

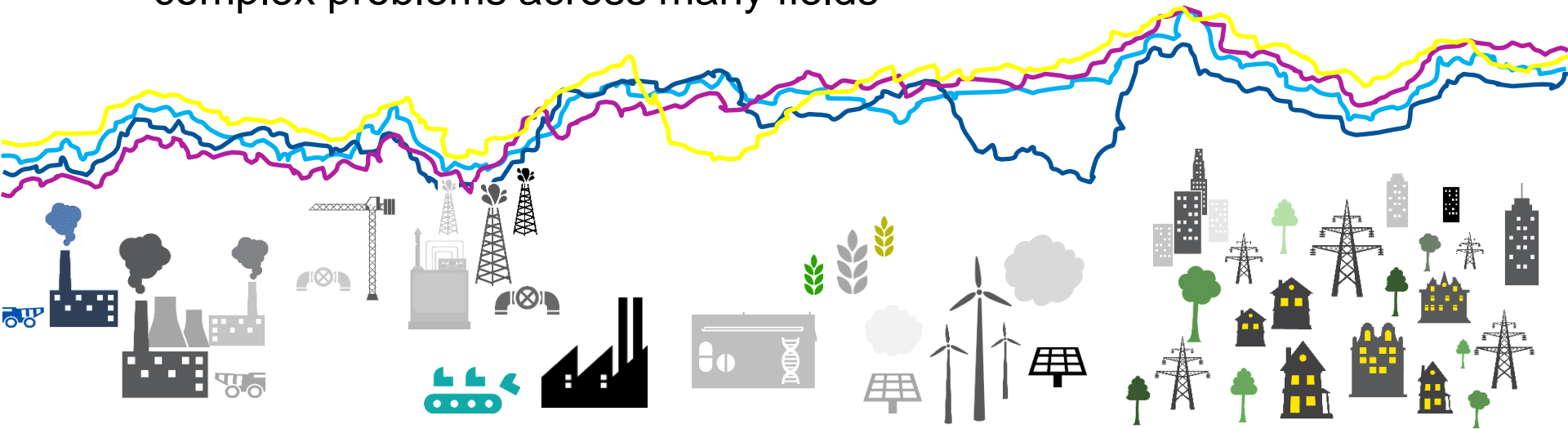
OSIsoft: Your Partner for Engineering Education

Presented by Erica Trump, PhD

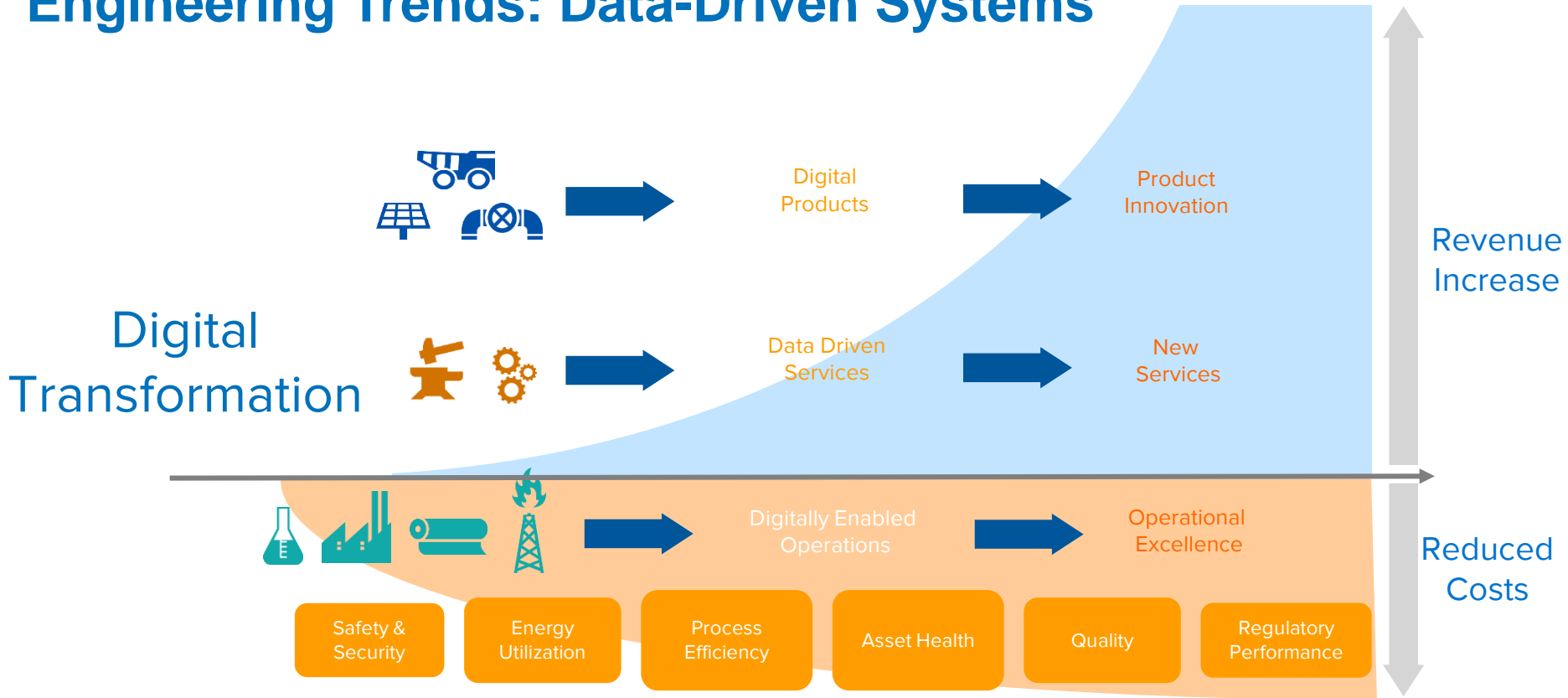


Need for Data-Focused Engineering Curriculum

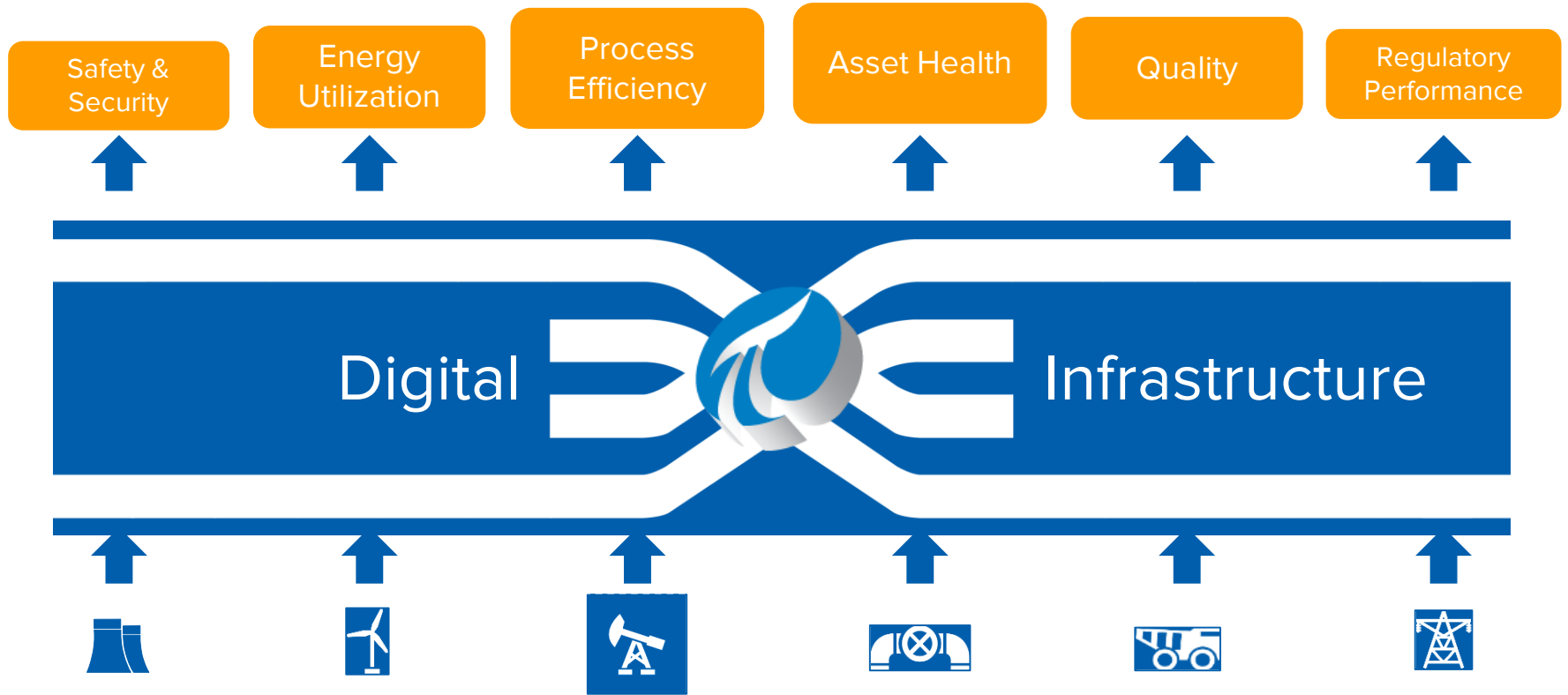
- Companies own terabytes of data
- Process data is generated rapidly
- Industry demand for highly skilled employees
- Data education enables engineers to solve complex problems across many fields



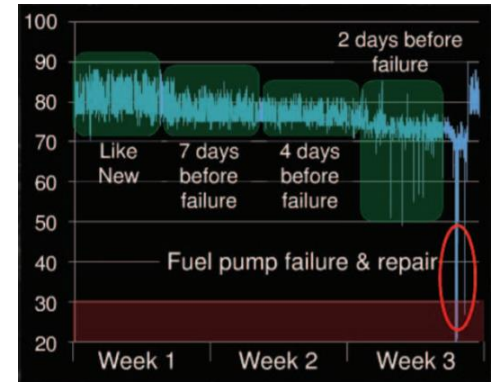
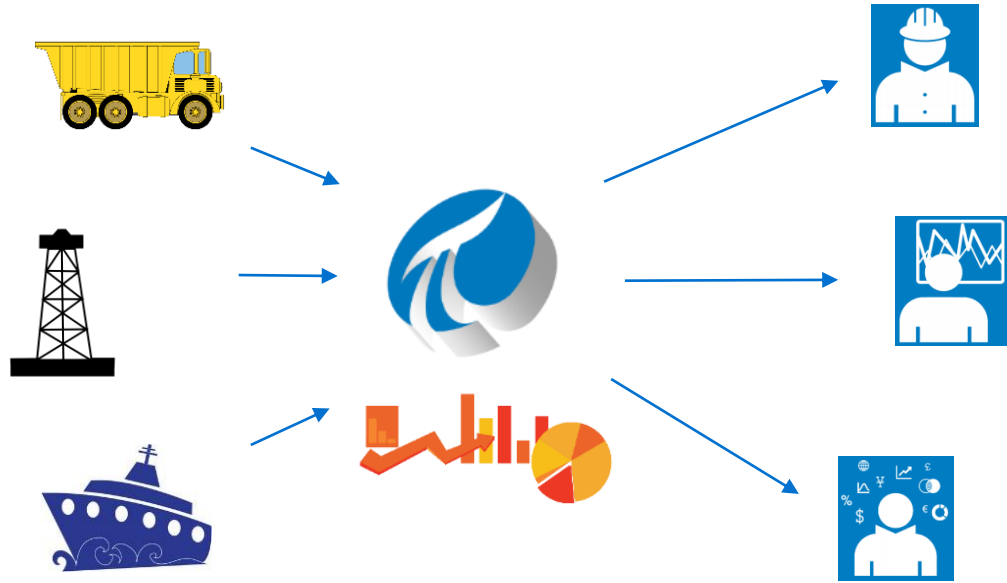
Engineering Trends: Data-Driven Systems




Engineering Trends: Data-Driven Systems



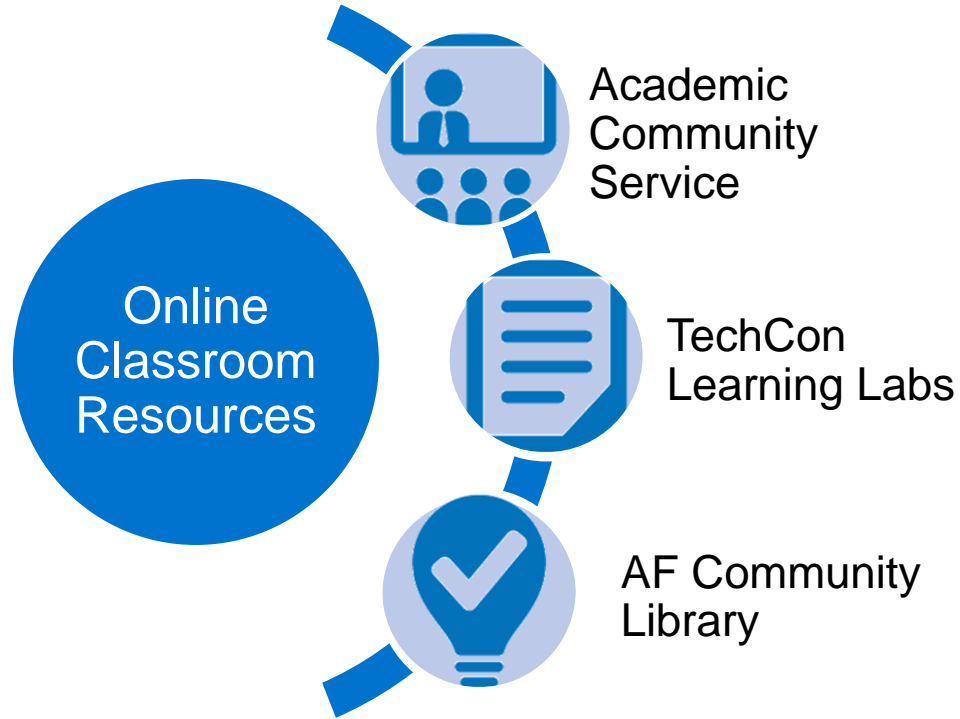
Engineering Trends: Data-Driven Systems





How can you best prepare your students
for current industry trends?

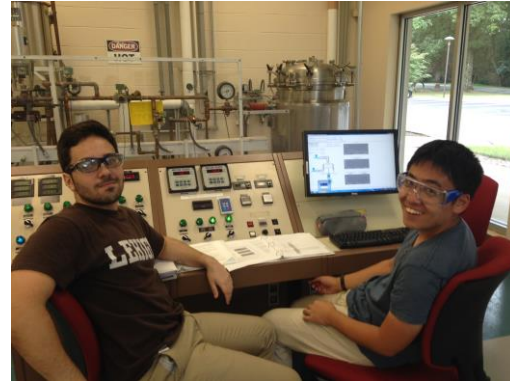
Transform Your Classroom



Academic Community Service

Prepare students for a career in industry

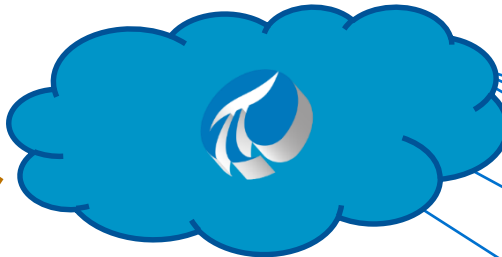
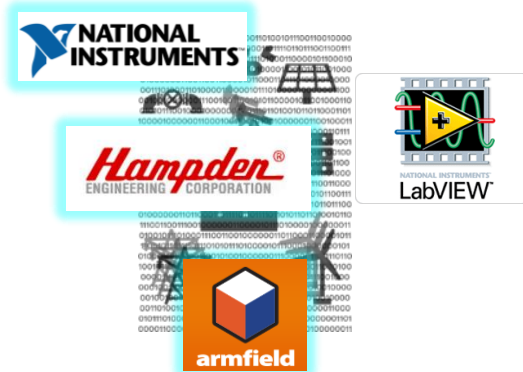
- Example: A *data-driven* approach to ChE Unit Operations
 - Bridge the gap between chemical engineering theory and practice
 - Students learn to work with complex, real-world data using the *process information system* that they will encounter in industry



Announcing: Academic Community Service

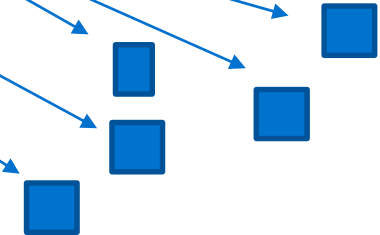
- A shared, cloud-based PI System to support **classroom initiatives**
 - Minimal on-campus footprint
 - Data is written to PI via NI LabVIEW
 - Web-based data-visualization and access tools
 - No-hassle data integration with tools including MATLAB, R, and Python

University Lab or Classroom



Academic Community Service
(Hosted by OSISOFT)

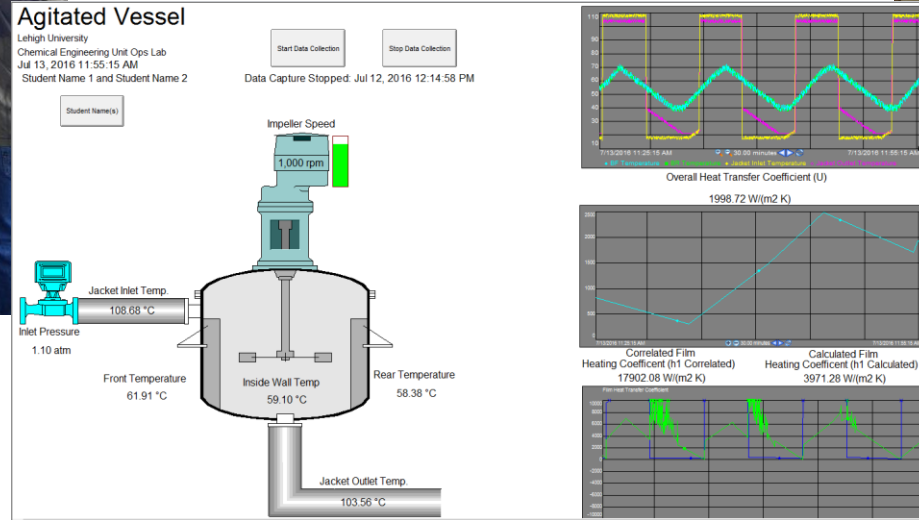
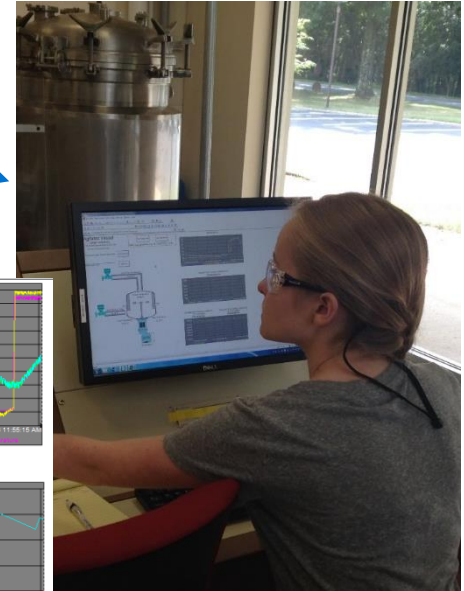
Students access data
anywhere, from any device



Example: Agitated Vessel Heat Transfer at Lehigh University



Academic Community Service
(Hosted by OSIsoft)



TechCon Learning Labs

Our TechCon Learning Labs

- Applied learning labs shared at OSIsoft Users Conferences
 - Developed training documents
 - Cloud-based learning environment
 - Include use of advanced tools for data science like R Framework, Azure Machine Learning, Power BI, Esri ArcGIS



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

TechCon Workbooks

Navigation

Search document

Headings Pages Results

- Learning Objectives, Problem State...
- Part I – Extracting PI System Data usin...
- Part II – Predict Equipment Failure Usi...
- Read the PI Integrator file output
- Do some statistics and data mu...
- Plotting engine failure distributi...
- Closer look at Engine 1 - is ther...
- Use odd numbered engines for...
- Extract principal components
- Plot engine cycle in terms of PC...
- Predictive Equation
- Part III – Ready the Prediction for Depl...
- Appendix A: Using Power BI to Evalua...
- Appendix B: Using PI WebAPI with R
- Appendix C: Follow-up questions from...
- Follow up questions
- Reference Materials

Navigation

Search document

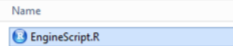
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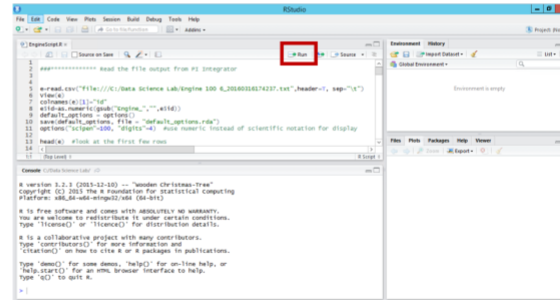
Part II – Predict Equipment Failure Using Statistical Analysis

From the Data Science Lab folder, select EngineScript.R and double-click to open it in R Studio.

► This PC ► Local Disk (C:) ► Data Science Lab



The screen below shows the R Studio user interface.



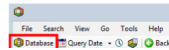
The following sections show the output when you step through the script line by line via <<Run>>.

The following pages have been extracted from the script document EngineAll.html (see Data Science Lab folder for the latest revision).

Open PI System Explorer from the Taskbar.



In PI System Explorer, ensure that you are connected to the AF Server PISRV01 and looking at **Engines** database. Select "Database" from the top toolbar and select "Engines" from the **Select Database**



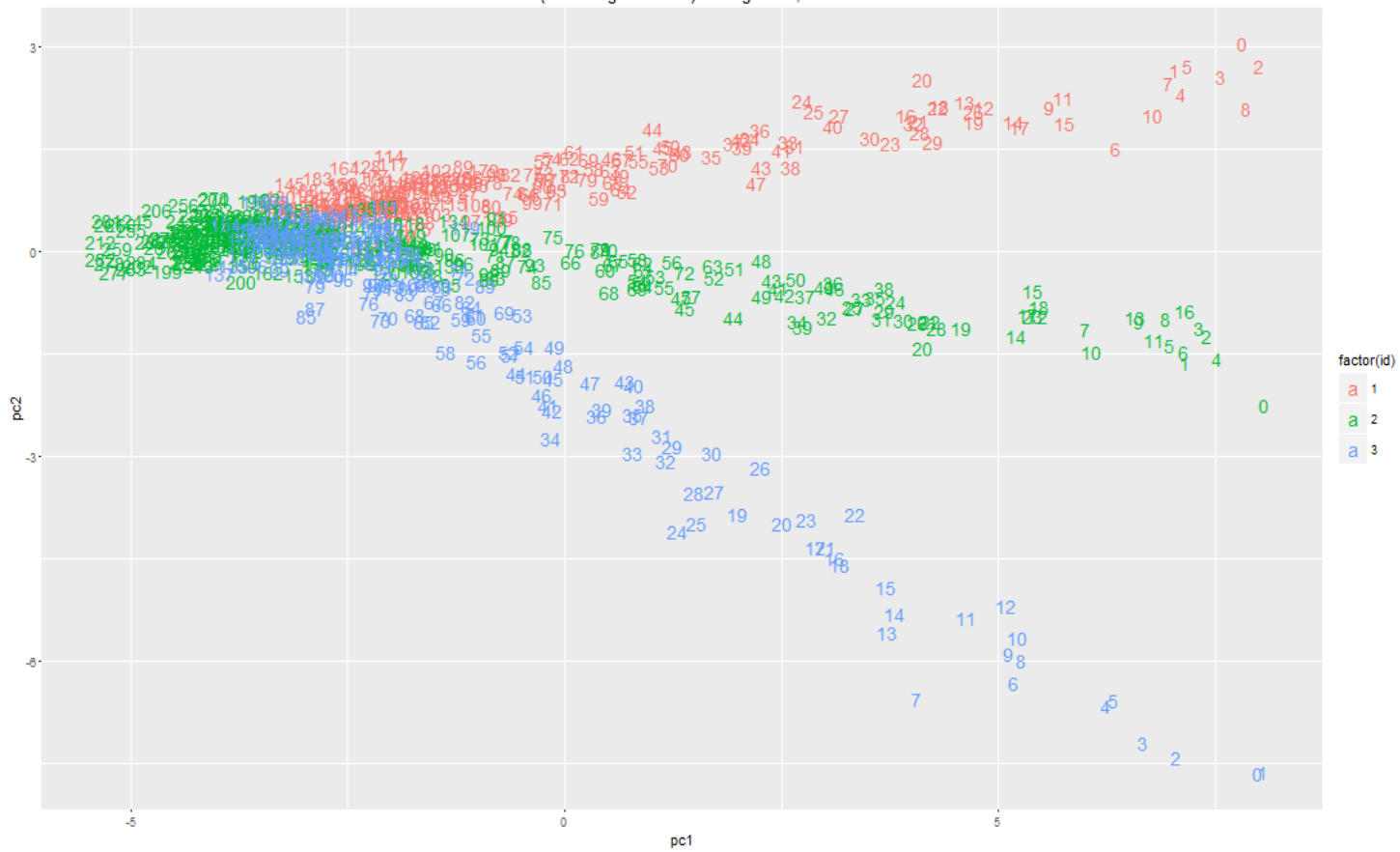
- Introductory information, exercises, walkthrough, and solutions

Engine data and analysis

	A	B	C	D	
1	id	cycle	setting1	setting2	set
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	

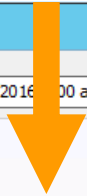
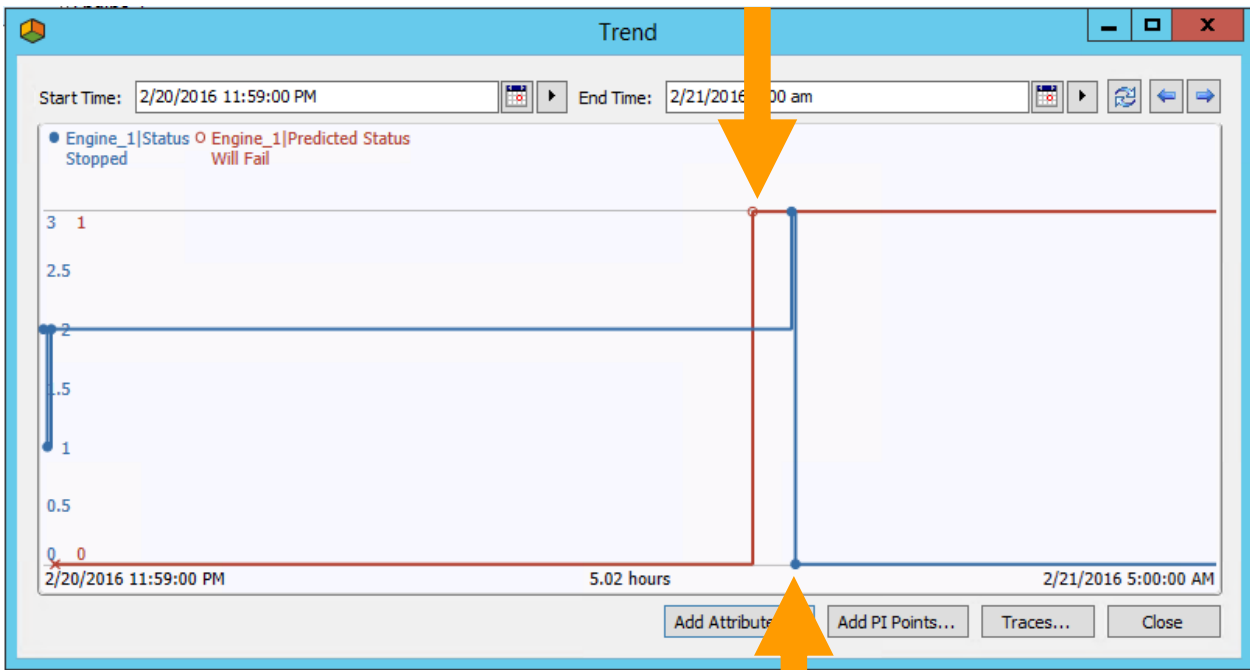
	A	B	C	D	
1	id	cycle	setting1	setting2	set
2	1	1	-0.0007	-0.0004	
3	1	2	0.0019	-0.0003	
4	1	3	-0.0043	0.0003	
5	1	4	0.0007	0	
6	1	5	-0.0019	-0.0002	
20625	100	193	-0.0001	0.0002	
20626	100	194	-0.0011	0.0003	
20627	100	195	-0.0002	-0.0001	
20628	100	196	-0.0004	-0.0003	
20629	100	197	-0.0016	-0.0005	
20630	100	198	0.0004	0	
20631	100	199	-0.0011	0.0003	
20632	100	200	-0.0032	-0.0005	

RUL (remaining useful life) for engines 1, 2 and 3



Real-time engine failure prediction

Engine Failure Predicted

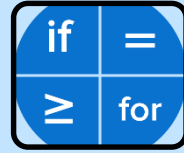


Engine Fails

Popular TechCon Learning Labs



Condition Based
Maintenance



Apply Data Science with
Machine Learning



Geospatial Analysis in
Real Time



Using Forecast Data with
the PI System



Modeling Your Process



Building Applications with
PI Web API



Detect and Track
Important Events

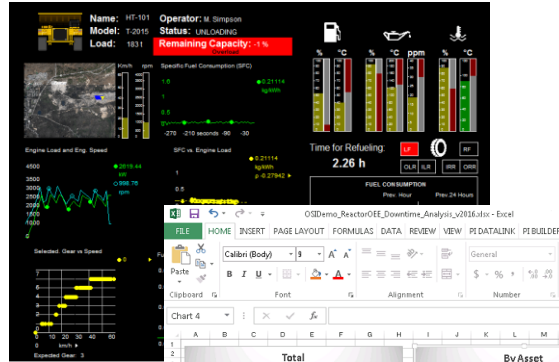


Developing Cross-
Platform Mobile Apps

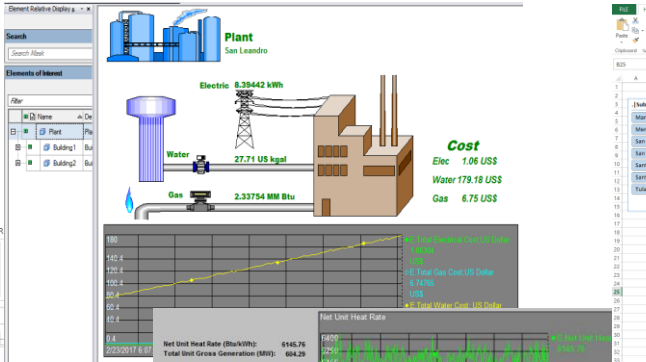
Community Library

Growing resource library for examples and templates

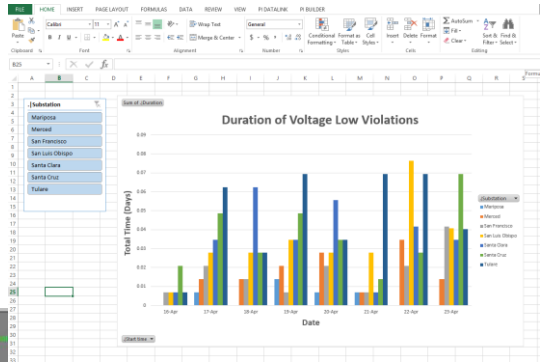
Mobile asset monitoring



Utilities cost management



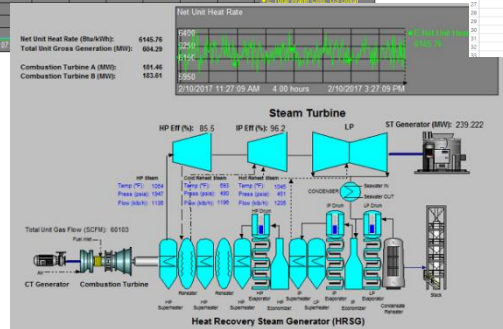
Feeder voltage excursions



Reactor OEE



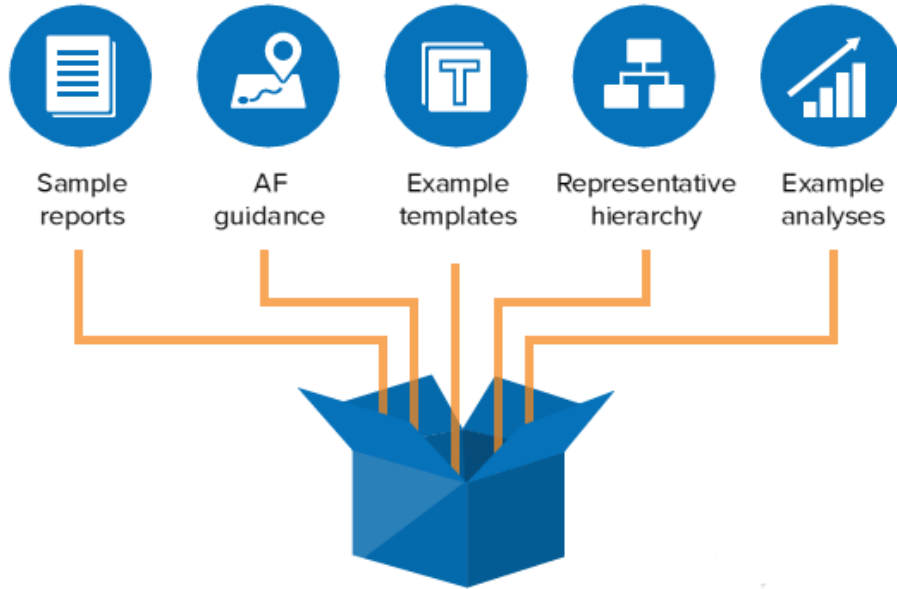
Turbine efficiency



....And many more!

Asset Based PI Example Kits

- *Explore how business initiatives take shape.*



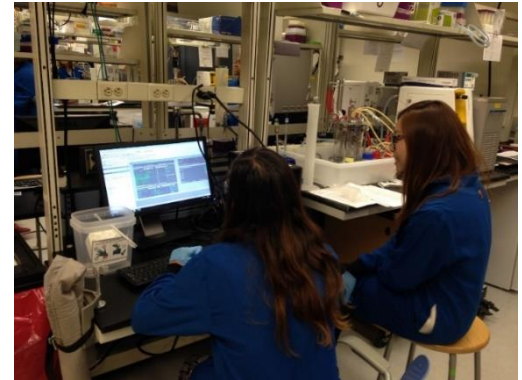
- Learning tool & starting point
- Installed on Academic Community Service
- Includes simulated data
- Available to everyone in the **AF Community Library** on PI Square

<https://pisquare.osisoft.com/community/all-things-pi/af-library>

On-Premises PI System

On-Premises PI Systems

- Best choice for complex implementations or research-level data
- OSIsoft provides training credits for system admins



Call to action – Come talk to us!

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etrump@osisoft.com

Program Manager, Academic Learning
OSIsoft, LLC

Nicolas Peels

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Academic Program Manager, EMEA
OSIsoft, LLC

Questions

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

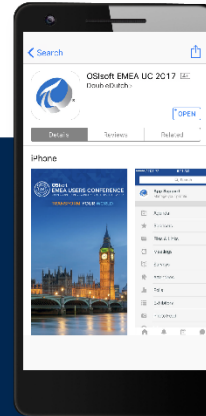


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감사합니다

Danke

谢谢

Merci

Gracias

Thank You

ありがとう

Спасибо

Obrigado