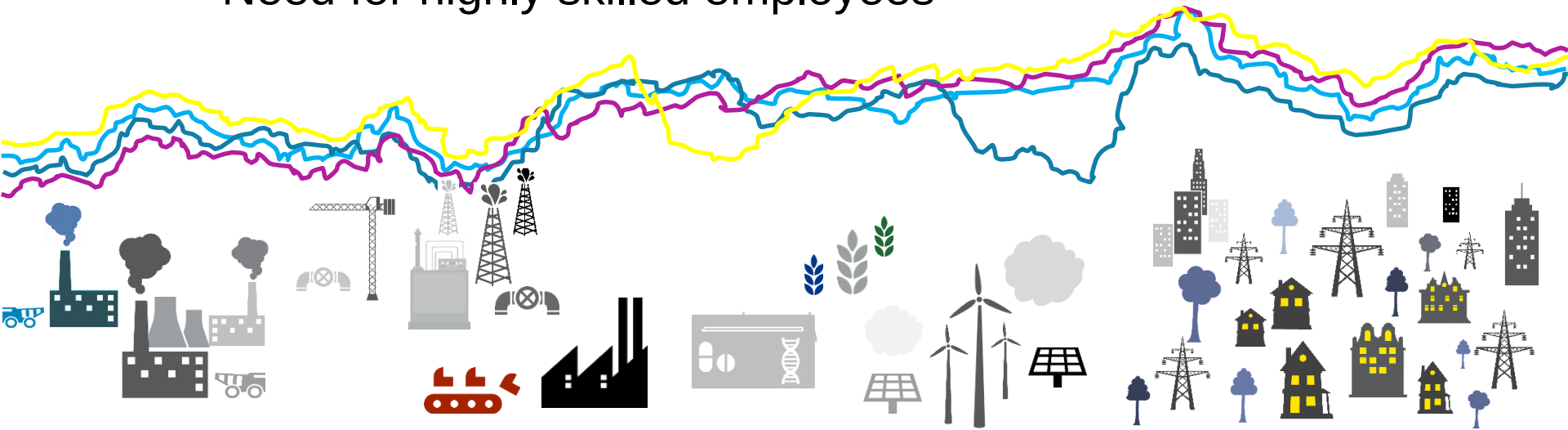
PI System for Big Data in the Classroom

Presented by **Erica Trump, PhD**

Need for Data Science in Curricula

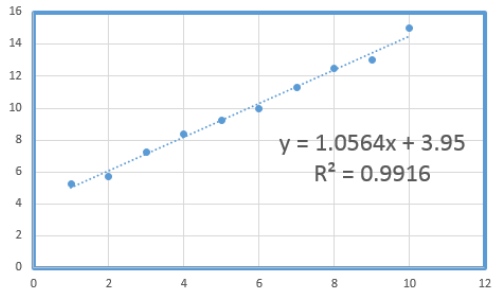
- Companies own terabytes of data
- Sensor-based data generated rapidly
- Value lies in making data actionable
  - Need for highly skilled employees



Evolving STEM Curricula: Data Education

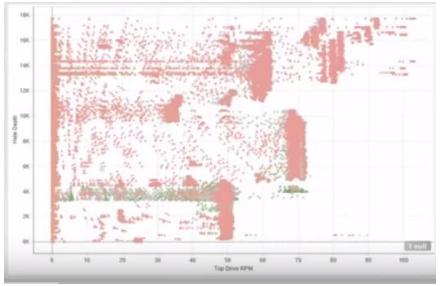
Traditional Approach

- Problem solving based on models
- Analysis of small datasets using basic statistics
- Simple data visualization



Data Science Approach

- Complex, real-world data
- Advanced analytical tools
- Interactive visualizations that aid in analysis



PI and Data Science

Big Data

Time Series

Relational

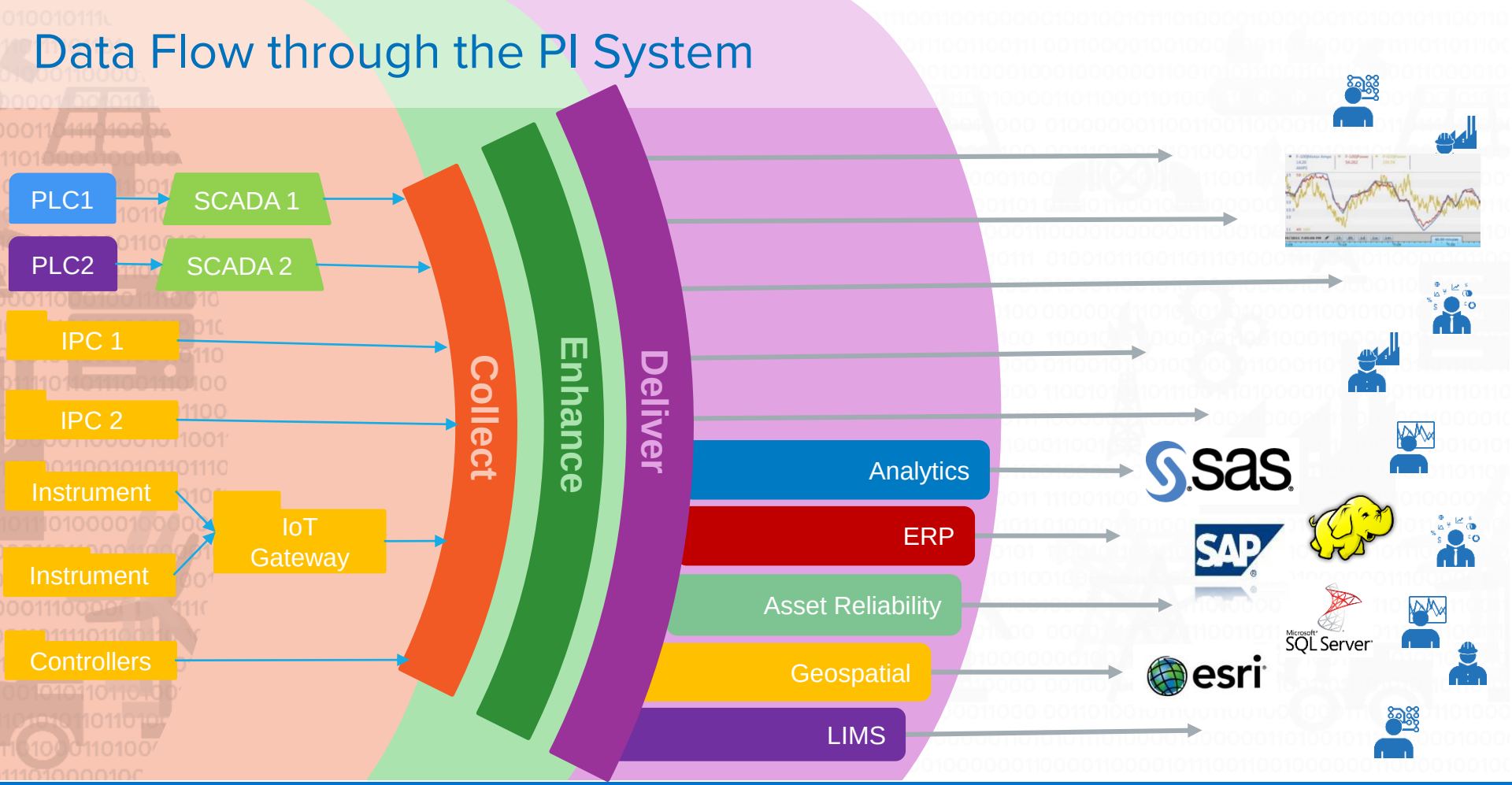
Unstructured

GIS

PI to Deliver Time-Series Data

- Live, time-series data seamlessly delivered to students
  - Many data sources on campus
    - Shared services and utilities
    - Buildings
    - IoT and lab-based sensors
  - Collaborations with industry
  - Hosted data and data sharing with other universities

Data Flow through the PI System



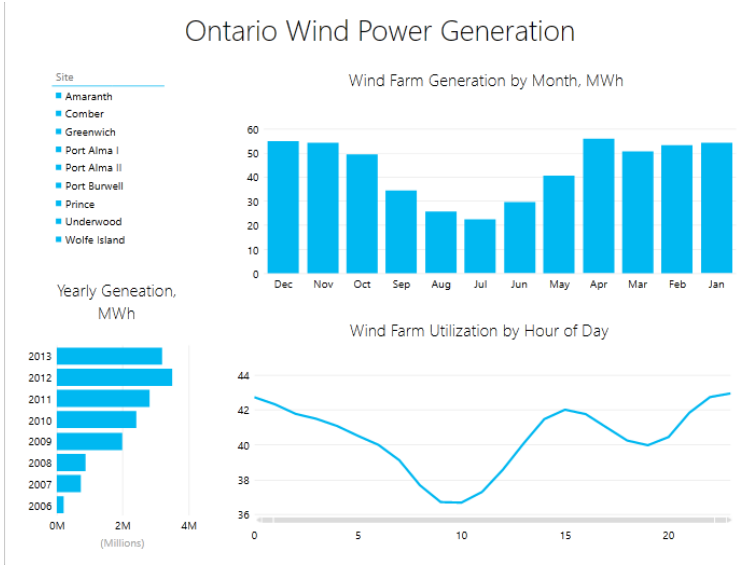
Toolbox for Data Science

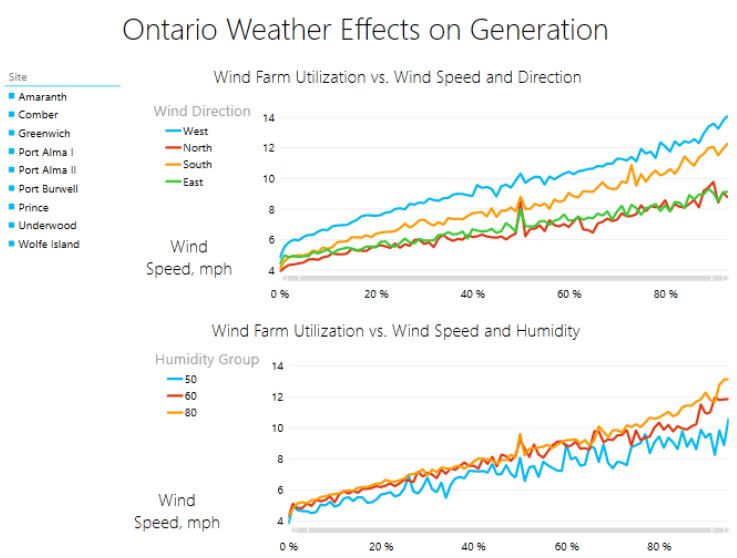
PI Integrator for Business Analytics

- PI System data integrated with sophisticated BI tools

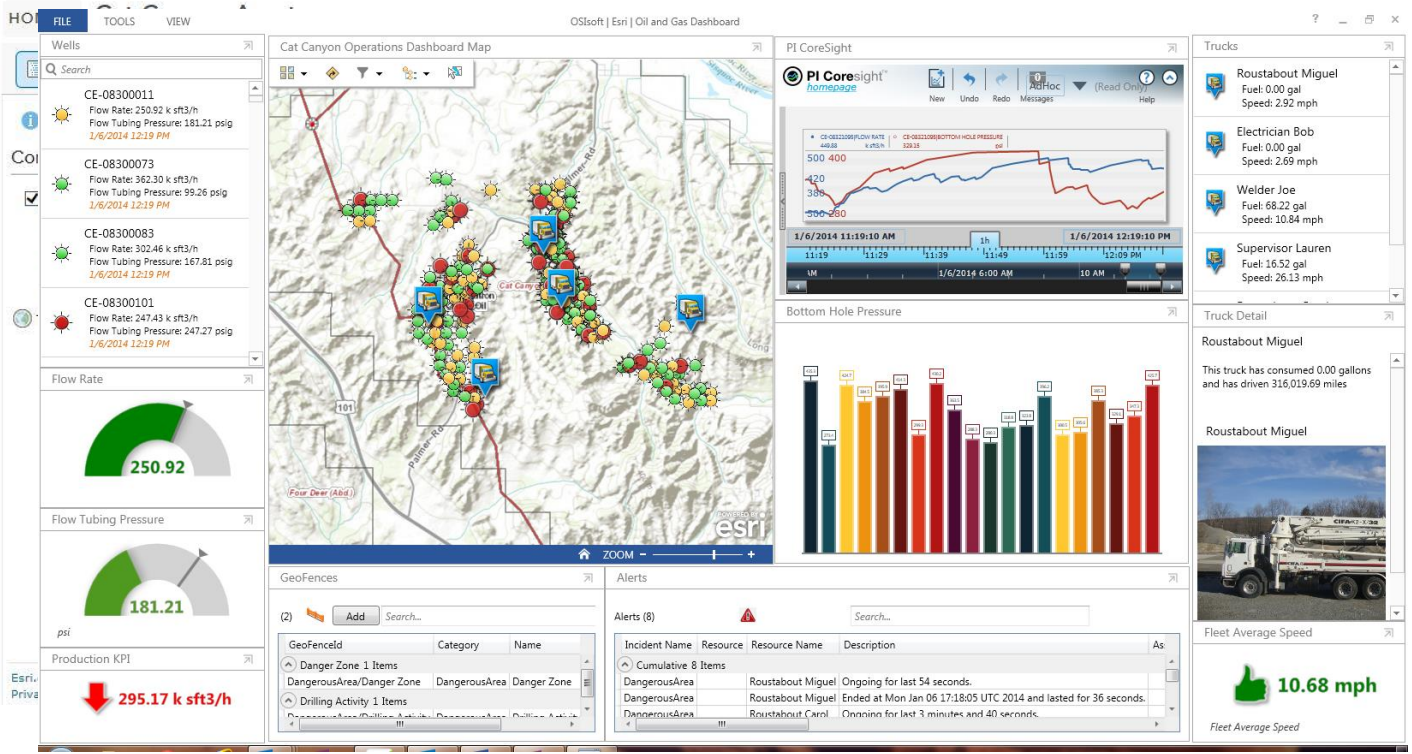
PI Integrator for Business Analytics

- Power BI & wind farm power generation data

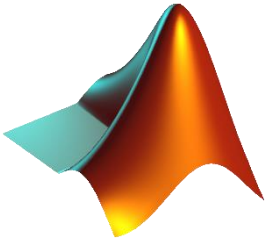




PI Integrator for Esri ArcGIS

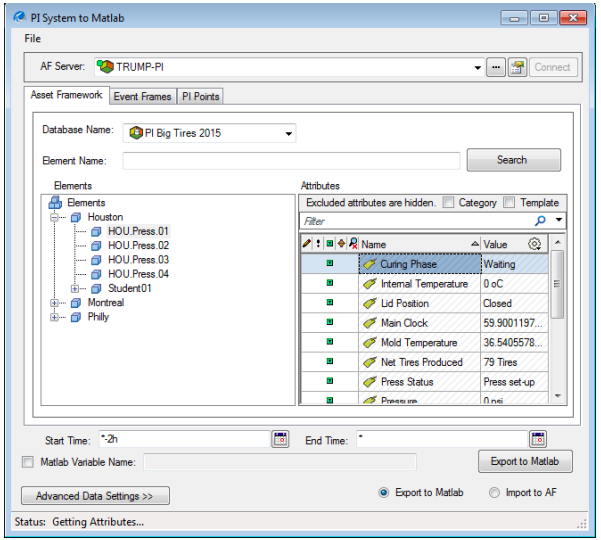


PI Integration with MATLAB



PI-to-MATLAB Utility

PI Developers Club White Paper



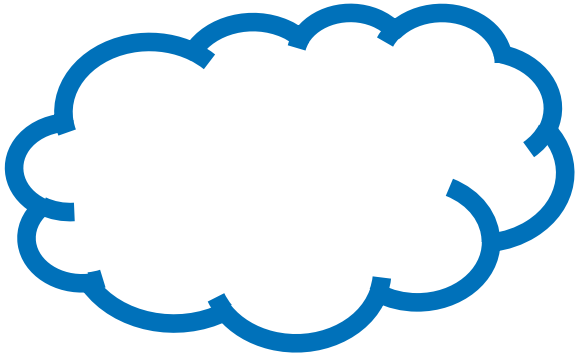
PI Integration with R

- R platform central to Data Science curricula
- PI Integrator for Business Analytics
- PI Web API
  - Real-time deployment, ability to write back to PI
  - Example program shared as a learning resource

Data Science Labs

Our Data Science Labs

- Teaching labs shared at OSIsoft Users Conferences
- Labs guide our customers to apply predictive analytics
  - R Framework
  - Azure Machine Learning
- Cloud-based learning environment
- Fully developed training documents



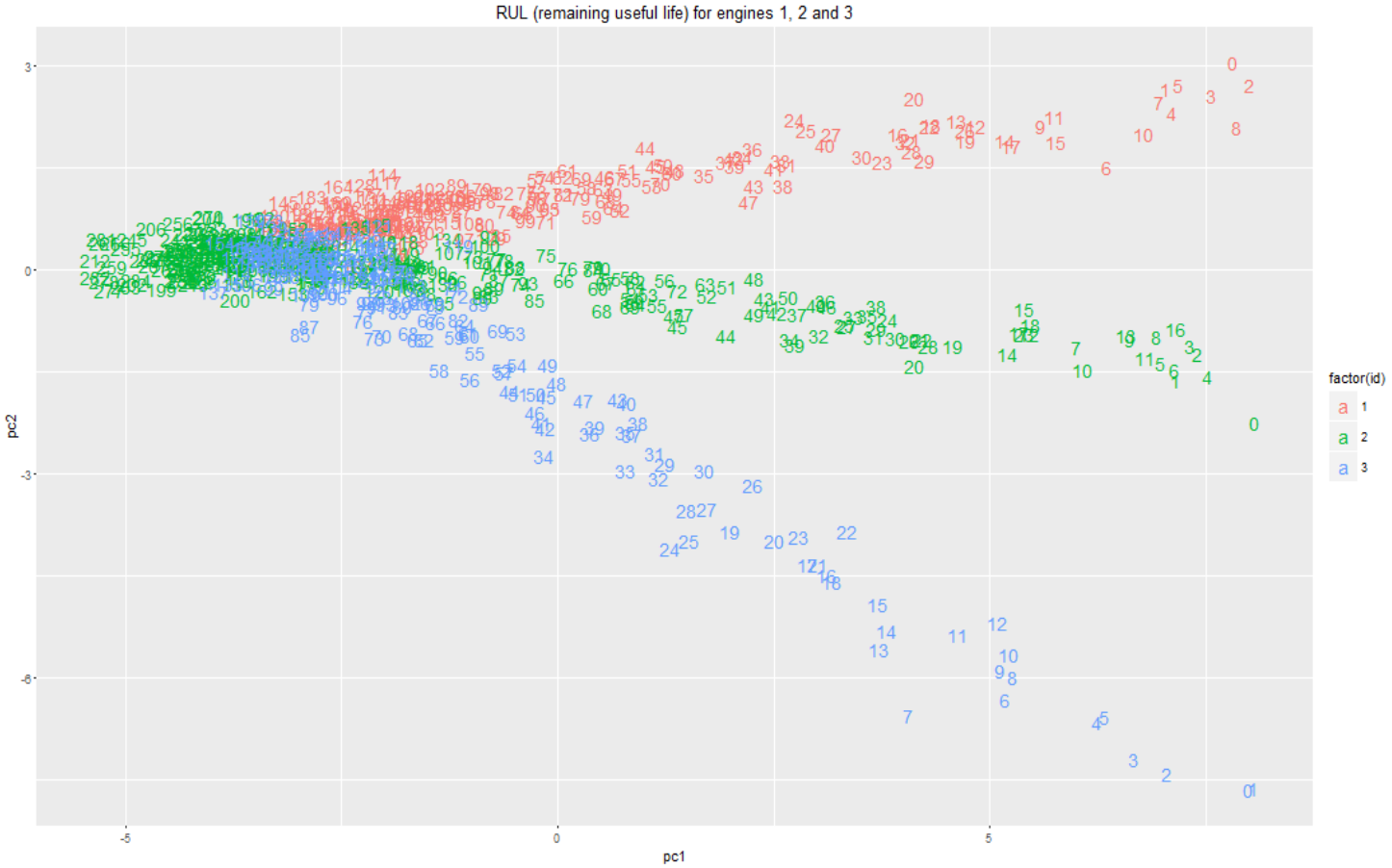
End-to-End Exercises

- Provide time-series datasets with asset context
- Motivated by industry need
  - Predictive maintenance – equipment failure
  - Predicting hourly energy usage – facility/building
- Well-defined problem with clear objectives
- Defined solutions

Engine data

	A	B	C	D
1	id	cycle	setting1	setting2
2	1	1	-0.0007	-0.0004
3	1	2	0.0019	-0.0003
4	1	3	-0.0043	0.0003
5	1	4	0.0007	0
6	1	5	-0.0019	-0.0002
190	1	189	-0.0006	0.0002
191	1	190	-0.0027	0.0001
192	1	191	0	-0.0004
193	1	192	0.0009	0
194	2	1	-0.0018	0.0006
195	2	2	0.0043	-0.0003
196	2	3	0.0018	0.0003
197	2	4	0.0035	-0.0004

	A	B	C	D
1	id	cycle	setting1	setting2
2	1	1	-0.0007	-0.00
3	1	2	0.0019	-0.00
4	1	3	-0.0043	0.00
5	1	4	0.0007	
6	1	5	-0.0019	-0.00
20625	100	193	-0.0001	0.00
20626	100	194	-0.0011	0.00
20627	100	195	-0.0002	-0.00
20628	100	196	-0.0004	-0.00
20629	100	197	-0.0016	-0.00
20630	100	198	0.0004	
20631	100	199	-0.0011	0.00
20632	100	200	-0.0032	-0.00

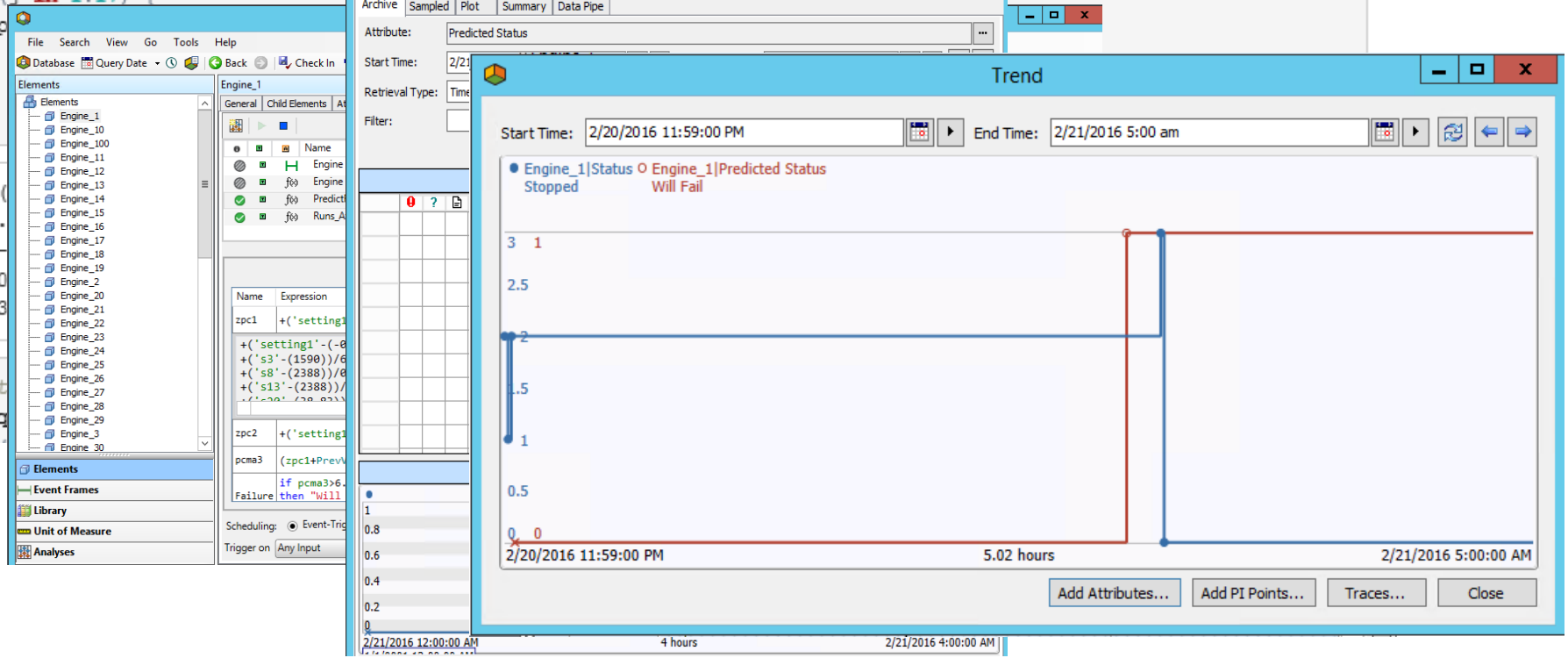


Engine failure prediction

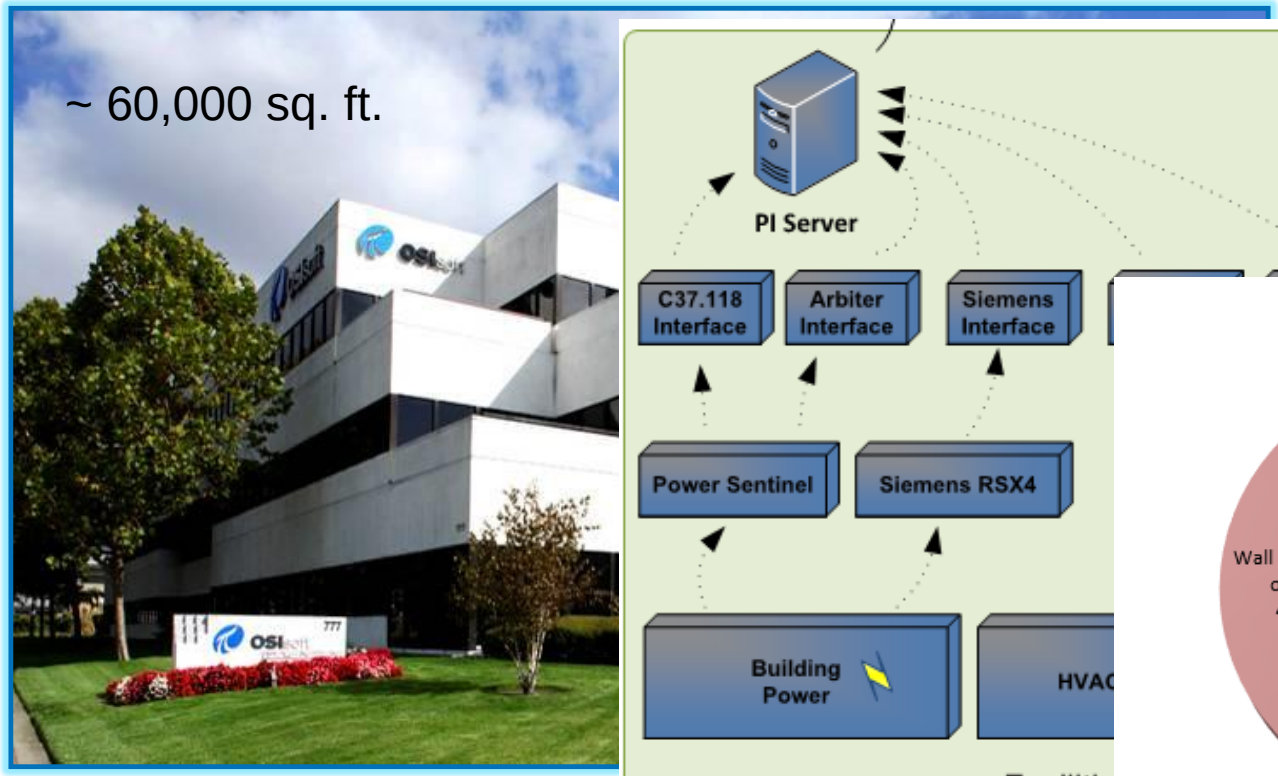
```
# get pc1 equation
pc1eq = ""
for (j in 1:17) {
    p
}

## +(
44*0.
984*-
5))/0
7'-(3

# get
pc2eq
```



Building/facility – HVAC and Power



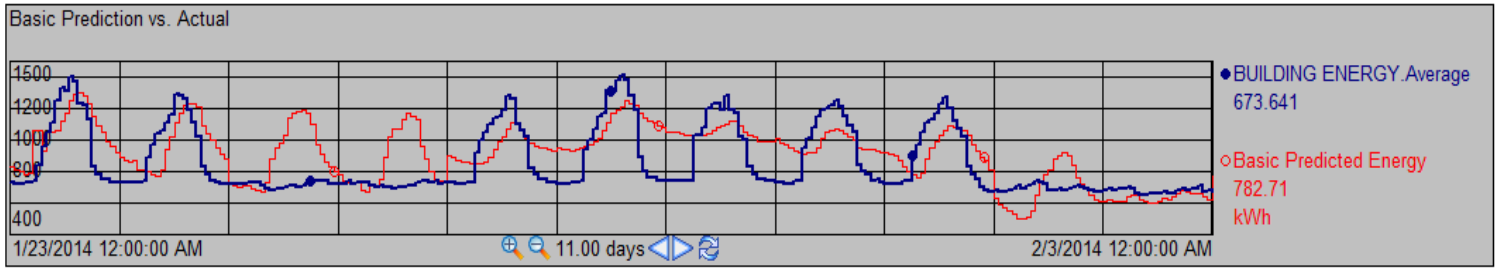
Building/facility - Predict hourly energy use

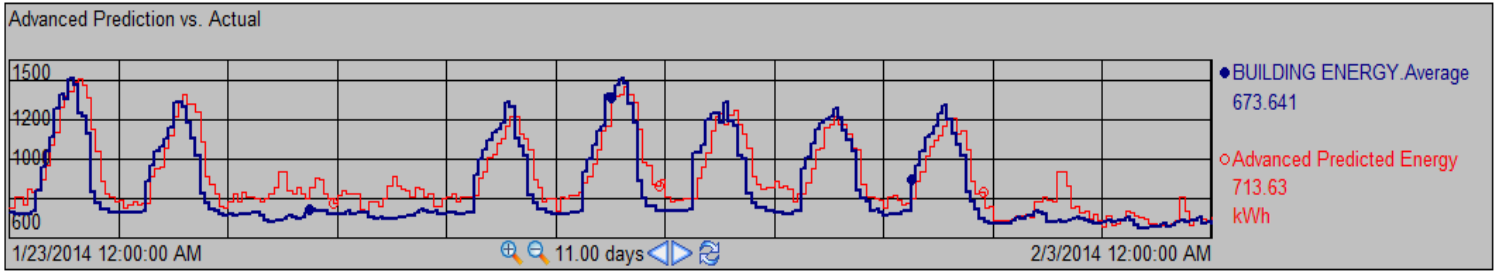
Lab Exercise

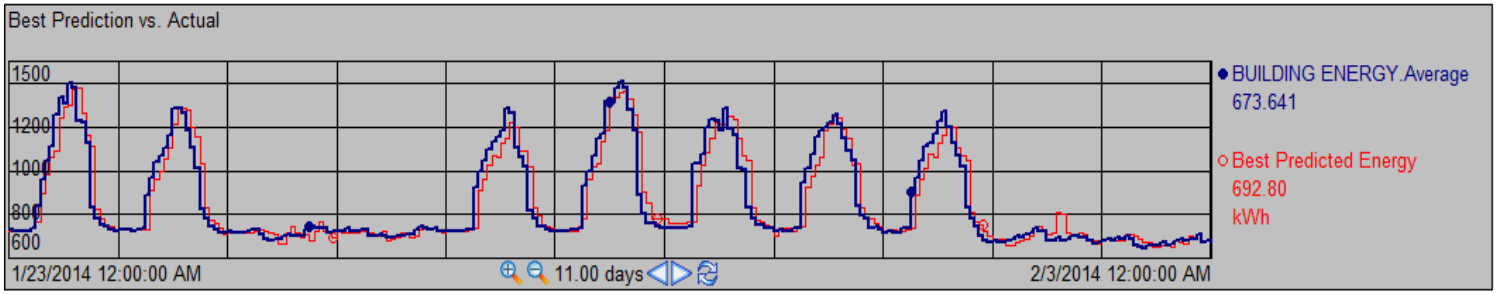
-Basic

-Advanced

-Best







Call to Action + Q&A

- Think about how these tools fit into your curriculum
- To discuss your course syllabus, contact Nicolas Peels

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감사합니다

谢谢

Danke

Gracias

Merci

Thank You

ありがとう

Спасибо

Obrigado