

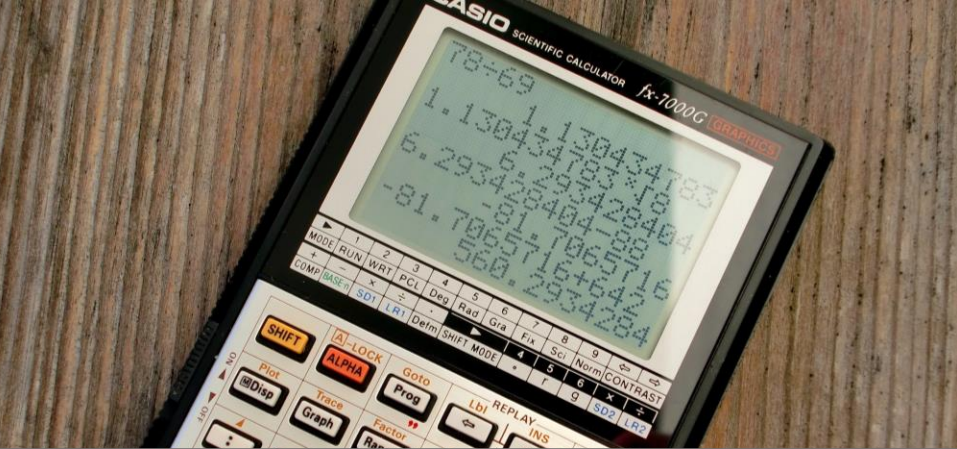
# Introduction to Analytics with the PI System

Sean Upson  
Systems Engineer

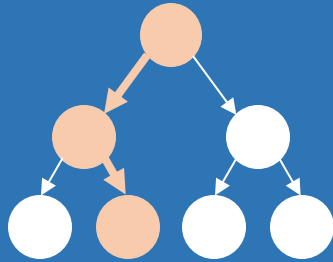


# In This Talk..

- Faster time to value
- Analytics in PI
- Sending PI System data to big data platforms

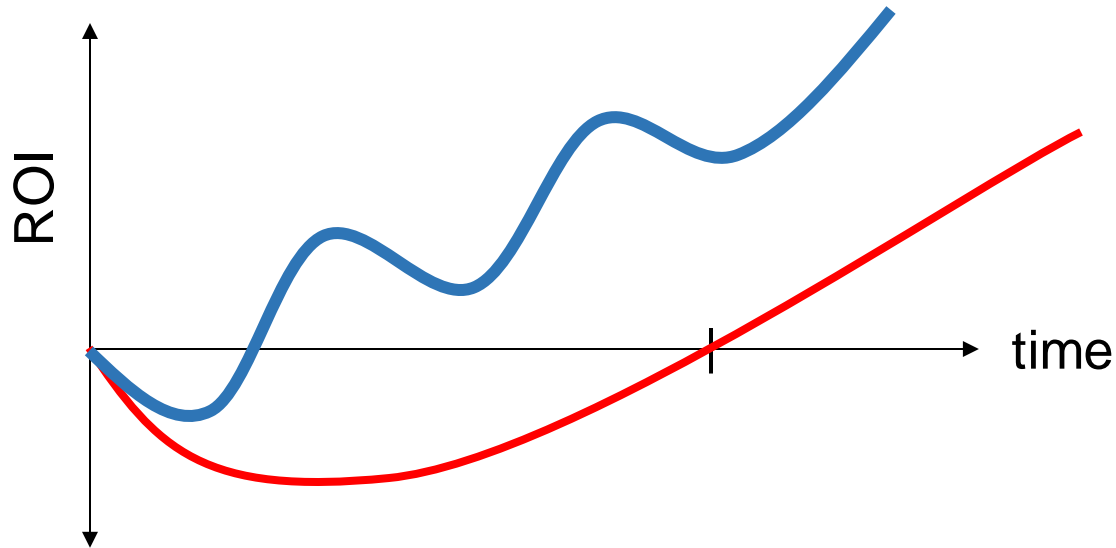

$$\frac{d[P]}{dt} = k(T)[A]^n[B]^m$$

“Analytics” can be overloaded



Where do I start?  
or  
Where are the quick wins?

# Small projects propel success for a large project



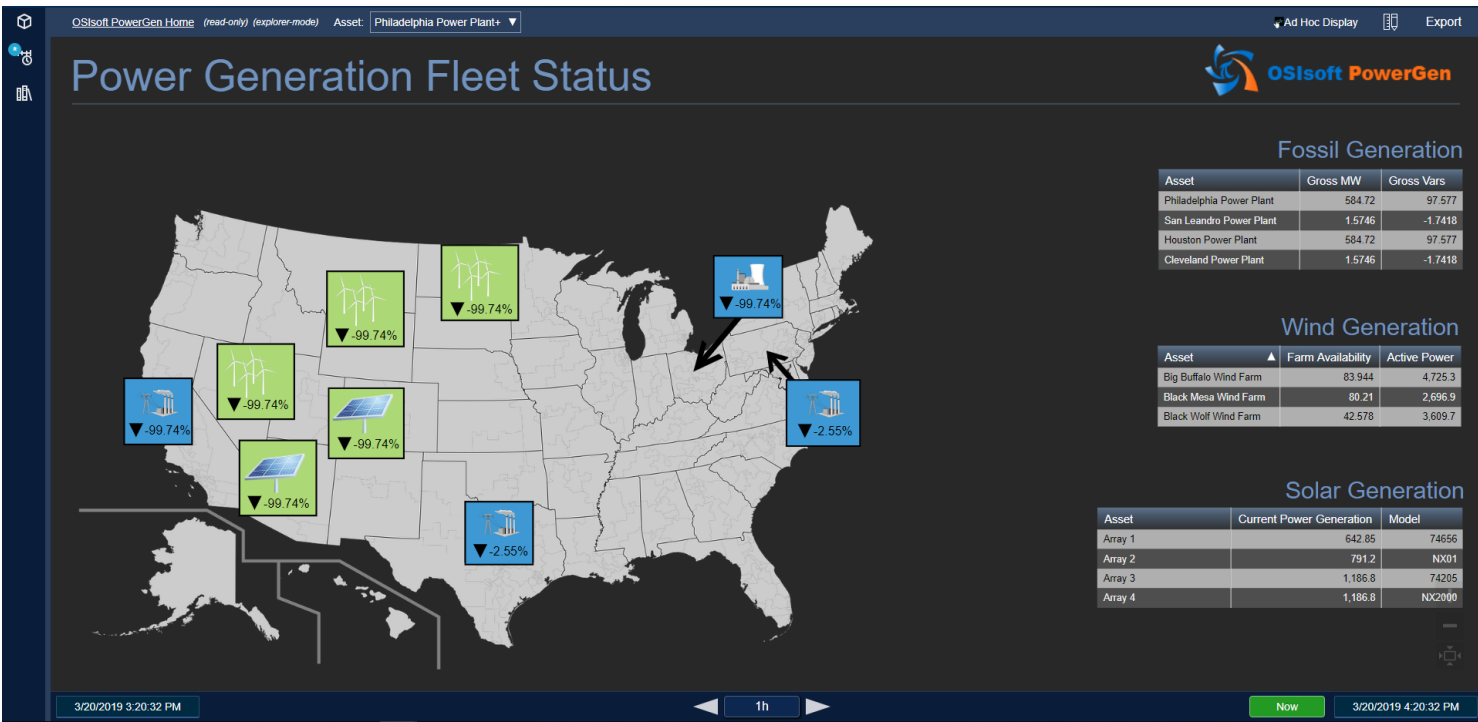
# Must Have Project Characteristics

- Subject matter expert included
- Sufficient business value
- Related to larger initiative



# Plant Manager

“What is our current capacity factor?”

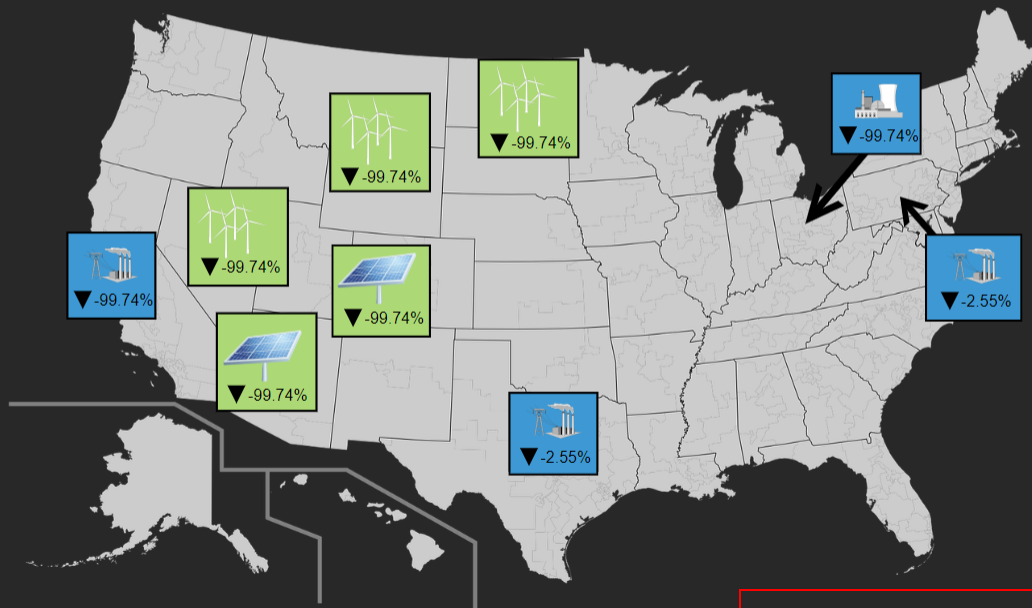


**Live KPIs for quick decisions**  
Know availability for the grid

**Additional supporting data**  
Asset-based data object

**Drill down for granularity**  
Equipment-level visibility

# Power Generation Fleet Status



## Fossil Generation

Asset	Gross MW	Gross Vars
Philadelphia Power Plant	584.72	97.577
San Leandro Power Plant	1,5746	-1.7418
Houston Power Plant	584.72	97.577
Cleveland Power Plant	1,5746	-1.7418

## Wind Generation

Asset	Farm Availability	Active Power
Big Buffalo Wind Farm	83.944	4,725.3
Black Mesa Wind Farm	80.21	2,696.9
Black Wolf Wind Farm	42.578	3,609.7

## Solar Generation

Asset	Current Power Generation	Model
Array 1	642.85	74656
Array 2	791.2	NX01
Array 3	1,186.8	74205
Array 4	1,186.8	NX2000

3/20/2019 3:20:32 PM

◀ 1h ▶

Now 3/20/2019 4:20:32 PM



Wind Farm Overview (explorer-mode) Asset: Black Mesa Wind Farm

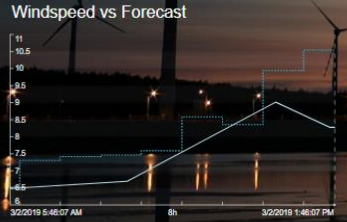
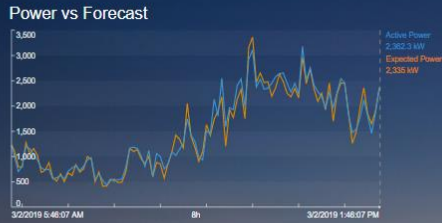
Ad Hoc Display | Export

# Black Mesa

Big Buffalo Wind Farm   Black Mesa Wind Farm   Black Wolf Wind Farm



Capacity Factor	62.166 %
Farm Availability	66.667 %
Turbines Installed	3
Turbines in Production	3



### Turbines

Turbine	Availability	Capacity (%)
GE05	5.0776 %	24.662
GE06	100 %	34.631
GE07	100 %	34.483

3/2/2019 5:46:07 AM

8h

Now

3/2/2019 1:46:07 PM



# Plant Operator

“What is occurring during turbine curtailments?”

## Self-service event comparison

No waiting on a central team

## Quick event comparisons

Find longest curtailment

## Insights without coding

Just learn to drag-and-drop



The screenshot displays the OSIsoft PI Vision interface. On the left, the 'Events' list shows several entries for GE05 turbines, including timestamps and status indicators. Below this, the 'Attributes' section provides detailed information for a selected event, such as 'Manufacturer: GE', 'Turbine: GE05', and 'Wind Farm: Wild River Wind Farm'. The main area contains two line charts showing 'Production Delta (kW)' over an 80-minute period. A semi-transparent comparison overlay is applied to the charts, highlighting differences between two specific events. On the right, the 'Edit Search Criteria' panel is open, showing filters for 'Database: Power Generation', 'Time Range: Last 30 Days', 'Event Severity', 'Event Name', 'Event Type and Attribute Value: Selected', 'Event Type: Wind Curtailment', 'Event Attribute', 'Asset Name: Any', and 'Asset Type: Wind Turbine'. The 'Number of Results' is set to 50, and the 'Search Mode' is 'Events Starting in Time Range'.

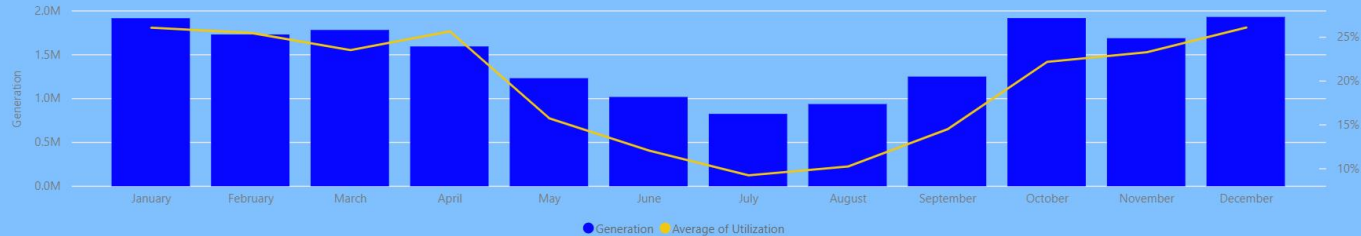
Ad hoc event comparison inherits event & asset structure enabling easy event comparison

# Ontario Wind Generation Overview

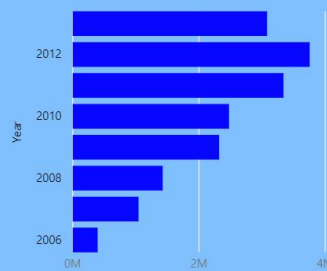
Site

Amaranth Comber Gosfield Greenwich Kingsbridge Port Alma I Port Alma II Port Burwell Prince Ripley South Underwood Wolfe Island

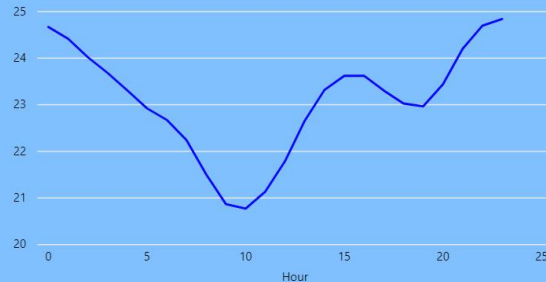
## Monthly Generation and Utilization



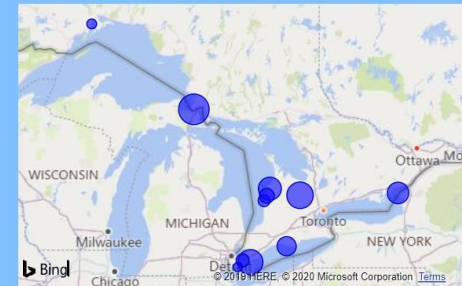
## Yearly Generation



## Generation by Hour



## Site Locations

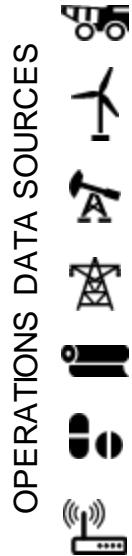


Overview Weather Effect

General Manager wants to analyze how much power was generated per month across multiple sites

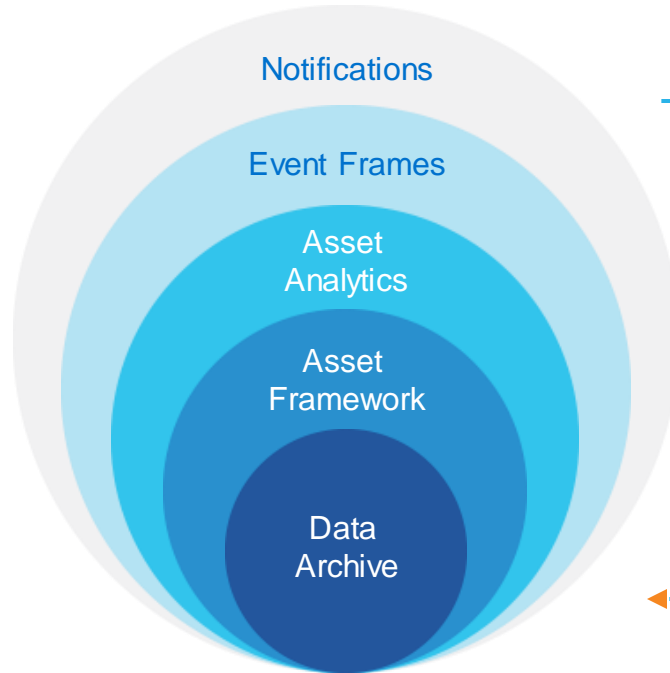
# How Does the PI System Work?

## COLLECT



Connections

## STORE & ENHANCE



PI SERVER

## DELIVER

Visualize



Share

PI Cloud Connect

Integrate

Business Intelligence Tools  
Amazon Web Services  
ESRI ArcGIS  
Microsoft Azure  
Hadoop ecosystem  
SAP HANA

Customize

Custom Applications  
Business Systems

80-5.Net Volume DC.SJ.PUE **TI-102** DC.Zero **DY-108** trigger  
 GE01\_A\_DT DC.SJ.C1.Z3.R3.PDU1.PF GE01\_A\_DT AC09.Power GE05\_Energy **C1:14AT5 AC03.Air Flow**  
 GE04\_OSAsset1Problem DC.SJ.SiteRealTim Anacortes Refinery.Alkylation.Asset **B737\_FG117** DC.TimeLoad  
 S **QI-122 FI-151** elTLoad.PR FT9001 Problems B210\_FG005.KPIExcursion **D-110.Tank Pressure.PV**  
 02F102.1HRAVGBGT001 403511195\_Wind Speed 4-36.NetVolume **AC04.Air Flow FI-101** bf5e1d1d-39c9- GE04\_DT **QI-121** GE03\_V\_WIN  
 PI-111 facility\_output 0\_ENG\_MODE\_STS F451 02T100 03LBB02C001-2 4b5b-b3d3-c2ce05fa3a26 **DC.Rk07R**  
**AQUA2-TI-201.PV** DC.NY.Actual.PWR.day.Tot 0 CLR\_FINAL\_OUT\_B TDC.Srv06R GE04\_Energy  
 AlarmTest.Input.Float32.1 **364511575-ACPower** MP 339511775\_Clear F506\_E990 **TI-121** FT9001  
**FI-101** bf5e1d1d-39c9-4b5b-b3d3-c2ce05f GE01\_DT **409510395\_Wind Speed QI-109** Global  
 BGE003 **FI-111** 02T100 GE01\_DT **Cooling Fan-711.Feed Rate** DC.Srv01R **Boiler-209.Fuel Gas**  
 AF\_FLOW3 02:T103 AT401 AQUA2-SI005.PV GE02\_Energy **Boiler-209.Fuel Gas** 94:GRDIDX.Tr  
 ACEDemo.Unit1.Output 0\_ENG\_MODE\_STS Volume **FI-151** D-110.Tank  
**TI-178 B352 W 778** 0\_CMP\_SVLV\_PCT DC.Z1R **Volume FI-151** **D-110.Tank**  
**02F104 CD:F161** 80-13.Net 0\_CMP\_HDR **Pressure.P**  
 94:BW.R **TI-101** 1-13.Net **DY-131** DM-05:BW.R **0\_ENG\_AUX\_STS** **Pressure.P**  
 F723\_E889 Volume **DY-131** DC.SJ.PUE **94:GRDIDX.ProdID** AT401 **Pump #1**  
**369512185-Temp** B045\_FG978 **Rate** fic1001.C GE02\_OT **Boiler-209.Fuel** **% CO2** **1-8.Net**  
 Compressor-439.Feed DC.SJ.PUE **FI-101** bf5e1d1d- **Gas Flow AF\_NOISE** GE05\_ES T **Volume**  
**DC.CH.DCE FI-** **FI-101** 39c9-4b5b-b3d3- **1-16.Net Volume** **CB1992\_MS** 03LBA32CT0  
**172:210** GE01\_DT c2ce05fa3a26 **0\_CMP\_FLOW\_TOTAL** 01-2  
**FI-121 AF\_FLOW3** DM05:BW.R AT401 **0\_ENG\_MODE\_STS** 0 CLR\_FINAL\_OUT\_B **DC.SJ.TLoad.PR** WR  
**0\_ENG\_MODE\_STS** TMP F506\_E990 **GE02\_Energy** FT9001 **TI-145**  
 GE03\_Q 339511775\_Clear Sky Globa l **fic1001.C FR5001** fastagFR2001  
**DY-131:166** GE01\_TD **FI-101** FT9001 **FeedBin.Cmt** **TI-178**  
 Boiler-334.Feed Rate Volume **403511195\_Wind** DC.Zone1.Number **GE04\_OS**  
 02F102.1HR BGE003 **FI-111** 02T100 **Speed DailyTigger** FrqPrbCost\_ER FT9001  
 AVG AF\_FLOW 3 02:T103 **45-2.Net Volume** FT9001 **DC.C2Z1.Pwr.Rippi** FR5001  
 BGT001 ACEDemo.Unit1.Output **TI-178** **02F104 CD:F161** **AlarmTest.Input** Float32.1 **DC.SJ.SiteRealTim**  
**PI-111** 0\_CMP\_SVLV\_PCT **FI-101** **elTLoad.PR FT9001** **QI-109** GE01\_DT **Cooling Fan-711** DM-05:BW.R  
**FI-144** GE04\_Status **FI-101** **DC.SJ.C1.Z1.R1.R** **DC.SJ.C1.Z1.R1.R**  
 02F100 fasttag02:F101.C **0\_ENG\_MODE\_STS** k06.S2.003.PWR **QI-111** **FeedProdBinOn**  
 AQUA2-SI005.PV GE02\_Energy **FI-151** 02T103.Q **DC.Z1R 0\_CMP\_HDR\_SUC\_PR** **DC.Z1R 0\_CMP\_HDR\_SUC\_PR** **FI-111** **Active Meters**  
**FI-111** **asset1\_output** GE01\_A\_DT **ASO** **fic1001.C** **94:GRDIDX.Pr**  
**AF\_NOISE** **PI-115** **DY-101** **02:F101.C** **odID Boiler-**  
 DM-05:BW.R **FR2001** **tic121** **209.Fuel Gas** **Flow**

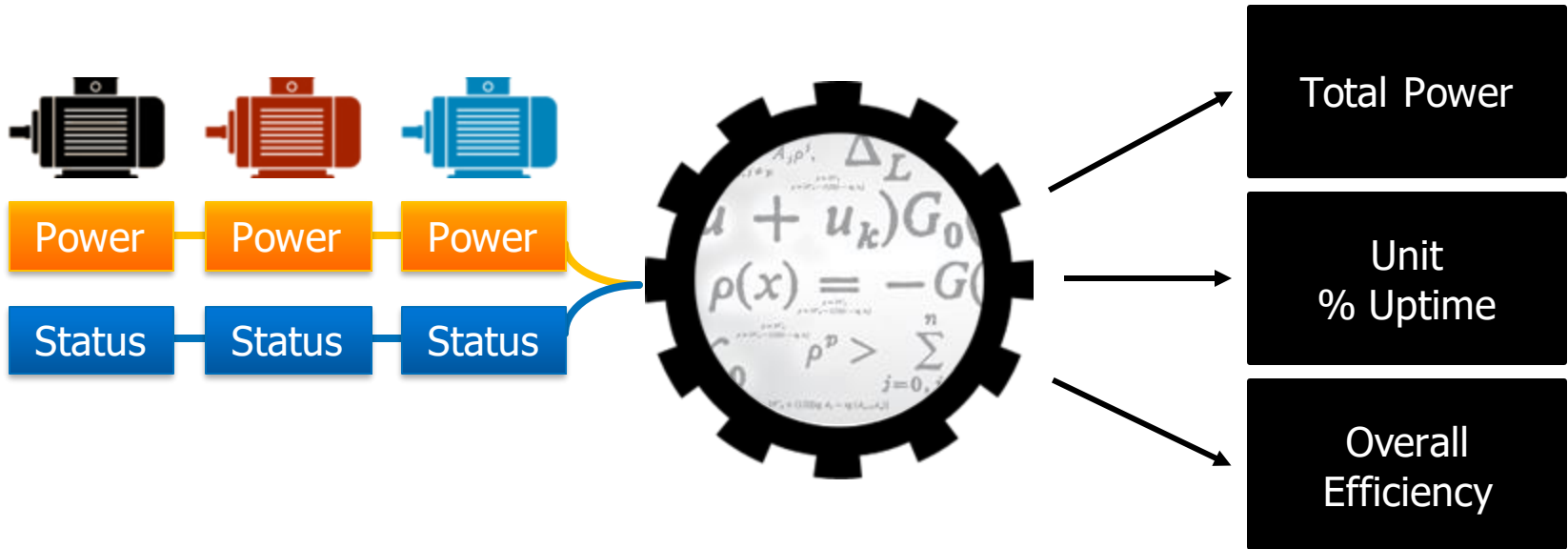
# Map raw data to the physical world and normalize it across the enterprise

**Crude Desalter**  
 Operating Pressure: 110 psi  
 Charge Rate: 14 gph  
 Mix Valve Pressure: 13 psi  
 Water Rate: 8%

**Weather Conditions**  
 Relative Humidity: 34%  
 Current Temp: 85 F  
 High: 92  
 Low: 57 F  
 Wind: 8 mph/N

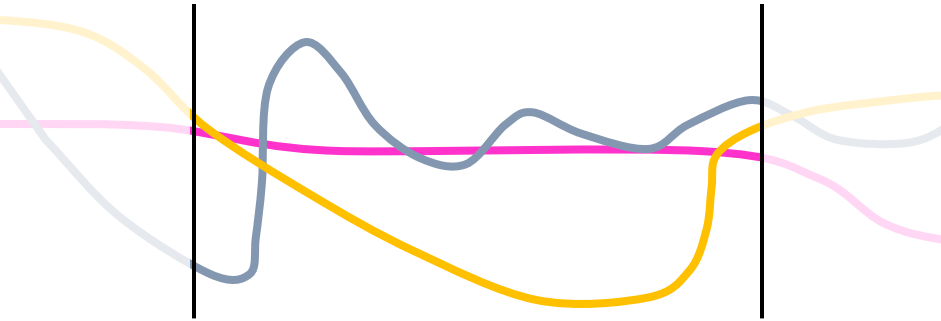
**Crude Furnace**  
 Draft Pressure: -0.5 WC  
 Stack Temp: 316 F  
 Oxygen: 2.5%  
 Outlet Temp: 840 F  
 Cold Oil Velocity: 6 ft/sec

# Make raw data decision-ready

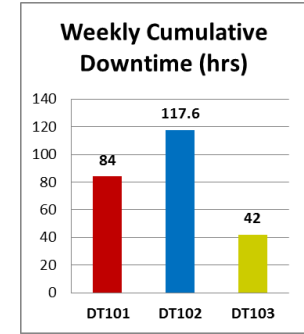
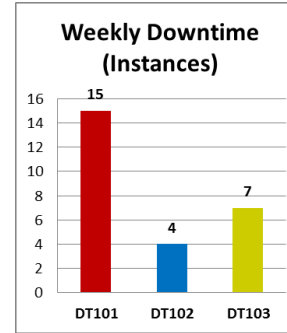


# Identify discrete events within continuous data streams

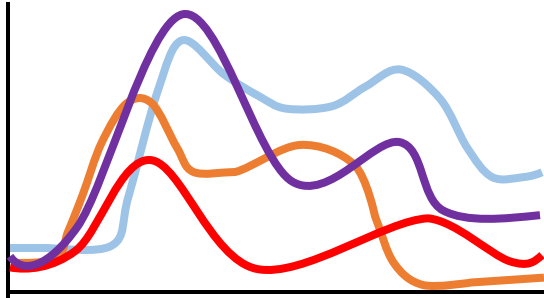
## Simplify Data Analysis



## Compare Assets



## Compare Events

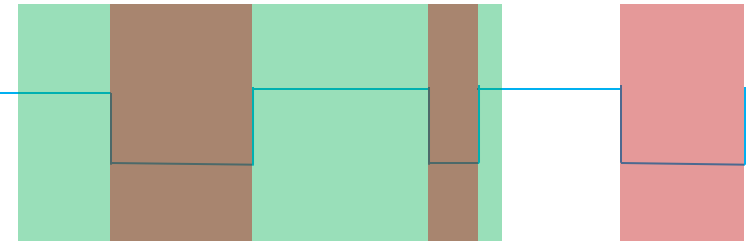


Name	Max
EF1	122.47
EF2	112.73
EF3	98.61
EF4	125.24

## Discover Event Interrelationships

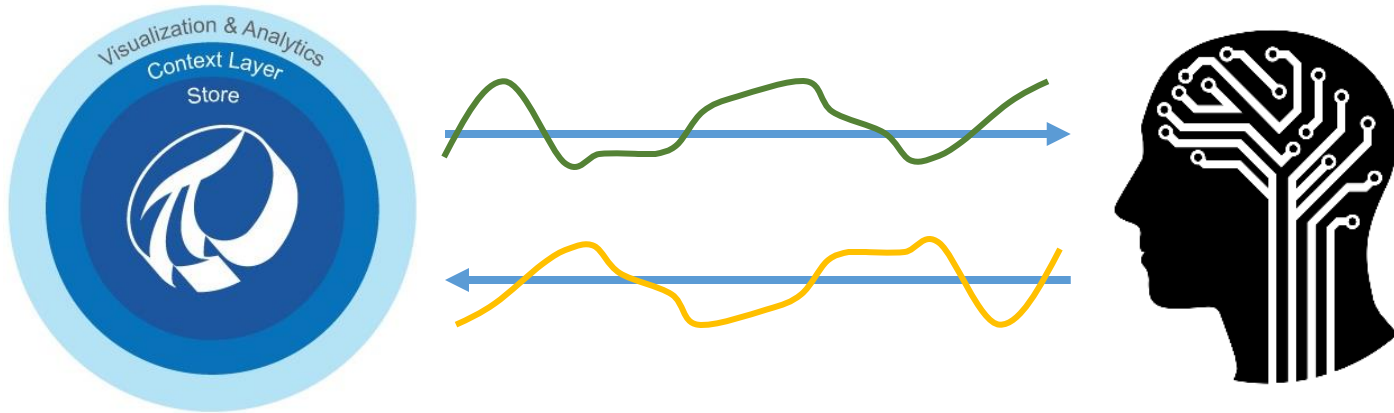
Running XYZ

Downtime





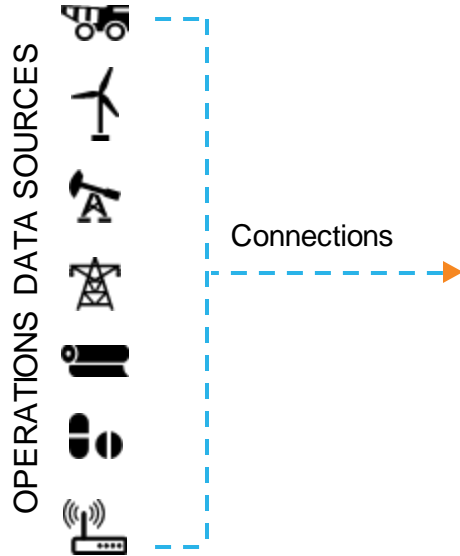
Integrate with other systems



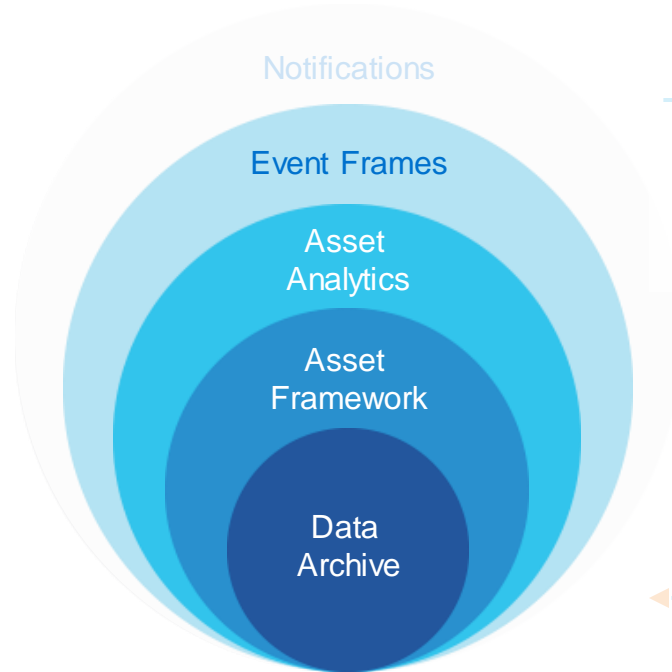
Send data back to the PI System

# How Does the PI System Work?

## COLLECT

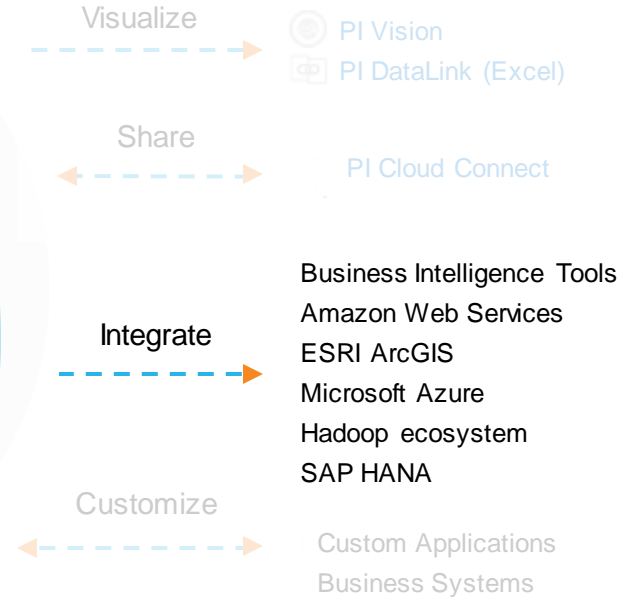


## STORE & ENHANCE



## PI SERVER

## DELIVER

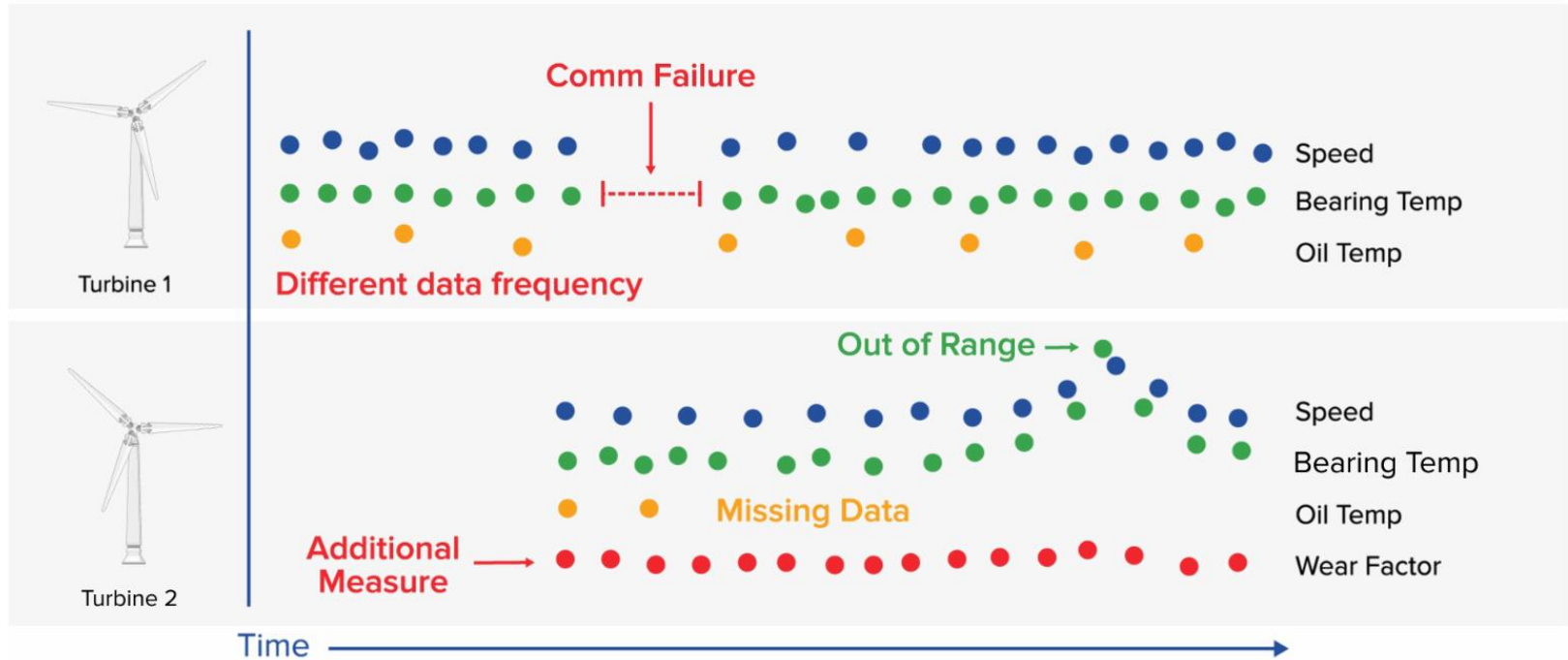


Wind Turbine	TimeStamp	Day of the Week	Active Power	Apparent Power	Bearing A Temperature	Capacity	Rotor Speed	Operati
GE01	3/18/2019 10:52:57.477 AM	Monday	1,517.787	1,523.764	42.523	62.831	19.927	90.403
GE01	3/18/2019 10:53:57.477 AM	Monday	1,518.78	1,517.996	42.515	62.877	20.39	90.421
GE01	3/18/2019 10:54:57.477 AM	Monday	1,528.438	1,527.098	42.507	62.924	19.877	90.44
GE01	3/18/2019 10:55:57.477 AM	Monday	1,524.599	1,525.12	42.498	62.97	20.002	90.459
GE01	3/18/2019 10:56:57.477 AM	Monday	1,521.875	1,521.751	42.49	63.016	19.913	90.478
GE01	3/18/2019 10:57:57.477 AM	Monday	1,525.674	1,531.629	42.481	63.063	19.726	90.497
GE01	3/18/2019 10:58:57.477 AM	Monday	1,535.935	1,536.558	42.473	63.109	20.013	90.516
GE01	3/18/2019 10:59:57.477 AM	Monday	1,517.37	1,519.13	42.465	63.155	20.232	90.535
GE01	3/18/2019 11:00:57.477 AM	Monday	1,528.547	1,529.658	42.456	63.202	20.065	90.554
GE01	3/18/2019 11:01:57.477 AM	Monday	1,529.736	1,524.135	42.448	63.248	19.922	90.573
GE01	3/18/2019 11:02:57.477 AM	Monday	1,517.794	1,525.652	42.439	63.294	19.955	90.592
GE01	3/18/2019 11:03:57.477 AM	Monday	1,505.852	1,512.247	42.431	63.341	19.708	90.61
GE01	3/18/2019 11:04:57.477 AM	Monday	1,519.556	1,521.107	42.423	63.387	20.054	90.627
GE01	3/18/2019 11:05:57.477 AM	Monday	1,519.952	1,523.781	42.414	63.433	20.173	90.644
GE01	3/18/2019 11:06:57.477 AM	Monday	1,523.877	1,508.615	42.406	63.48	19.949	90.662
GE01	3/18/2019 11:07:57.477 AM	Monday	1,533.151	1,532.751	42.397	63.526	19.94	90.68
GE01	3/18/2019 11:08:57.477 AM	Monday	1,525.437	1,526.634	42.389	63.572	19.999	90.698
GE01	3/18/2019 11:09:57.477 AM	Monday	1,523.269	1,518.825	42.381	63.619	19.862	90.716
GE01	3/18/2019 11:10:57.477 AM	Monday	1,522.443	1,522.936	42.372	63.665	20.009	90.733
GE01	3/18/2019 11:11:57.477 AM	Monday	1,509.033	1,522.19	42.364	63.712	19.63	90.75
GE01	3/18/2019 11:12:57.477 AM	Monday	1,524.965	1,525.264	42.355	63.758	20.008	90.767
GE01	3/18/2019 11:13:57.477 AM	Monday	1,511.918	1,508.629	42.347	63.804	19.621	90.784
GE01	3/18/2019 11:14:57.477 AM	Monday	1,519.61	1,523.788	42.339	63.851	19.749	90.801
GE01	3/18/2019 11:15:57.477 AM	Monday	1,526.237	1,524.405	42.33	63.897	19.949	90.818
GE01	3/18/2019 11:16:57.477 AM	Monday	1,532.863	1,525.036	42.322	63.943	19.886	90.835
GE01	3/18/2019 11:17:57.477 AM	Monday	1,509.635	1,515.866	42.313	63.99	19.921	90.855
GE01	3/18/2019 11:18:57.477 AM	Monday	1,522.636	1,525.022	42.305	64.036	19.992	90.876
GE01	3/18/2019 11:19:57.477 AM	Monday	1,518.829	1,519.512	42.296	64.082	20.067	90.893
GE01	3/18/2019 11:20:57.477 AM	Monday	1,527.32	1,526.332	42.288	64.129	20.043	90.91
GE01	3/18/2019 11:21:57.477 AM	Monday	1,515.018	1,516.249	42.28	64.175	19.828	90.926
GE01	3/18/2019 11:22:57.477 AM	Monday	1,506.233	1,506.149	42.271	64.221	19.684	90.943

BI Tools & Algorithms  
expect time-aligned data

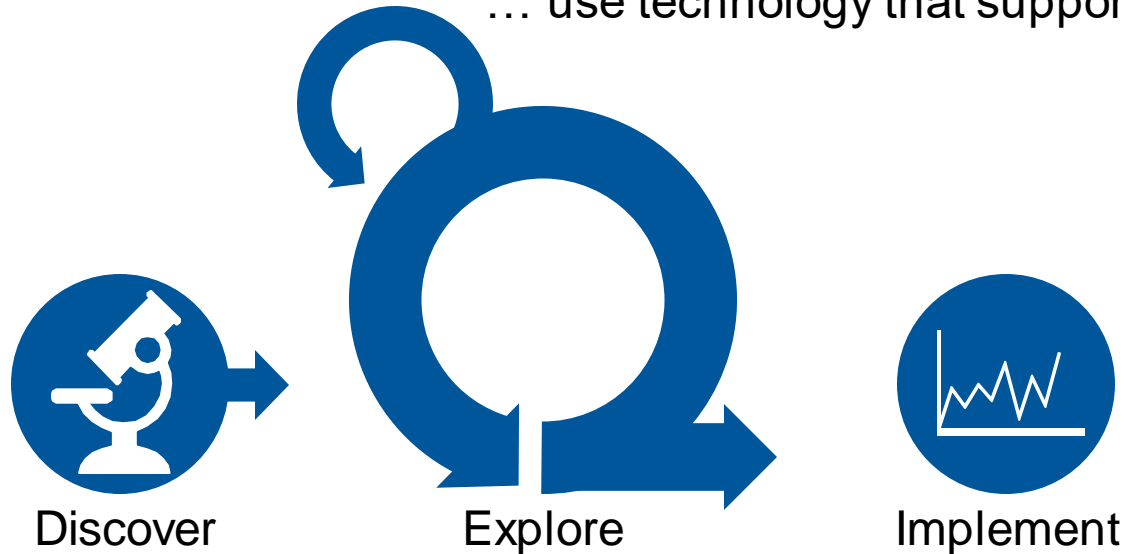
Data Scientists & Business Analysts  
need that data contextualized

# Time-series Data is Not Naturally Aligned or Contextualized



# Advanced Analytics Workflows are Iterative and Need SMEs

... use technology that support this approach



Source Assets

Server: DFPIAFSERVERPRD

Database: Power Generation

Assets

- Generation
  - Equipment List
  - Fossil Generating Station
  - Matador 1 CCGT
  - OSIsoft Power
  - PowerCo
  - Solar Power Generation Fleet
  - Wind Power Generation Fleet
    - Big Buffalo Wind Farm
    - Black Mesa Wind Farm
      - GE01
      - GE02
      - GE03
      - GE04
      - GE05
      - GE06
      - GE07

Attributes Filter

Select All

- Active Power
- Apparent Power
- Apparent Power (calc)
- BatchWindBinFilter

Search Shape

Asset Shape

- Wind Turbine
  - Active Power
  - Apparent Power
  - Bearing A Temperature
  - Capacity
  - Operating Efficiency
  - Rotor Speed

Select Data > Modify View > Publish

Source Assets

Server: DFPIAFSERVERPRD

Database: Power Generation

Assets

- Generation
  - Equipment List
  - Fossil Generating Station
  - Matador 1 CCGT
  - OSIsoft Power
  - PowerCo
  - Solar Power Generation Fleet
  - Wind Power Generation Fleet
    - Big Buffalo Wind Farm
    - Black Mesa Wind Farm
      - GE01
      - GE02
      - GE03
      - GE04
      - GE05
      - GE06
      - GE07

Attributes Filter

Select All

- Active Power
- Apparent Power
- Apparent Power (calc)
- BatchWindBinFilter
- Blade3, Set Value
- Capacity
- Circuit Breaker Cut-Ins

Begin from common nomenclature & hierarchy



Discover

Pick from measurements that shape the model or view

Edit Filters

Asset Name: GE05

Asset Template: Wind Turbine

Asset Category: Wind Turbine

+ Add Filter

Cancel Save

Filter based on similar assets

9 columns   
  1 Row Filter   
  Interpolated Values Every 1 minute

Start Time: \*-1d    End Time: \*   

Wind Turbine	TimeStamp	Day of the Week	Active Power	Apparent Power	Bearing A Temperature	Capacity	Rotor Speed	Operati
GE01	3/18/2019 10:52:57.477 AM	Monday	1,517.787	1,523.764	42.523	62.831	19.927	90.403
GE01	3/18/2019 10:53:57.477 AM	Monday	1,518.78	1,517.996	42.515	62.877	20.39	90.421
GE01	3/18/2019 10:54:57.477 AM	Monday	1,528.438	1,527.096	42.507	62.924	19.877	90.44
GE01	3/18/2019 10:55:57.477 AM	Monday	1,524.599	1,525.12	42.498	62.97	20.002	90.459
GE01	3/18/2019 10:56:57.477 AM	Monday	1,521.875	1,521.751	42.49	62.946	19.813	90.478
GE01	3/18/2019 10:57:57.477 AM	Monday	1,525.674	1,531.629	42.481	62.915	20.002	90.459
GE01	3/18/2019 10:58:57.477 AM	Monday	1,535.935	1,536.558	42.473	62.915	20.002	90.459
GE01	3/18/2019 10:59:57.477 AM	Monday	1,517.37	1,519.13	42.465	62.915	20.002	90.459
GE01	3/18/2019 11:00:57.477 AM	Monday	1,526.547	1,529.658	42.456	62.915	20.002	90.459
GE01	3/18/2019 11:01:57.477 AM	Monday	1,529.736	1,524.135	42.448	62.915	20.002	90.459
GE01	3/18/2019 11:02:57.477 AM	Monday	1,517.794	1,525.652	42.439	62.915	20.002	90.459
GE01	3/18/2019 11:03:57.477 AM	Monday	1,505.852	1,512.247	42.431	62.915	20.002	90.459
GE01	3/18/2019 11:04:57.477 AM	Monday	1,519.556	1,521.107	42.423	62.915	20.002	90.459
GE01	3/18/2019 11:05:57.477 AM	Monday	1,519.952	1,523.781	42.414	62.915	20.002	90.459
GE01	3/18/2019 11:06:57.477 AM	Monday	1,523.877	1,508.645	42.406	62.915	20.002	90.459
GE01	3/18/2019 11:07:57.477 AM	Monday	1,533.151	1,532.751	42.397	62.915	20.002	90.459
GE01	3/18/2019 11:08:57.477 AM	Monday	1,525.437	1,526.634	42.389	62.915	20.002	90.459
GE01	3/18/2019 11:09:57.477 AM	Monday	1,523.269	1,518.825	42.381	62.915	20.002	90.459
GE01	3/18/2019 11:10:57.477 AM	Monday	1,522.443	1,522.936	42.372	62.915	20.002	90.459
GE01	3/18/2019 11:11:57.477 AM	Monday	1,509.033	1,522.19	42.364	62.915	20.002	90.459
GE01	3/18/2019 11:12:57.477 AM	Monday	1,524.965	1,525.264	42.355	62.915	20.002	90.459
GE01	3/18/2019 11:13:57.477 AM	Monday	1,511.918	1,508.629	42.347	62.915	20.002	90.459
GE01	3/18/2019 11:14:57.477 AM	Monday	1,519.61	1,523.788	42.339	62.915	20.002	90.459
GE01	3/18/2019 11:15:57.477 AM	Monday	1,526.237	1,524.405	42.33	62.915	20.002	90.459
GE01	3/18/2019 11:16:57.477 AM	Monday	1,532.863	1,525.036	42.322	62.915	20.002	90.459
GE01	3/18/2019 11:17:57.477 AM	Monday	1,509.635	1,515.866	42.313	62.915	20.002	90.459
GE01	3/18/2019 11:18:57.477 AM	Monday	1,522.636	1,525.022	42.305	62.915	20.002	90.459
GE01	3/18/2019 11:19:57.477 AM	Monday	1,518.829	1,519.512	42.296	64.082	20.067	90.893
GE01	3/18/2019 11:20:57.477 AM	Monday	1,527.32	1,526.332	42.288	64.129	20.043	90.91
GE01	3/18/2019 11:21:57.477 AM	Monday	1,515.018	1,516.249	42.28	64.175	19.828	90.926
GE01	3/18/2019 11:22:57.477 AM	Monday	1,506.233	1,506.149	42.271	64.221	19.684	90.943

### Row Filters

Add New Row Filter

- Include rows based on whether the contents of a column match a string pattern
- Include rows based on whether the contents of a column contain certain digital values
- Include rows based on whether the contents of a column contain certain numeric values
- Include rows where the contents of a column contain a value
- Include rows where certain Event Frames are active



Discover

Various ways to clean the data







Discover

Include multiple filters to clean data

**Row Filters** [Close]

Event Row Filter 1 [Edit] [Delete] [Add New Row Filter]

Criteria: Event Related

**Add Numeric Row Filter** [Close]

**Row Filters** [Close]

- Include
- Exclude

Bearing A Temperature > -273.15

**Event Row Filter 1** [Edit] [Delete]

**Criteria 1: Match Event Frames where**  
Event Template = Wind Curtailment  
Related Shape Asset is **any**

**Add New Row Filter**

- String**: Include rows based on whether the contents of a column match a string pattern
- Digital**: Include rows based on whether the contents of a column contain certain digital values
- Numeric**: Include rows based on whether the contents of a column contain certain numeric values
- Null Values**: Include rows where the contents of a column contain a value
- Event Frame**: Include rows where certain Event Frames are active

[Close]



Discover

Select Data > **Modify View** > Publish

Back

Next

+ Add Column  
9 columns

▼ Edit Row Filters  
1 Row Filters

≡ Edit Value Mode  
Interpolated Values  
Every 1 minute

Start Time

~-1d

End Time

\*

Apply

Wind Turbine	TimeStamp	Day of the Week	Active Power	Apparent Power	Bearing A Temperature	Capacity	Rotor Speed	Operati
GE01	3/18/2019 10:52:57.477 AM	Monday	1,517.787	1,523.764	42.523	62.831	19.927	90.403
GE01	3/18/2019 10:53:57.477 AM	Monday	1,518.78	1,517.996	42.515	62.877	20.39	90.421
GE01	3/18/2019 10:54:57.477 AM	Monday	1,528.438	1,527.098	42.507	62.924	19.877	90.44
GE01	3/18/2019 10:55:57.477 AM	Monday	1,524.599	1,525.12	42.498	62.97	20.002	90.459
GE01	3/18/2019 10:56:57.477 AM	Monday	1,521.875	1,521.751	42.49	63.016	19.913	90.478
GE01	3/18/2019 10:57:57.477 AM	Monday	1,525.674	1,531.629	42.481	63.063	19.726	90.497
GE01	3/18/2019 10:58:57.477 AM	Monday	1,535.935	1,536.558	42.473	63.109	20.013	90.516
GE01	3/18/2019 10:59:57.477 AM	Monday	1,517.37	1,519.13	42.465	63.155	20.232	90.535
GE01	3/18/2019 11:00:57.477 AM	Monday	1,528.547	1,529.658	42.456	63.202	20.065	90.554
GE01	3/18/2019 11:01:57.477 AM	Monday	1,529.736	1,524.135	42.448	63.248	19.922	90.573
GE01	3/18/2019 11:02:57.477 AM	Monday	1,517.794	1,525.652	42.439	63.294	19.955	90.592
GE01	3/18/2019 11:03:57.477 AM	Monday	1,505.852	1,512.247	42.431	63.341	19.708	90.61
GE01	3/18/2019 11:04:57.477 AM	Monday	1,519.556	1,521.107	42.423	63.387	20.054	90.627
GE01	3/18/2019 11:05:57.477 AM	Monday	1,519.952	1,523.781	42.414	63.433	20.173	90.644
GE01	3/18/2019 11:06:57.477 AM	Monday	1,523.877	1,508.615	42.406	63.48	19.949	90.662
GE01	3/18/2019 11:07:57.477 AM	Monday	1,533.151	1,532.751	42.397	63.526	19.94	90.68
GE01	3/18/2019 11:08:57.477 AM	Monday	1,525.437	1,526.634	42.389	63.572	19.999	90.698
GE01	3/18/2019 11:09:57.477 AM	Monday	1,523.269	1,518.825	42.381	63.619	19.862	90.716
GE01	3/18/2019 11:10:57.477 AM	Monday	1,522.443	1,522.936	42.372	63.665	20.009	90.733
GE01	3/18/2019 11:11:57.477 AM	Monday	1,509.033	1,522.19	42.364	63.712	19.63	90.75
GE01	3/18/2019 11:12:57.477 AM	Monday	1,524.965	1,525.264	42.355	63.758	20.008	90.767
GE01	3/18/2019 11:13:57.477 AM	Monday	1,511.918	1,508.629	42.347	63.804	19.621	90.784
GE01	3/18/2019 11:14:57.477 AM	Monday	1,519.61	1,523.788	42.339	63.851	19.749	90.801
GE01	3/18/2019 11:15:57.477 AM	Monday	1,526.237	1,524.405	42.33	63.897	19.949	90.818
GE01	3/18/2019 11:16:57.477 AM	Monday	1,532.863	1,525.036	42.322	63.943	19.886	90.835
GE01	3/18/2019 11:17:57.477 AM	Monday	1,509.635	1,515.866	42.313	63.99	19.921	90.855
GE01	3/18/2019 11:18:57.477 AM	Monday	1,522.636	1,525.022	42.305	64.036	19.992	90.876
GE01	3/18/2019 11:19:57.477 AM	Monday	1,518.829	1,519.512	42.296	64.082	20.067	90.893
GE01	3/18/2019 11:20:57.477 AM	Monday	1,527.32	1,526.332	42.288	64.129	20.043	90.91
GE01	3/18/2019 11:21:57.477 AM	Monday	1,515.018	1,516.249	42.28	64.175	19.828	90.926
GE01	3/18/2019 11:22:57.477 AM	Monday	1,506.233	1,506.149	42.271	64.221	19.684	90.943

Operational data of an asset that is usable by algorithms or BI Tools!!

- Asset Context
- Data Alignment
- Asset Normalization
- Filtered on a Curtailment Event Type
- Filtered for  $T > -273.15\text{ C}$





Discover

LK\_WindFarm

Select Data > Modify View > Publish

**Target Configuration**

Westeros

**Run Mode**

Run Once

Run on a Schedule

First Run

\*

Recur every 5 minutes

**Summary**

Shape and Matches

- There are 75 Matching Instances

Timeframe and Interval

- Your Start Time is \*-1d
- Your End Time is \*
- Your Time Interval gets an interpolated measurement Every 1 minute

Publish

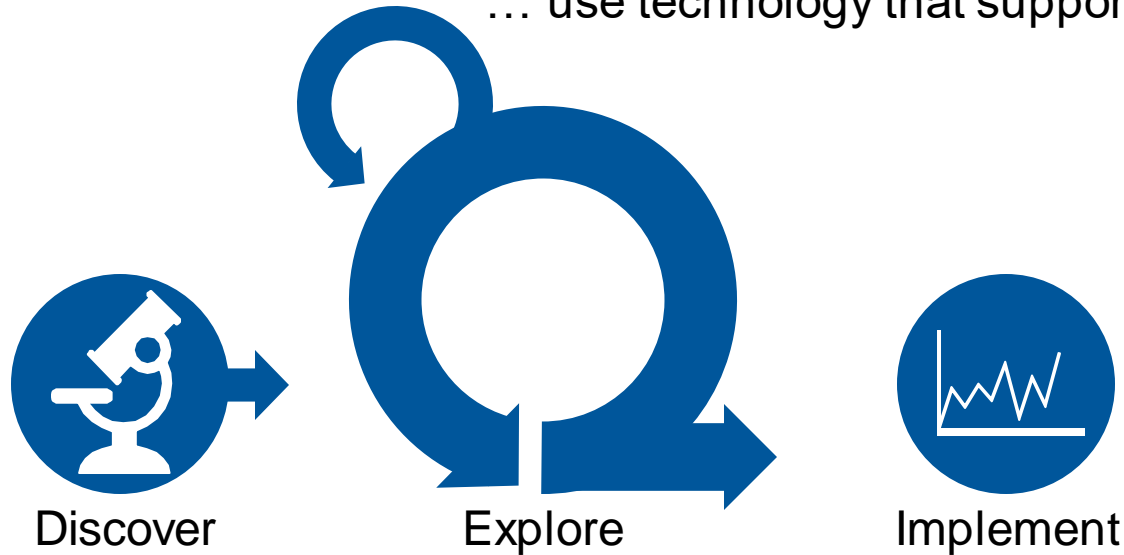
Select where you want to publish

One-time bulk or incrementally push

Benefit from native integration to AWS, Azure, Hadoop, and SAP HANA

# Advanced Analytics Workflows are Iterative and Need SMEs

... use technology that support this approach



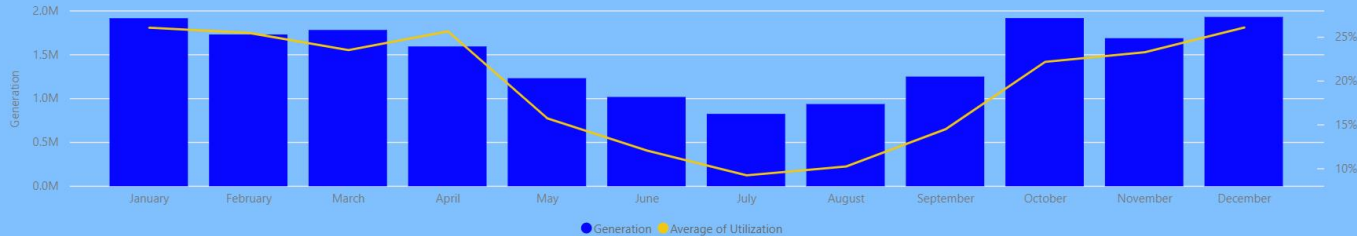


# Ontario Wind Generation Overview

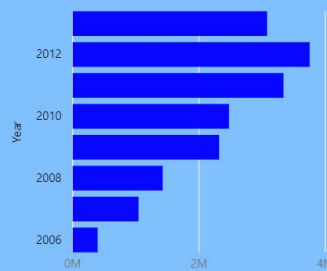
Site

Amaranth Comber Gosfield Greenwich Kingsbridge Port Alma I Port Alma II Port Burwell Prince Ripley South Underwood Wolfe Island

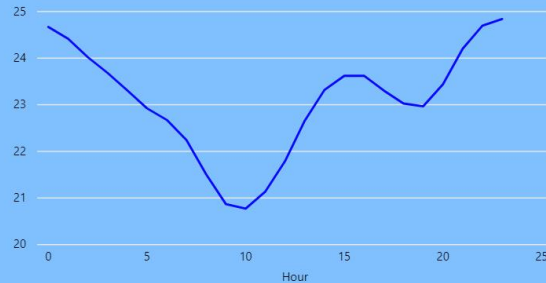
## Monthly Generation and Utilization



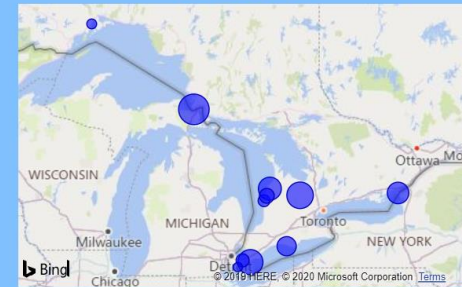
## Yearly Generation



## Generation by Hour



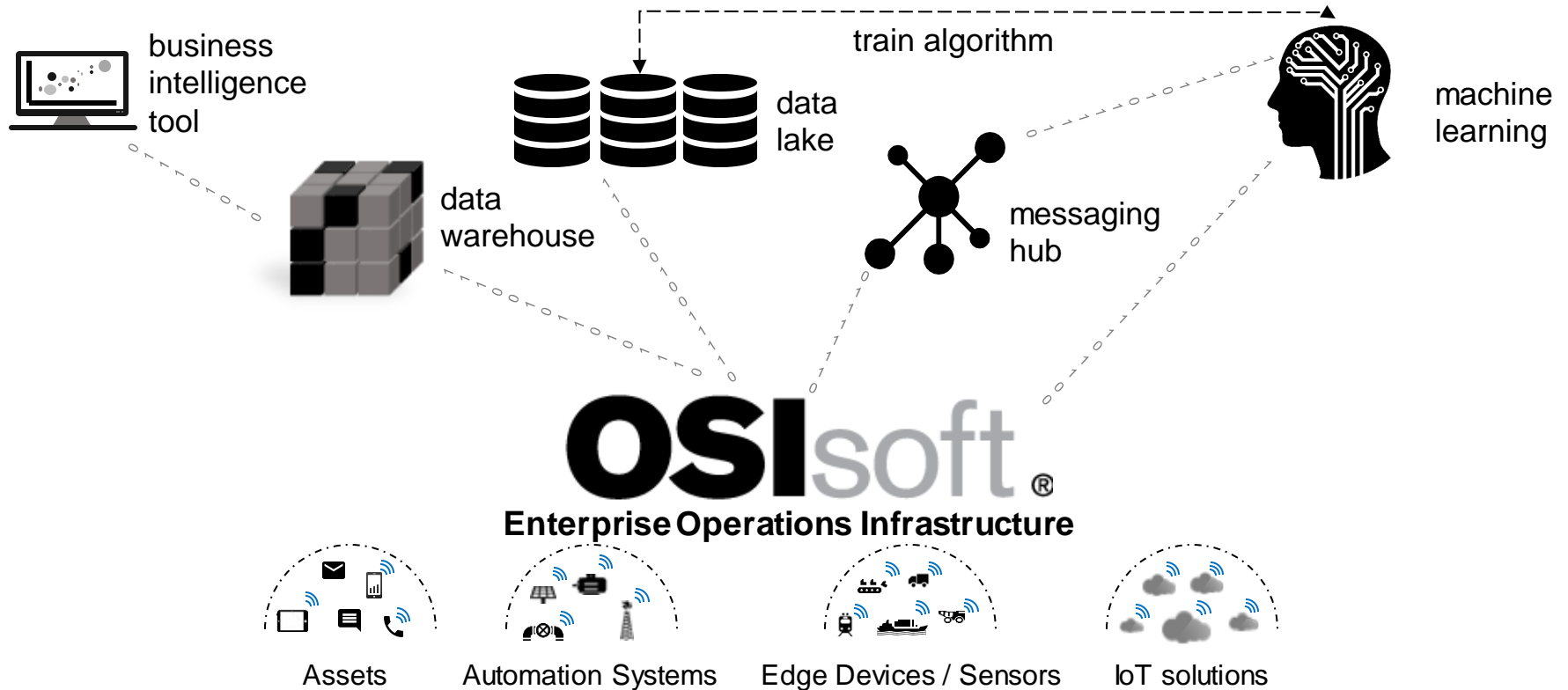
## Site Locations



Overview Weather Effect

General Manager wants to analyze how much power was generated per month across multiple sites

# PI System integrates to a variety of advanced analytics components



# Takeaways

- Obtain quick value by providing data to experts
- Start small to de-risk advanced analytics projects
- **PI System** enables you to accelerate your analytics with **context** and **normalization** layered on top of raw operational data

## Data Scientist

Investigate how  
**PI Integrators** can  
save you time  
preparing data

## Engineer/Operator

See how **PI Vision** can  
give a full view of your  
processes and systems

## General Manager

Speak to our customers  
about the value they  
gain from **PI System**  
*and* checkout industry  
tracks



# Contact us for more information...



Sean Upson

[supson@osisoft.com](mailto:supson@osisoft.com)

Systems Engineer

OSIsoft LLC

謝謝 KEA LEBOHA  
 TAPADH LEIBH 고맙습니다  
 БАЯРЛАЛАА MISAOTRA ANAO  
 DZIĘKUJĘ CI NGIYABONGA TEŞEKKÜR EDERIM GRACIES OBRIGADO شكرا SALAMAT  
 DANKON TANK TAPADH LEAT  
 KÖSZÖNÖM DANKIE TERIMA KASIH GRACIES  
 СПАСИБО  
 PAKMET CIZGE  
 GO RAIBH MAITH AGAT  
 БЛАГОДАРЯ GRACIAS MAHADSANID  
 ТИ БЛАГОДАРАМ  
 TAK DANKE MAHANSANID  
 RAHMAT MERCI  
 HATUR NUHUN  
 GRAZZI PAKKA PÉR  
 PAXMAT САГА  
 CẢM ƠN BẠN  
 WAZVIITA  
 FALEMINDERIT  
 TI БЛАГОДАРАМ  
 СИПОС  
 OSISoft.  
**PIWorld**  
**THANK YOU**  
 MULȚUMESC  
 HVALA FAAFETAI  
 ESKERRIK ASKO  
 HVALA ХВАЛА ВАМ  
 TEŞEKKÜR EDERIM  
 DANK JE EΥΧΑΡΙΣΤΩ GRATIAS TIBI  
 AČIŮ SALAMAT MAHALO IĀ 'ŌE TAKK SKALDU HA  
 ДЗЯКУЙ GRAZIE  
 DI OU MÈSI  
 ĎAKUJEM  
 MATUR NUWUN  
 SIPAS JI WERE TERIMA KASIH  
 UA TSAUG RAU KOJ  
 TI БЛАГОДАРАМ  
 СИПОС