AVEVA PI WORLD

Advance monitoring and analytics combined cycle gas plant

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AVEVA

LIFE IS OUR DUTY

Life is the most precious asset.

A2A takes care of it every day by taking care of environment, water, energy, in a circular economy.

And it does so through the most advanced technologies, because we have a long-term vision.
We think of the future of our Planet.
To improve everyone's life.

A2A.
LIFE COMPANY.

Sustainability leads A2A's **new strategy**

Energy

Waste

Networks

Circular Economy

Enabling circular economy to preserve the planet's resources and protect the environment

Energy

Waste

Networks

Energy Transition

Guaranteeing the production and use of clean energy by speeding up decarbonization and enabling the electrification of consumption

A2A, data-driven company, accelerates through digital and innovation

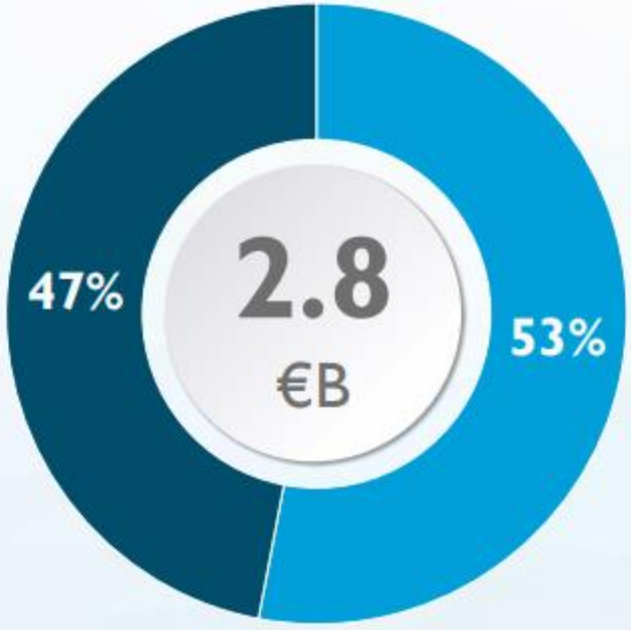
Cumulative CAPEX | 2021-30

Technologies of generation, storage and hydrogen

Innovative energy and material recovery solutions

Network flexibility and resilience

***Open innovation* through start-ups / CVC[1]**



Increased performance and plant availability

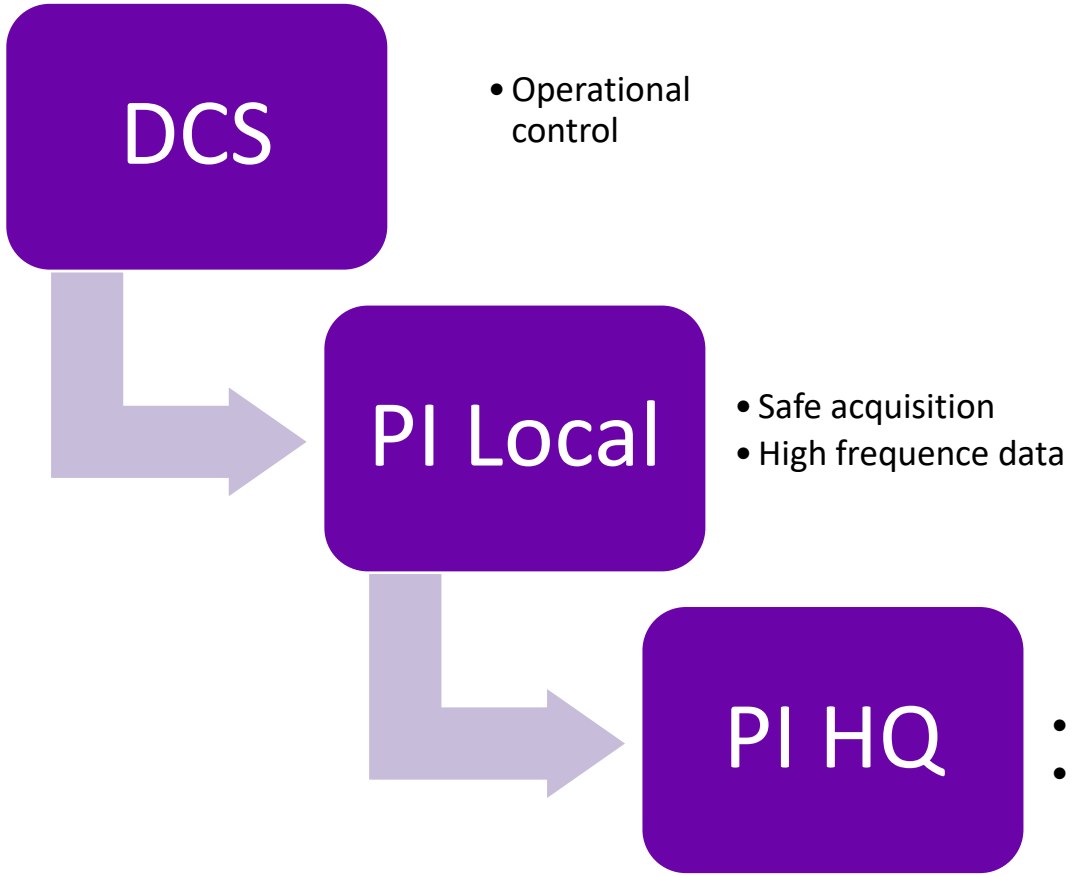
Operation efficiency and automation

Multi-channel *Customer experience*

New advanced work tools

Notes: (1) Corporate Venture Capital

PI System in A2A



- Operational control

- Safe acquisition
- High frequence data

- Central datawarhouse
- Multiple analysis engines: AF, SEEQ, GCP.

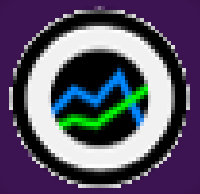
Some number

- 15 PI Server on site generally with OPC interface
- UP to 20 AF databases
- More than 10.000 analysis
- More than 1000 PI Vision displays
- More than 200 users

RADAMES Project - Technical Realization

- PI DA Data to extract each parameter statistics and to generate expected values curves

- Asset Framework and Analytics:
  - Detecting the near steady state condition
  - Modeling and Comparing expected and measured values
  - Generating Events



- PI Vision Real Time Visualization

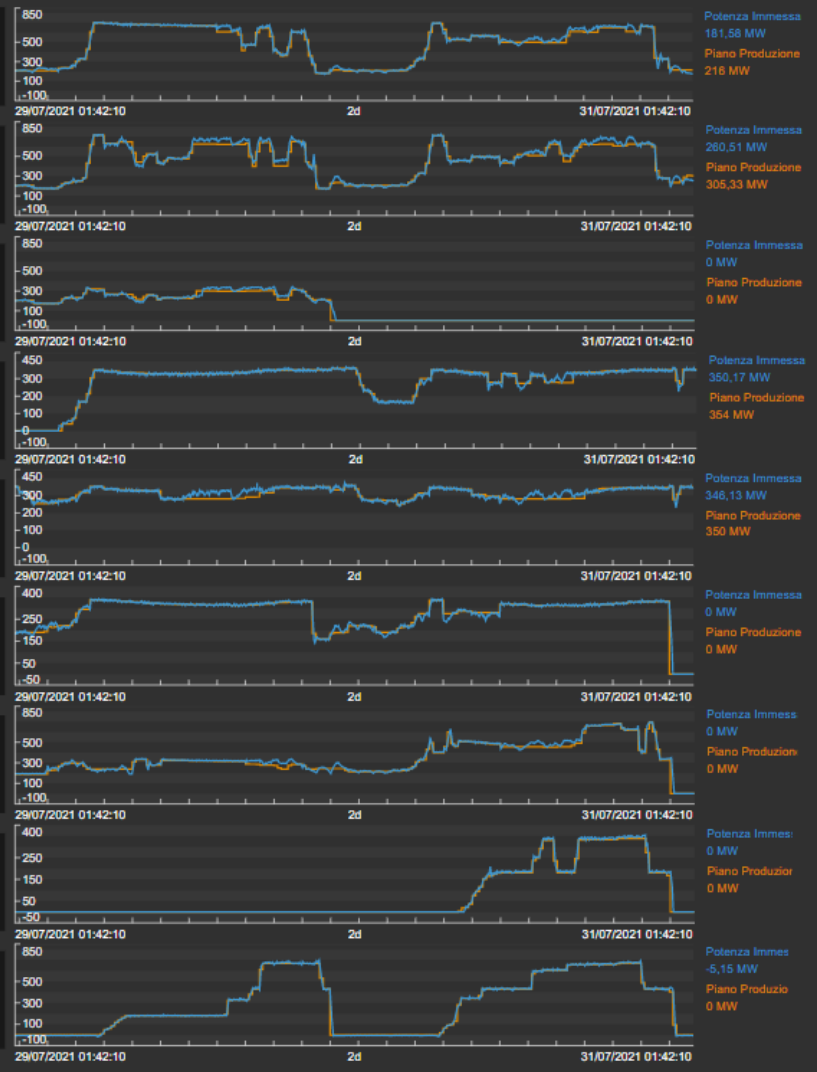
PI VISION: Fleet monitoring

RADAMES RIEPILOGO IMPIANTI

Monitoraggio Rendimento

a2a

Impianto	Stato	CaricoTotaleLordo	RendimentoNetto	NumAllarmiAttivi
CC2	Transitorio	187,72 MW	46,21 %	0
CH1	Transitorio	265,61 MW	51,38 %	0
CH2	Stazionario	87,69 MW	0,00 %	2
GI1	Stazionario	355,57 MW	54,60 %	2
GI2	Stazionario	350,23 MW	54,09 %	2
PM2	Fermo	-0,05 MW	0,00 %	0
PZ4	Fermo	0,80 MW	No Data %	0
SE3	Fermo	-0,80 MW	0,00 %	0
SE4	Transitorio	-0,55 MW	0,00 %	0



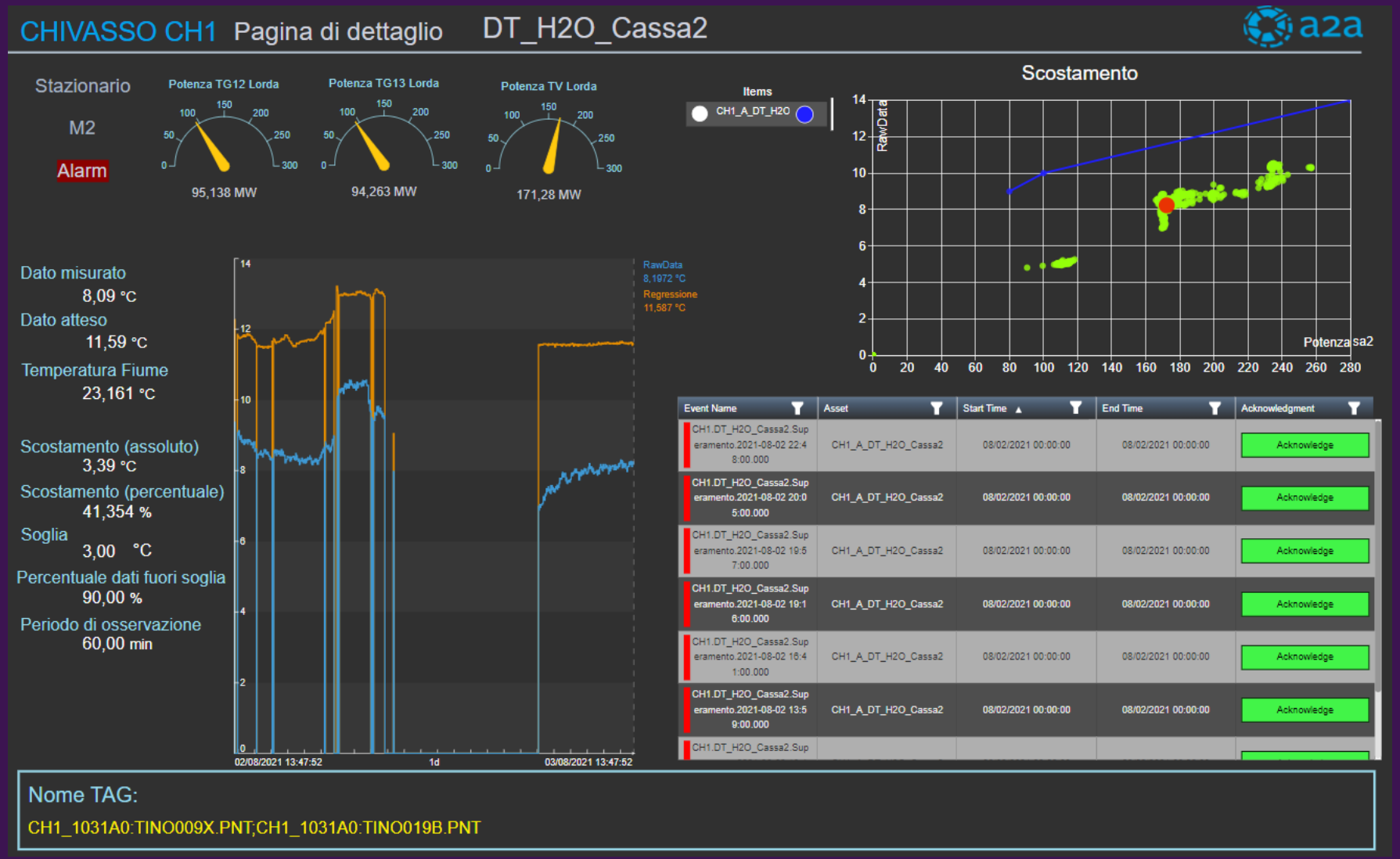
Different GT technology (GE, Alstom, Siemens) one solution: PI AF & PI Vision

ematica AVEVA

PI VISION: Plant monitoring

- 40 key parameter for each plant
- Real time forecast based on historical data
- Multiple alert audio, video and mail
- Starting point for other analyses tools (SEEQ)

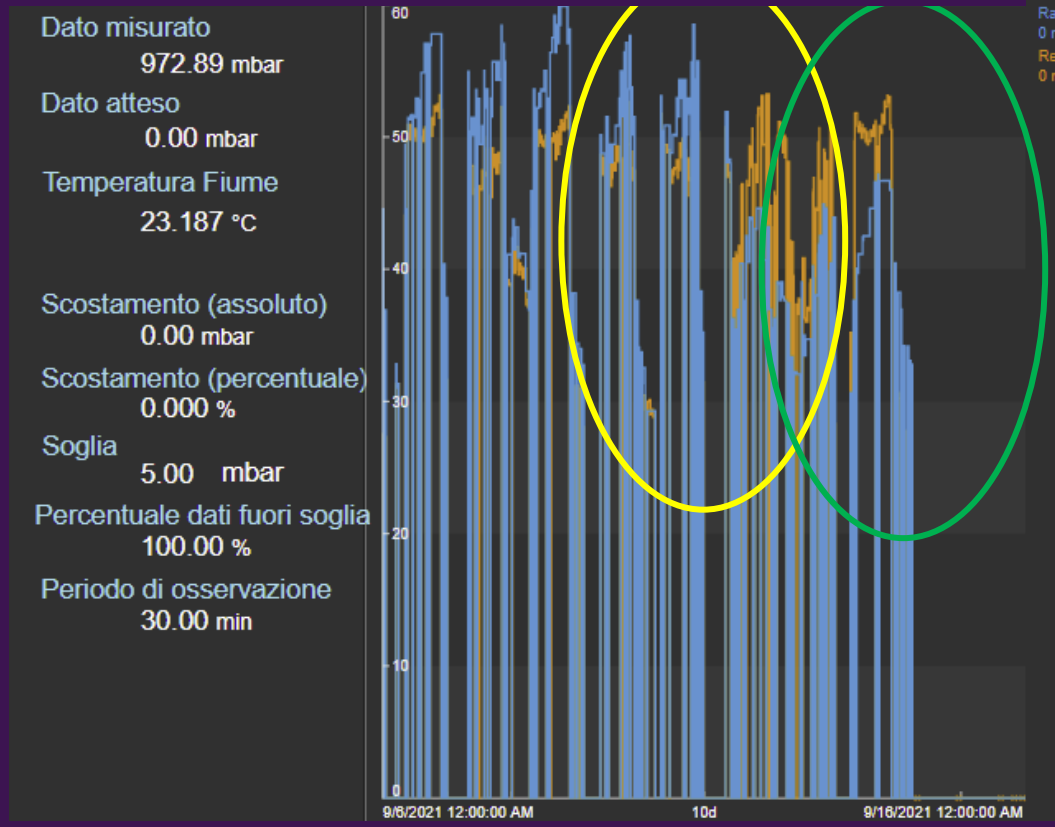
PI VISION: Plant monitoring



- Event Frames Generation
- XY Plot:
  expected curve vs measured
- Expected and measured versus time

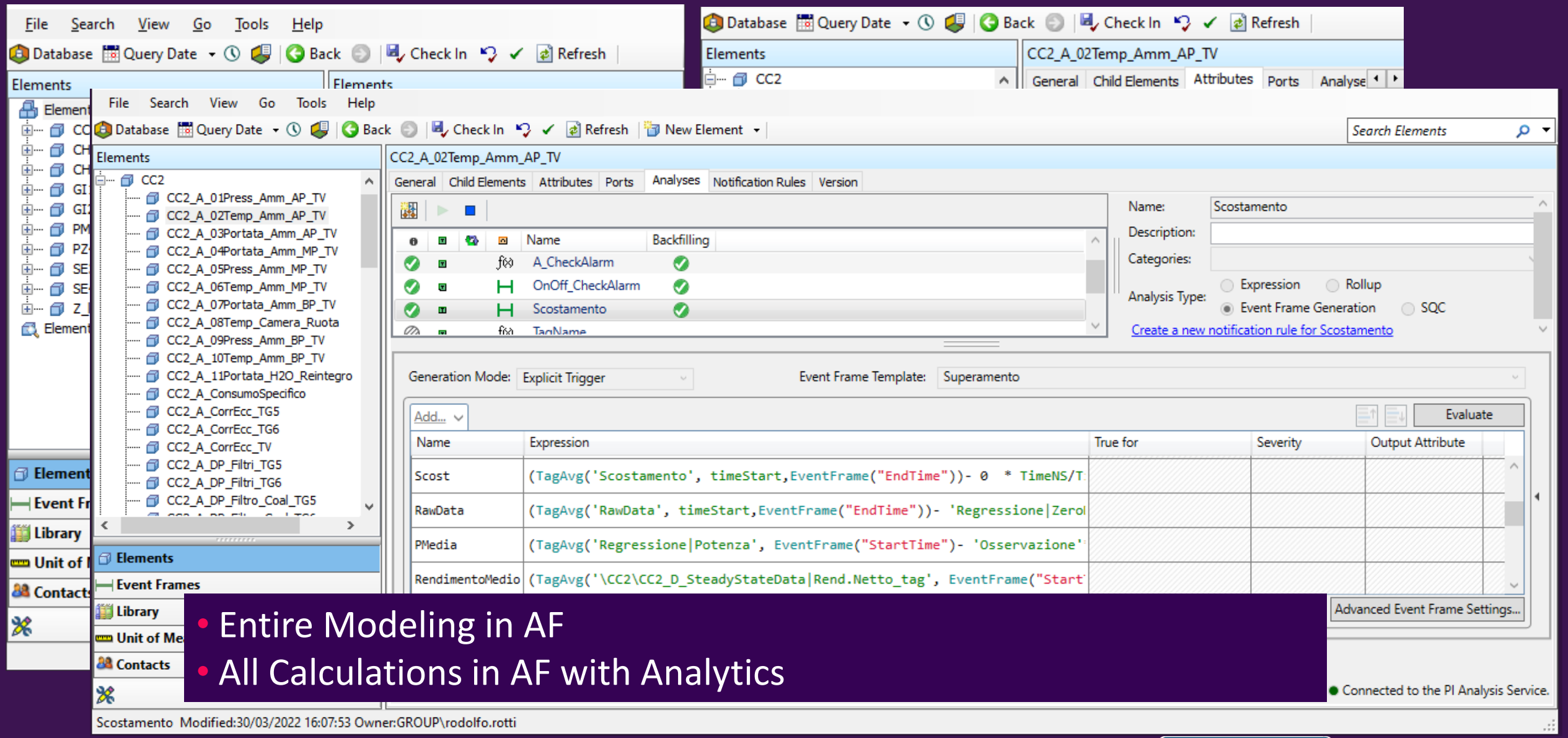
Real Case: Condenser pressure anomaly detection

- The Condenser has been cleaned after anomaly on Pressure of Cooling Water Condenser
- Afeter Cleaning Pressure improved (and efficiency too!)



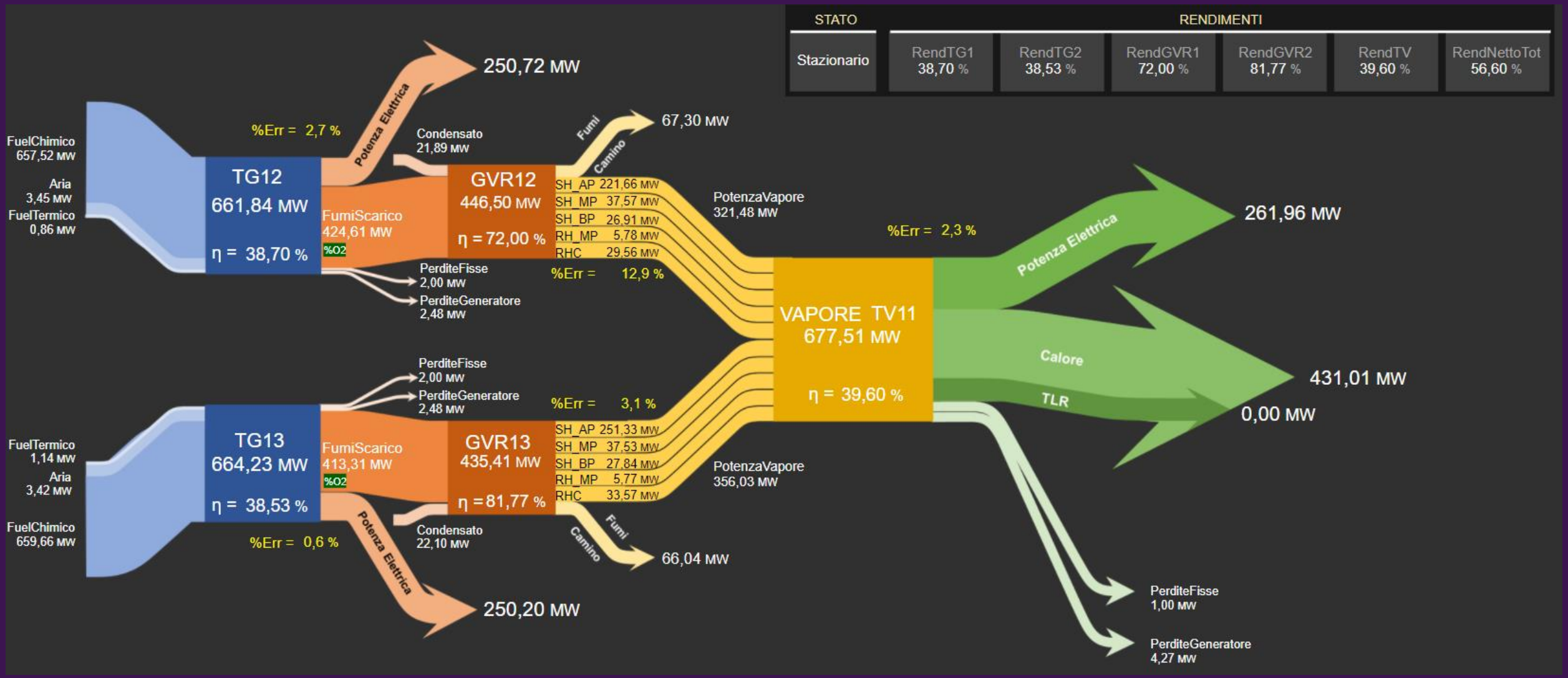
Event Name	Asset	Start Time	End Time	Acknowledgment
CH1.PressioneCondensatore_TV.Superamento.2021-09-06 00:44:00.000	CH1_A_PressioneCondensatore_TV	9/6/2021 12:44:00 AM	9/6/2021 12:53:00 AM	Acknowledge
CH1.PressioneCondensatore_TV.Superamento.2021-09-06 15:54:00.000	CH1_A_PressioneCondensatore_TV	9/6/2021 3:54:00 PM	9/6/2021 4:03:00 PM	Acknowledge
CH1.PressioneCondensatore_TV.Superamento.2021-09-06 17:47:00.000	CH1_A_PressioneCondensatore_TV	9/6/2021 5:47:00 PM	9/6/2021 9:12:00 PM	Acknowledge
CH1.PressioneCondensatore_TV.Superamento.2021-09-06 21:47:00.000	CH1_A_PressioneCondensatore_TV	9/6/2021 9:47:00 PM	9/6/2021 9:52:00 PM	Acknowledge
CH1.PressioneCondensatore_TV.Superamento.2021-09-06 23:39:00.000	CH1_A_PressioneCondensatore_TV	9/6/2021 11:39:00 PM	9/6/2021 11:52:00 PM	Acknowledge
CH1.PressioneCondensatore_TV.Superamento.2021-09-07 14:29:00.000	CH1_A_PressioneCondensatore_TV	9/7/2021 2:29:00 PM	9/7/2021 2:30:00 PM	Acknowledge
CH1.PressioneCondensator	CH1_A_PressioneCondensat			

Asset Framework: Data Model and Analysis



- Entire Modeling in AF
- All Calculations in AF with Analytics

Side results: energy balance



Side results Web reports

- Production / Consumption on different states also transient also aggregated
- List of different states allowing to identify failed start
- List of events of higher residuals

Codice Stato	Stato	Master	En Assorbita Lorda MWh	En Prodotta TG12 Lorda MWh	En Prodotta TG13 Lorda MWh	En Prodotta TV Lorda MWh	Gas TG12 sm3	Gas TG13 sm3	En Prodotta UP Netta MWh
1100	Fermo	Fermo	55.2	32.8	3.8	0.5	14,180.3	10,564.6	19.05
1221	Avvio: Fermo M1	TG13	16.8	2.9	144.4	37.5	1,192.8	74,674.5	166.73
1420	Stato: M1	TG13	49.4	7.6	1086.7	697.7	3,963.6	350,758.5	1736.16
2111	Avvio: Fermo M1	TG12	1.3	0.2	0.0	0.2	96.1	58.0	0.14
2222	Fermata: M2 Fermo	TG13	103.5	1862.8	1857.5	2416.3	567,031.0	569,604.7	6020.75
2421	Avvio: M1M2	TG13	13.1	86.3	235.0	141.3	45,419.2	72,801.7	446.42
2422	Fermata: M2M1	TG13	3.2	6.0	85.9	60.9	3,882.1	23,839.0	149.30
4110	Stato: M1	TG12	93.7	3367.7	1.5	1757.0	917,822.8	4,662.1	5030.97
4211	Avvio: M1M2	TG12	18.7	445.1	92.8	265.7	123,403.8	54,087.7	783.03
4212	Fermata: M2M1	TG12	4.8	135.2	3.0	88.9	37,661.0	2,769.4	222.20
4410	Stato: M2	TG12	207.3	5055.1	5036.2	5479.0	1,363,938.3	1,366,310.0	15358.20
4420	Stato: M2	TG13	177.7	4120.0	4146.3	4500.8	1,129,953.4	1,139,227.0	12600.10
Totale	Tot Ore **117.54**		**744.6**	**15121.8**	**12693.1**	**15445.8**	**4,208,544.5**	**3,669,357.2**	**42533.07**

Goal & Benefit

Economical Goal & Benefit

- Economical quantification of parameters' residuals. Knowing how much loss (or additional gas consumption) a residual generates help taking better decisions. It allows also to compare the project cost with benefits obtained.

… and next step

- Focusing on performance generated a set of question (e.g. how to compare different plants, which is the impact of environment variables). The complexity requires the helps of neural networks to be answered.

Advance monitoring and analytics for combined cycle gas plants

Challenge

- Providing state-of-the-art real-time monitoring and analytics capabilities for the entire fleet.
- Chose a common set of parameters to compare the plants
- More than 5GW of flexible power

Solution

Deployed the latest AVEVA PI System technology:

- PI AF to organize and analyze data
- PI Vision with custom widget to show data clearly

Benefits

- Increased operational efficiency
- Use data to prevent faults
- Significantly accelerated ‘Time to Value’ with AF analytics engine

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