OCTOBER 25, 2023

AVEVA™ PI System™ for Western Energy Imbalance Market

Brandon Pufall

© 2023 AVEVA Group plc and its subsidiaries. All rights reserved.

Brandon Pufall

EIM OPERATIONS ANALYST

Tucson Electric Power

Brandon.Pufall@tep.com

© 2022 AVEVA Group plc and its subsidiaries. All rights reserved.

AGENDA

WEIM Introduction And Challenge

PI Integration and Technical Architecture

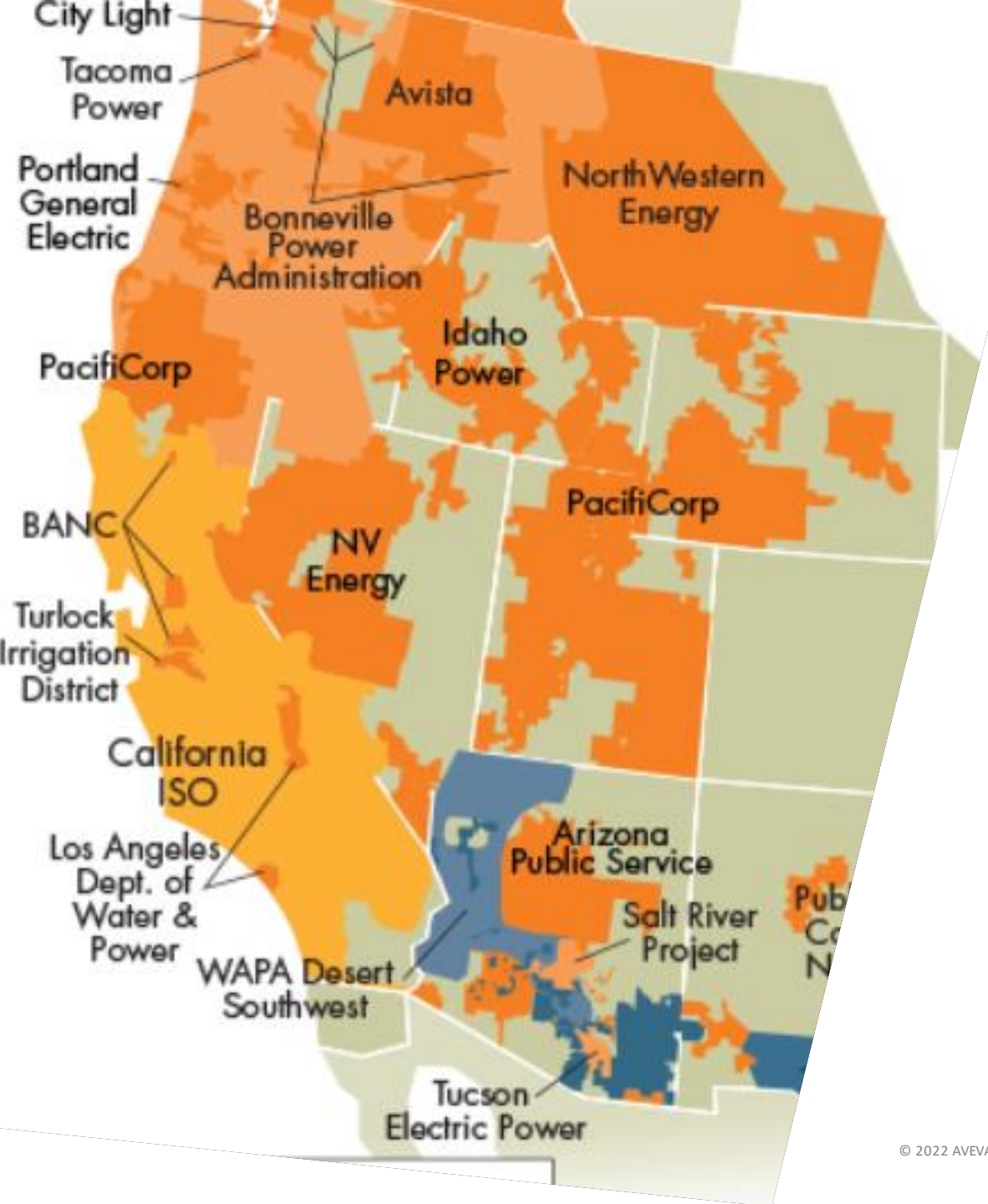
Solution

- EIM Asset Framework
- EIM Displays
- EIM Analysis

Future Opportunity and Improvements

© 2022 AVEVA Group plc and its subsidiaries. All rights reserved.

AVEVA



Western Energy Imbalance Market Introduction

- The Western Energy Imbalance Market (WEIM) is a real-time wholesale energy trading market that enables participants anywhere in the west to buy and sell energy.
- Reduces production costs by balances fluctuations in supply and demand by using lower-cost resources to meet real-time power needs.
- Allows for more efficient use and integration of renewable energy.
- Currently 22 entities
- 4.2 Billion gross benefits since Nov 2014

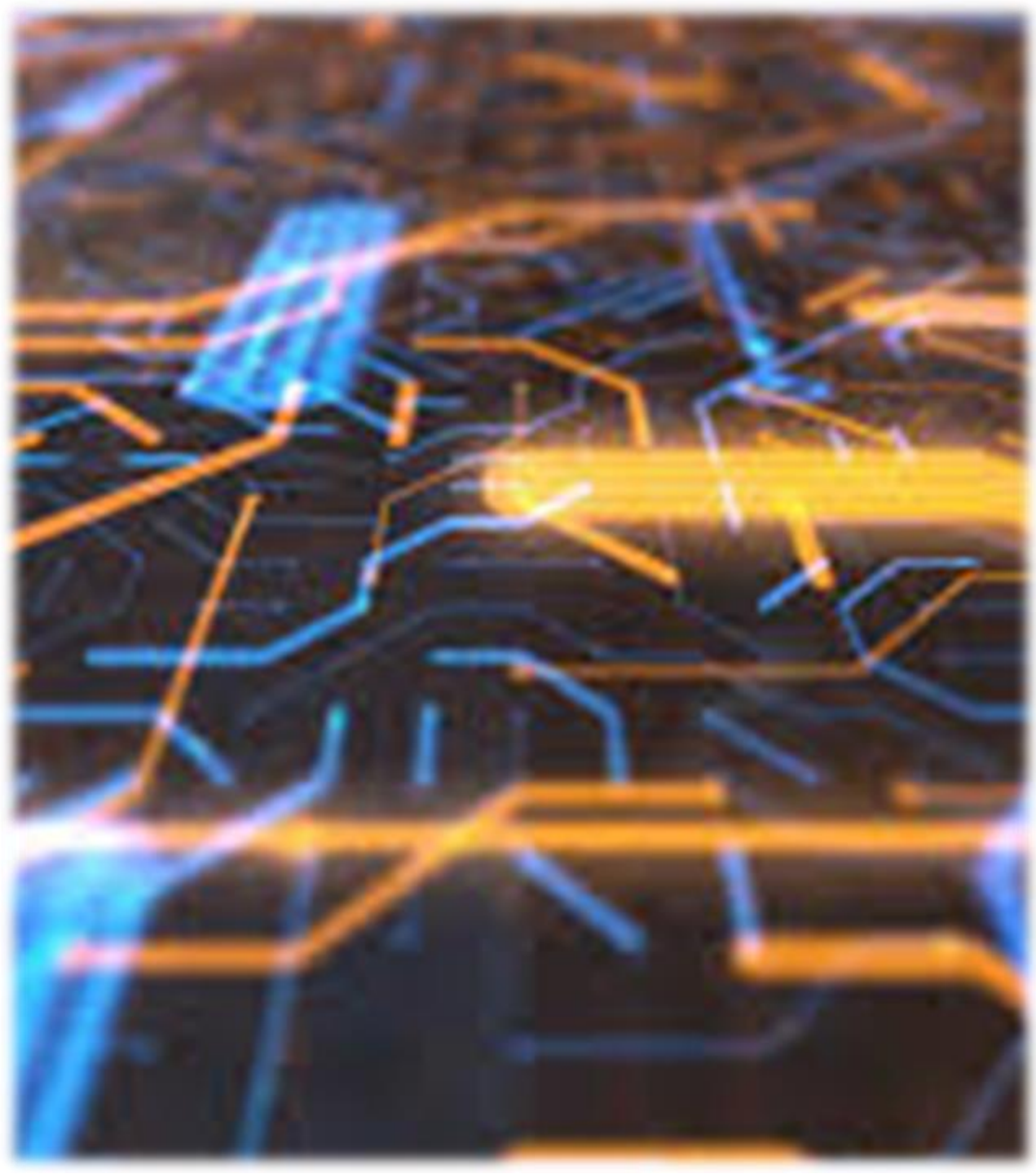
© 2022 AVEVA Group plc and its subsidiaries. All rights reserved.

AVEVA

Why the AVEVA PI System?

- WEIM introduces the need to manage a tremendous amount of data quickly and efficiently
  - Pre-hour submissions
    - Unit availability
    - Resource Plan
    - Bilateral Sales/Purchases
    - Bids
  - Real-time telemetry from SCADA to CAISO
  - Real-time market inputs into EMS
  - Real-time market adjustments
  - Post Analysis Data
- One common challenge nearly all WEIM entities encounter is providing real-time visualization and decision-making tools to ad operators in decision making

© 2022 AVEVA Group plc and its subsidiaries. All rights reserved.



Systems

CAISO

- BAOOP (Operations Portal)
- BSAP (Base Schedules)
- ADS (Dispatches)
- webOMS (CAISO OMS)
- SIBR (Bids)

EESC (BA)

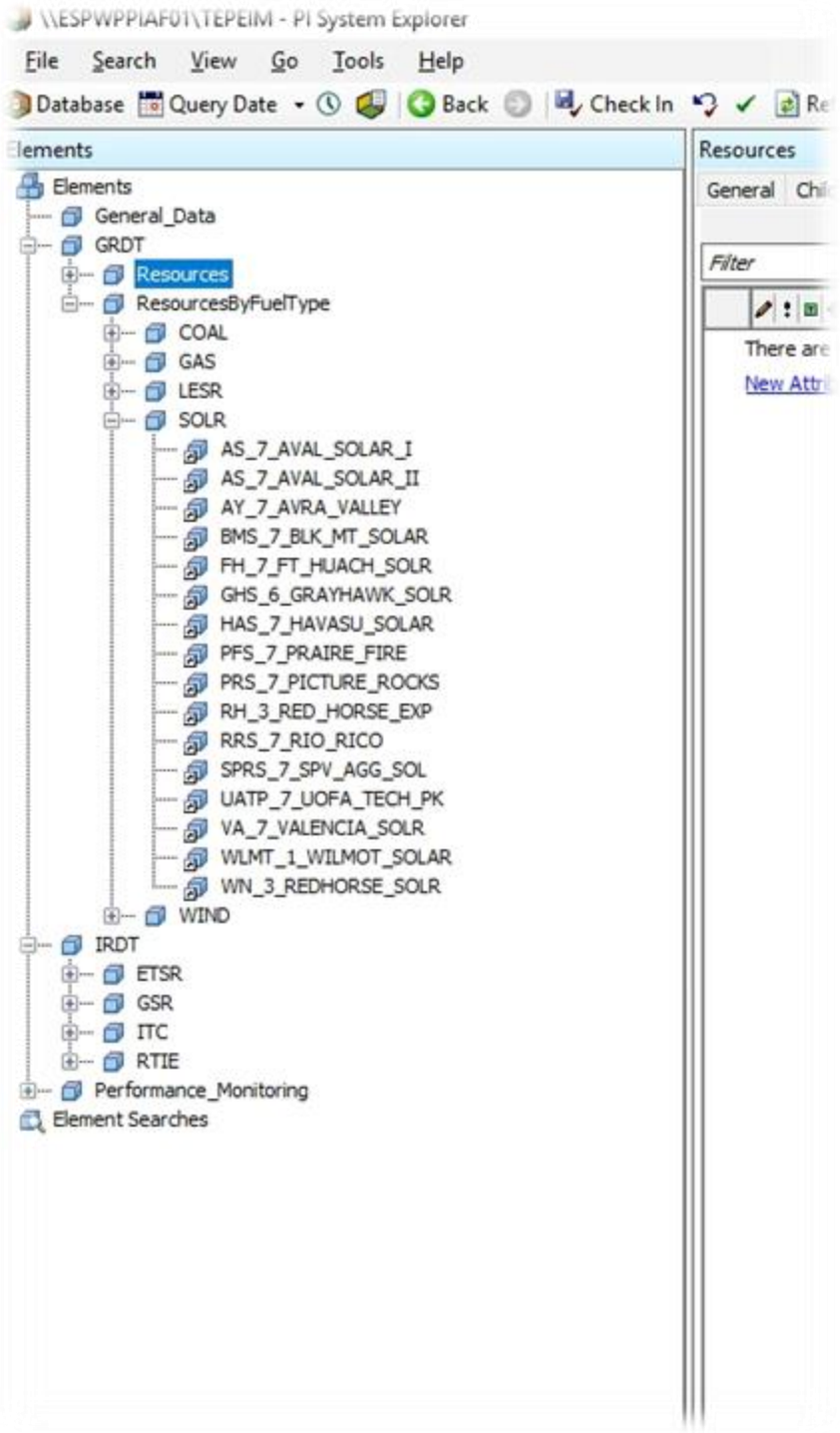
- EMS (OSII/AspenTech Monarch)
- webEIM (EESC)
- webTrans
- webAccounting
- OATI DMZ (SQL Server Data Warehouse)

PRSC (Marketing)

- webEIM (PRSC)
- webTrader
- webOMS (TEP OMS)
- webCalc

© 2022 AVEVA Group plc and its subsidiaries. All rights reserved.

AVEVA



Asset Framework Design

- Create a standard Asset Framework, for participation in WEIM, that contains all/most of the standard parameters common among all WEIM entities
- Able to integrate into the business processes/practices of updating CAISO resource templates to ensure that operational display are in sync with the market
- Allows flexibility between the static elements, while also allowing dynamic elements to evolve as needed

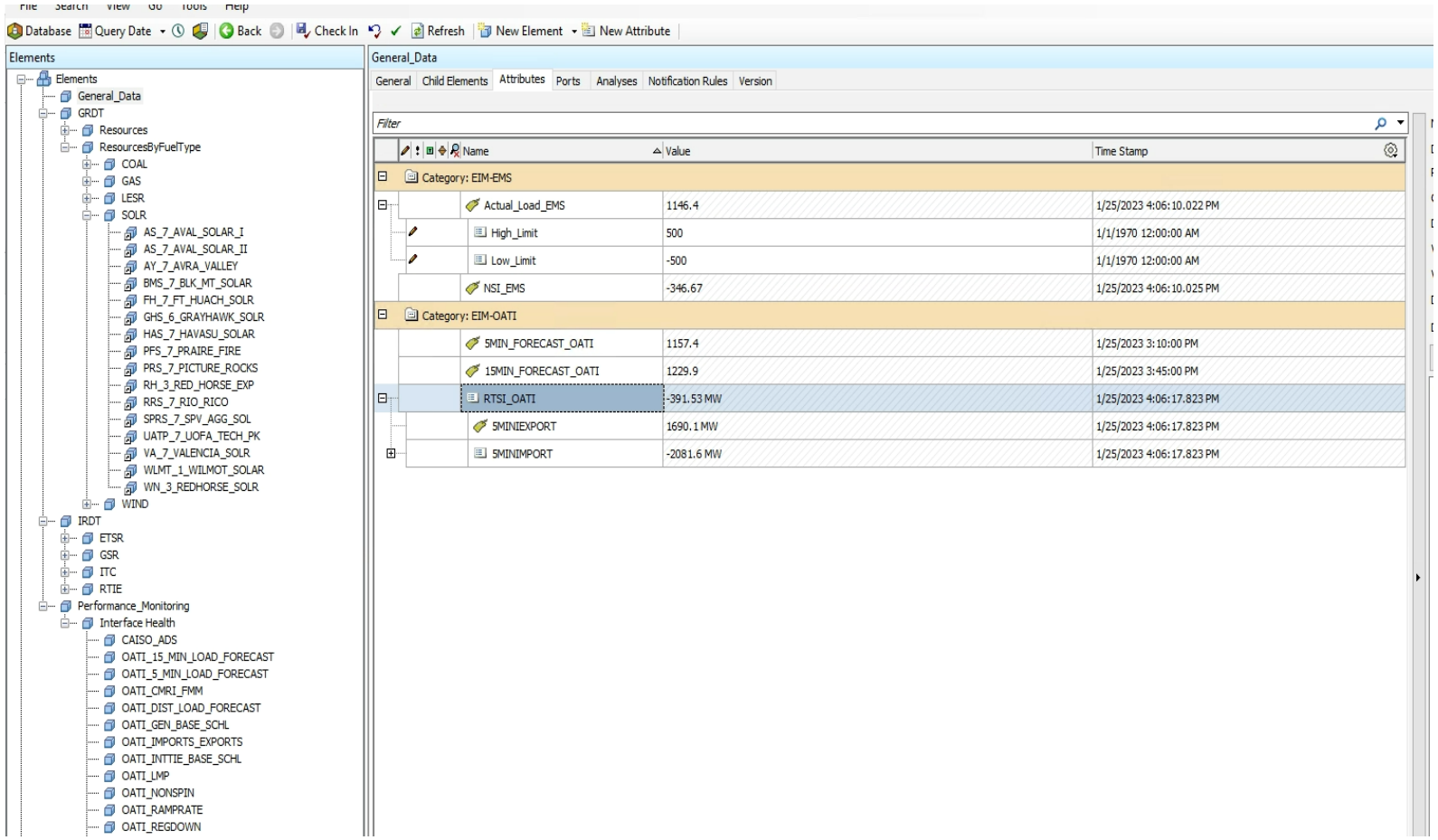
© 2022 AVEVA Group plc and its subsidiaries. All rights reserved.

AVEVA

GRDT And IRDT As Foundation

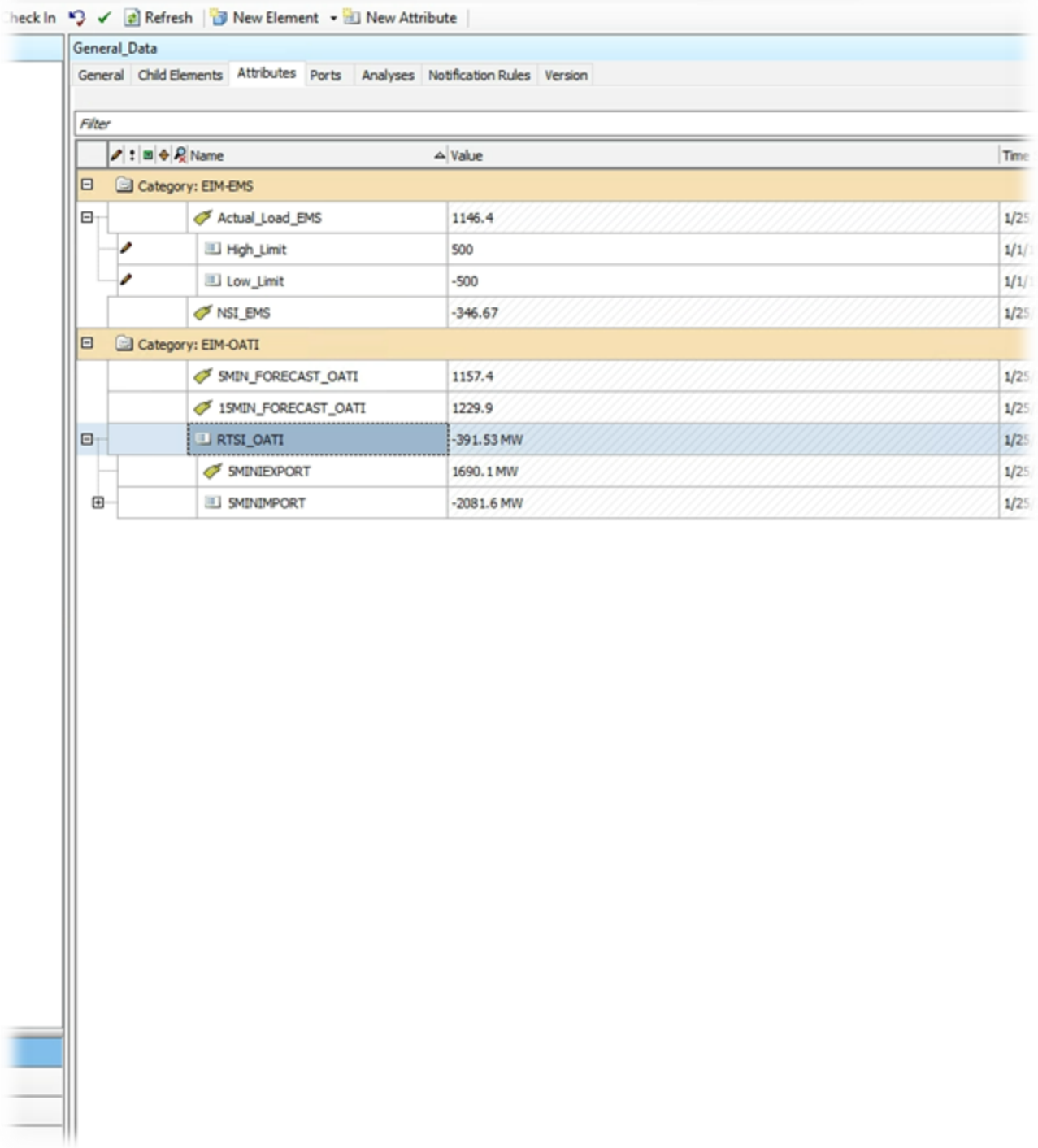
ID	Resource ID	Maxi / Gene / Capa
	RES_ID	MAX_
	AS_7_AVAL_SOLAR_I	
	AS_7_AVAL_SOLAR_II	
	AY_7_AVRA_VALLEY	
	BK_6_BLK_MTN_1	
	BK_6_BLK_MTN_2	
	BMS_7_BLK_MT_SOLAR	
	BW_3_BORDERLANDS	
	DP_7_DEMOSS	
	FH_7_FT_HUACH_SOLR	
	GHS_6_GRAYHAWK_SOLR	
	GR_5_GILA_RIVER_2	
	GR_5_GILA_RIVER_3	
	HAS_7_HAVASU_SOLAR	
	IHB_7_IRONHORSE_BAT	
	IR_1_IRVICT_1	
	IR_1_IRVICT_2	
	IR_1_SUNDT_3	
	IR_1_SUNDT_4	
	IR_7_RICE_1	
	IR_7_RICE_10	
	IR_7_RICE_2	
	IR_7_RICE_3	
	IR_7_RICE_4	
	IR_7_RICE_5	
	IR_7_RICE_6	
	IR_7_RICE_7	
	IR_7_RICE_8	

Code | RESOURCE | RAMPRATE | HEATRATE



© 2022 AVEVA Group plc and its subsidiaries. All rights reserved.

AVEVA

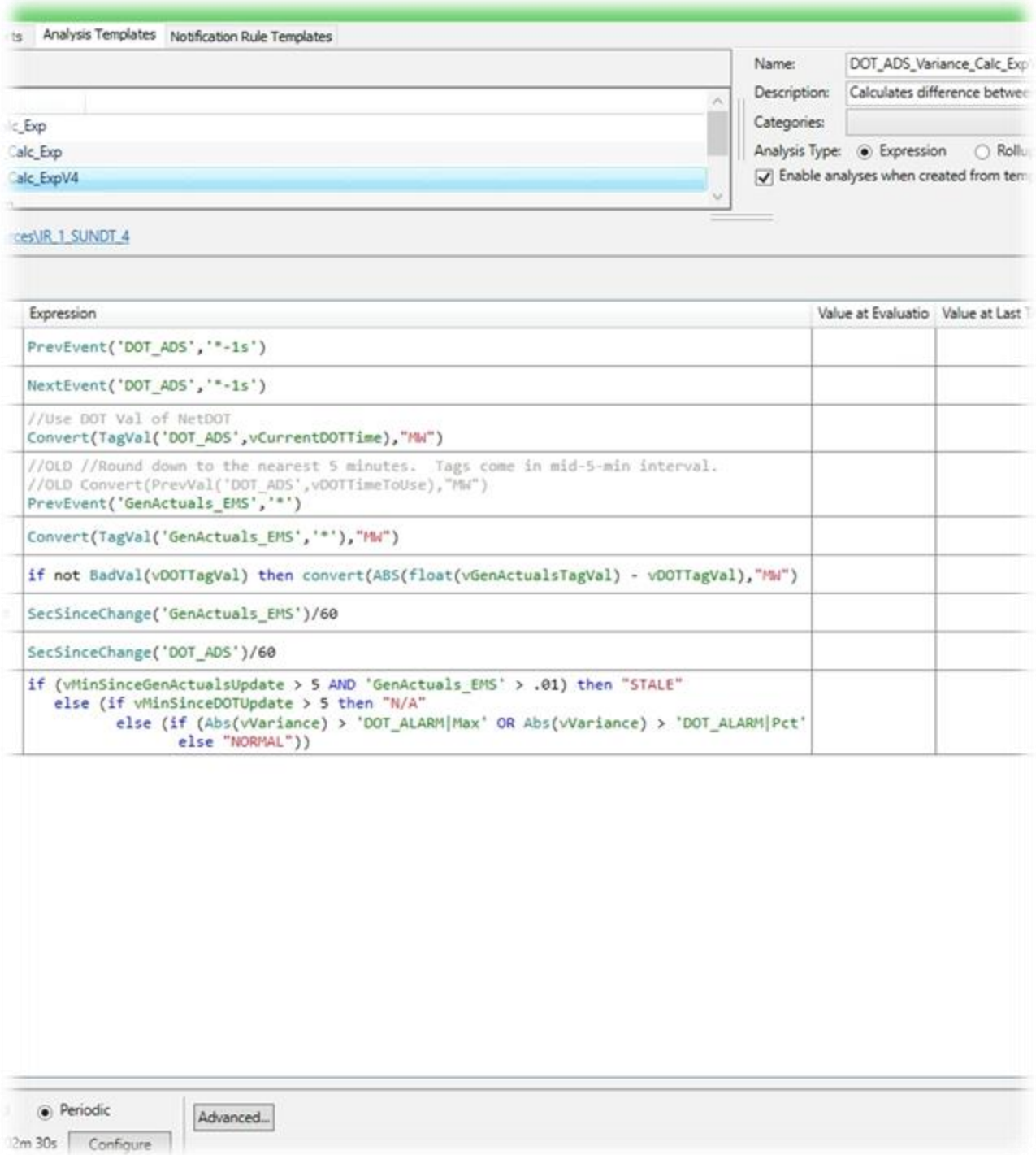


Custom Data Elements

- Dispatch Operating Target (DOT)
  - Generation
  - Dynamic ETSR's
- Dispatch Operating Projection (DOP)
- Telemetry
- Unit Thresholds
- Resource Plan (Base Schedules)
- Net Schedule Interchange (NSI)
- Real Time Schedule Interchange (RTSI)
- Load Forecast
  - Internal
  - CAISO
- Etc.

© 2022 AVEVA Group plc and its subsidiaries. All rights reserved.

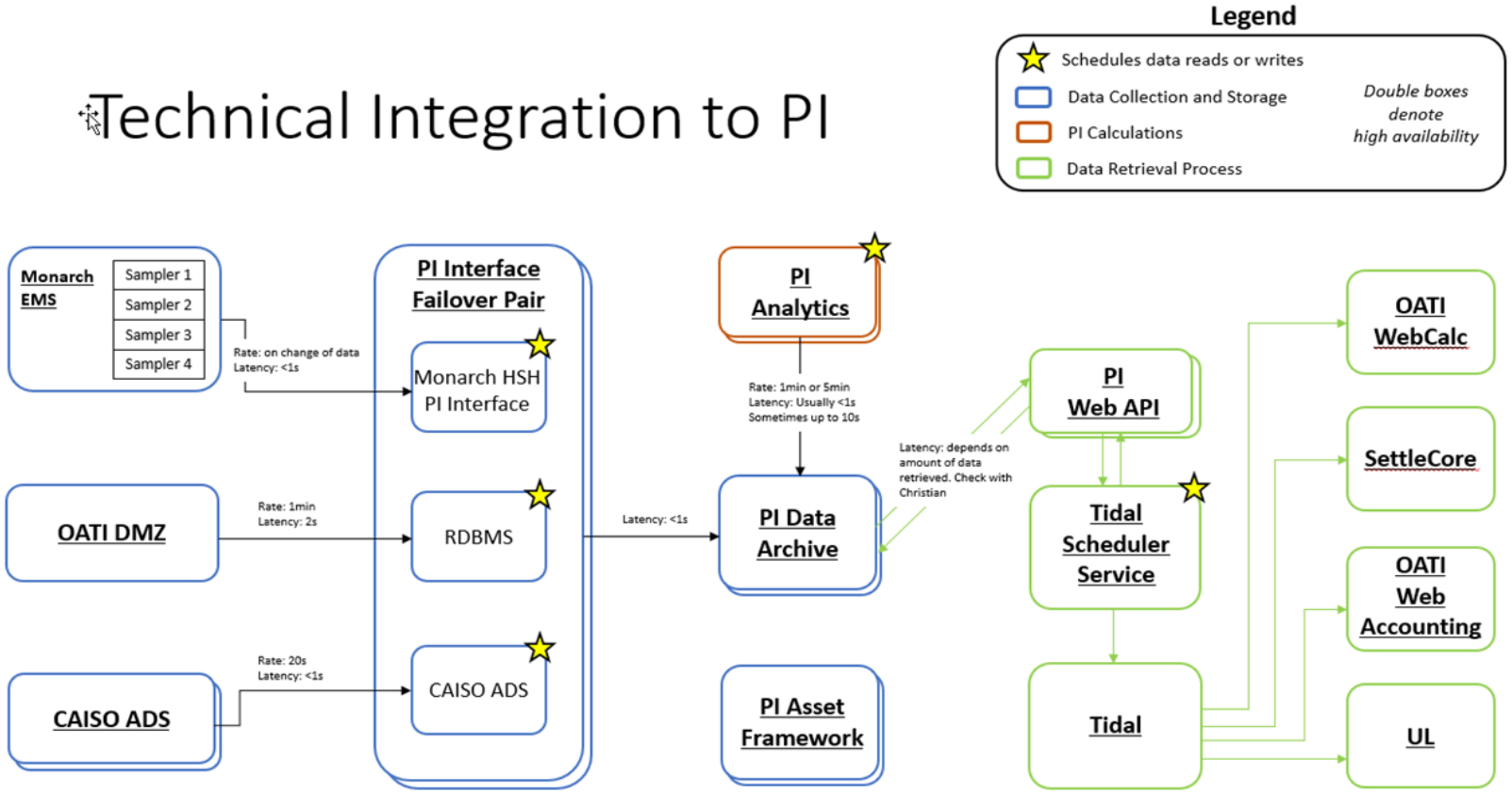
AVEVA



EIM Analysis Points

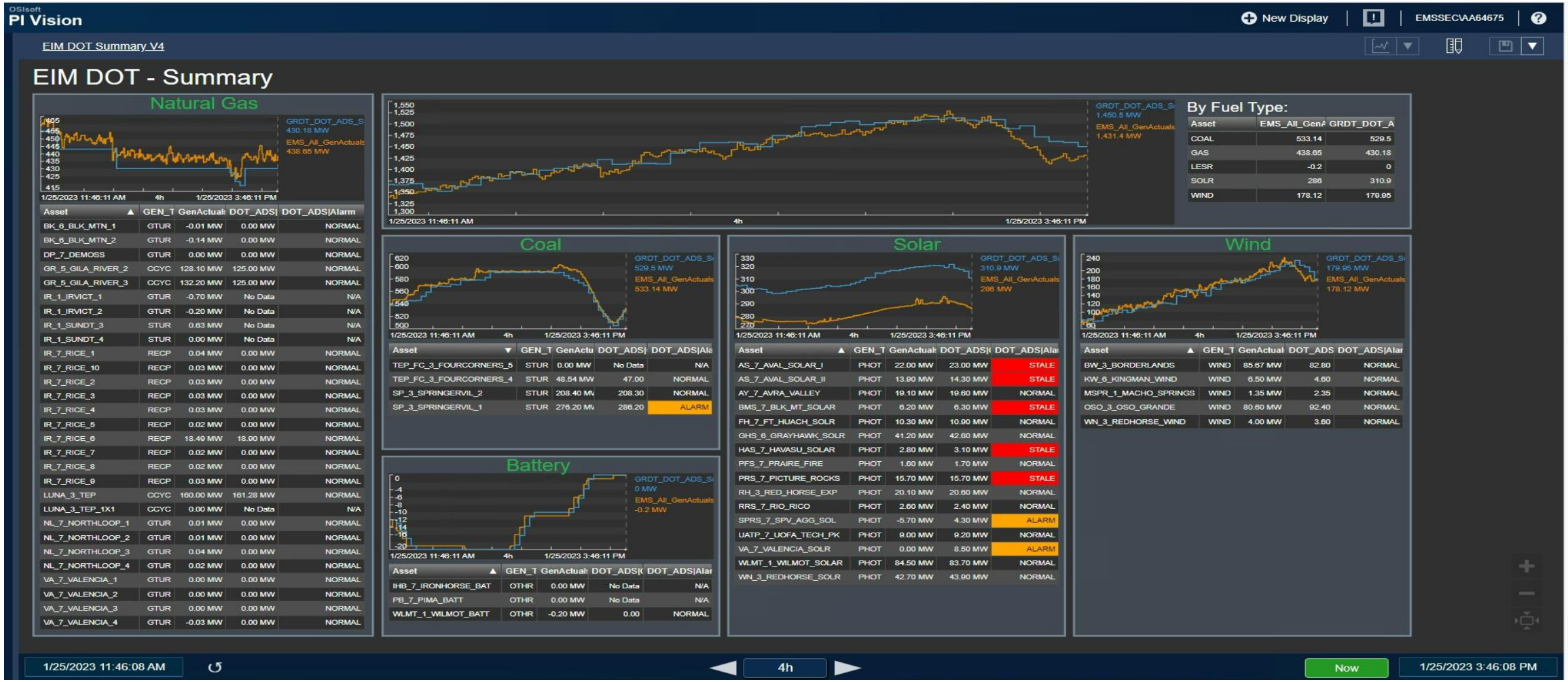
- DOT Variance Alarms
- Telemetry Staleness
- Telemetry Floor/Ceiling
- ITC Limits
- Integration Health Checker
- Etc.

Technical Integration Diagram



© 2022 AVEVA Group plc and its subsidiaries. All rights reserved.

DOT Summary Display



© 2022 AVEVA Group plc and its subsidiaries. All rights reserved.

Unit Details Display

© 2022 AVEVA Group plc and its subsidiaries. All rights reserved.

NSI, Forecast and Health Check Displays

© 2022 AVEVA Group plc and its subsidiaries. All rights reserved.

Real-time Operational Analytics

- Provides aggregated real-time information on performance within the market
- Provides information on where the market is driving the BA and potential future misalignment
- Provides operators information to minimalize financial impacts on the settlements

What's Next

- Additional Displays and Alarms
- Model Maintenance Improvements
- Expansion of the AF model to include the BA grid
  - Overlays of market data onto the BA framework
  - Allows additional analysis of grid operations vs. market solution
- Utilization of EIM AF for KPI and Dashboards

Questions?

Please wait for the microphone.

State your name and company.

Please remember to…

Navigate to this session in the mobile app to complete the survey.

Thank you!

© 2023 AVEVA Group plc and its subsidiaries. All rights reserved.

This presentation may include predictions, estimates, intentions, beliefs and other statements that are or may be construed as being forward-looking. While these forward-looking statements represent our current judgment on what the future holds, they are subject to risks and uncertainties that could result in actual outcomes differing materially from those projected in these statements. No statement contained herein constitutes a commitment by AVEVA to perform any particular action or to deliver any particular product or product features. Readers are cautioned not to place undue reliance on these forward-looking statements, which reflect our opinions only as of the date of this presentation.

The Company shall not be obliged to disclose any revision to these forward-looking statements to reflect events or circumstances occurring after the date on which they are made or to reflect the occurrence of future events.

© 2023 AVEVA Group plc and its subsidiaries. All rights reserved.

linkedin.com/company/aveva

@avevagroup

ABOUT AVEVA

AVEVA is a world leader in industrial software, providing engineering and operational solutions across multiple industries, including oil and gas, chemical, pharmaceutical, power and utilities, marine, renewables, and food and beverage. Our agnostic and open architecture helps organizations design, build, operate, maintain and optimize the complete lifecycle of complex industrial assets, from production plants and offshore platforms to manufactured consumer goods.

Over 20,000 enterprises in over 100 countries rely on AVEVA to help them deliver life's essentials: safe and reliable energy, food, medicines, infrastructure and more. By connecting people with trusted information and AI-enriched insights, AVEVA enables teams to engineer efficiently and optimize operations, driving growth and sustainability.

Named as one of the world's most innovative companies, AVEVA supports customers with open solutions and the expertise of more than 6,400 employees, 5,000 partners and 5,700 certified developers. The company is headquartered in Cambridge, UK.

Learn more at www.aveva.com

© 2023 AVEVA Group plc and its subsidiaries. All rights reserved.

AVEVA