OSIsoft. PI World SAN FRANCISCO

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# PI World 2020 Lab

## PI Vision – Beyond the Basics

OSIsoft. PI World

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## Introduction

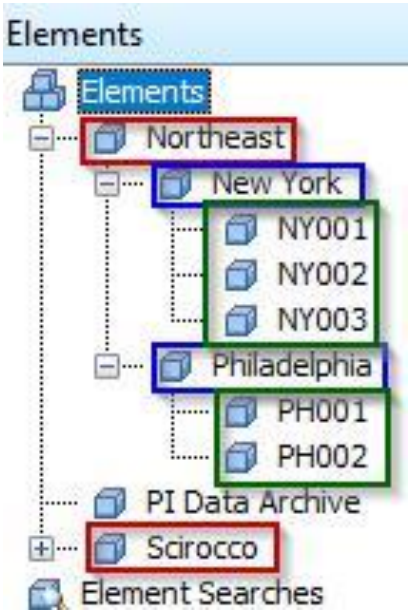
This lab is designed for people who already have already used PI Vision. Students should already be familiar with how to create displays in PI Vision and understand how PI Vision is able to leverage AF Templates.

## Approach

Specific questions or scenarios will be presented to solve primarily using OSIsoft PI Vision as your visualization and analysis tool. More advanced features of PI Vision will have a strong reliance on AF so you will also need to use PI System Explorer (PSE). Each exercise can be completed with PI Vision and PSE. If you are stuck, ask one of the lab monitors for assistance.

## Scenario: Energy Management Solutions

You have just been hired as a consultant for Energy Management Solutions. Your first client is a Wind Farm energy company and you are tasking with creating some advanced PI Vision displays that employees can use to monitor their turbines. Luckily the company has just completed a project building out an AF database that has correctly templatized their AF Assets. Their AF structure features three main levels, Region, Farm, and Turbine.




Red – Region
Blue – Farm
Green - Turbine

Within AF, the customer has configured Event Frames to monitor Turbine downtime. These Event Frames are set to trigger whenever the turbine is in a status other than “Run”.

You know that this structure will make it possible for you to utilize template dependent features within PI Vision which can save you time when building out displays.

Note: PI AF database used in these exercises is a slight modification of the **Wind Farm Monitoring Asset Based PI Example Kit** available on PI Square:

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# Exercises

## Exercise 1: Creating a Turbine Information Display

**Exercise Objectives:**

- Create a display showing Turbine level information
- Utilize a multi-level collection to navigate through their AF database

**Scenario:**

Your first assignment is to create a Turbine Information Display. The client would like to have a display that shows Power and Production information for each Turbine that is selected. The client has 22 turbines in total. With your knowledge of PI Vision, you know if you make a display using attributes from the same template you can use the Asset Drop Down box to make a reusable display that can be applied to all turbines. The client informs you though that they do not want to have users using the Asset Drop Down box. They would like to have an on-screen symbol that they can select to change the context of the display at various levels and only be able to see Turbines in the selected Region and Farm.

**Approach:**

1. Use the shortcut on the desktop to launch PI Vision using Chrome.

    a. Alternatively, start Chrome and navigate to https://pivision/pivision

2. Click New Display in PI Vision.

3. Create three collections, one for each level of the hierarchy that contain the asset name. There should be one for **Region Name**, **Farm Name**, and **Turbine Name**.

**Hint:** On the OSIsoft Learning Channel there is a video called: PI Vision Alternative Context Switching with Collections and Multiple Filters (https://www.youtube.com/watch?v=_QlyKSJyy9o&t=387s)

4. Configure the collection's navigation link to change the root context of the current display

5. Create symbols in PI Vision that can be used to monitor Power and Production of the Turbines. Specifically the **Active Power, Apparent Power,** and **Lifetime Production** attributes will be useful.

6. Once finished, select the drop down arrow on the right hand side of the Asset Drop Down box and click the gear icon. Then in the Configure Context Switching pane on the right select the option for "Do not show".

7. Save the display as *Windfarm Turbine Overview.*

**Questions:**

What is the **Hourly Lifetime Production** for Turbine GE004 in Santaella?

What is the difference in **Active Power** and **Apparent Power** for Turbine RB009 in Finisterre?

## Exercise 2: Turbine Events Display

**Exercise Objectives:**

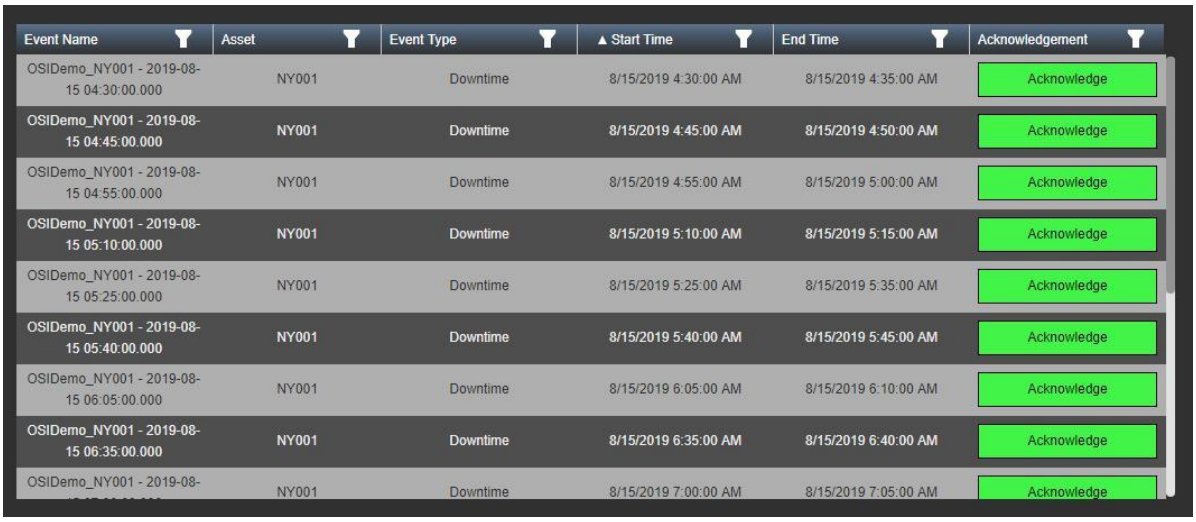
- Use the Events Table to see recent Event Frames
- Analyze Event frames with the Details page

**Scenario:**

Your client loved your Turbine information display but they would also like to see a display they can use to better track their Event frames. Currently they are monitoring turbine downtime events and would like a display to visualize that. They would like the display to contain all the most recent events from the selected turbine.

**Approach:**

1. Create a new display in PI Vision.
2. Create symbols on the display showing the Turbine name and status.
    a Only create the display using data from one turbine.
3. Add an Events Table show Event Frames for all assets on the display.
    a Hint: This can be done by selecting the Events tab and using the Create Events Table button



| Event Name | Asset | Event Type | ▲ Start Time | End Time | Acknowledgement |
|---|---|---|---|---|---|
| OSIDemo_NY001 - 2019-08-15 04:30:00.000 | NY001 | Downtime | 8/15/2019 4:30:00 AM | 8/15/2019 4:35:00 AM | Acknowledge |
| OSIDemo_NY001 - 2019-08-15 04:45:00.000 | NY001 | Downtime | 8/15/2019 4:45:00 AM | 8/15/2019 4:50:00 AM | Acknowledge |
| OSIDemo_NY001 - 2019-08-15 04:55:00.000 | NY001 | Downtime | 8/15/2019 4:55:00 AM | 8/15/2019 5:00:00 AM | Acknowledge |
| OSIDemo_NY001 - 2019-08-15 05:10:00.000 | NY001 | Downtime | 8/15/2019 5:10:00 AM | 8/15/2019 5:15:00 AM | Acknowledge |
| OSIDemo_NY001 - 2019-08-15 05:25:00.000 | NY001 | Downtime | 8/15/2019 5:25:00 AM | 8/15/2019 5:35:00 AM | Acknowledge |
| OSIDemo_NY001 - 2019-08-15 05:40:00.000 | NY001 | Downtime | 8/15/2019 5:40:00 AM | 8/15/2019 5:45:00 AM | Acknowledge |
| OSIDemo_NY001 - 2019-08-15 06:05:00.000 | NY001 | Downtime | 8/15/2019 6:05:00 AM | 8/15/2019 6:10:00 AM | Acknowledge |
| OSIDemo_NY001 - 2019-08-15 06:35:00.000 | NY001 | Downtime | 8/15/2019 6:35:00 AM | 8/15/2019 6:40:00 AM | Acknowledge |
| OSIDemo_NY001 - 2019-08- | NY001 | Downtime | 8/15/2019 7:00:00 AM | 8/15/2019 7:05:00 AM | Acknowledge |

4. While in run mode, single click the Event to open the Details display.
5. Save the display as *Windfarm Turbine Detail.*

**Questions:**

When was the last time turbine PH002 in Philadelphia had a downtime Event?

What was the approximate peak **Lost Revenue Rate** in that time range?

What was the approximate minimum **Apparent Power** for that time range?

## Exercise 3: Linking the displays

**Exercise Objectives:**

- Use AF to dynamically build URLs to the Event Details display.
- Create an Asset Comparison table to display those URLs in PI Vision.

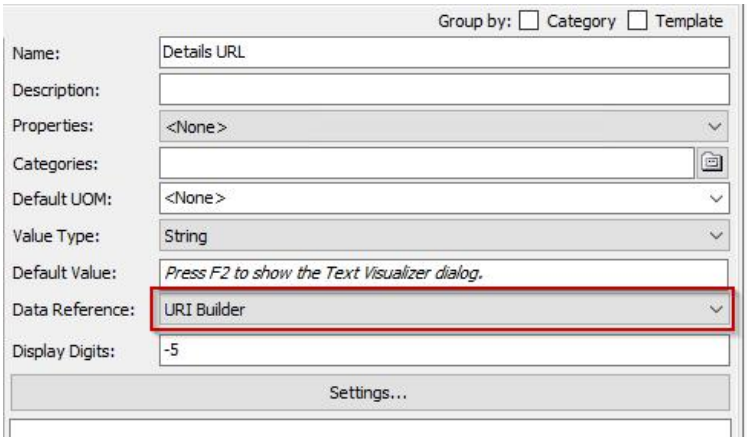
**Scenario:**

Again, your latest display was well received by the client. As you already know they do not like to have their users go through the Asset Drop Down box to change the context of the display, so they are looking for an alternate solution. What they would like to have is a way to navigate from the Information display to the Events display and have that link provide the context for the Events display.

**Approach:**

1. Open PI System Explorer and select the Wind Farm Database
2. Navigate to Library and under Templates > Element Templates > Turbine
3. Modify the Details URL attribute so it will take you to the Turbine Events

Display **Hint 1:** The URI builder data reference may be of use here




**Hint 2:** URL parameters can be used to set the context of the display
https://livelibrary.osisoft.com/LiveLibrary/content/en/vision-v2/GUID-C643F092-EB07-41EC-8DC8-5981BF2692F4

**Hint 3:** Substitution parameters can be used to quickly build out the path to the element.

i. **%System%** - Gets the name of the AF Server the attribute is on

ii. **%Database%** - Gets the name of the database the attribute is on

iii. **%ElementPath%** - Gets the path to the element the attribute is on (not including server and database)

4. Create an Asset Comparison table in PI Vision and pull in the URL attributes

5. Modify the Details URL Yesterday attribute in AF to also change the time context of the display and add those attributes to your Asset Comparison Table as well. For the time context use “y” as the start time and “t” as the end time

**Questions:**

What does the time range of start time “y” and end time “t” correspond to?

Try to use another URL parameter in System Explorer.

## Exercise 4: Ad Hoc Trending in PI Vision

**Exercise Objective:**

- Analyze an existing display using the Ad Hoc functionality of PI Vision

**Scenario:**

After seeing the advance displays you have been making your client has taken it upon themselves to make a display of their own. They created a display called Wind Farm Overview but are having trouble analyzing the display to answer specific questions about their operations.

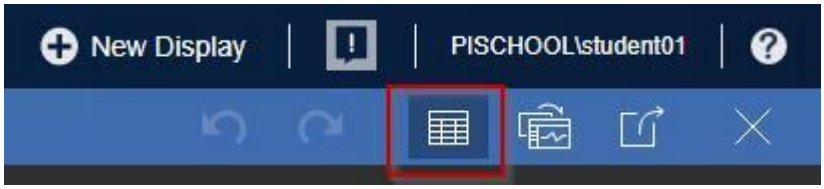
**Approach:**

1. Open the display called Wind Farm Overview.

2. While in Run mode, hold the CTRL key and select the Wholesale Price attributes and Lost Power attributes.

3. Click the Ad Hoc trend button:

4. Ensure the summary table is being shown:



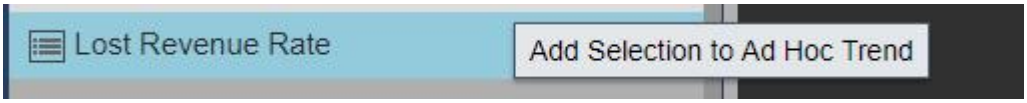

What was the maximum **Wholesale Price** over the last 8 hours for both regions?

What was the **Wholesale Price** for the Northeast region yesterday at 1 PM?

5. Close the Ad Hoc display workspace and add the **Total Revenue** attributes which are shown in the trend symbols to the Ad Hoc Trend workspace.

6. On the same display drill down to the **Lost Revenue Rate** attribute for PH001.

7. Right Click the attribute and select “Add Selection to Ad Hoc Trend.




8. Open your Ad Hoc display workspace and hide the trends for **Wholesale Price** and **Lost Power** for the Scirocco region.

Is there a correlation between the **Lost Revenue Rate** of PH001 and the entire Northeast region?

## Exercise 5: XY Plot with Reference Curve

**Exercise Objective:**

- Create an XY Plot in PI Vision.
- Add a Reference Curve to the XY Plot

**Scenario:**

The client has now informed you that they would be interested in visualizing the relationship between Active Power and Apparent Power on each of their turbines in the Turbine Events Display. On the customer's side they have set up an AF Analysis that is calculating a value for their Apparent Power.

**Approach:**

1. Open the Windfarm Turbine Detail Display and drill down to the Turbine currently on the display.

2. Create an XY plot with **Active Power** on the X axis and **Apparent Power** on the Y axis.

3. For the Y axis column add the **Calculated Apparent Power** attribute.

4. Configure the second set of markers to serve as a reference curve.

**Hint:** https://customers.osisoft.com/s/knowledgearticle?knowledgeArticleUrl=KB01580

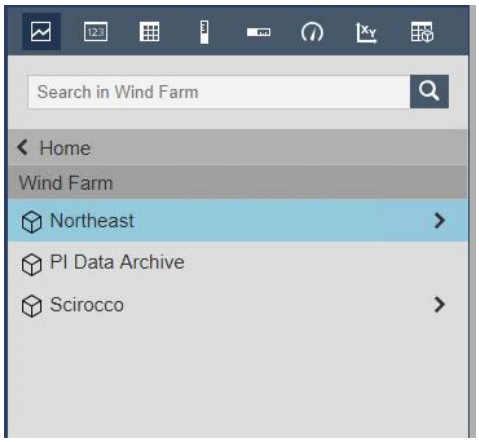
## Solution for Exercise 1: Creating a Turbine Information Display

1. Connect to PI Vision by clicking the PI Vision shortcut on the desktop.

2. Click the New Display button.

3. On the left hand tree select the Wind Farm database that corresponds to your user.
    a. For example Student02 will use the database Wind Farm – Student02

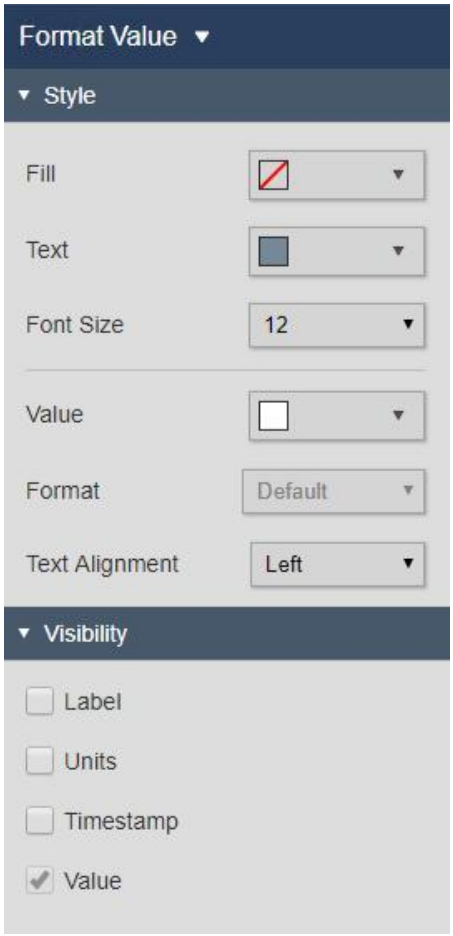
4. Drill down to the Northeast level in the Assets pane.




5. On the top symbol bar select the Value symbol.

6. From the Attributes pane select the **Region Name** attribute and drag it onto the display.

7. Format the Value symbol to only show the Value by right clicking the symbol and selecting "**Format Value…**"




8. Increase the font size to make the symbol larger.

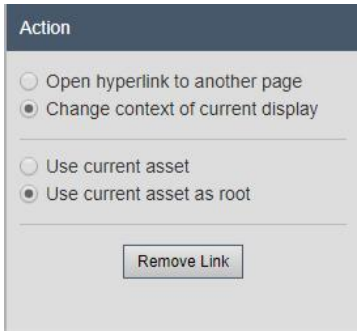
9. Once finished formatting click back in the display space.

10. Right click the symbol and select "**Convert to Collection…**"

11. Click back in the display to close the Configuration pane. Then select the collection and click "**Modify Collection**"

12. Then right click on the Value symbol and select "**Add Navigation Link**"

13. Under the Action section select "**Change context of current display**" and "**Use current asset as root**"

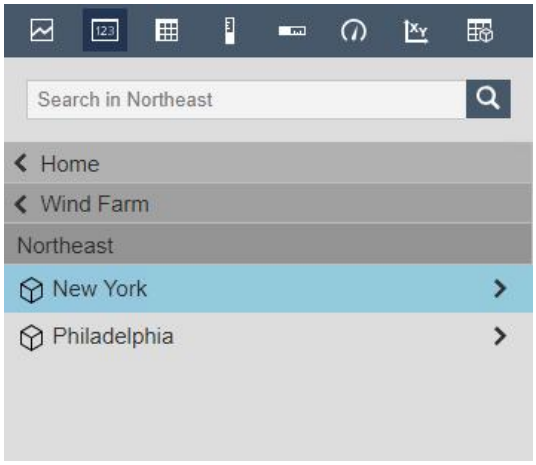



14. Click back onto the display and click the Exit Modify Mode button.

15. Ensure you are in build mode.

16. Format the collection so only one item is showing.

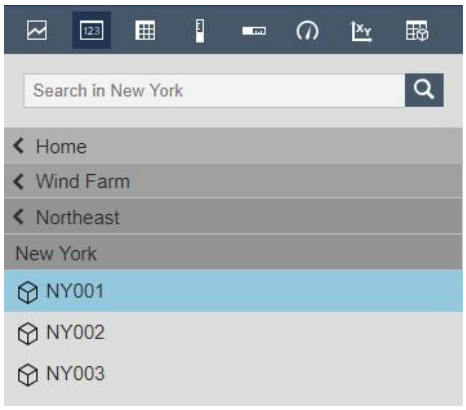
17. In the Assets pane drill down to the **New York** Element.




18. Confirm the Value symbol is still selected, find the **Farm Name** attribute, and drag it onto the display.

19. Repeat steps 7-15 to format the symbol, create a collection, and configure the navigation for the symbol.

20. Drill down to the **NY001** Element




21. Confirm the Value symbol is still selected, find the **Turbine Name** attribute, and drag it onto the display.

22. Repeat steps 7-15 to format the symbol, create a collection, and configure the navigation for the symbol.

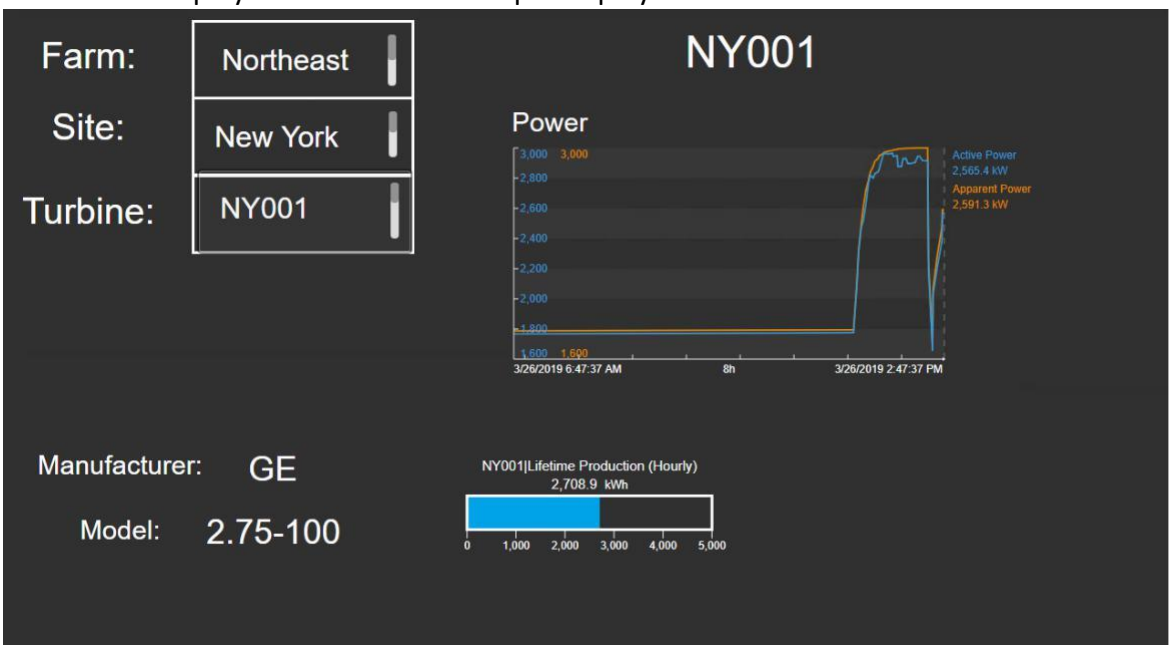
23. Add text symbols to the display and format the collections as desired. An example can be seen below:

24. While still on turbine NY001 create another value symbol to show the **Turbine Name.** This will not be made into a collection and can be used to show which turbine is selected.

25. Select the horizontal gauge symbol and find the **Lifetime Production (Hourly)** attribute. Drag it onto the screen to create the symbol.

26. Select the trend symbol and select the **Active Power** and **Apparent Power** attributes. Drag those onto the display to make a trend symbol.

27. Format the display as desired. An example display can be seen below:




28. Select the drop down arrow on the right hand side of the Asset Drop Down box and click the gear icon.

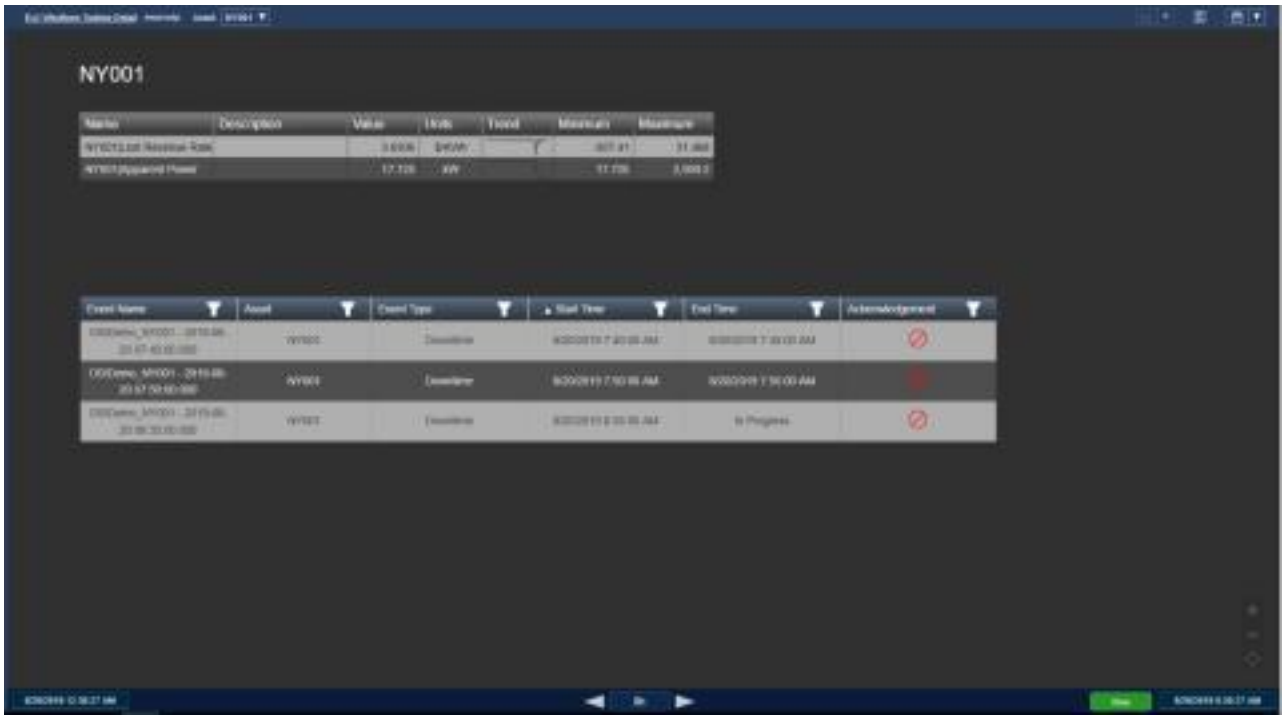
29. In the Configure Context Switching pane on the right select the option for "**Do not show**".

30. Ensure your display is in run mode and select the collections to change the display.

31. Save the display and answer the exercise questions.

## Solution for Exercise 2: Turbine Events Display

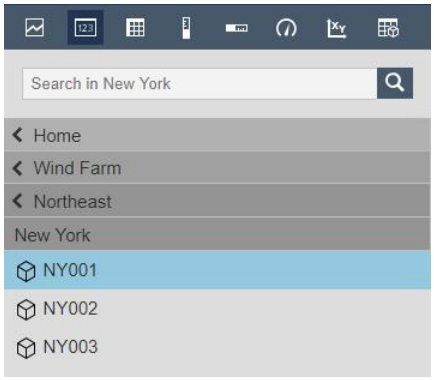
Example of a display that we will create in this exercise:




1. Connect to PI Vision by clicking the PI Vision shortcut on the desktop.

2. Click the New Display button.

3. Drill down to the Turbine **NY001** in the Assets pane.




4. Select the Value symbol and drag over the **Turbine Name.**

5. Configure the symbol to just show the turbine name.

6. Add either a table or value symbols for the **Lost Revenue Rate** and **Apparent Power.**

7. On the left side of the screen select the Events icon to explore Event Frames.

8. Verify that Event Frames have populated in the Events Pane and select the "**Create Events Table**" button. If no Events are present ensure the "Automatically refresh the list" option is checked.

9. Right-click on the event table and select the **Configure Table…** option and enable the Event Type column.

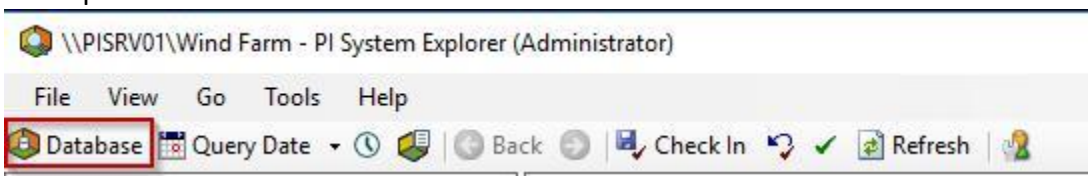
10. Save the display as *Windfarm Turbine Detail*.

11. Put the display in run mode and click on an Event in the table. This will open the details display and you can answer the exercise questions. If you need to change the context of the display you can use the Asset drop down box.

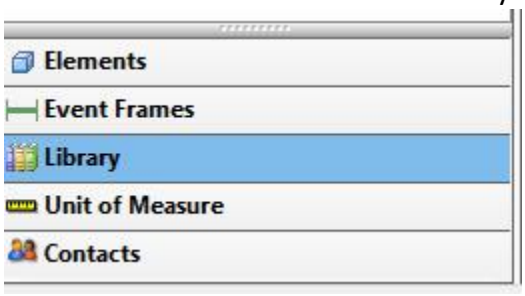
## Solution for Exercise 3: Linking the displays

1. Open up PI System Explorer by clicking the PI System Explorer shortcut on the desktop.

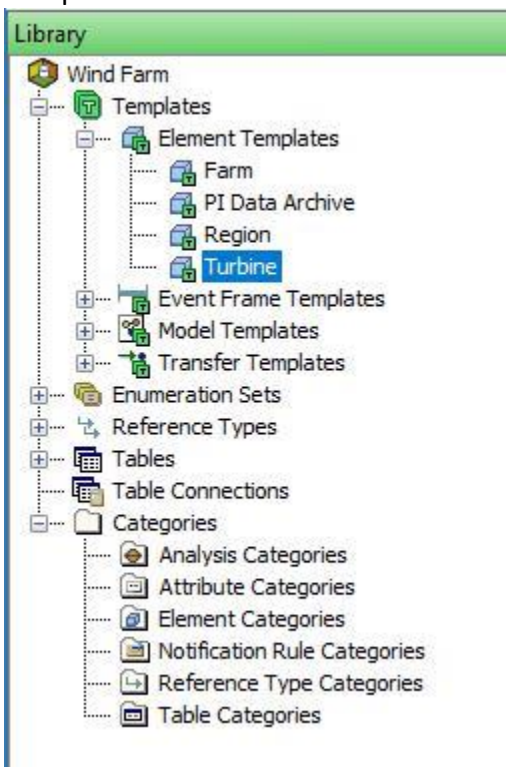
2. Open up your Wind Farm – StudentXX database by clicking the Database icon near the top left.




3. Once in the database select the Library tab in the bottom left.

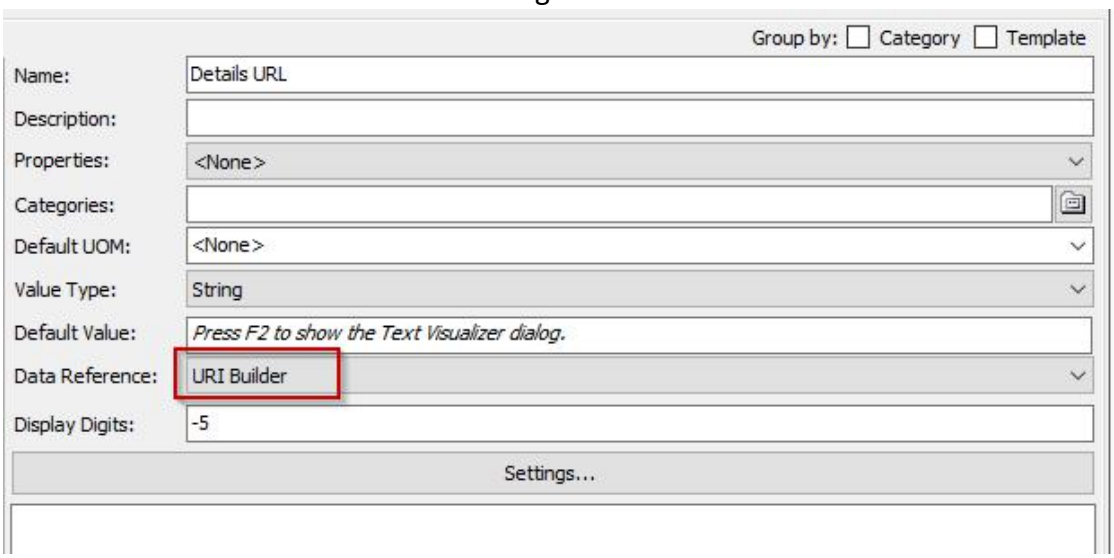



4. Expand the Templates section of the hierarchy and then expand the Element Templates section.



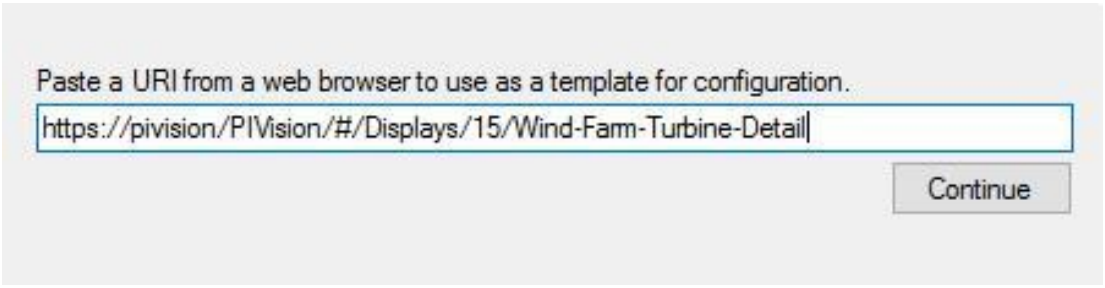
5. Select the Turbine Template then select the Attribute Templates tab as that is where we are going to configure the Details URL.

6. Select the Details URL attribute and change the Data Reference to URI Builder.



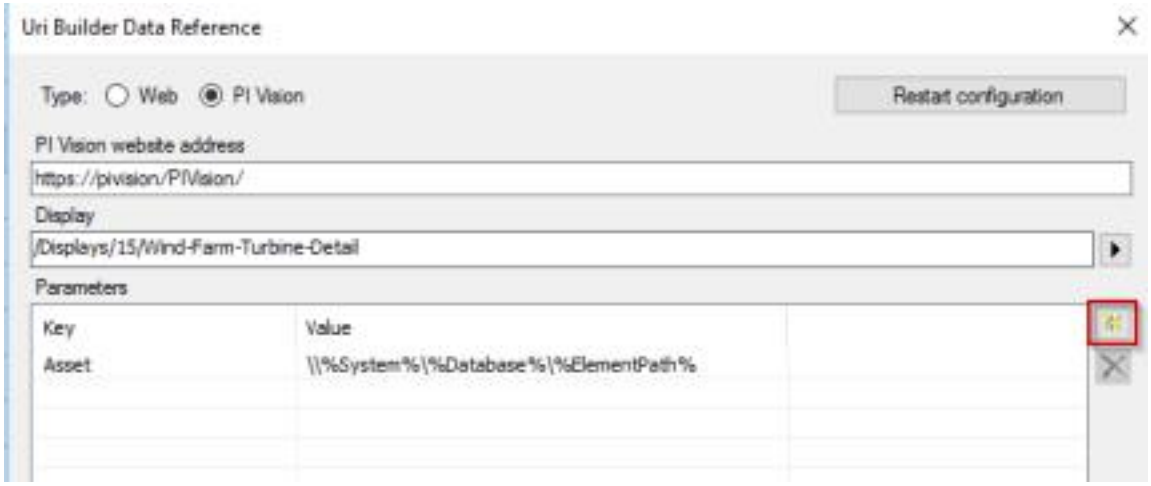

7. Click the “Settings…” button.

8. In the box copy and paste in the URL for the display you created in Exercise 2 and click Continue.




9. For the Type select PI Vision.

10. Click the * icon to add a new key.




11. For the key select Asset and for the value type \\%system%\%database%\%elementpath%

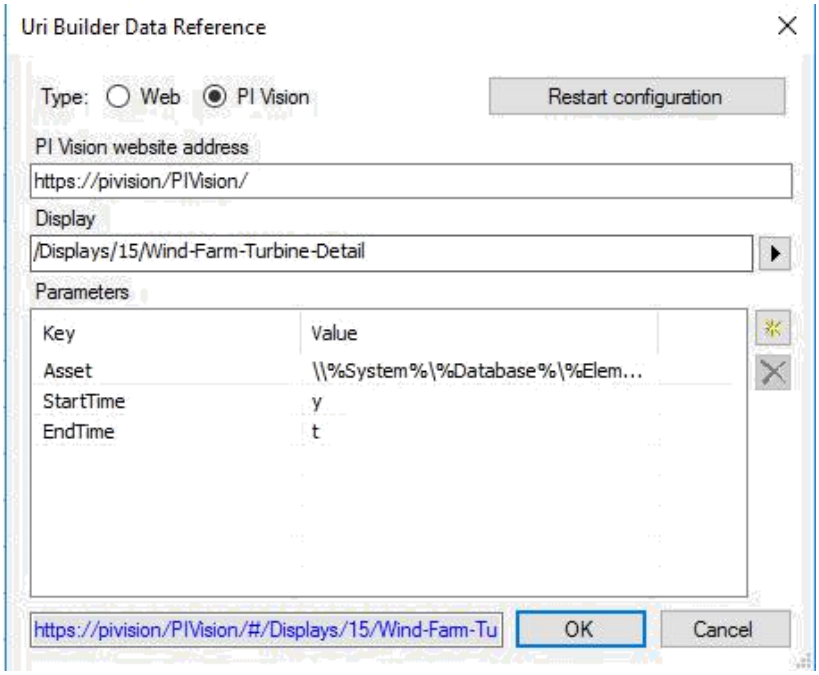
12. Click OK.

13. Select the Details URL Yesterday attribute.

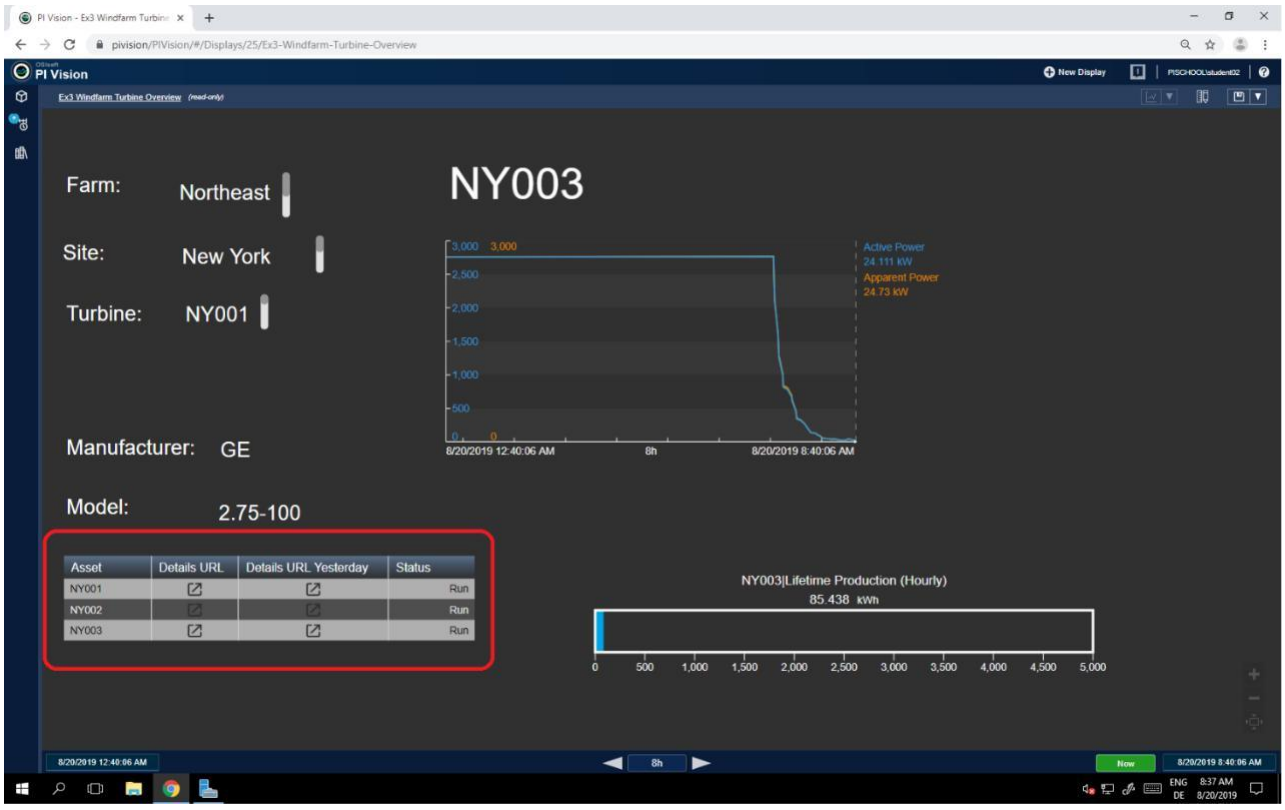
14. Repeat steps 6-11 for the new attribute.

15. In addition to the Asset key, create a StartTime key and set its value to “y”

16. Create an EndTime key and set its value to “t” and click on OK




The display that was created in exercise 1 will be expanded by an asset comparison table with the URI Builder attributes created before. Example:



17. Return to PI Vision and open the *Windfarm Turbine Overview* display you created in Exercise 1.

18. Create an Asset Comparison Table Symbol on the display that includes the following attributes:
    a. **Status**
    b. **Details URL**
    c. **Details URL Yesterday**

19. Save the display and test the links by using Run mode and clicking on them.

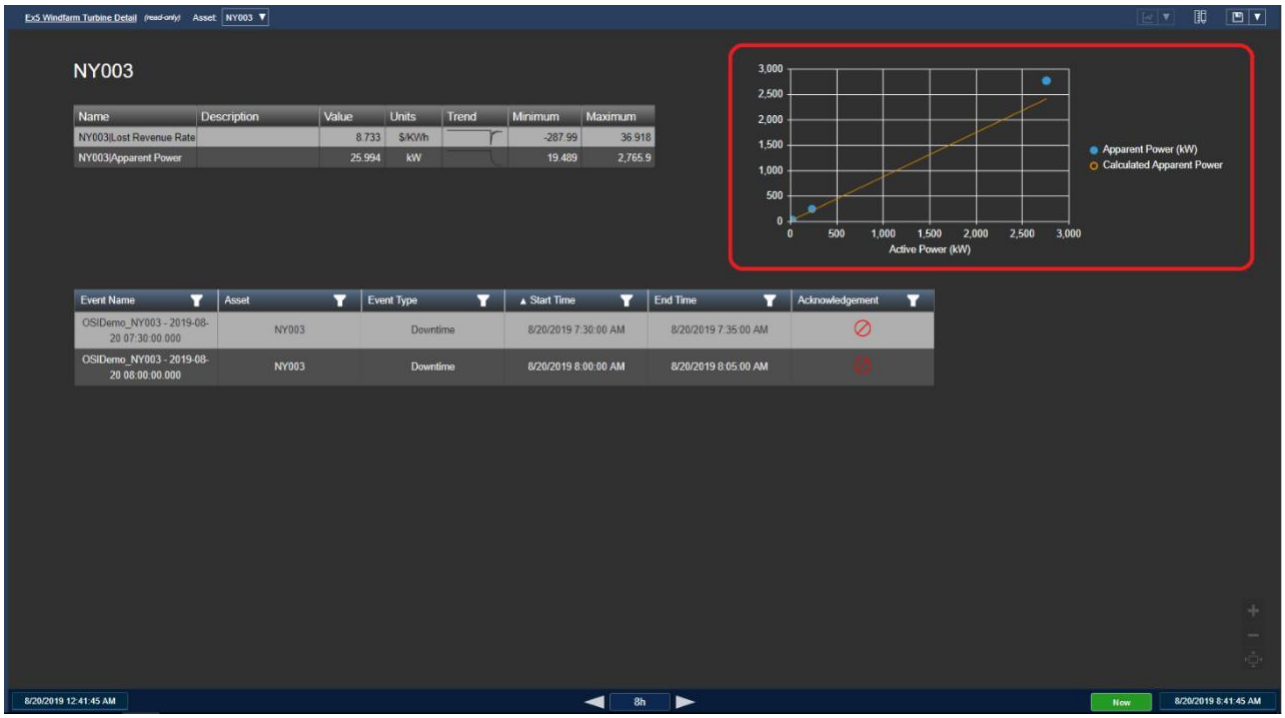
20. For question 2, you can modify the Details URL Yesterday attribute by adding a new key.

## Solution for Exercise 4: Ad Hoc Trending in PI Vision

This Exercise was written to already provide step-by-step instructions. If you are having any difficulty, following those instructions let a lab assistant know and we can help you out.

## Solution for Exercise 5: XY Plot with Reference Curve

The *Windfarm Turbine Detail* display that was created in exercise 3 will be expanded by an XY plot. Example:




1. In PI Vision open the Turbine Events display you created in Exercise 2
2. Drill down in the Assets pane to whatever Turbine is currently shown on the display
3. Select the XY Plot symbol
4. In the Attributes pane select both the **Active Power** and **Apparent Power** attributes. You can select multiple attributes in PI Vision by holding the Ctrl key. Drag those on to a blank area in the display to make the XY plot
5. Right Click the XY Plot and select "**Configure XY Plot…**"

6. From the attributes pane find the **Calculated Apparent Power** attribute and drag it to the Y-axis of the XY Plot configuration

7. Under the Format section select the second row that has the **Calculated Apparent Power** attribute
8. Click the check box for Connecting Line and uncheck the box for Markers
9. Now click back in the display space and save your display.

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