**OSI**soft®

**Using Real-Time Data for Datacenter
Operations, Energy & Sustainability initiatives**

**Mark Peterson**
**OSIsoft**

# Agenda

- PI System overview

- Emerging Datacenter Operation Best Practices

  - The Green Grid & the Datacenter maturity model

- Datacenter Benefits using PI

- Examples of PI use in Datacenters

- PI in Microsoft Datacenters

- Q&A

Empowering Business in Real Time.

# The OSIsoft PI System

## Connect
Collect data from hundreds of sources.

**Interfaces**

## Manage
Gather and archive large volumes of data. Scale to meet your growing business needs.

**Real Time Data**

## Analyze
Access real-time or historical role-based data for the entire enterprise at any time.

**Analytics**

## Present
View data, identify problems, and take corrective action with familiar, easy-to-use graphical tools.

**Visualisation**

The OSIsoft PI System is the highly scalable and secure real-time and event infrastructure that connects people with the right operational and production information at the right time to analyze, collaborate, and act.

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# OSIsoft: what we do



| PI System | COLLECT | HISTORIZE | FIND | ANALYZE | DELIVER | VISUALIZE |

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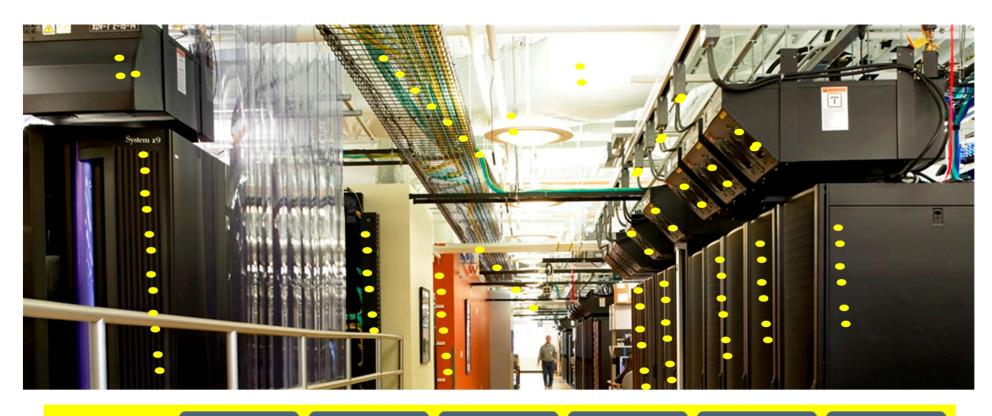
# OSIsoft: what we also do



**PI System**

COLLECT · HISTORIZE · FIND · ANALYZE · DELIVER · VISUALIZE

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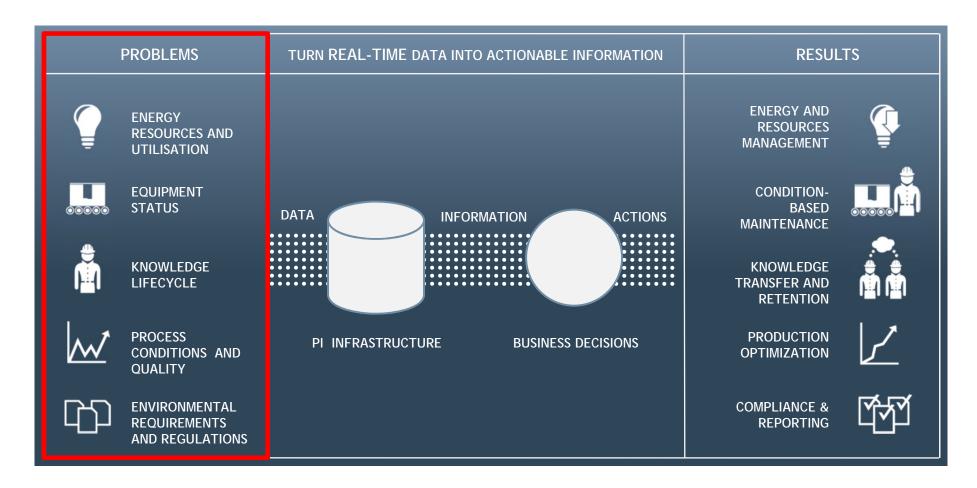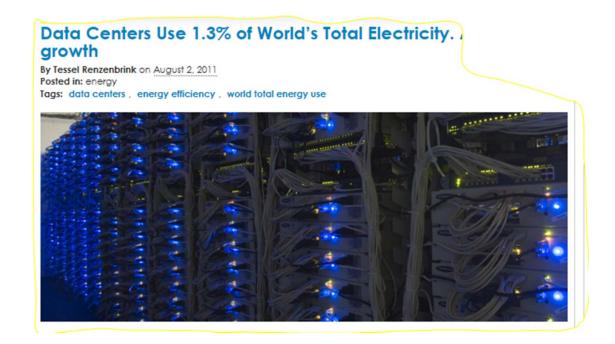
# PI System: Real-time Data in to Actionable Information

| PROBLEMS | TURN REAL-TIME DATA INTO ACTIONABLE INFORMATION | RESULTS |
|---|---|---|
| ENERGY RESOURCES AND UTILISATION | | ENERGY AND RESOURCES MANAGEMENT |
| EQUIPMENT STATUS | DATA · · · INFORMATION · · · ACTIONS | CONDITION-BASED MAINTENANCE |
| KNOWLEDGE LIFECYCLE | | KNOWLEDGE TRANSFER AND RETENTION |
| PROCESS CONDITIONS AND QUALITY | PI INFRASTRUCTURE · · · BUSINESS DECISIONS | PRODUCTION OPTIMIZATION |
| ENVIRONMENTAL REQUIREMENTS AND REGULATIONS | | COMPLIANCE & REPORTING |

**Challenges that apply in process industries also apply in Datacenter environments**

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# Why PI in Datacenters?

Data Centers Use 1.3% of World's Total Electricity. growth

By Tessel Renzenbrink on August 2, 2011
Posted in: energy
Tags: data centers , energy efficiency , world total energy use

New DatacenterDynamics Research Study Predicts Global Data Center Energy Consumption Could Increase 19% By 2012

Globally, the new study identifies 31 GW of data center power – enough energy to power all residential households in the United Kingdom, France or Italy.

London, United Kingdom (PRWEB UK) 26 September 2011                    ShareThis    Email    PDF    Print

Estimated consumption at 235.5 BkWh annually (2010).

In the US total energy consumption % figure is closer to 2%.

Source: Jonathan Koomey, professor in the civil and environmental engineering department at Stanford University
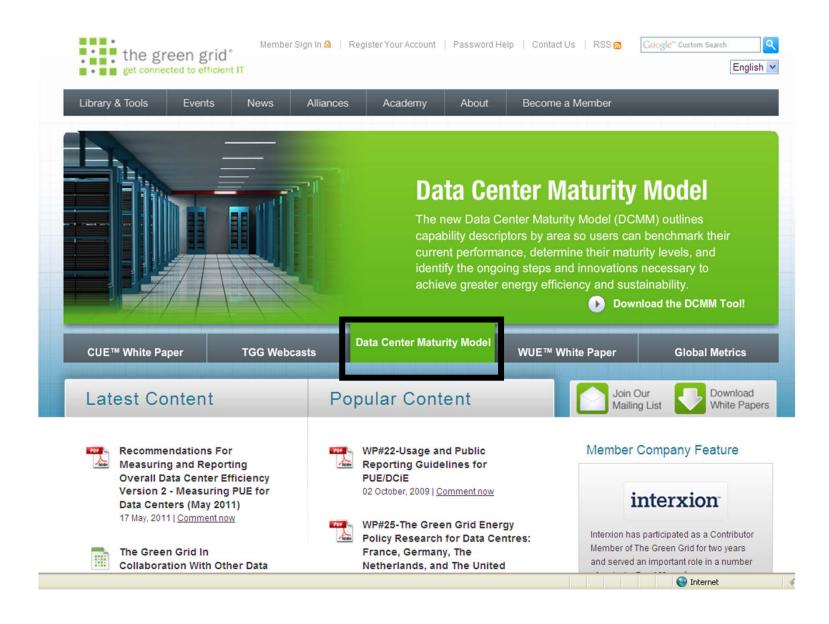
**Improving Uptime and Service levels are also primary Datacenter operation concerns**

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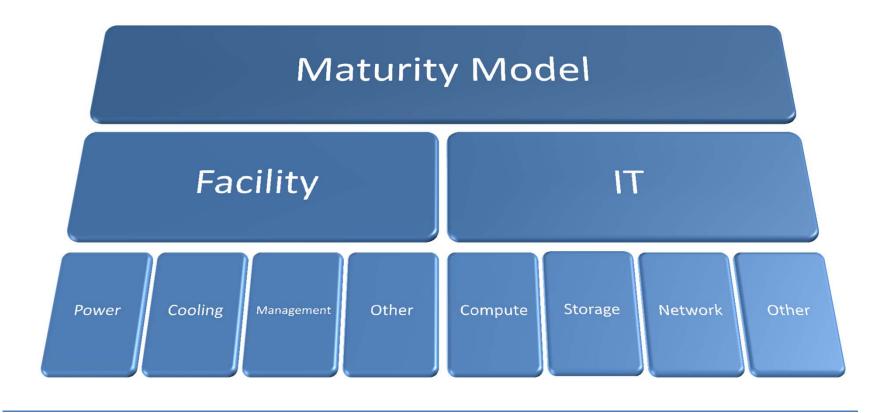
# Green Grid: Data Center Maturity Model

# Green Grid: Datacenter Maturity Model

- **Data Center Energy Efficiency**
  - Energy demand
  - Energy supply – low carbon generation
  - Utilization / Effectiveness

- **Data Center Sustainability**
  - Carbon
  - Water
  - Waste heat
  - Materials management
    - E-Waste
    - Cradle to cradle approach – lifecycle
  - Building sustainability

- **Data Center Monitoring/metrics**

# Datacenter: IT operations & Workload

| Compute | Storage | Network | Management |
|---------|---------|---------|------------|
| Utilization | Workload | Utilization | Utilization |
| Workload Management | Architecture | Workload | IT Sizing |
| Operations | Operations | Operations | Internal Power Supply |
| Power management | Technology | Technology | Service Catalogue/SLA's |
| Server populations | Provisioning | Base Performance | Incentivizing change for efficient behaviour |
| | | Provisioning | E-Waste |
| | | | Procurement |

# Datacenter: Facilities Operations & Performance

| Power | Cooling | Other | Management |
|---|---|---|---|
| Critical Power Path Efficiency – Building Entrance to IT load | PUE – Cooling Contribution | Operational Resilience | Monitoring |
| Architecture | RCI (hi) & RCI (lo) – if applicable | Resilience vs. Need | PUE |
| Operations | Mechanical/Refrigerant Cooling reduction | Lighting | Waste heat reuse (as measured by ERF/ERE) |
| Generation | Environmental – set point range at inlet to IT equipment | Building/Shell | CUE |
| | Environmental – monitoring and control | M&E Waste | WUE |
| | Operations | Procurement | xUE/additional metrics |

Real time Monitoring

Data Intensive

# Data Center Maturity Model



- Provides clear goals and direction for Datacenter operators to improve energy efficiency and sustainability

- Provides guidelines by data center area such that operators can benchmark current performance, thereby:
  - Understand how far they are from best practice
  - Identify ongoing steps & innovations required to achieve greater energy efficiency & sustainability improvements, both today & into the future.
  - Using the higher levels of the model to inform data center and IT strategy.

- Roadmap for the industry to significantly improve efficiency and sustainability

# Value Now, Value Over Time...



**Value and Effort** (y-axis)

**Time** (x-axis)

Collect / Aggregate / Visualize

**Target** (time, value)

**Effort**

Value with PI

Initial Software Investment

- **Capacity Planning**
- **Energy Management**
- **Environmental Compliance**
- **Cooling System Analysis**
- **Power Distribution Analysis**
- **Condition Based Maintenance**
- **Branch Circuit Monitoring**
- **Value of Historical Data**
- **Collect, Aggregate, Visualize**

**Incremental effort yields sustainable gains**

# Data Center Benefits using PI

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## Benefits

**A** Decrease equipment downtime & preventative maintenance via condition-based maintenance.

**B** Improve Strategic Asset Management & Outage Prevention by analyzing real time and historical data to identify root cause of anomalies & equipment failure.

**C** Provide real-time/ historic data records and trend analysis to support planning.

**D** Support cost reduction by monitoring and improving efficiency (PUE); reducing carbon footprint (future regulation). Assess design criteria to actual demands

**E** Establish real time alarming and response plans to reduce off-spec impacts, optimize corrective action. Develop condition assessment algorithms & equipment alarms.

**F** Increase effectiveness by aggregating time-critical information at Enterprise level in Single Dashboard. Display KPI and facility performance.

**G** Use Real Time data to support performance claims (validate availability)

### Benefit Map by Role/Function



Operations/ Maintenance

Corporate Planning

Engineering

IT

Marketing/Sales

# Data Center Monitoring and Metrics

- Branch Circuit Monitoring

- Capacity planning

- Bill back to business units

- Corporate Dashboards
  - Carbon Foot Print, PUE / Energy Efficiency, other metrics

- Benchmark against state-of-the-art facilities

- Proactive Maintenance of Assets within the Facility
  - Create a condition based maintenance program vs. a calendar

- Manager of Managers/NOC
  - Alarming
  - Troubleshooting

- Multi-site data aggregation

- Correlation between IT load & the power consumed by IT equipment

- Uncontrolled cooling

- Air blockages

- Air recirculation

- Chiller efficiency

- CRAC unit efficiency

- Cooling tower efficiency

- UPS efficiency

- Reactive power loss

- Correlation between energy cost and energy use

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# Example: Data Center Transformer load over time
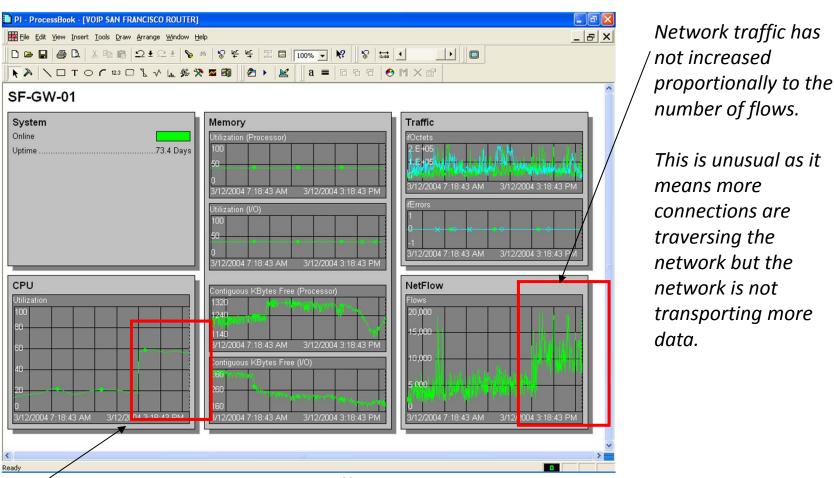
# Example: UPS Monitoring

# Example: Root-Cause Analysis: Trend Analysis



*Network traffic has not increased proportionally to the number of flows.*

*This is unusual as it means more connections are traversing the network but the network is not transporting more data.*

*High CPU and increases in NetFlow traffic are correlated with the time that Jitter reached an unacceptable level.*

# Customers



**Datacenters & Critical Facilities**

**Process Industries**

**Utilities**

Value now.  Value over time.

# PI System in Microsoft Datacenter's

## North America Region

## Europe Region

## Asia Pacific Region

Quincy

Chicago

Newark, NJ

Bay Area, CA

Los Angeles, CA

Ashburn, VA

Des Moines, IA

Miami, FL

San Antonio

São Paulo, BR

Dublin

Stockholm, SE

Amsterdam, NL

Paris, FR
Zurich, CH

Vienna, AT

### Microsoft Chooses PI System® to Monitor Critical Facilities
Microsoft Technology Centers and Enterprise Engineering Center

The Microsoft Technology Centers (MTCs) and Microsoft's Enterprise Engineering Center (EEC) have chosen the OSIsoft® PI System® to monitor and analyze performance of the MTC's and EEC's critical facilities, including power, mechanical, and IT. OSIsoft (www.osisoft.com) is provider of the PI System, the industry standard enterprise infrastructure for management of time-series data and events.

The 18 MTCs provide customers with experts and resources to envision, plan, build, deploy, operate and optimize secure customized computing solutions based on Microsoft and partner technologies.

Today, OSIsoft and Microsoft empower enterprise manufacturers and utilities to gain a competitive advantage by presenting users with dynamic operational, business, and energy data they can use to make better-informed decisions while driving excellence across the value chain. With the MTC and EEC, OSIsoft and Microsoft can further drive end customer value with their critical facilities.

"We are pleased to support Microsoft Technology Centers and its customers," said John O'Shea, OSIsoft Senior Vice President. "Adoption of OSIsoft's PI System infrastructure will help Microsoft increase efficiency and reduce costs across the MTC network to support their sustainability and environmental goals. Together, we can take these 'lessons learned' to our joint customers for their benefit. OSIsoft plans to use the Microsoft MTCs as part of our joint sales and business development engagements with Microsoft and customers."

"Microsoft and OSIsoft have a joint commitment to sustainable IT," commented Michael Valletta, Technical Director, MTC New York. "In meeting this commitment, Microsoft has expanded its use of the PI System by our Global Foundation Services (GFS) unit and the Microsoft Enterprise Engineering Center (EEC) in Redmond, WA, to include the global MTCs. This will enable our customers and visitors to see our joint technology for energy and environmental visualization at work, while we continue to reduce energy use at these facilities."

"The very large scale infrastructure and mission-critical nature of the monitoring required by the Microsoft EEC represents the kind

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Global Foundation Services

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# Q&A



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