Efficient & Transparent Use of Enegy
In Cement Industry

Rosy Wang, Global Solution Director for Cement

6º CONGRESSO BRASILEIRO DO CIMENTO
Associação Brasileira de Cimento Portland
SNIC
19 a 21 maio 2014 ● São Paulo/SP ● Brasil

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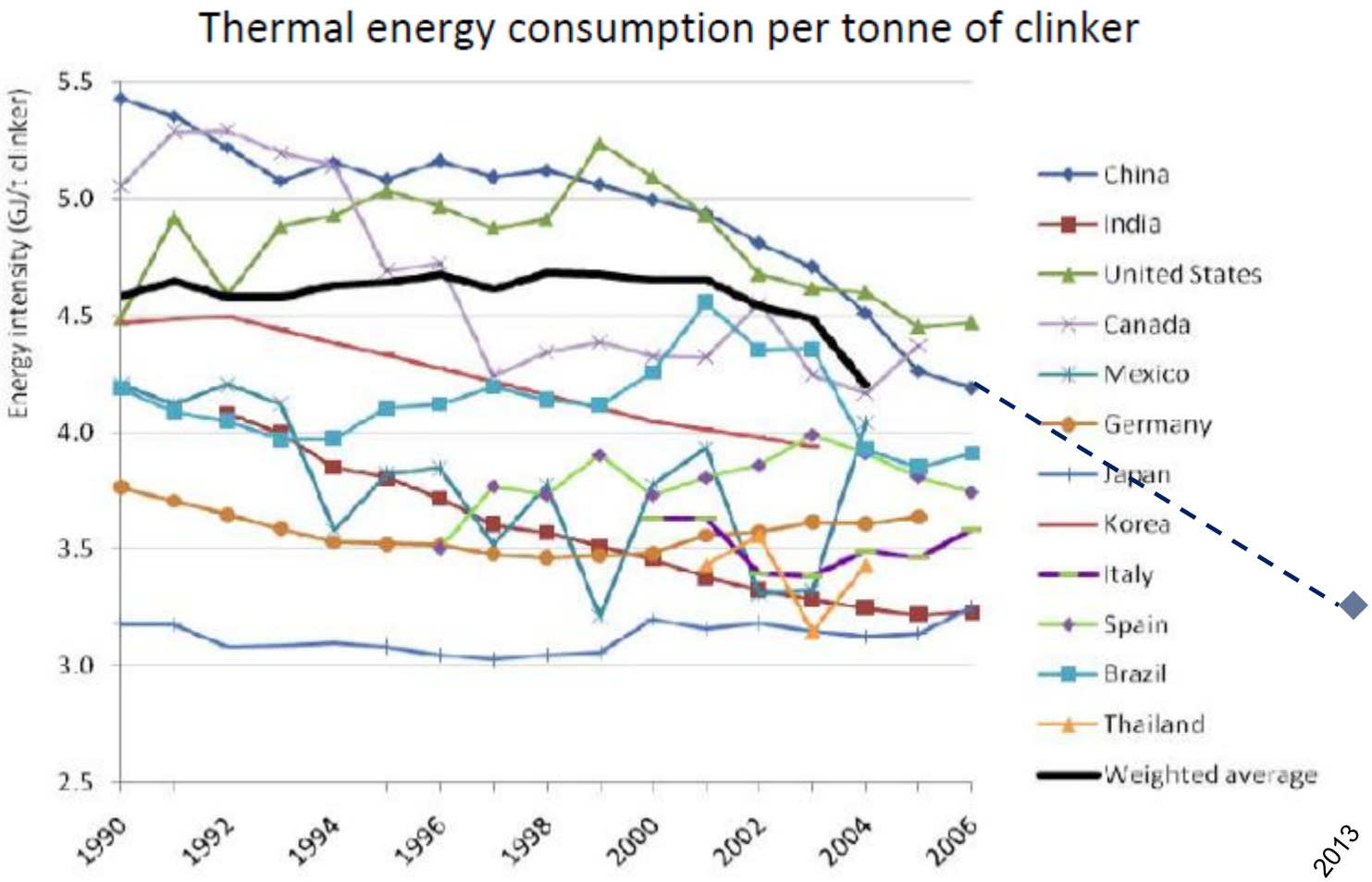
- Cement Challenges & Trends
- Common Issues
- Energy Performance Solution

  - Efficient & Transparent Use of Enegy
- Customer Examples
- Solution Process
- Result & Conclusion
- Q & A

The Trend for Energy Efficiency



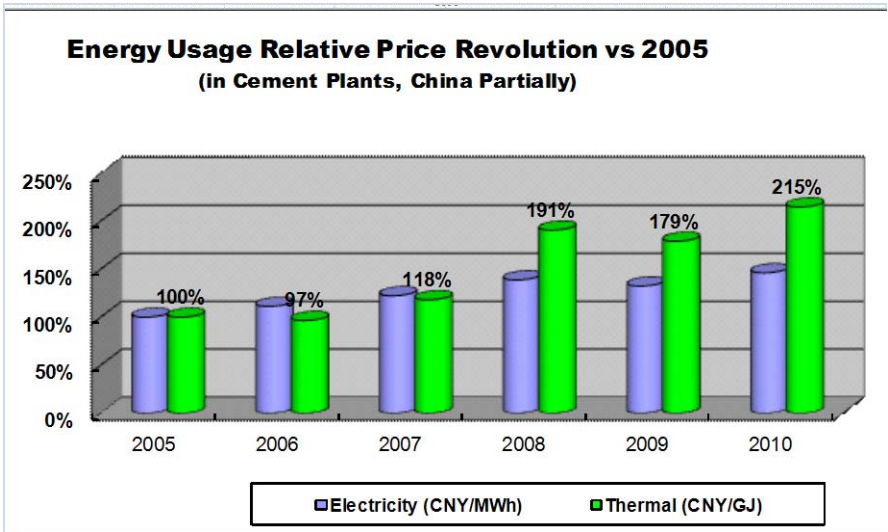
Sources: CSI, 2008; Soares and Tolmasquim, 2000; Worrell *et al., 2001; IBGE, 2008; EEA, 2006; AITEC, 2008; USGS, 2008c; PCA, 2008;*

The Trend for Energy Efficiency (Focus on China)

Larger capacity & Market Consolidation

	2001	2013
Cement production (Billion Ton)	700	2,000
No. of Cement plants	6,000	1,800
Market share of Top 10 cement company	4%	45%

•CNBM: >300 plants
•Conch: >100 plants



Energy Standard Revised

	2006	2013	2013 advanced
Clinker Specific Heat Consumption (kg.coal/t)	112	107	103
Clinker Specific Power Consumption (kWh/t)	64	60	58
Cement Specific Power Consumption (kWh/t)	90	88	85

•Alternative Fuel: Lafarge, HuaXin, BBMG, etc

Environmental protection standard Revised

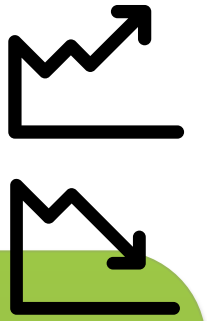
	Before 2013	2013 Green F 2015 existing	2013 (critical area)
Dust emission from kiln	50	30	20
NOx	800	400 (320)	320
SO2	200	100	50

•SNCR surge in cement to be ready by 2014

Cement Industry is Under Pressure

- **2nd largest energy consuming industrial sector**
  - **Cost of energy versus production costs**
  - **Serious GHG footprint**

- **Business and operational challenges**
  - **Increasing production, plant availability, flexibility**
  - **Reducing energy consumption per ton**
  - **Reducing the cost of energy per ton**
  - **Taking control of emissions**



Energy Management Program

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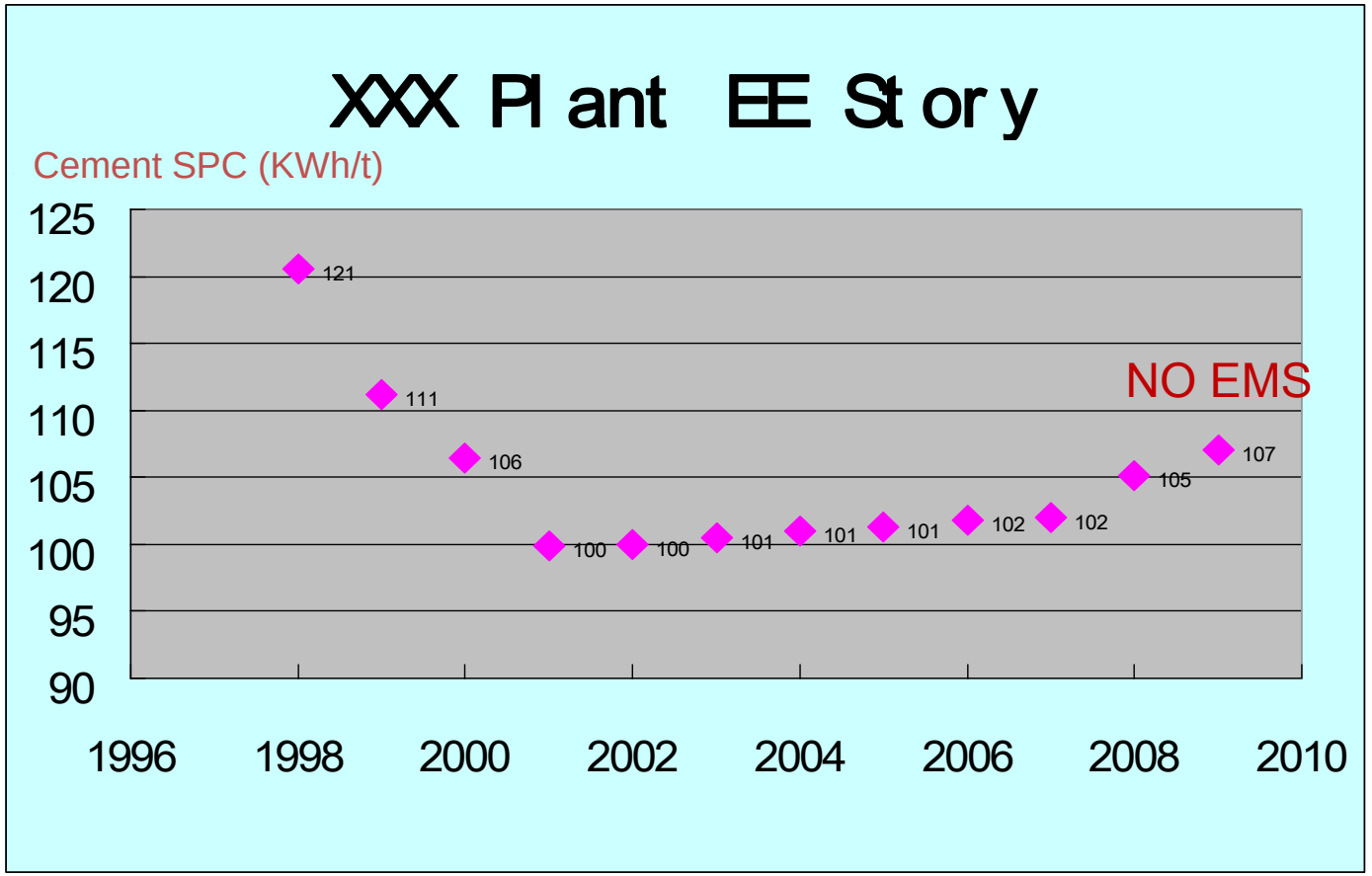
Common Issues

- Insufficient **contextual data** on individual assets
- Spreadsheet culture with **disparate data**
- **Manual data collection** into a multiple systems
- Lack of detailed **KPIs** for achieving sustainability
- Misconception that **reducing energy consumption means reduced production**
- Solutions to address **WAGES**

How to Maintain Continuous Improvement?



Plant C in China: SPC decreased with process and mechanical improvement in 3 years (1998~2001), but no continuous improvement


Customer Voice
in Energy Management

Customer Voice on Energy Management

CEO : "We need Energy cost reduction"; " How to Get Real Time Information from My Plants on Energy Efficiency & CO2 Emission with Overview & With Benchmark…";

CPO: " How to benchmark performance of my plants and with others?" ; "How to provide prompt support from TC with less effort?" ; "How to ensure my return on investment for EMS?"

CFO: "Why I Got the Power Penalty" "Am I Getting the Right Power Bill; Is any index to benchmark power use price"

Plant Manager: "I have been investing a lot but still specific power consumption is high, why?"; "How Can my plant make Continuous improvement" ; "Lack of Efficient & transparent use of energy"

Energy Manager /Process :
"It is always too late to know the over consuming event." ; "It is difficult to analyze huge amount of data ";"How can I find opportunities for energy saving? ";

Electrical manager:
"How Can I avoid penalty for exceeding limit? What is the my power quality, reliability?"

Prod manager/Kiln coach:
"How Can Make Sure My Operators Are Optimizing in Day to Day Operation? "How Can I manage crew performance on real time? With less effort?

Operators: "How Can I Optimize Energy Consumption?" "Where and when I can save?"

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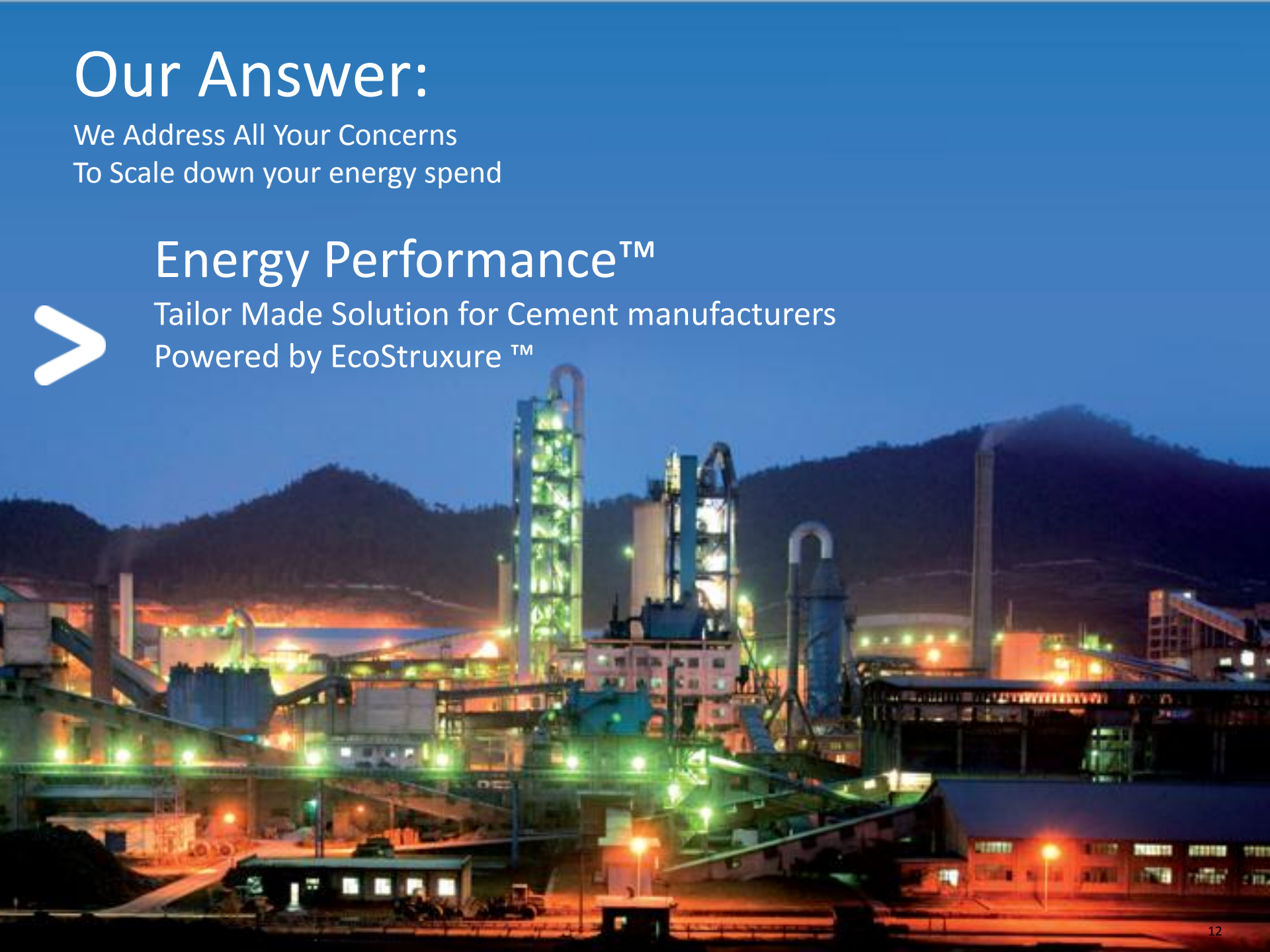
Our Answer:

We Address All Your Concerns
To Scale down your energy spend

Energy Performance™

Tailor Made Solution for Cement manufacturers
Powered by EcoStruxure ™



A Efficient Platform Helps Optimizing Energy at Different Levels of Enterprise
A Transparent Platform Enables Gov Getting Real Picture

- **Enterprise level**
  - **CEO**
  - **COO, Industrial / Energy efficiency director，Chief engineer**
  - **Financial director/Procurement director**

- **Plant level**
  - **Plant manager**
  - **Production/Operation manager/Process manager**
  - **Supervisor/ Operator**
  - **Maintenance**

- **Public & Government**

  Includes internal users (plant staff, corporate managers)
  and external users (Government, Cement Association, CSI, visitors, customers)

Energy Performance™

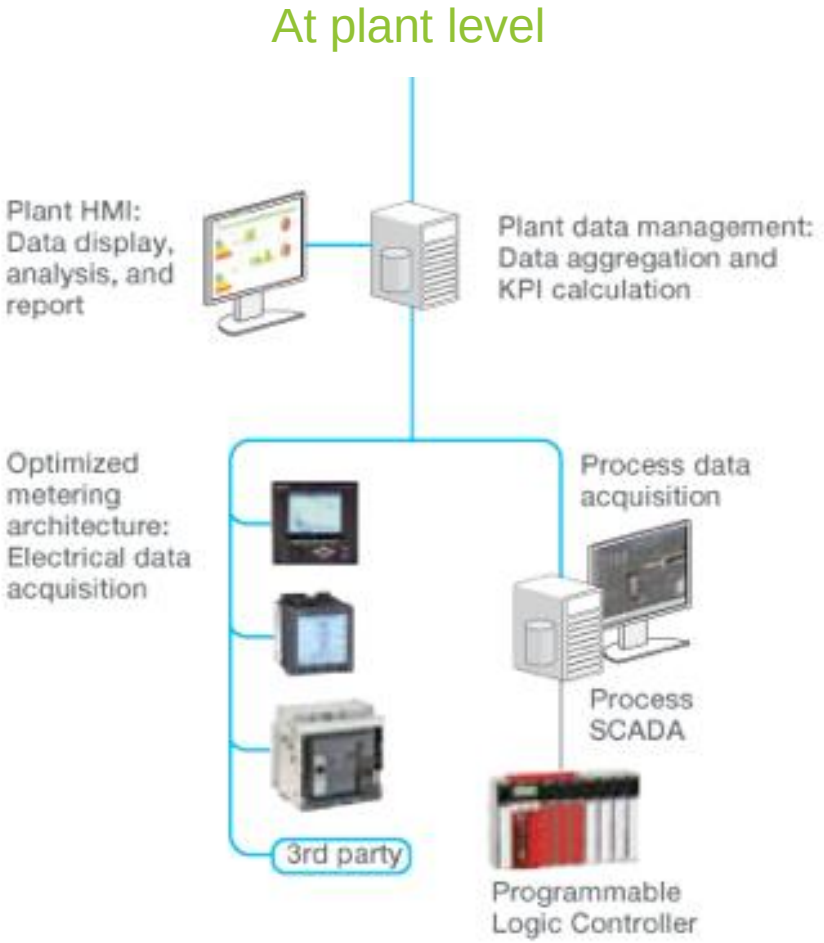
From site-wide up to enterprise-wide

Optimized metering and communication architecture

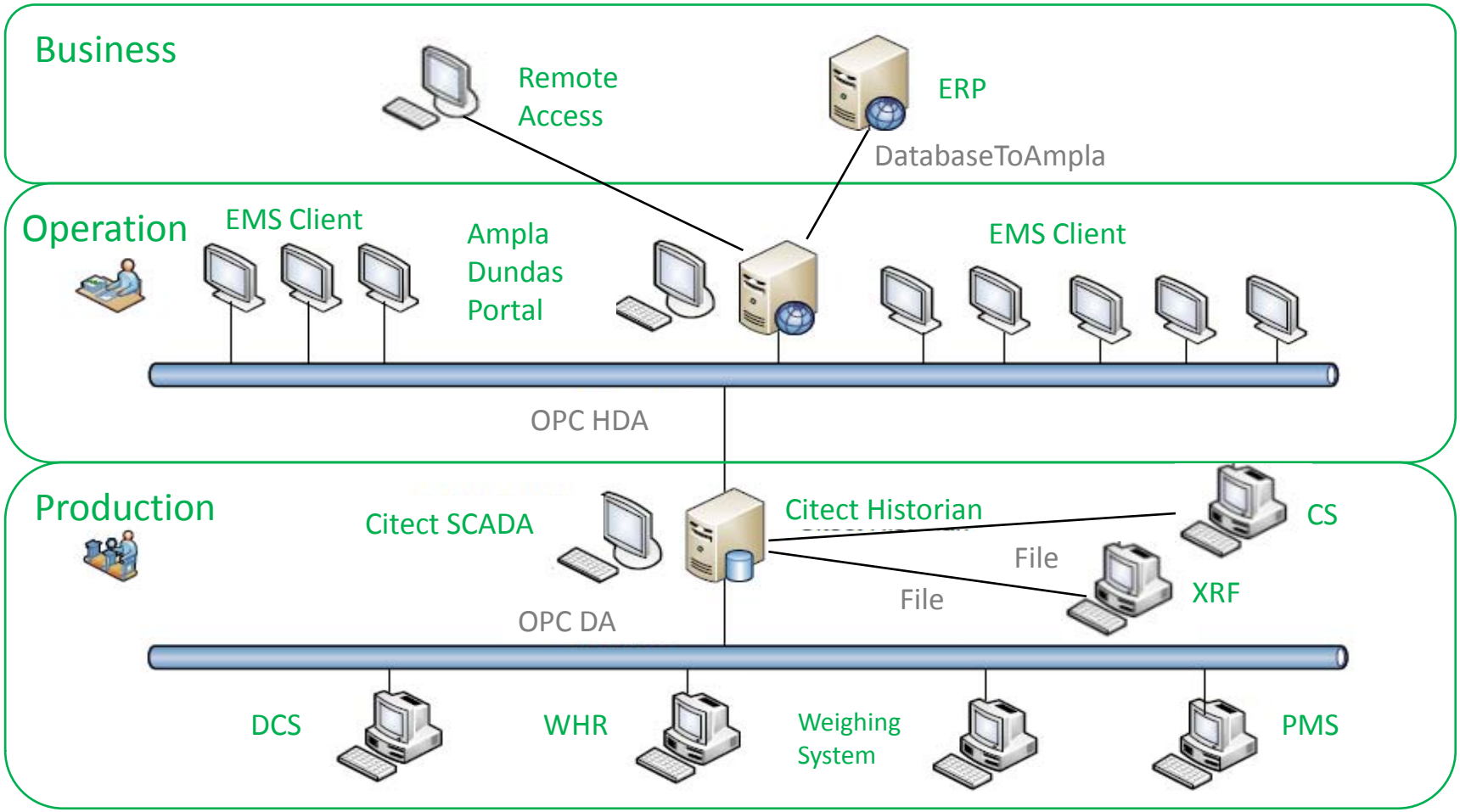
- The architecture is designed to optimize new sites and existing installations with third-party or Schneider Electric equipment
- Flexible and open-ended, it reads and transmits plant's energy data at high speed

Plant data management

- Energy Performance **aggregates** energy data at load, workshop, line, and plant levels
- To compute KPI scores, it acquires data from the process SCADA to **combine** with energy data
- It **converts** the raw data into meaningful KPIs
- It logs this information at load, workshop, line, and plant levels



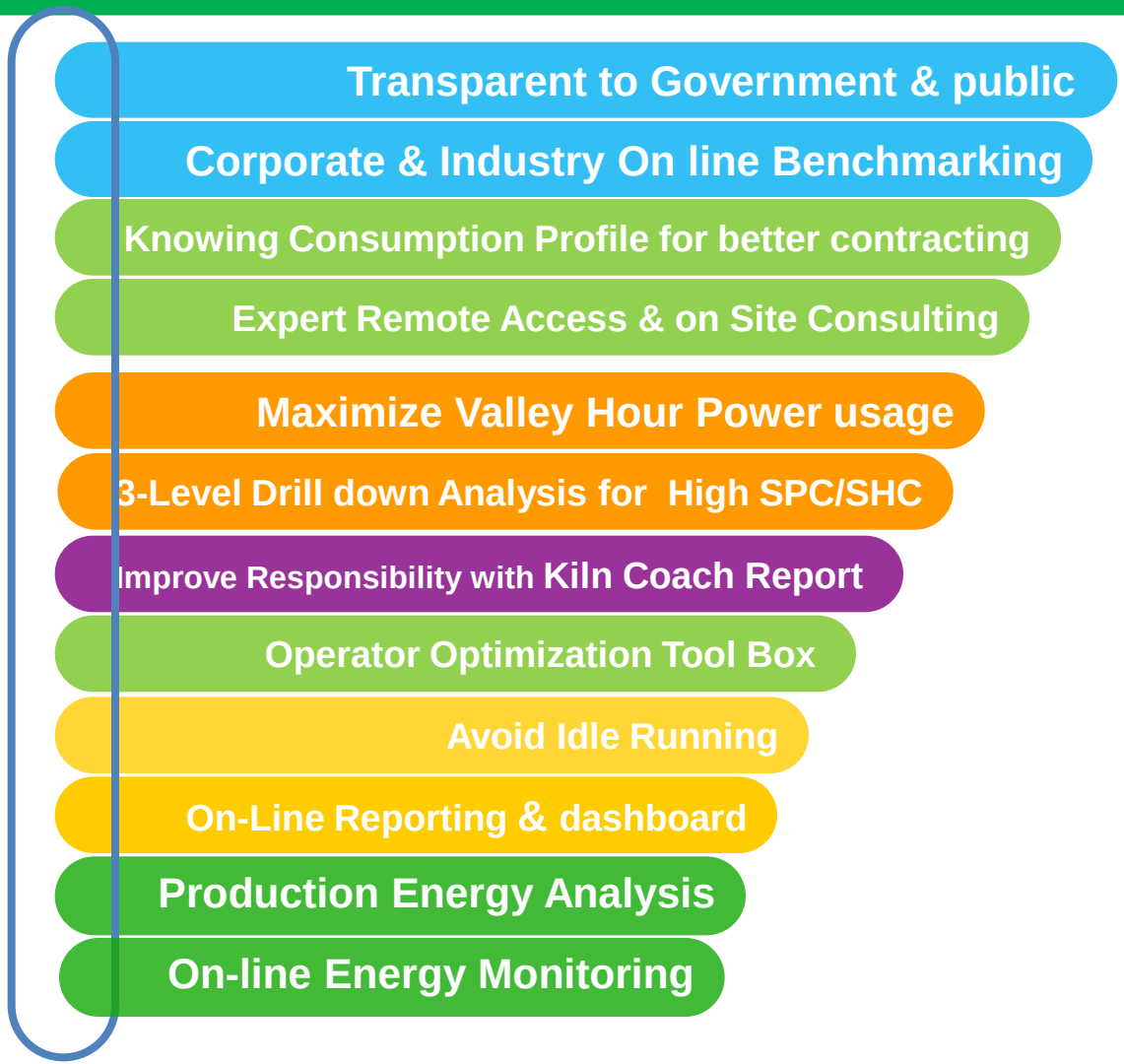
Network Architecture for Plant (extended)



Built on KPIs Validated by Cement Manufacturers

- Among them:
- Output (t/h)
- SPC (Specific Power Consumption): kWh/t.cement, kWh/t.clinker kWh/tonne for finish grinding
- SHC (Specific Heat Consumption): MJ/t.clinker
- AF(Alternative Fuel) substitution rate
- Cement/Clinker ratio
- SPC, SHC by crew
- Real Time Energy Cost: $/MWh, $/GJ, $/t.cement for power, $/t.clinker for fuel
- CO_2 emissions: tCO2/t.clinker, tCO2/t.cement
- Water required to produce 1 tonne of cement: tonne of water/tonne of cement
- WHR: Power Generation per tonne of clinker: kWh/t.clinker, self consumption %
- Total energy cost and breakdown per utility (thermal and electrical energy)
- … (See the Appendix 1)

EP Enables Improve Energy Performance



Information Tools

Analytics, Visualization

Dashboards (samples)

Role-based capability to:
- monitor and improve operations
- analyze and drill to detail according to individual needs.

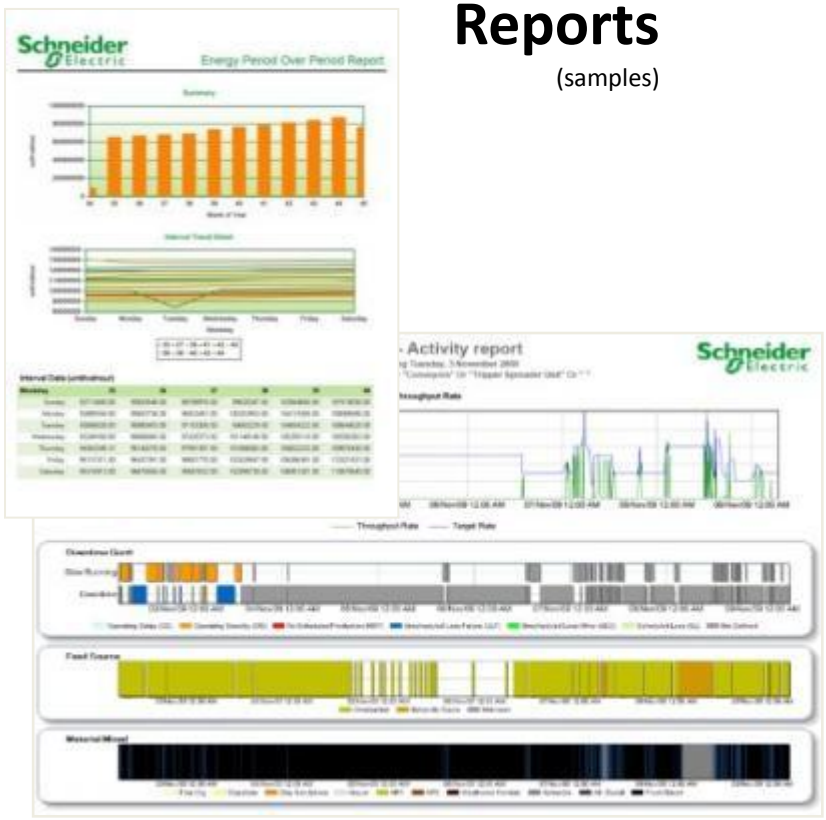
Information Tools

Analytics,Visualization, Reporting

Dashboards (samples)

Reports

(samples)



Role-based capability to monitor, analyze and drill to detail.
Triggered or automatic reports in standardized or customized format.

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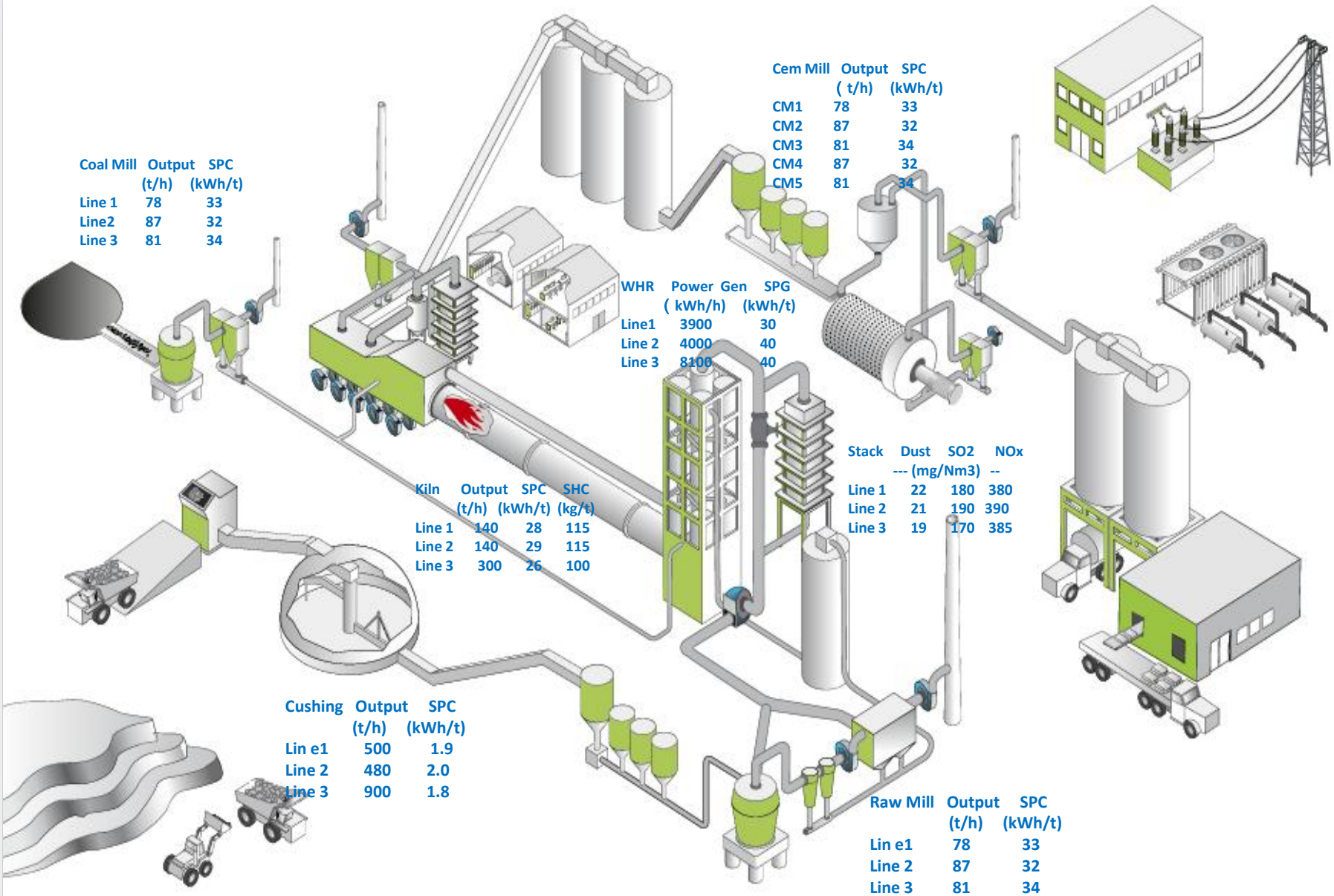
Lafarge Dujiangyan / Conch / Evergreen/ CUCC / Quzhai



Coal Mill	Output (t/h)	SPC (kWh/t)
Line 1	78	33
Line2	87	32
Line 3	81	34

Cem Mill	Output (t/h)	SPC (kWh/t)
CM1	78	33
CM2	87	32
CM3	81	34
CM4	87	32
CM5	81	34

WHR	Power Gen (kWh/h)	SPG (kWh/t)
Line1	3900	30
Line 2	4000	40
Line 3	8100	40

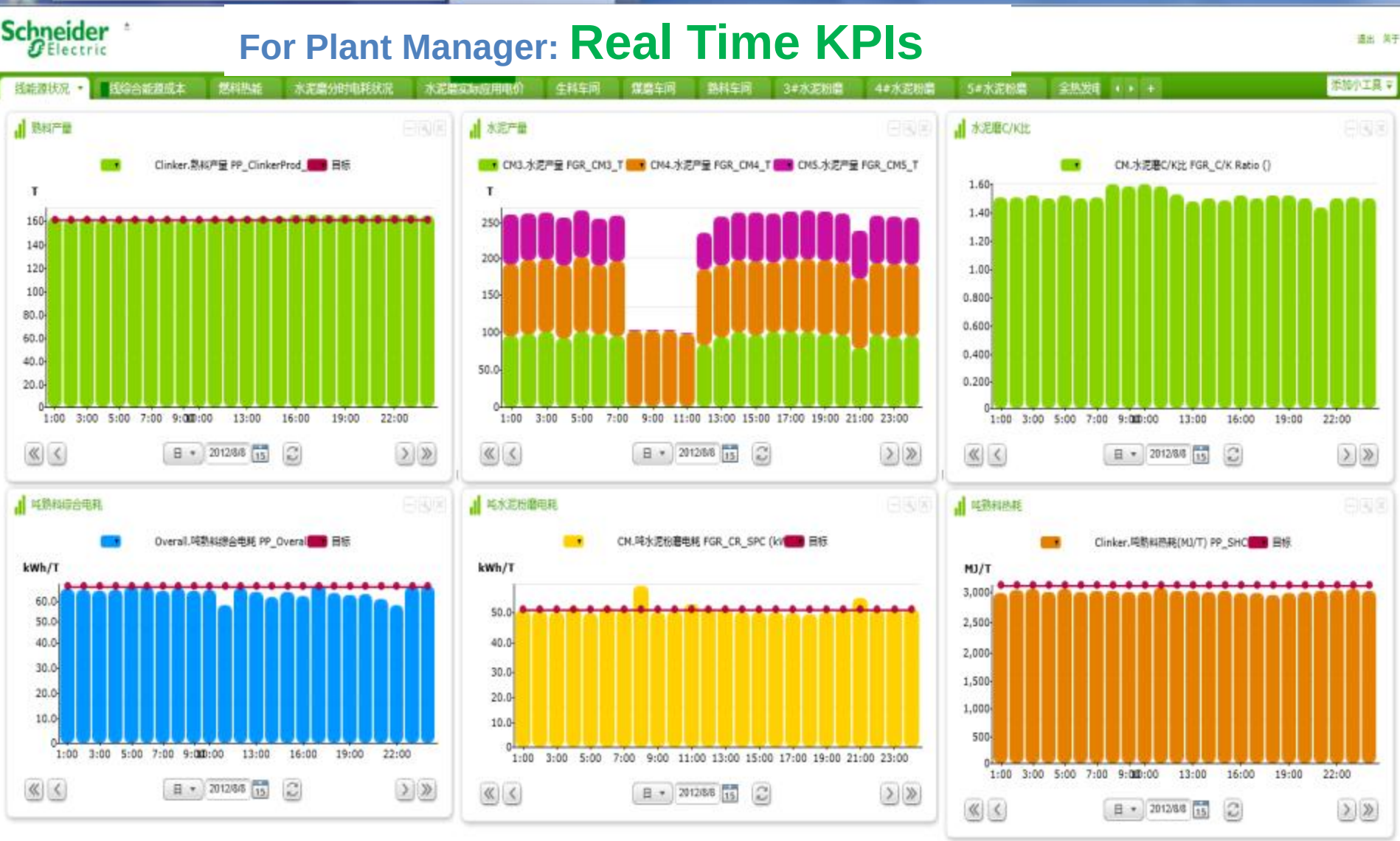
Kiln	Output (t/h)	SPC (kWh/t)	SHC (kg/t)
Line 1	140	28	115
Line 2	140	29	115
Line 3	300	26	100

Stack	Dust --- (mg/Nm3)	SO2	NOx --
Line 1	22	180	380
Line 2	21	190	390
Line 3	19	170	385

Cushing	Output (t/h)	SPC (kWh/t)
Lin e1	500	1.9
Line 2	480	2.0
Line 3	900	1.8

Raw Mill	Output (t/h)	SPC (kWh/t)
Lin e1	78	33
Line 2	87	32
Line 3	81	34

For Plant Manager: Real Time KPIs



For Plant Manager: Daily Report Automated

鹿泉市曲寨水泥有限公司三线

2014 年1-12月份生产综合日报表 2014年5月6

一线中央控制室生料磨系统运行

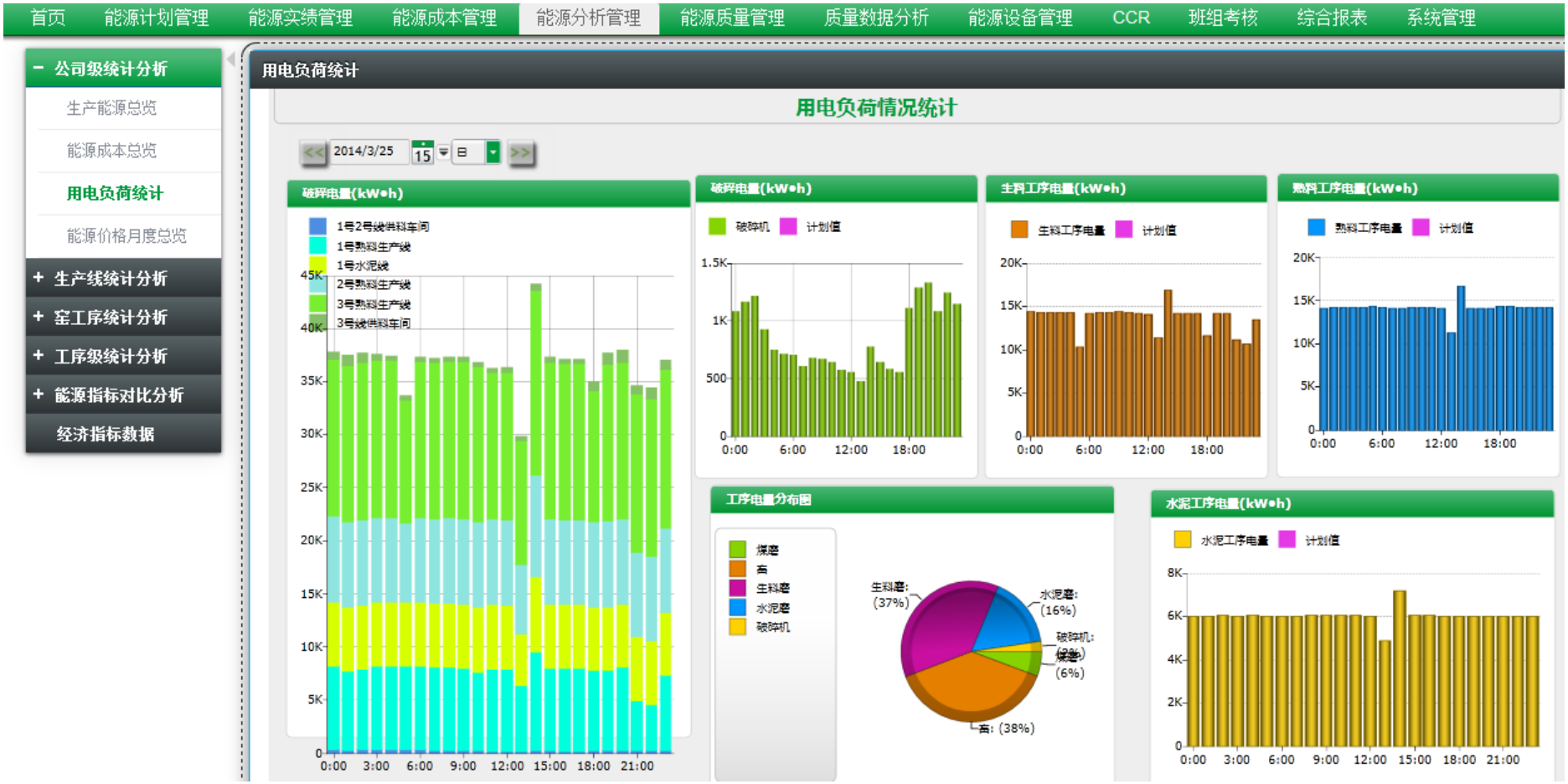
For Environment Manager:

CO2 On Line Report

Helps Plant Reduce Footprint & Supports Carbon Trading

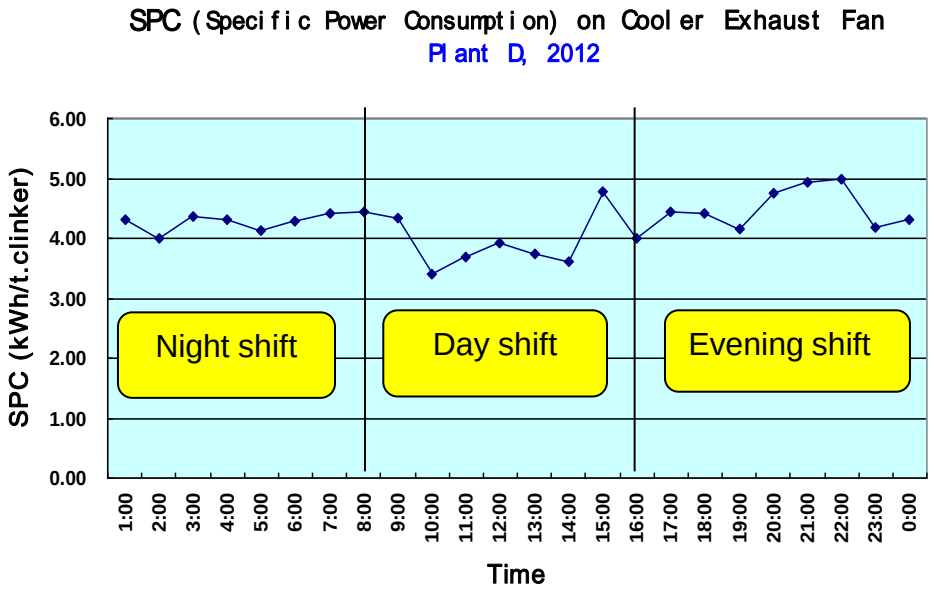
- It is On Line & Real Time CO2 emission, 0.74tCO2/t.cement is in good range
- The pie chart tells you CO2 breakdown: 57% of it is from CaCO3 decomposition, 31% from fuel combustion and 12% indirect CO2 from electricity consumption

For Electrical manager: Whole Plant with 3 Lines



For Production Manager / Kiln Coach:

Crew Performance Tracking , Improve Responsibility



For Kiln Coach:

Daily, monthly and yearly

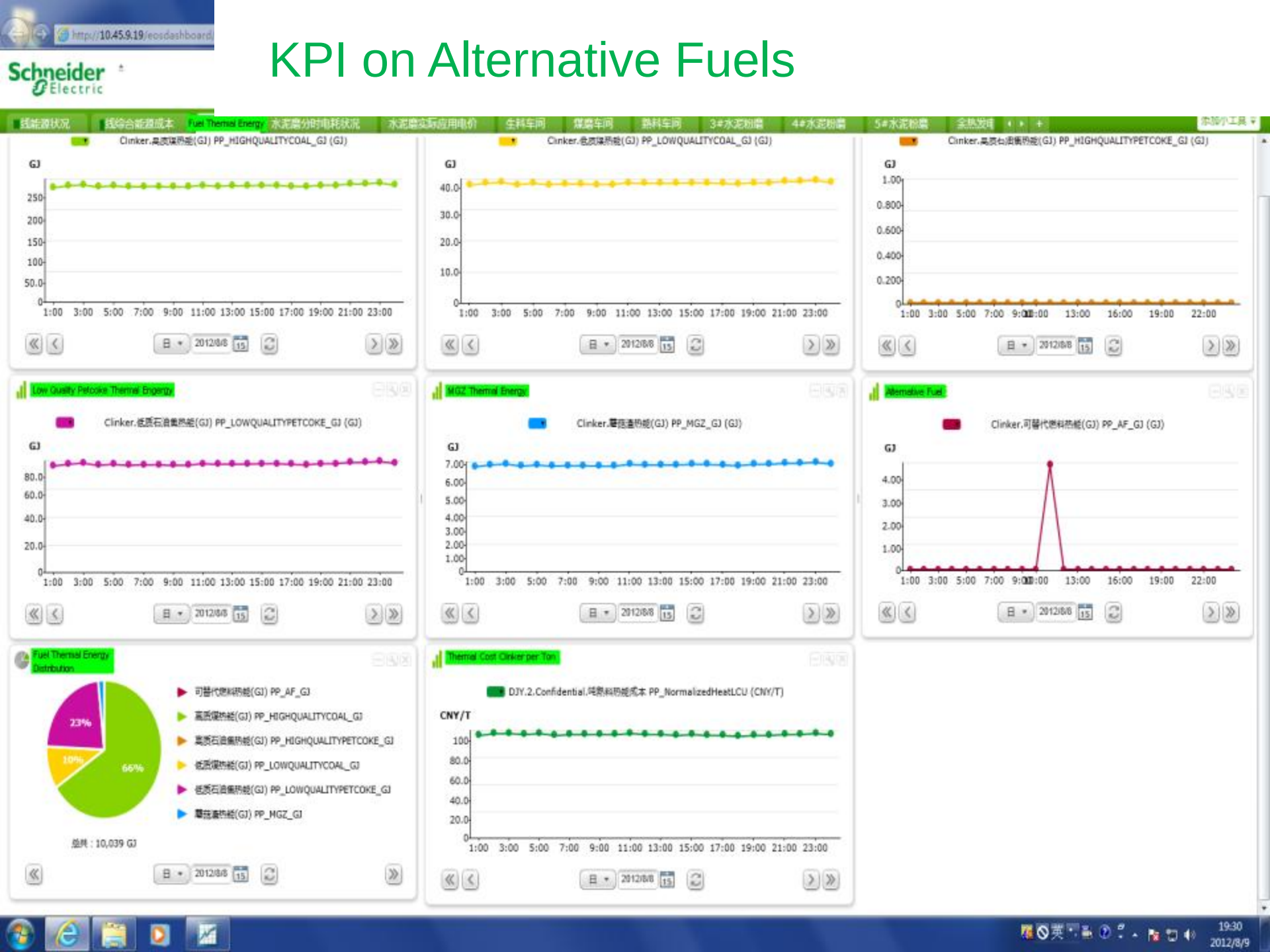
Automatically Generated

Kiln Coach Report

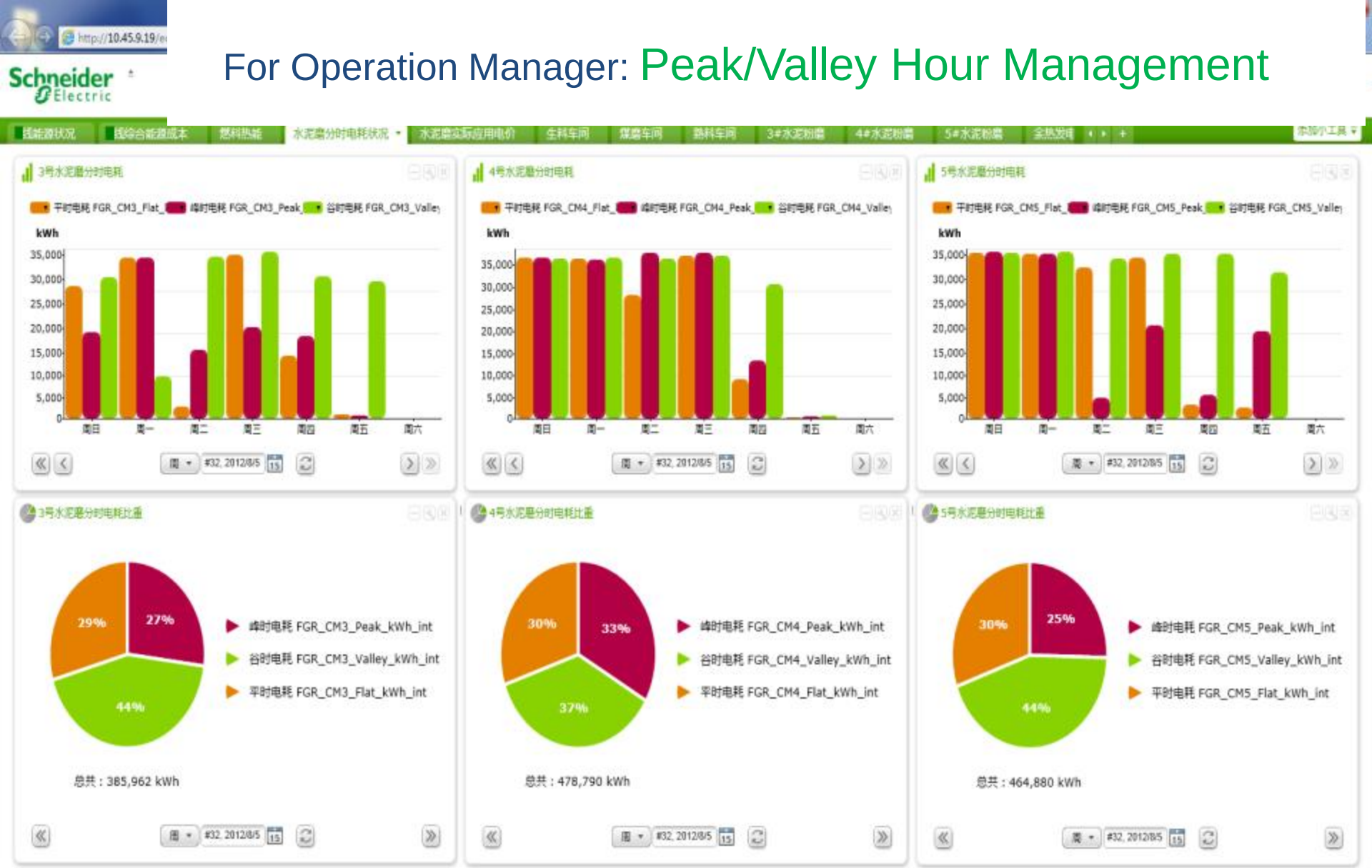
KPI		Clinker production	SHC	SPC	f-CaO Qualified <1.5%	f-CaO Optimized 0.7~1.5%	Overall Efficiency
		t/shift	kJl/kgcl	kWh/t.cl	%	%	
Traget		1700	3270	25	90	85	
Actual	Operator:						
	Kumar	1680	3313	24	92	87	B
	Peter	1738	3300	23	90	85	A
	Raji	1645	3331	25	91	86	C
	Ashu	1667	3330	25.3	93	88	C

For Financial Manager: Real Time Energy Cost

KPI on Alternative Fuels

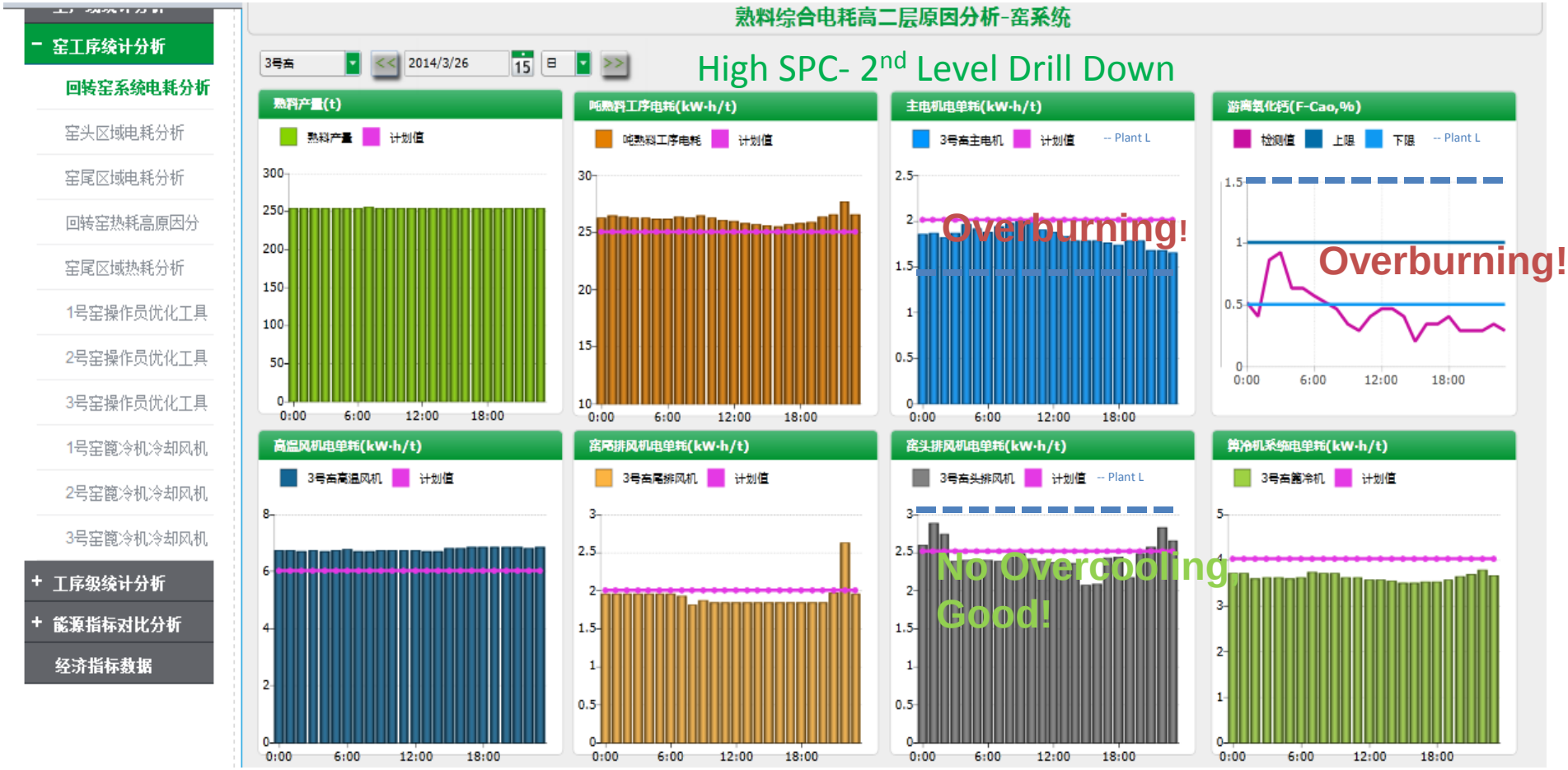


For Operation Manager: Peak/Valley Hour Management

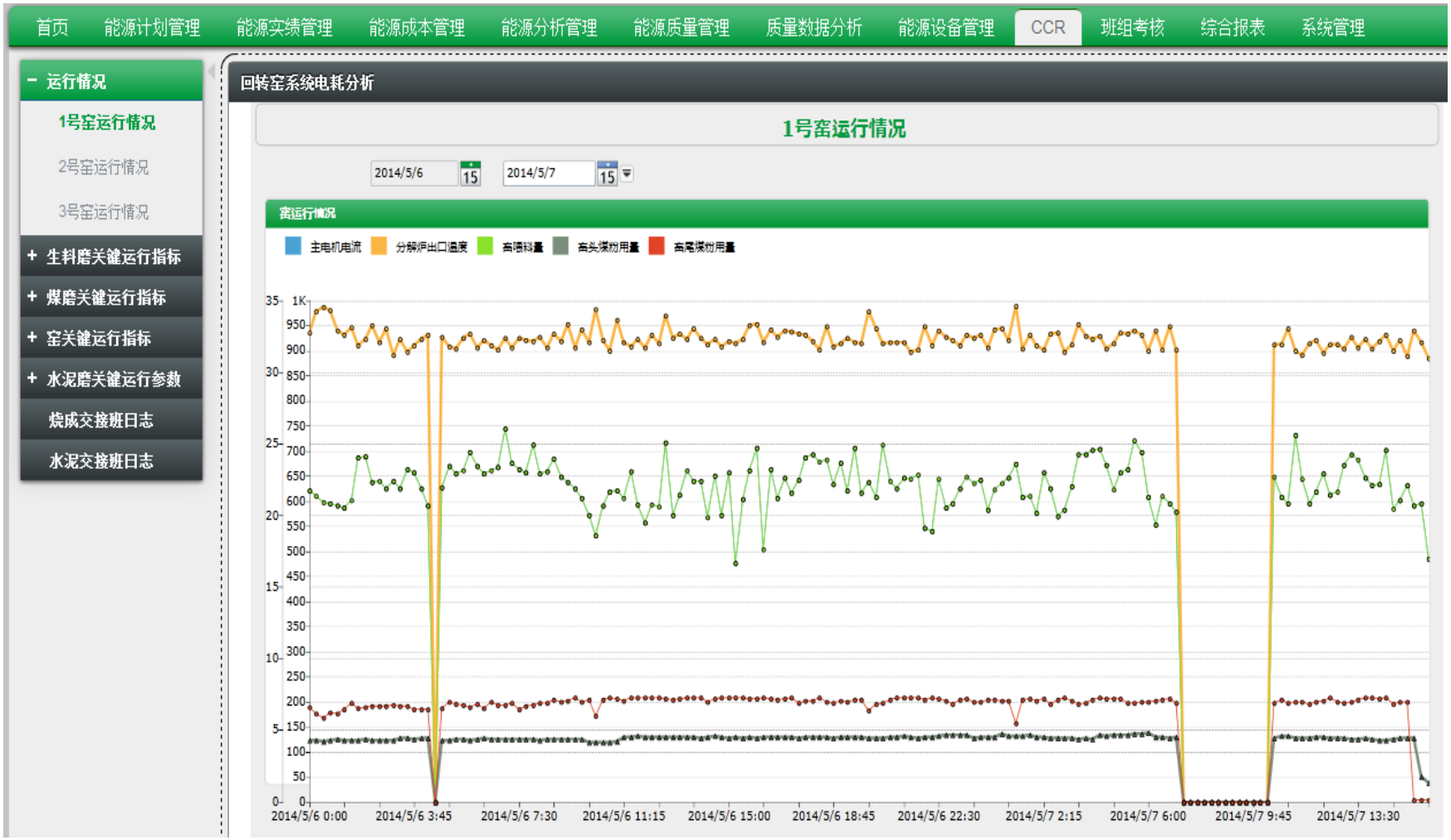


For Process Manager: Tool for High SHC Analysis

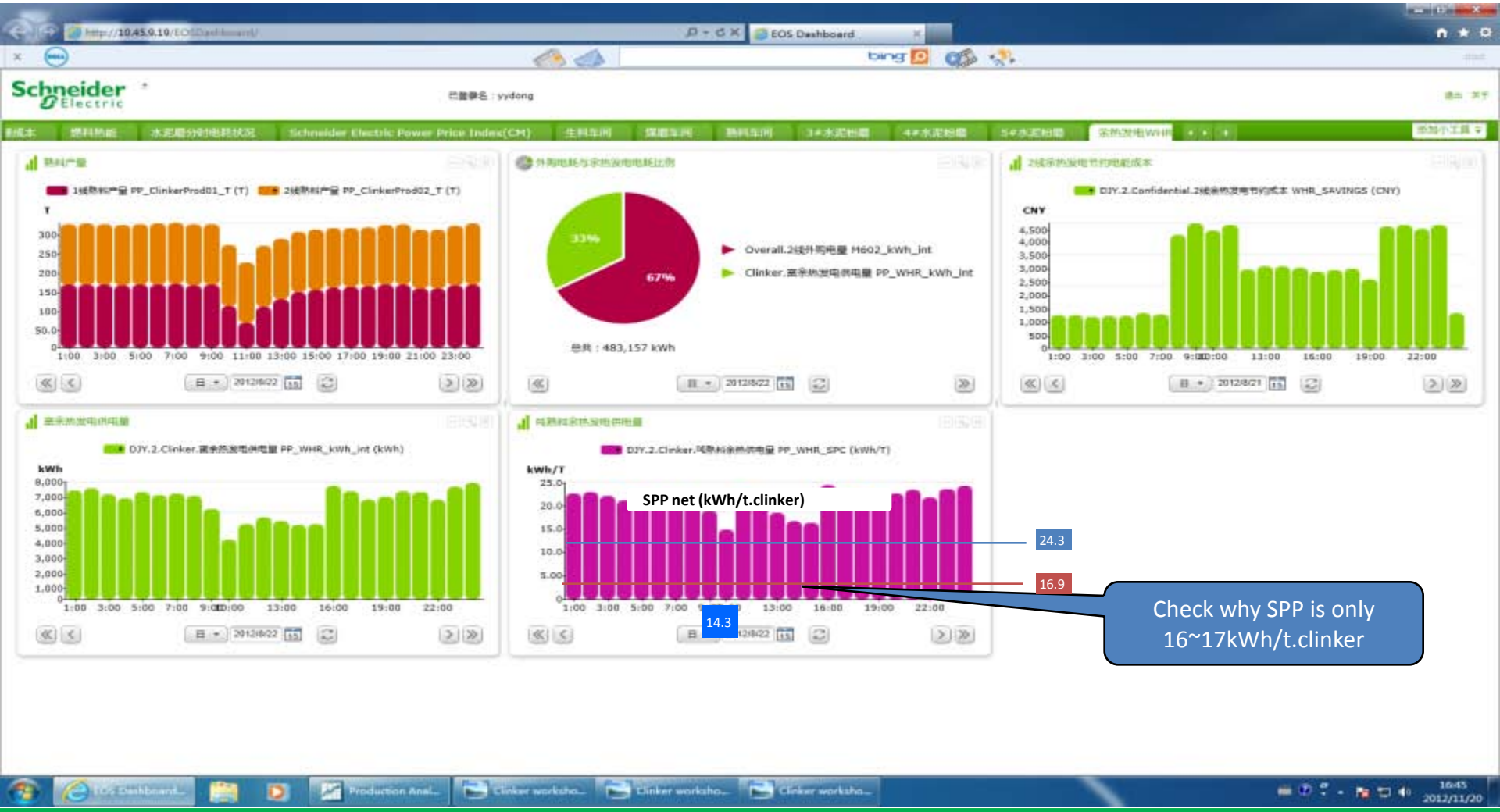
For Process Manager: Tool for High SPC Analysis



For Process manager: Process Trend

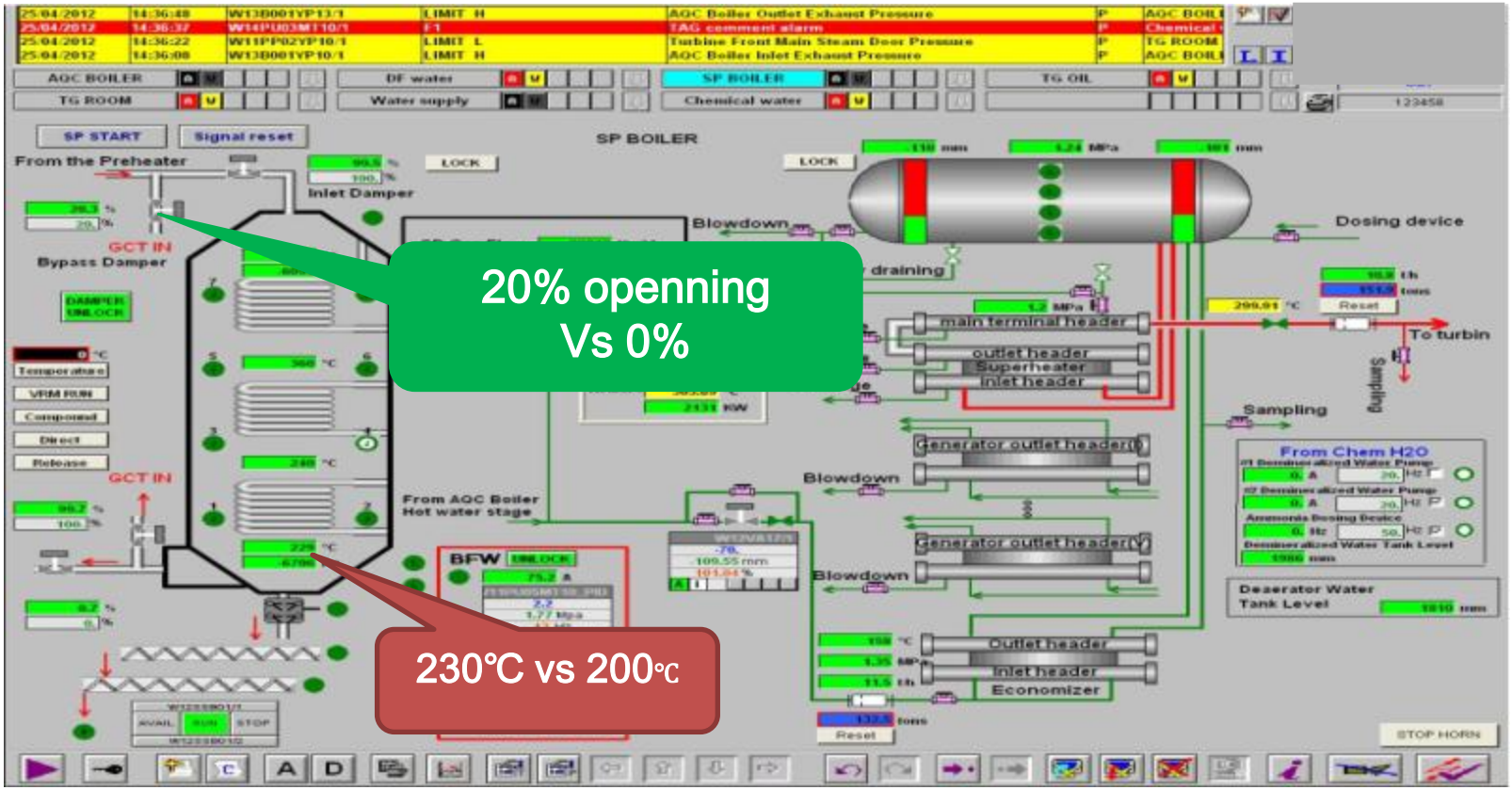


For WHR manager: WHR KPIs



For Energy Consultant: Remote Access for Easy Analysis

Remote Access to WHR operation

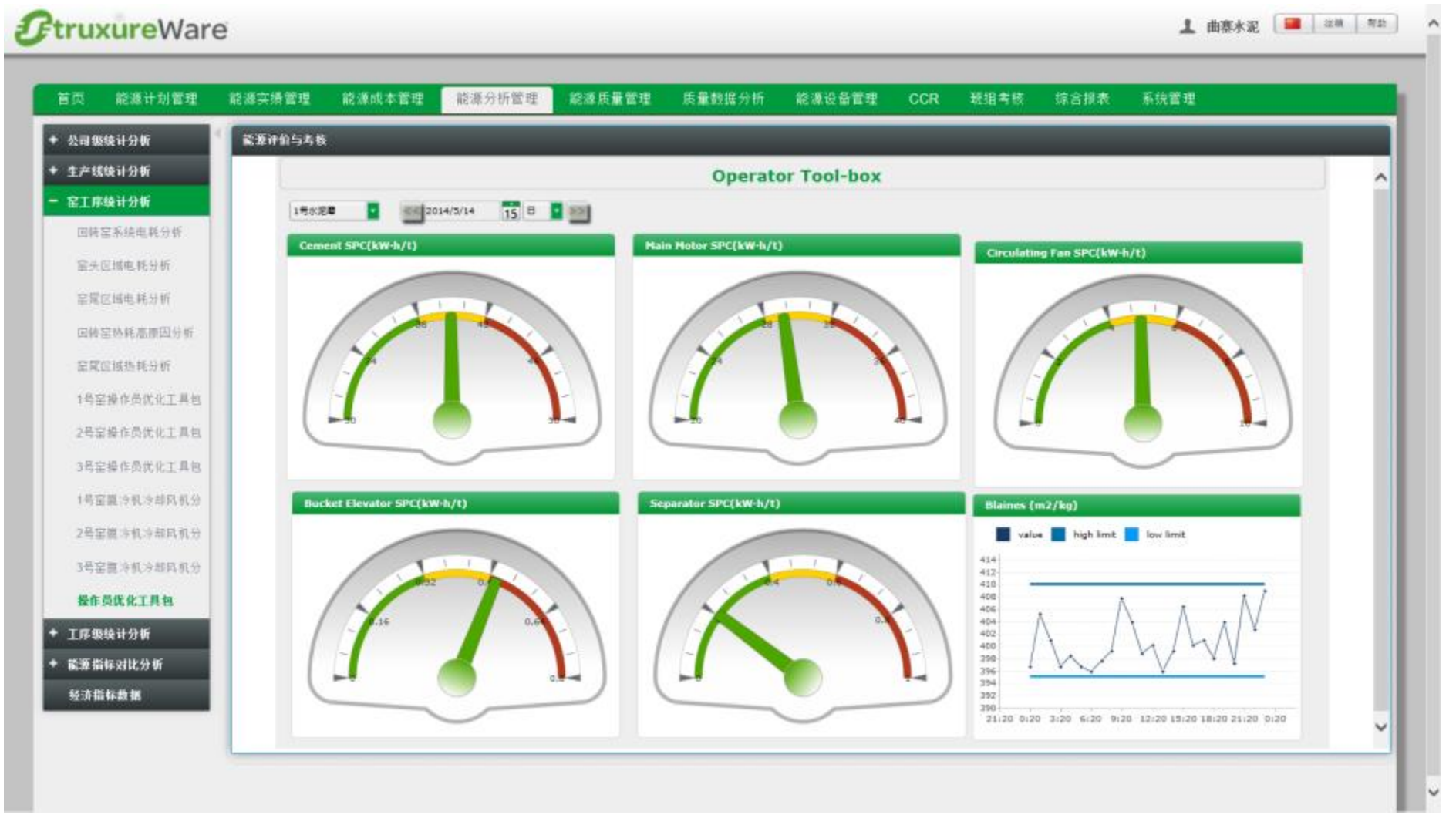


If the SPG or SPP is lower than target, energy consultant will look at:

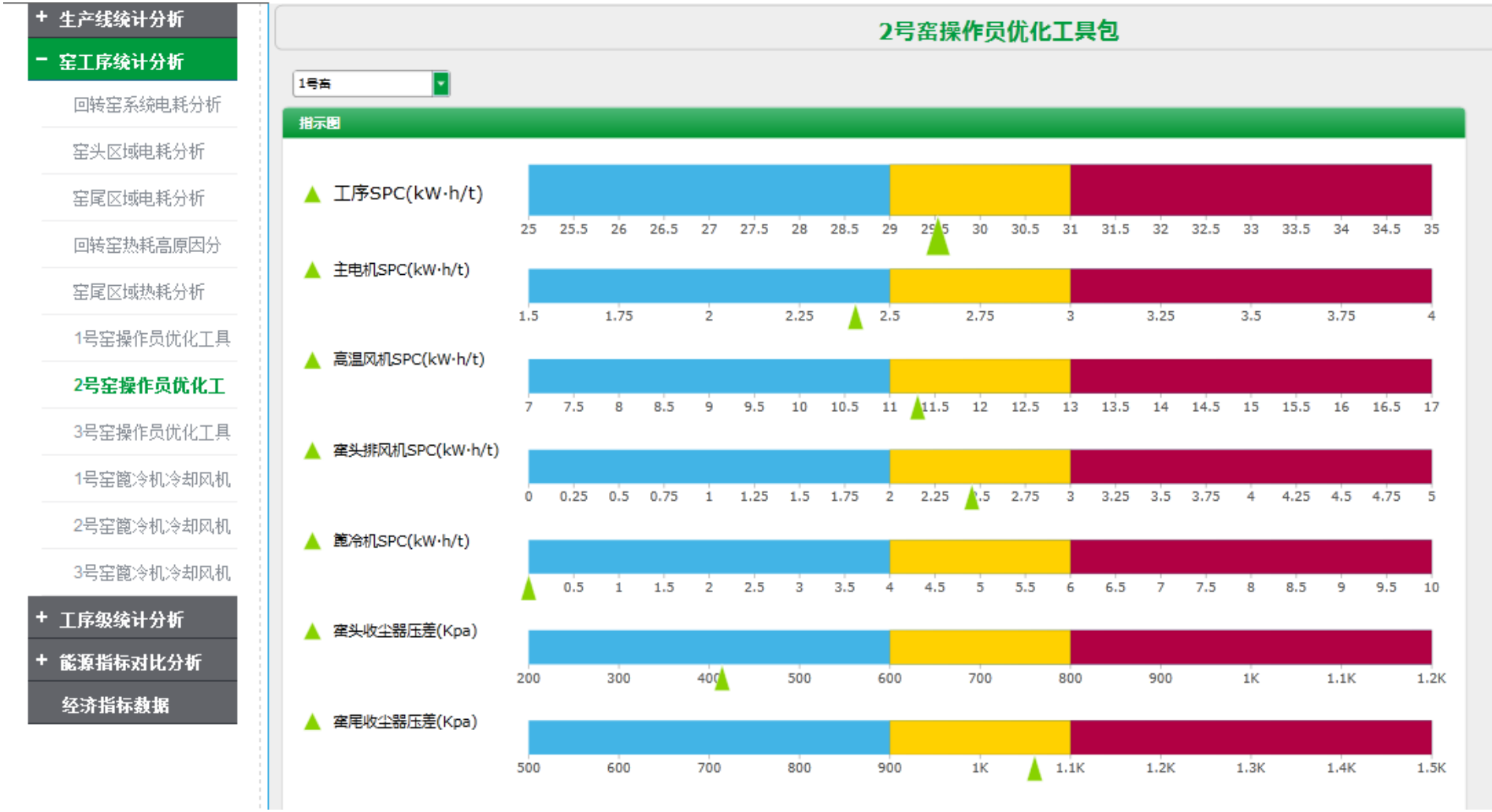
- **SPC boiler outlet T**
- by pass %, etc

For Kiln Operator: Tool Box (Historical View)

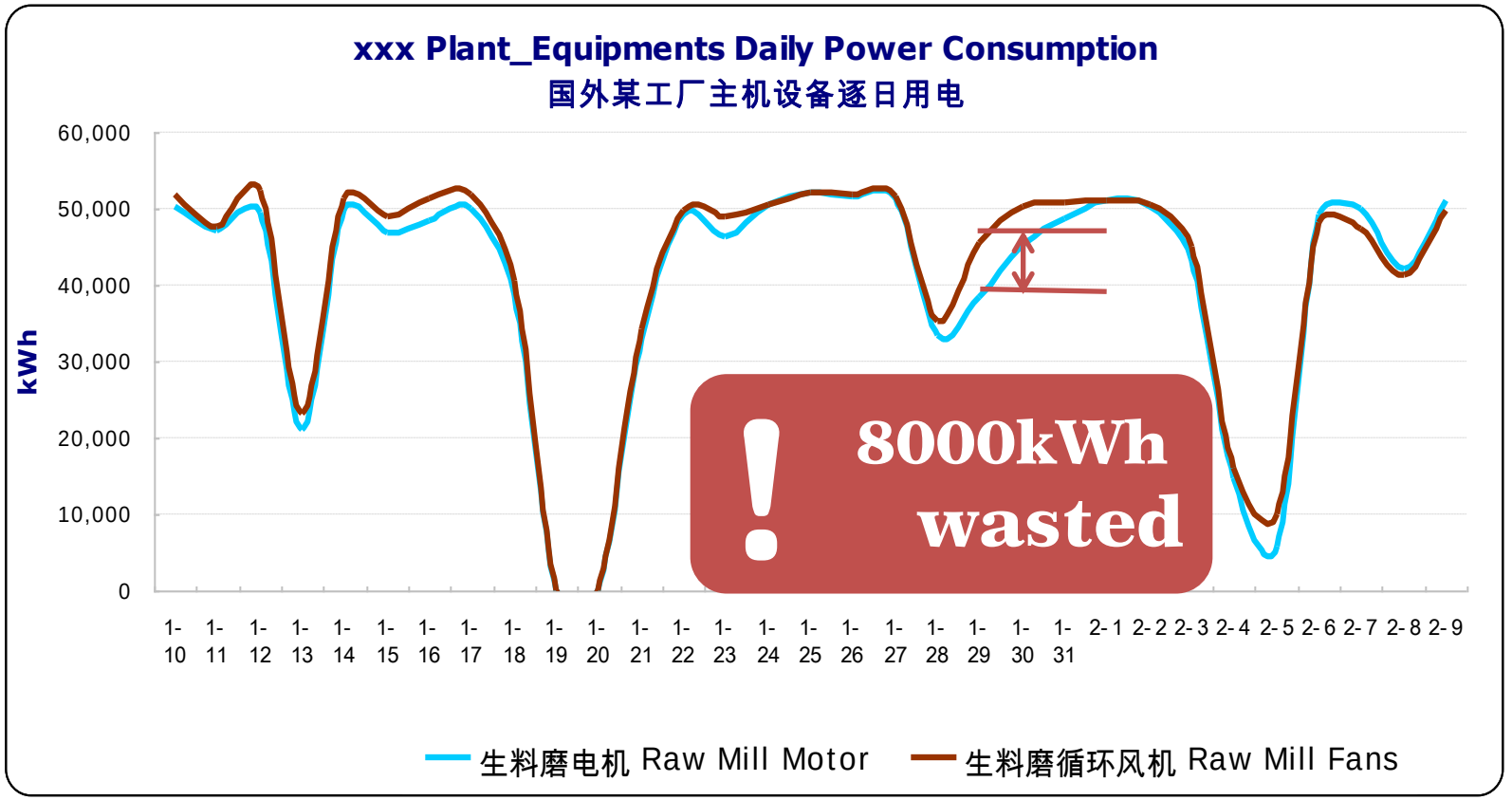
Kiln Operators: Optimization Tool Box



For Kiln Operator: Tool Box



Energy Saving Manager: Avoid Idling Running



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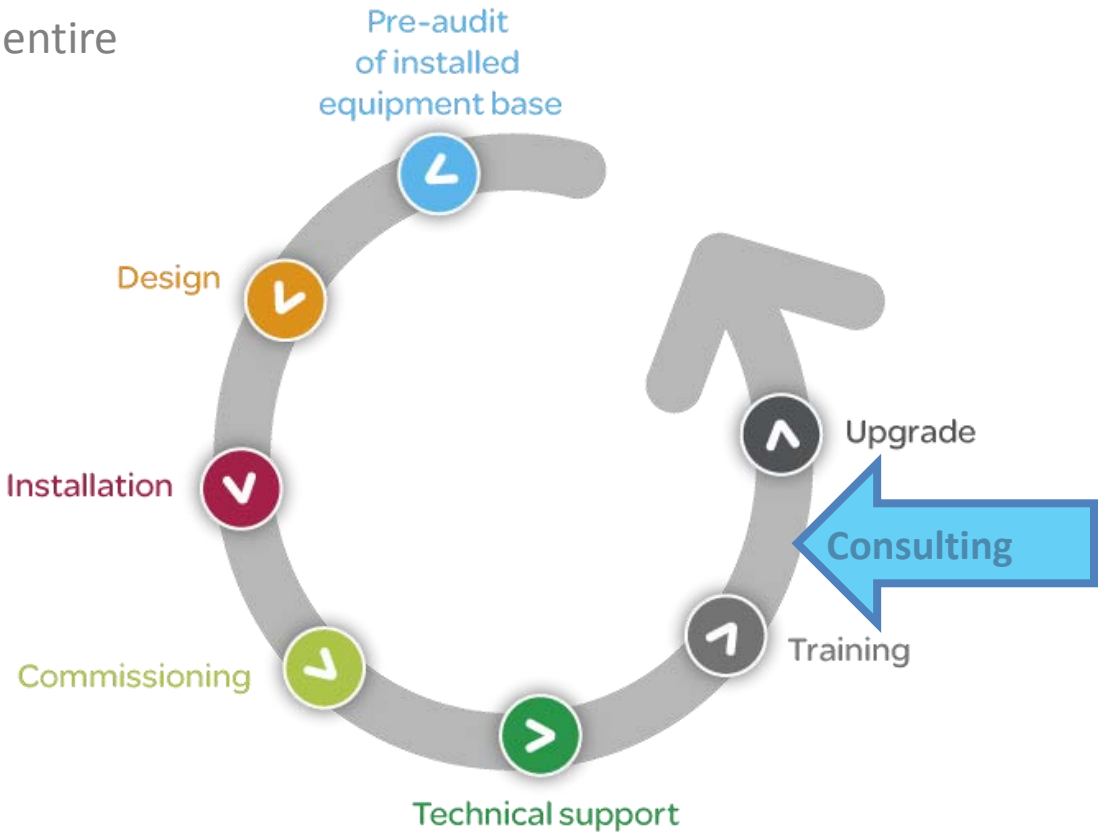
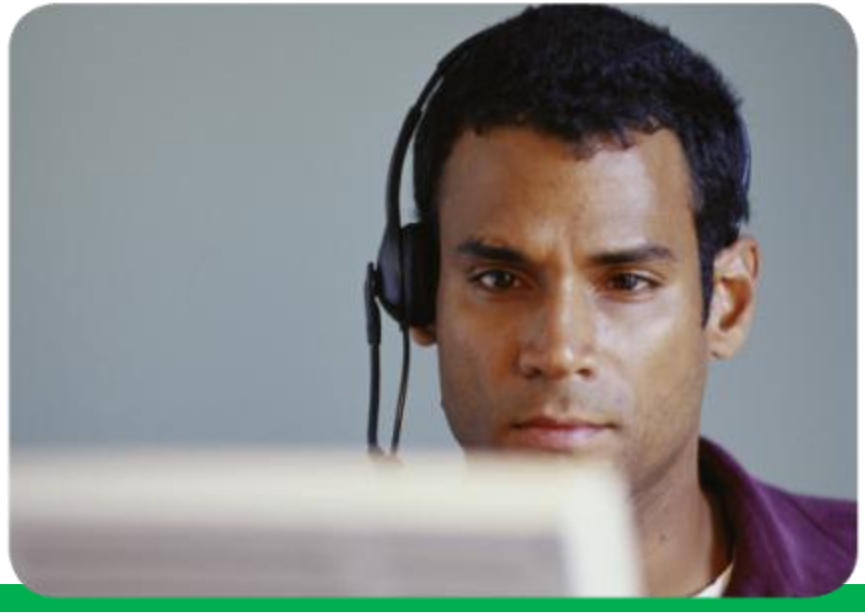
Implemented and supported by Schneider Electric

Get the support of our project and services teams worldwide throughout the entire system lifecycle



Professional Service

- Remote Access+ site service
- Energy Report with Action plan step by step
  - Technical support contract
  - Consulting contract



Consulting + Customer Involvement

= Guarantted Saving & Return on Investment

Leveraging energy and sustainability solutions and services, Schneider Electric's consultative approach looks in detail at current production processes and identifies optimal standards and improvements that can be implemented across your process and operations.

- 12 Golden Rules
- Interaction at Customer site with different Roles
- Change management
- Process optimization

✦ Customer site 1

✦ Customer site 2

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Detailed Results

- **Actual energy savings and benefits:**

Recommendation implemented	Energy saving [kWh/t cement]	Annual benefit [RMB/year]
Process fans of kiln system optimization	0.5	437500
Cement mill peak shifting and averting management	0.4	406180
Air compressors control system optimization	1.3	1137500
Total	**2.2**	**1981180**

- **Conservative energy savings and benefits:**

Recommendation implemented	Energy saving [kWh/t cement]	Conservative factor	Energy saving [kWh/t cement]
Process fans of kiln system optimization	0.5	0.4	0.2
Cement mill peak shifting and averting management	0.4	0.4	0.184
Air compressors control system optimization	1.3	0.4	0.52
Total	**2.2**	**0.4**	**0. 8**

Customer Testimonial

Success Story
-Lafarge DJY

Schneider Electric

June 26th 2013
[2013 06 26]

Post Code: Box 068, 611833

Dong Yiyu
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[公司总经理]
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Dear Mr.Dong Yiyu,
尊敬的[董益宇]先生

Thank you for allowing Schneider Electric to interview you for the purpose of appearing in our Schneider Electric publications. To make sure you are comfortable with the usage of the collateral we generate as a result of your success story/case study, please review the following points:
感谢您抽空接受了施耐德电气的访问以供我们发表。为让您对我们使用您的成功事迹或案例感到放心，请您核实以下几点：

You have indicated to us either via interview on May 16th 2013 that Schneider Electric is entitled to utilize your success story/case study for the following purposes (check off all categories that apply):
您已经通过[电子邮件]的方式于[2013 06 26]向我们示意，施耐德电气有权将您的成功事迹或案例用于以下用途（请核查所有适用的类目）：

___ **Schneider Electric print newsletter and Web**
___ **施耐德电气印刷的新闻简报和网页**
___ **Schneider Electric editorial usage (i.e. white papers)**
___ **施耐德电气的刊物（即白皮书）**
___ **Schneider Electric University course materials**
___ **施耐德电气的大学课程教材**
___ **Schneider Electric press releases**
___ **施耐德电气的新闻稿**
___ **Schneider Electric catalogs, brochures, mailers, email**
___ **施耐德电气产品目录、彩页宣传册、材料、电子邮件**
___ **Schneider Electric annual reports**
___ **施耐德电气的企业年报**
___ **Schneider Electric advertisements**
___ **施耐德电气广告**
___ **Schneider Electric video**
___ **施耐德电气发布的视频**

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Schneider Electric

___ **Schneider Electric given permission to share success story/case study information and contact information with publication editors and industry analysts**
___ **施耐德电气有权与出版编辑与业内分析师分享这些成功事迹/案例信息和联系方式**

This letter serves as reconfirmation of your approval. Should you have any objections, please contact Rosy Wang at your earliest convenience within two weeks of the date of this letter. If we have no contact from you within two weeks, we assume that you agree to publish and will proceed with publication.
此信函用以和您作相关的确认。如果您有任何异议，请在收到此信函的两周内尽早联系[王志荣]。如果我们于两周内未收到您的异议回函，我们将视为您同意我们按照原定计划将其发表。

We value you as a customer and are extremely proud to be featuring you in our print publications, marketing collateral and Web communications (if applicable). Please sign below to indicate reconfirmation of approval. Thanks again for your interest in Schneider Electric.
您是我们非常重视的一个客户，而且我们感到十分荣幸能够将您的事迹发表在我们的刊物上、行销推广资料中、网络资讯中（如果可行的话）。请在下方确认回函处签名以向我们确认您对此表示同意。再次感谢您对施耐德电气的关注与厚爱。

Name (signature):_____
姓名（签名）：_____

Company: Lafarge Dujiangyan Cement Co.Ltd
公司：都江堰拉法基水泥有限公司

Sincerely,
此致，

Rosy Wang, Global Solution Director for Cement

[王志荣，水泥行业全球解决方案总监]

Payback period : 2 years

Expected Result

Expected Overall Result:
(assume customer current performance is average)

~2kWh/t.clinker reduction
~1kWh/t reduction for cement grinding & packing

In world Clinker production 2.5Bt/a

Cement production 4 Bt/a

Expected Overall Result:	
Saving due to clinker：	2.5 x 2 = 5.0 BkWh
Saving due to finish grinding：	4 x 1 = 4.0 BkWh
Power Saving：	9.0BkWh
Indirect CO2 emission reduction:	9.0 BkWhx 0.86 t/MWh= 7.7Mt/a
Cost reduction:	9 BkWh x 100 $/MWh = 900 M$/a

For a Typical
5000TPD Line

(Assume: 100$/MWh)

Expected Result:	
Saving due to clinker：	5000 x 365 x 92% x 2 = 3.36MkWh
Saving due to finish grinding：	2,000,000 x 1 = 2.00 MkWh
Power Saving：	5.36MkWh/a
Indirect CO2 emission reduction:	5.36MkWhx 0.86 t/MWh= 4.6 kt/a
Cost saving:	5.36MkWh x100$/MWh =**536k$/a**

Conclusion

- **For Energy related industry challenges, Energy Management as holistic approach**
- **Energy Performance solution has a key role in strategy and continuous improvement process**
- **Energy Performance solutions provide**
  - **Real-time visibility of energy KPIs and cost**
  - **Analytics, planning and purchasing support**
  - **Sustainability KPIs to facilitate decision making**
- **Confirmed savings and acceptable ROI period**
- **Energy Performance solution enables:**

Efficient & transparent use of energy!

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