# WELCOME

## Facilities, Water, and Energy Management

Presented by **David Doll, Industry Principal**

**Gary Wong, Industry Principal**



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# Agenda

- Welcome
- Business Challenges
  - Facilities and Energy Management
  - Water
- United Utilities
- Summary for the day


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# WELCOME to Day Two


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# Day One – Did you see…

- Transforming Your World
- Roadmap: PI Vision, New Integrators, Edge
- Billy Beane and data driven baseball
- Discussion forums
- IoT, IoT, IoT


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# Facilities and Energy


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# How big is the problem?

**6**
**MILLION**
commercial buildings and industrial facilities in the United States[1]

**40%**
percentage of all U.S. greenhouse gas emissions that are caused by commercial and industrial buildings[3]

**$400**
**BILLION**
combined annual energy costs of commercial and industrial facilities[2]

**30%**
portion of energy in commercial and industrial buildings used inefficiently or unnecessarily[4]

SOURCES
1 Energy Information Administration
2 U.S. Department of Energy
3 U.S. Environmental Protection Agency
4 https://www.energystar.gov/buildings/about-us/facts-and-stats


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# Lessons from last year




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# Happy World Water Day!
# 2017 Theme: Wastewater


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# Past Successes




**Reliability:** "Every front page news event Water Corporation can avoid saves them $1M." *Ian Scott, Asset Management Lead at Water Corporation*

**Metering:** Proactive by sending "leak" letters to customers. Saved one customer $21,000.




**Metering:** Found 7% more leaks.

**Energy:** Reduced energy costs by 6% across water operations.

**Forecasting:** PI is the center of their real-time big data strategy forecasting water demand to reduce energy and chemical costs.

"The PI System is an important part of the information system of Veolia Eau d'île de France. It has become the repository for all real-time measurement." *Guillaume Gallon, IT Manager, Veolia Water*


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# SFPUC's Wastewater Enterprise

San Francisco Water Power Sewer

Services of the San Francisco Public Utilities Commission





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# Adaptive Water Demand Forecasting for Near Real-time Management of Smart Water Distribution Systems

Presented by **Gary Wong & Kleanthis Mazarakis**

On behalf of **Kevin Woodward & Michele Romano**

United Utilities
helping life flow smoothly



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# Business Challenges & Drivers

- Regulatory and customer commitments
- Changing environment
- ODIs, Leakage, Blockages
- Reduce Totex – Capex and Opex
- Apply intelligence and innovation

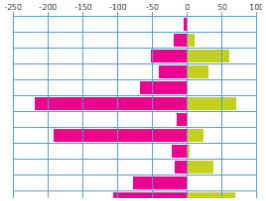






Ofwat

Towards Water 2020







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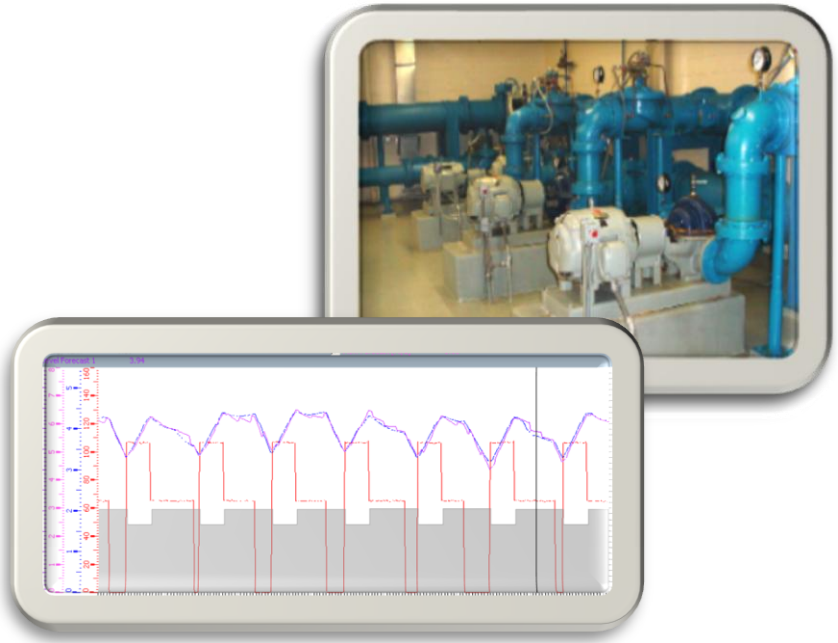
# Why do Demand Forecasting (DF)?

- DF provides indications of what the future customer demand will look like
- This has several applications in United Utilities:
  - Pump Scheduling
  - Production Planning
  - Event Recognition
  - Dynamic Hydraulic Modelling
  - … Many Others
- With associated business benefits:
  - Energy Savings
  - More efficient Operations
  - Better Customer Service
  - … Many Others

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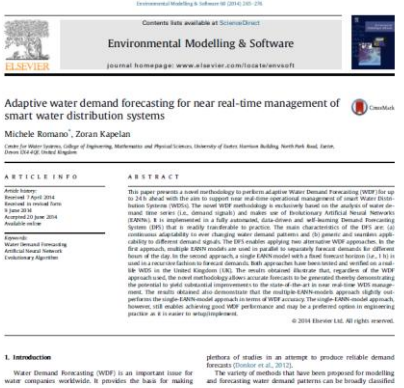
# DF Methodology

Predicts water demands for the scheduling horizon (i.e., next 24 hours) to support near real-time operational management of smart Water Distribution Systems (WDSs)

- data-driven and self-learning DF
- embedded in a piece of software developed in MATLAB
- use Evolutionary Artificial Neural Networks (EANNs)





Contents lists available at ScienceDirect

Environmental Modelling & Software

journal homepage: www.elsevier.com/locate/envsoft

Adaptive water demand forecasting for near real-time management of smart water distribution systems

Michele Romano*, Zoran Kapelan

Romano, M., and Kapelan, Z. (2014). “Adaptive Water Demand Forecasting for Near Real-Time Management of Smart Water Distribution Systems”. Environmental Modelling & Software Journal, 60, 265–276. [Permalink: http://dx.doi.org/10.1016/j.envsoft.2014.06.016].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# DF Approaches

***ensemble EANNs (eEANNs)***

<u>24 ANN models</u>

- The models run in parallel
- ANNs with different forecasting horizon
- ANN models tailored to the particular forecasting horizon

***recursive EANNS (rEANNs)***

<u>1 ANN model</u>

- The runs are performed sequentially
- Fixed forecasting horizon (i.e., 1 hour ahead)
- Accuracy can decrease due to error accumulation




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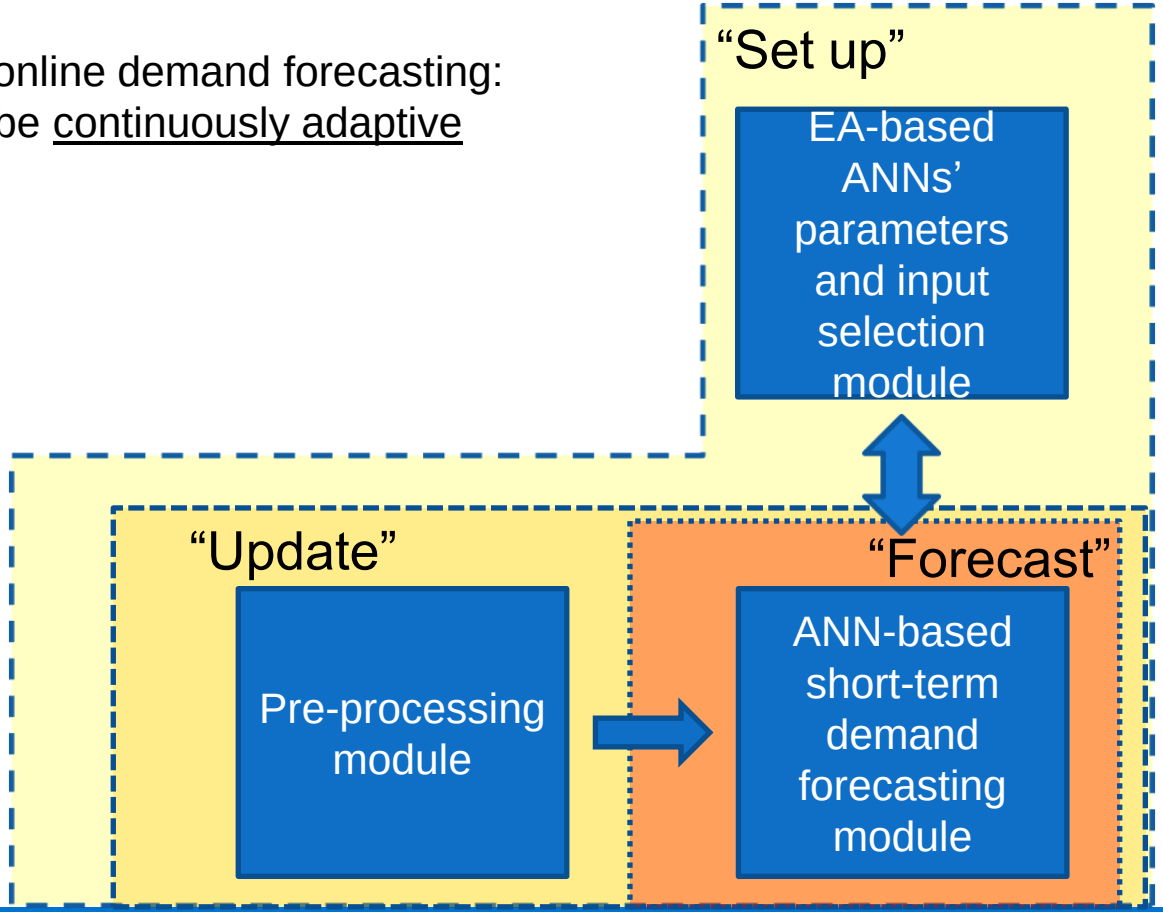
# DF Methodology Components & Modes of Operation

Requirement for online demand forecasting:

- System must be continuously adaptive




Three main modes of operation:

Set up:
Runs when the module is initialised and when operational changes occur

Update:
Runs every *n* days (e.g., every 7 days)

Forecast:
Runs every *p* hours (e.g., every hour)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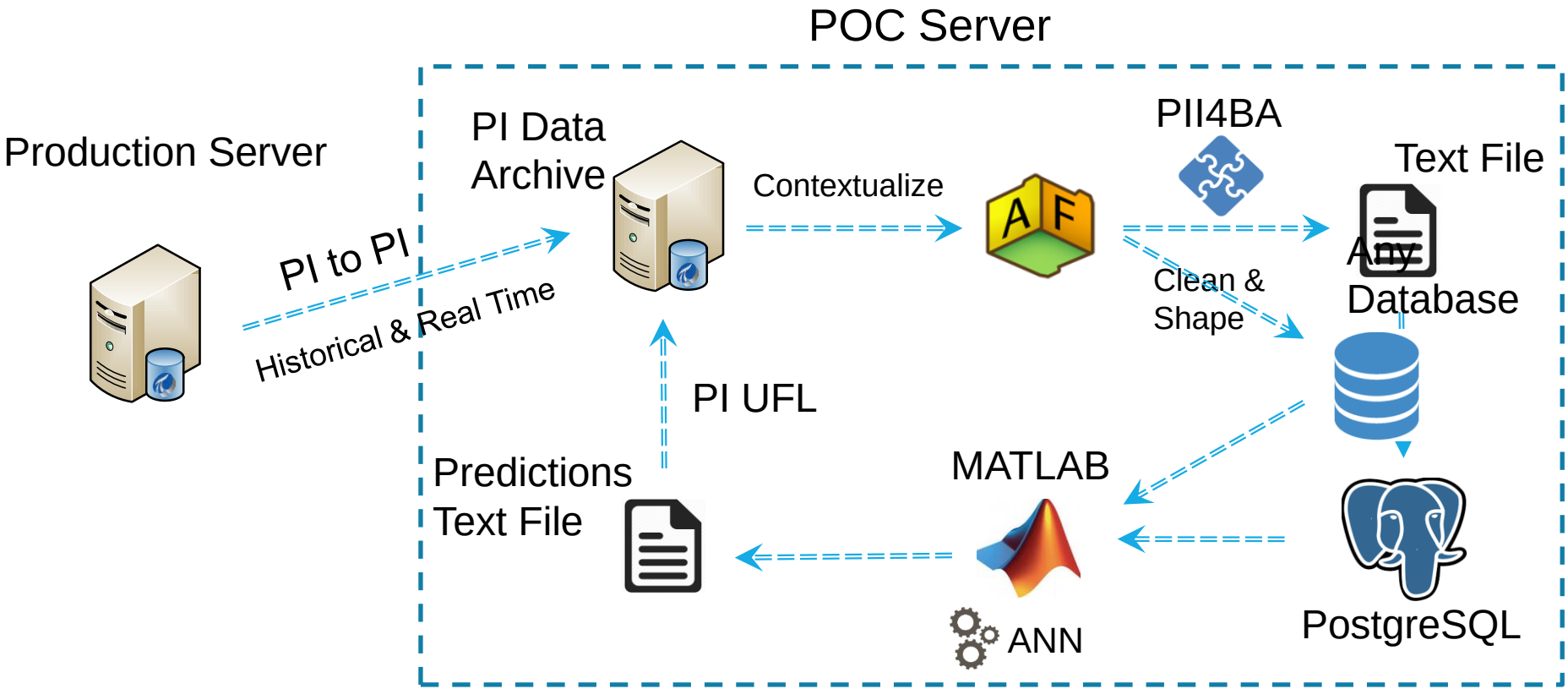
# POC Architecture





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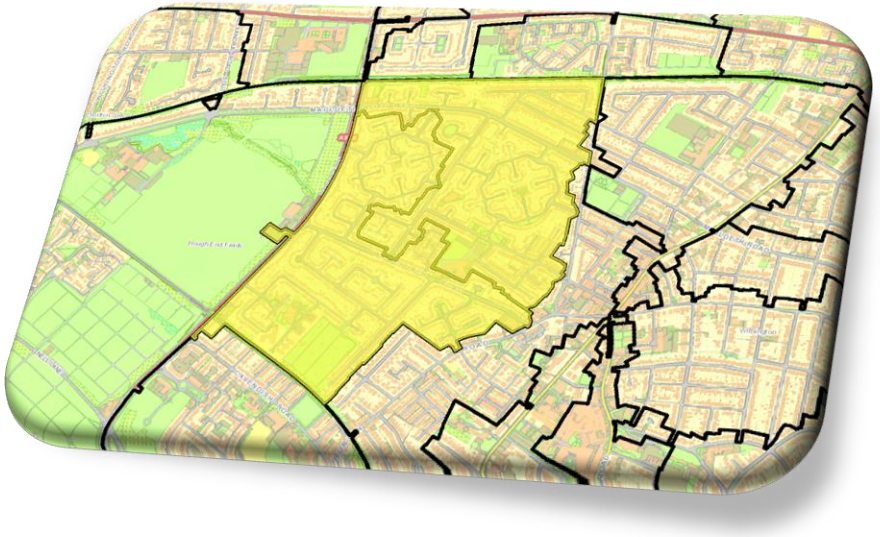
# Case Study

- 5 demand zones (DZs) with different sizes and characteristics e.g. light industrial, urban and rural
- Data for the period from 01/11/2016 to 15/03/2017
- Demand forecasting using the two alternative approaches (i.e. 1 ANN model & 24 ANN models)



| Demand Zone Name | Commercial Customers | Residential Customers | Mains Length (Km) | Average Demand (m3/h) |
|---|---|---|---|---|
| DZ1 | 8 | 327 | 5.1 | 5.4 |
| DZ2 | 121 | 1751 | 10.7 | 30.8 |
| DZ3 | 129 | 2078 | 16.4 | 57.1 |
| DZ4 | 258 | 4156 | 70.2 | 122.3 |
| DZ5 | 516 | 8312 | 118.5 | 215.6 |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# To be continued at Parc 55 Hotel…



| | Hilton Hotel | | Parc 55 Hotel | |
|---|---|---|---|---|
| | **Product Track 1 – Imperial A** | **Product Track 2 – Imperial B** | **Developer Track 1 – Cyril Magnin II** | **Developer Track 2 – Cyril Magnin III** |
| 8:30am-10:00am | Opening Session | Opening Session - Simulcast | **OSIsoft** Intro - Welcome Session – *Ray Verhoeff, Mike Sloves, Bodo Bachmann, Frank Garriel, David Moler, Ahmad Fattahi* | Intro - Welcome Session - Simulcast |
| 10:00am-10:15am | **Transfer Time** | | | |
| 10:15am-11:00am | **OSIsoft** PI System 101: Basics for Beginners – *Stuart Collins, Kevin Doherty* | **OSIsoft** PI Integrator for Esri ArcGIS: Bringing Maps to Life – *Elizabeth Ammarell* | **OSIsoft** How to Pick the Right PI Developer Technology for Your Project – *Ray Verhoeff* | No Session |
| 11:00am-11:30am | **Break** | | | |
| 11:30am-12:15pm | **OSIsoft** PI Server 2017 – *Janelle Minich, Stephen Kwan* | **OSIsoft** Connectivity from A to Z - Roadmap for PI Connectors and PI Interfaces – *Chris Coen, Rajesh Balaraman, Xiaoli Tang* | **OSIsoft, LLC** How secure are your PI Systems? A primer for PI System security baselining – *Harry Paul* | **OSIsoft** Adaptive Water Demand Forecasting for Near Real-time Management of Smart Water Distribution Systems – *Kleanthis Mazarakis* |

Thursday, March 23rd, Day 3 of the conference


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# Today’s Breakout Sessions


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# Comox Valley Regional District

Brian Pearson

## Improving SCADA Data Access Across the Enterprise with OSIsoft's PI System

- *Many remote sites and long distances*
- *Reducing electricity usage and staff travel times*


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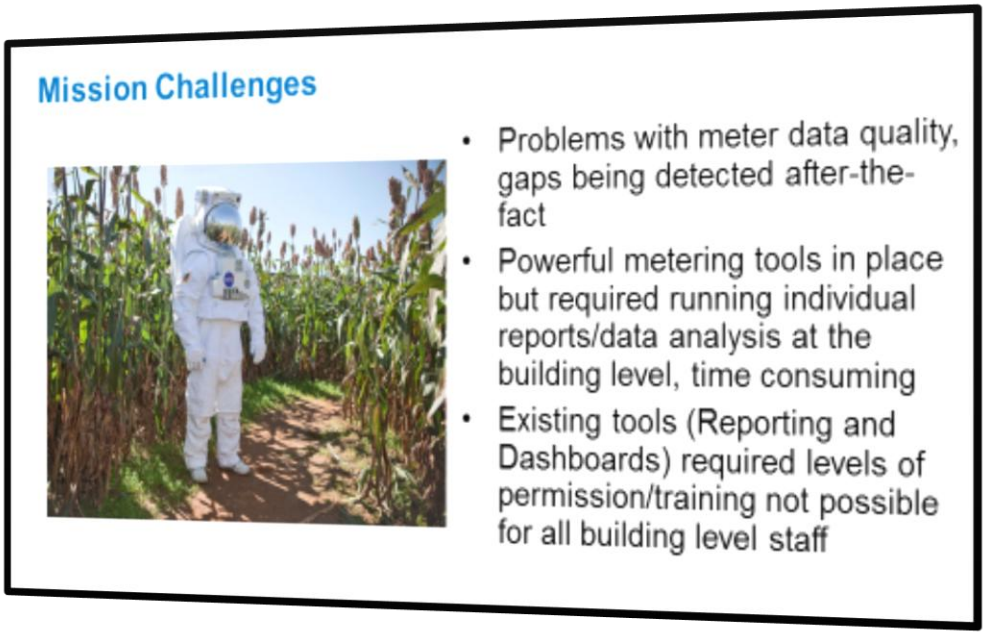
# NASA Langley Research Center

Todd Herbert

**Using the PI System For Real-Time Energy Management at NASA Langley Research Center**

- *Managing a wide variety of critical buildings*
- *Overcoming meter data problems*





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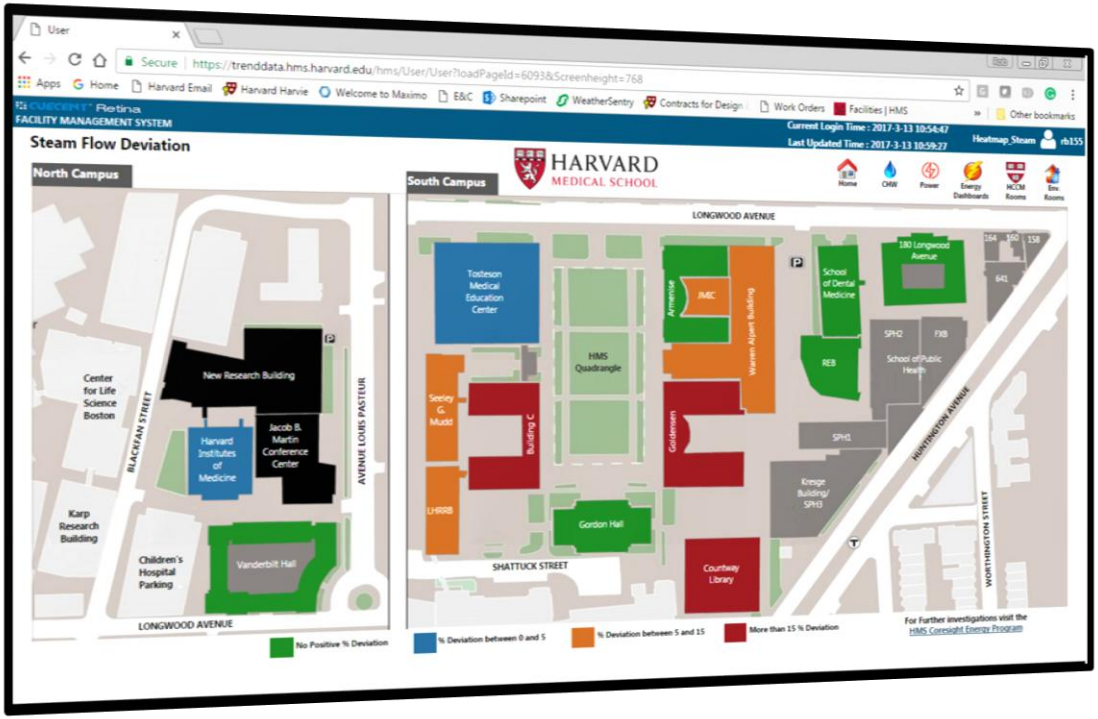


# Harvard Medical School

Robert Behrant
Stanley Sathianthan

## Harvard Medical School Transformed Using PI System Data

- Real-time visibility across the campus
- Managing billing and real-time performance to meet sustainability goals


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# Digital Realty

Stephanie Gupana
Brandon Lake

## Demystifying the Data Center

- *Infrastructure challenges and integrating data silos*
- *Power Usage Effectiveness (PUE) – saving costs and identifying issues early*





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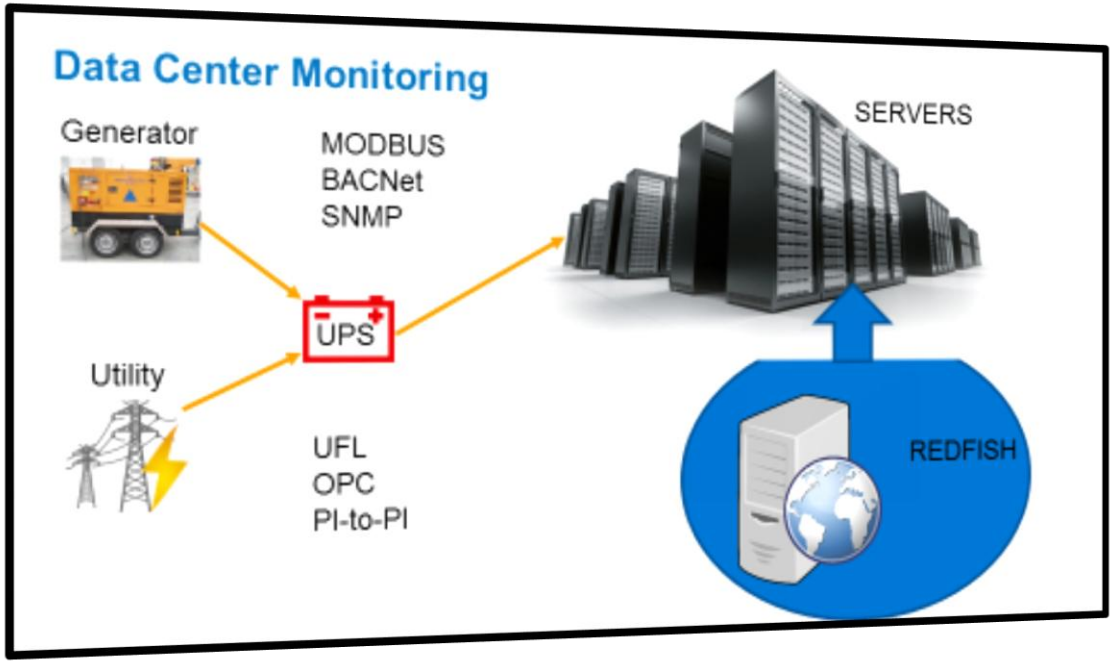


# QUALCOMM

Keith Ward

## Managing Backup Power Assets

- *Uptime is #1*
- *Notifications and alerts to monitor critical back assets to maintain reliability*


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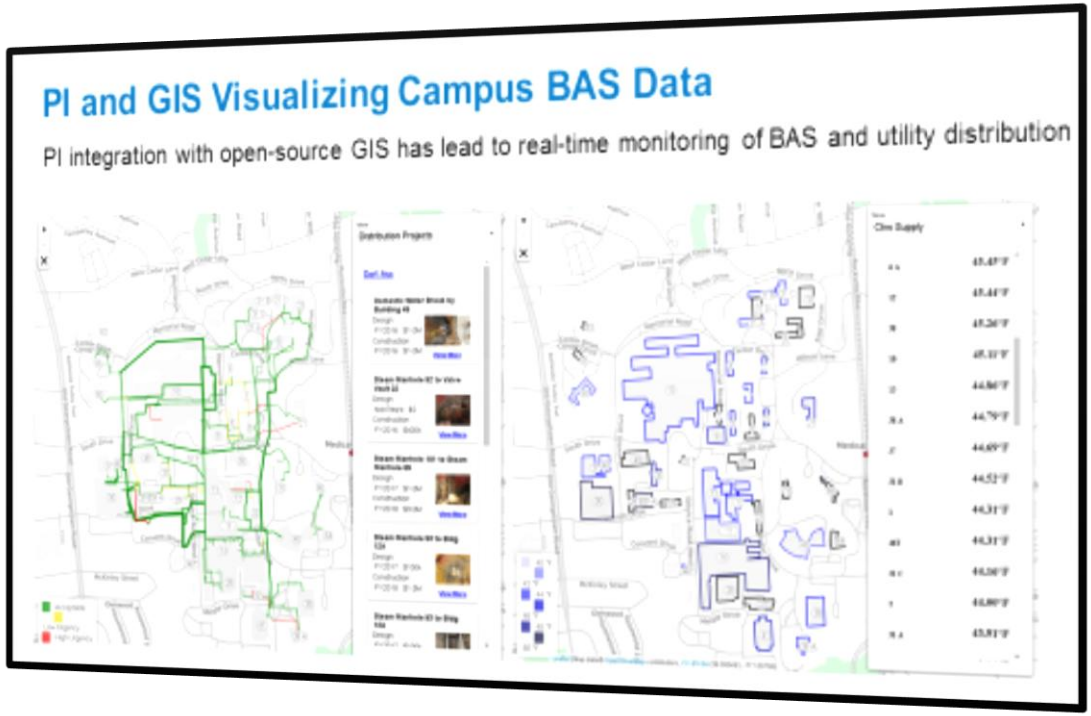
# National Institutes of Health

Don Guan
Eric Wisehart
Joseph Nieves

## PI System Transforms NIH Central Utilities Plant Operations

- *One of the largest Central Utility Plants under one roof*
- *Saving millions despite increased energy demand*





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# Facilities and Water and Wastewater PI User Groups

Join to discuss best practices, white papers, share news, and exchange ideas.

165 Facility Group Members
83 Water Group Members



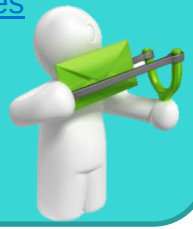

Objectives:

- Identify Best Practices
- Share knowledge and ideas across our industry
- Foster communication with OSIsoft regarding our industry Needs

This is NOT an avenue for sales presentations or marketing

Want to opt in?
https://pisquare.osisoft.com/groups/facilities
https://pisquare.osisoft.com/groups/water

Or contact jsirois@osisoft.com



Have questions?

- jsirois@osisoft.com – any user group
- Visit the PI Square Booth

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# Questions

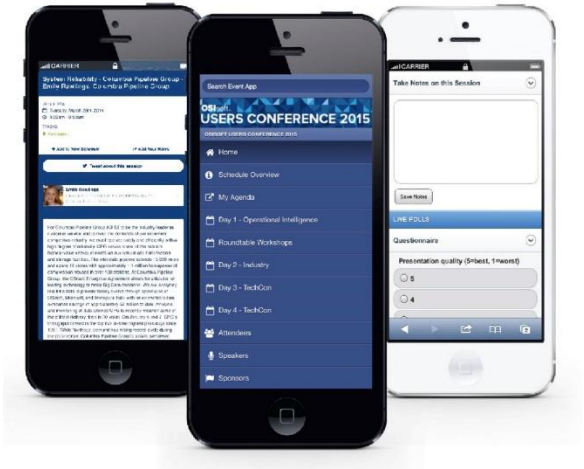
Please wait for the **microphone** before asking your questions



State your **name & company**

# Please don't forget to…

Complete the Online Survey for this session





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감사합니다

谢谢

Danke

Gracias

Merci

# Thank You

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Спасибо

Obrigado



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# Wrap-up

## Facilities, Water, and Energy

Presented by **David Doll, Industry Principal**

**Gary Wong, Industry Principal**

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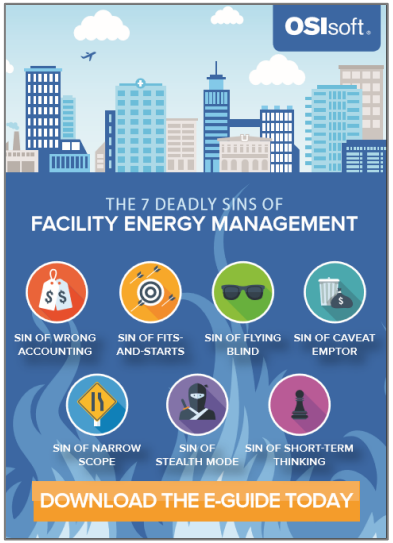
# Helpful content

- Websites
  - www.osisoft.com/corporate/facilities
  - www.osisoft.com/corporate/waterutilities/

- Customer presentations www.osisoft.com
  - Past Users Conferences
  - Coming soon – this UC

- PI Square https://pisquare.osisoft.com/
  - Facilities Users Group
  - Water Utilities Users Group

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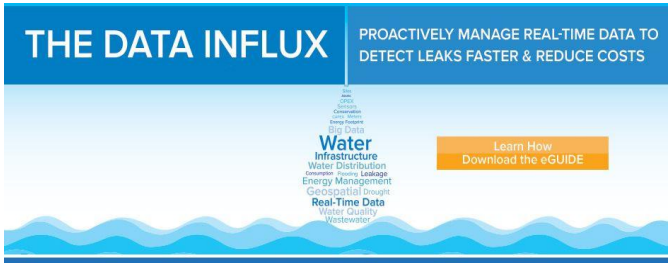


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谢谢

Danke

Gracias

Merci

# Thank You

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