Harvard Medical School Transformation using PI System Data

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Stanley Moses – Bahwan CyberTek Inc

Harvard Medical School (HMS)

Mission - To create and nurture a diverse community of the best people committed to leadership in alleviating human suffering caused by disease

- Established September 19th,1782
- 10 Pre Clinical Departments
- 11,366 Total faculty
- 235 MD, 170 PhD, 204 Medical Students
- 9 Noble prizes, 15 Recipients
- Numerous first - Introduced smallpox vaccine to US

https://hms.harvard.edu/

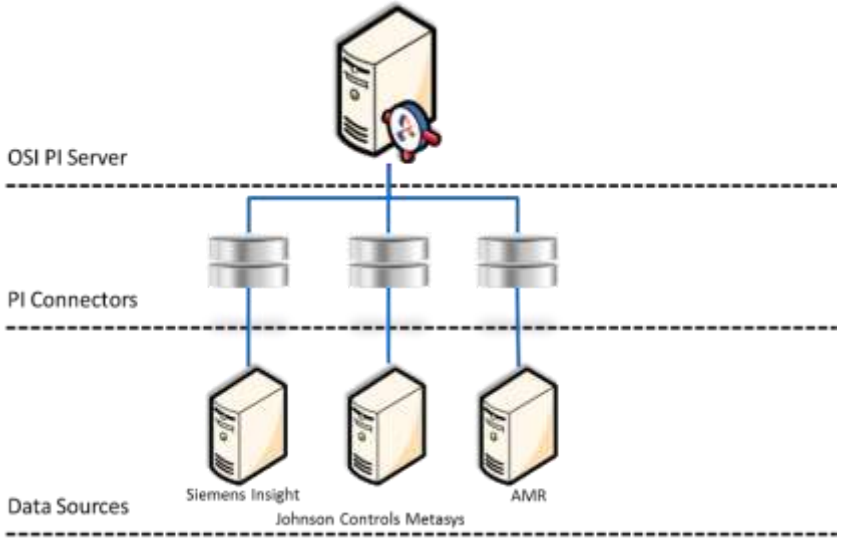
Harvard Medical School Facilities

- Located in the nucleus of Long wood Medical Area
- 20 Buildings
- ~ 3 million square feet of wet lab / computational lab research, and medical education facilities
- Iconic HMS Quadrangle

- Facilities Staff: 5 (Contract Staff of 50+)
- Budget: $60M
- 24/7 Operations, Around 33,000 Assets
- Usage:
  - Electric: 15 MW
  - Steam: 90K lbs/hr Peak
  - Chilled Water: 10k Tons
- Research Support

OSISOFT PI at HMS

- Working with OSISoft PI for 10 Years
- 3936 PI Points
- Energy Meters
  - Steam - 259 Points
  - Chilled Water - 335 Points
  - Electricity -137 Points
- Critical Room Parameters
  - 656 Points
- Prediction values calculated in PI
- Users – Facilities team, Control Center



Need for data conversion and sharing effectively

General
- Facilities CYOA
- Time consuming retrieval
- Effective format of display and transmission

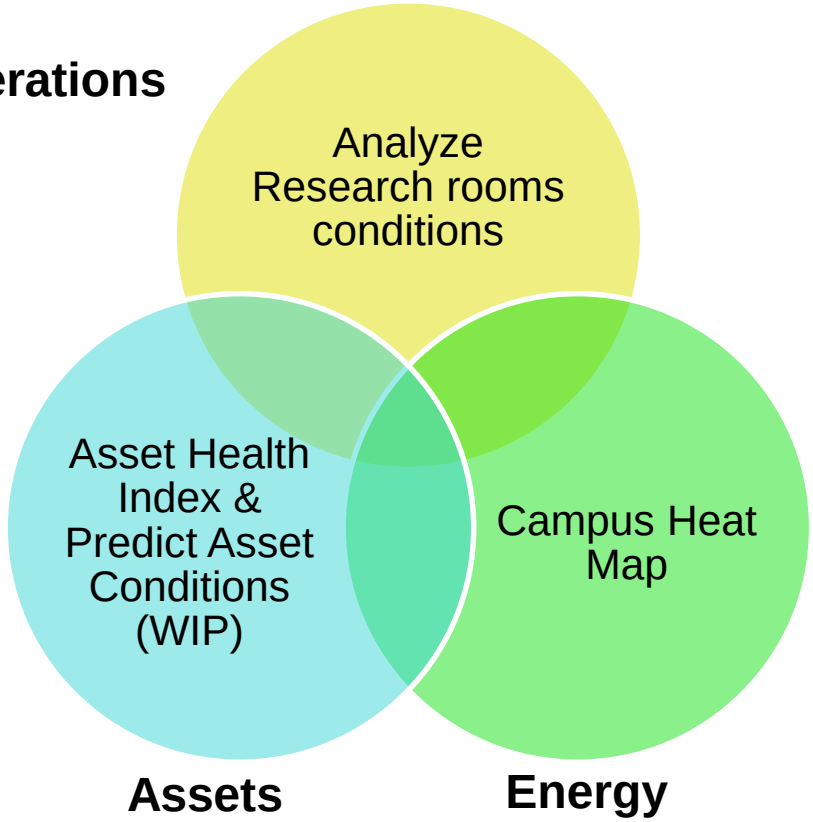
Operations
- Customers (Research Teams) wanted Data – Was never meant for customer distribution
  - Why are we using so much energy
  - Why did my experiment go wrong
  - Can we be warned about anomalies

Energy
- Peak Demand charges
- Energy consumption reductions and penalties
- Green initiatives participation

Assets
- Critical infrastructure failure
- Non-availability of support staff during nights and weekends

Today, HMS is effectively using OSI PI System data to

Operations



using

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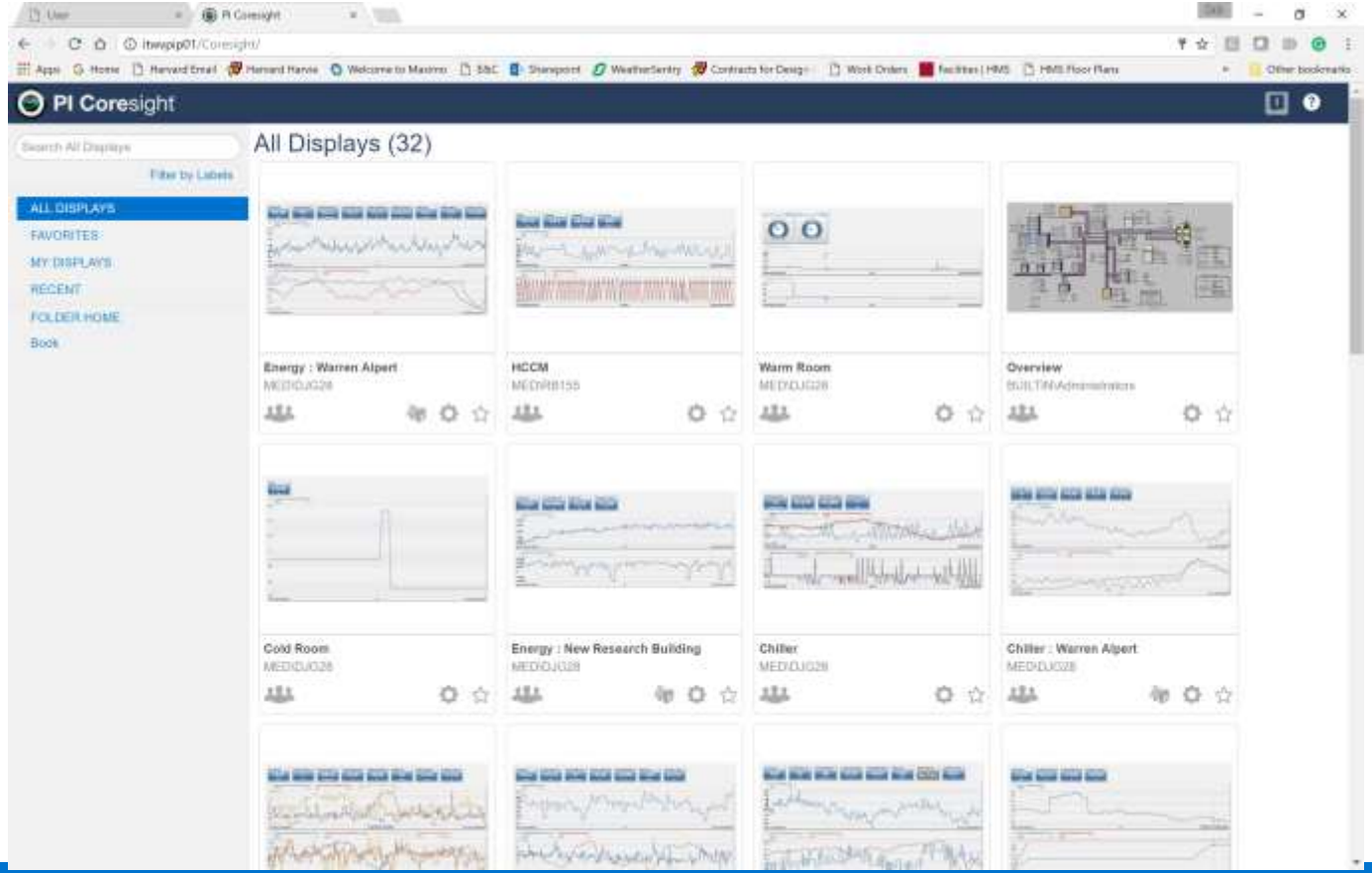
CUECENT RETINA

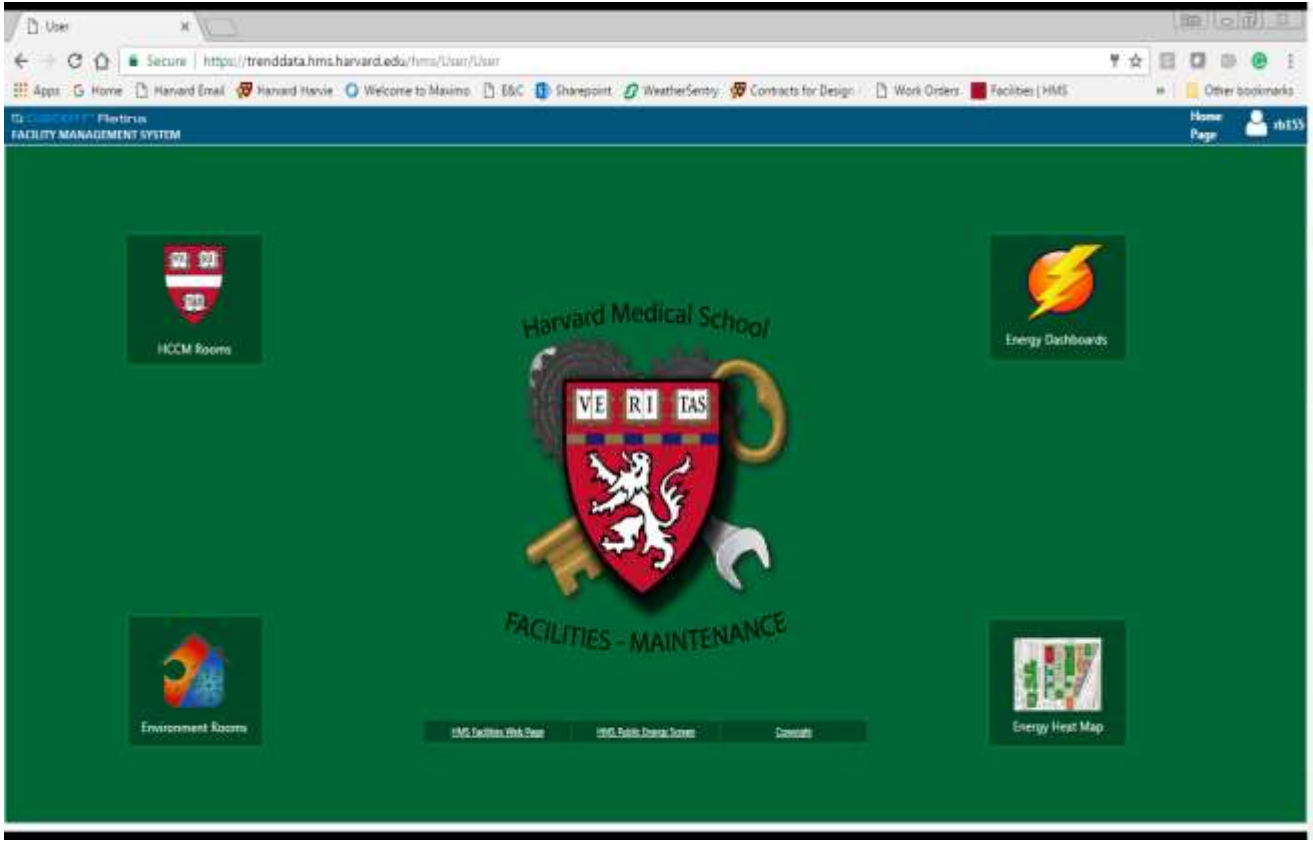
(Real Time Integration & Analytics)

Started with PI Asset Frame Work and PI Coresight



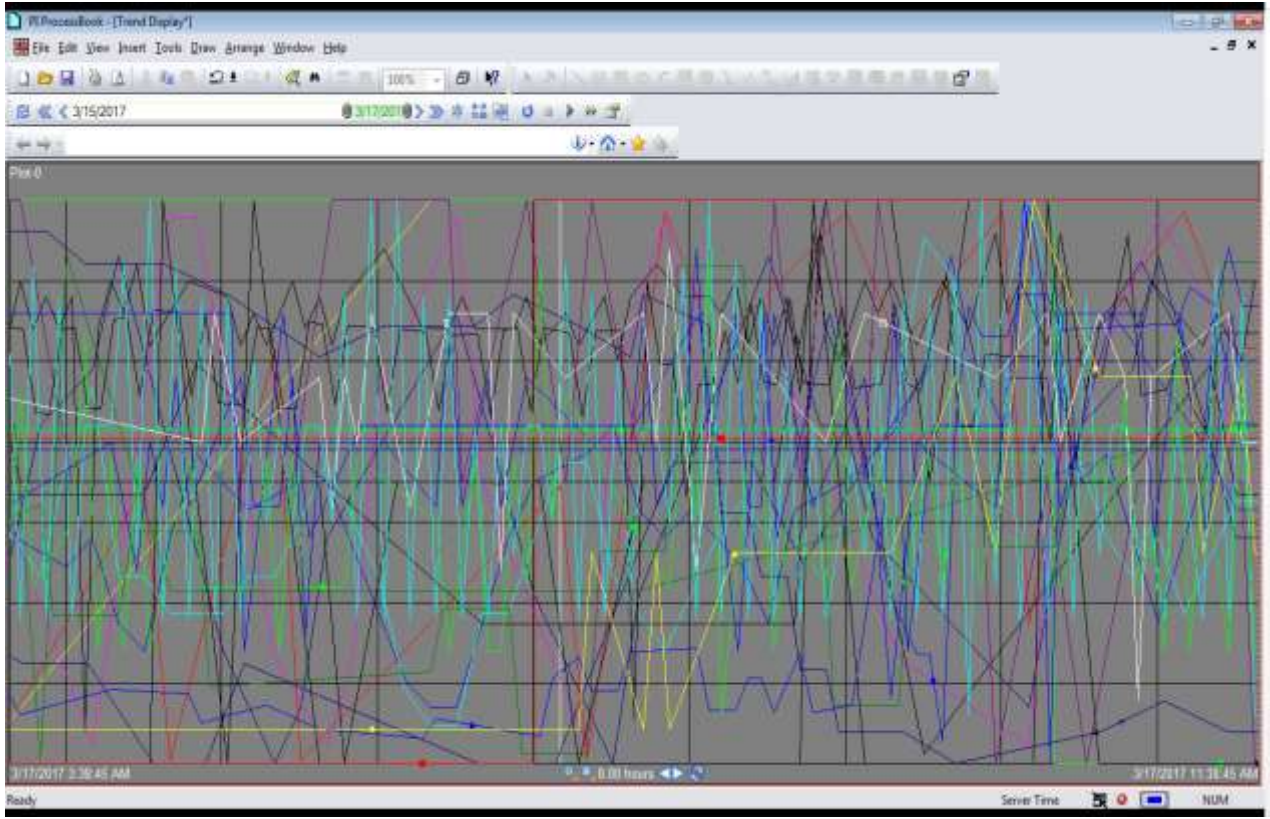
Web Portal with login access and download option

- HCCM Room Data
- Environmental Room Data
- Energy Dashboard
- Energy Heat Map



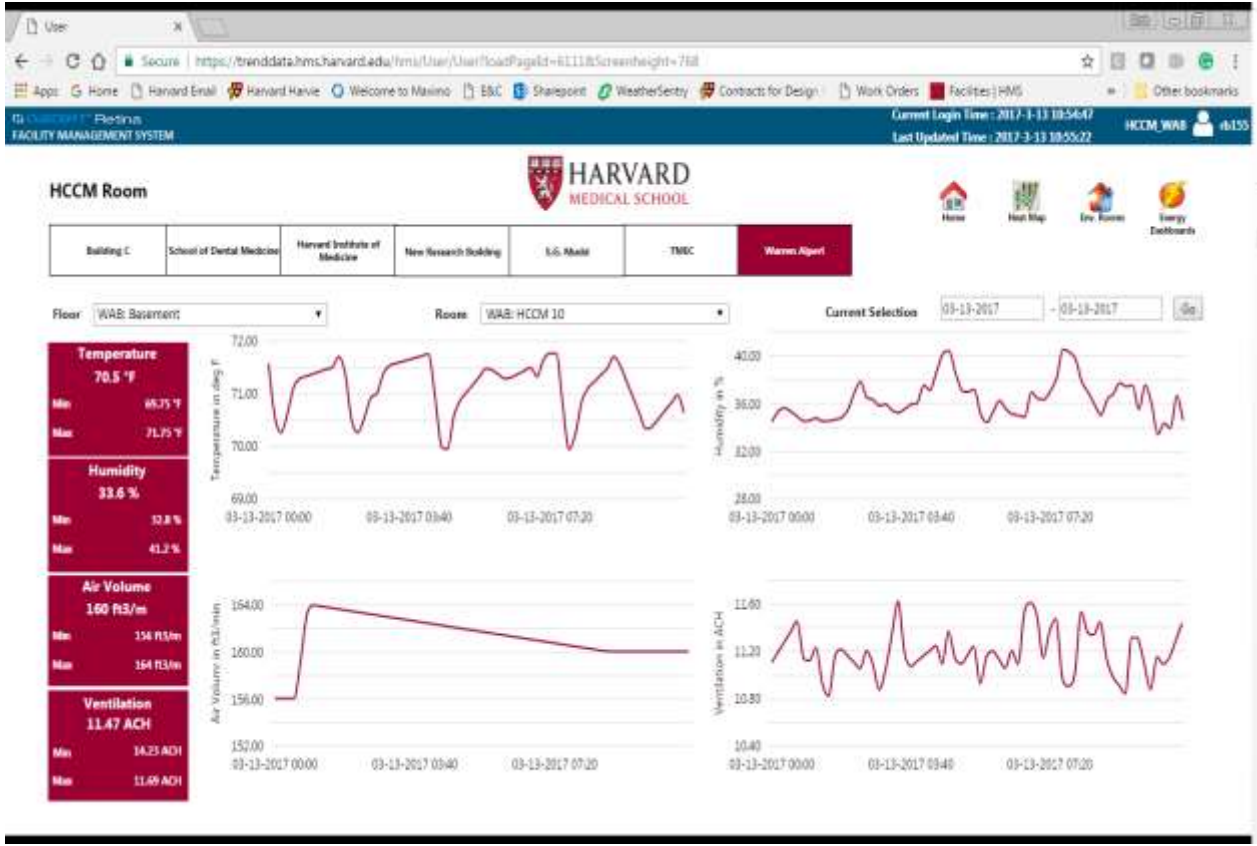
Sample of Vivarium Data

- Typical view of data sent to principal investigators
- Temperature, Pressure, Humidity Data
- Difficult to spot outliers and get insights



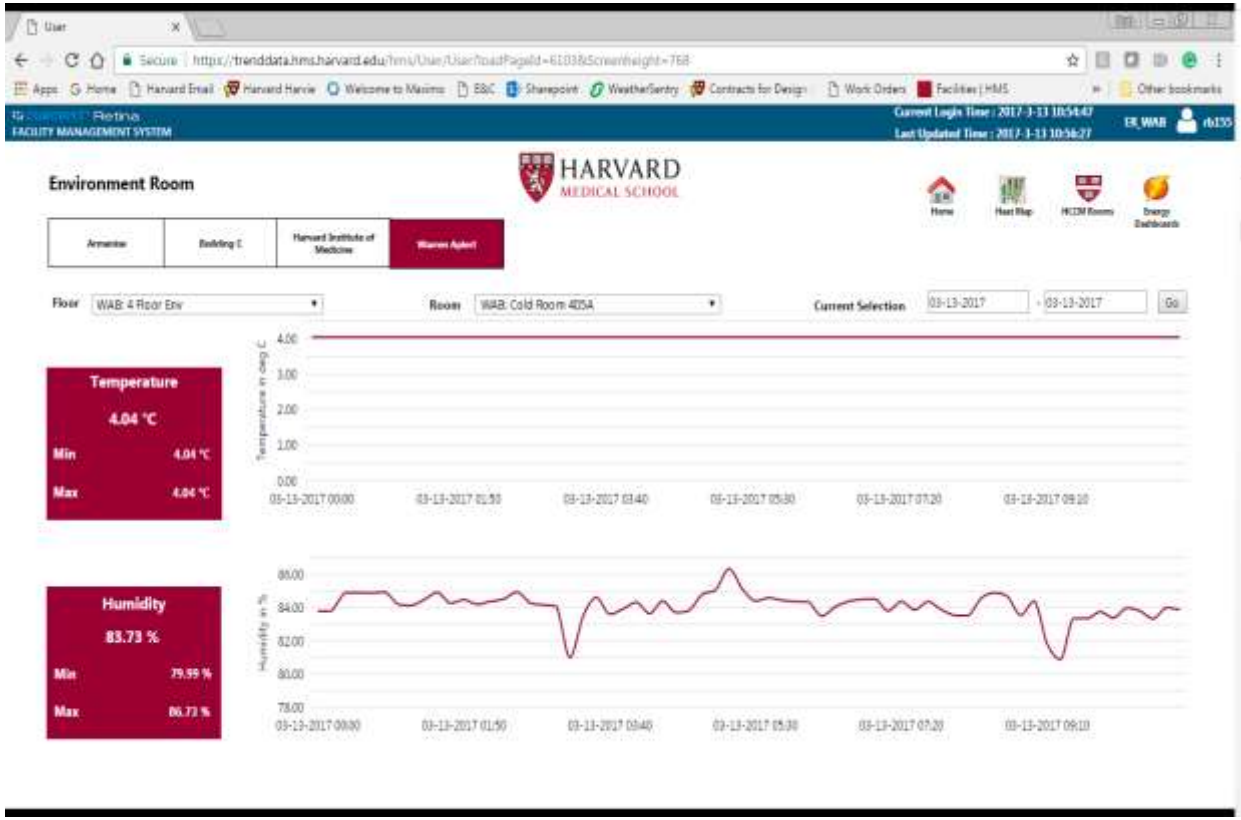
HCCM Room Data

- Simpler & Sharper View
- Individual access using HMS login
- Convenience for users
- Less work for facilities



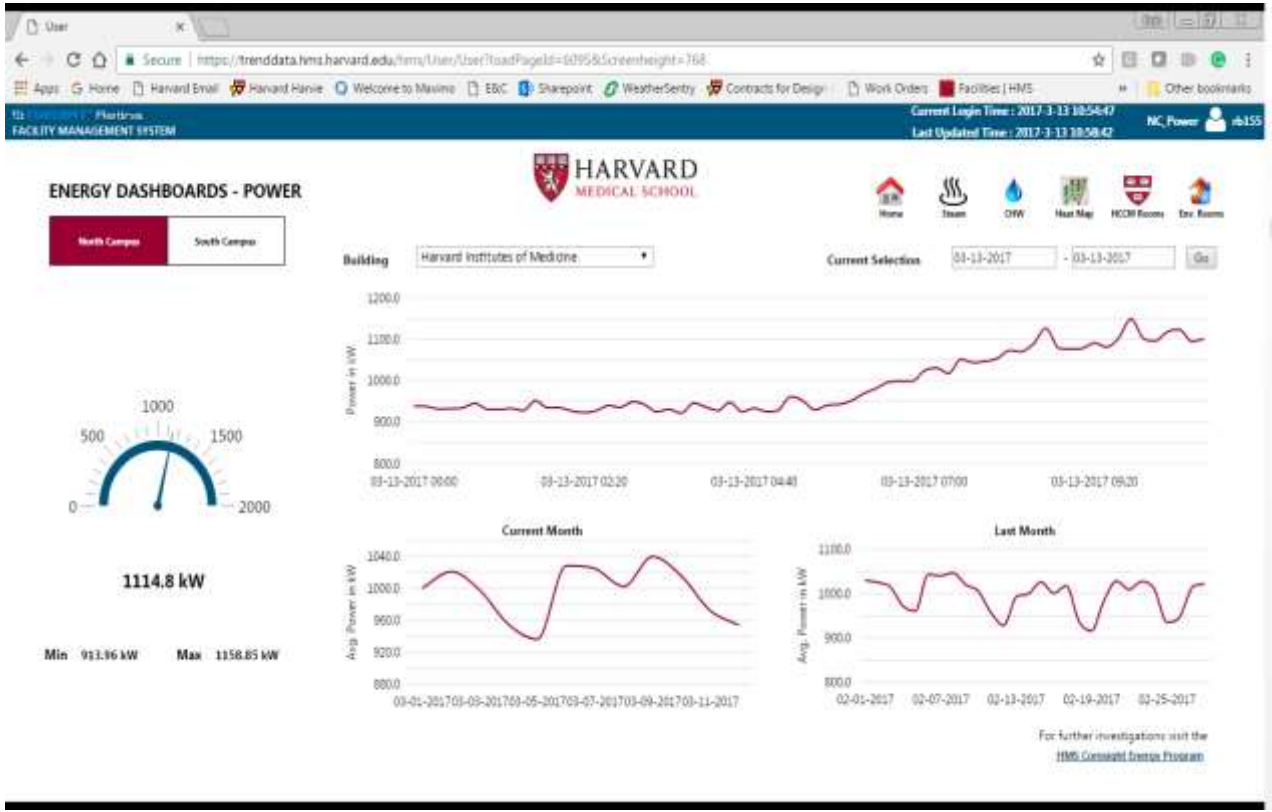
Environmental Room Data

- Simpler & Sharper View
- Individual access using HMS login
- Convenience for users
- Less work for facilities



Energy Dashboards

- Green initiative proactive participation
- Building Managers view – Day, Month, Year
- Faster identification on abnormal usage



Building KBTU Trend – Before & After

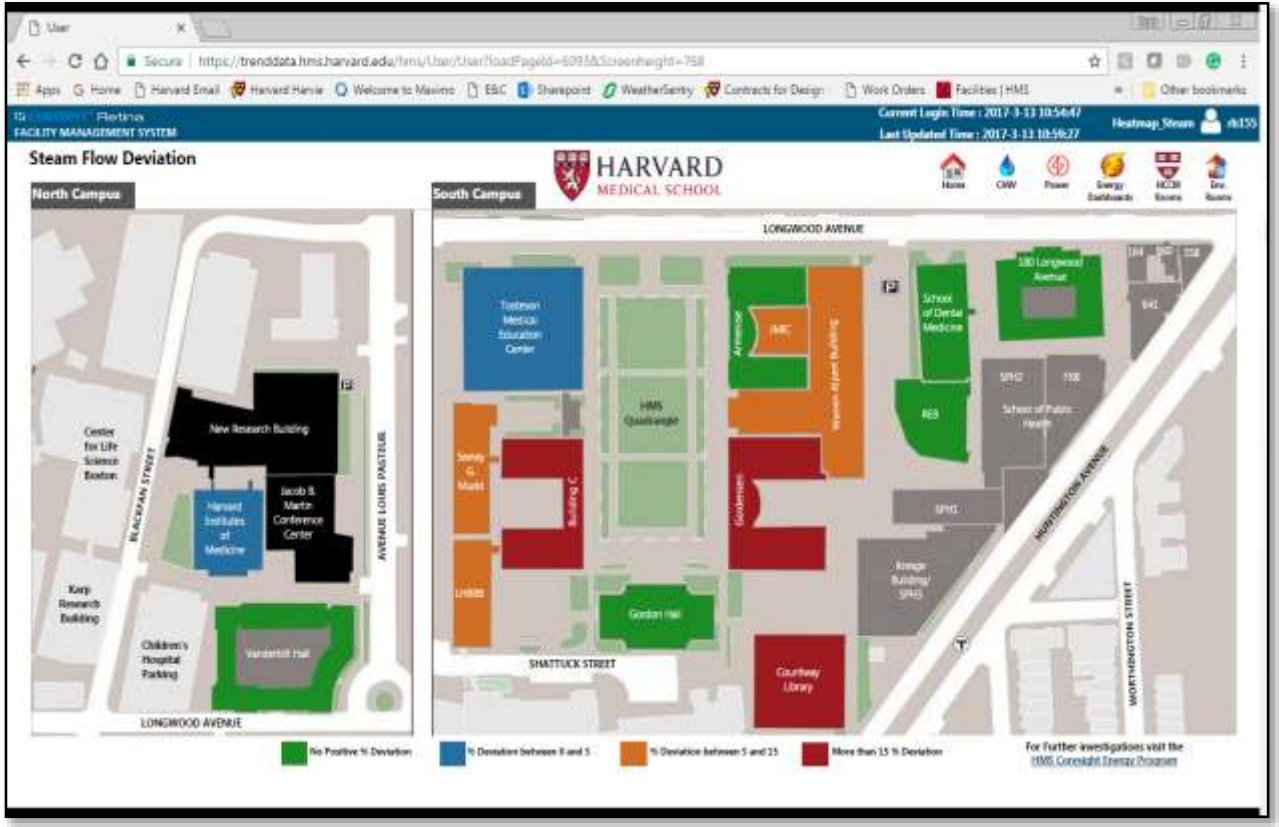
Energy consumption reduced by 15%

Buildings / Areas / Floors to analyze easily identified

Buildings	Total KBTU/sq.ft Jan-17	Total KBTU/sq.ft FY2016	Total KBTU/sq.ft FY2015	Total KBTU/sq.ft FY2014	Total KBTU/sq.ft FY2013	Total KBTU/sq.ft FY2012	Total KBTU/sq.ft FY2011	Total KBTU/sq.ft FY2010
Gordon Hall	140.46	140.26	135.27	132.53	134.39	131.25	144.91	139.34
Goldenson	206.50	196.82	214.50	233.58	218.73	218.05	230.00	226.82
C Building	201.16	200.46	218.29	264.27	250.99	185.44	192.30	227.33
Armenise	180.01	176.22	201.09	203.99	207.61	291.70	302.90	301.63
Modell	291.75	139.94	178.96	174.78	175.67	193.37	133.84	148.35
TMEC	195.61	191.11	160.64	182.85	197.64	192.98	212.14	214.72
180 Longwood	126.94	121.24	152.13	188.05	202.19	199.47	203.72	194.17
LHRRB	367.67	363.37	358.94	364.14	372.30	365.21	375.29	379.16
Mudd	400.84	401.60	466.59	499.94	462.12	409.63	421.72	392.07
Warren Alpert	267.27	291.64	310.60	313.11	317.74	312.28	338.71	298.81
Vanderbilt	94.99	95.01	95.51	103.50	116.48	97.81	99.41	86.36
Countway	167.27	154.24	175.22	150.51	162.37	179.62	213.15	183.85
Dental Total	256.49	234.62	277.68	301.58	312.91	281.72	340.11	328.01
NRB	250.70	233.13	291.77	325.88	304.24	277.51	307.18	278.85
HIM	439.53	486.16	509.56	519.84	479.06	471.95	446.67	394.92
Total	249.13	248.63	276.81	294.86	285.74	273.81	290.64	269.93

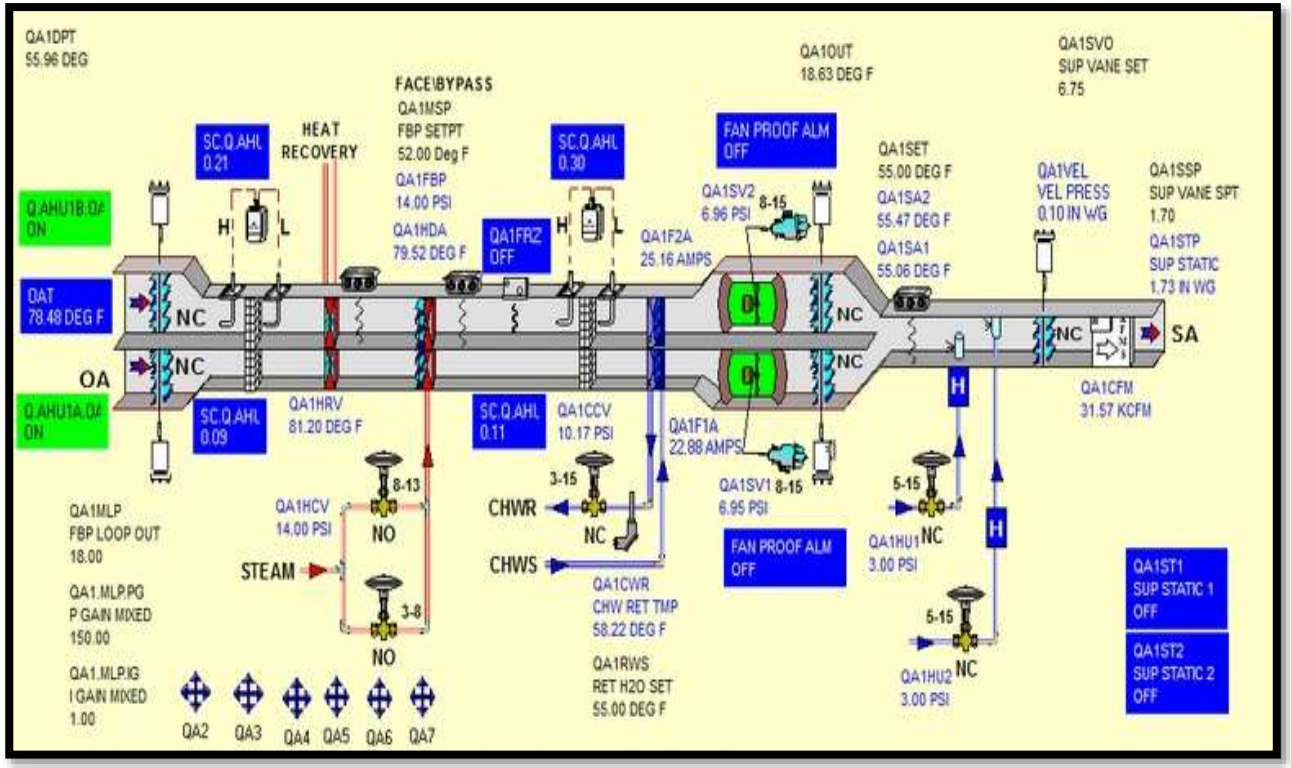
Campus Energy Heat Map informs building managers

- Avoids peak power and abnormal energy bills
- Real time view of Electricity, Steam & Chilled Water
- Single view with drill down to floor level
- Color Coding for easy outlier identification
- Linked into PI Notifications



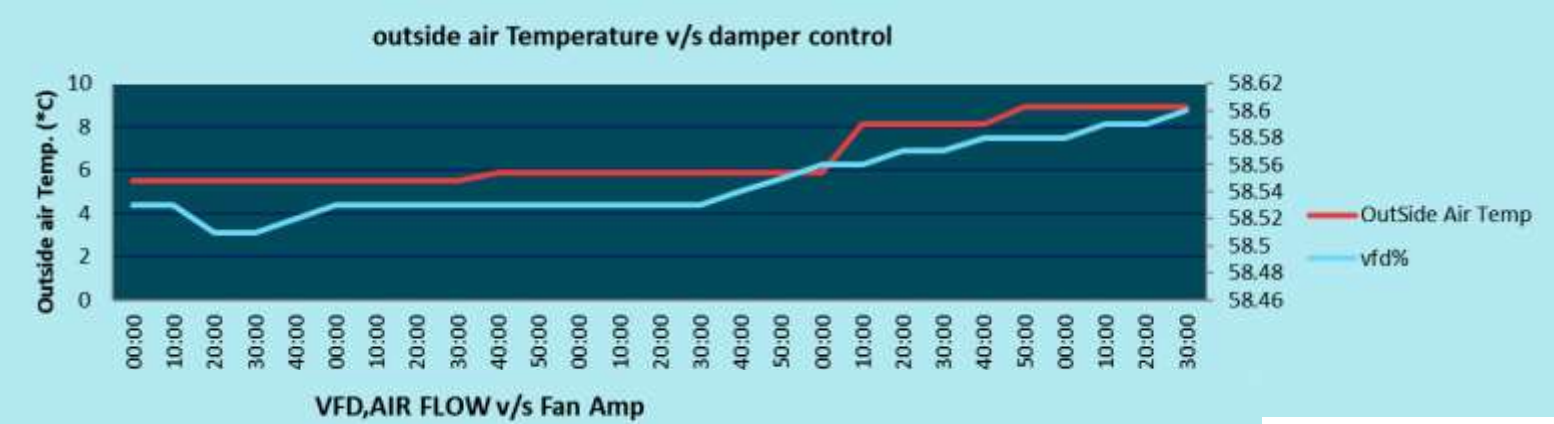
Asset data provides insights for decision making

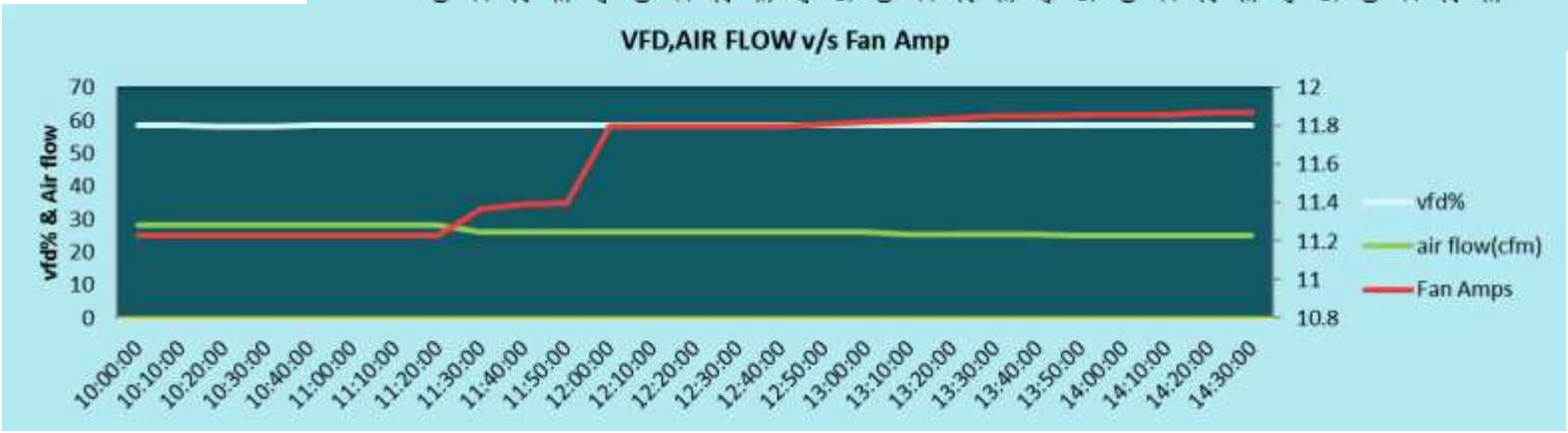
- Challenges - Improper Steam utilization, Sensor validations, KPI relations
- Timely service needs & Lower maintenance cost
- Increased efficiency Improves asset utilization
- Prioritization during budget allocation
- Data Analysis Methods
  - Expert Logic
  - Pattern Analysis
  - Regression



Maintenance, Operations, Purchase, Senior mangement uses these data

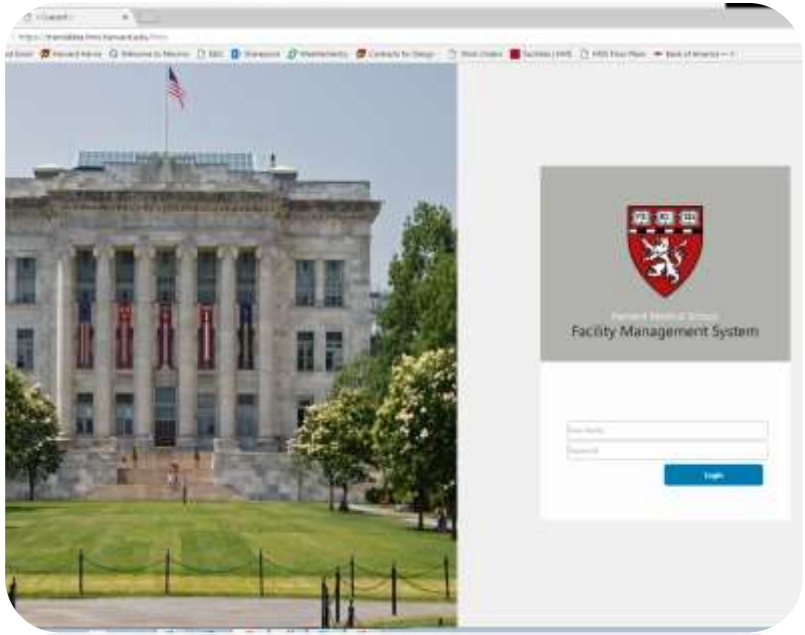
Illustration





Tour of HMS putting data to work

https://trenddata.hms.harvard.edu/hms



Use data → Make life easier

COMPANY and GOAL

HMS is primarily a research facility with medical education. The goal of the facilities department is to create and energy efficient environment to provide the best place to conduct the schools mission to end human suffering from dieses.

HARVARD MEDICAL SCHOOL

CHALLENGE

Though data was available in real time decision making was difficult.

- Operations (stakeholders) were with no access stopping them to make decisions
- Energy usage was high but reason couldn't be found unless analysis was run
- Assets reliability
- Providing 100% outside air and energy requirements of lab building in the most efficient way.

SOLUTION

Data gathering, Processing Contextualization, Visualization with easier access → **Analytics**

- PI Connectors, PI Notifications
- PI Asset framework, PI Coresight
- Expert logic, Pattern analysis, Regression

RESULTS

Effective use of data improved operations, reduced energy consumption and improved asset reliability

- Happy internal customers for facilities team
- Energy consumption reduced by 15%
- Improved fault identification reducing downtime

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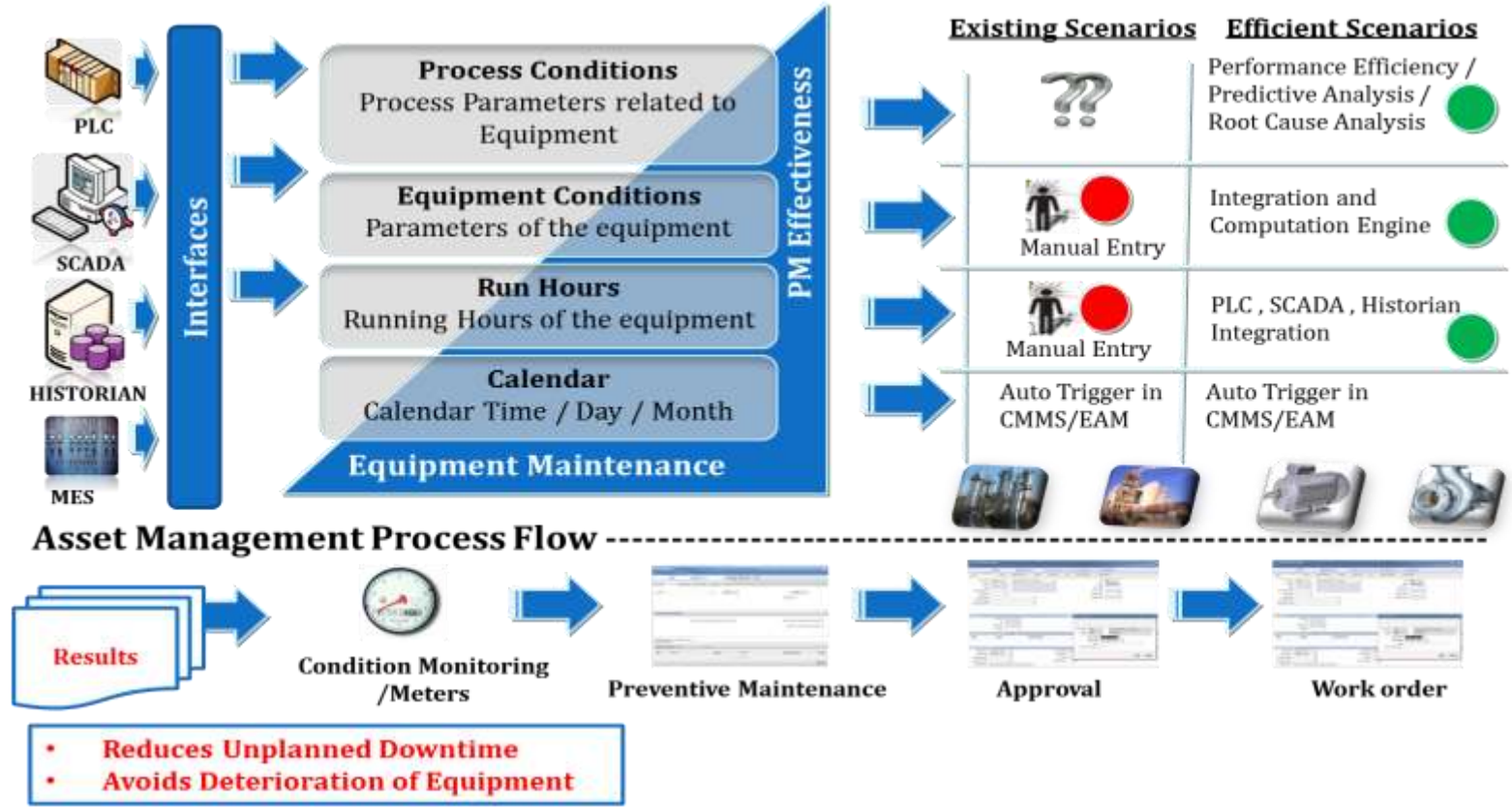
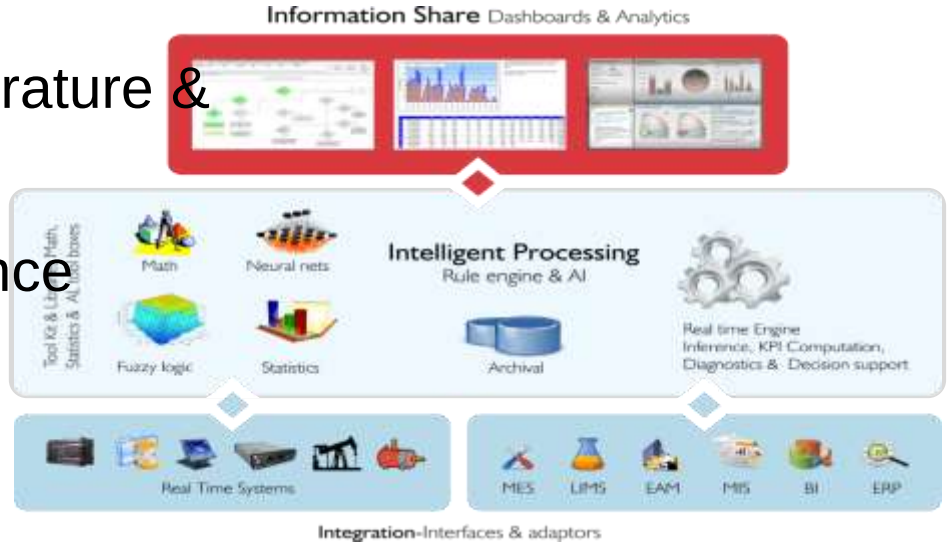


Next Steps in AI type Analytics for HMS

- Energy Analytics beyond Temperature & Enthalpy
- Predictive Equipment Maintenance
  - Fault Detection
  - AI assisted troubleshooting
- Automatic Work Order Generation
- Real time Peak Power recommendations
- Meter fault predictions



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감사합니다

谢谢

Danke

Gracias

Merci

Thank You

ありがとう

Спасибо

Obrigado