

Smarter Physical Infrastructure

*Sanil Nambiar,
Global Technology services, IBM India
sanil.nambiar@in.ibm.com*



Business without **LIMITS 2012**

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Who Depends on Physical Infrastructure?

Business



People



Society



An Unusual scenario played out last month in India

- 3 out of 5 Indian Regional Grids collapsed
 - Northern Regional grid (NR)
 - Eastern Regional grid (ER)
 - North Eastern Regional grid (NER)
- Impact
 - 600 million people in 22 states without power[1]
 - 200 coal miners got trapped[1]
 - 300 trains came to a grinding halt[1]
 - Presumptive losses in Crores



[1] <http://www.indianexpress.com/news/power-grid-fails-again;-blackout-blankets-half-of-india/981887/0>

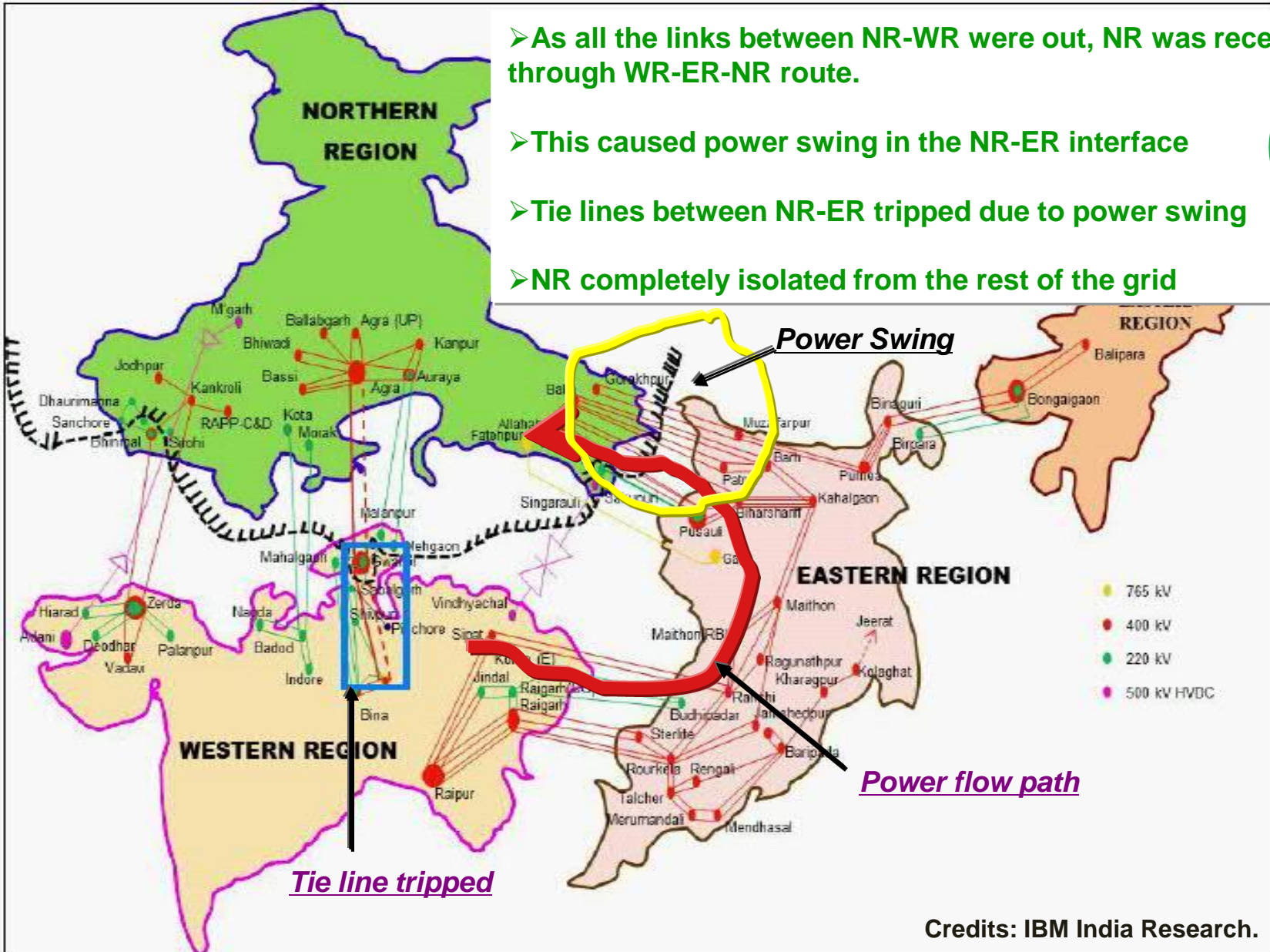
Credits: IBM India Research.

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Physical Infra Events on the Grid on July 30th 2012

- As all the links between NR-WR were out, NR was receiving power through WR-ER-NR route.
- This caused power swing in the NR-ER interface
- Tie lines between NR-ER tripped due to power swing
- NR completely isolated from the rest of the grid



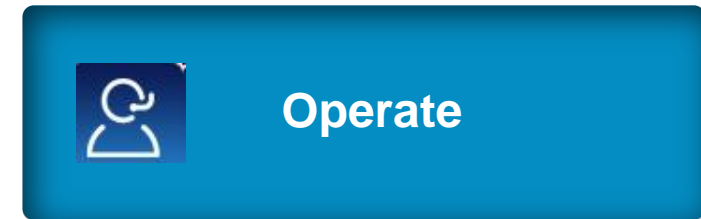
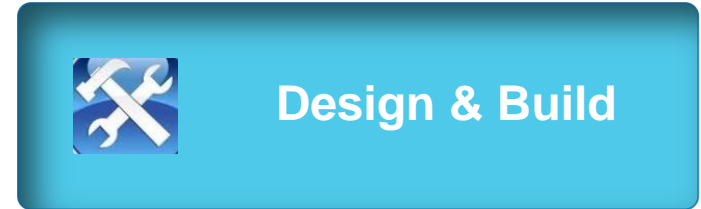
Enquiry committee recommendations for preventing blackouts

- **Hardware Based**
- **Regulation based**
- **IT based**
 - (among other things....)
 - **Coordinated outage planning**
 - **Real time congestion management**
 - **Analyzing the present grid conditions and predicting anticipated scenarios which might lead to any such disturbances in future**



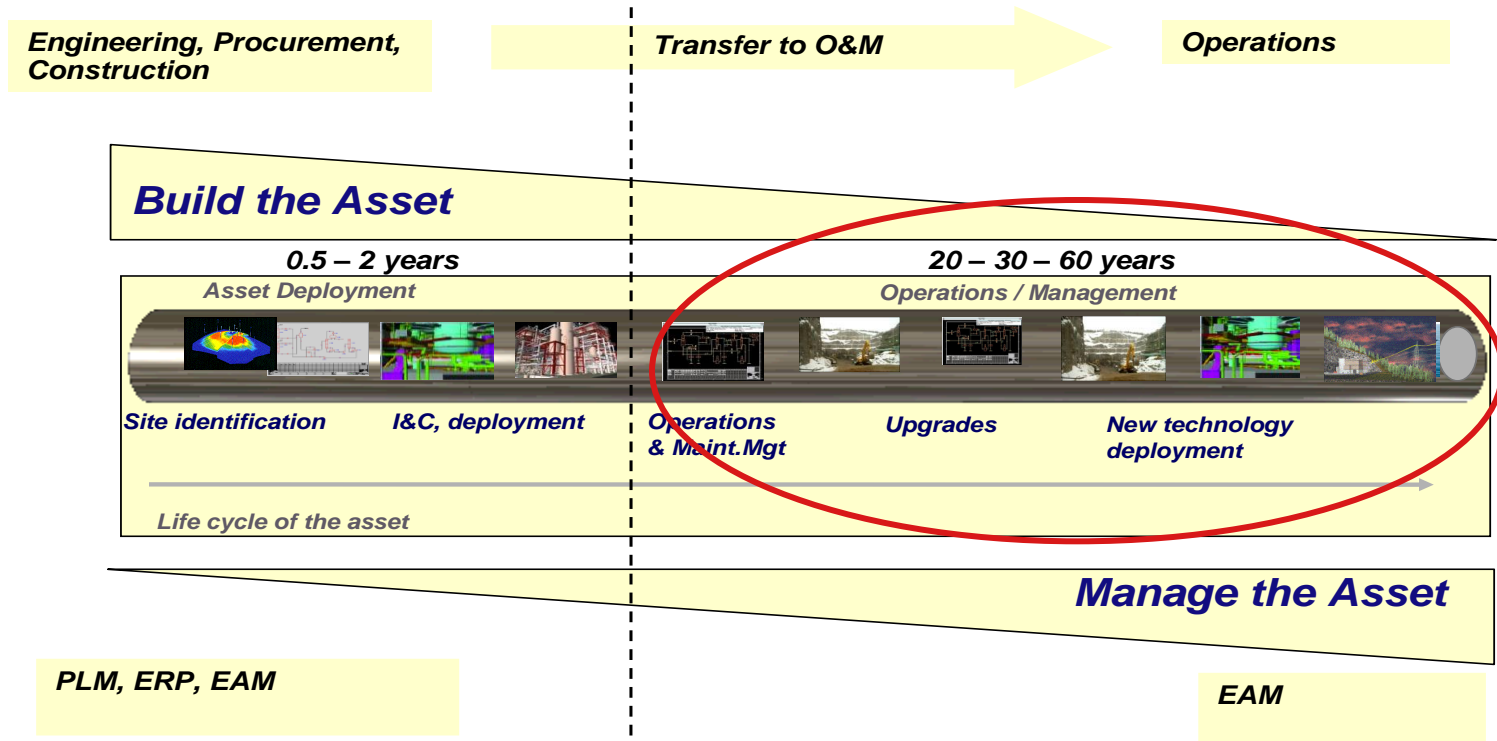
....resulting in a Smarter Infrastructure

- **Today's progressive global organizations are:**
 - **Transitioning to smarter, flexible infrastructures**
 - **Enabling more intelligent enterprise assets**
 - **Delivering insight, recommendations, performance, and optimization across their organization**

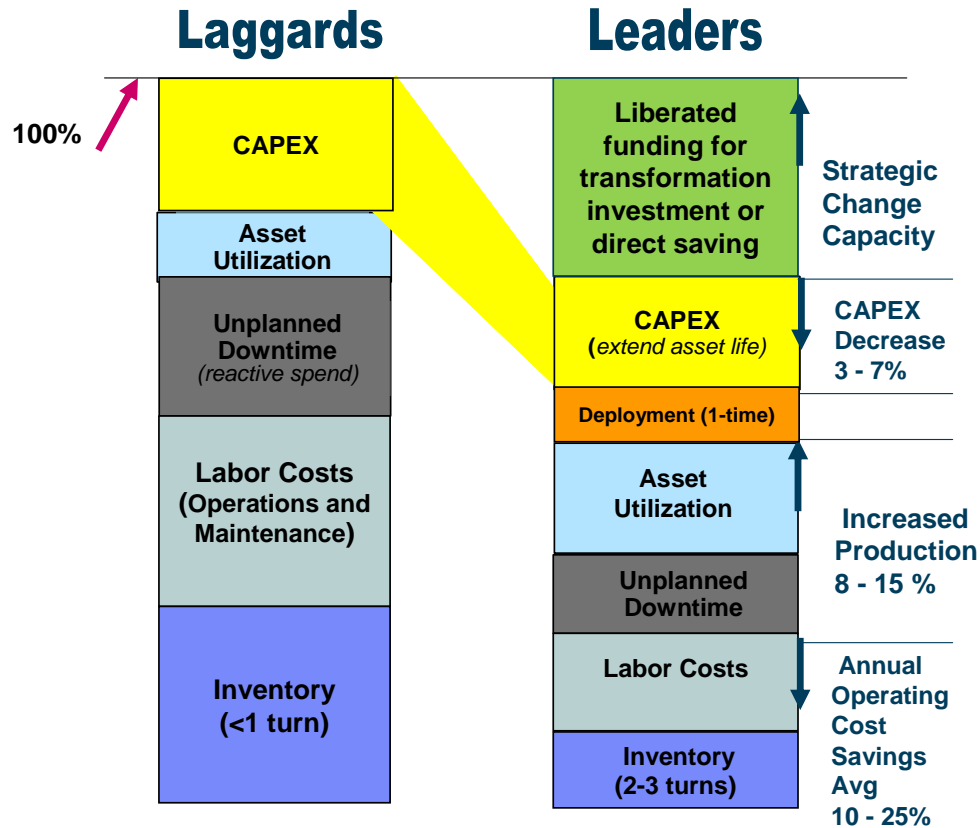


Overview

- **Physical infrastructure is an asset-intensive business**
 - **Lifecycle : Asset deployment, followed by provision of space, power and services to customers (internal or external) over many years**
- **In steady-state, business performance is directly linked to capital Expenditure (Capex) and opex (Operational expenditure) productivity**

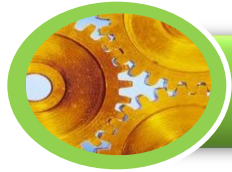


IBM PoV - Impact on capital-intensive businesses



Where can IBM help?

Smart Physical Infrastructure Applies Across Industries



Manufacturing

- Plants and production lines
- Warehouses



Transportation

- Roads, bridges, vehicles
- Rails, trains
- Airports, aircraft



Energy

- Transmission and distribution networks
- Power plants
- Drilling platforms and wells
- Refineries



Buildings

- Commercial offices
- Government buildings
- Schools and college campuses
- Hospitals



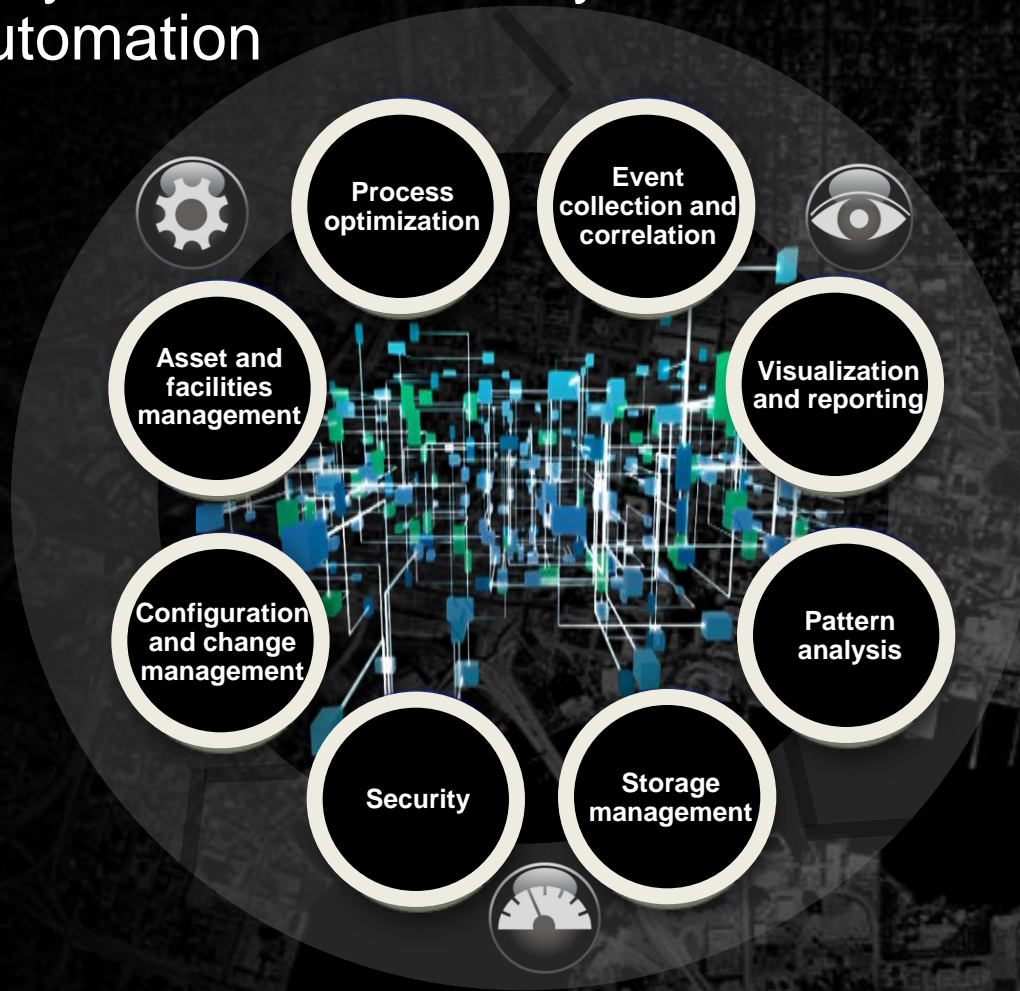
Water

- Wells and dams
- Treatment plants
- Pipes and valves



How do we Help?

Real-time, analytics-based visibility,
control and automation



Decisions based on fact & insight.

In India, IBM is engaged with clients to build

- Smarter Buildings
- Smarter Telecom Infrastructures
- Smarter Supply Chain
- Smarter Transmission Grids
- Smarter Cities
-



What does it mean to be a Smarter Building?

The interconnection of physical assets and information technology can optimize efficiency, production and consumption in many types of buildings.

Smarter Commercial Building



- Provides integrated facilities operations information for owners/operators in order to optimize energy usage and services based on tenant's needs.

Smarter Data Center



- Integrated facilities and IT insight to energy efficiency of datacenter and the correlation of IT and facilities information.

Smarter Cell Tower



- Integration of active and passive management enables optimized operations to reduce truck rolls.

Smarter Campus

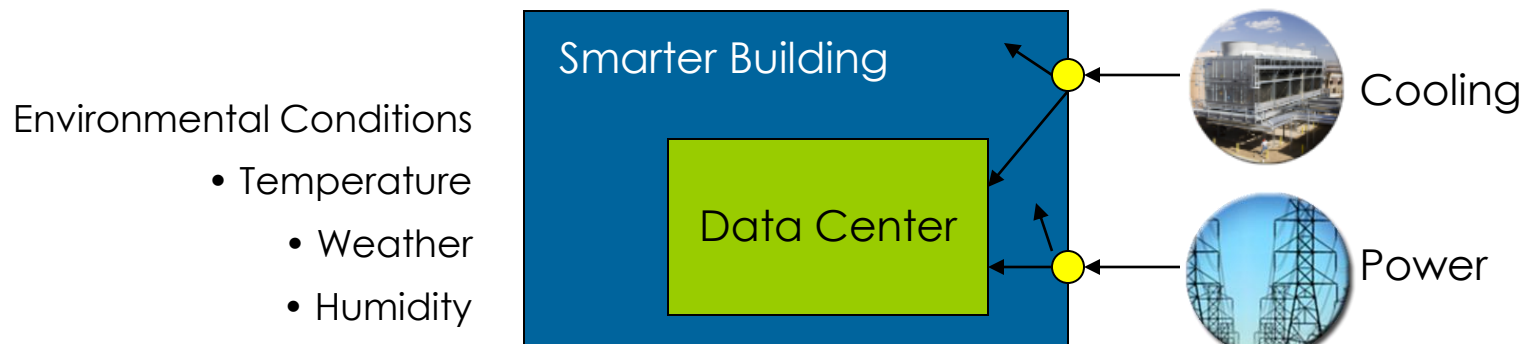


- Intelligent infrastructure platform and tools to manage plug-in electric vehicle stations, buildings, badging, central utility plant



Data Center is a specialized type of Building

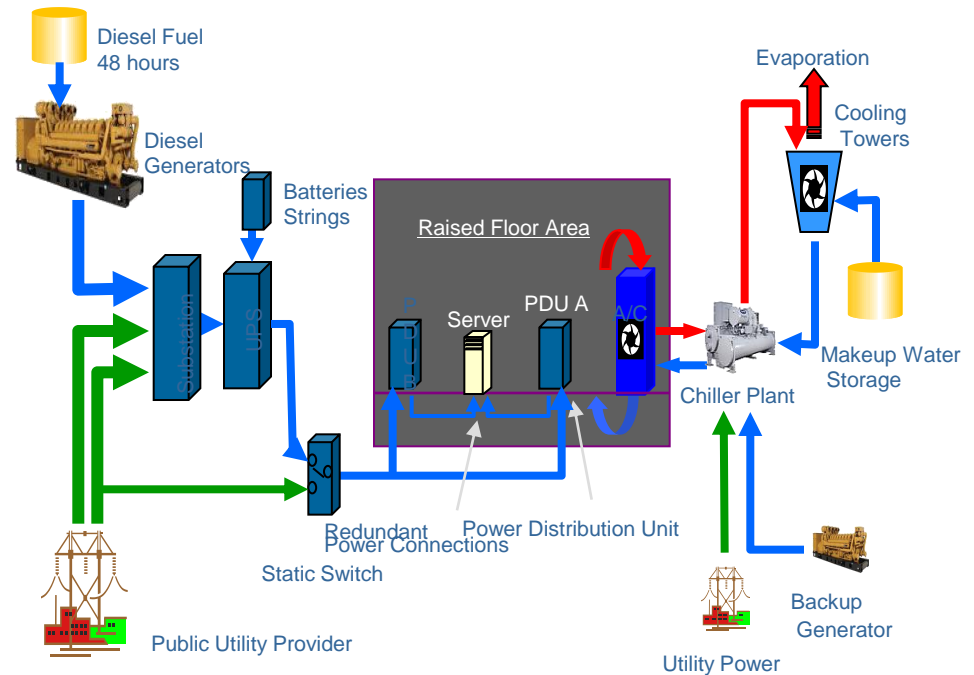
- **The Data Center has some unique characteristics**
 - High Kw per square foot power consumption
 - High cooling requirements per square foot
 - Low number of occupants
 - Large concentration of assets
 - Cost of energy and cooling often secondary to availability and service delivery
- **Data Center needs to be managed as part of a Smarter Building strategy**
 - Data Center typically in a building that has additional uses (offices, manufacturing, etc.)
 - There is often shared power and cooling infrastructure
 - Management of a Smarter Building can have implications on the Data Center
 - Management of a Data Center can have implications on the Smarter Building



What is a smarter data center?

- “Smarter” data centers are specialized Smart Buildings that integrate and optimize building management and IT systems in individual buildings and groups of buildings to create facilities that:

- Constantly monitor energy and thermal information
- Understand where the energy is being consumed within the data center
- Know the efficiency of the resources in the data center
- Adjust and react to energy related events and alerts
- Provide historical and real-time analytics and reporting
- Improve asset lifecycle management for energy efficiency
- Improve processes by leveraging energy and efficiency information



• PDU – Power Distribution Unit



Smarter Buildings

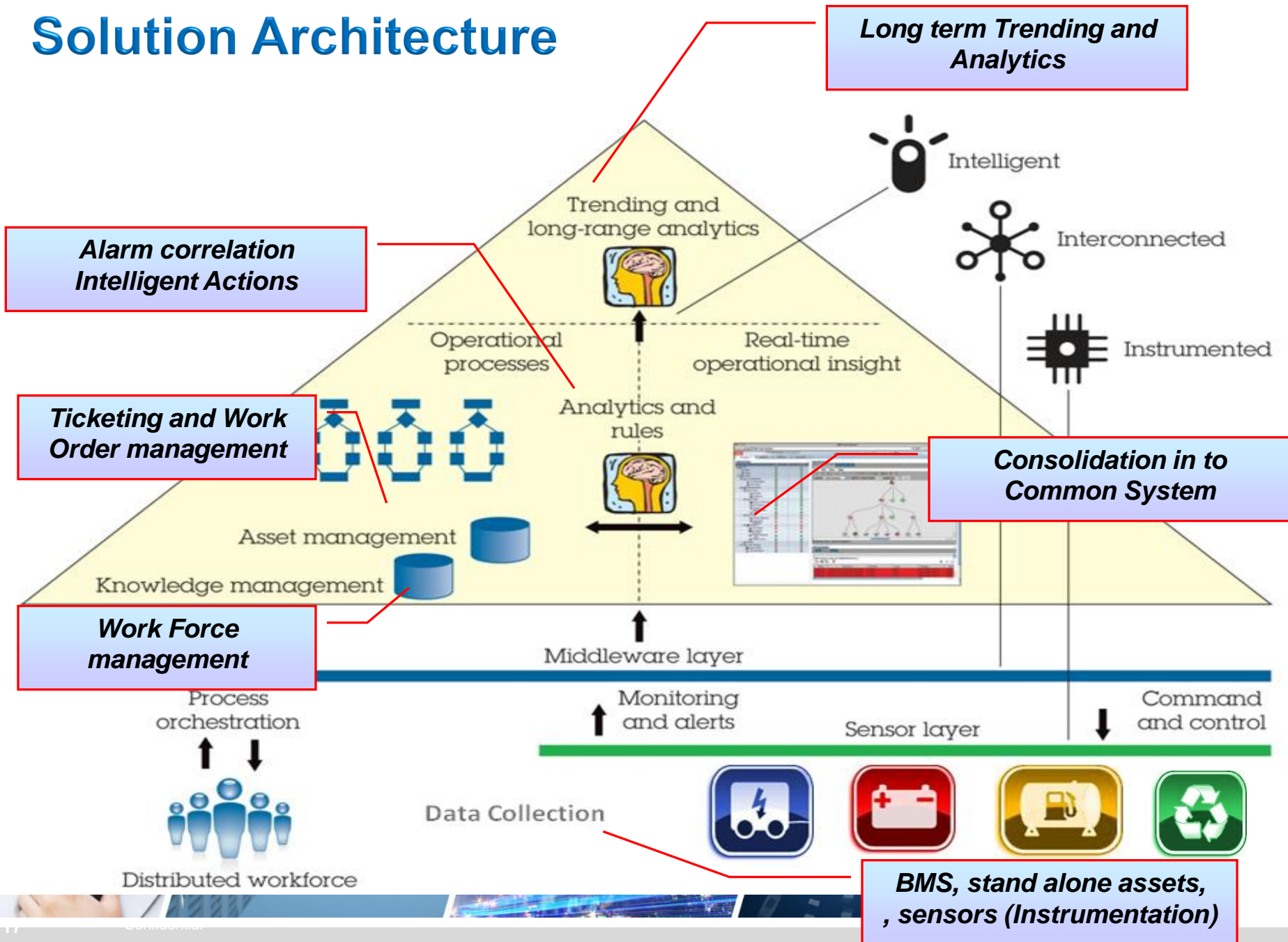
IBM TRIRIGA ENERGY OPTIMISATION



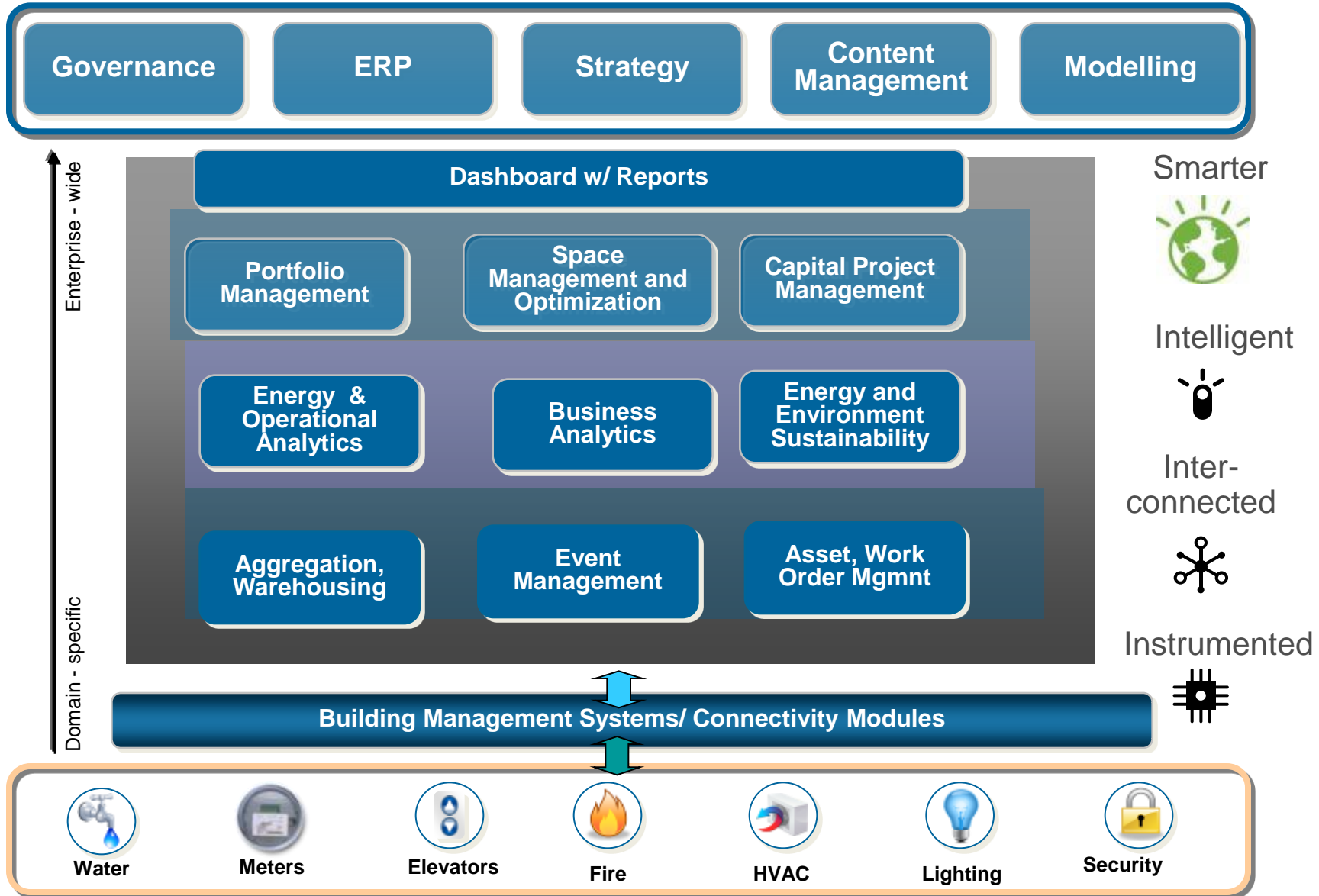
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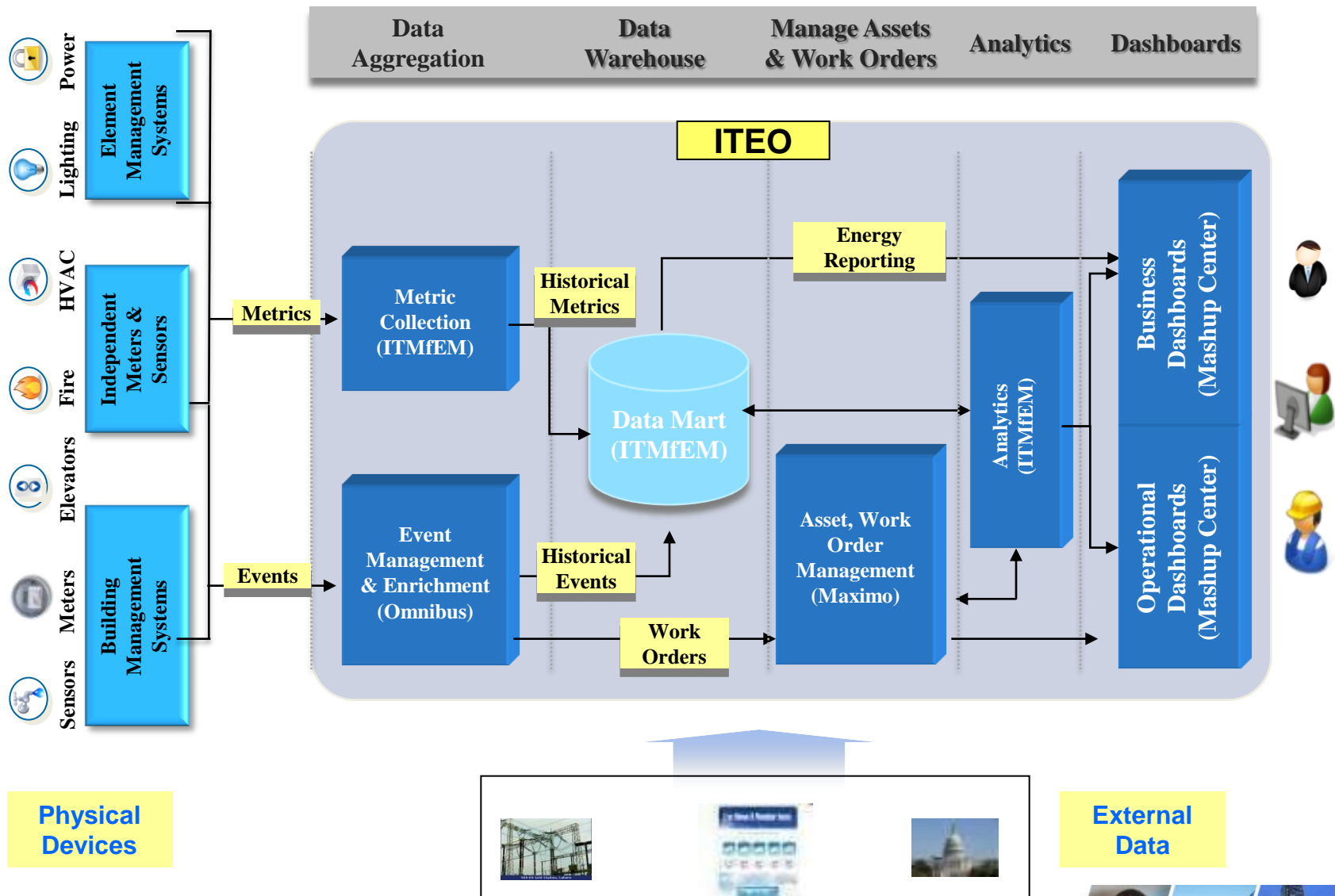
Solution Architecture



Architectural view of IBM's smart building Solution



IBM Tririga Energy Operations Architecture

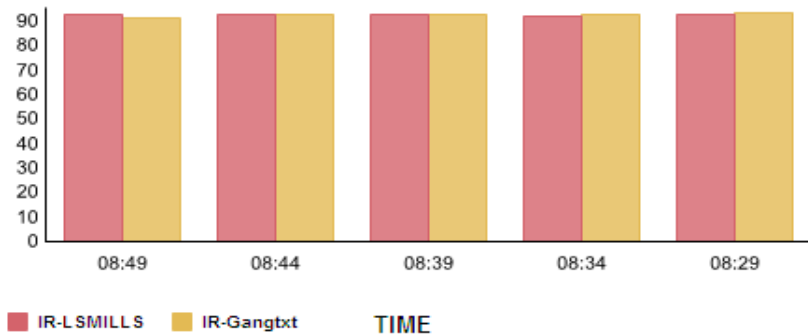


Real IBM Smarter Building (ITEO) implementations -

Widgets are Hosted within Lotus Mashup center to show real time data from the physical assets. Any Flash / HTML5 charting can be used.

Centac Compressor - Analog Inputs - All Sites - System Pressure

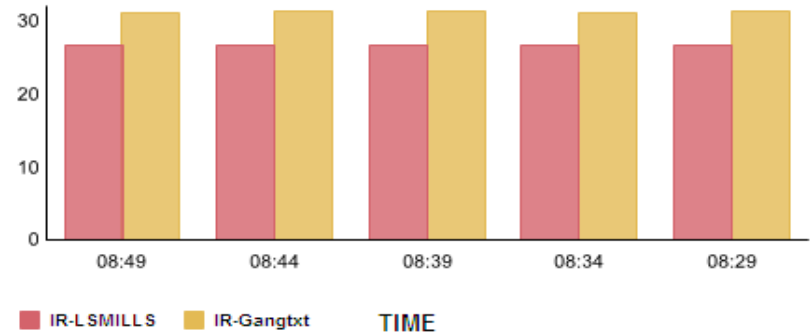
SYSTEM PRESSURE



[Switch to table format](#)

Centac Compressor - Analog Inputs - All Sites - LubeOil Pressure

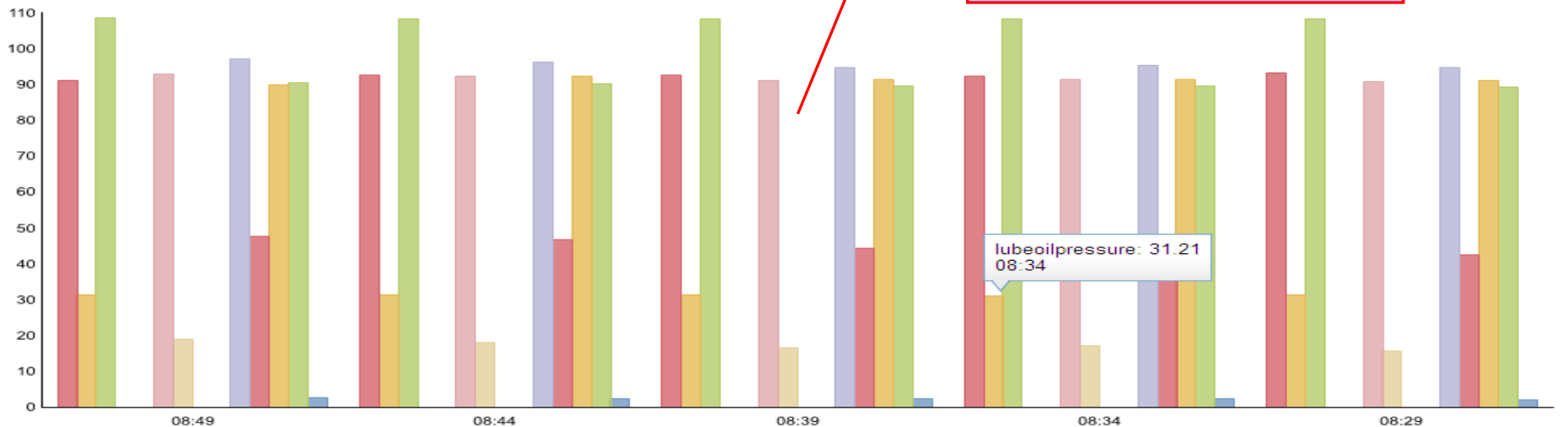
LUBE OIL PRESSURE



[Switch to table format](#)

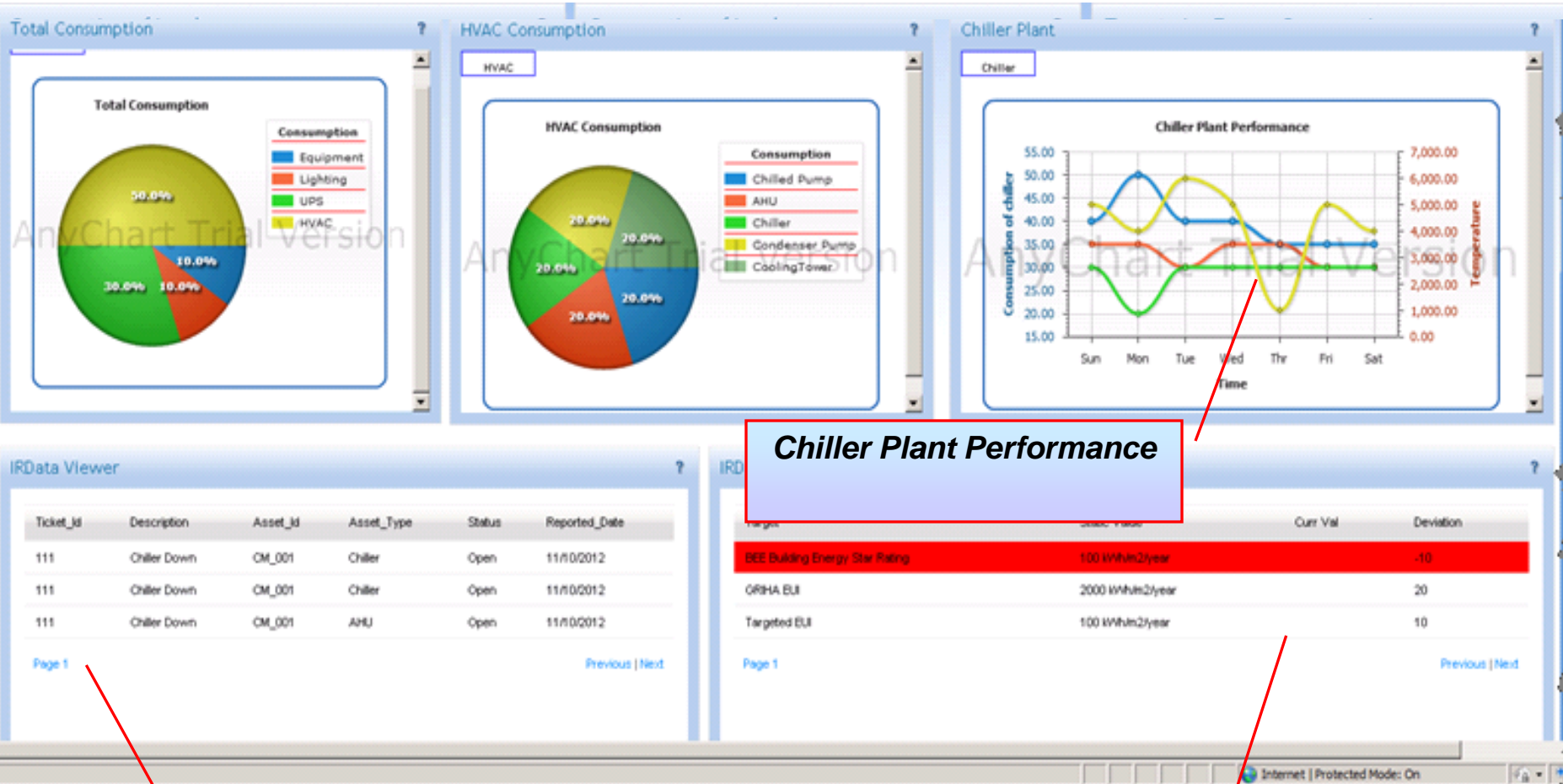
Critical Metrics over last 30 minutes

Centac Compressor - Analog Inputs for Site Gangotri Textiles- Last 30 Minutes



lubeoilpressure: 31.21
08:34

Interactive Charting showing Building Health



Chiller Plant Performance

Trouble Tickets and Work Orders generated by the System or Manually

Deviation from Star ratings and Energy Benchmarks



In built Analytics

Analytical Rules are shipped with the product and are added with every release. With appropriate licensing, Clients can add new rules

- AH00001 - **AHU** simultaneously heating and cooling - Based on valve positions
- AH00003 - **AHU** cooling control alert - High building zone temp, rolling 2 hrs
- AH00004 - **AHU** heating control alert - Low building zone temp, rolling 2 hrs
- AH00005 - **AHU** temperature sensor drift detected
- AH00006 - **AHU** operating in override mode, rolling 2 hrs
- AH00007 - **AHU** operating outside of weekday office hour schedule, rolling 2 hrs
- AH00008 - **AHU** operating outside of weekend office hour schedule, rolling 2 hrs
- AH00009 - **AHU** excessive loading of variable frequency drives, rolling 2 hrs
- AH00013 - **AHU** cooling valve passing - Leakage detection, rolling 3 hrs
- AH00014 - **AHU** heating valve passing - Leakage detection, rolling 3 hrs
- AHSR00001 - **AHU** heating coil for multi-zone unit in operation where OAT > SAT
- AHSR00002 - **AHU** heating control alert - Heating valve open where OAT > supply air temp, rolling 2 hrs
- AHSR00003 - **AHU** cooling control alert - Cooling valve open where OAT < min threshold temp, rolling 4 hrs
- AHSR00004 - **AHU** cooling control alert - AHU cooling when in free cooling mode, rolling 2 hrs
- AHSR00005 - **AHU** economiser mode alert - Not in free cooling mode
- AHSR00006 - **AHU** economiser mode alert - Not in optimal mechanical cooling mode (With CO2 sensing)
- AHSR00007 - **AHU** economiser mode alert - Not in optimal mechanical cooling mode (Without CO2 sensing)
- CR00003 - **Chiller** low supply temperature
- CR00004 - **Chiller** cooling substance temperature delta
- CR00005 - **Chiller** efficiency
- CR00012 - **Chiller** cooling substance temperature setpoint comparison
- CRSR00001 - **Chiller** free cooling not being utilized
- HXSR00001 - Perimeter heater detected operational where OAT > min threshold temp
-



Out of the box content improves Time to Value

Dashboards

• Executive Page

Executive Scoreboard
 Energy Costs
 Trend Energy
 Consumption Trend
 Space Utilization Trend
 CO2 Emissions Trend

• Energy Page

Energy Scoreboard
 Energy Usage Chart
 Energy Usage
 List Energy Usage
 (Chart/List) Filter

• Alerts Page

Alerts Scoreboard
 Alerts Chart
 Alerts List
 Alerts (Chart/List) Filter

• Work Orders Page

Work Orders Scoreboard
 Work Orders Chart
 Work Orders List
 Work Orders (Chart/List)
 Filter

Analytics

• Platform + Content

iLOG Server
 18 Analytics included with
 the solution for highest
 energy-consuming
 equipment

• Examples

AHU- simultaneous
 heating & cooling
 AHU-cooling – low
 building zone
 temperature
 AHU operating in override
 AHU operating outside of
 normal operating hours
 AHU cooling or heating
 value open when outside
 air temperature is greater
 than or less than threshold
 and more.....

Adapters

• Adapters

JCI Metasys
 Siemens Apogee
 OPC (generic) adapter
 Schneider Continuum
 Ingersoll Rand
 Honeywell



IBM smarter buildings case studies & benefits



Tulane University

Smart is: Collecting, managing and analyzing data from buildings to gain intelligence and insight to energy and facilities management for a significant projected energy savings.



IBM Real Estate Site Operations

Smart is: Consistently achieving energy cost reduction on equipment monitored of between 10-15% and reactive maintenance decreased by 16%



Global 20 Company

Smart is: Improved operational processes and performance management resulting in reported real estate cost savings of \$925 million within first four years.

MOSWOS extended to Buildings!



IBM Rochester, 3.3M sq ft multi-building mixed use light industrial campus. Facilities date to the 1950s. Consistently achieved year on year energy reductions of 5% to 7% over the last 10 years.

- Reactive maintenance decreased by 16%
- Hours per work order reduced by 34%
- Total number of work order hours decreased by 49%
- Energy cost reduction on equipment monitored of between 10-15%

IBM Rochester Campus

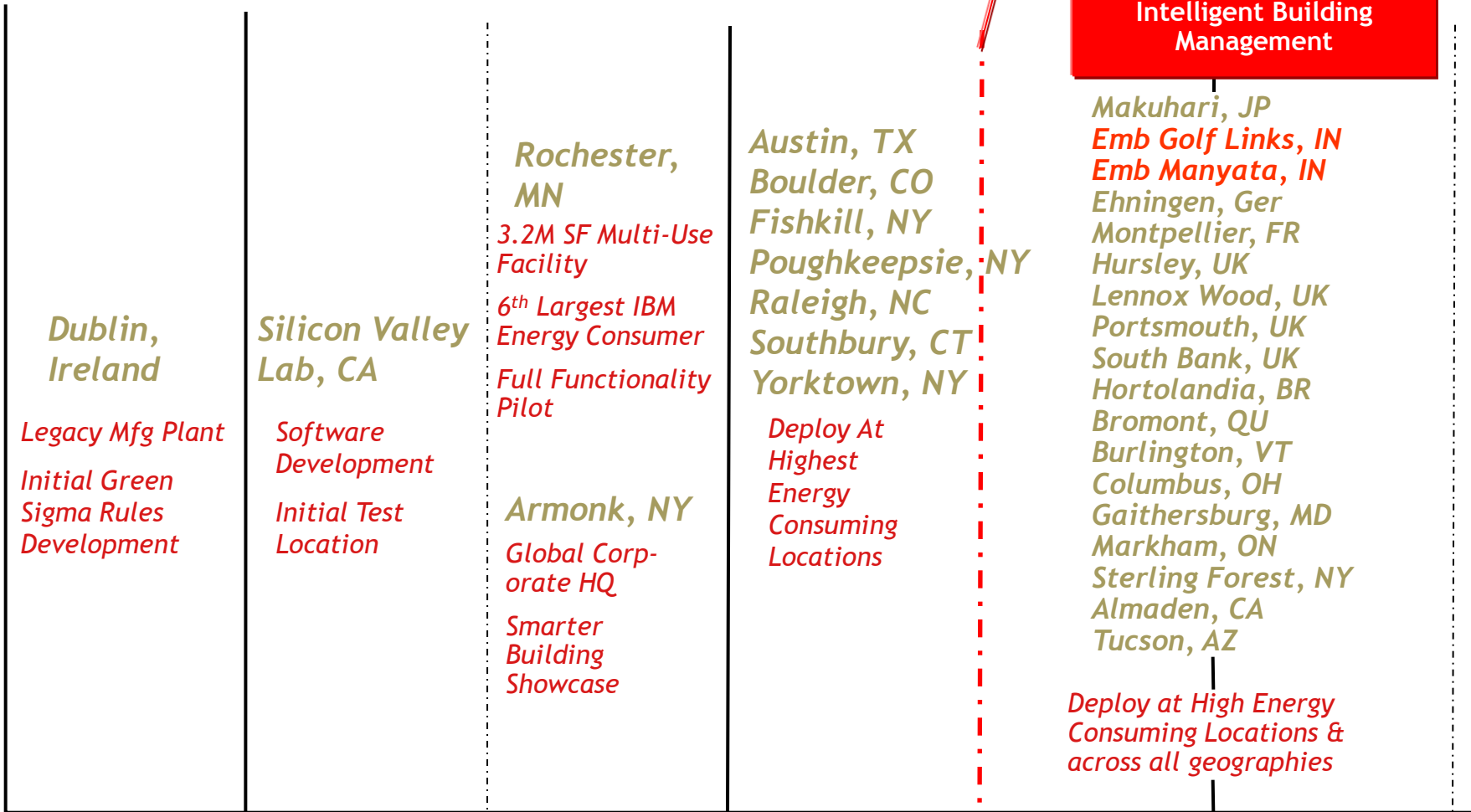
The dashboard provides a comprehensive overview of the IBM Rochester Campus operations. It features a map of the facility with a pop-up window for 'IBM - Rochester Facility' located at Rochester, Minnesota 55901. The 'Operations Alerts' table lists various alerts and their corresponding building numbers. The 'Operations Cost' chart shows a comparison between Maintenance and Operations costs. The 'Work order analysis' chart displays the number of work orders categorized by Routine, Prio_Work_Order, and Emergency. The 'Supplier Performance' chart shows performance metrics for different quarters from 2009 to 2010.

Summary	Building
Supply alarm variable frequency drive	301
Chilled water return alarm	035
Chilled water return alarm	305
High static alarm AHU 5	021
Supply alarm variable frequency drive	002
Chilled water return alarm	205



IBM Smarter Building Rollout

As of YE 2011 we have over 100 buildings, 20M sq ft and 800+ AHUs being optimized by IBM Intelligent Building Management



- Makuhari, JP
- Emb Golf Links, IN
- Emb Manyata, IN
- Ehningen, Ger
- Montpellier, FR
- Hursley, UK
- Lennox Wood, UK
- Portsmouth, UK
- South Bank, UK
- Hortolandia, BR
- Bromont, QU
- Burlington, VT
- Columbus, OH
- Gaithersburg, MD
- Markham, ON
- Sterling Forest, NY
- Almaden, CA
- Tucson, AZ

Deploy at High Energy Consuming Locations & across all geographies

2009

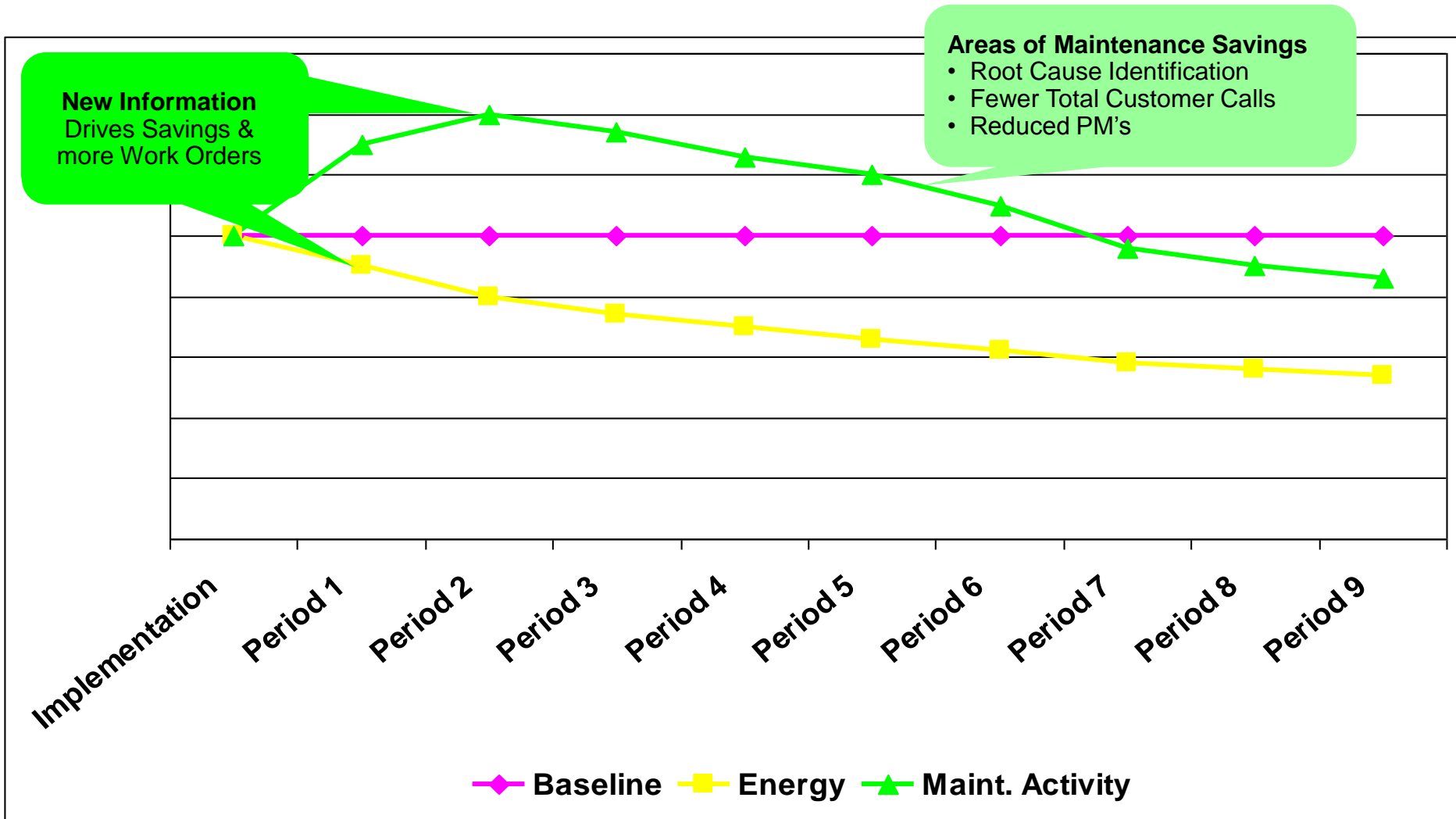
2010

2011

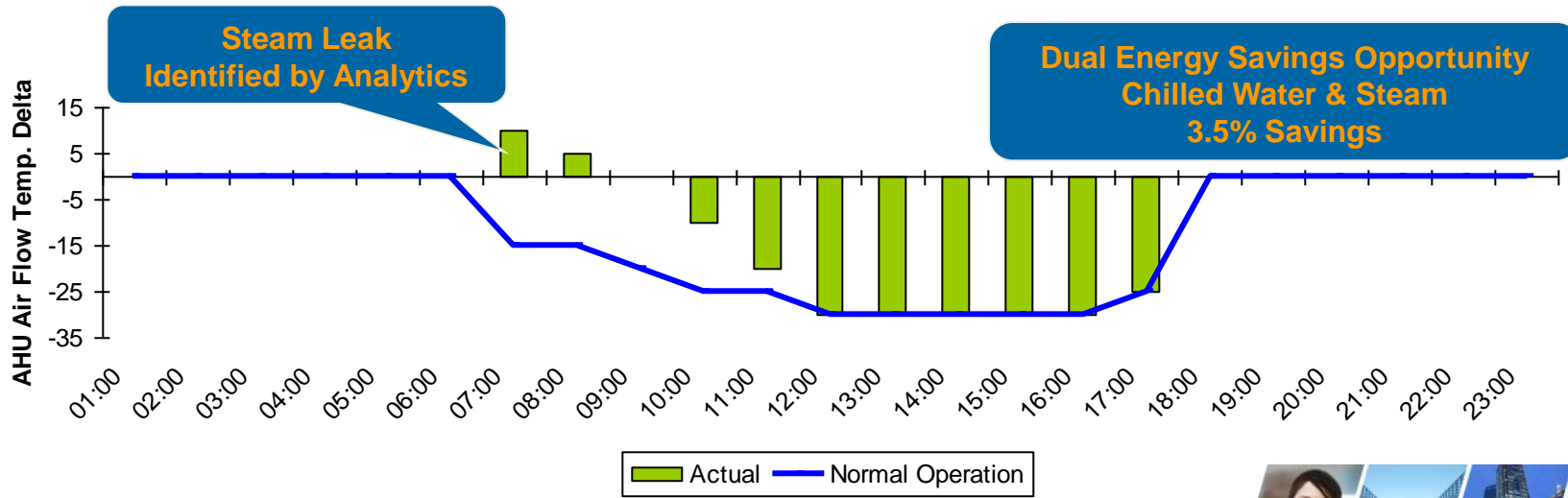
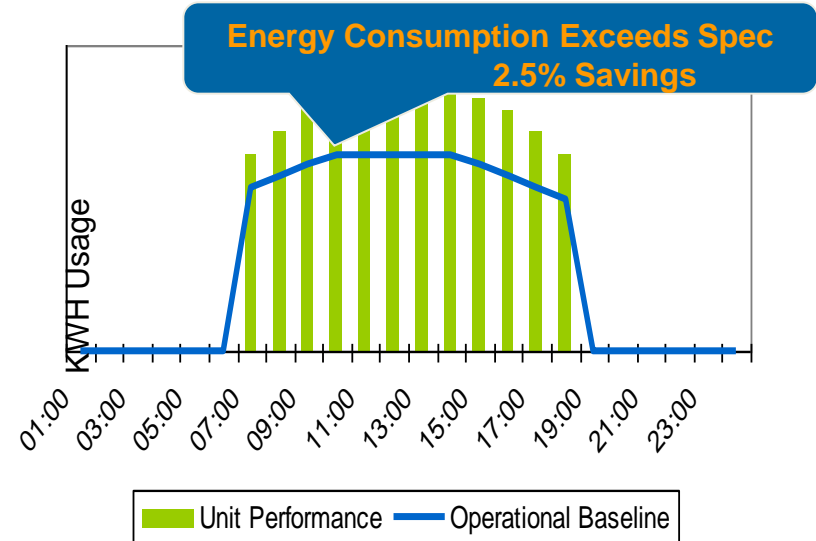
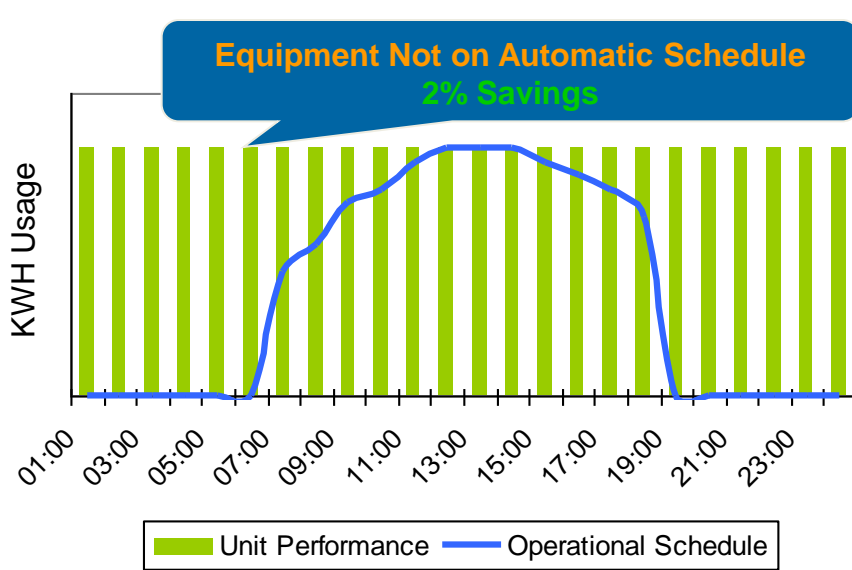
2012



Work Order Related savings



IBM Energy Savings



How can we engage? – The ROI Tool is a good starter

IBM Intelligent Building Management Solution

One of IBM's Smarter Buildings initiatives

Setup and administration: click a tile to continue

CASES

Add or select a situation to analyze



ADMIN PANELS

Customize settings or norms



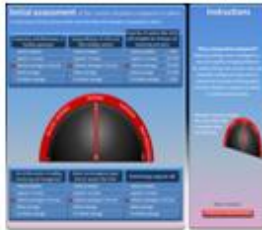
Case: Sample Case

Click a tile: to load a different case click the "cases" tile above

1,800,000 sqft/6 buildings

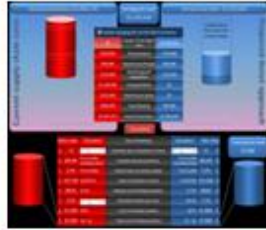
INITIAL ASSESSMENT

compared to others



VALUE

calculate the savings



PAY BACK

5-year costs/benefits flow



EMISSIONS

benefits to the planet



PRESENTATIONS

show off your results



Current Capabilities

Energy Management	✓
Facilities Operations	✓
Emissions reductions	✓
Single and Multiple-similar building scenarios	✓
Investment Payback Period	✓



Sources of information used in building this tool

- **IBM Internal resources**

- Case studies from IBM Rochester and IBM Armonk implementations
- IBM RESO
- IBM Center for Applied Insights
- IBM Business Value Assessments
- IBM SWG (Tivoli Maximo + IIBM architects and product management)
- IBM STG

- **External resources**

- US Department of Energy
- Environmental Protection Agency
- LEED, BREEAM, EN ISO16001 standards
- Lutron Electronics
- Associated General Contractors of America



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