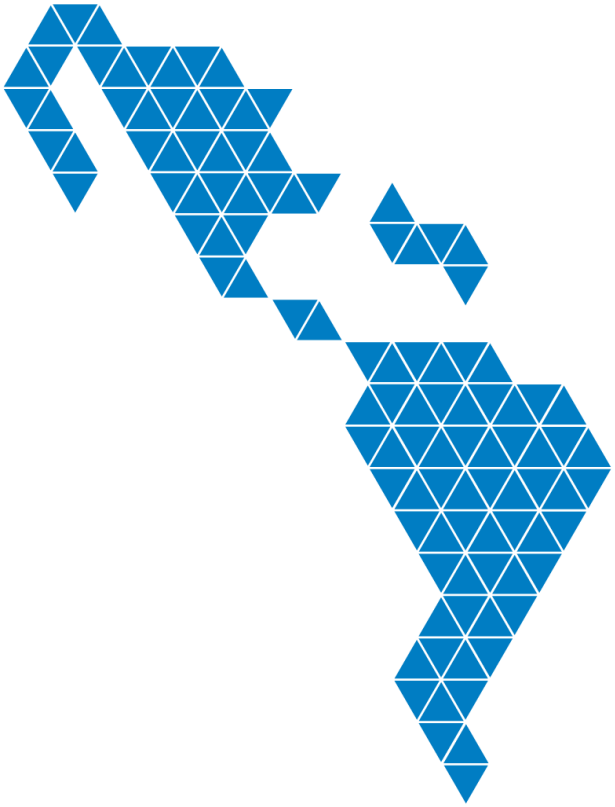


OSIsoft®

SEMINÁRIO REGIONAL 2011

LATAM SOUTH

Water and Energy Performance Monitoring at the Enterprise

Presented by

Osvaldo A. Bascur

Enterprise Business Executive

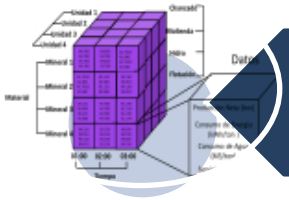
Agenda

Overview of the Large Industrial Complexes

Sustainability Strategies are good business

Real Time Enterprise Collaboration

Southern Peru Copper, CS Huachipato, Rio Tinto Kennecott Utah Copper



Further work and Conclusions

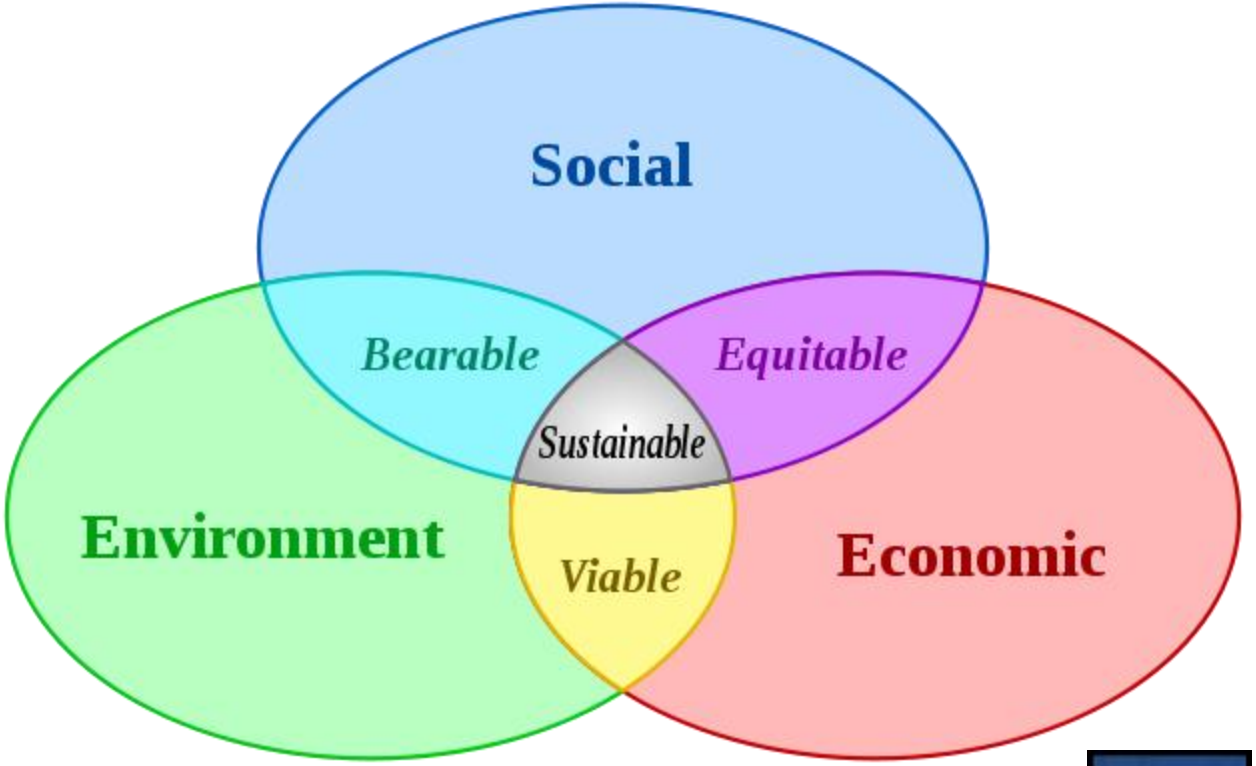
The Blue Gold

- WATER is now called Blue Gold.

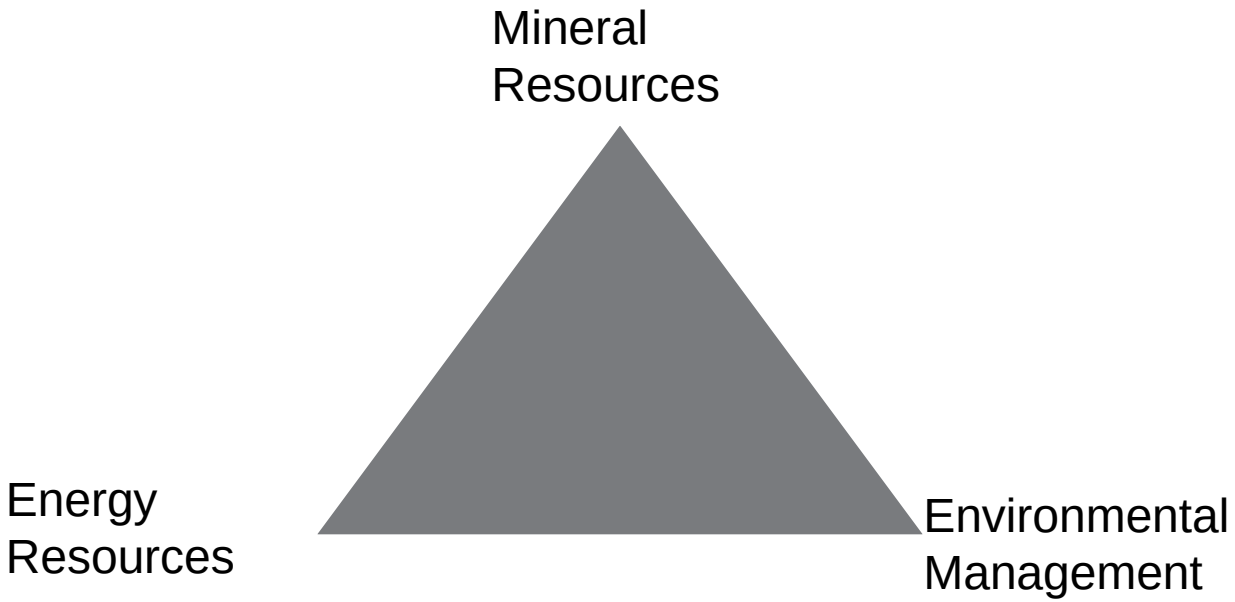
ORO AZUL

El mercado de las aguas finas está creciendo y Chile tiene una nueva marca reconocida en ese selecto club: Glaciares de Peteroa, que nace en la región del Maule. Aquí presentamos una selección de botellas que pueden ser tan sofisticadas y apropiadas para acompañar comidas como el vino. Por Marcelo Soto.

Sustainability: Energy and Water Conservation Strategies



Mineral Resources Triangle



- Technological innovations needed:
  - Decrease energy requirements
  - Increase recovery of from lower grade resources and metal recycling (more energy resources)
  - Collaboration between Operational and Strategic Teams
  - Proactive avoidance of downtime events (Waste Management)

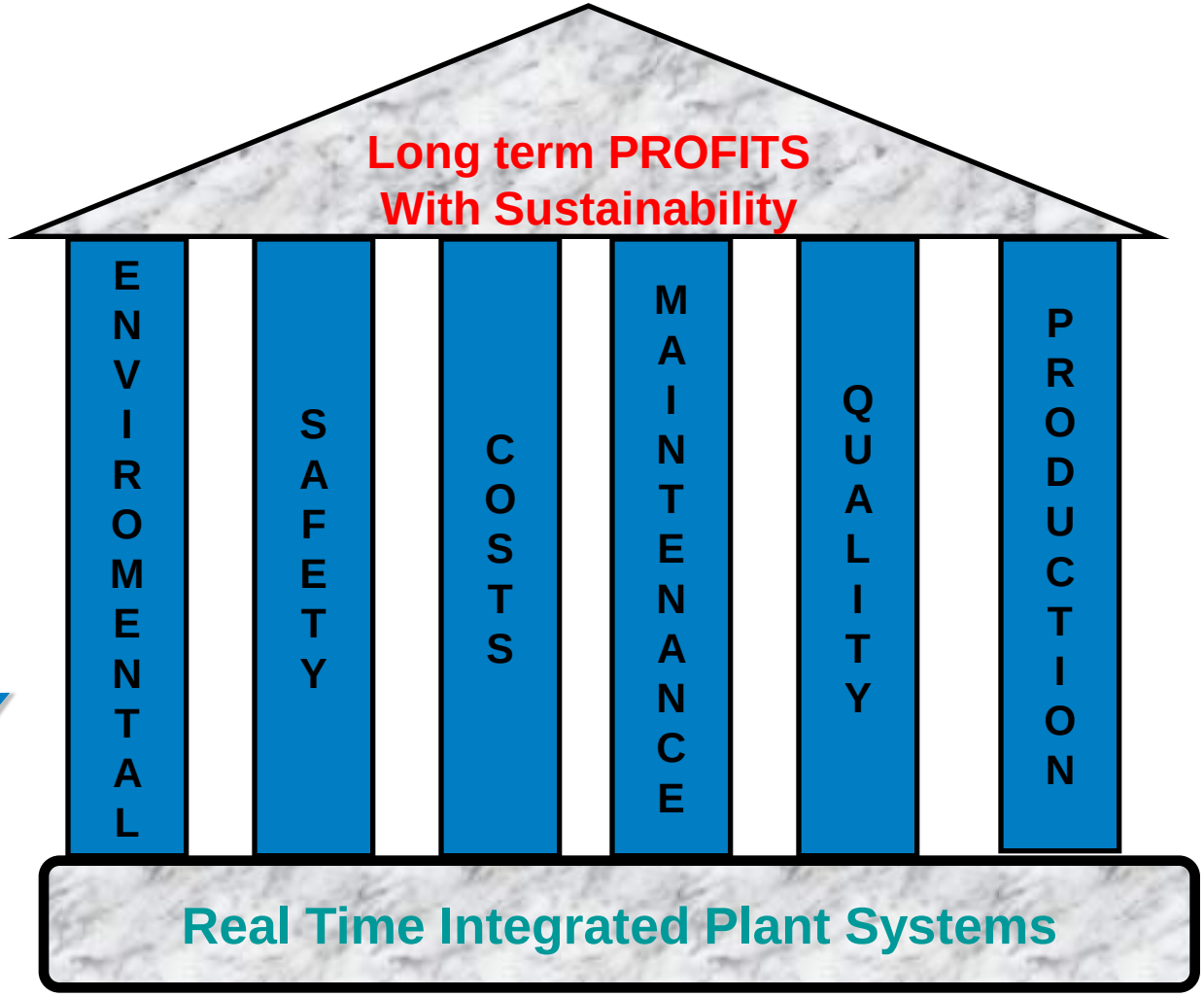
Overall Process Effectiveness

Results

Opportunities $

Porter
Shared VALUE
Strategy
SUSTAINABILITY

Systems



Mines, Concentrators, Smelters and More

Non-Ferrous Metals	Precious Metals	Aluminium	Iron/Steel	Energy Minerals	Industrial Minerals
Glencore	Glencore	Glencore	Glencore	Glencore	Glencore
Rio Tinto	Rio Tinto	Rio Tinto Alcan	Rio Tinto	Rio Tinto Coal	Rio Tinto
IncoVale		Vale	Vale		
Chinalco		Chinalco			
BHP B	BHP B	BHP B	BHP B	BHP B Coal	BHP B
Freeport McMoRan	Newmont	Rio Tinto Comalco	Xstrata Cr	Xstrata Coal	Cemex
Codelco	Barrick Gold	Alcoa	AHMSA	Foundation Coal	ItalCementi
Grupo Mexico	NewCrest	Aluminerie Alouette	AK Steel	Peabody Energy	Melon
Xstrata Cu	Oceana Gold	Alunorte	ArcelorMittal	Syncrude	Lafarge
Xstrata Ni	Kinross Gold	Dubai Aluminium	Cliffs Minerals	Suncor	Mozaic
Xstrata Zn	UMICORE	Logan Aluminium	CSn	AngloAmerican	Cargill
Teck Cominco	Agnico Eagle	Norandal	Ecometales	Bitumar	Potash Corp
KGHM	AngloPlats	Norsk Hydro	Essar Steel	Cameco	Aditya Birla
Aurubis	KCGM	Novelis	JFE	Cliffs Mineral	Asahi Glass
Anglo American		Parapanema	Kobe Steel	Sunoco	Corning
Antofagasta Minerals		Queensland Alumina	Nippon Metals		Imerys
Cerro Matoso		Sherwin Alumina	Nippon Steel		Nippon Sheet Glass
Koniambo		Titania	Severstal		Straits Bulk
MIM Holdings		Windalco	One Steel		Taiheliyo Cement
Minera Alumbrera			Quebec Metals		
Minera Pelambres			Tata Steel		
OK Tedi Mining			ThyssenKrup		
Penoles			Tokyo Steel		
PortoVesne			US Steel		
Quadra Mining			Usiminas		
Sandvick			Votorantin		
Southern Peru Copper			Wabush Mines		
Sumitomo					
Votorantin					
Yanggu Xiannguang					
Zhejiang Tianhong					

Partial list of M&M Customers

Large Water and Energy Costs

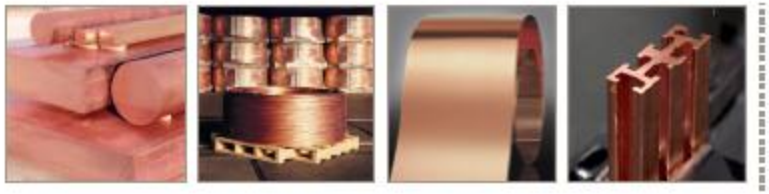
Ore

Energy

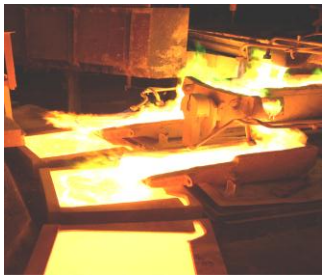
Water

Sag Milling

Concentrate

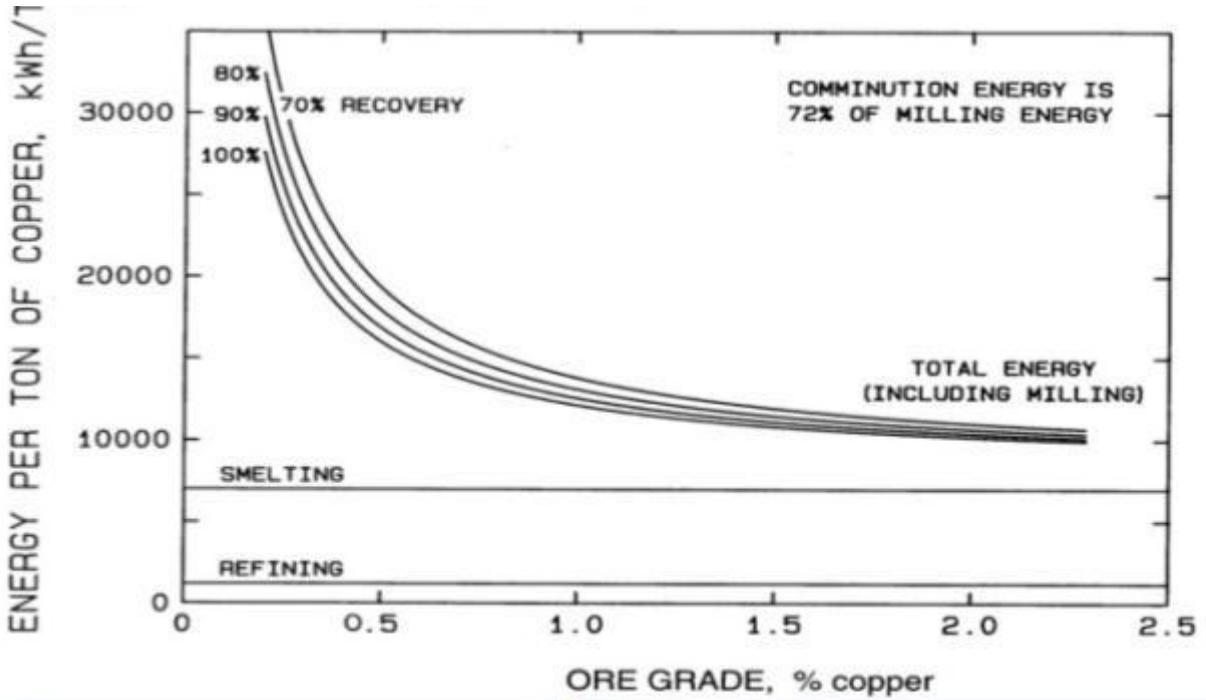


Products



Metal

Energy and Water Requirements



Open pit:

Mining 3-5kWh/t ore
Milling 15-24 kWh/t <100mesh grind, flotation

Underground:

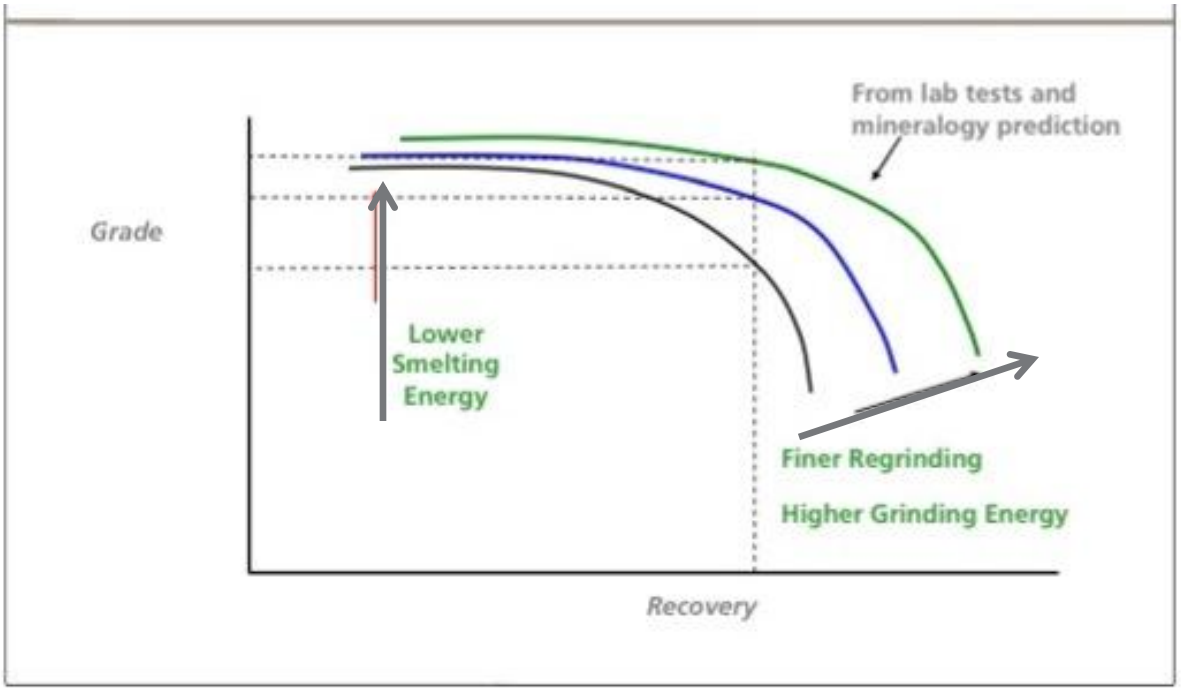
Mining 12-40 kWt/ore
Milling 24-34 kWh/t <200mesh grind, flotation

Energy & Minerals Initiative - Perth - 23 June 2009

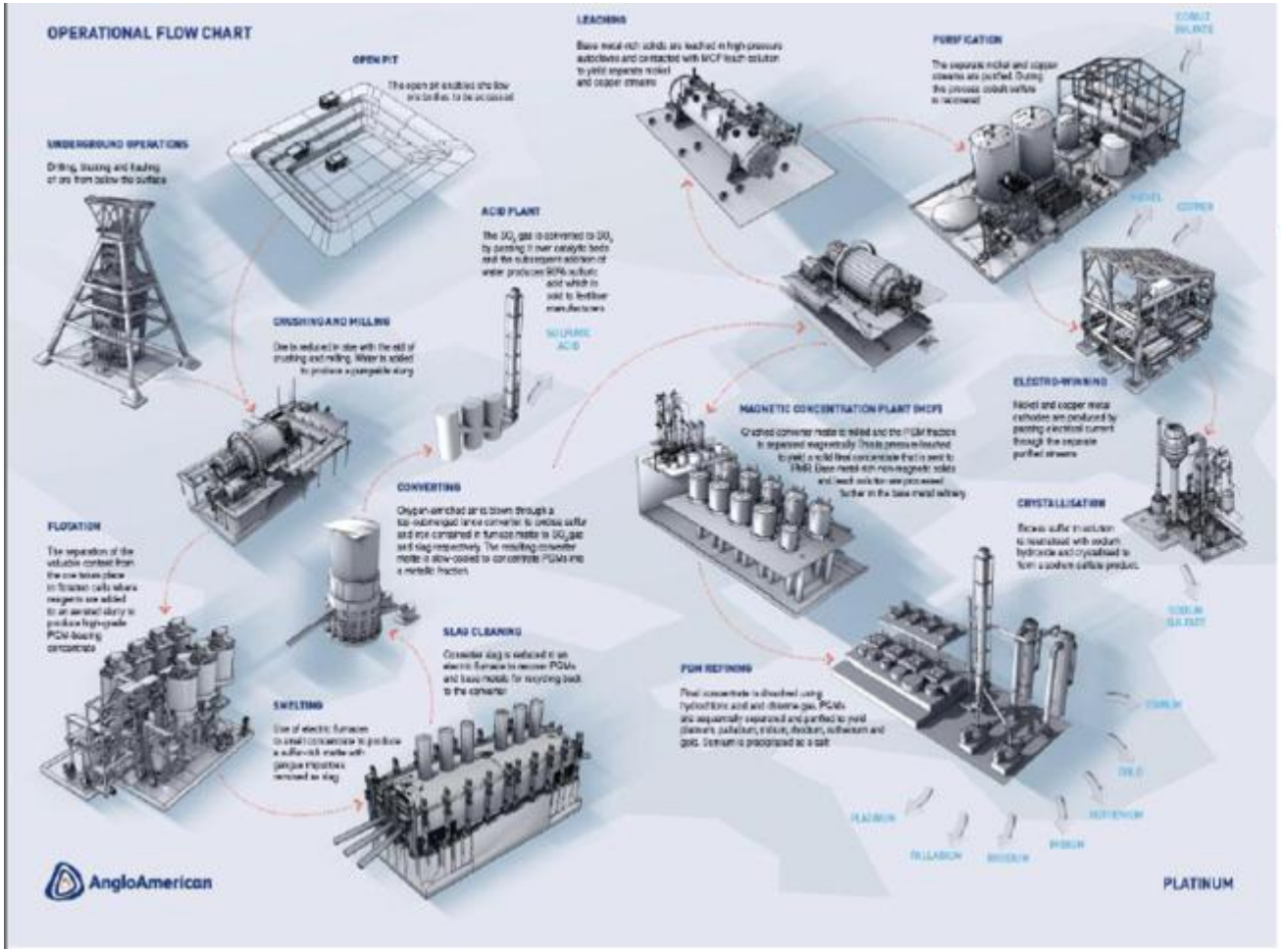
Source :Douglas W. Fuerstenau Douglas W. Fuerstenau, University of California, Berkeley

26

Energy Water Strategies



Variety of Assets

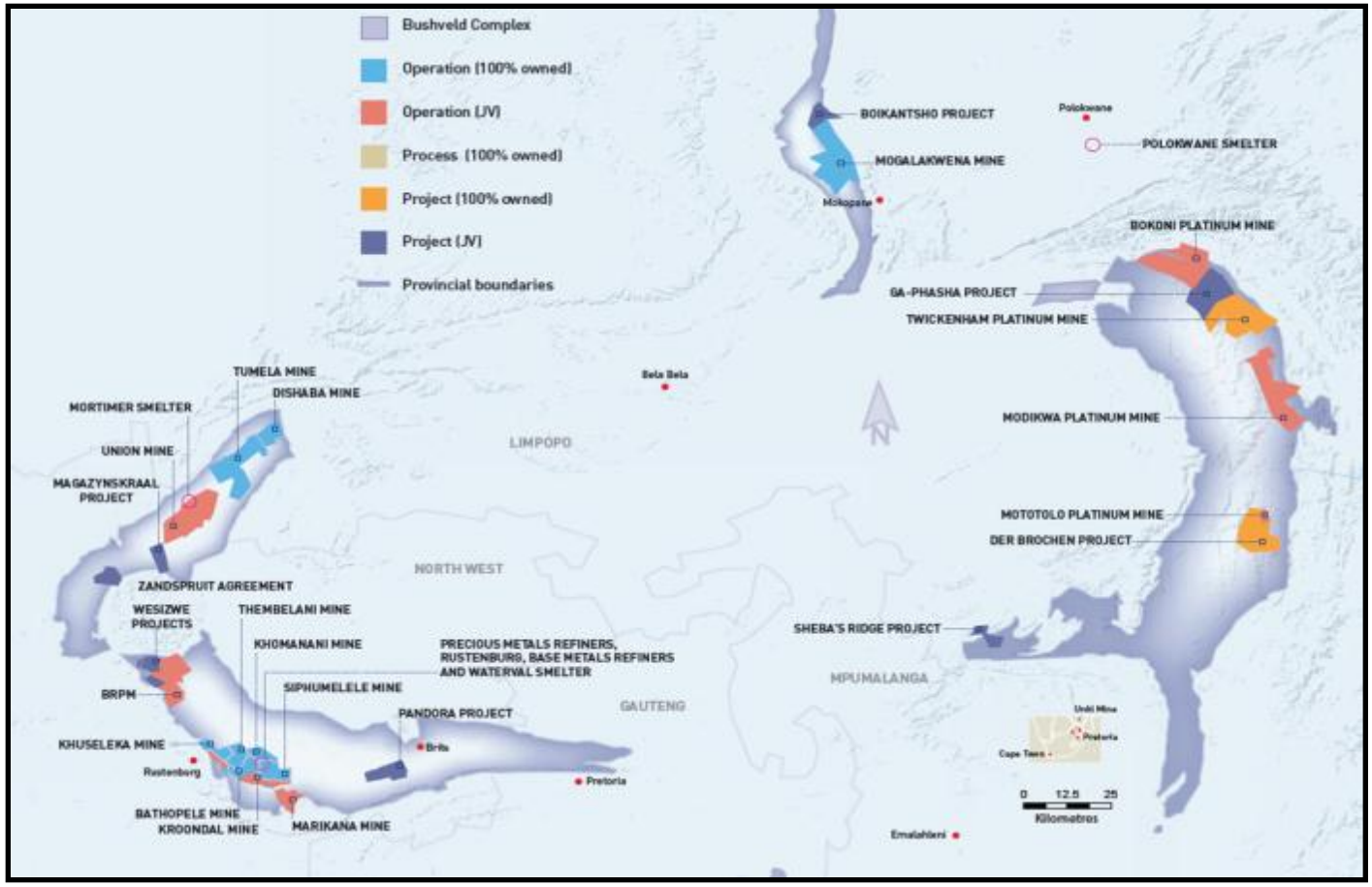


Platinum Process

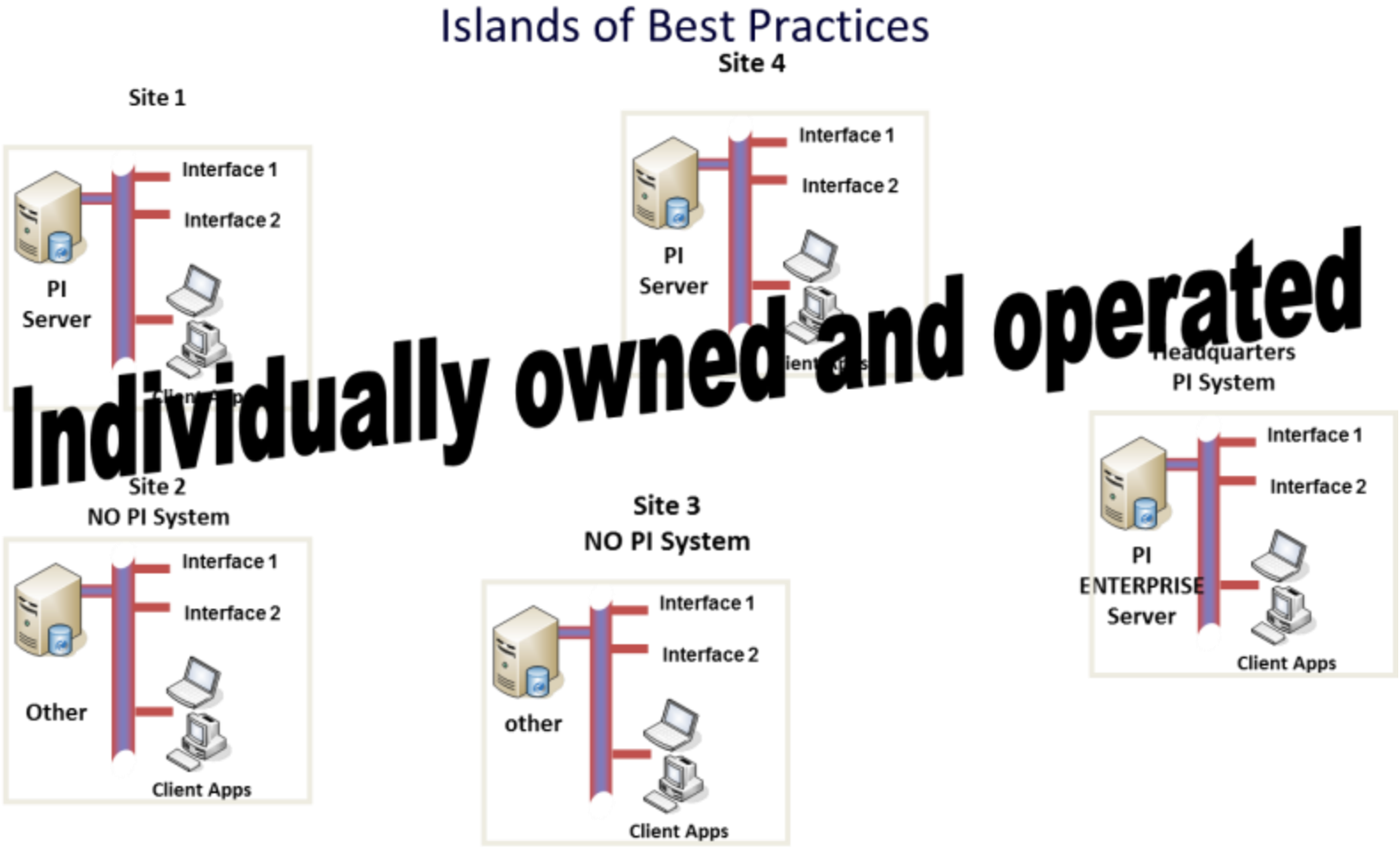
- Long value chain in comparison to most minerals
- Technically complex
- Comparatively low volumes but high value
- A significant material pipe line
- Energy and water intensive

Remote and Disperse Locations

Anglo American Platinum
Mines, Beneficiation, Smelting and Refining



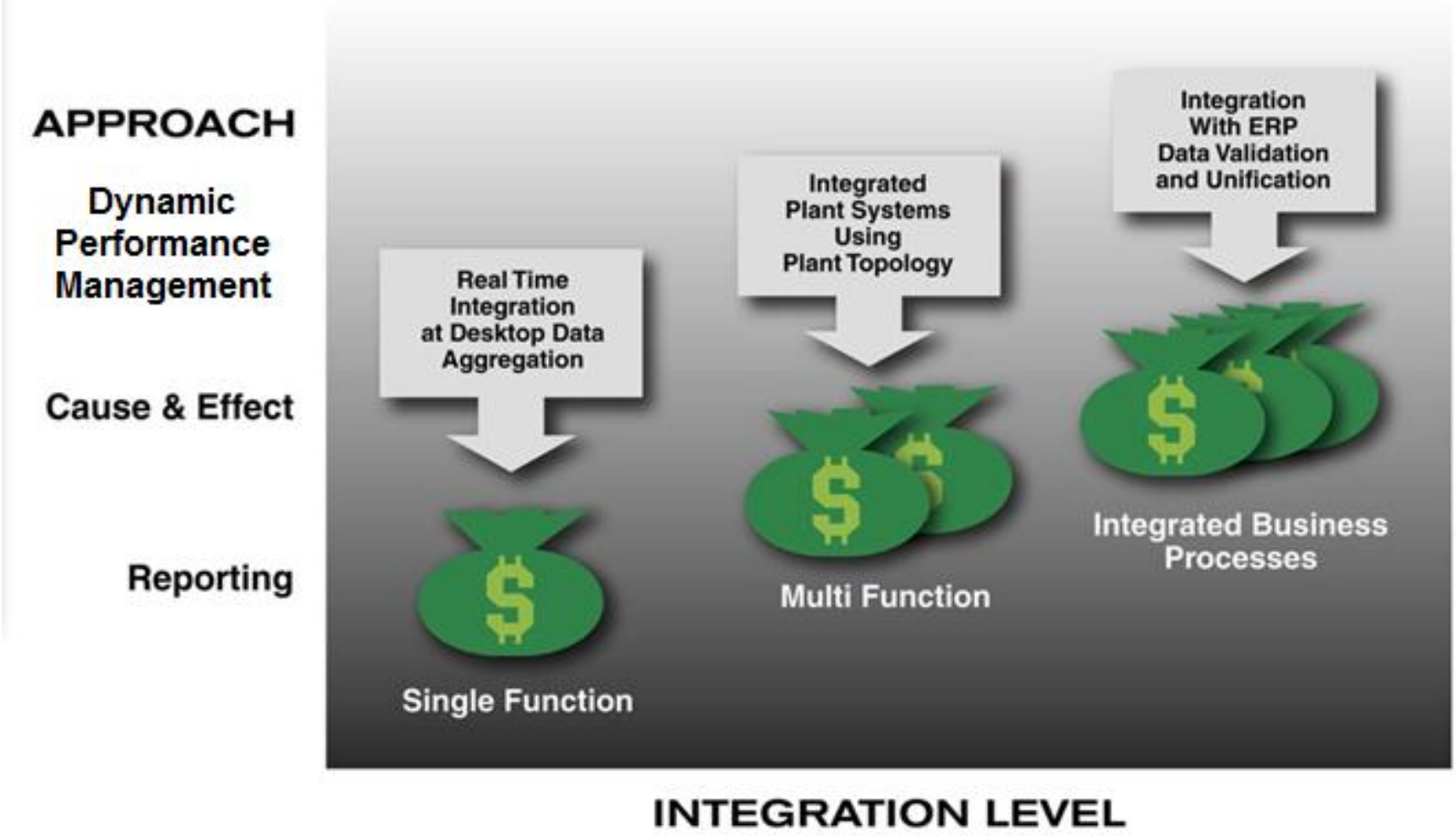
THE SYSTEM EFFECT



Business Strategy Value Proposition

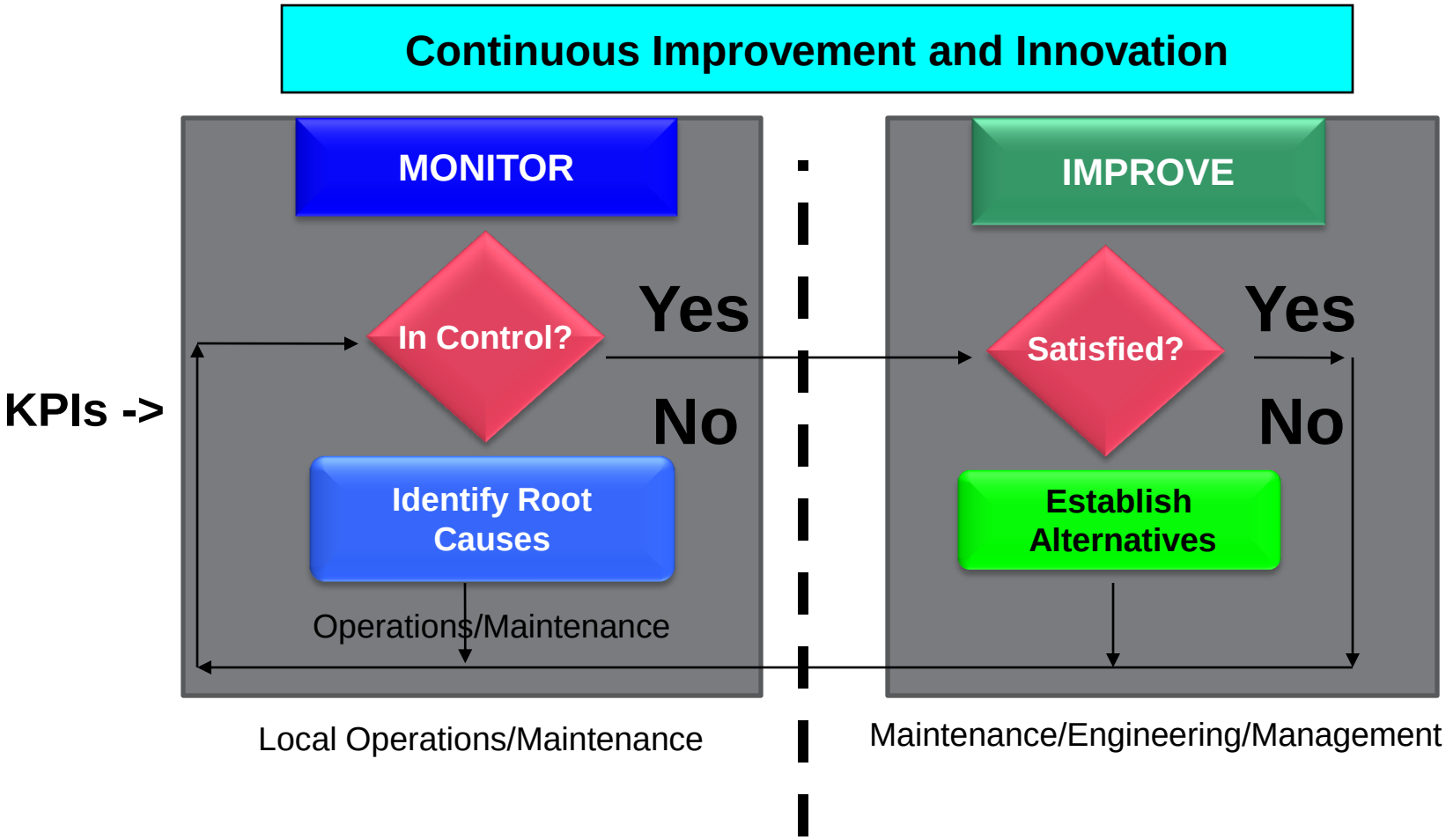
- Business Process
- People
- Competence Center Collaboration

Business Process and Operational Assets

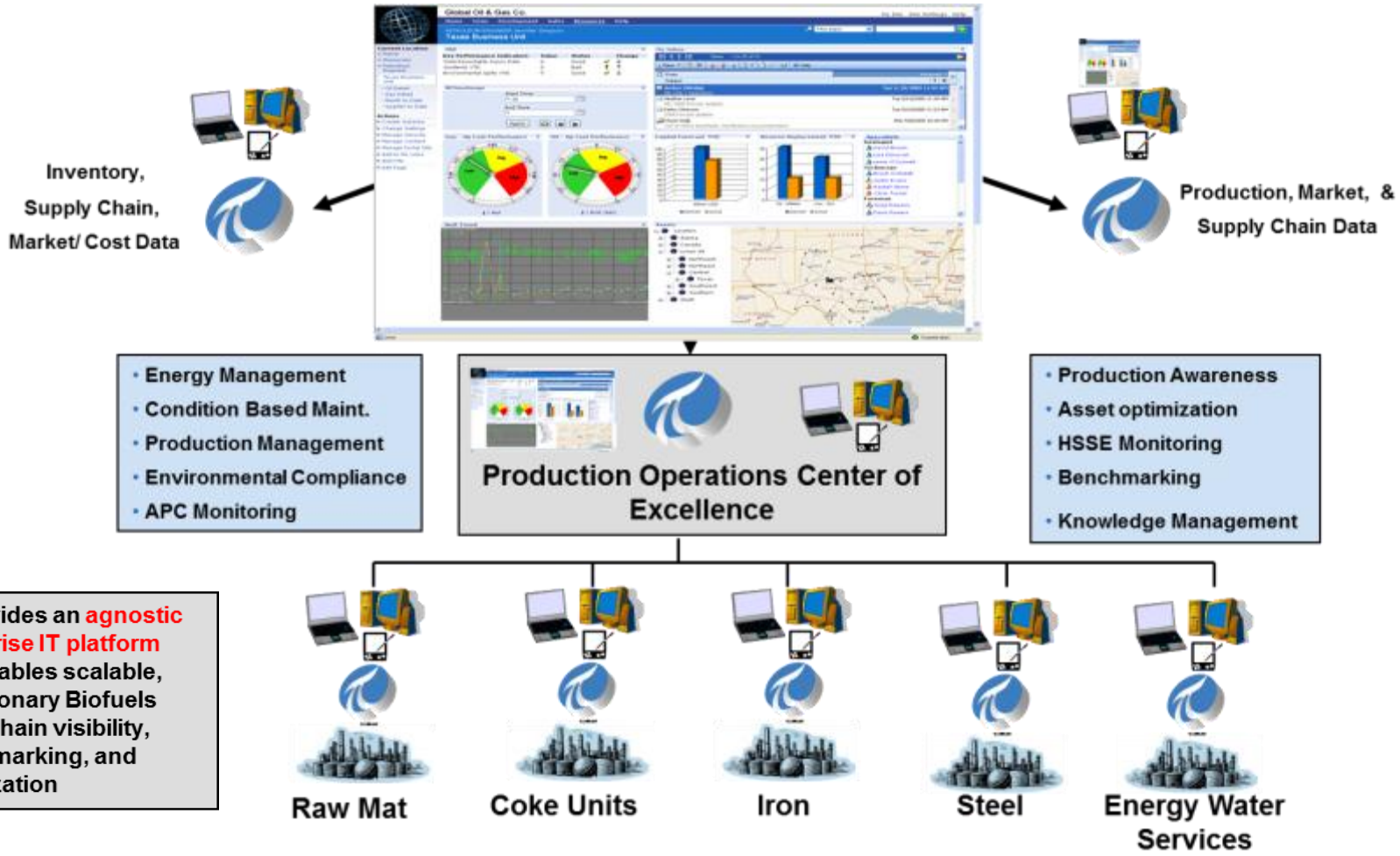


THE PEOPLE EFFECT
Local vs. Collaborative Decision Making

KPI Examples: Production, Quality, Costs, Equipment Availability, Environmental and Safety alerts with fast resolution and improved decision making.

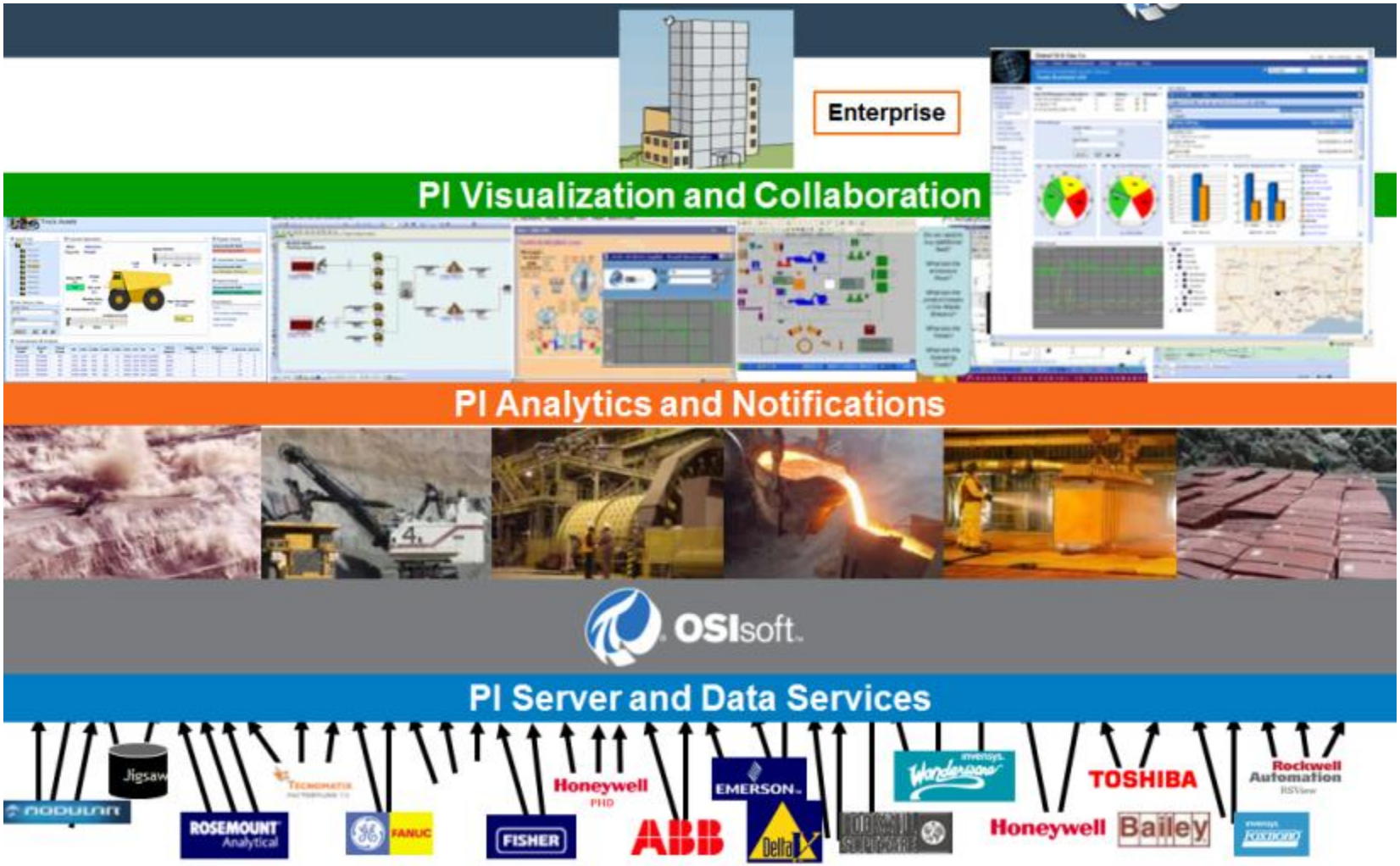


Real-time Enterprise Competence Center

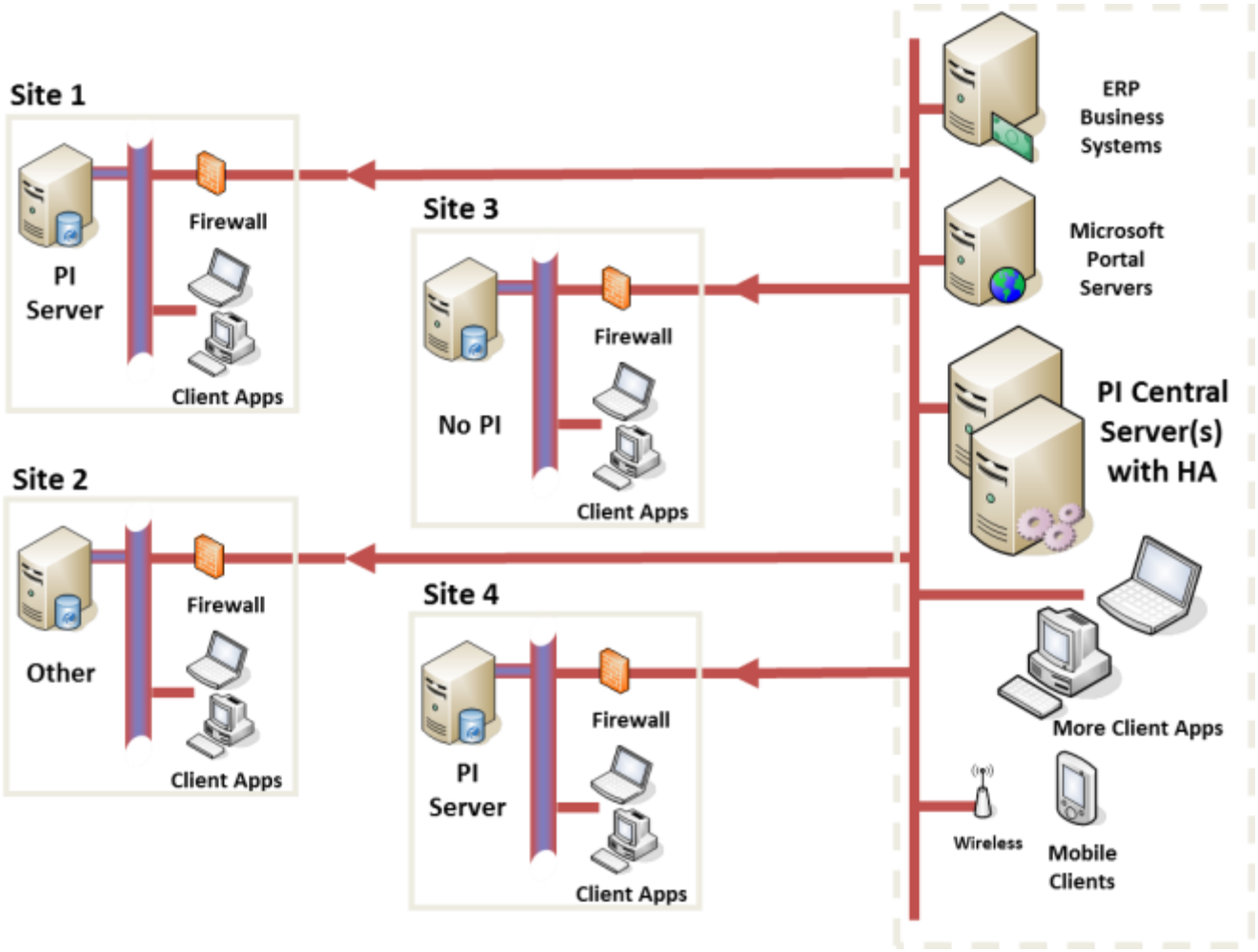


PI provides an agnostic enterprise IT platform that enables scalable, evolutionary Biofuels value chain visibility, benchmarking, and optimization

Strategy: Business Value Chain Integration

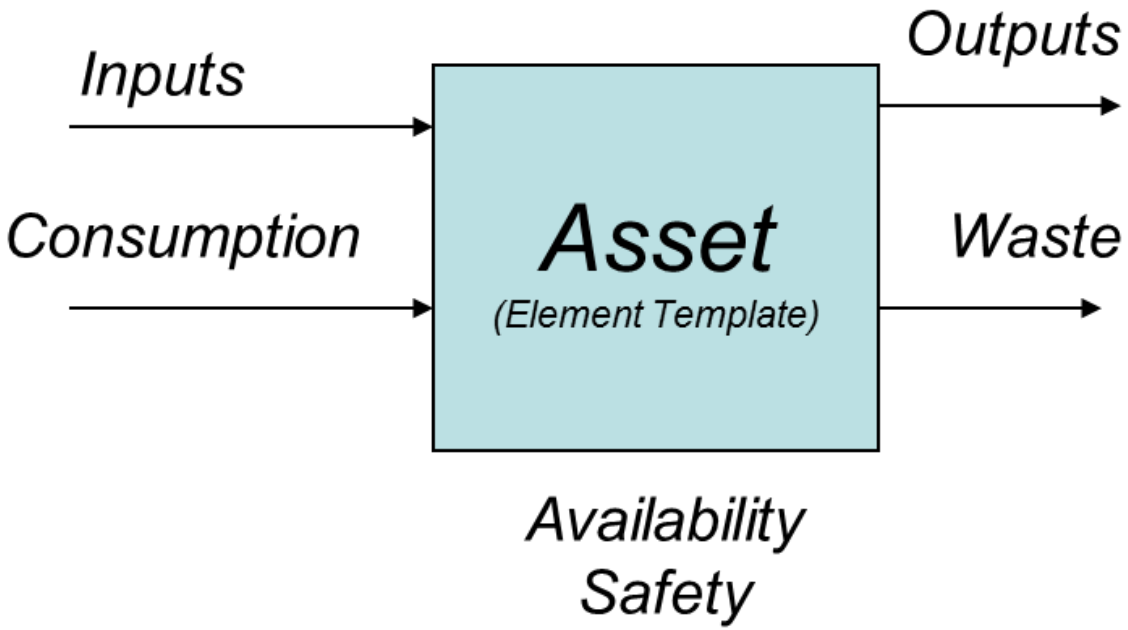


Strategy: Enterprise Driven Standards

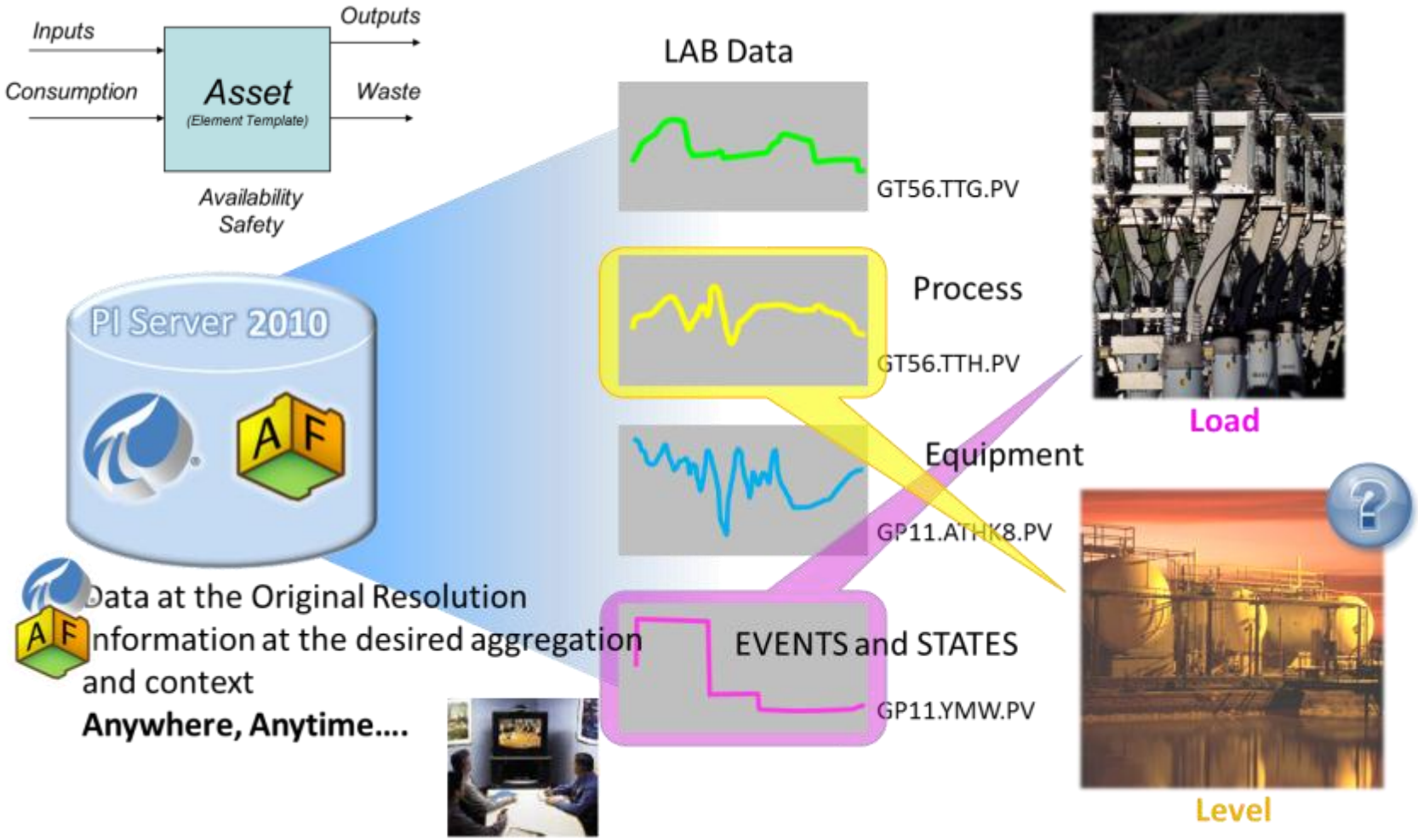


Enterprise Standard Asset Definition

- Strategic Block Diagram



Strategy: Standardization of Assets and with Dynamic Contextual Information



Weather and Country Energy Limitations

Most Arid Region in the World

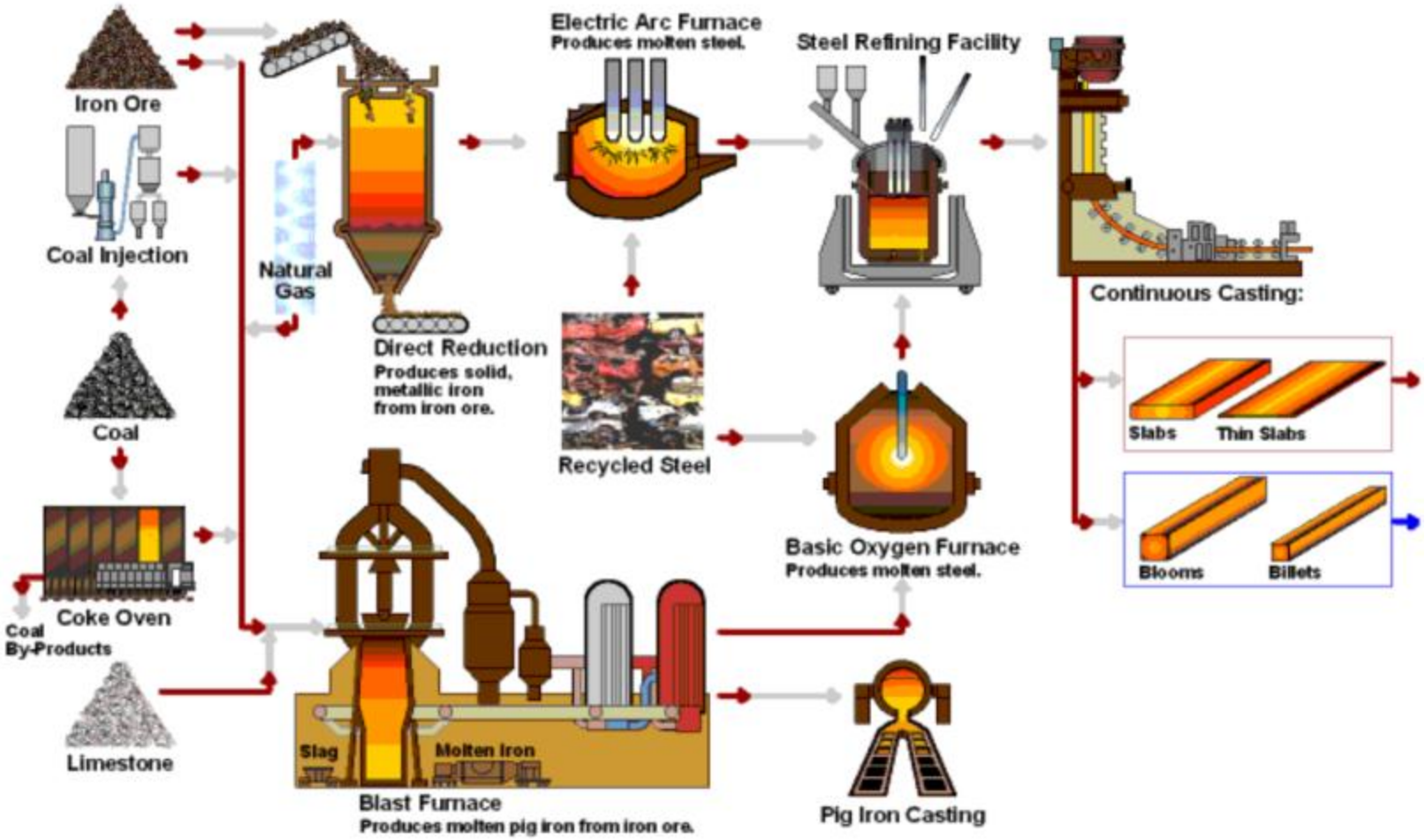
Large Energy Requirements

Endesa Latam Competence Center

Hydro
Gas
Fuel
Wind
Solar

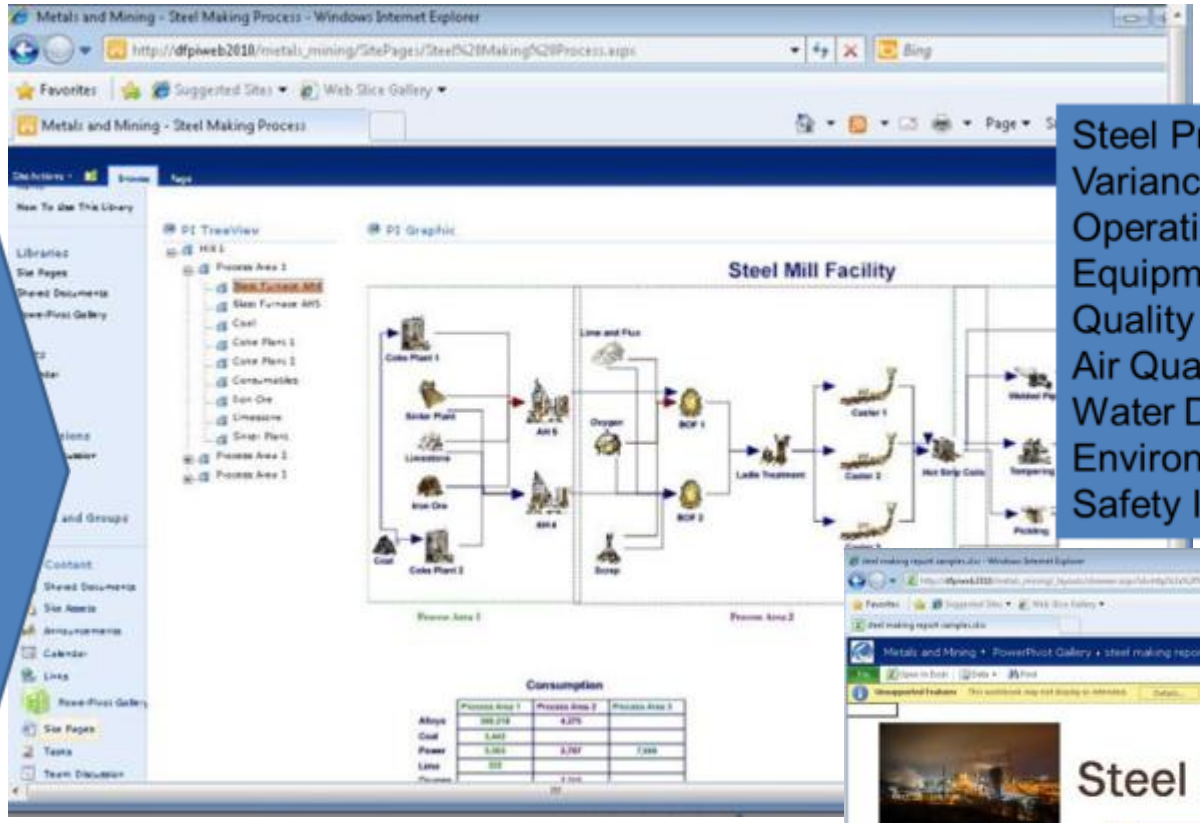
Endesa Latam Competence Center

Example 1: Iron and Steel



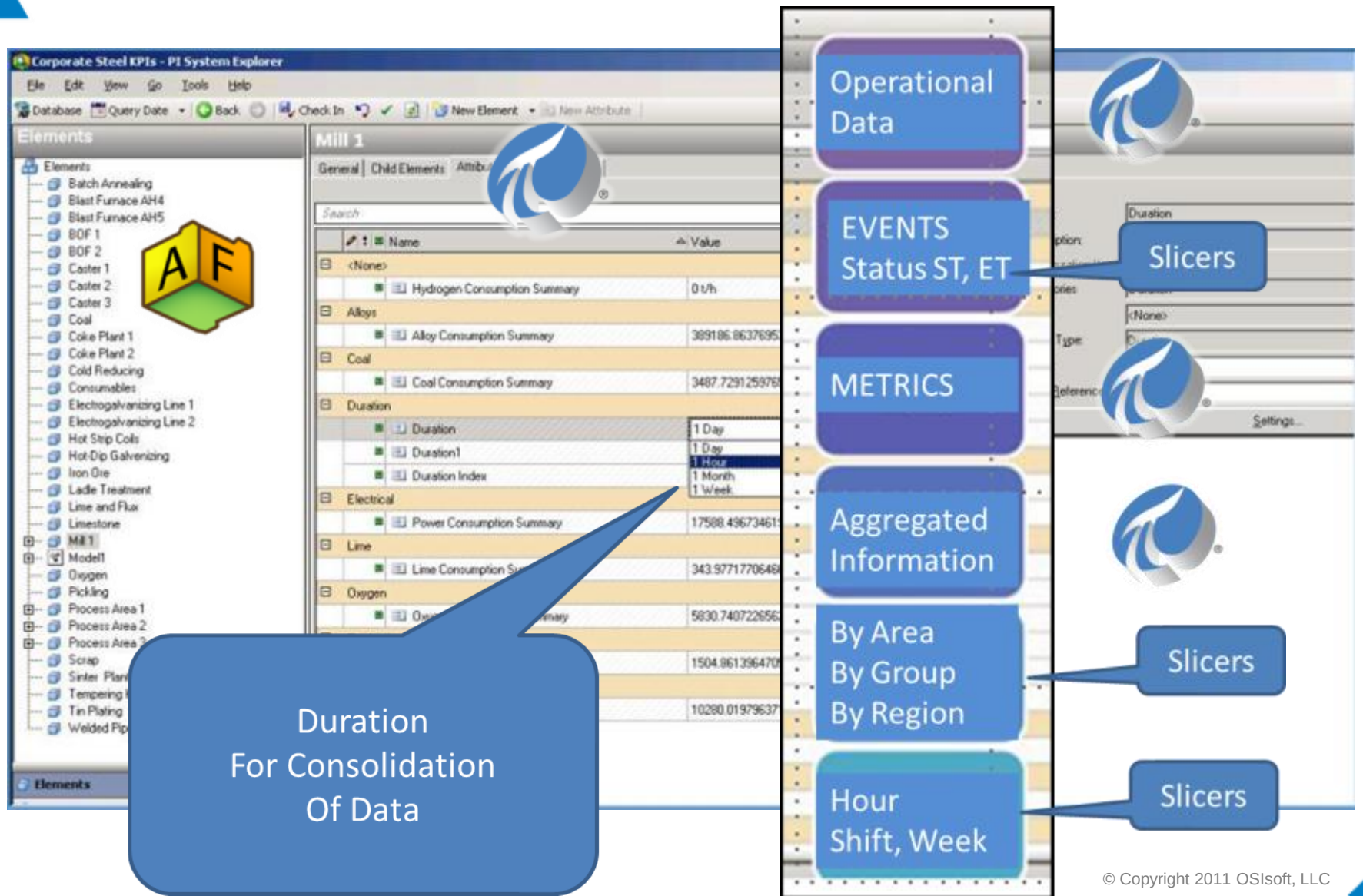
Example: Iron and Steel Metallurgical Complex

Iron
Limestone
Oxygen
Coal
Air
Fuel
Energy
Water
Alloys (Zinc, Moly, Chrome, etc)
Scraps

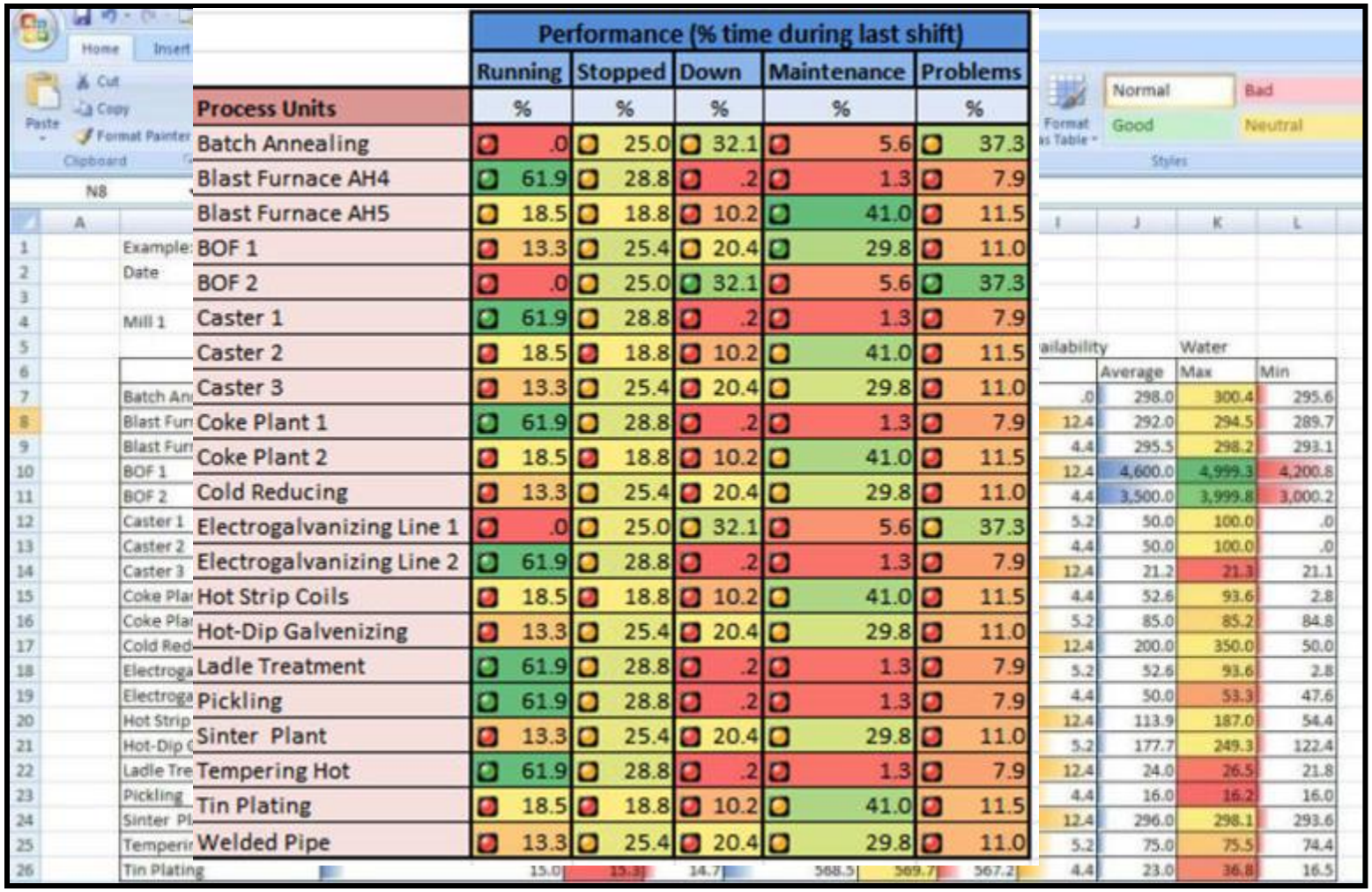


Steel Production
Variances
Operational Time Wasted
Equipment Availability
Quality
Air Quality Emissions
Water Discharge Emissions
Environmental
Safety Incidents

Integration of Data, Metrics and Events

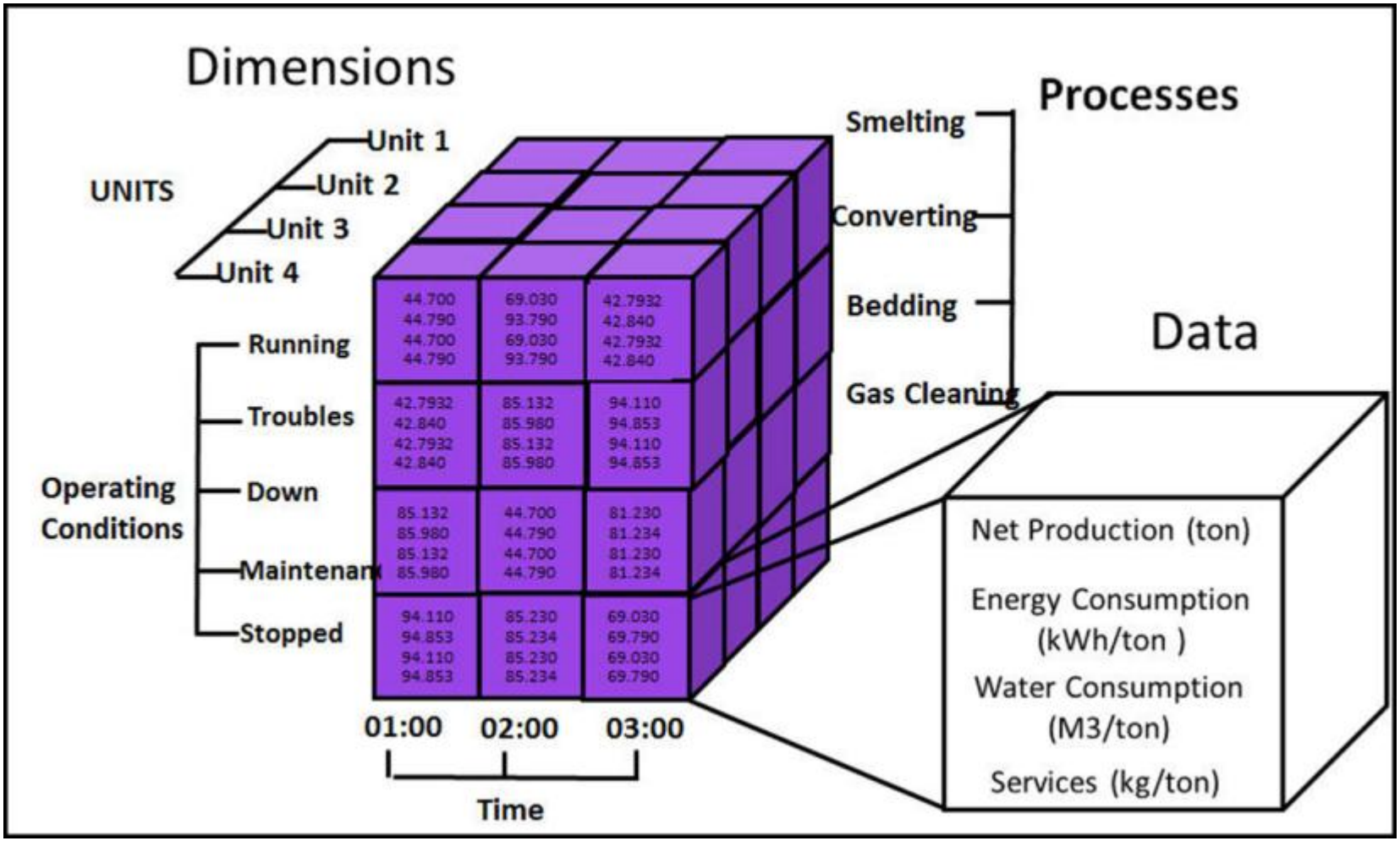


Report Based on Enterprise Driven Standards



Process Units	Performance (% time during last shift)				
	Running	Stopped	Down	Maintenance	Problems
	%	%	%	%	%
Batch Annealing	.0	25.0	32.1	5.6	37.3
Blast Furnace AH4	61.9	28.8	.2	1.3	7.9
Blast Furnace AH5	18.5	18.8	10.2	41.0	11.5
BOF 1	13.3	25.4	20.4	29.8	11.0
BOF 2	.0	25.0	32.1	5.6	37.3
Caster 1	61.9	28.8	.2	1.3	7.9
Caster 2	18.5	18.8	10.2	41.0	11.5
Caster 3	13.3	25.4	20.4	29.8	11.0
Coke Plant 1	61.9	28.8	.2	1.3	7.9
Coke Plant 2	18.5	18.8	10.2	41.0	11.5
Cold Reducing	13.3	25.4	20.4	29.8	11.0
Electrogalvanizing Line 1	.0	25.0	32.1	5.6	37.3
Electrogalvanizing Line 2	61.9	28.8	.2	1.3	7.9
Hot Strip Coils	18.5	18.8	10.2	41.0	11.5
Hot-Dip Galvenizing	13.3	25.4	20.4	29.8	11.0
Ladle Treatment	61.9	28.8	.2	1.3	7.9
Pickling	61.9	28.8	.2	1.3	7.9
Sinter Plant	13.3	25.4	20.4	29.8	11.0
Tempering Hot	61.9	28.8	.2	1.3	7.9
Tin Plating	18.5	18.8	10.2	41.0	11.5
Welded Pipe	13.3	25.4	20.4	29.8	11.0

Operational Multidimensional Analysis



Dynamic Visibility and Collaboration

PI Cubes and PI Slicers

SLICERS

Steel Making Process

Integrated Production
And Manufacturing Services
(Production, Power, Water,
Consumption per Ton

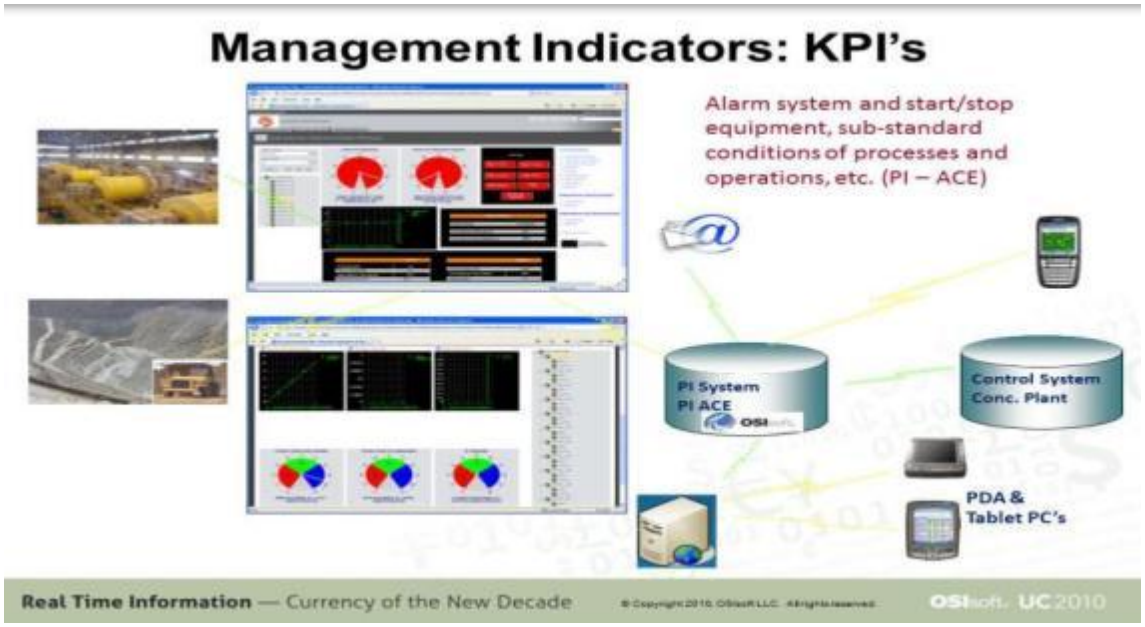
Operating State	Day	Hour	Shift
Down	18 19 20	0 1 2 3	Turno 1
Maintenance	21 22 23	4 5 6 7	Turno 2
N/A	24 17 25	8 9	Turno 3
Problems		... ...	

		Consumption					
Element	Time	Alloy (t/h)	Lime (kg/h)	Oxygen (kNm3/h)	Power(kWh)	Water (m3/h)	Production (t/h)
Blast Furnace AH4	10/18/2010 1:00:00 AM	1.00	1.92	0.00	54.28	4.22	2.64
Blast Furnace AH4	10/18/2010 5:00:00 AM	2.00	1.92	0.00	60.53	4.23	2.44
Blast Furnace AH4 Total			1.92	0.00	57.41	4.22	2.54
Blast Furnace AH5	10/18/2010 1:00:00 AM	1.00	2.34	0.00	25.49	4.28	3.43
Blast Furnace AH5	10/18/2010 5:00:00 AM	2.00	2.74	0.00	25.20	4.29	4.40
Blast Furnace AH5 Total			2.54	0.00	25.34	4.28	3.92
BOF 1	10/18/2010 1:00:00 AM	1.00	0.00	10.26	4.10	68.54	0.76
BOF 1	10/18/2010 5:00:00 AM	2.00	0.00	37.57	4.13	68.56	1.14
BOF 1 Total			0.00	23.92	4.11	68.55	0.95
BOF 2	10/18/2010 1:00:00 AM	2.00	0.00	69.12	4.27	54.32	3.43
BOF 2	10/18/2010 5:00:00 AM	1.00	0.00	18.71	4.28	54.32	4.40

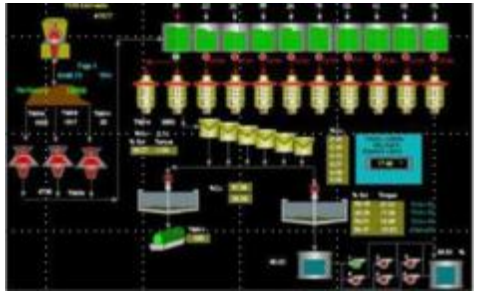
Tabla de Datos | Consumos por unidad | Rolling diario | Porcentaje de estados

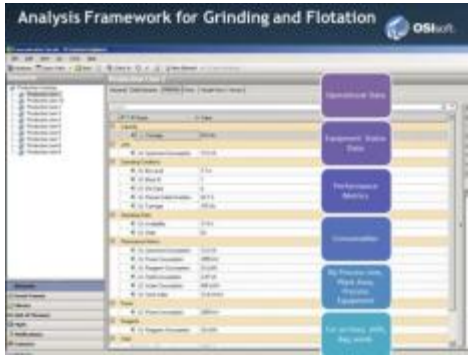
Southern Peru Copper: Cuajone

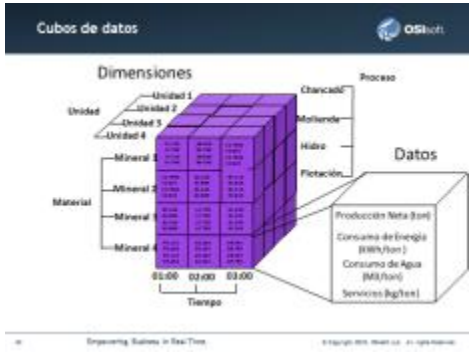
- Cuajone
- Production 87,000 MT fine Copper per day.
- Conventional open-pit mine
- Concentrator - 10 Grinding Lines.

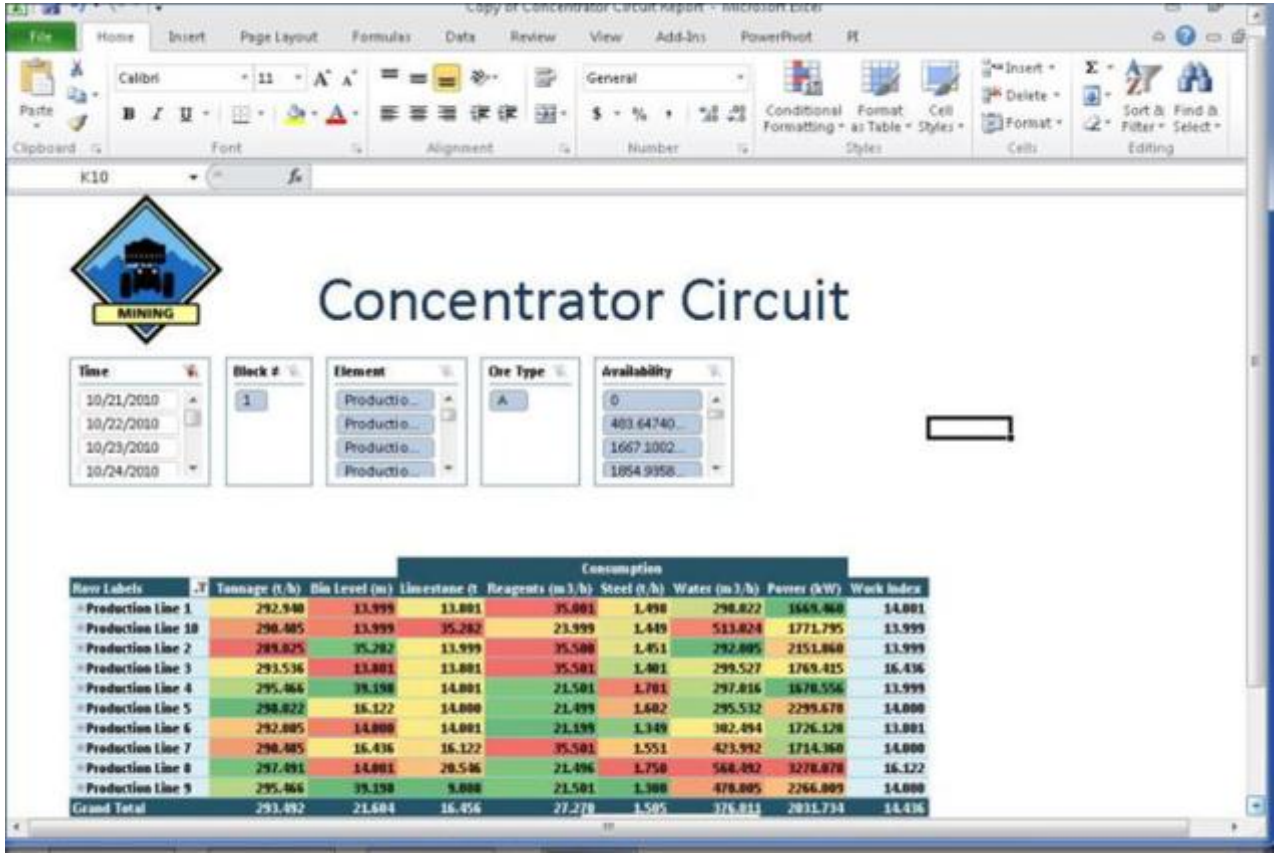


Southern Peru Copper: Cuajone









Tangible benefits: Advanced Mine to Mill Integration

UC 2010

Production Benefits:

- Increase of ore milling: 4.6%
- Decrease of mil power: 3.9%
- Decrease of fresh water consumption: 6.8%

Economic Benefits:

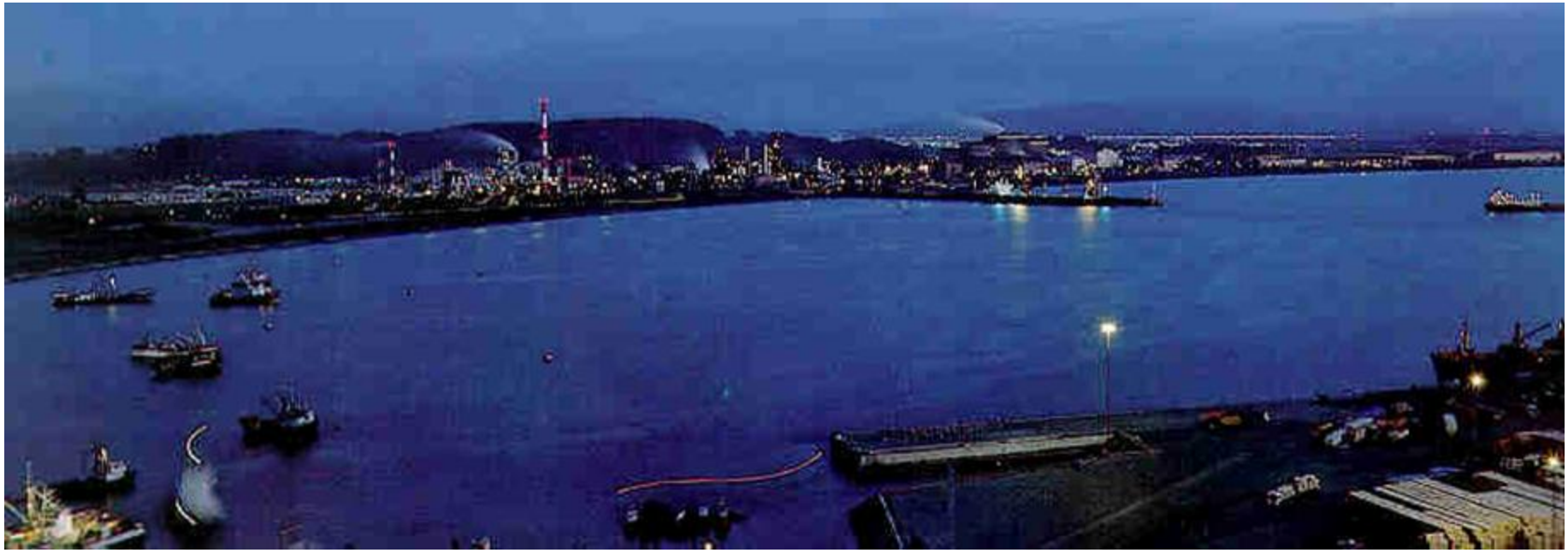
- Net profit: US$ 31.8 million (period: 2009/04/04 to 2009/12/31
- PI System contribution: US$ 7.95 million (same period)

Integration of Mine Feed Knowledge with Milling, Flotation and Dewatering.

CAP Acero Huachipato Steel Mill

PI System Seminar Chile Y2009

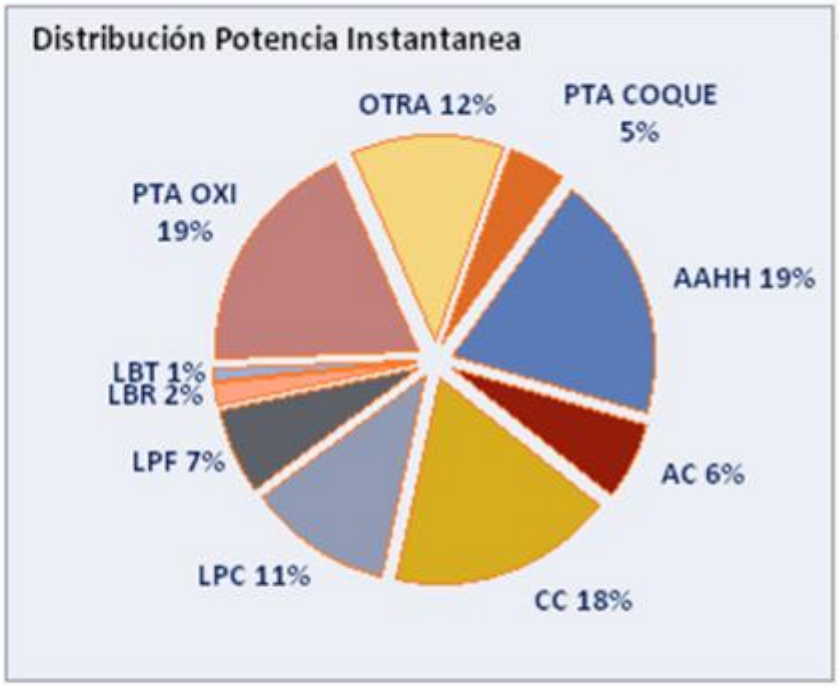
- Fully Integrated Steel Company
- Reduction of Pellets in Blast Furnaces to produce Iron
- Steel produced in BOF then casted into Slabs
- 1.2 Tones of Steel per Year.



Tangible benefits: Instant Power CAP ACERO

Actualizar

POTENCIA INSTANTANEA			
UNIDAD		MW	%
CAP-Acero	CAP	61,18	100
Planta de Coque	PTA COQUE	2,79	5%
Altos Hornos	AAHH	11,88	19%
Acería	AC	3,62	6%
Colada Continua	CC	11,05	18%
Laminador LPC	LPC	6,96	11%
Laminador LPF	LPF	4,23	7%
Laminador LBR	LBR	0,96	2%
Laminador LBT	LBT	0,61	1%
Planta Oxígeno	PTA OXI	11,54	19%
Otras	OTRA	7,53	12%

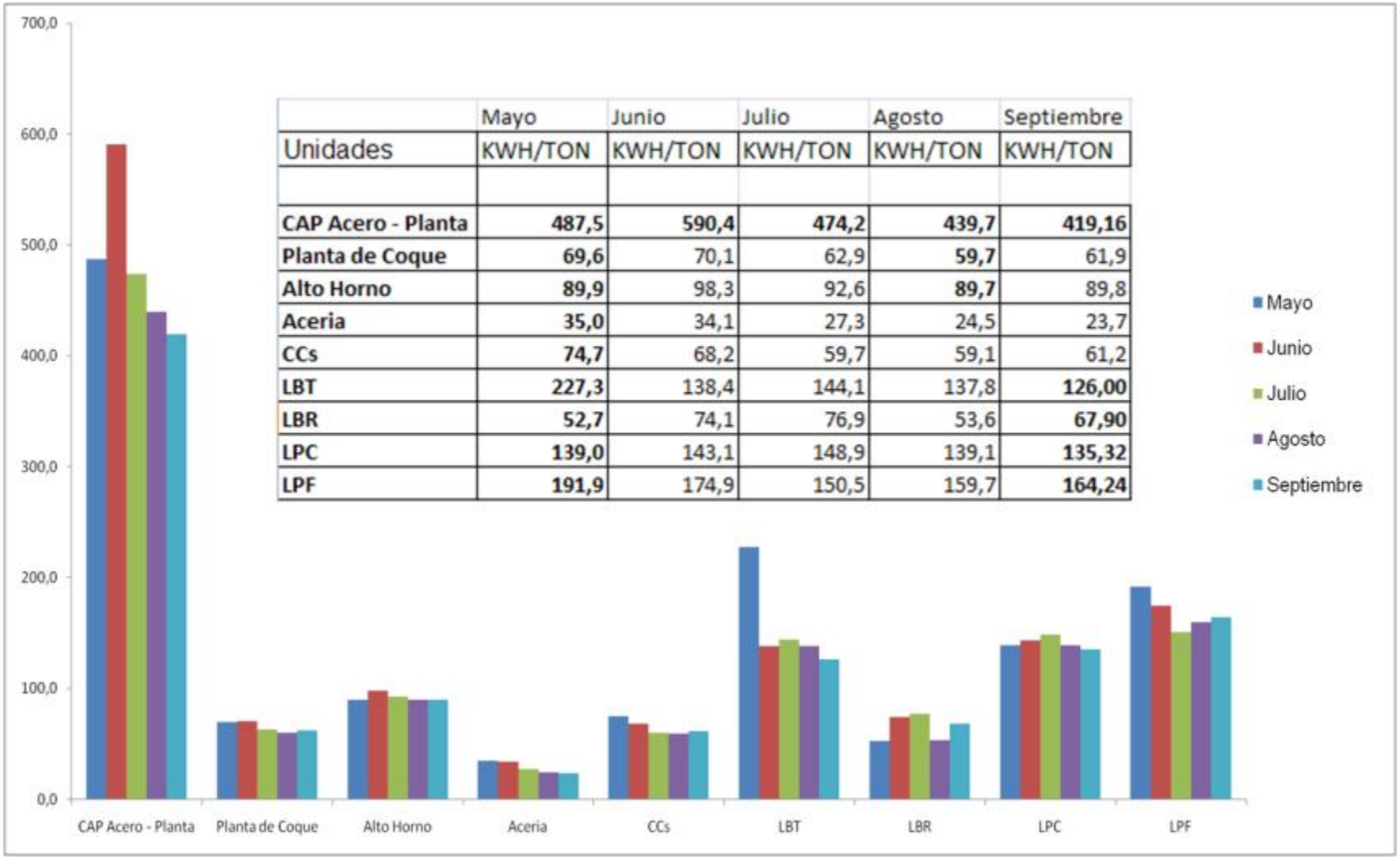


Periodo Potencia Instantanea

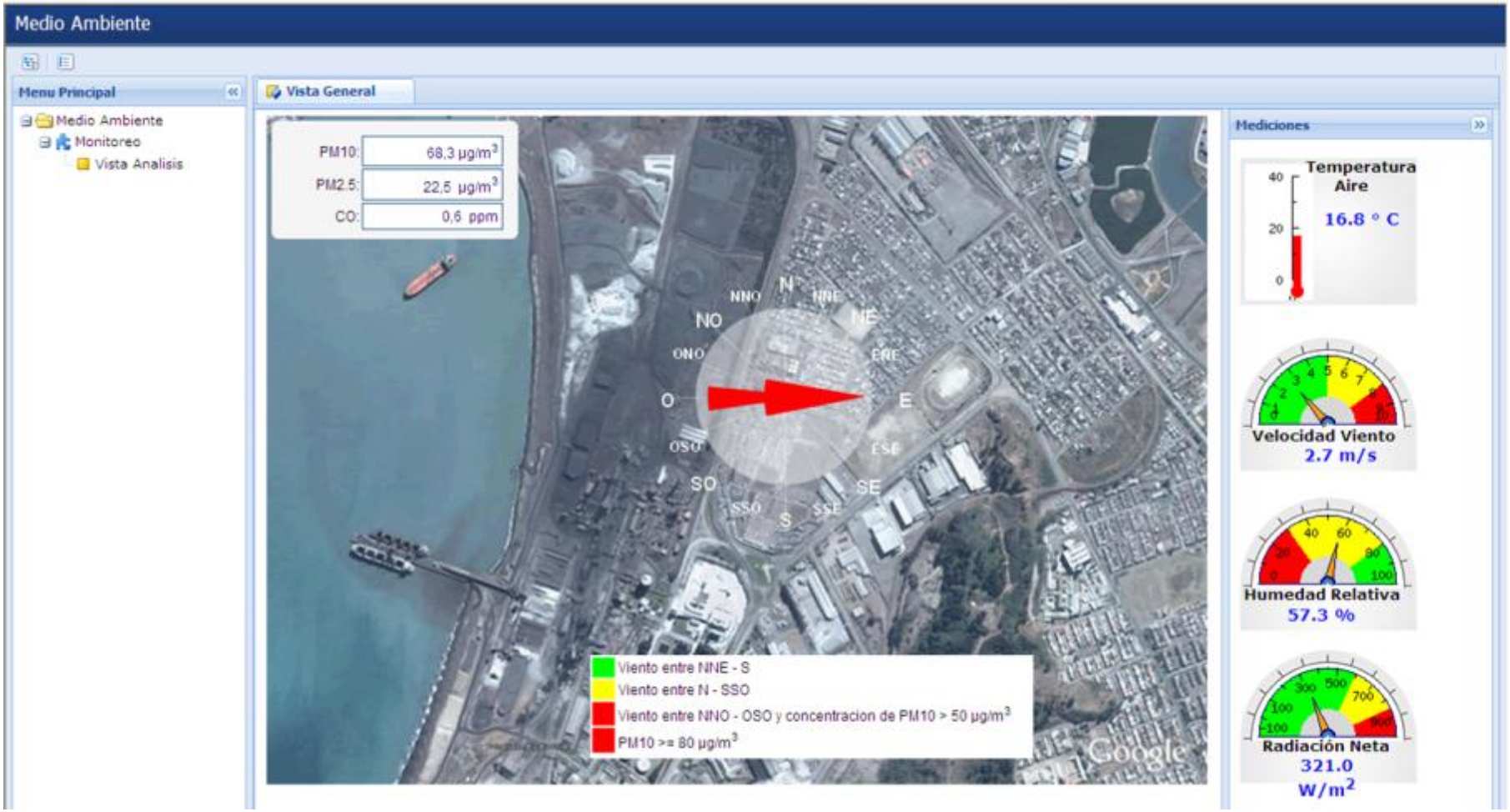
Start Time *-2h End Time * Apply

Tangible benefits: Specific Power Management

	Mayo	Junio	Julio	Agosto	Septiembre
Unidades	KWH/TON	KWH/TON	KWH/TON	KWH/TON	KWH/TON
CAP Acero - Planta	**487,5**	**590,4**	**474,2**	**439,7**	**419,16**
Planta de Coque	**69,6**	70,1	62,9	**59,7**	61,9
Alto Horno	**89,9**	98,3	92,6	**89,7**	89,8
Aceria	**35,0**	34,1	27,3	24,5	23,7
CCs	**74,7**	68,2	59,7	59,1	61,2
LBT	**227,3**	138,4	144,1	137,8	**126,00**
LBR	**52,7**	74,1	76,9	53,6	**67,90**
LPC	**139,0**	143,1	148,9	139,1	**135,32**
LPF	**191,9**	174,9	150,5	159,7	**164,24**



Tangible benefits: Web Based Air Quality Management for Authorities



Results

- **3 Clear References**
- **Full Integration for Reduction of Energy, Water and Environmental Reporting**
  - **Gained data visibility across all operations**
  - **Gather data from multiple systems & sites,**
  - **Leverage opportunities to reduce**
  - **Identify and promote best practices**

Results

- ✓ **Dynamic Performance Management Infrastructure with Collaborative Services**
- ✓ **PI Asset Framework standardization and cross-pollination at the local plant and at the Enterprise**
- ✓ **PI Asset Notification using Performance Metrics and Statistical Tools**
- ✓ **Visibility Using Internet Web Services with standard BI tools.**
- ✓ **PI System provides the required granularity and consolidation**

What is Coming Next?

Thank you

Osvaldo Bascur
Cel +1 936 443 6527
Email: osvaldo@osisoft.com

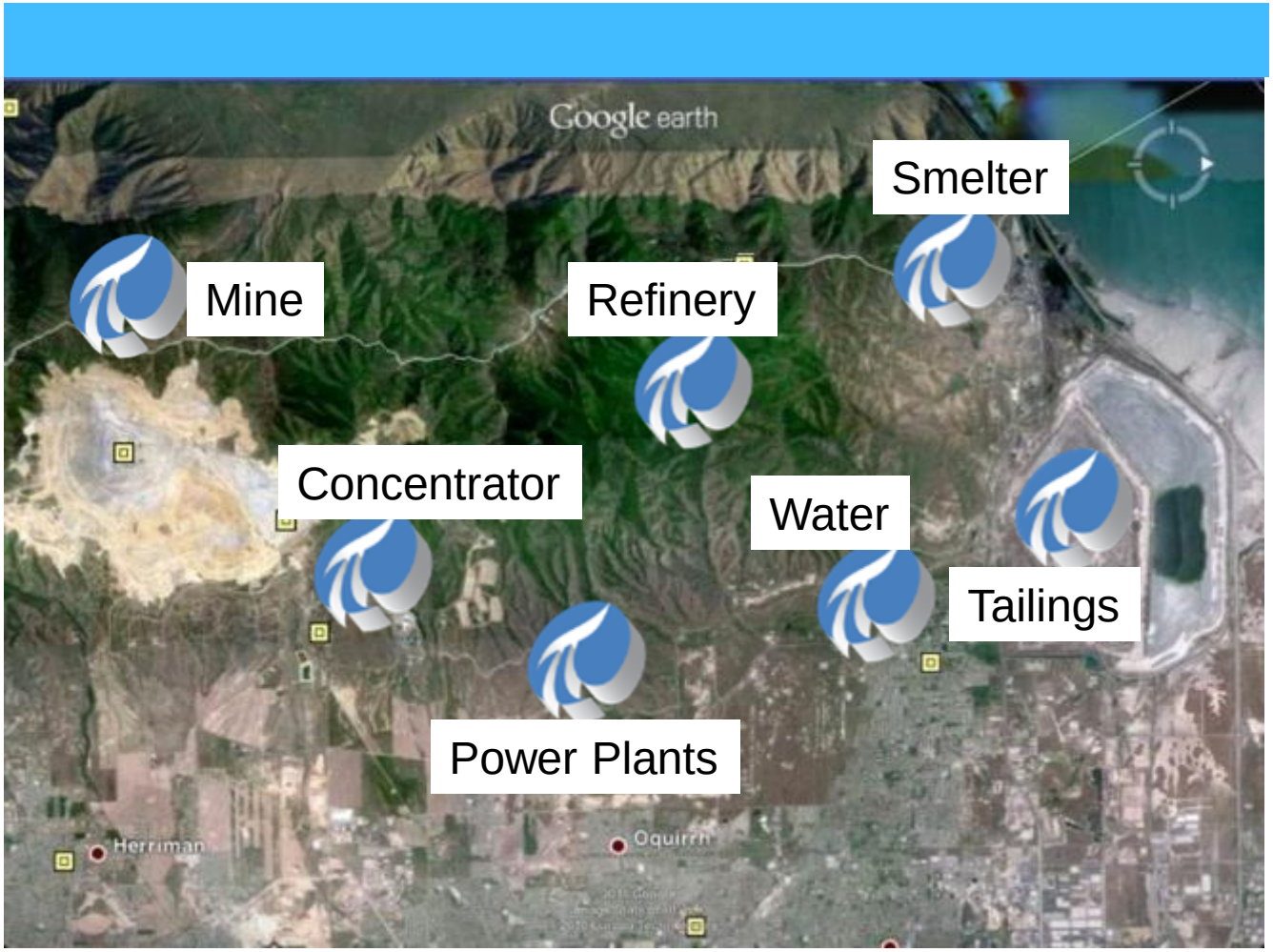
References

- Anglo American Platinum, Michael Halhead, Data Validation with PI AF, UC 2011
- Anglo American Platinum, Michael Halhead, Energy Monitoring, OSIsoft Region Seminar South Africa, Y2011
- Anglo American Platinum, Warren Armstrong, Downtime Reporting, OSIsoft Regional EMEA Seminar, Y2011
- Southern Peru Copper, Nelver Benavides, Development and Implementation of the PI System at the Southern Peru Copper Cuajone Concentrator and Mine. UC2010
- Endesa Latam, Jose Lobo, PI System Seminar Santiago, Chile, Y2007
- Endesa Latam, Rodrigo Paredes, PI System Seminar Santiago, Chile, Y2009.
- Enel, Pestonesi, D., Scapeccia, Costarelli, and Franceschini, L, Remote Supervision Center for Enel Combined Cycle Plants, In Book, Modeling, Control, Simulation and Diagnosis of Complex Industrial and Energy Systems, Ferrarini L and Veber C. Editors. ISA, Y
- Cap Acero, Mario Flores y Rene Aroqui, Implementacion de PI en CAP Acero, Compania Siderurgica Huachipato, PI System Seminar Santiago, Chile, Y2009.
- Rio Tinto, Jake Mather, PI-Sigmafine Development at Kennecott Utah Copper (KUC), UC2007
- Rio Tinto, Roger Roth, Kennecott Utah Copper Company PI Server, UC2007
- DTE Energy, John Kapron and Sumanth Makunur, Fleet Optimization through PI, UC 2007
- Iberdrola, Maria Martin, Miguel Chavero, Ignacio Perezm,UC 2005, UC2011

Rio Tinto Kennecott Utah Copper

- KUC Process Overview
  - Mine
    - Ore body of ~0.6% copper
  - Mill/Concentrator
    - Grind and float ore to get ~25% copper concentrate
  - Smelter
    - Smelt and convert concentrate to get ~99.5% copper anodes
  - Refinery
    - Refine anodes to get ~99.99% copper cathodes

Integration: Rio Tinto Kennecott Utah Copper



Integration: Rio Tinto Kennecott Utah Copper

Energy and Water Tracking

Mining

Mineral Processin

Metallurgical

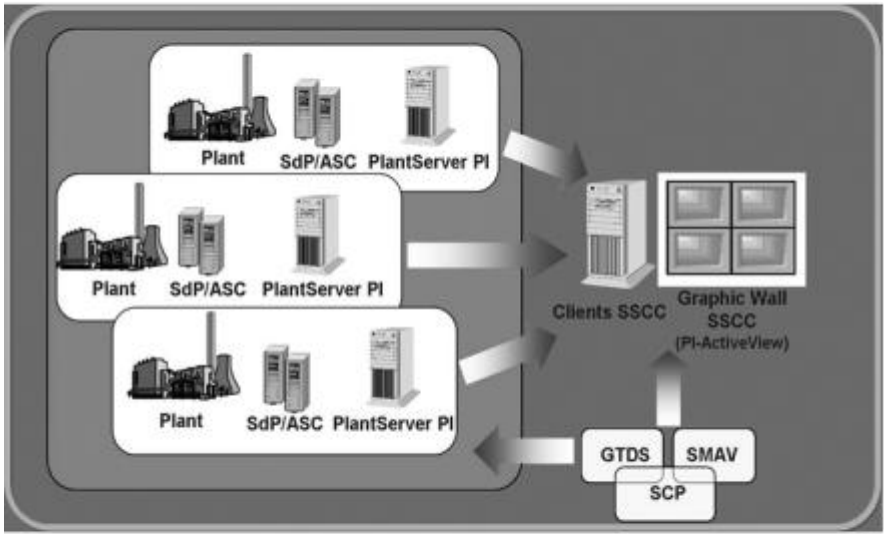
Products

Energy **Assets** **Reagents** **Environmental**

INTEGRATE- FIND – ANALYZE- DELIVER-VISUALIZE

Enel Competence Center

ENEL: Center of Excellence in La Casella , Italy



PI Tree View for Asset Optimization of all operations

Enterprise Driven Standards