Thermal Performance Analysis using PI Asset Framework

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Luminant

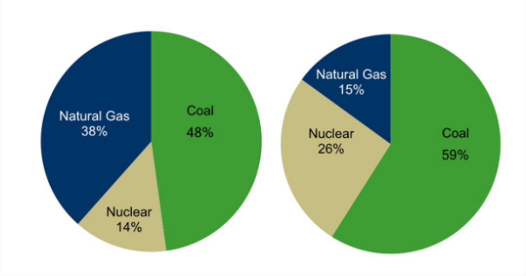
- Largest Generator in Texas – 17,814 MW
- 2018 – 180 MW Solar Plant
- 2018 – Retire 1,800 MW Coal Plant
- 2017 - 1,054 MW Combined Cycle Plant
- 2016 – 1,912 MW Combined Cycle Plant
- 2016 – 1,076 MW Combined Cycle Plant

2016 Generation Portfolio

Most of the energy Luminant generates is produced by its reliable, low-cost nuclear and coal plants.

2016 Generating Capacity
Total: 16,760 MW

2016 Energy Production[1]
Total: 77,574 GWh



Graphs illustrate 2016 only.

Generation Summary

FUEL TYPE	CAPACITY (MW)	NUMBER OF PLANTS	NUMBER OF UNITS
Nuclear	2,300	1	2
Coal	8,017	5	12
Natural gas	7,497*	10*	42*
- Thermal	2,480	4	7
- Simple-Cycle	975	3	15
- Combined-Cycle	4,042	3	20
TOTAL	[1] 17,814	16	56

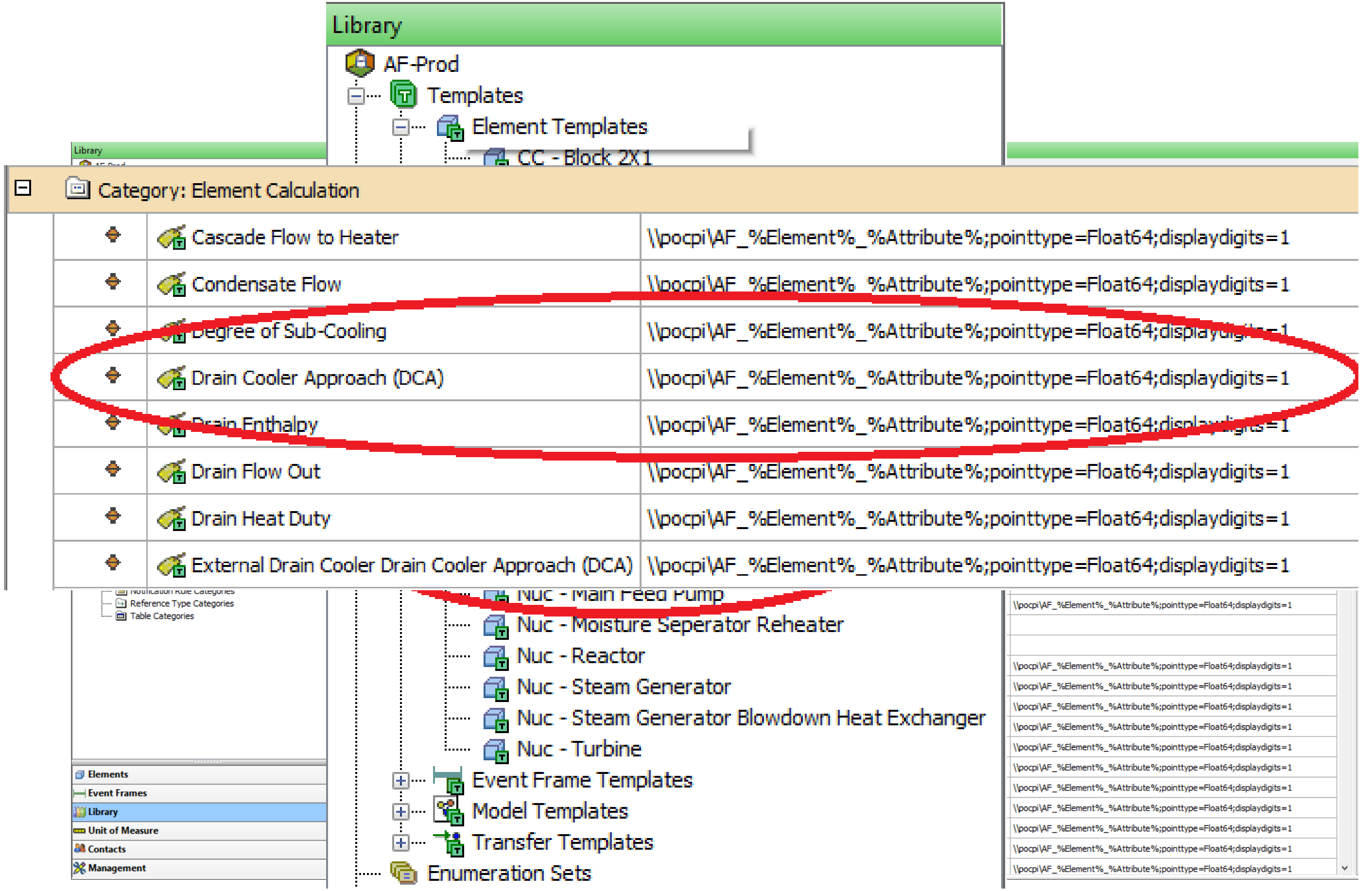
*Includes all thermal, simple-cycle and combined-cycle units.

Business Challenge

- Onboarding new generation assets
- Competitive electric market
- Distributed applications
  - 3 different thermal performance tools
  - 13 different applications
  - Each requires maintenance and expertise
- Challenged to consolidate thermal performance analysis
- Solution must be scalable and easy to maintain

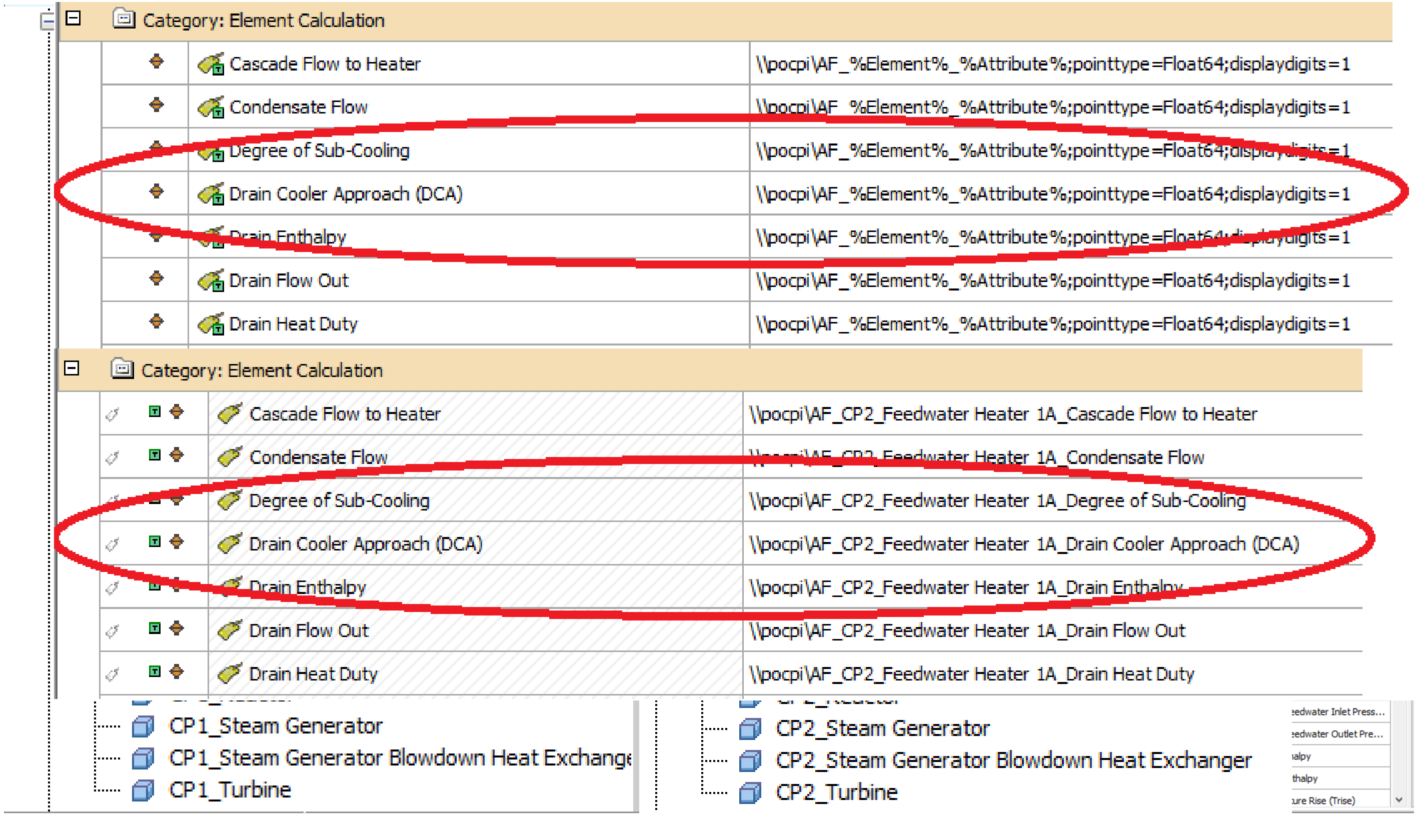
Templates

- Allow for scale
- Substitution Parameters are key



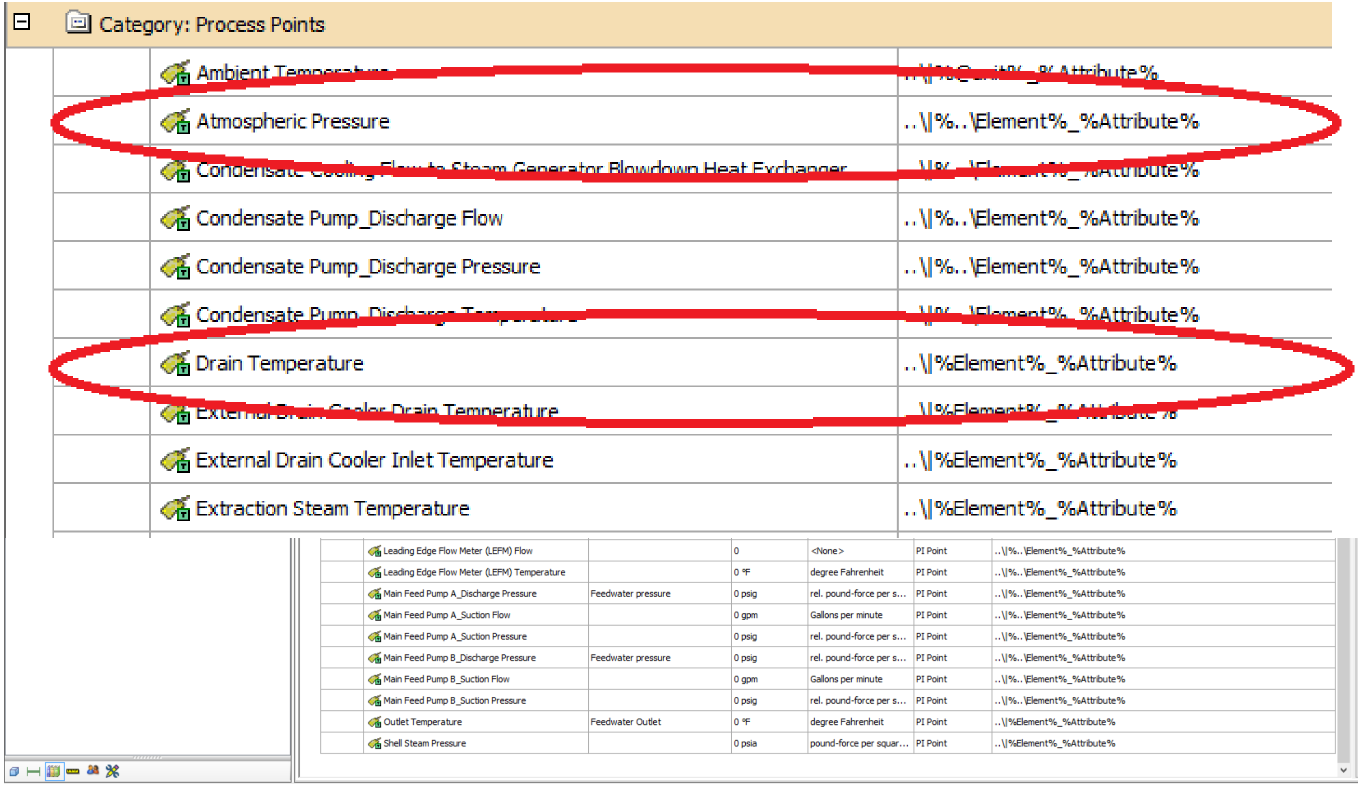
Templates

- 24 elements from 1 Template
- Substitution Parameters create PI Tags



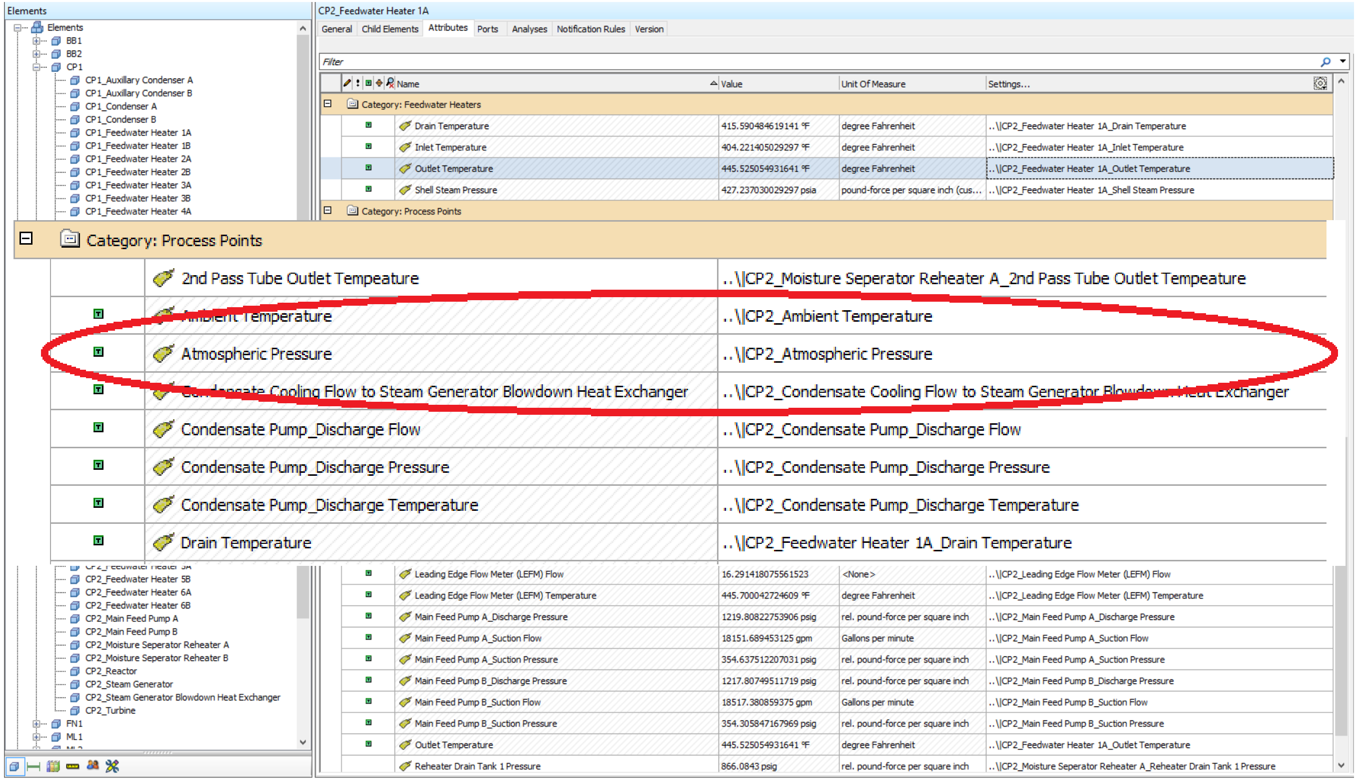
Templates

- Substitution Parameters create attribute references



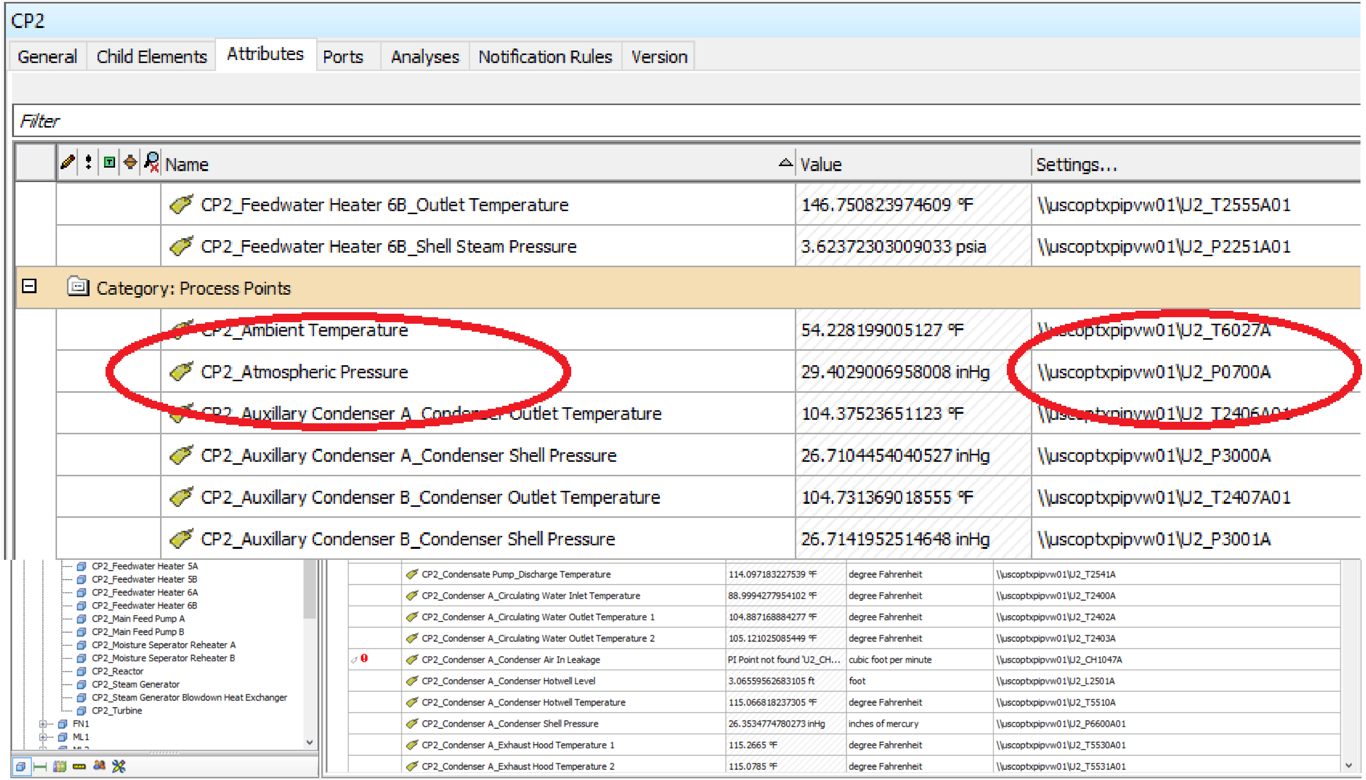
Templates

- Attributes references are managed at the asset level



Templates

- PI tag references are managed at the unit level



Analysis Templates

- Allow for scale
- Backfill Sequence established
- Calculations are converted from Excel worksheets

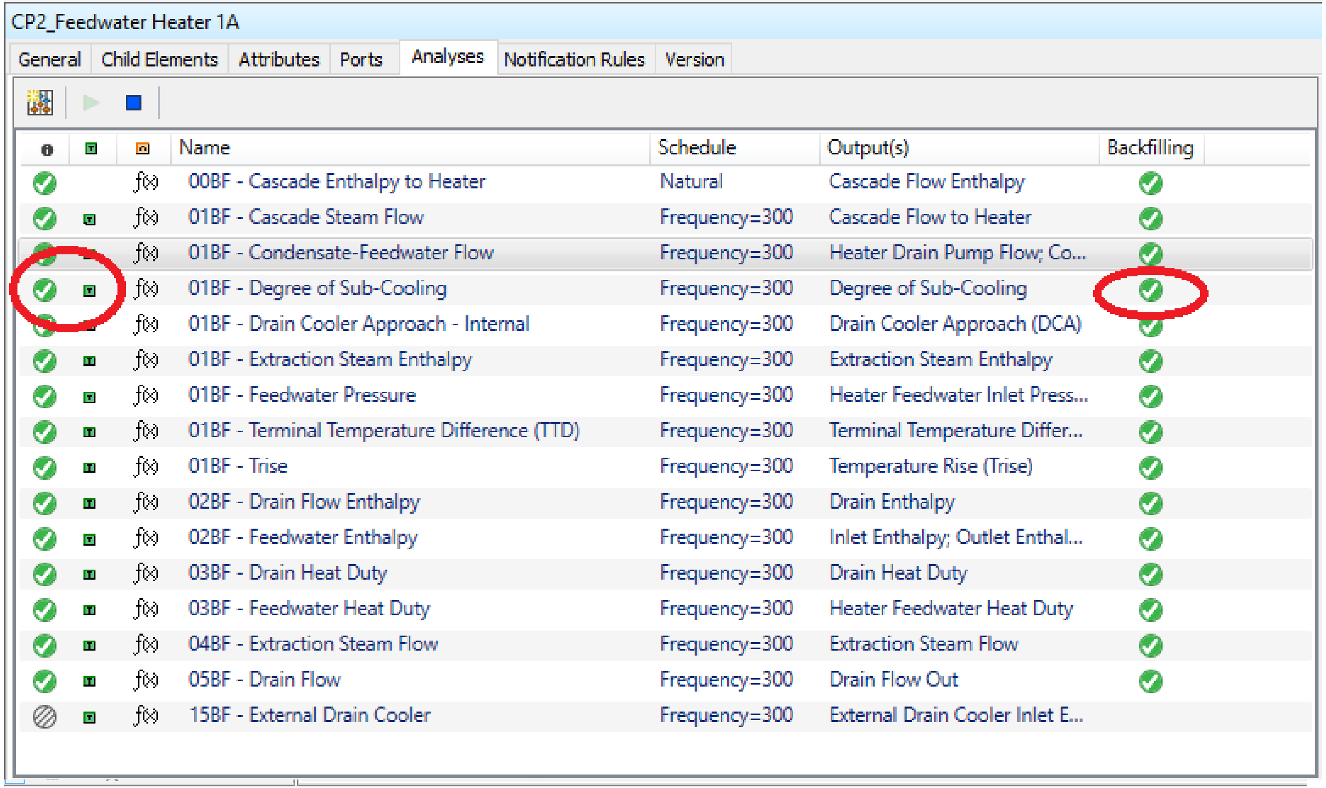
Library | Nuc - Feedwater Heater

Example Element: CP2\CP2_Feedwater Heater 1A

Name	Expression	Value at Evaluatio	Value at Last Trigg	Output Attribute
C30	'Leading Edge Flow Meter (LEFM) Flow'*1000	16277	16277	Map
C21	convert('Heater Drain Pump_Discharge Temperature',"°C")	181.07 °C	181.07 °C	Map
C18	Convert(Convert(avg('Main Feed Pump A_Suction Pressure','Main Feed Pump B_S	2549.3 kPa	2549.3 kPa	Map
C31	Steam_VPTL(C18,C21)	1.1275 cm3/g	1.1275 cm3/g	Map
C31Eng	c31*0.0160185	0.018062	0.018062	Map
C20	'Heater Drain Pump_Discharge Flow'	13697 gpm	13577 gpm	Map
C32	//HD Pump Disch Flow - klb/hr C20*0.13368*1/C31Eng*60/1000	6082.7	6029.2	Heater Drain Pump Flow
C33	//Condensate Flow (per LEFM Flow) - klb/hr C30-C32	10194	10248	Condensate Flow

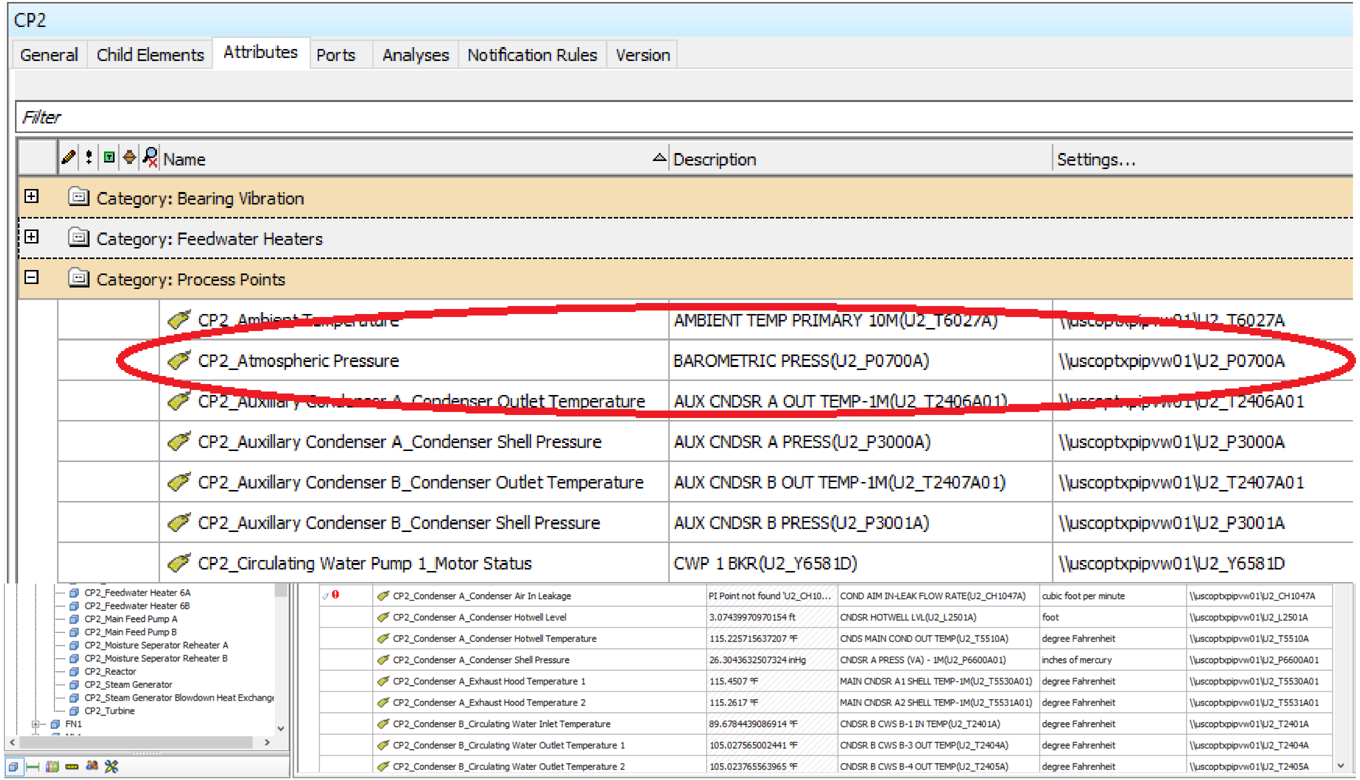
Analysis Templates

- Analysis is running
- Backfill Complete



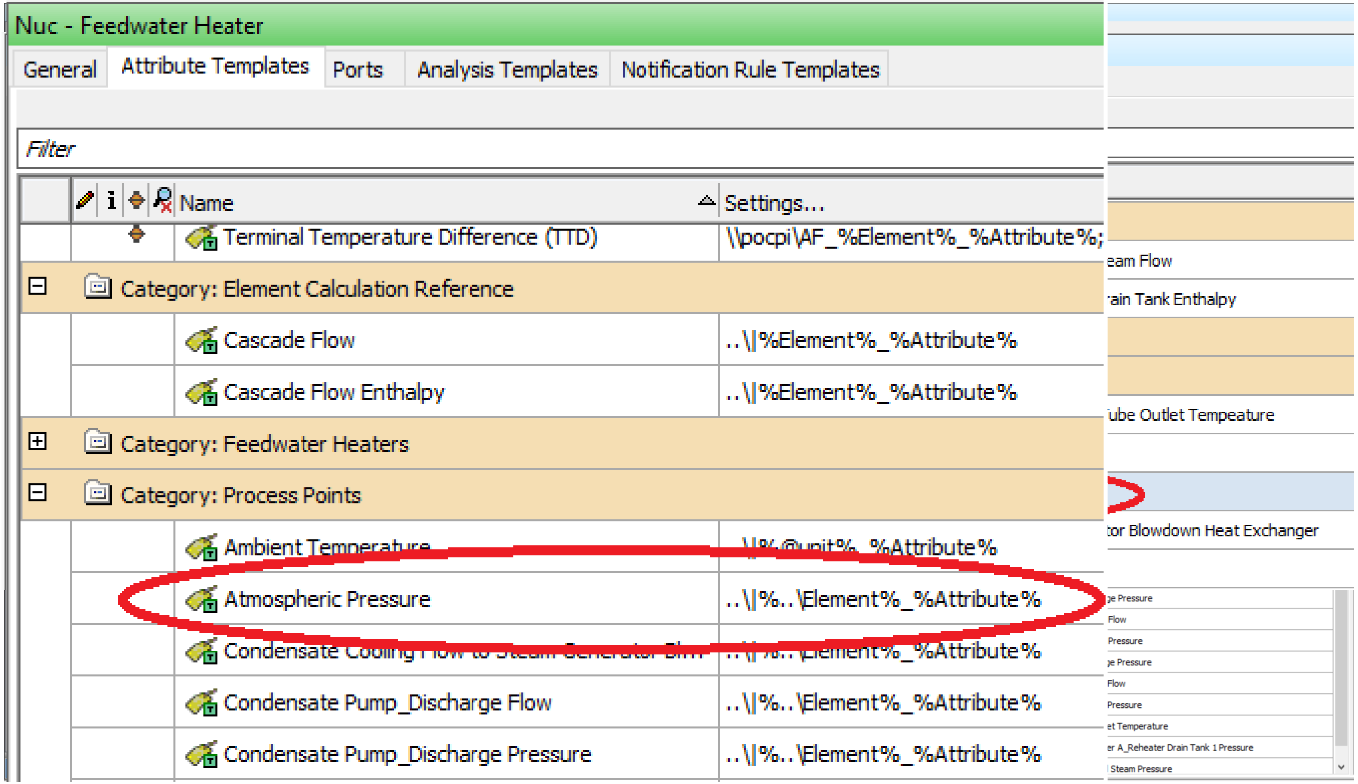
Flat Hierarchy – Unit Level

- Easy Maintenance
- Description references DCS or PI Server
- Naming Convention is important



Flat Hierarchy – Asset Level

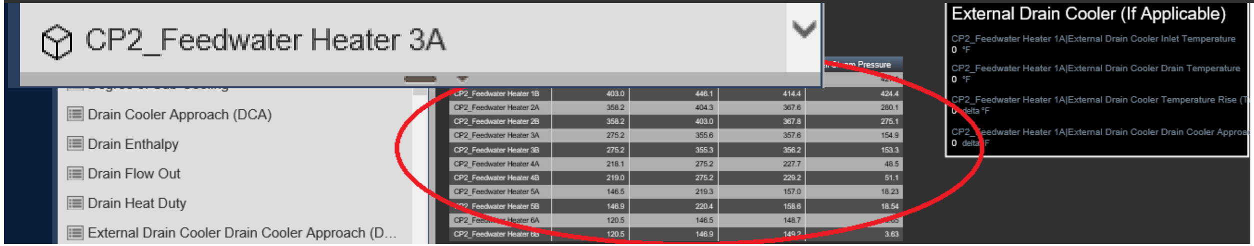
- Attributes reference to main level
- Naming Convention is important



PI Vision

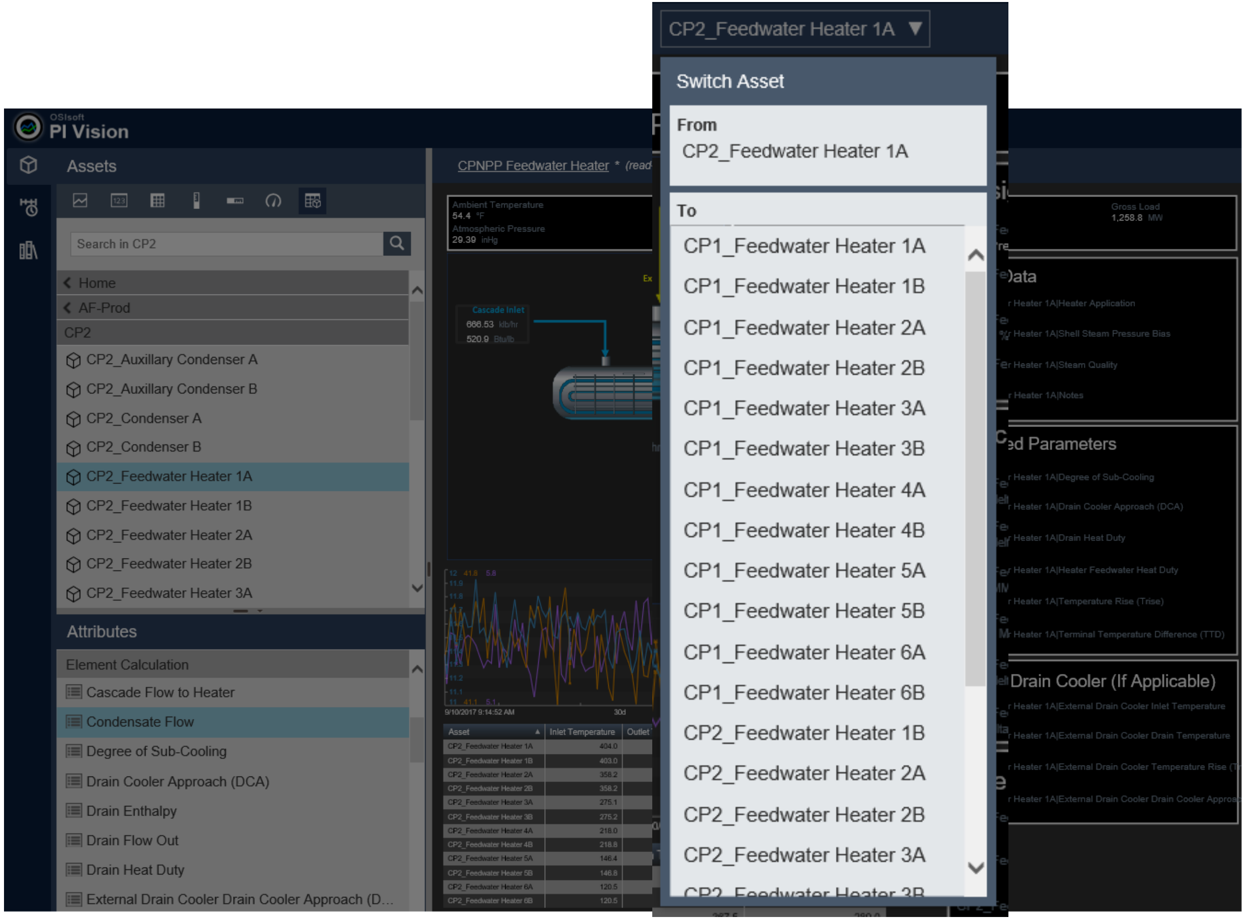
- Element Relative Display
- One display multiple assets
- Asset Comparison Table

Asset ▲	Inlet Temperature	Outlet Temperature	Drain Temperature	Shell Steam Pressure
CP2_Feedwater Heater 1A	404.0	445.5	415.8	427.2
CP2_Feedwater Heater 1B	403.0	446.1	414.3	424.6
CP2_Feedwater Heater 2A	358.2	404.0	367.5	280.0
CP2_Feedwater Heater 2B	358.2	403.0	367.7	275.0
CP2_Feedwater Heater 3A	275.1	355.7	357.6	154.9
CP2_Feedwater Heater 3B	275.1	355.4	356.1	153.3
CP2_Feedwater Heater 4A	218.1	275.1	227.8	48.5
CP2_Feedwater Heater 4B	218.9	275.1	229.3	51.1
CP2_Feedwater Heater 5A	146.4	219.2	156.9	18.23
CP2_Feedwater Heater 5B	146.8	220.3	158.8	18.53
CP2_Feedwater Heater 6A	120.5	146.4	148.7	3.65
CP2_Feedwater Heater 6B	120.5	146.8	149.2	3.63



PI Vision

- Switch between assets



Lessons Learned

- AF Kickstart session is very helpful
- Templates allow for scale
- Substitution parameters are key
- Hierarchy is important for maintenance
- Naming convention is important for Vision
- Backfill sequence needs to be noted
- Asset interdependence needs to be known

Thermal Performance using PI Asset Framework

Luminant

COMPANY and GOAL

Luminant wanted to leverage PI Asset Framework to perform thermal performance analysis of its generation fleet

CHALLENGE

Thermal performance had traditionally been performed with a 3rd party application.

- Cost to implement 3rd party applications have historically been $100K+ per unit
- Luminant resources were required to implement and maintain 3rd party applications

SOLUTION

Build out thermal calculations in PI asset framework

- Element templates were utilized to standardize across fleet
- Substitution parameters were utilized to scale the application
- Flat Hierarchy was utilized to simplify maintenance

RESULTS

Thermal performance calculations for Luminant's generation fleet can now be performed utilizing PI AF.

- PI AF was used on Luminant’s most recent combined cycle unit saving $160K.
- Standardization across the fleet allows for 1 system vs. 13 separate 3rd party applications.

Contact Information

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Questions

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

State your **name & company**

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감사합니다

谢谢

Danke

Merci

Gracias

Thank You

ありがとう

Спасибо

Obrigado