

NOVEMBER 2022

Aggregating data with AVEVA™ Data Hub asset rules and data views for analytics and applications

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Agenda

- Overview – AVEVA Data Hub
- AVEVA Data Hub for Machine Learning
- Capabilities
- Demo
- Customer Success Story
- Summary

**Data
science**



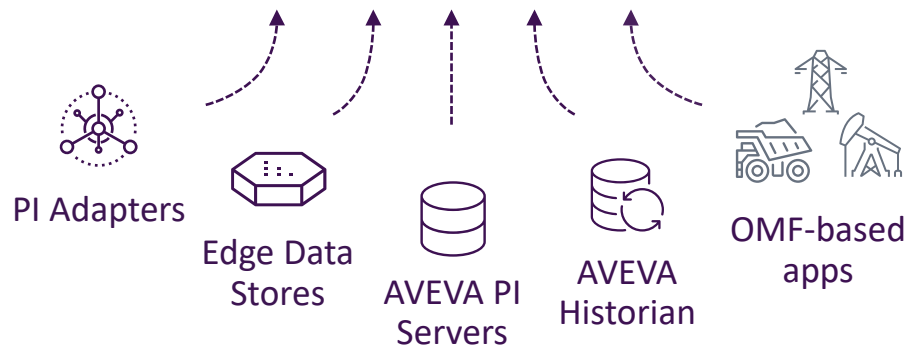
**Remote
monitoring**



**Partner
apps**



**Data
sharing**



Cloud-native industrial
platform designed for
real-time operations

Managed, secure, multi-tenant platform

Operated & maintained by AVEVA

High speed, scalable, elastic, & resilient

Modern, secure REST APIs

Built & deployed on Microsoft Azure

Why AVEVA Data Hub?

For Data Science/Machine Learning Projects

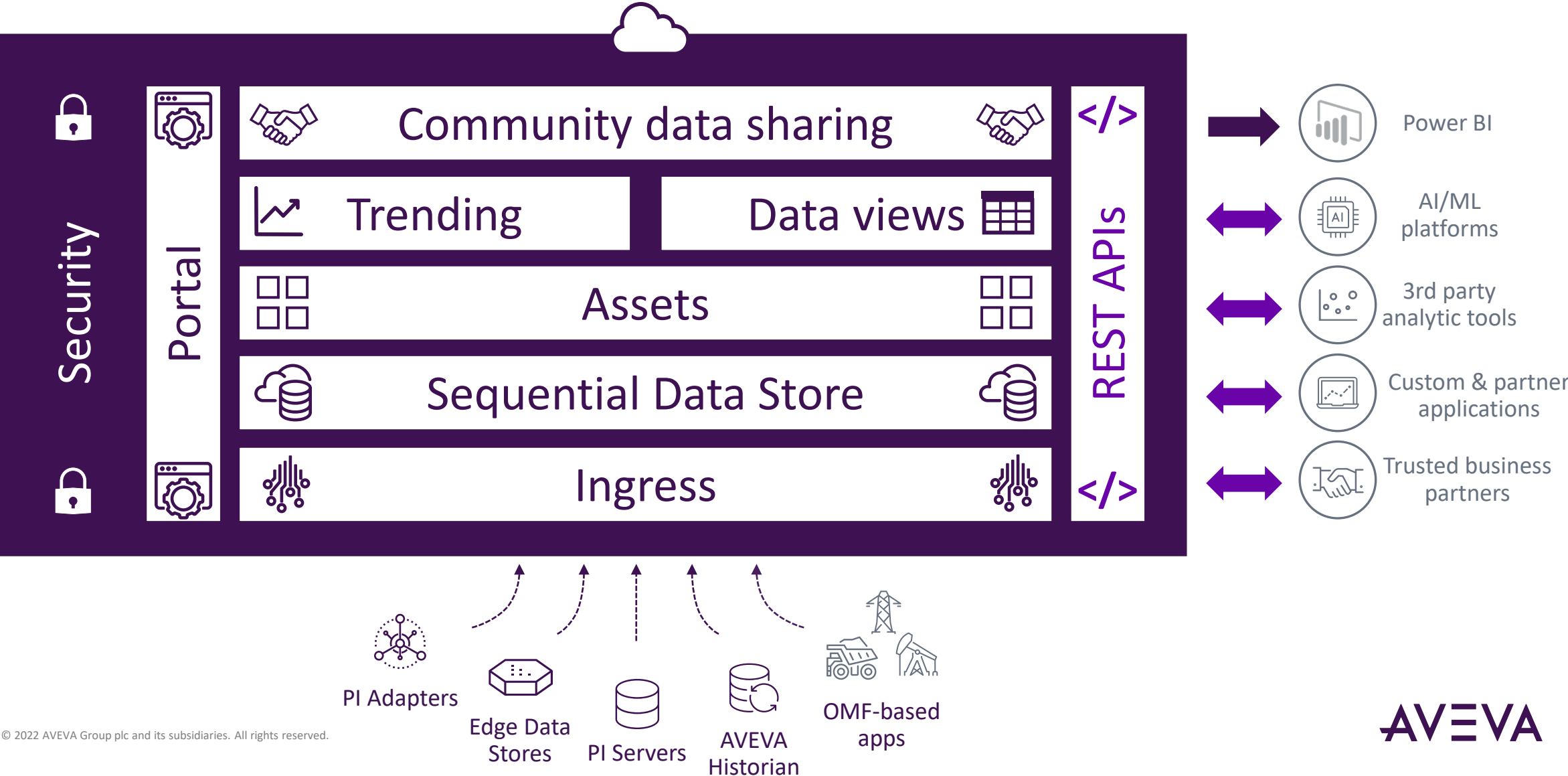
Platform as a
Service – Zero
Maintenance

Contextualization
at Scale

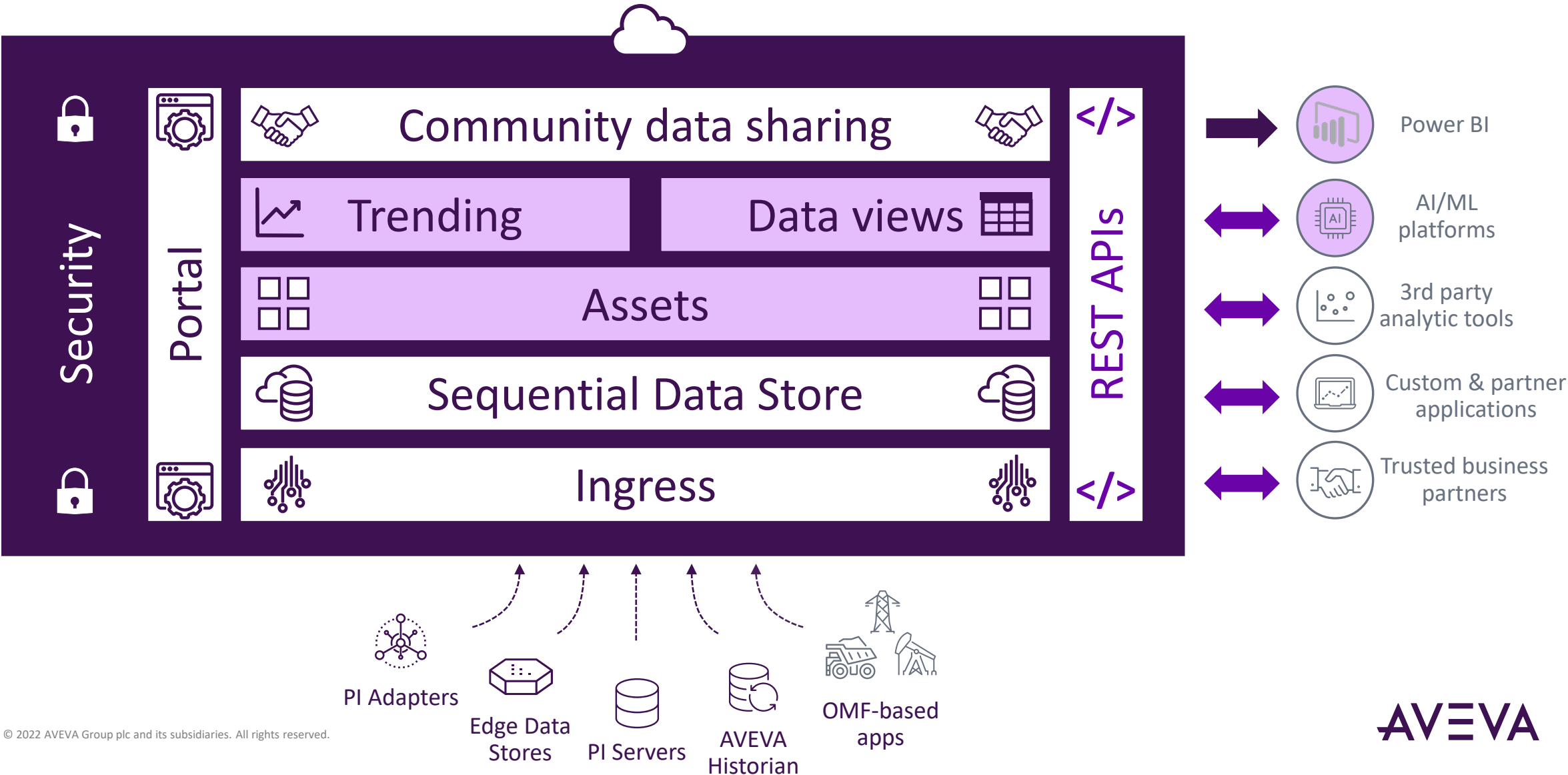
Data Science-
Ready

REST API

AVEVA Data Hub Capabilities




AVEVA Data Hub Capabilities



Assets give useful context to your data streams

Assets

AE01 

Generated Windtopia Wind Turbine Asset

Asset Type: GE Wind Turbine

Metadata	Properties	Status
Metadata	Value	UOM
Altitude	1,000	m
Gearbox Serial Number	4800000-0000-0	
Latitude	44.563149	°
Longitude	-109.25416	°
Manufacturer	Truvalle	
Model	T95-2MW	
Overheating delta limit	60	°C
Power Rated	1,500	kW
Region	NA	
Serial Number	M000000	

- **Static metadata** (Region: North America, Wind farm: Big Buffalo Wind Farm, Asset Type: GE Wind Turbine, Manufacturer: Truvalle, ...)



Assets give useful context to your data streams

Assets

AE01



Generated Windtopia Wind Turbine Asset

Metadata		Properties		Status	
Property		Last Value	UOM		Timestamp
<input type="checkbox"/> Auto Stop Reason		4.000			10/17/22, 7:10 AM
<input type="checkbox"/> Apparent Power		1,514.068			10/17/22, 11:14 AM
<input type="checkbox"/> Revenue - Daily		266.340			10/17/22, 11:03 AM
<input type="checkbox"/> Expected Power - 10 min rolling avg		1,500.011			10/17/22, 11:09 AM
<input type="checkbox"/> Energy Production - Monthly		266.981			10/17/22, 11:03 AM
<input type="checkbox"/> Revenue Rate		53.246			10/17/22, 11:14 AM
<input type="checkbox"/> Wind Deviation 1s		-27.461	°		10/17/22, 11:14 AM
<input type="checkbox"/> Wind Deviation 10s		-10.698	°		10/17/22, 11:13 AM
<input type="checkbox"/> Wind Speed		14.415	m/s2		10/17/22, 11:14 AM

- **Static metadata** (Region: North America, Wind farm: Big Buffalo Wind Farm, Asset Type: GE Wind Turbine, Manufacturer: Truvalle, ...)
- **Stream reference properties** (Active power, expected power, operating state, etc.)



Assets give useful context to your data streams

Assets

Property

T Auto Stop Reason | Value  

Value

System OK



Gear Box Vibration



Pitch Motor



High Gear Box Vibration



High Generator Vibration



Status



- **Static metadata** (Region: North America, Wind farm: Big Buffalo Wind Farm, Asset Type: GE Wind Turbine, Manufacturer: Truvale, ...)
- **Stream reference properties** (Active power, expected power, operating state, etc.)
- **Asset status** (stream property values mapped to status: good, warning, bad)



Asset status enables real-time monitoring

The screenshot displays the AVEVA Assets management interface. On the left, a vertical sidebar contains icons for various asset types: cloud, lock, network, code, handshake, grid, line graph, 4x4 grid, database, and circuit board. A large grey arrow labeled "Assets" points from this sidebar towards the main content area.

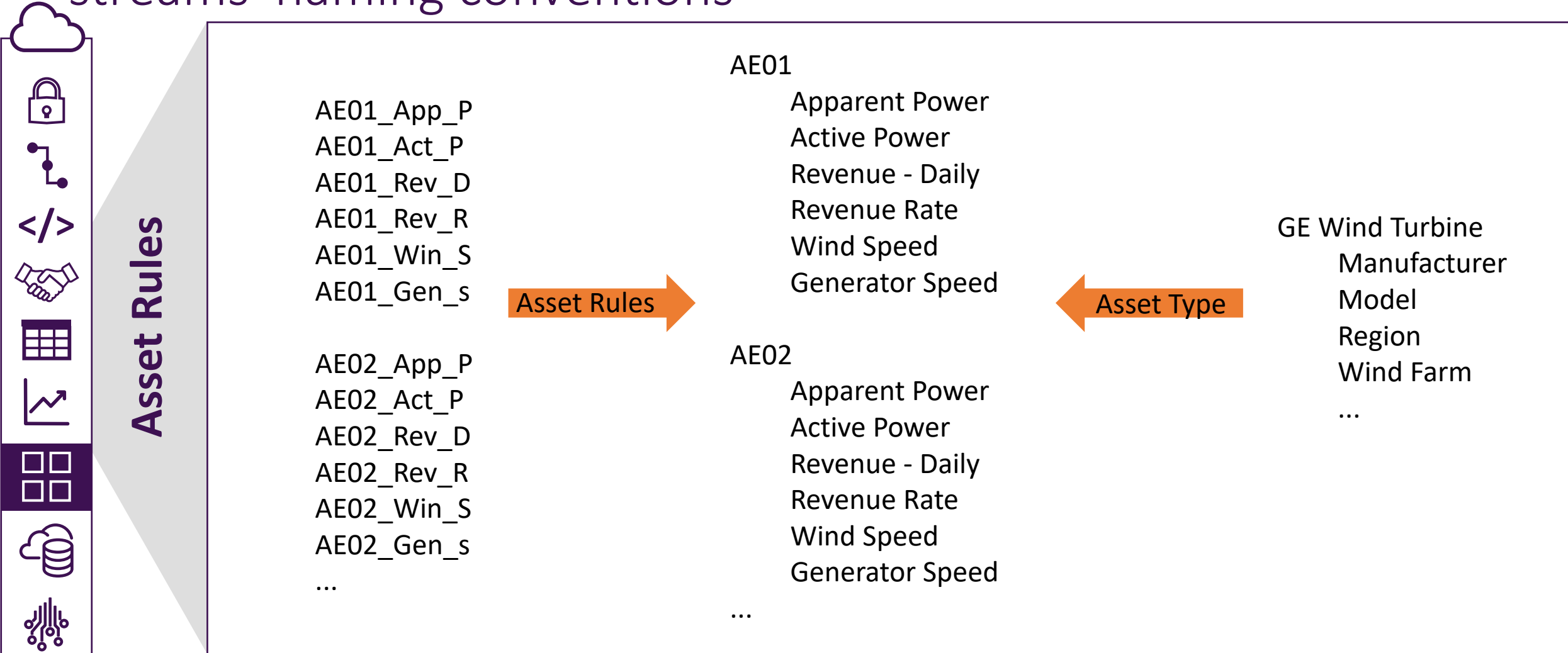
The main interface features a top navigation bar with a search bar labeled "Search for Assets", a "+ Add Asset" button, and a "GE Wind Turbine" filter tag. Below the search bar is a "Filter facets" section, which is highlighted with a red box. This section includes two expandable filters: "Status" and "Asset Type".

The "Status" filter is expanded, showing four options: "Good" (checked with a green checkmark), "Warning" (unchecked with a yellow warning triangle), "Bad" (unchecked with a red X), and "Unknown" (unchecked with a blue question mark). The "Asset Type" filter is also expanded, listing various asset types with checkboxes. "GE Wind Turbine" is selected with a blue checkmark. Other asset types listed include VAVCO, VAVRH, EV Charging Station, VAVCO CO2, VAVRH CO2, Windtopia Wind Turbine, DataCollectorService, IDF, and Emissions Intensity. "Clear All" and "Show More" buttons are located at the bottom of the filter facets.

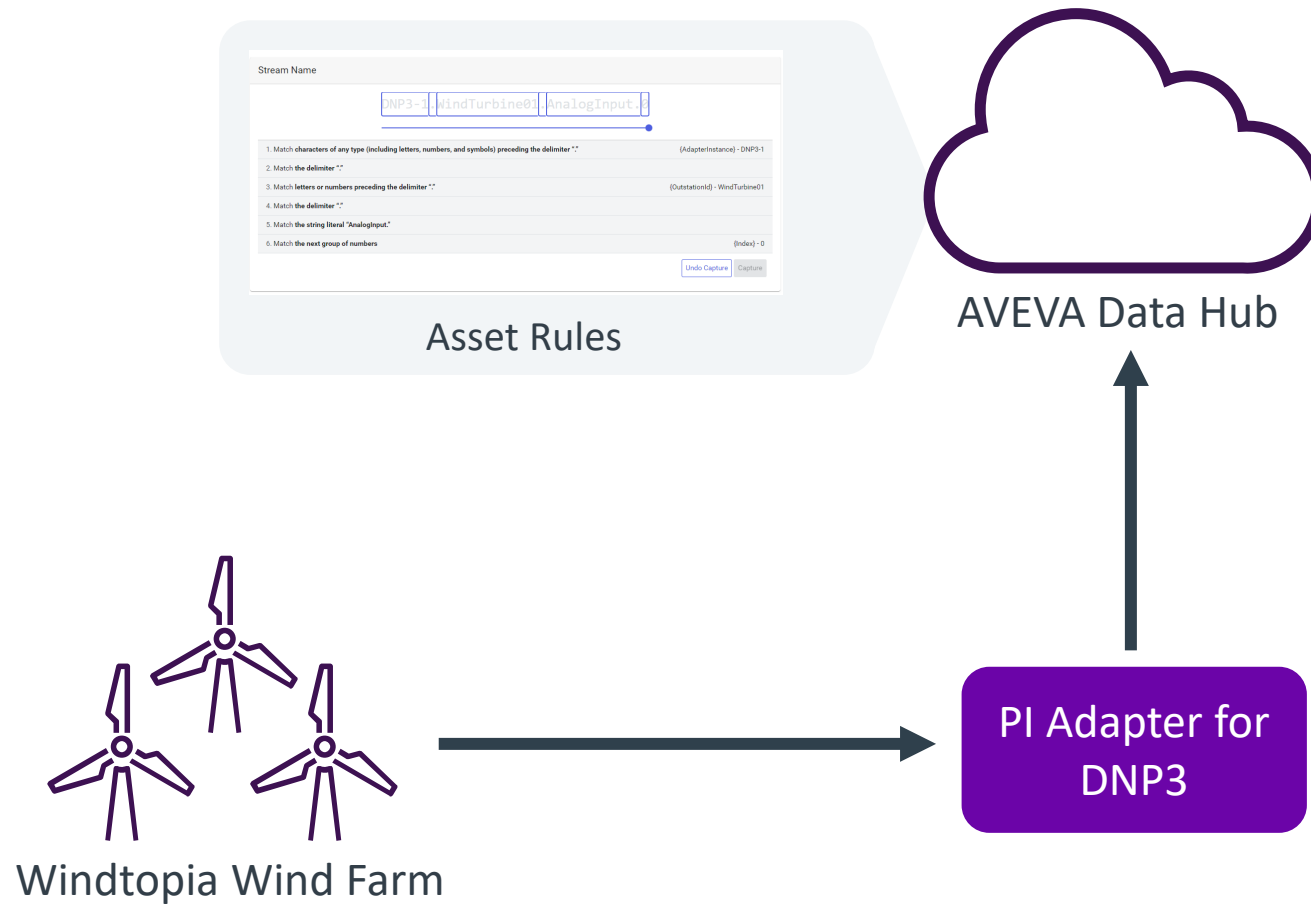
The main content area displays a grid of asset cards, also highlighted with a red box. Each card shows an asset ID (AE01 through AE10) and its status, indicated by a green checkmark for "Good" or a red X for "Bad". The cards are arranged in a 3x4 grid, with the last cell in the third row being empty.

Asset ID	Status
AE01	Good
AE02	Good
AE03	Good
AE04	Good
AE05	Good
AE06	Good
AE07	Bad
AE08	Good
AE09	Good
AE10	Bad

Assets rules automatically create/update assets based on streams' naming conventions



Demo

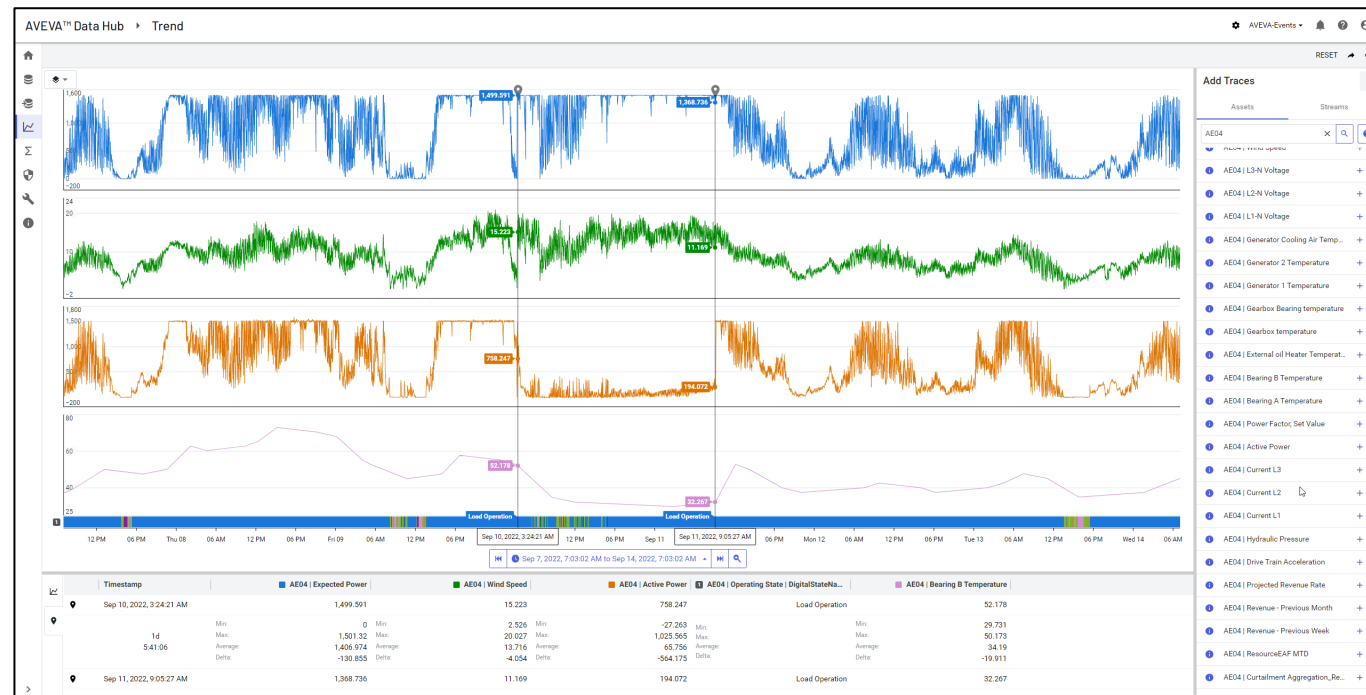


Visual trending enables asset root cause analysis & investigations

Trending

- ✓ Stream & asset search
- ✓ Common trend interactions
- ✓ Stacked trends
- ✓ Trend summary calcs
- ✓ Min/max easy cursors
- ✓ Multiple cursor delta summary calcs
- ✓ Trend sharing
- ✓ URL parameters
- ✓ String & Enum trending
- ✓ Seamless contextual navigation from Asset Explorer
- ✓ Trending asset properties
- ✓ Asset swapping
- ✓ Trending shared streams

Trending



Sharing with URL Parameters

<https://datahub.connect.aveva.com/tenant/cee3a3fd-aeb2-4950-80f5-4b72c77322b1/trend?origin=1;cee3a3fd-aeb2-4950-80f5-4b72c77322b1;uswe.datahub.connect.aveva.com;ed809cce-0e64-446f-a4c3-ada80bcf3367&trace=a;1;d68f33a8-0bc8-43a6-a9b4-9aadd041ed1f;Expected%2520Power;Value;%25231A76D9&trace=a;1;d68f33a8-0bc8-43a6-a9b4-9aadd041ed1f;Wind%2520Speed;Value;%2523008A00&trace=a;1;d68f33a8-0bc8-43a6-a9b4-9aadd041ed1f;Active%2520Power;Value;%2523DC7300&trace=a;1;d68f33a8-0bc8-43a6-a9b4-9aadd041ed1f;Operating%2520State;DigitalStateName&trace=a;1;d68f33a8-0bc8-43a6-a9b4-9aadd041ed1f;Bearing%2520B%2520Temperature;Value;%2523D28CD2&mode=stacked&cursor=2022-09-10T07:24:21.797Z&cursor=2022-09-11T13:05:27.127Z&selectedTrace=null&startIndex=2022-09-07T11:03:02.714Z&endIndex=2022-09-14T11:03:02.715Z>

Data Views curate operational data for external consumption

Enabling data exploration, integration, & data science

Data View

Timestamp	Name	Wind Farm	Active Power Value (kW)	Manufacturer	Revenue Rate - 10 min rolling avg Value (USD)	Expected Power Value (kW)	Revenue - Monthly Value (USD)	Revenue - Daily Value (USD)	Power Rated (kW)	Availability Flag Value (USD)
Step 10, 2022, 12:00:00 AM	GE01	Big Buffalo Wind Farm	86.75869	Tosulae	1.7596787547179	65.5403898906009	5541.58020647792	420.02137679603	1500	1
Step 10, 2022, 1:00:00 AM	GE01	Big Buffalo Wind Farm	184.10322	Tosulae	3.5766203183543	5329.04892729966	422.406545405057	1500	1	1
Step 10, 2022, 2:00:00 AM	GE01	Big Buffalo Wind Farm	246.43189	Tosulae	7.18624781431081	228.126701976912	8515.31742485883	426.573407596796	1500	1
Step 10, 2022, 3:00:00 AM	GE01	Big Buffalo Wind Farm	342.88108	Tosulae	6.550132523322162	160.12362882137012	5558.08800713333	31.87328584001976	1500	1
Step 10, 2022, 4:00:00 AM	GE01	Big Buffalo Wind Farm	67.33086	Tosulae	2.011336761377593	8.12884580872411	5488.188367133071	5.444515037584125	1500	1
Step 10, 2022, 5:00:00 AM	GE01	Big Buffalo Wind Farm	189.30527	Tosulae	6.40595951650536	230.914830176992	5487.470938442415	19.444484850311448	1500	1
Step 10, 2022, 6:00:00 AM	GE01	Big Buffalo Wind Farm	219.2198	Tosulae	11.23817352455899	119.2646015492146	5485.645642004991	24.4575759384782	1500	1
Step 10, 2022, 7:00:00 AM	GE01	Big Buffalo Wind Farm	389.45375	Tosulae	25.77235420192604	785.361426201001	3527.221764539865	31.76479595842274	1500	1
Step 10, 2022, 8:00:00 AM	GE01	Big Buffalo Wind Farm	891.52384	Tosulae	34.5146278193253	952.261292170775	3571.35987035474	64.36945060301	1500	1
Step 10, 2022, 9:00:00 AM	GE01	Big Buffalo Wind Farm	1276.4695	Tosulae	39.12007324622	1462.194861720208	3512.96303733083	115.12456457783369	1500	1
Step 10, 2022, 10:00:00 AM	GE01	Big Buffalo Wind Farm	732.8507	Tosulae	27.410071891647	739.864832836077	3537.16648368333	147.6482276201914	1500	1
Step 10, 2022, 11:00:00 AM	GE01	Big Buffalo Wind Farm	1314.1014	Tosulae	28.8461646558384	1421.8954618618	3562.11389554431	170.5720627619192	1500	1
Step 10, 2022, 12:00:00 PM	GE01	Big Buffalo Wind Farm	789.54614	Tosulae	23.024208249197465	791.851846459689	3708.892495970375	184.4722449493405	1500	1
Step 10, 2022, 1:00:00 PM	GE01	Big Buffalo Wind Farm	242.73896	Tosulae	16.5058444650165	269.164054444532	3729.94576760895	215.43445414767	1500	1
Step 10, 2022, 2:00:00 PM	GE01	Big Buffalo Wind Farm	296.9541	Tosulae	17.4335572133453	234.840233133453	3737.49275676993	229.5382156276193	1500	1
Step 10, 2022, 3:00:00 PM	GE01	Big Buffalo Wind Farm	239.26328	Tosulae	6.14332687826335	226.3718428944037	3734.608823274995	248.299550233102	1500	1
Step 10, 2022, 4:00:00 PM	GE01	Big Buffalo Wind Farm	174.40339	Tosulae	4.72181192220372	162.168203573597	3766.23238721566	263.6879636437027	1500	1
Step 10, 2022, 5:00:00 PM	GE01	Big Buffalo Wind Farm	140.1543	Tosulae	4.45027441247092	170.546111761276	3751.6461746253	280.057576605053	1500	1
Step 10, 2022, 6:00:00 PM	GE01	Big Buffalo Wind Farm	249.39136	Tosulae	7.42555569797375	196.72389144540774	3764.55972546854	296.256465147479	1500	1
Step 10, 2022, 7:00:00 PM	GE01	Big Buffalo Wind Farm	238.33301	Tosulae	5.74611465584584	245.4230532721155	3807.03535919442	311.103663177054	1500	1
Step 10, 2022, 8:00:00 PM	GE01	Big Buffalo Wind Farm	189.76676	Tosulae	5.93237876818178	129.655564530535	3817.865269269348	324.283365157397	1500	1
Step 10, 2022, 9:00:00 PM	GE01	Big Buffalo Wind Farm	75.793974	Tosulae	1.614218399118823	34.8732413898801	3823.17863990783	333.50624918939174	1500	1
Step 10, 2022, 10:00:00 PM	GE01	Big Buffalo Wind Farm	134.65382	Tosulae	1.6864407454057933	108.8835861745191	3837.10563313546	347.7576143202703	1500	1
Step 10, 2022, 11:00:00 PM	GE01	Big Buffalo Wind Farm	185.22301	Tosulae	2.7296746034746434	144.25848818541706	3849.727464454411	360.85118038174204	1500	1
Step 10, 2022, 12:00:00 AM	GE01	Big Buffalo Wind Farm	344.9632	Tosulae	5.45107955548751	389.8980118199024	3864.055725561548	374.765022433763	1500	1

Data Science Tools & Data Exploration

Data Science via Code

Partners & Apps

Cloud Platforms

Easily slice & dice your AVEVA Data Hub data in Power BI



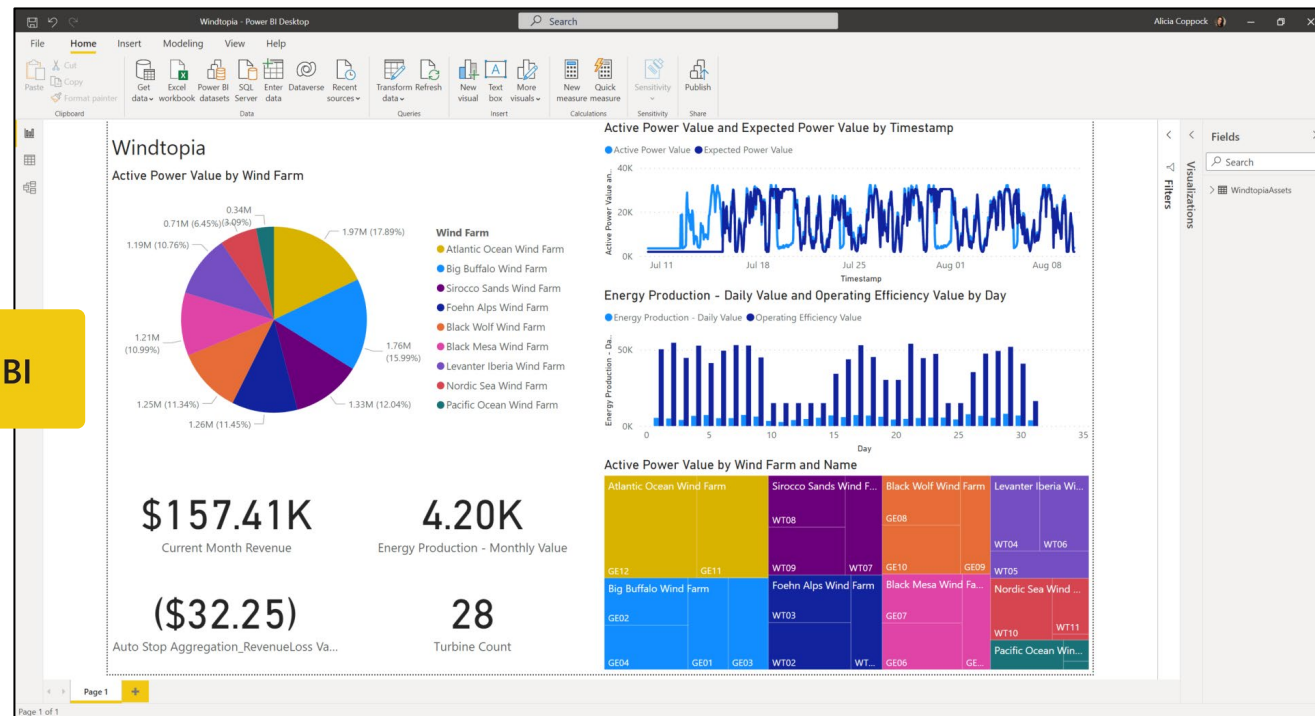
Power BI Connector

AVEVA
Data Hub
Data Views



Power BI

AVEVA Data Hub Power BI Connector



- ✓ Import AVEVA Data Hub Data Views into Power BI
- ✓ Stored & Interpolated retrieval modes

- ✓ No coding required
- ✓ Power BI Desktop and Power BI Service (through On-Premises Data Gateway)

AVEVA™ Data Hub

API Console

Full Path

v1

uswe.datahub.connect.aveva.com/api/v1/Tenants/cee3a3fd-aeb2-4950-80f5-4b72c77322b1/Namespaces/ed809cce-0e64-446f-a4c3-ada80bcf3367/DataViews/Wind Turbine Analysis/Data/Interpolated?startIndex=2022-09-12T04:00:00.000Z&endIndex=2022-09-15T04:00:00.000Z&form=table&interval=00.01:00:00

URI

GET

/Namespaces/ed809cce-0e64-446f-a4c3-ada80bcf3367/DataViews/Wind Turbine Analysis/Data/Interpolated?startIndex=2022-09-12T04:00:00.000Z&endIndex=2022-09-15T04:00:00.000Z&form=table&interval=00.01:00:00

History

Parameters

Headers

Copy

startIndex

2022-09-12T04:00:00.000Z

endIndex

2022-09-15T04:00:00.000Z

count

interval

00.01:00:00

continuationToken

cache

☐ Return tabular data (form=table)

GET

URI Path

GET uswe.datahub.connect.aveva.com/api/v1/Tenants/cee3a3fd-aeb2-4950-80f5-4b72c77322b1/Namespaces/ed809cce-0e64-446f-a4c3-ada80bcf3367/DataViews/Wind Turbine Analysis/Data/Interpolated?startIndex=2022-09-12T04:00:00.000Z&endIndex=2022-09-15T04:00:00.000Z&form=table&interval=00.01:00:00

Status

Code: 200

Text: OK

JSON

Table

730 Total Response Values

Filter Response Values...

Download Values

Tim...	Name	Win...	Acti...	Man...	Rev...	Exp...	Rev...	Rev...	Pow...	Avai...
Sep 15, ...	GE01	Big Buff...	1520.4...	Truval...	26.085...	1470.5...	6754.1...	520.30...	1500	1
Sep 15, ...	GE02	Big Buff...	1446.1...	ACME	25.054...	1479.3...	6764.6...	533.47...	1500	1
Sep 15, ...	GE03	Big Buff...	1513.7...	ACME	26.361...	1500.2...	6480.9...	534.57...	1500	1
Sep 15, ...	GE04	Big Buff...	1507.8...	Truval...	26.519...	1498.3...	6544.2...	572.81...	1500	1
Sep 15, ...	GE05	Black M...	777.45...	Truval...	15.561...	1437.1...	4178.8...	454.24...	800	1
Sep 15, ...	GE06	Black M...	1500.8...	Truval...	27.083...	1488.9...	6394.6...	660.46...	1500	1
Sep 15, ...	GE07	Black M...	953.48...	ACME	20.621...	845.80...	6094.1...	629.93...	1500	1

Sample Calls

Data Store Calls

GET /Namespaces/250ba352-e3f3-4eb0-a50f-21bde8d301bc/Streams

GET /Namespaces/a1936e4a-28c2-4c63-a3c8-c367d715b7eb/Streams

GET /Namespaces/acfc461-1fa1-43f4-8227-bff8ebaa0d0f/Streams

OMF Ingress Calls

GET /Namespaces/250ba352-e3f3-4eb0-a50f-21bde8d301bc/Topics

GET /Namespaces/250ba352-e3f3-4eb0-a50f-21bde8d301bc/Subscriptions

GET /Namespaces/a1936e4a-28c2-4c63-a3c8-c367d715b7eb/Topics

GET /Namespaces/a1936e4a-28c2-4c63-a3c8-c367d715b7eb/Subscriptions

GET /Namespaces/acfc461-1fa1-43f4-8227-bff8ebaa0d0f/Topics

GET /Namespaces/acfc461-1fa1-43f4-8227-bff8ebaa0d0f/Subscriptions

Favorite Calls

0


C#

Python

Java

NodeJS

Angular



<https://github.com/osisoft>

General / Home Energy Usage v2.0

Master Bedroom 1Min 363 W

Living Room 1Min 332 W

Office 1Min 227 W

Kitchen 1Min 178 W

Media Room 1Min 69 W

Current Day Power Total 13.1 kWh

Current Day Power Cost \$1.26

Current Month Total Power Usage 956 kWh

Current Month Bill \$110.89

Hourly Power by Device

Daily Power Usage

Month Power Total

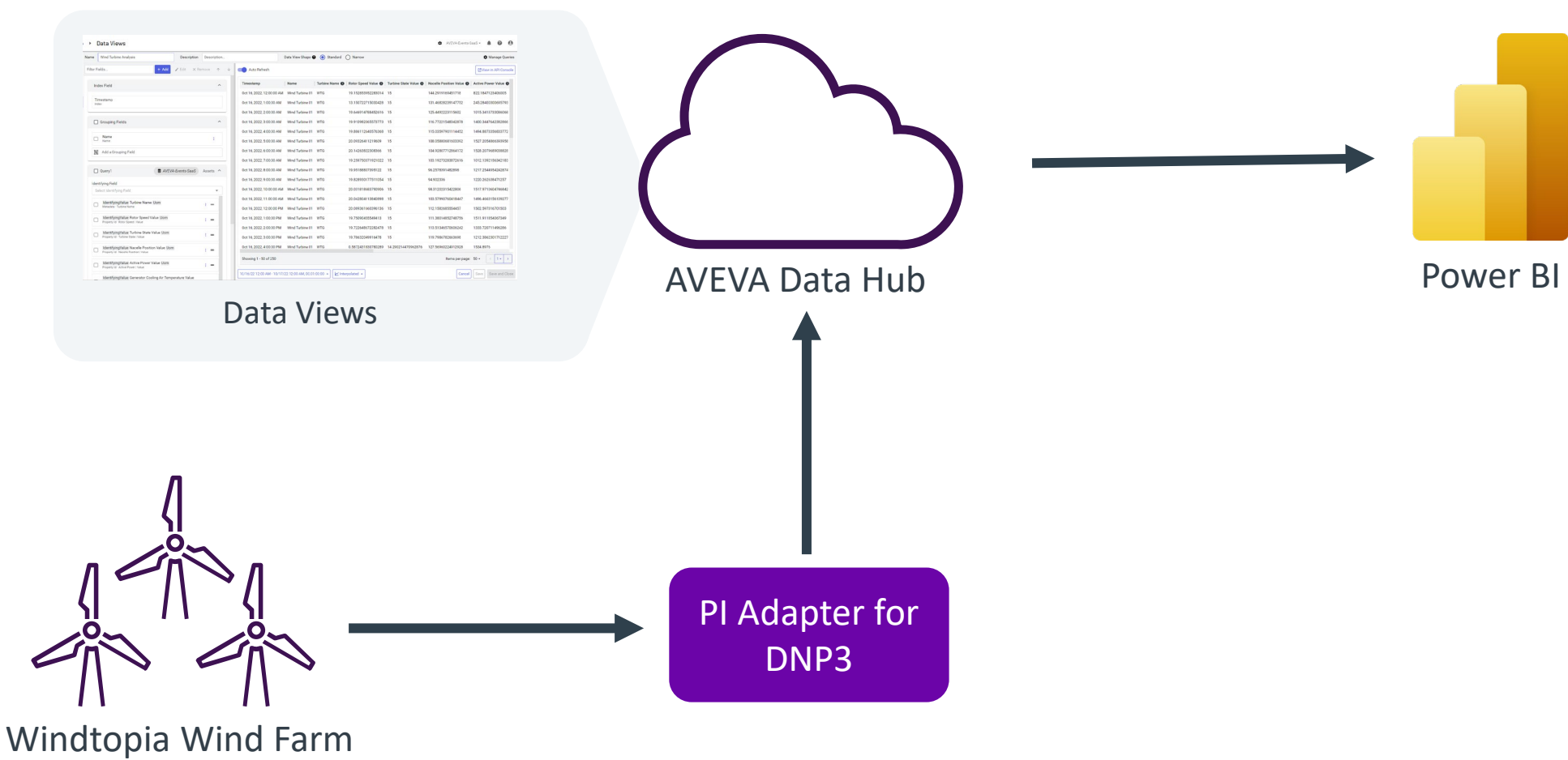
Top 5 Devices Last Week

Power Spikes This Week



<https://github.com/osisoft>

Demo



Home

Data Management

Data Collection

Visualization

Analytics

Security

Developer Tools

Support

Retrieve Data Views in Microsoft Power BI for advanced data visualization and analysis: [Download Power BI Connector](#)

Filter Data Views...

+ Add Data View

Id ↑	Name	Description	Query Sources
Wind Turbine Analysis	Wind Turbine Analysis		AVEVA-Events-SaaS

Showing 1 - 1 of 1Items per page: 501

Wind Turbine Analysis

Id

Wind Turbine Analysis

Name

Wind Turbine Analysis

Shape

Standard

API URL

https://uswe.datahub.connect.aveva.com/api/v1/Tenants/cee3a3fd-aeb2-4950-80f5-4b72c77322b1/Namespaces/250ba352-e3f3-4eb0-a50f-21bde8d301bc/DataViews/Wind%20Turbine%20Analysis

Queries

Query1

AVEVA-Events-SaaS

Assets

Query Value

assetTypeName:"DNP3 Windtopia Wind Turbine"

Fields

IdentifyingValue Turbine Name Uom

Metadata · Turbine Name

IdentifyingValue Rotor Speed Value Uom

Property Id · Rotor Speed | Value

IdentifyingValue Turbine State Value Uom

Property Id · Turbine State | Value

IdentifyingValue Nacelle Position Value Uom

Property Id · Nacelle Position | Value

IdentifyingValue Active Power Value Uom

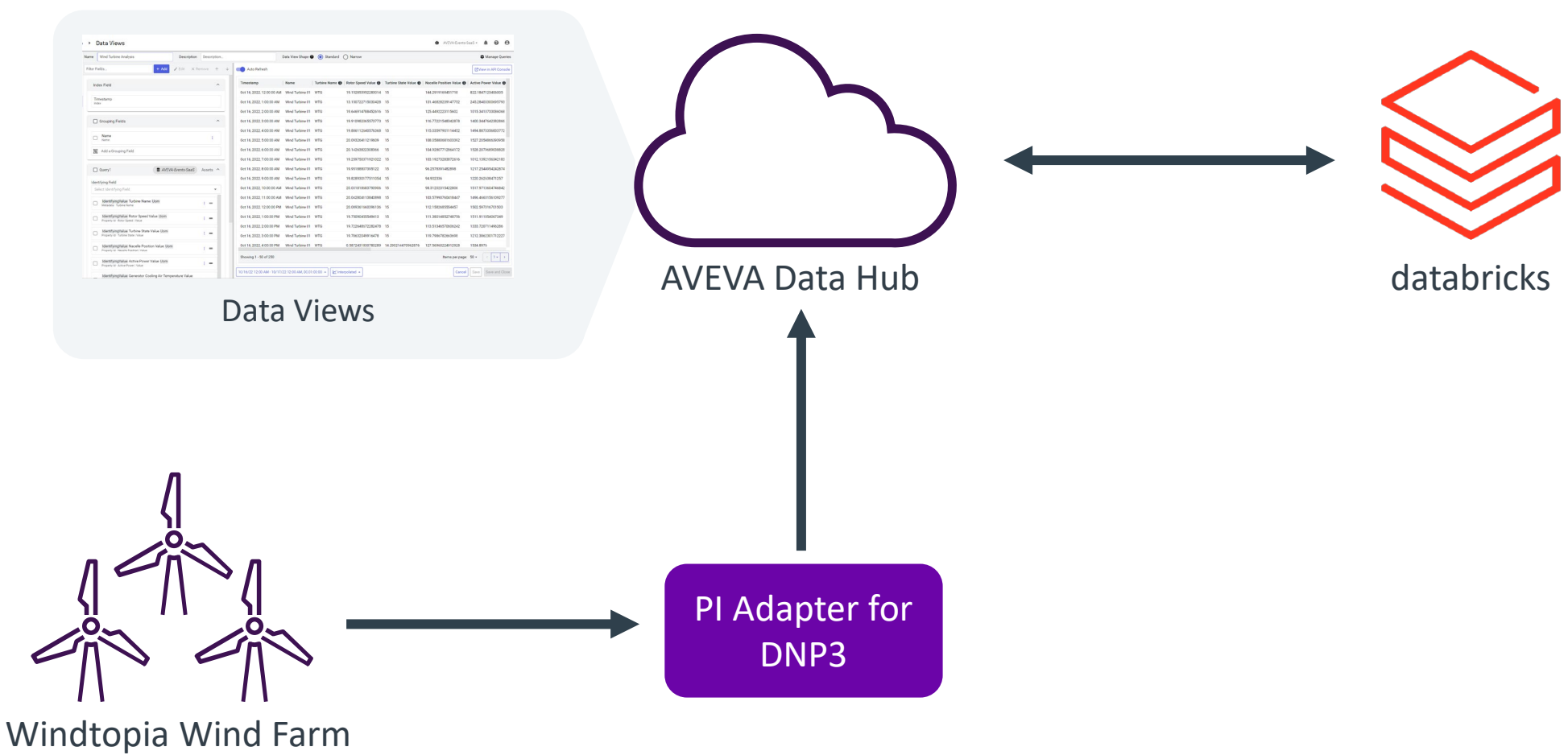
Property Id · Active Power | Value

IdentifyingValue Generator Cooling Air Temperature Value Uom

Property Id · Generator Cooling Air Temperature | Value

IdentifyingValue Wind Speed Value Uom

Demo



AVEVA DATA HUB

Customer Success Story

Machine Learning Using AVEVA PI System Data w/ AVEVA Data Hub



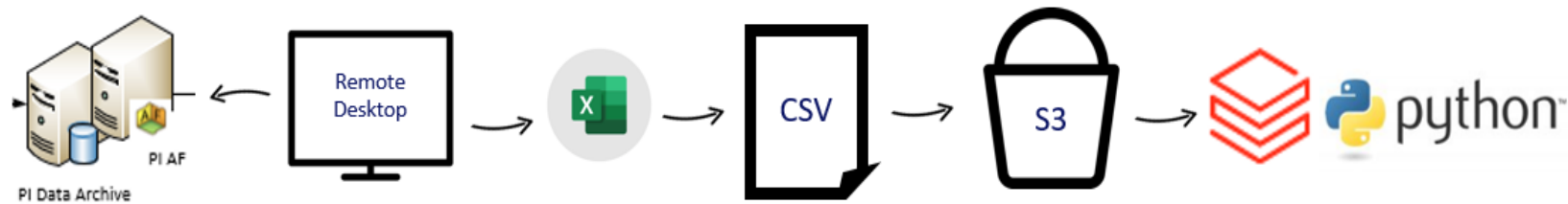
Minimizing downtime with smart maintenance



Challenge

- 'Gas in Coolant' leaks can cause unpredicted downtime, resulting in significant loss per incident.
- Generators are taken out for service too early due to lack of visibility of generator defects.
- Fuel mill blockages impose significant cost of outages & repairs.
- No tools available to work with live data on predictive functionalities.

From...



- Remote desktop used to access Drax systems
- PI Datalink on remote machine used to pull data into CSV
- CSV saved on Sharepoint
- CSV downloaded locally
- CSV uploaded to S3
- CSV now accessible from S3 and usable in Databricks

Entire process takes a **minimum of 30 minutes** much longer for large data pulls (repeated often).

Minimizing downtime with smart maintenance



Challenge

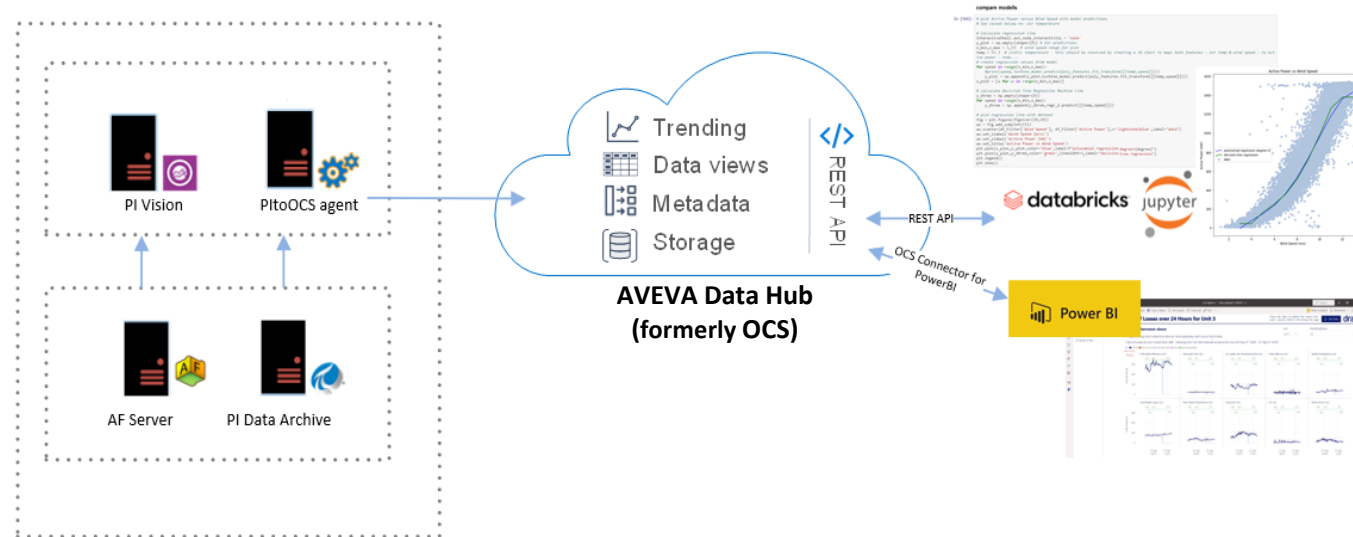


Solution

- ‘Gas in Coolant’ leaks can cause unpredicted downtime, resulting in significant loss per incident.
 - Generators are taken out for service too early due to lack of visibility of generator defects.
 - Fuel mill blockages impose significant cost of outages & repairs.
 - No tools available to work with live data on predictive functionalities.
- Lighthouse: deploy AVEVA Data Hub as a cloud data platform to make PI data available to Drax’s data science teams & tools - automated and at scale. (was a manual workload for small data sets before)
 - Enables predictive analytics on historical and fresh data.
 - Calculate lead time predictions for Generator ‘Gas in Coolant’ leaks as well as for Fuel Mill blockages, to enable longer service times (postpone maintenance based on data).

To: AVEVA Data Hub greatly improves Drax's Data Pipeline

The Data Science team can now access PI Data from Databricks, Drax's chosen Data Science platform.



- Data ingested from AVEVA PI System by AVEVA Data Hub agent
- Data Views to prep data
- AVEVA Data Hub Rest API queried from Databricks notebook
- Small repeated queries made to Data Hub using Databricks for close to live data
- Large queries made to Data Hub and saved to S3 for repeated use (Large data set for training ML models)



Minimizing downtime with smart maintenance

Challenge

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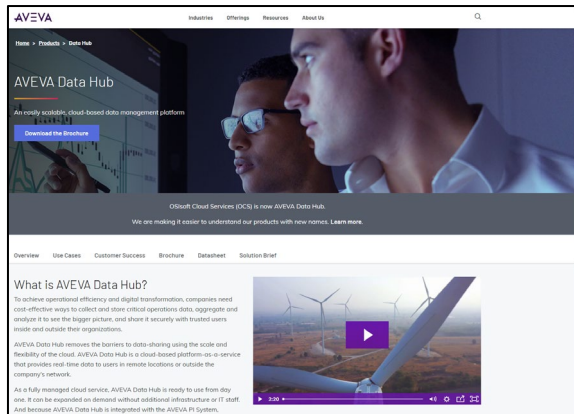
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- Enables predictive analytics on historical and fresh data.
- Calculate lead time predictions for Generator ‘Gas in Coolant’ leaks as well as for Fuel Mill blockages, to enable longer service times (postpone maintenance based on data).

Benefits

- Outages can be avoided, service times prolonged and repairs planned more efficiently. Significant savings per day due to maintenance reduction, and production output de-risked through analytics driven alarms and improved dome scheduling.
- Standardized, off the shelf SAAS environment to enable data science scenarios at scale - without impacting on-premise operations systems. This solution is now available to enable more use cases and business value.

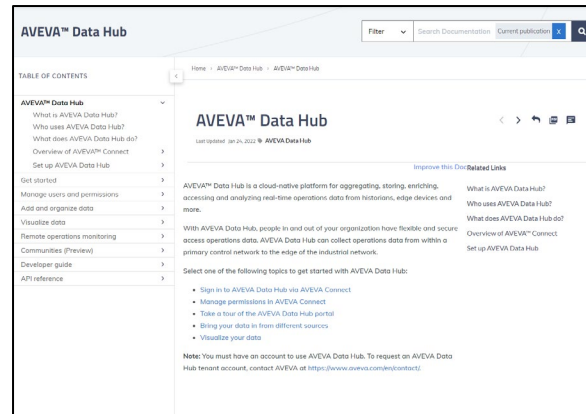
Where to find more information on AVEVA Data Hub

Overview & Resources



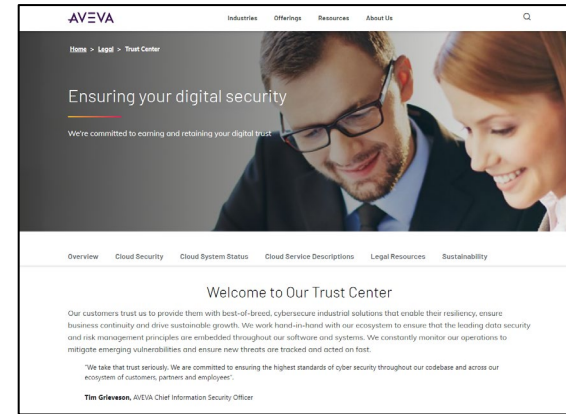
<https://www.aveva.com/en/products/data-hub/>

Documentation



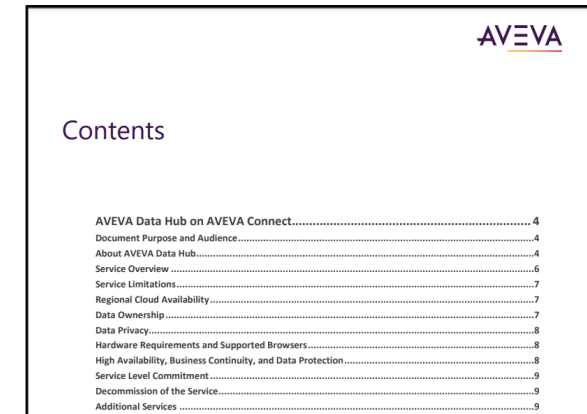
<https://docs.osisoft.com/bundle/data-hub/page/adh-content-portal-overview.html>

Security & Trust Center



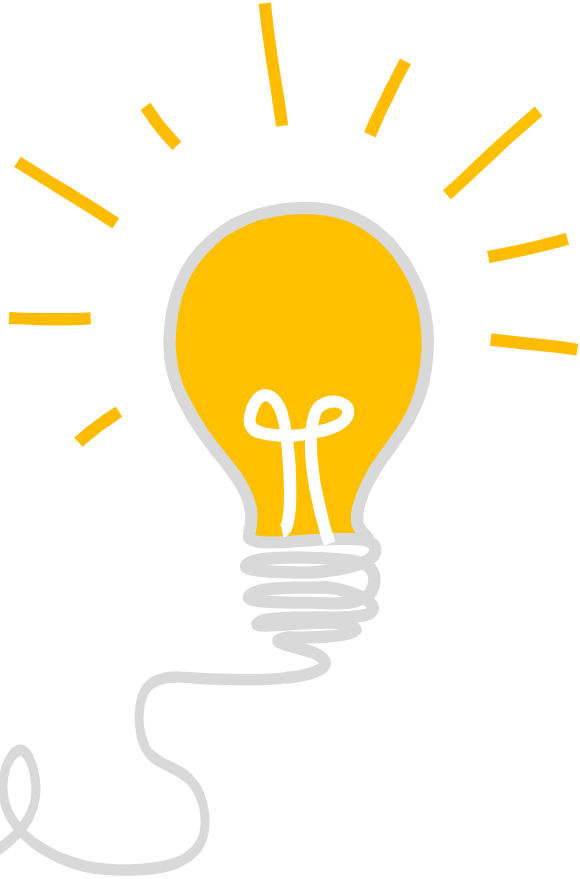
<https://www.aveva.com/en/legal/trust/>

Service Description



https://www.aveva.com/content/dam/aveva/documents/legal/service-documents/AVEVA-Data-Hub-on-AVEVA-Connect_v1-0.pdf

How can you influence the AVEVA Data Hub roadmap?



<https://feedback.aveva.com>

Let us know your product feedback!



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