

# Intelligent Dashboards From Lab to Market

Presented by **Bertrand Lasternas**  
**Carnegie Mellon University**

# Intelligent Dashboards

Demonstrate real-time, analytic and visualization capabilities to integrate, monitor and diagnose building performance indices.

Generate knowledge and distribute it through the decision chain from the Occupant to the City Level.



## Business Challenge

- Monitor, diagnose and optimize building performance.
- Inform, engage, empower occupants, building executives, decision makers.

## Solution

- PI Server, PI AF, PI ProcessBook, PI Coresight, PI WebServices, PI WebParts
- Microsoft 365 solutions
- CMU dashboards and innovative solutions

## Results and Benefits

- Ensure Energy Savings and Carbon footprint reduction.
- Increase Occupants Comfort, Satisfaction and Productivity.
- Prioritize investments and retrofit actions.

# Why didn't we save energy?

**We had no idea what we were using**

**We had no idea how important it was**

**There was no easy way to change outcomes**

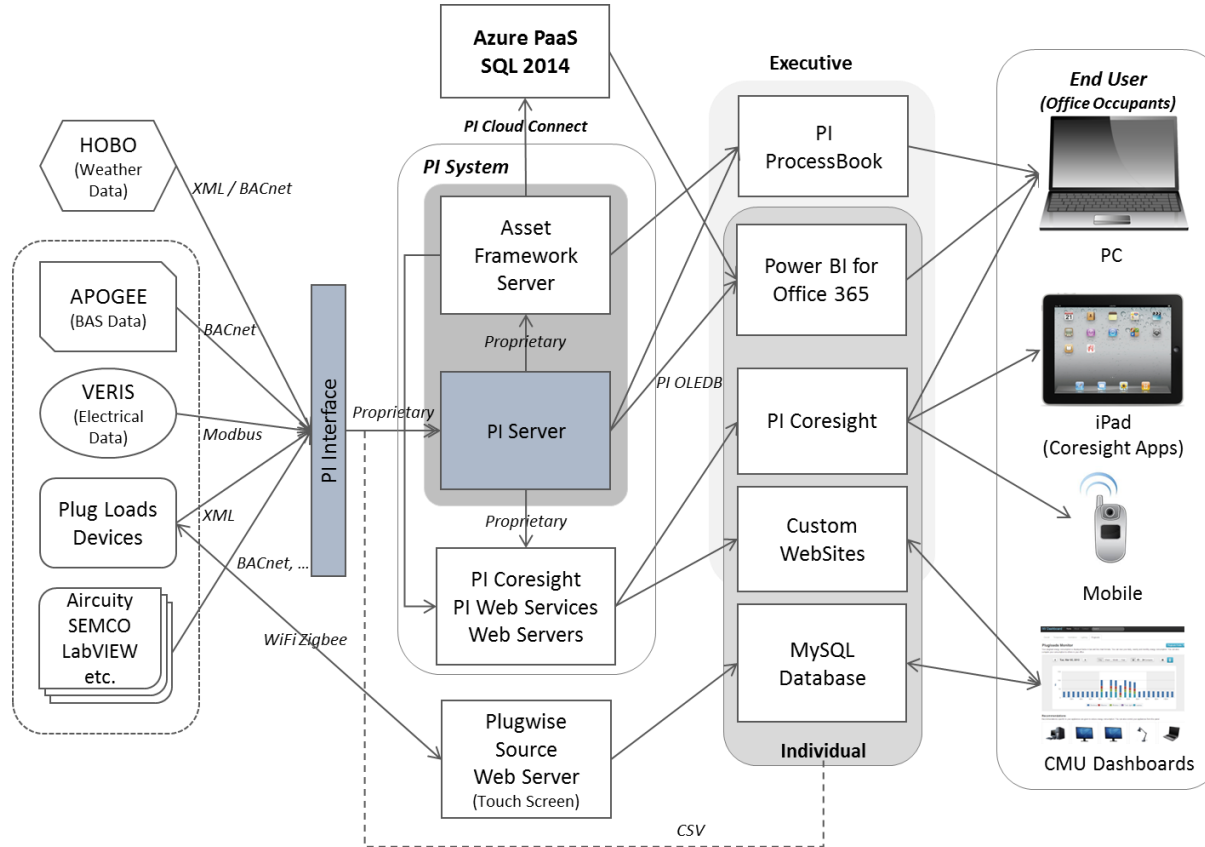
**We could not do numbers**

# What are the steps?

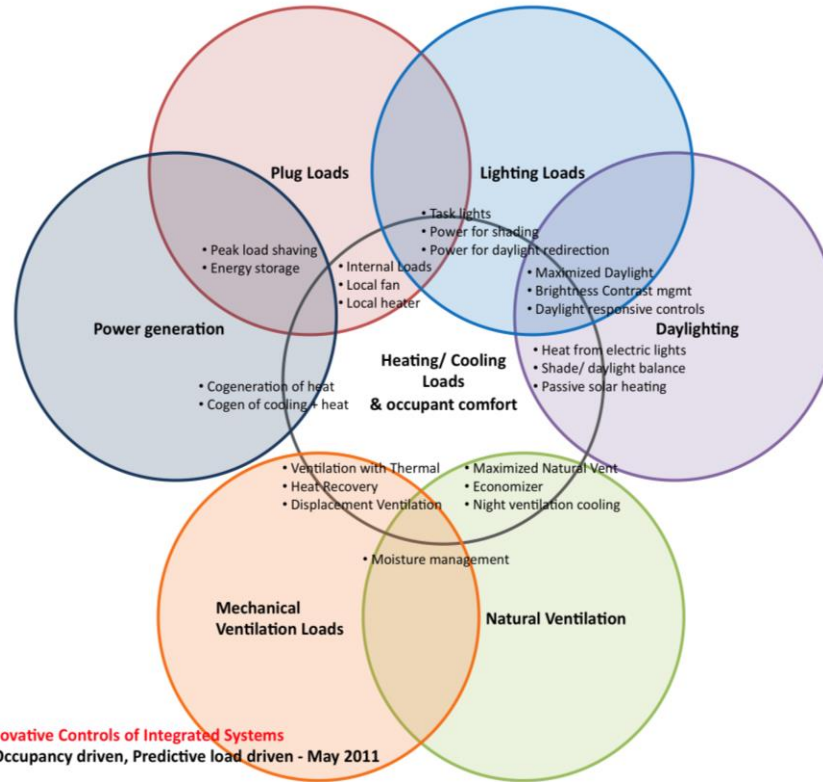
1. **Integrate all information**
2. Continuously **monitor and diagnose** building performance
3. Make information accessible to **Facility Managers and Executives**
4. Display information for **Building Occupants**
5. Display information for **the Public (Disclosure)**
6. Enable Building Occupants to **control their environment**

# How do we do this?

## PI System + CMU Dashboards + Microsoft Power BI “stack” solutions



# Why an integrated platform?



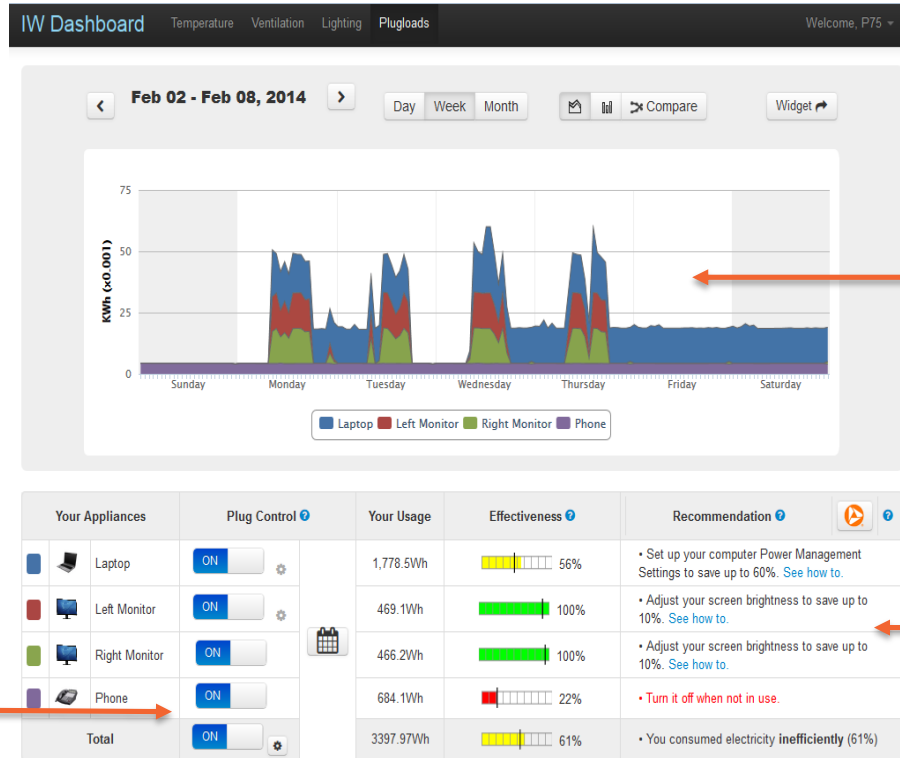
# Levels of Engagement

- Individual (ID-O)
- Facility Executives (ID-F)
- Campus, Corporate & City Leaders (ID-C)

**What are the best Dashboards for each?**

# (ID-O) Engaging occupants to save plug load energy

## Dashboard C<sup>3</sup> Features



Communication

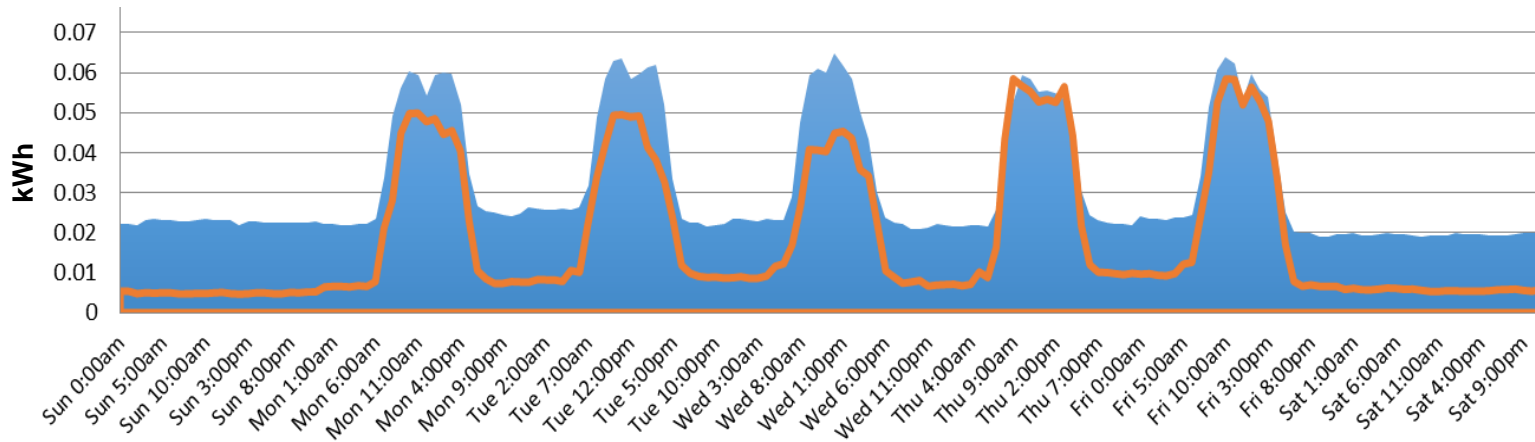
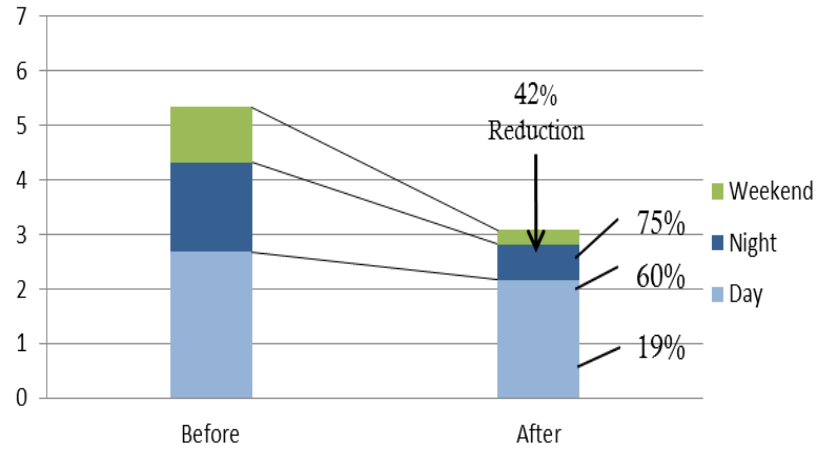
Control

Expert Consulting  
[Recommendation]

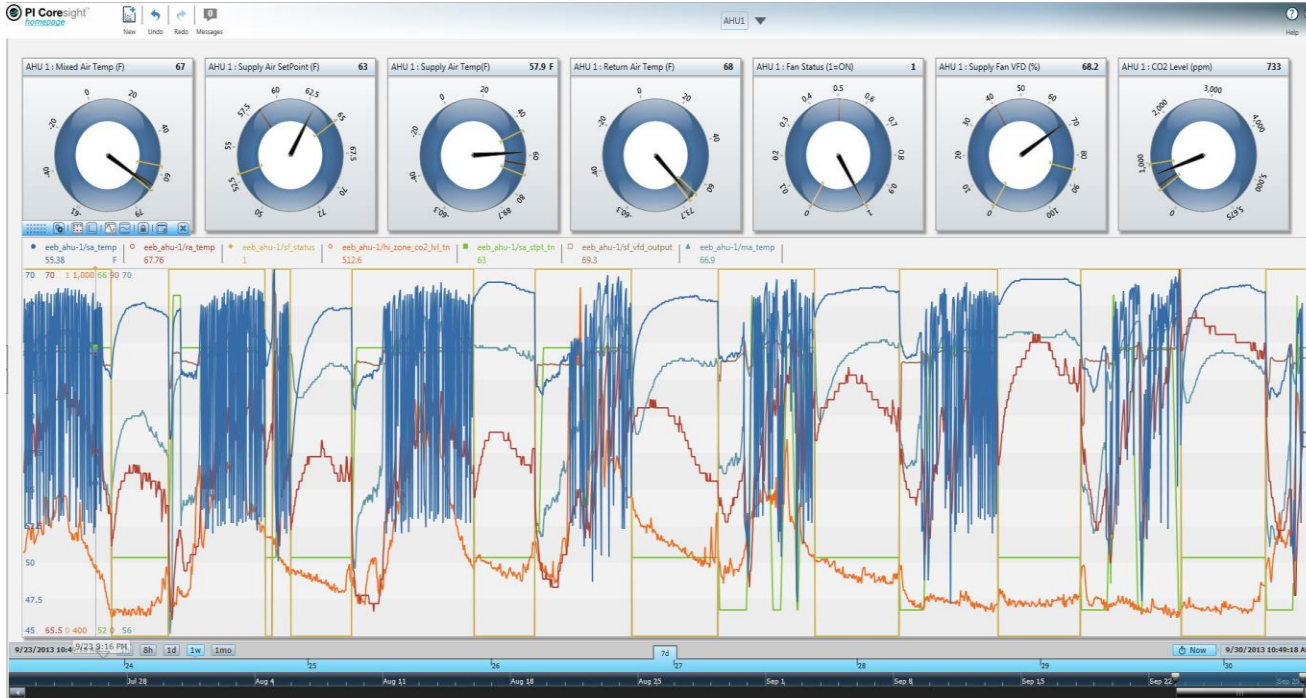
© Intelligent Workplace Dashboard 2013



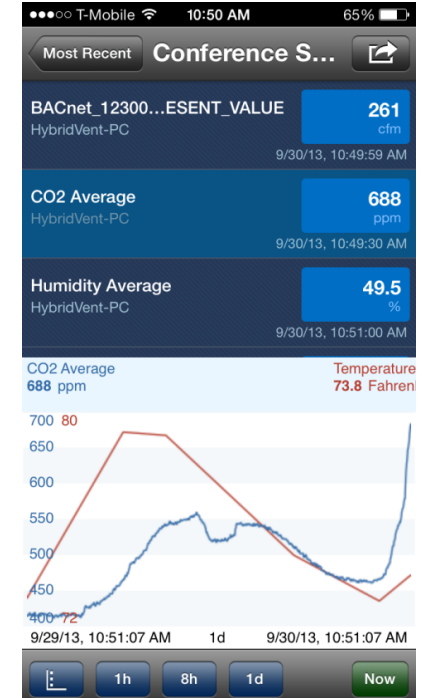
# From Lab to Market : Implementation



# PI Coresight Occupant Dashboards

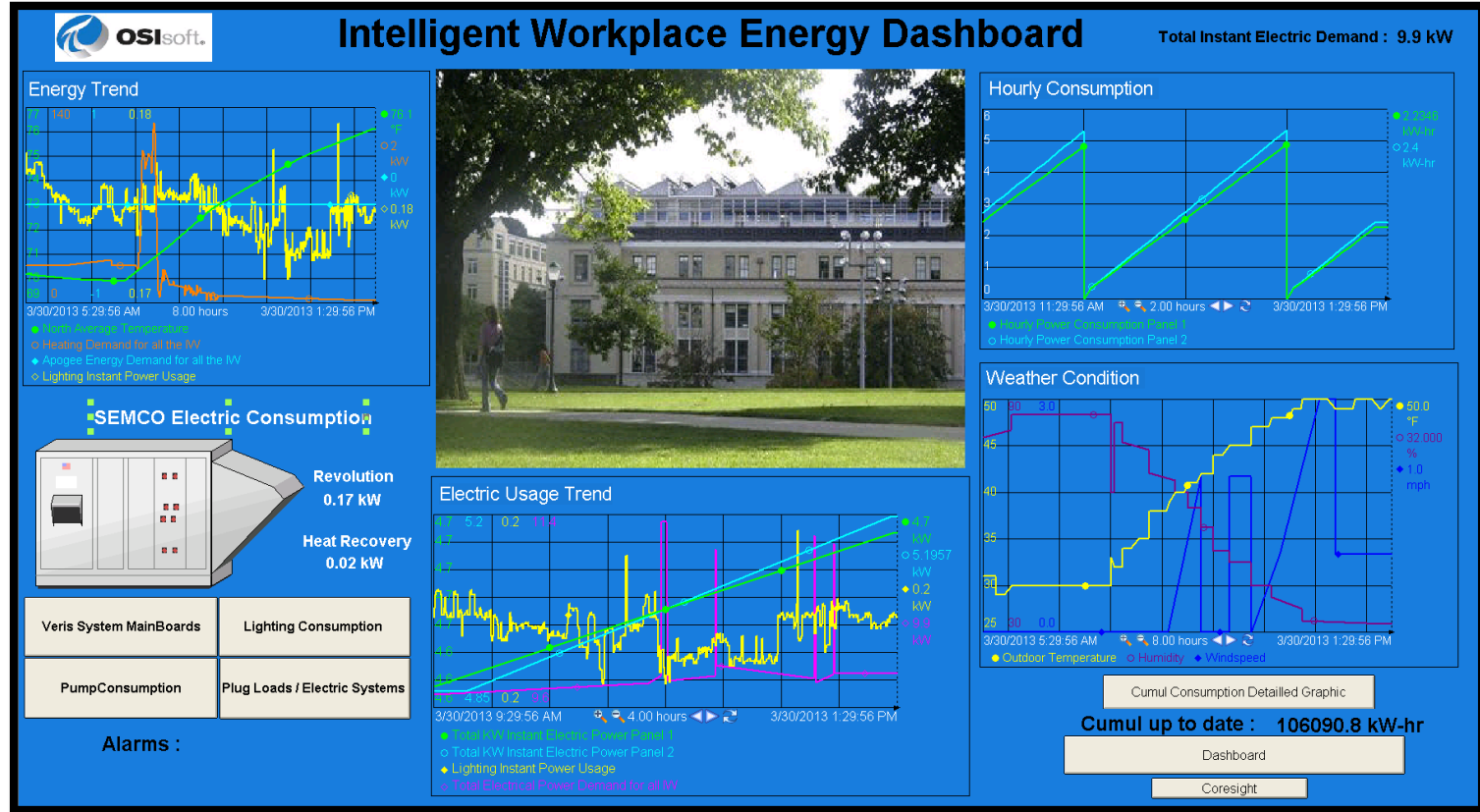


Online webpage and tablets interface

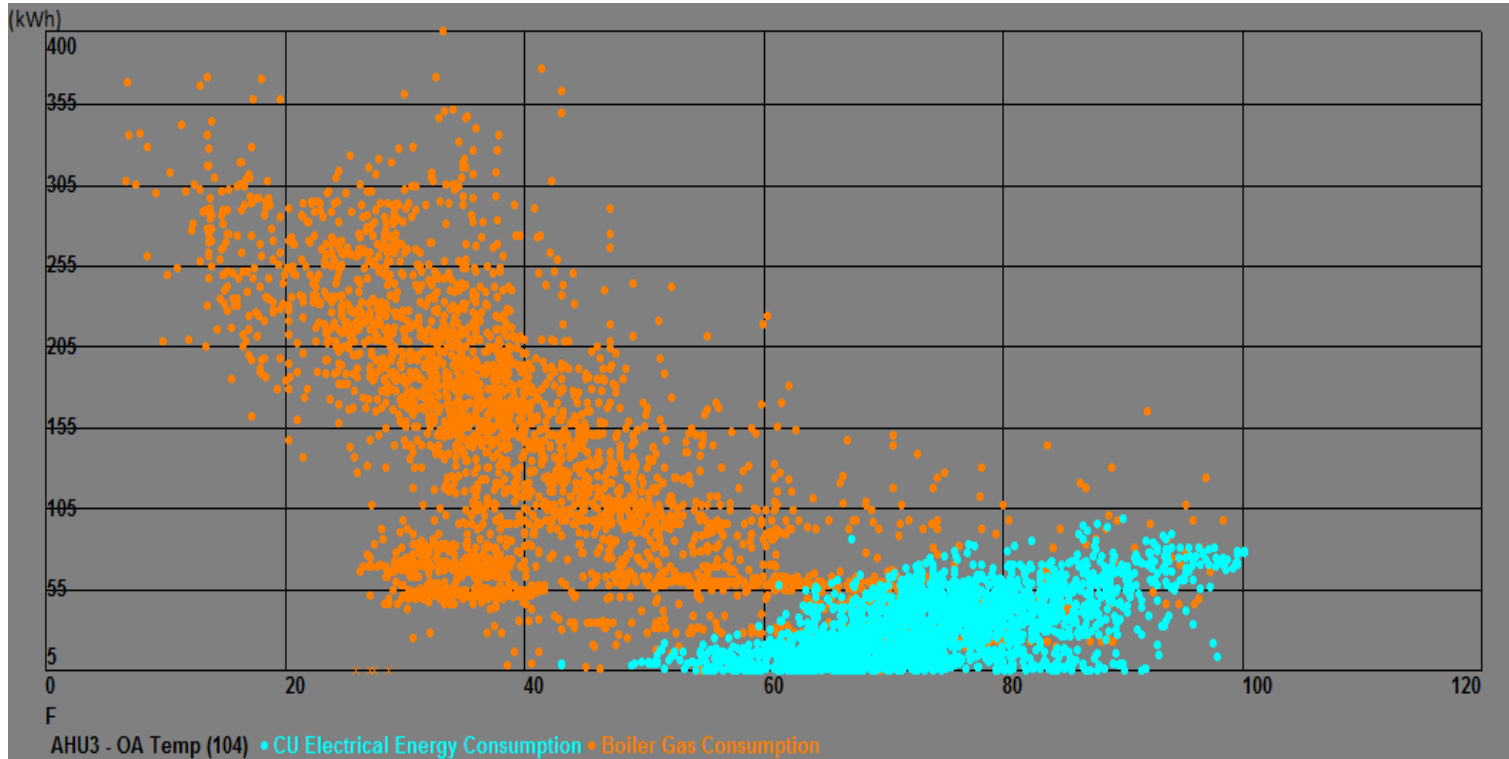


iPhone interface

# (ID-F) Facility Manager Dashboards

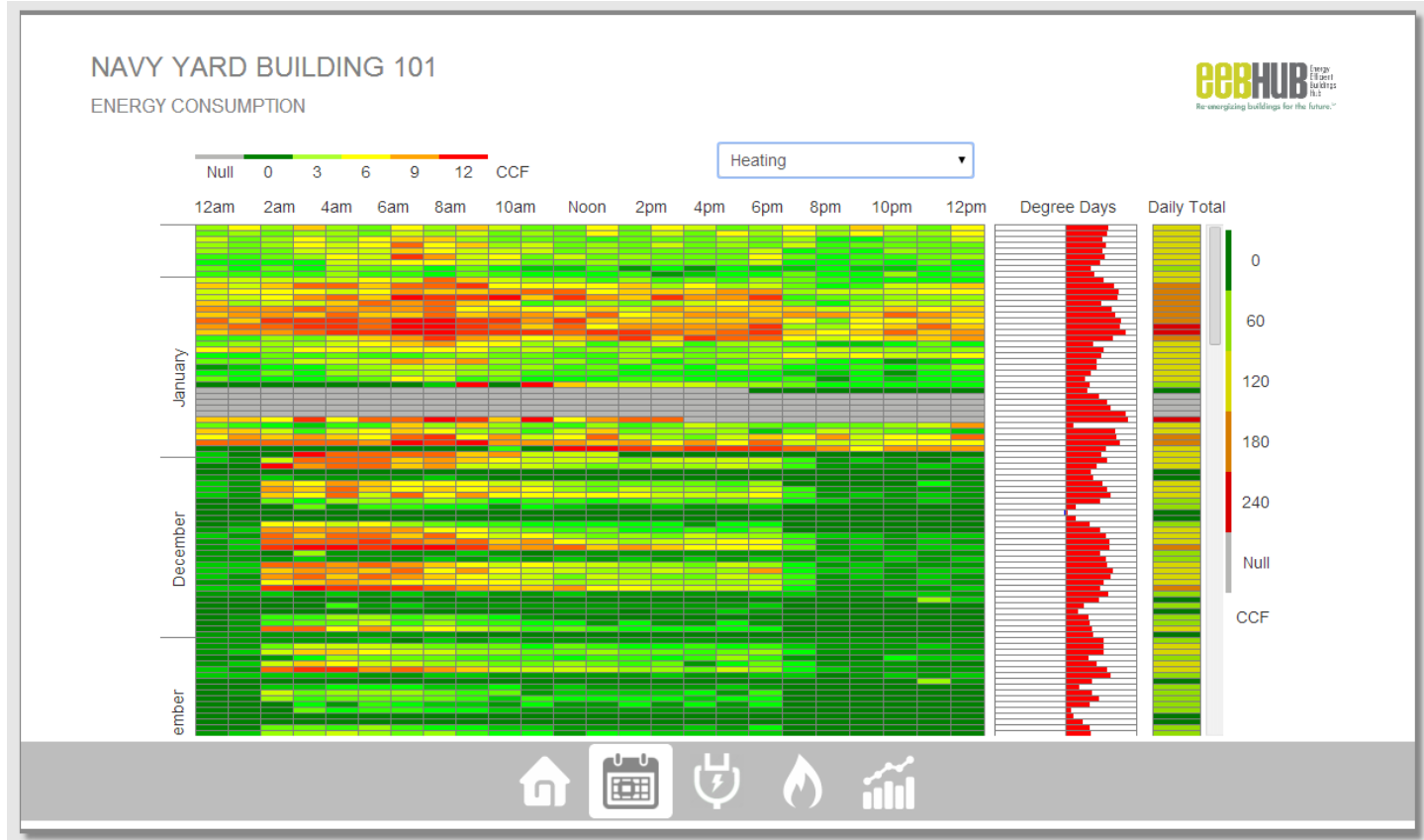


# (ID-F) Data Analytics

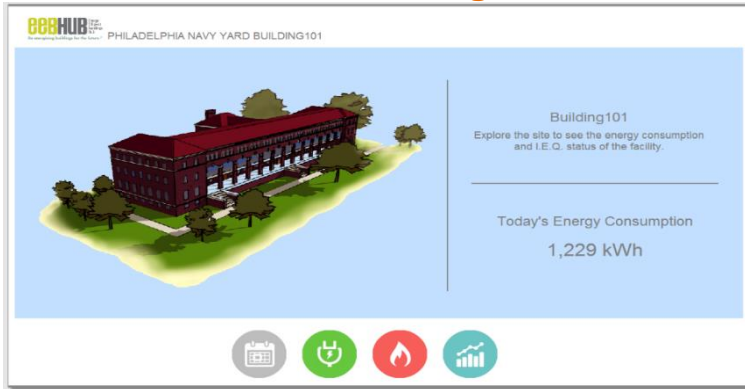


Real Time Measured data for meaningful diagnostics

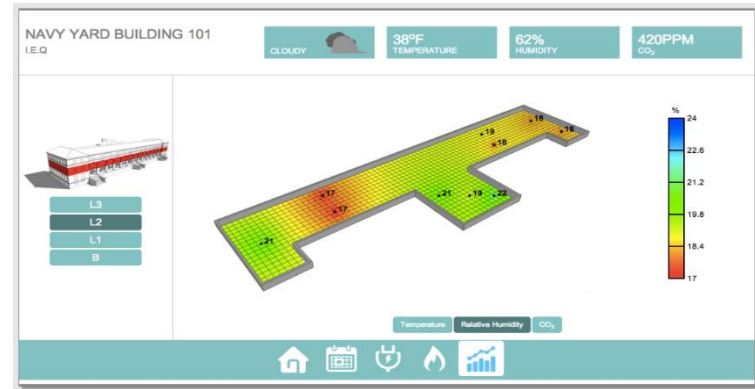
# Energy Map



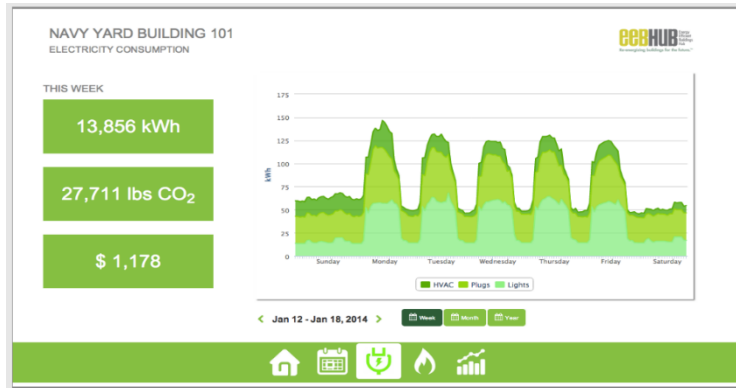
## Welcome Page



## Real-Time IEQ Status



## Electrical/Gas Trending



## Energy Consumption Maps (8760 hrs/1 yr)



Customized Data Displays through PI Web Services



# Bring Researchers together :EEBHub

## Second Floor

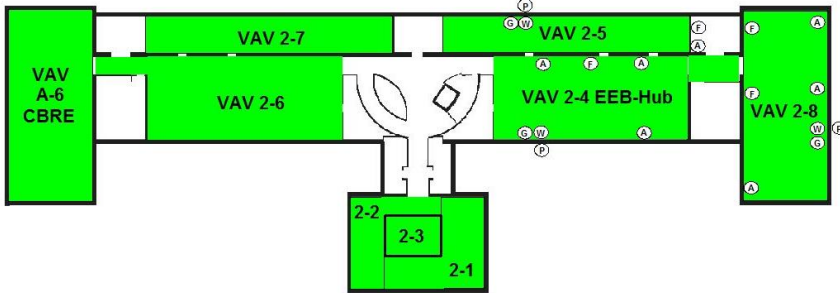
W Wall Sensor    A Aircurity  
P Pyranometer    G Glazing Sensor

Outside Air Temp.	73.4	F
Outside RH	49.4	%
Exterior Condition		

Zone CO2	573	ppm
Zone RH	45	%
Zone Temp	74.9	F
Discharge Air Temp.	63.5	F
Air Flow Rate	1880	cfm
206_VAV_2-7		

Zone CO2	534	ppm
Zone RH	46	%
Zone Temp	73.0	F
Discharge Air Temp.	62.8	F
Air Flow Rate	1435	cfm
222_VAV_2-5		

Zone CO2	495	ppm
Zone RH	45	%
Zone Temp	72.7	F
Discharge Air Temp.	62.7	F
Air Flow Rate	1029	cfm
227_VAV_2-8		



Zone CO2	587	ppm
Zone RH	47	%
Zone Temp	73.9	F
Discharge Air Temp.	63.7	F
Air Flow Rate	3135	cfm
201_VAV_A-6		

Zone CO2	543	ppm
Zone RH	45	%
Zone Temp	74.8	F
Discharge Air Temp.	63.5	F
Air Flow Rate	2216	cfm
205_VAV_2-6		

Zone CO2	516	ppm
Zone RH	49	%
Zone Temp	72.5	F
Discharge Air Temp.	72.0	F
Air Flow Rate	588	cfm
214_VAV_2-1		

Zone CO2	530	ppm
Zone RH	43	%
Zone Temp	74.8	F
Discharge Air Temp.	62.4	F
Air Flow Rate	1463	cfm
223_VAV_2-4		

Zone CO2	544	ppm
Zone RH	46	%
Zone Temp	74.8	F
Discharge Air Temp.	72.8	F
Air Flow Rate	245	cfm
212_VAV_2-2		

Zone CO2	519	ppm
Zone RH	44	%
Zone Temp	75.3	F
Discharge Air Temp.	72.9	F
Air Flow Rate	90	cfm
213_VAV_2-3		



AHU1 Building Automation System 9/30/2013 10:25:00 AM  
Hub Scientific Database 9/29/2013 12:01:00 AM

Return Air Temp.	68.0	F
Damper Position	84	%
Return Air Temp.	74.2	F
Return St. Pressure	-0.07	in
Return Air Humidity	42.2	%
Return Air CO2	467	ppm
Return Air		

Mixed Air Temp.	67.0	F
Mixed Air Static Pres.	1.15	in
Return Air Temp.	74.2	F
After Filter St. Pres.	-0.07	in
Mixed Air Humidity	42.1	%
Mixed Air		

Return Air Flow (calc)	-0.07	in
OA Air Flow	1.6	cfm
Supply Air Flow	0	cfm
Systems Flow & Energy		
Temperature	67.6	F
Static Pressure	-0.07	in
After Heating Coil		

External Pressure	1.12	in
External Pressure Stpt	1.13	in
Temperature	57.9	F
Temperature Stpt.	63.0	F
Avg. Supply Velocity	0	fpm
Avg. Supply Temp.	75.5	F
Supply Air Temp.	75.6	F
Supply Air St. Pressure	-0.07	in
Supply Air RH	40.4	%
Supply Air CO2	522	ppm
Supply Air		

OA Temp	73	F
OA Humidity	49	%
Damper Position	16	%
Avg. Fresh Air Temp.	64	F
Avg. Fresh Air Veloc.	0	fpm
OA		
Damper Position	13	%
Outside Air		

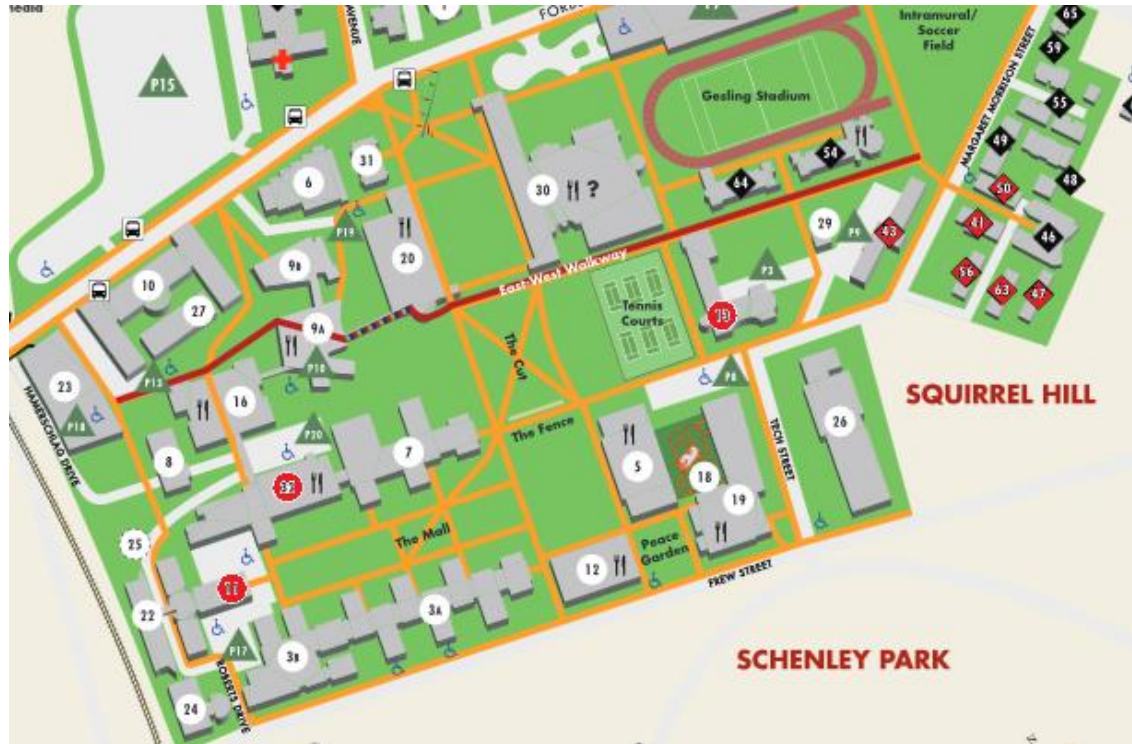
Status HW Heat. Valve	0	%
HW Temp. Supply	79	F
HW Temp. Return	77	F
HW Heating Energy	0	Btu/h
Status HW Heat. Valve	81	%
Heating Coil / Boiler		

Hot Gas Bypass Temp.	74	F
Liquidline Temp.	63	F
Evap. Coil & Cond. Unit		

Supply Fan Status	0	/
Fan Speed	76	%
Fan Speed	0	rpm
Fan		

More than 20 Universities can access and share real time building information

# (ID-C) Implementation on Carnegie Mellon Campus



Early stages : 9 Buildings monitored, to be expanded (work with Facility Managers)



# Urban Energy Information Modeling

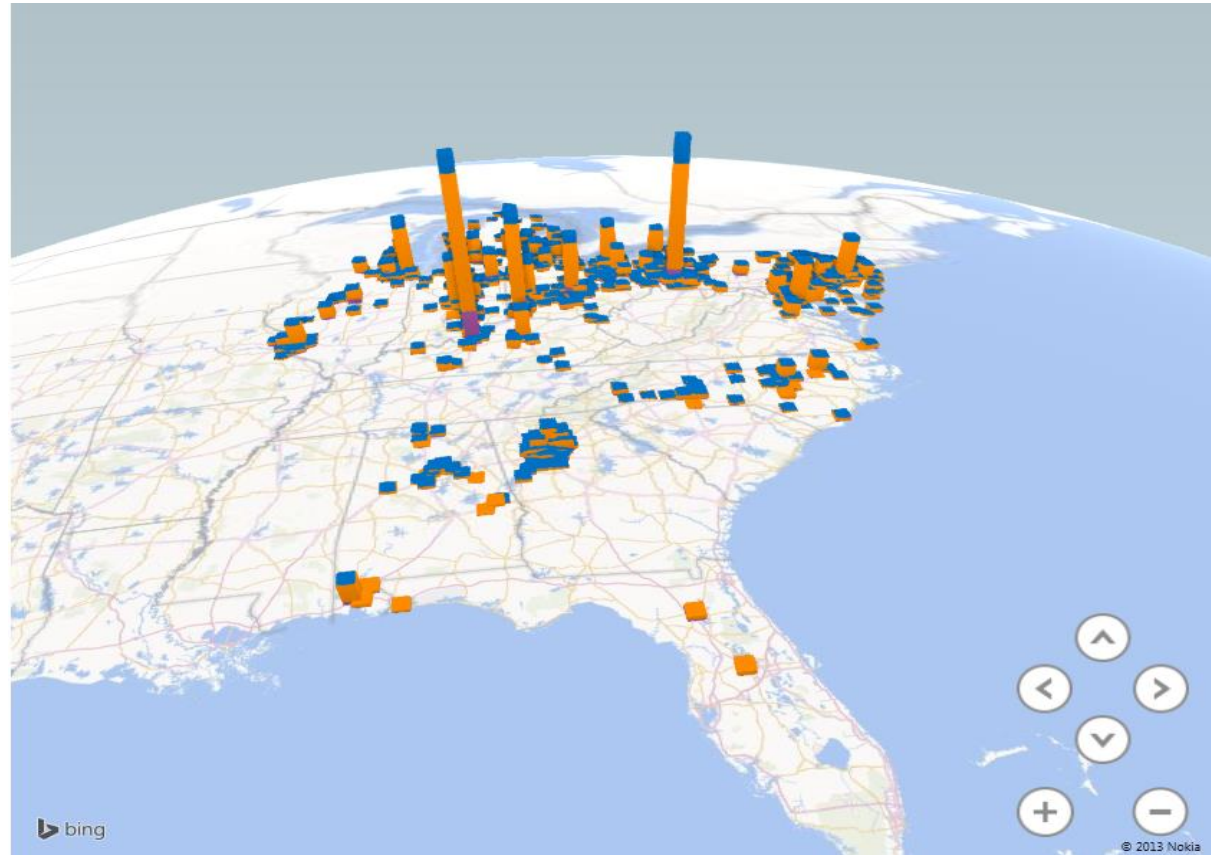
## Aggregated High Fidelity Building Simulation for District Energy Systems



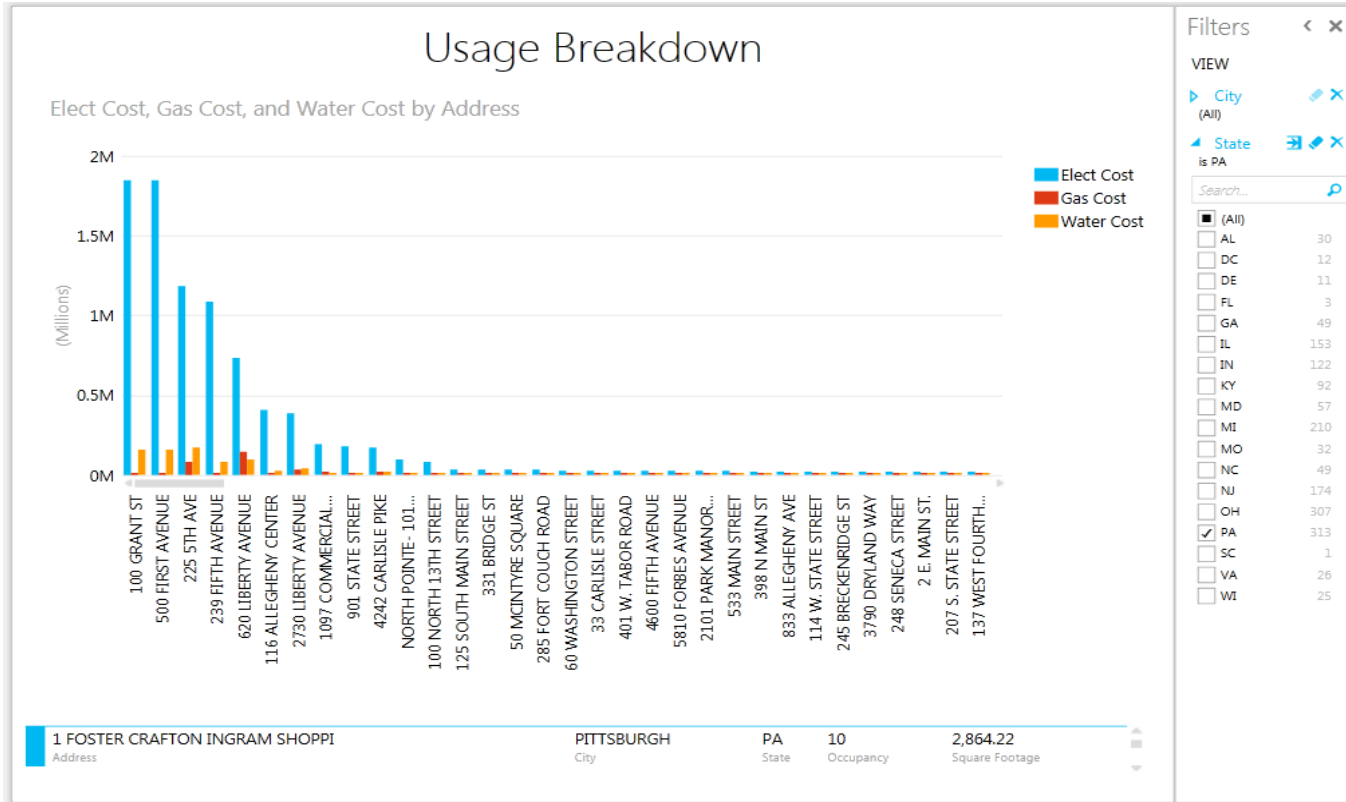
# Commercial Partner : Pittsburgh Bank

## ID-C Challenge :

To monitor and analyze a portfolio of 4000 Assets (Headquarter, datacenters, branches, ATMs) for strategic improvements



# Commercial Partner : Pittsburgh Bank



Query the Energy consumption breakdown of any building in 3 clicks

# Conclusion

- Drawing data from multiple sources
- With the most granular data available
- Linking Energy and IEQ
- Engaging the occupants, the facility managers and the portfolio leaders
- Creating Fast and Meaningful analysis
- Expanding the Knowledge chain  
(by data sharing through integrated portals)

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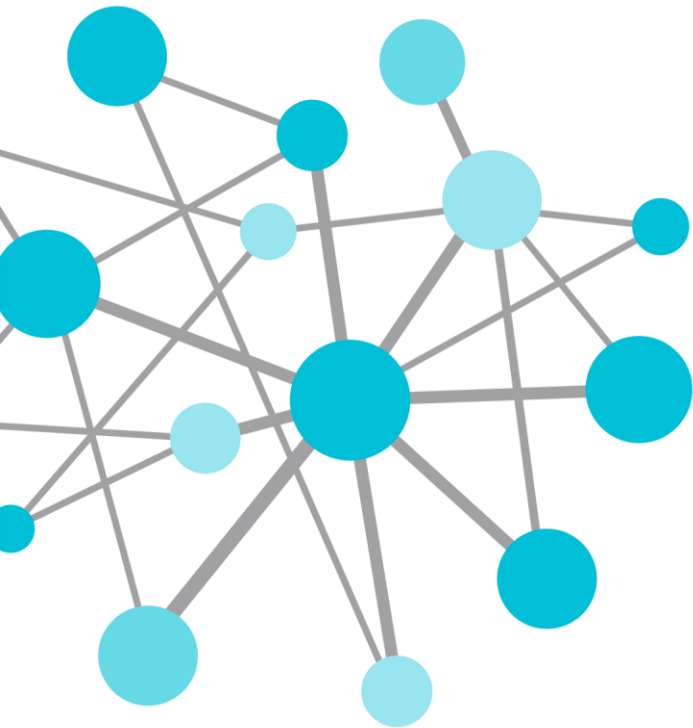
Researcher

Carnegie Mellon University

## Intelligent Workplace Team:

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Chenlu Zhang, Leah Mo, Ray Yun, Sebastian Peters...



THANK  
YOU

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