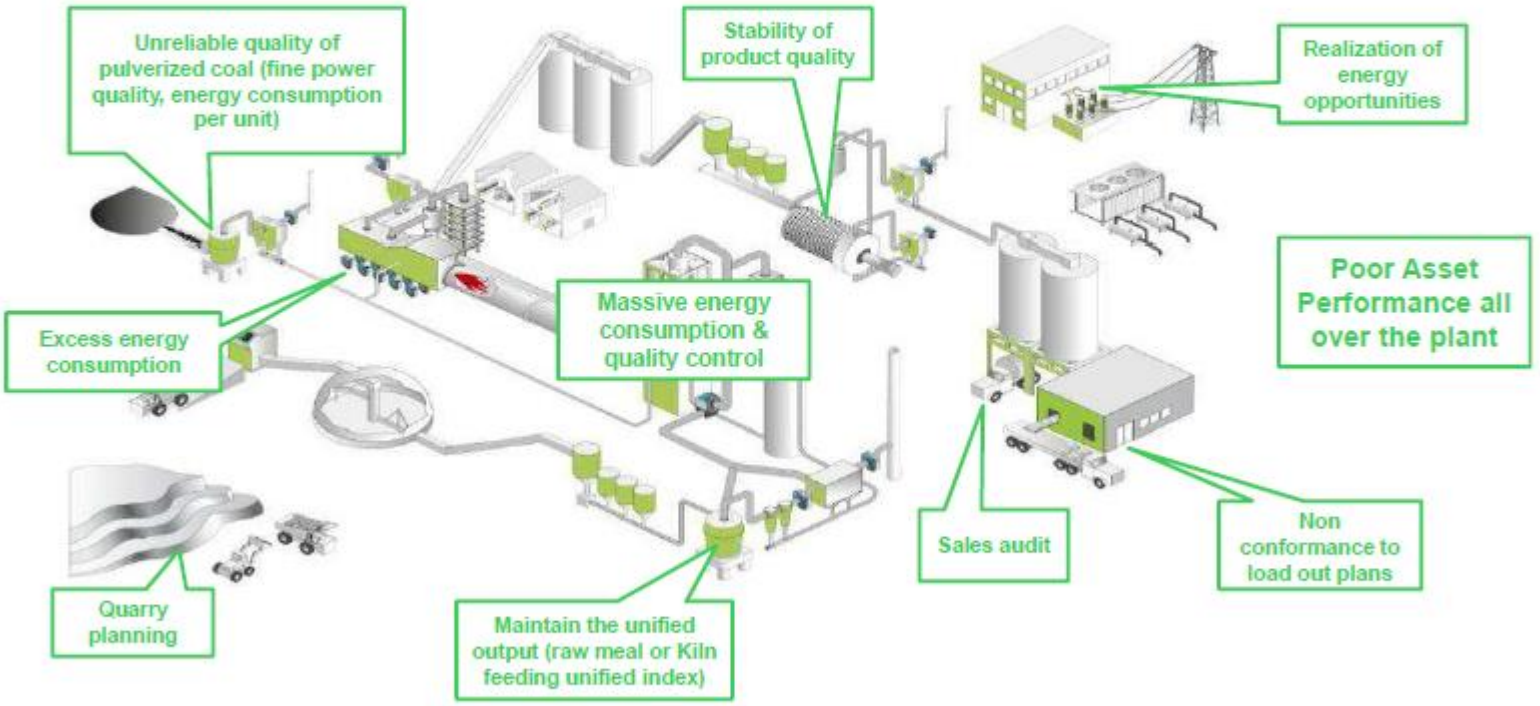
We are a trusted partner with a complete portfolio of innovative products, solutions, and services that can help cement companies achieve better operational and energy efficiency; exceed their safety and sustainability goals; and maximize their overall financial performance.

"With Cement Production Optimization from Schneider Electric, I now have the tools I need to effectively balance production and energy efficiency, and to optimize plant operations while reducing energy costs."

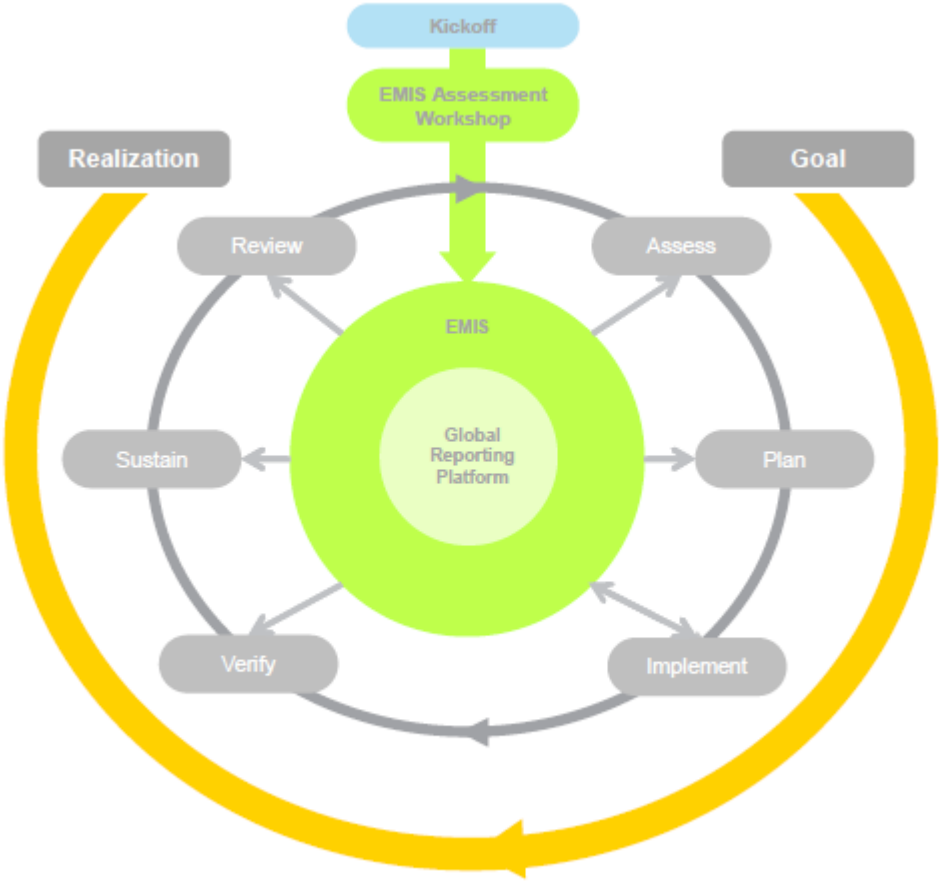
Niu Ziliang
Quzhai Cement, China

Optimizing the production of cement

Challenges



Energy Optimisation Approach



Definitions:
EMIS : Energy Management Information System

Monitoring and performance Benchmarking

- **Transparent energy use in the production context**

> **Reduces energy consumption** and emissions per unit of production

> Helps to **analyze** the process conditions and **improves** operating practices

> Enables multi-site **benchmarking** and to share expertise and best practises

> View aggregated and contextualized data across your enterprise

> Drill down level by level, region, plant, line, workshop, and load

Industry specific performance indicators

- Output:
  t.clinker/h, t.cement/h
- Cement/Clinker ratio
- SPC (Specific Power Consumption):
  kWh/t.cement or clinker, kWh/t finish grinding, …
- SHC (Specific Heat Consumption):
  MJ/t.cement, MJ/t.clinker, …
- AF (Alternative Fuel) substitution rate
- Real Time Energy Cost:
  $/MWh, $/GJ, $/t.cement for power, …
- Emissions:
  tCO2/t.clinker, tCO2/t.cement
- WHR Power Generation:
  kWh/t.clinker, self consumption %

Plant performance dashboard example

How to save energy?

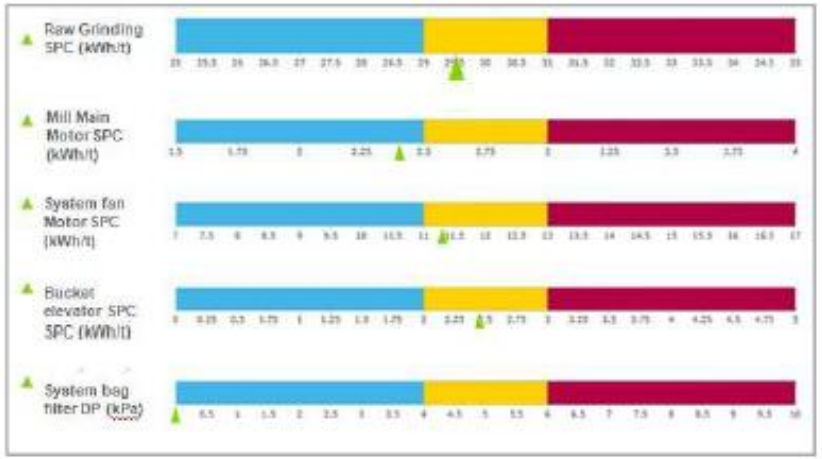
- Toolbox to support kiln and mill in their daily duty
- Monitoring of selected KPIs and acceptable ranges to optimize the process

Avoid

> Over-burning

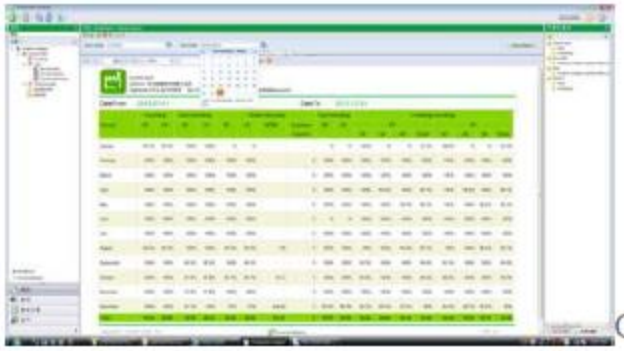
> Over-cooling

> Over-grinding



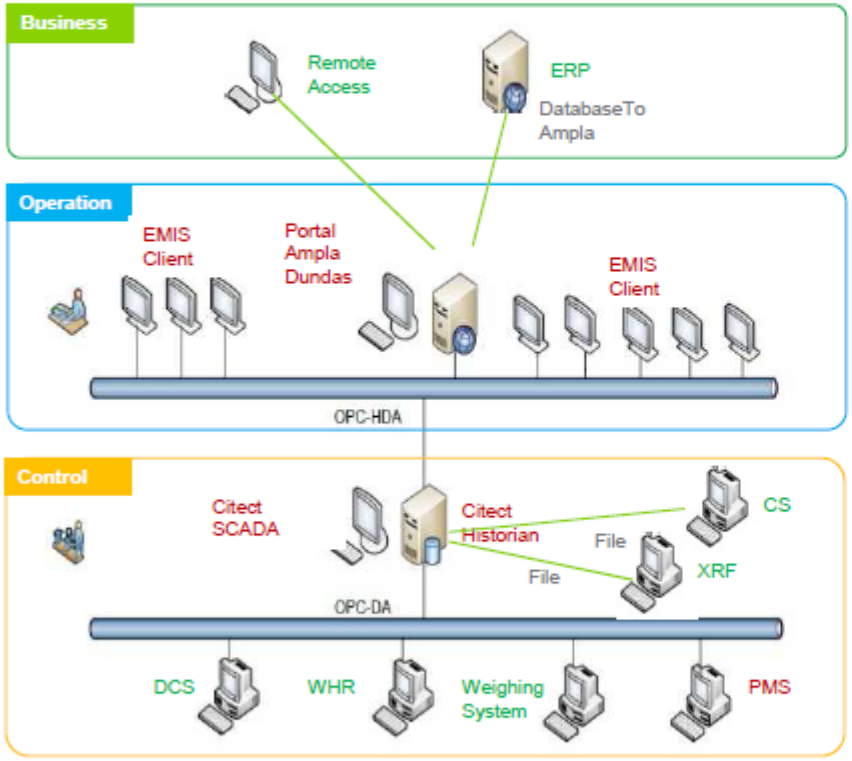
Reporting

Advanced reporting functionality to track, analyze and compare performance



Online and offline reporting capability

Network Architecture for Plant



Energy | Asset - DownTime | Environment - Emission | Quality

Minimum Requirements

Plant data management

- **Log & Aggregate** Energy data - load, workshop, line, and plant levels
- **Combine** Data – process/ Production data with energy data to compute KPI / scores
- **Converts** the raw data into meaningful information's

Enterprise HMI

Aggregate of information from **plant to plant** and **country to country**

Optimized metering and communication architecture

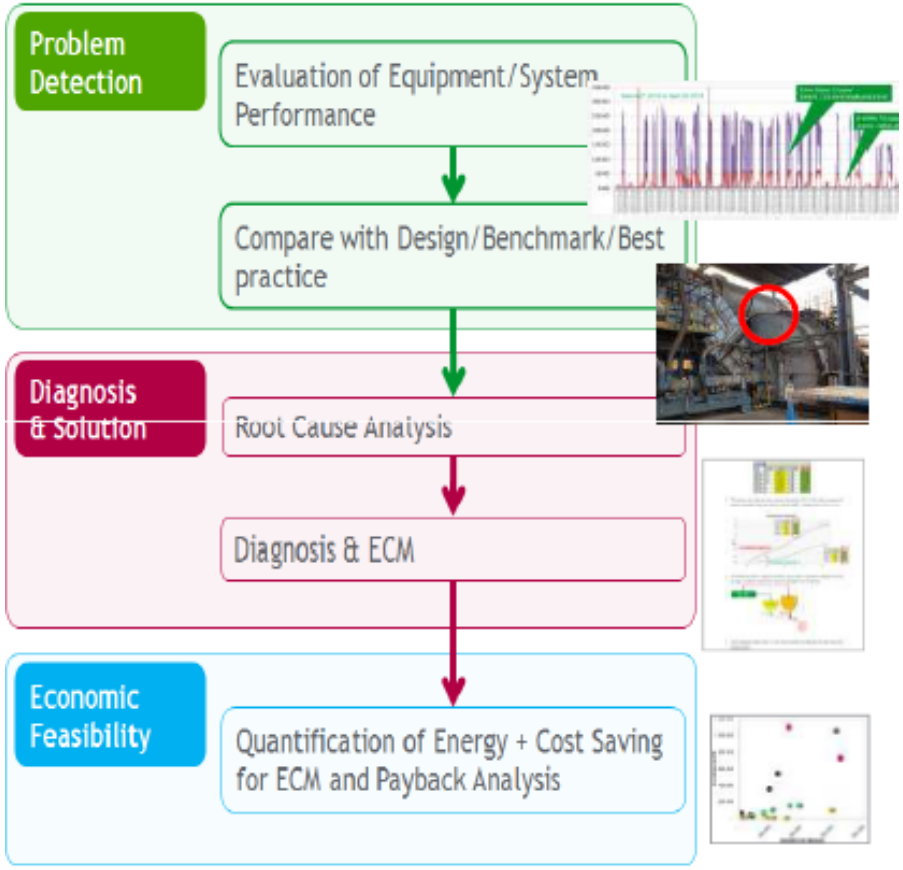
- **Flexible and open-ended** : Architecture Supports new sites and existing installations

Connection to ERP and MES

This information is stored at company level and can be fed into the company's ERP or MES

Plant assessment

- Develop a clear picture of the site energy usage
- Perform detailed energy efficiency analysis of major equipments and systems
- Identify energy savings measures and make a first assessment of technical and economic feasibility



Assessment scope of work

- **Major Equipments**

Mechanical

- Crushers / Grinding Mills
- Separators, Material conveying
- Fans and Blowers (process / air supply / exhaust/ ventilation/ dust collection)
- Air compressors and compressed air systems
- Pumping systems (process / water treatment / cooling water)

Thermal

- Kiln / Precalciner
- Heat recovery system (Preheater / Clinker Cooler)
- Hot Gas Generator (Drying)
- Boilers and its auxiliaries (waste heat/fired)
- Steam turbine and its auxiliaries
- Cooling towers

Electrical

- Transformers
- Motors
- Capacitor / Power Compensation
- Lighting systems

Assessment scope of work

- Types of analysis

Mechanical

- Pressure Drop,
- Flow rate Measurements ,
- Air infiltration Evaluation,
- Efficiency, etc

Thermal

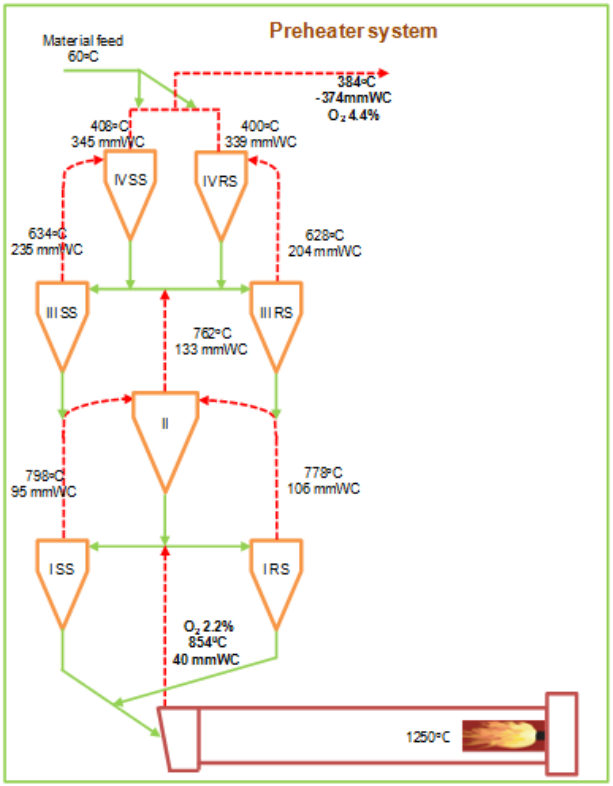
- Heat balance,
- Combustion Analysis,
- Heat Losses evaluation

Electrical

- Load schedules
- Peak demand analysis
- Tariff analysis with respect to power factor, time of use etc

Assessment scope of work

- Examples of Analysis



Description -Pyro Process Heat balance	Total losses	Specific heat losses	Percentage
	Mkcal/hr	kcal/kg cl	%
Quantity of heat required for clinker formation	106.769	430	57.51%
Quantity of heat required to remove moisture present in the raw meal	25.032	100.81	13.48%
Quantity of heat required to remove moisture present in the coal	3.398	13.69	1.83%
Heat carried by clinker from kiln	4.547	18.31	2.45%
Heat carried by the cooler vent air	7.302	29.41	3.93%
Surface convection and radiation losses from cooler	0.062	0.25	0.03%
Total heat losses due to surface convection & radiation from kiln	12.87	51.83	6.93%
Heat carried away by raw mill vent gas	10.454	42.1	5.63%
sensible heat carried away by raw meal	4.07	16.39	2.19%
Surface losses from Raw mill & coal mill & GCT (assumed 2 % of total heat supplied)	0.633	2.55	0.34%
Heat carried away by vent gases from coal mill	2.59	10.43	1.39%
Sensible heat carried by coal	0.735	2.96	0.40%
Heat losses by convection and radiation in the duct carrying the flue gases	3.677	14.81	1.98%
Unaccounted losses in the system	3.36	13.53	1.81%

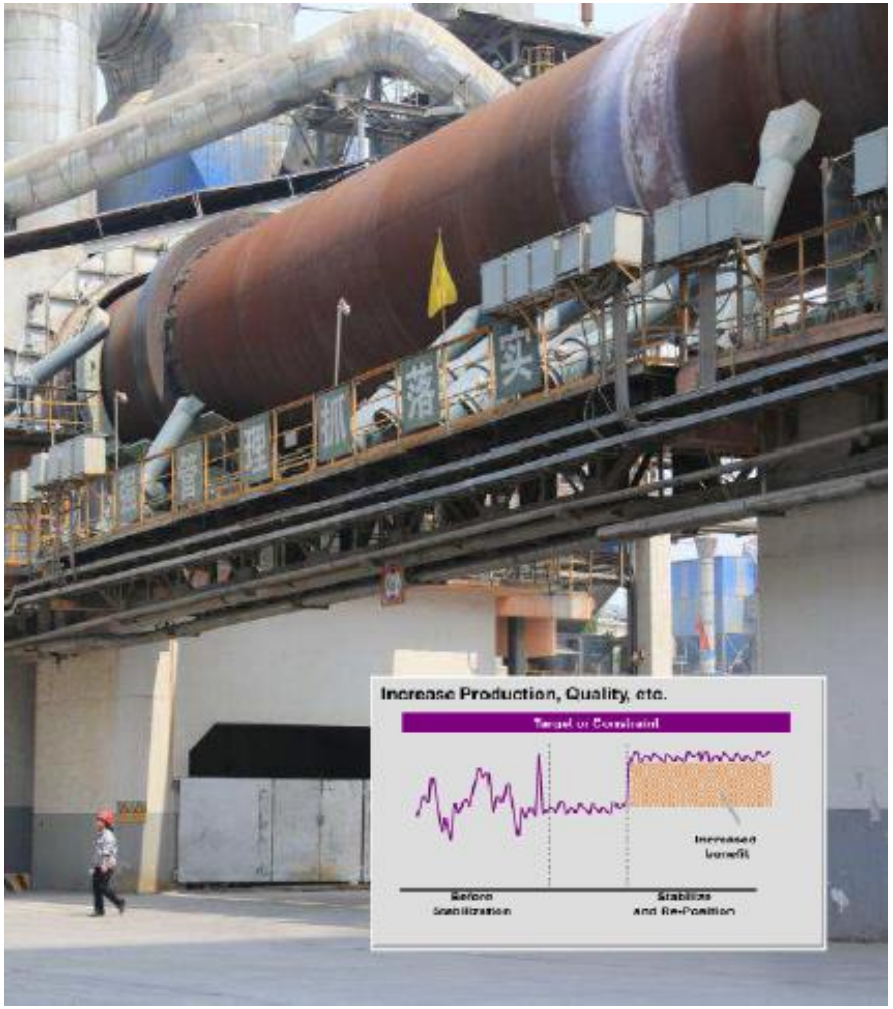
Typical benefits of Plant Assessment

- Below 6 months Return on investment:
  - 3-5 % savings with no or minimum investment
- Between 6 months to 5 years Return on Investment
  - 8-10 % savings with investments

Kiln, Cooler and Mill Optimization

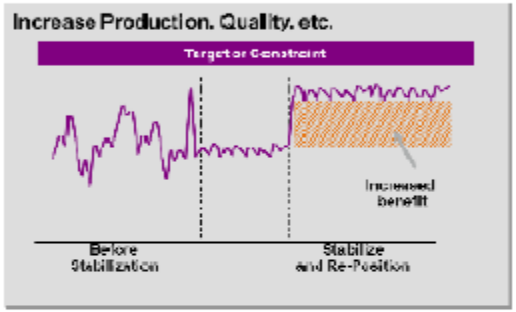
- Higher quality and stable grade
- Increased throughput
- Operation closer to process limits
- Efficiency improvements, less energy and waste

- Selected features of and Advanced Process Control Solution:
  - Model-based predictive control that can deal with long delays, complex dynamics, and multivariable interactions
  - Nonlinear model and rule-based conditional strategies
  - Multiple parallel models for prediction/control that switch automatically when operating condition/grade changes
  - Data historization and trending capability
  - OPC connectivity to all DCS/PLC systems



Leverage technology Advanced Process Control

- Moves the operating process closer to multiple constraints at the same time
- Allows operation to be closer to operating limits by reducing variations
- Provides access to a wide range of process operations
- Improves quality
- Increases operating profit



Typical benefits of Advanced Process Control

- **Quantifiable ROI**
  - Reduce standard deviation by up to 30%
  - Increase throughput by up to 5%
  - Increase process yields 2% – 10%
  - Reduce specific energy consumption up to 10%
  - Reduce waste and energy related emissions
- **Example for 1 mtpa kiln**
  - 0.3% increase in free lime
  - 3% reduction in energy requirement
  - $300 000 pa cost benefit

Selected reference in China

- **Scope**
  - Energy Performance™ Solution
  - Detailed Energy Efficiency Assessment
  - Operation Optimization with Process

- **Results (annual savings)**
  - Total Savings: 3,240 K€ - 12.9 MR$
  - Simple Payback Period: 2.6 Months
  - Impact on Specific Energy Consumption and CO2 Emissions

Energy Saving & Annual Benefits	Plant 1	Plant 2
Cement SPC [kWh/t. cement]	3.67	4.7
Clinker SHC [kg coal equivalent/t. clinker]	2.78	4.3
CO2 Emissions Reduction [t/a]	21,700	31,700

Obrigado