

OCTOBER 25, 2023

Energy Development Corporation: Natural Catastrophe Project

CSR , Sustainability & AVEVA™ PI System™ Analytics

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AVEVA

Contact Persons:

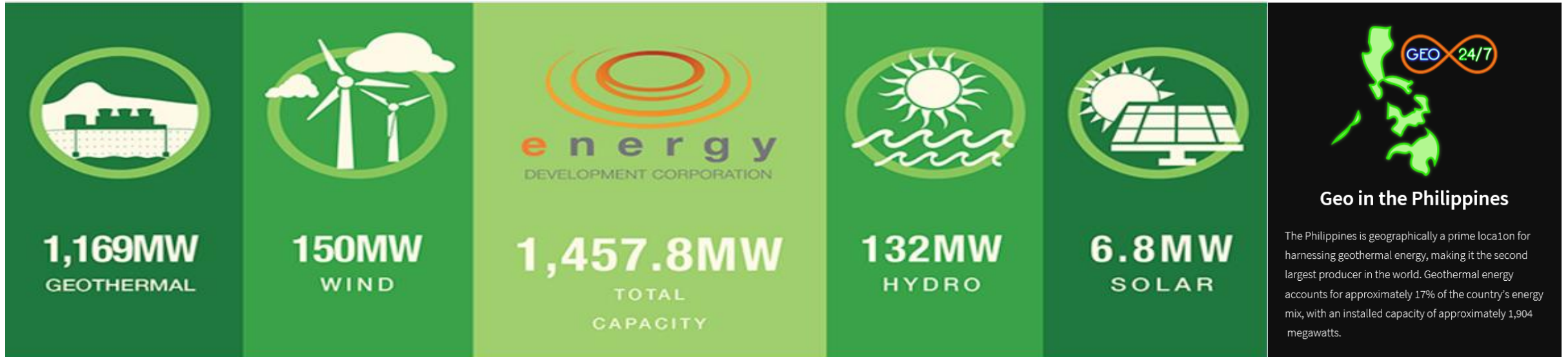


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Energy Development Corporation (EDC)



- 40 years of Geothermal Operations in the Philippines
- 4 Sites nationwide with a total of 25 Operating Turbine Units
- EDC is part of the First Gen Corporation (“First Gen”) Group, which has the largest portfolio of power plants using clean and renewable technology in the Philippines with capacity of 2,763 MW – about 10% of the total Philippine Capacity 13,272 MW.

Energy Development Corporation (EDC)

EDC'S WAY TO PLAY

1 Sustainable Generation – expansive understanding and management of geothermal resource to develop and optimize resilient assets

1,189.34
MW

Geothermal Power Plants

150
MW

Wind Plant

11.99
MW

Solar Plants

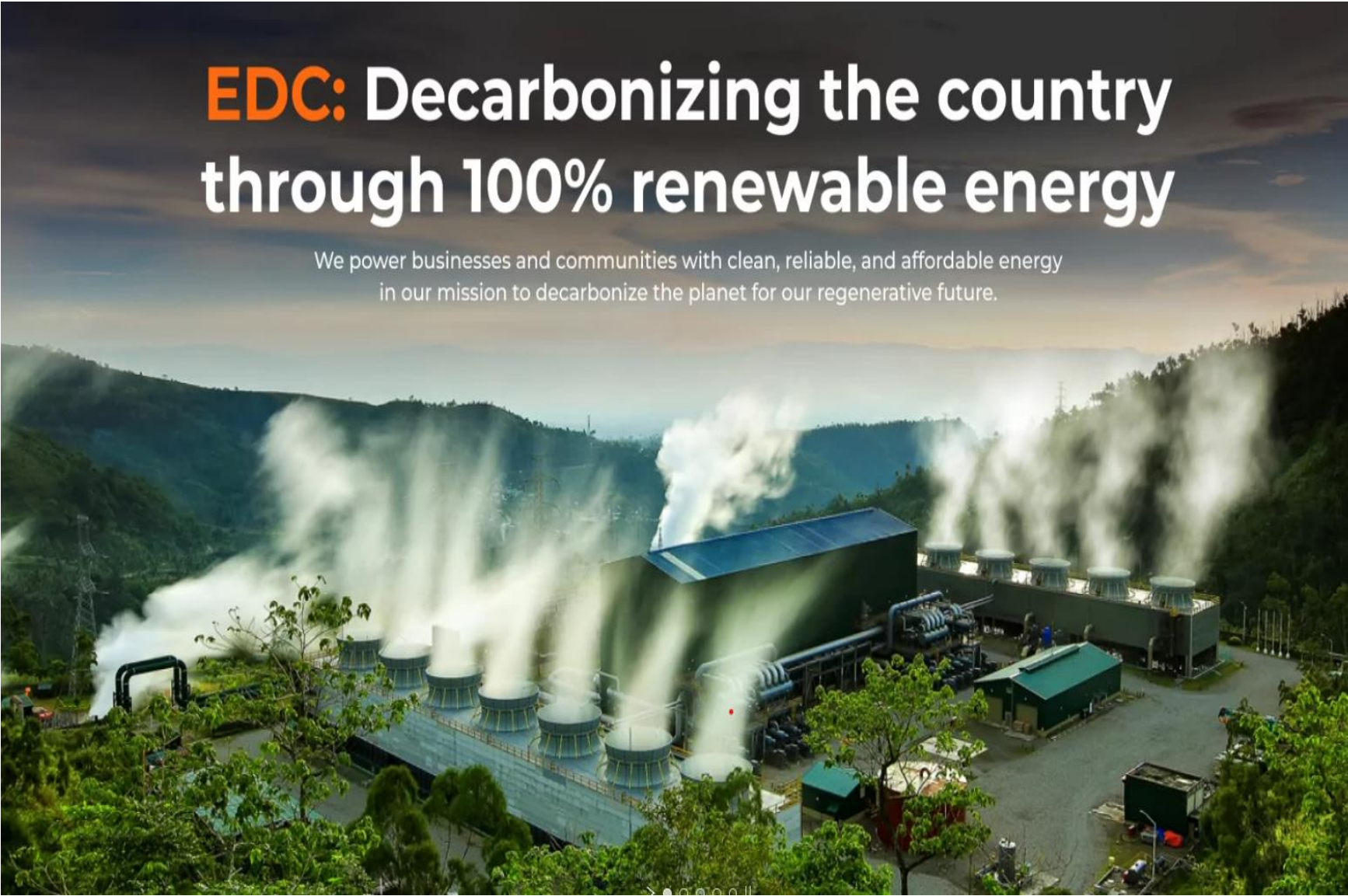
132.80
MW

Hydro Plants

Our 100% Renewable
Energy Portfolio

1,484.13
MW Overall total





EDC: Decarbonizing the country through 100% renewable energy

We power businesses and communities with clean, reliable, and affordable energy in our mission to decarbonize the planet for our regenerative future.

Our **RE**generative Power.

EDC strives to create a world that can thrive and flourish in the years to come. Beyond generating clean energy, we are working to bring everyone together, from our employees, customers, and partners to our communities and the environment, to move toward this goal.

This is what #OurREgenerativePower is all about.

- 40 years of Geothermal Operations in the Philippines
- 4 Sites nationwide with a total of 25 Operating Turbine Units
- EDC is part of the First Gen Corporation (“First Gen”) Group, which has the largest portfolio of power plants using clean and renewable technology in the Philippines with capacity of 2,763 MW – about 10% of the total Philippine Capacity 13,272 MW.

Digital Transformation Vision and Strategy

← **IMPROVE O&M BY DIGITIZING THE VALUE CHAIN** →

UPSTREAM		DOWNSTREAM	
Drilling	Reservoir Management	Steam Field	Power Plant

5C STRATEGY

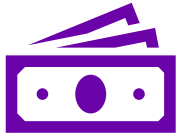
Digital Drilling Digital Reservoir Digital Steam Field Digital Power Plant Digital Geo Sciences Digital Solar Digital Wind	CONNECT COLLECT COMPUTE COMMUNICATE CORRELATE	Real-time Data Situational Awareness Operational Insight Data Driven Decisions Automated Reports Quick Access to Info Analytics
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EDC Digital Transformation Roadmap

	2018	2019	2020	2021+			
	VISIBILITY	ROLE-BASED DASHBOARDS	OPERATIONAL INSIGHT	KPI MANAGEMENT	TECHNICAL MONITORING	CONDITION BASED MAINTENANCE	PREDICTIVE MAINTENANCE
B G B U	Pressure and Flow Sensors	Well Head Availability Alert Notifications via Email and SMS	Well Head Variation Reinjection Loading Well Output		Early Warning System Reservoir Decline		
L G B U	PI System + Integra Smart Steam Field Smart Power Plant	Alert Notifications via Email and SMS	Steam Loss / Inefficiency / Revival		Priority 1 Wells Equipment Monitoring - Vibration - Rotating Equipment - Turbine and Generator		
N I G B U	Thermal Mapping PI Server Implementation	Alert Notifications via Email and SMS		Critical Asset Risk Score Asset Management	Priority 1 Wells		
M A G B U	Pressure and Flow Sensors PI Server Implementation	Alert Notifications via Email and SMS			MHPS Collaboration Priority 1 Wells		
C E N T R A L	PI Server Implementation	Reliability Performance	Reliability Trending and Analysis Performance Trending and Analysis	Asset Health Index Asset Management			

INCREASING COMPLEXITY

Business impact



Cost Effective Solution across the Fleet

- *Development by Local Service Provider – Calibr8*



People Empowerment

Corporate and Community Services

Sustainability – proving that People, Process, Technology can produce results



Correlation to all data that is being collected



Better Planning for All Assets & Facilities

Insurance Premium Savings

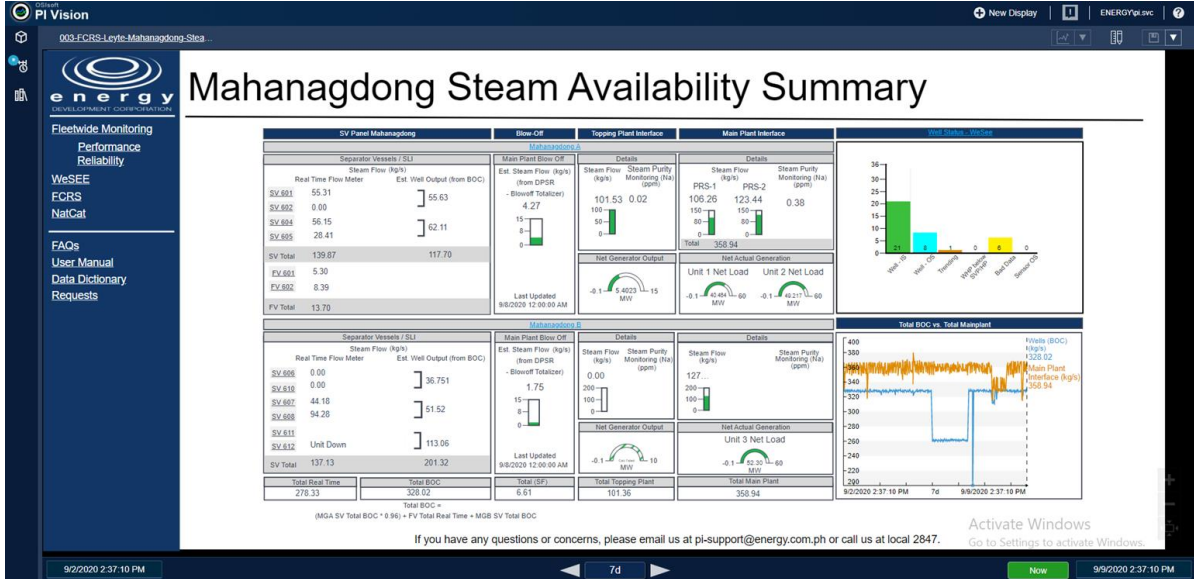
Local Government



Future Proof Solution that will be rolled out across the fleet

- *NO Excuse for Data Collection*
- *PI UFL via IoT Gateway*
- *Manual Data or Batch Inputs*
- *Internal expertise can be a shared resource across*

Well Monitoring: Fluid Collection Reinjection System (FCRS)



Challenges

- There are no Steam Flow, Mass Flow and Water Flow, calculation for each Well. Only Pressure sensors are available.



Solution

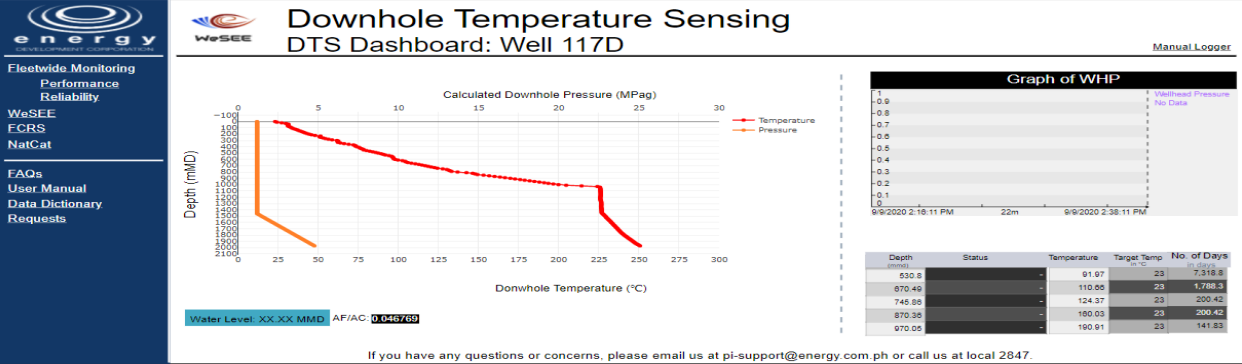
- Display all well parameters that are available
- Use Bore Output Curve (BOC) Coefficients to calculate the estimated Steam Flow, Mass Flow and Water Flow of each well
- Use AF Function like Steam_TPH to calculate Flows



Results

- Real time Well Data
- Able to compare Sensor Data with Computed Well BOC Data
- Estimated MW Output per well

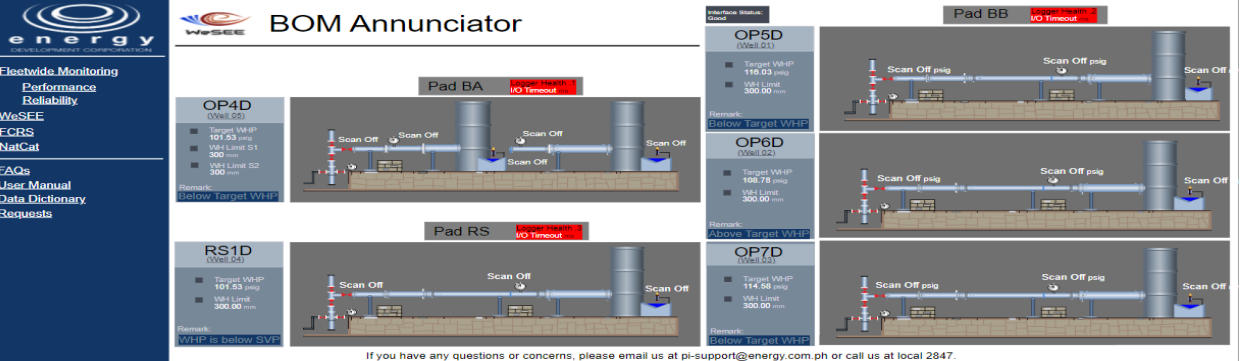
Steamfield Monitoring: WeSEE



If you have any questions or concerns, please email us at pi-support@energy.com.ph or call us at local 2847.

Challenges

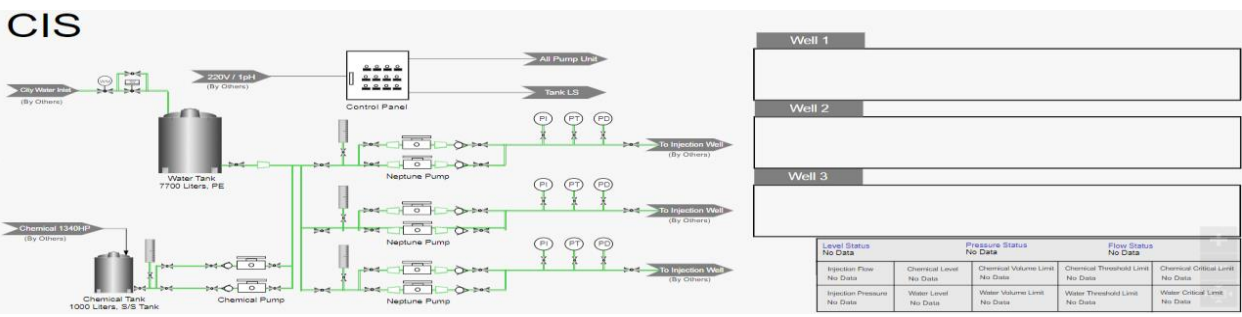
- Temporal changes of the temperature profile of a geothermal well
- Calciting wells
- Inadequate and not user-friendly access to values of well parameters



If you have any questions or concerns, please email us at pi-support@energy.com.ph or call us at local 2847.

Solution

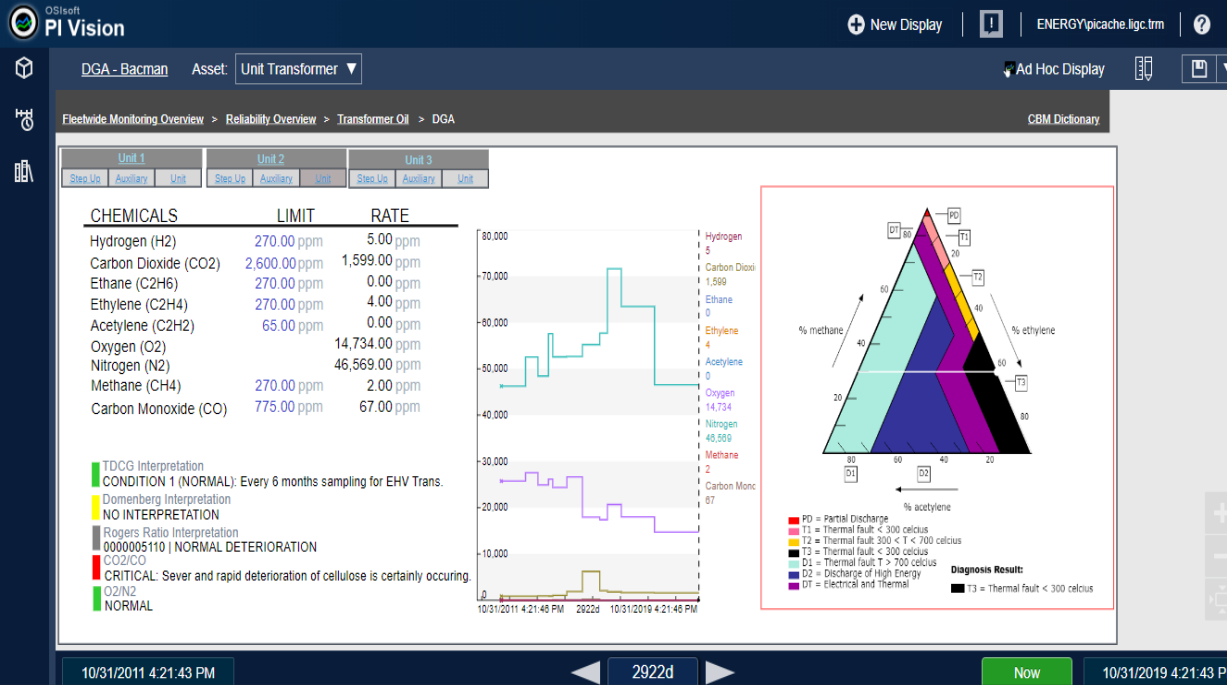
- Display all well parameters that are available
- Study parameters, how are they affecting each other
- Create well status analysis or remarks for the alarms (e.g WHP is below SV, Below/Above Target WHP)



Results

- Real-time data visualizations
- Do interventions when they observed a certain alarm (maximize downtime)
- Water level is determined using Pressure profile

Dissolved Gas Analysis



Challenge

- Data are being collected manually
- Analyses and Interpretations are conducted manually
- Difficulty to monitor asset health real-time



Solution

- Data concentrator to pull data together from multiple sensors.
- Real-time data update for asset health monitoring
- Integrate analysis and dashboards for faster decision making and assessment.



Results

- Quickly identify frequent triggering parameters and its impact to performance
- Being able to identify asset aging for reliability monitoring

SEEQ results in AVEVA™ PI Vision™



Minimum increase of 1 MW hourly

Is it enough?

Beyond sustainability: Here's how EDC is making a difference



We are the largest vertically-integrated company in the world

EDC has put the Philippines on the map as the third-largest geothermal energy producer and the world's largest vertically-integrated geothermal company.



We are the only 100% renewable energy company in the Philippines

EDC is the largest and only 100% renewable energy company in the Philippines, with an installed capacity of 1,484.13 MW. For over four decades, we have continued to deliver clean, renewable, and affordable energy to Filipino businesses and communities.



Forging collaborative pathways to a decarbonized and regenerative future

Beyond providing 100% renewable energy, EDC elevates its customers, partners, the environment, communities, and employees with the regenerative touch by forging collaborative partnerships.



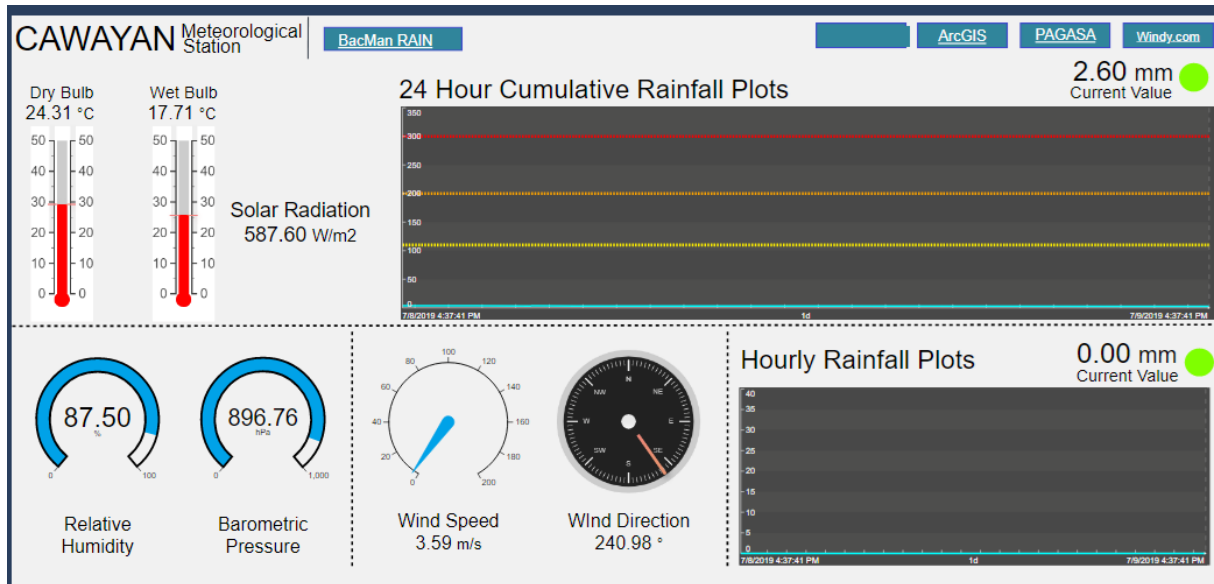
USE CASE

Resiliency and Sustainability (Natural Catastrophe)

Is an application developed to have visibility on occurrence of Earthquake, Typhoon and Landslide around the area powerplant and steamfield

AVEVA

Resiliency (Natural Catastrophe): Meteorological Station Data



Challenge

- Power plants are commonly located on remote areas. For safety precautions, company wants visibility and awareness if there are typhoons that might affect the location and its operations.



Solution

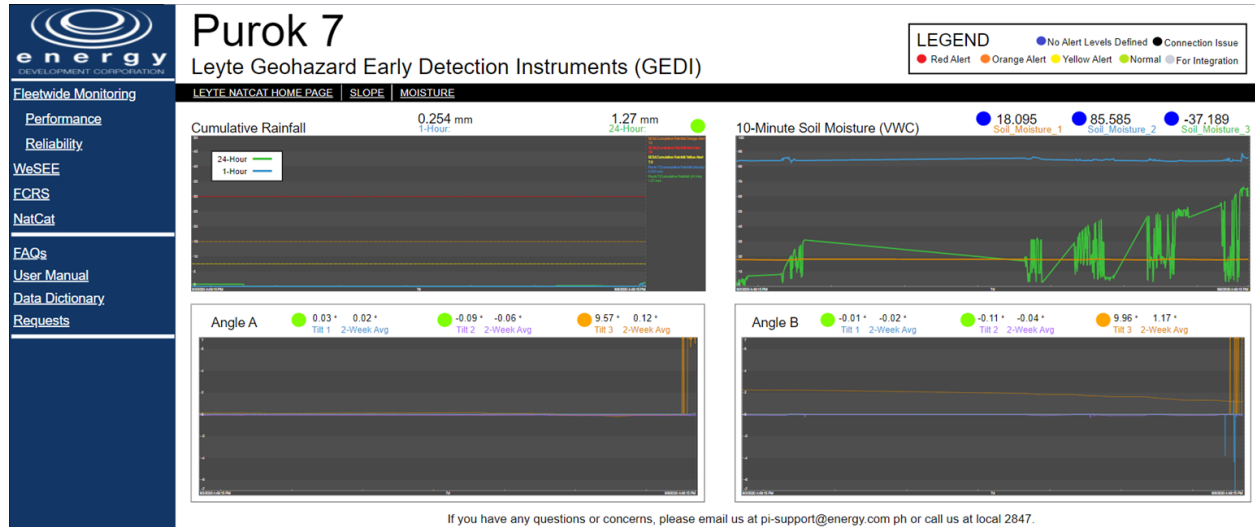
- Integrate visual representation for weather and its forecast
- Analysis of contributing factors for weather assessment.
- Notify if a parameter breached its limit.



Results

- Situational Awareness
- Quickly Notify respective departments

Resiliency (Natural Catastrophe): Slope Data Monitoring



Challenge

- Power plants are commonly located on remote mountainous areas. For safety precautions, various contributing factors to landslides are monitored.



Solution

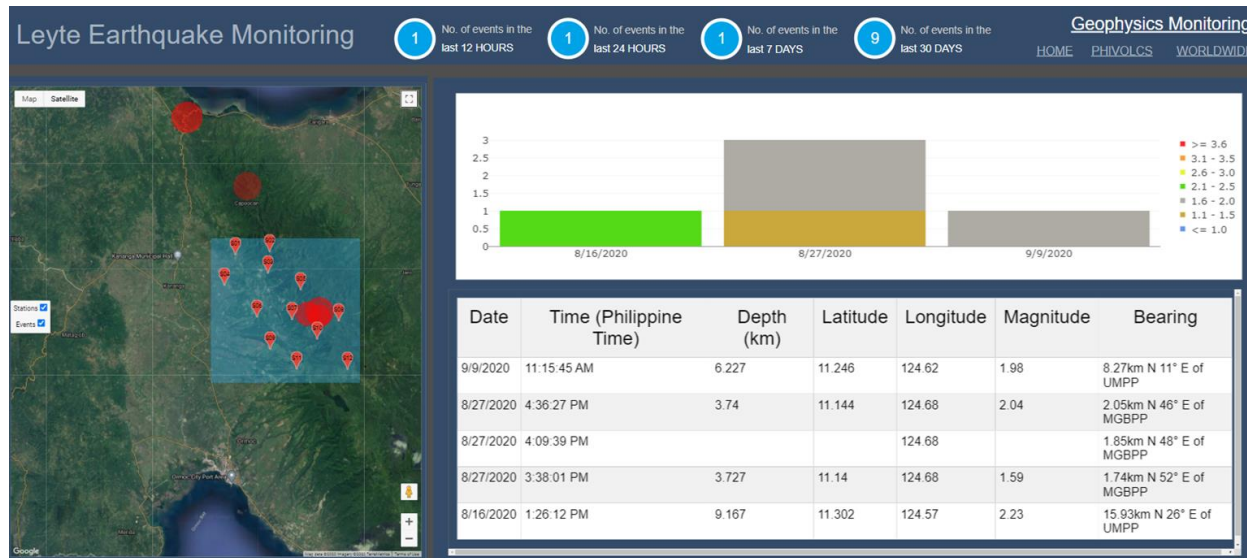
- Integrate visual representation for rain, soil moisture content, and slope tilt values
- Notify if a parameter breached its limit.



Results

- Situational Awareness
- Quickly Notify respective departments

Resiliency (Natural Catastrophe): Seismic Data Monitoring



Challenge

- Seismic events in the power plant location are vital to the operations whether the event is small or strong. These events are recorded and are mapped for visual analysis.



Solution

- Record parameters about the seismic events
- Map seismic events for visual analysis
- Tallying seismic event frequency for a given time
- Notify when a seismic event occurs



Results

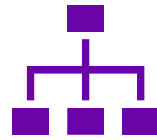
- Situational and Spatial Awareness
- Quickly Notify respective departments

AVEVA™ PI System™ Technologies



Connect Data Sources

- Without integration to the DCS
- Via IoT Gateway and AVEVA PI System Interfaces
 - PI UFL
 - PI HTML
 - PI MQTT
 - PI Modbus
- Calibr8 Offline Loggers



Integrate into the AVEVA™ PI Server™ Asset Framework

- All Algorithms was imputed into PI AF

Category: Transformer Oil- Rogers Ratio-Auxiliary	Category: Transformer Oil- DGA-Auxiliary
C2H2/C2H4	Acetylene
C2H2/CH4	Carbon Dioxide
C2H4/C2H6	Carbon Monoxide
C2H6/C2H2	Ethane
CH4/H2	Ethylene
CO2/CO	Hydrogen
	Methane
Category: DGA Diagnostics	Nitrogen
CO/CO2 Interpretation	Oxygen
Domenberg	TDCG generation rate
Domenberg Interpretation	Total Dissolved Comb Gases
O2/N2 Interpretation	Total Dissolved Gases
O2/N2 Ratio	Transformer Condition
Rogers Ratio Code	
Rogers Ratio Interpretation	
TDGC	Category: Transformer Oil Condition-Auxiliary
TDGC Interpretation	Dielectric breakdown
	Particle Count 3 um
	Particle Count 15 um
	Particle Count 3-150 um
	Total Acid Number
	Water Content



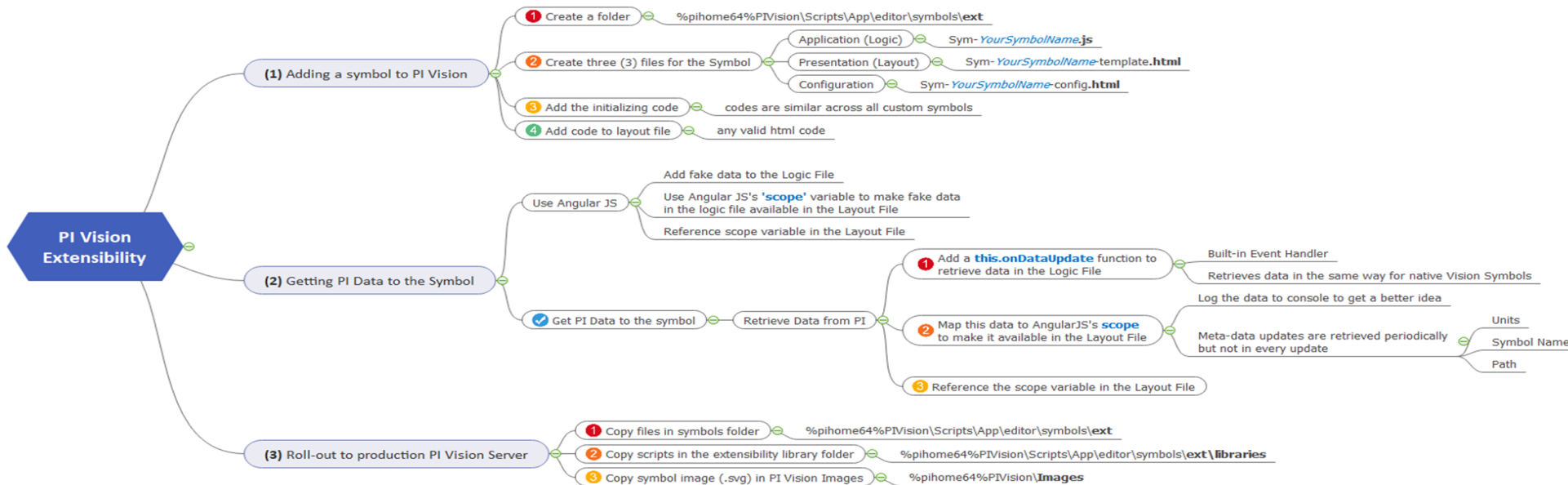
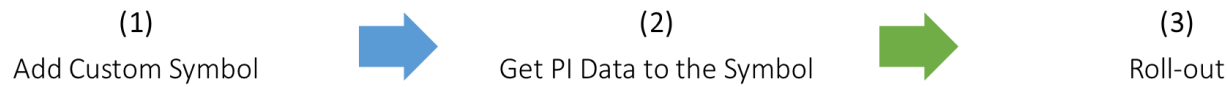
Develop Custom Symbols in AVEVA™ PI Vision™

- Developed by Calibr8 Systems – Services Provider
 - Integration to Maps
 - Special Symbols



AVEVA™ PI Vision™ extensibility – building custom symbols

The AVEVA PI Vision Extensibility Framework is a powerful model that enables you to write custom symbols and tool panes for use in PI Vision displays, including unique or industry-specific ways of visualizing PI data.



OSIsoft **PI Vision** + New Display | 3 | LGBU-PV-SVR-01\agluba.g.cal | ?

Leyte NatCat Accelerograph T&D Stat... Asset: T&D Ad Hoc Display

Leyte Peak Ground Acceleration Monitoring NatCat Home Page

Station ID: 3982
Location: T&D

WARNING LOG

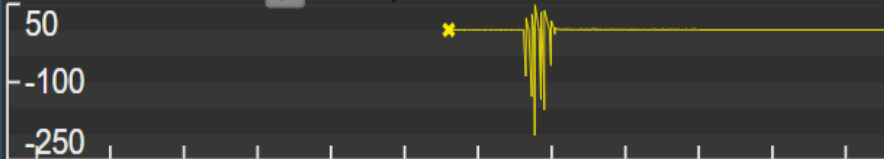
Last Recorded Event
9/13/2019 12:26:46 PM

pga[mm/s ²]		
a	b	c
2,013.82	105.71	75.10

Intensity **7**

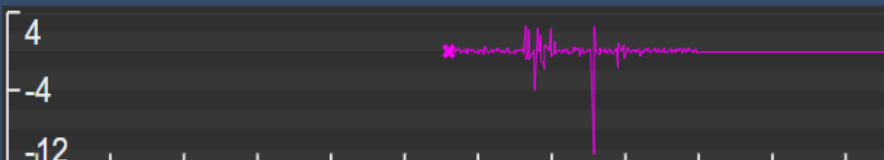
Last Recorded Event Earthquake Records

Sensor A Acceleration
0.734



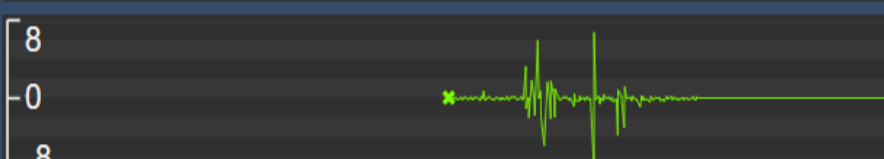
9/13/2019 12:24:46 PM 2m 9/13/2019 12:26:46 PM

Sensor B Acceleration
-0.091



9/13/2019 12:24:46 PM 2m 9/13/2019 12:26:46 PM

Sensor C Acceleration
0.027

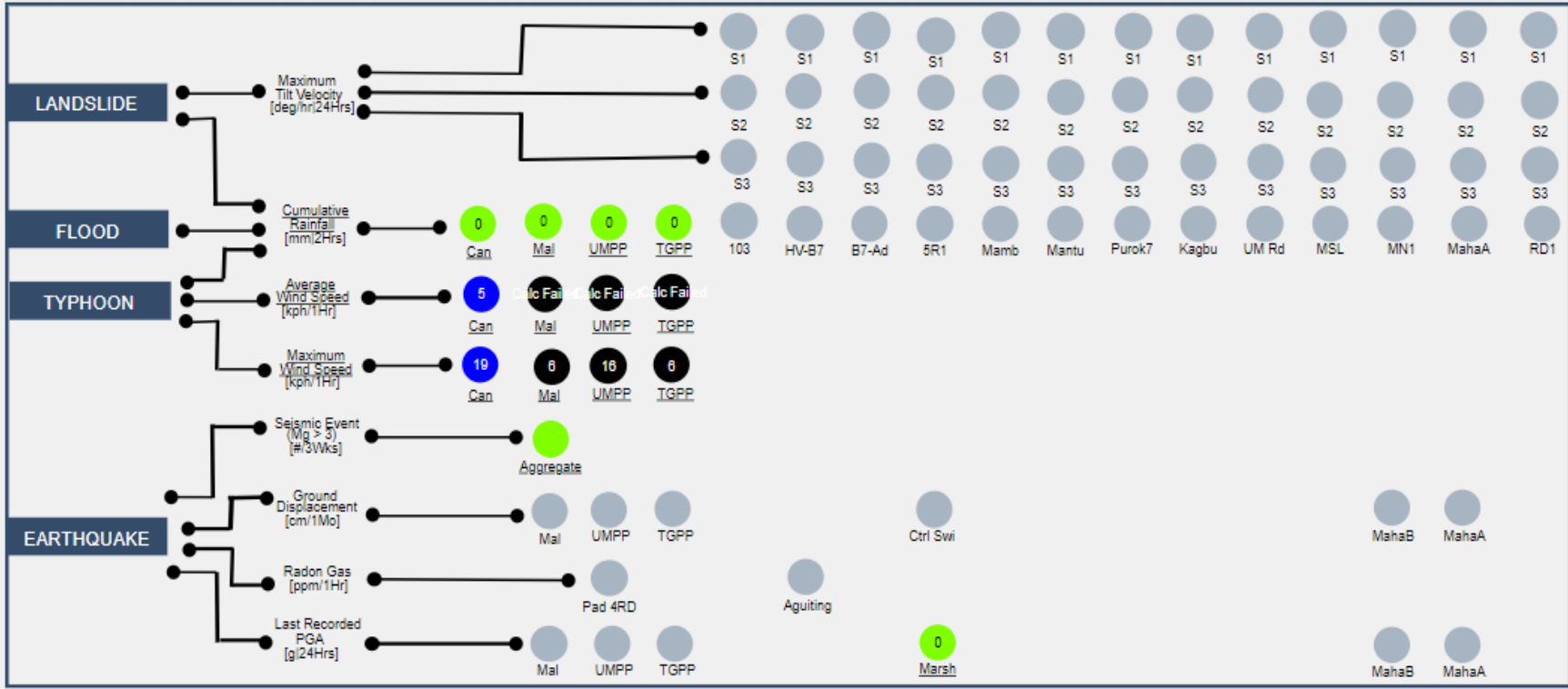


9/13/2019 12:24:46 PM 2m 9/13/2019 12:26:46 PM

Note: If trend is not displaying after 5 seconds, click *Now* to display latest trends

9/13/2019 12:24:46 PM
◀ 2m ▶
Now
9/13/2019 12:26:46 PM

NATURAL HAZARD DASHBOARD



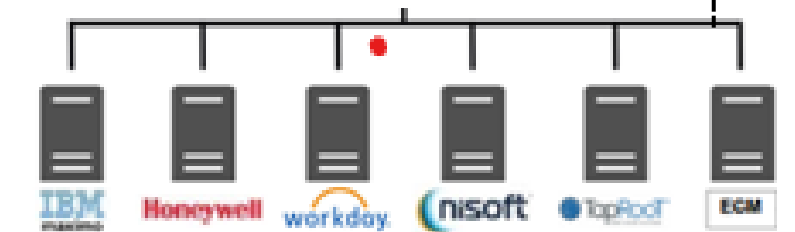
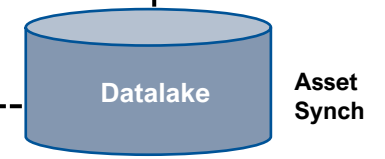
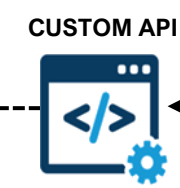
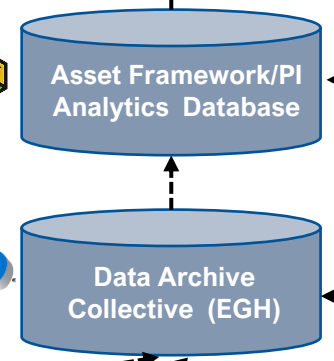
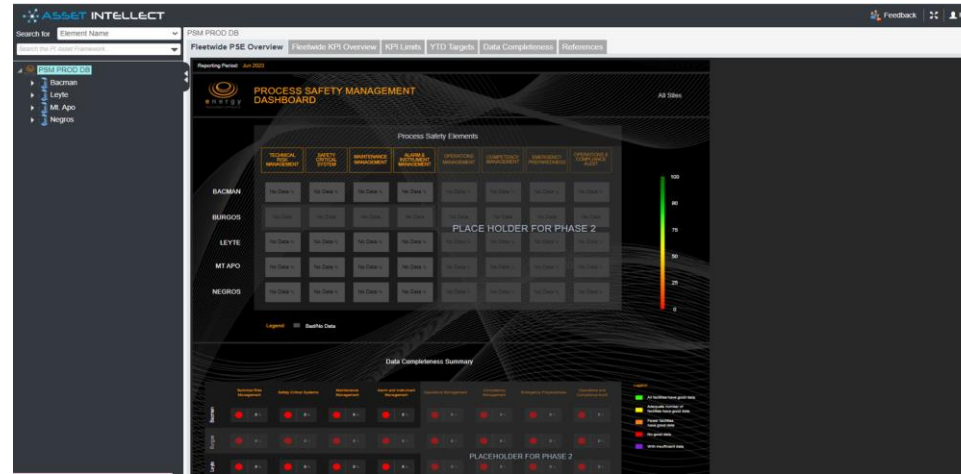
10/4/2019 4:53:32 AM

8h

Now

10/4/2019 12:53:32 PM

What's Next – More Data, More Visibility



H2scan
ADVANCED HYDROGEN SENSING

SUBSTATION
Real-time Data

SUBSTATION / STEAM PIPELINE
Real Time Data Values from Thermal Cameras

Manual Loggers
And Other Data

Transactional Data Acquisition
AVEVA

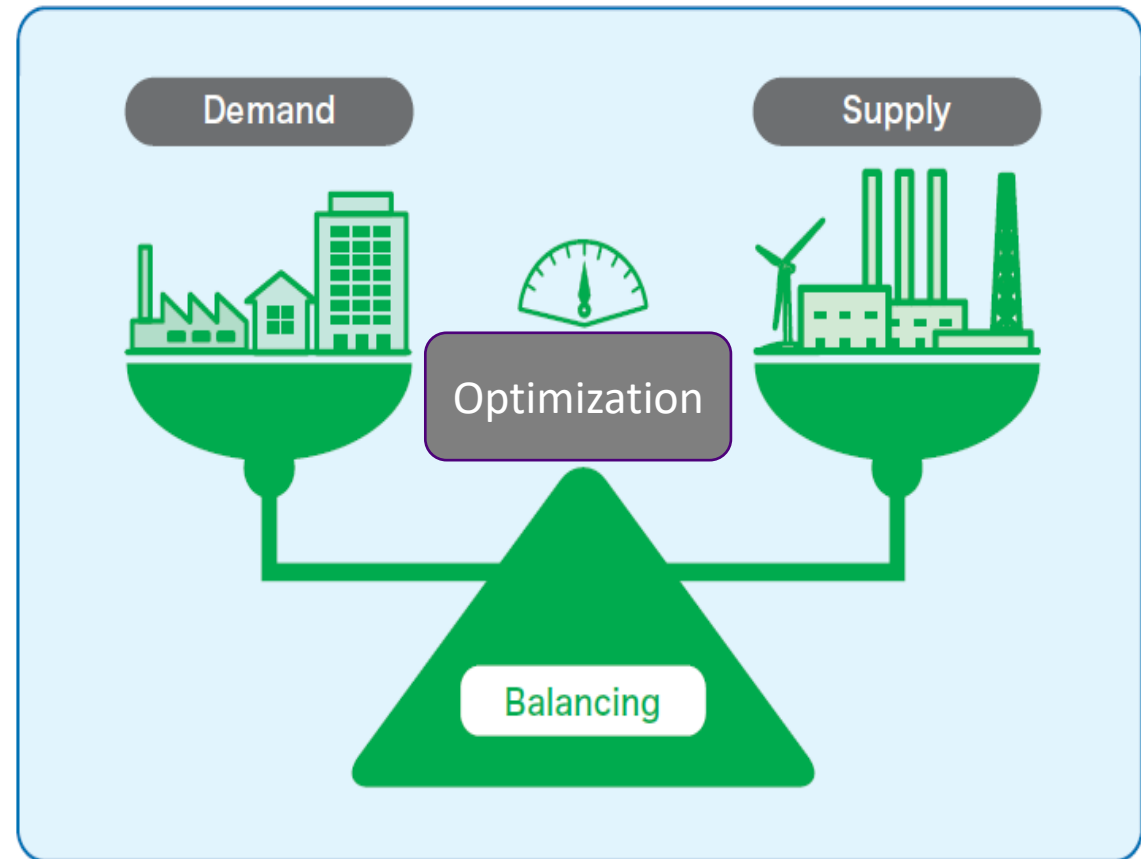
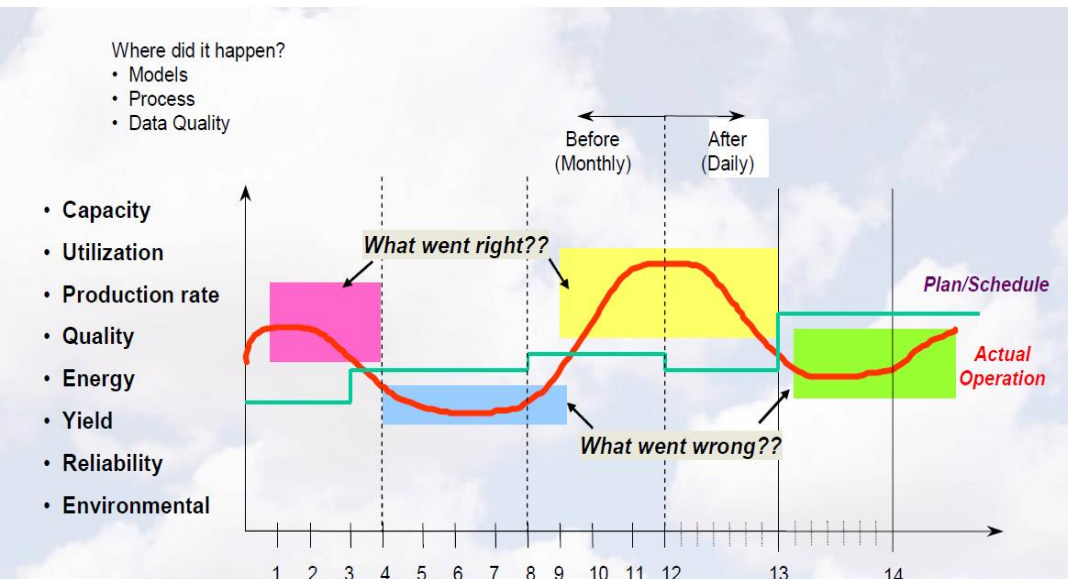
Data = Optimization = Sustainability



What do you do when your maintenance and utility expenses go over the roof?

You optimize.

#EveryWattCounts



The power is in your hands

Energy Development Corporation improves resiliency, sustainability and safety with AVEVA

Challenge

- Power plants are commonly located in remote areas. For safety precautions, Energy Development Corporation (EDC) wanted visibility and awareness of natural catastrophes such as typhoons, landslides, and seismic events.
- EDC wanted to improve operations and maintenance (O&M) by digitizing the entire value chain including drilling, reservoir management, steam fields, and power plants.

Solution

- Worked with local system integrator Calibr8 to implement AVEVA™ PI System™ to enable better data management and the realization of EDC's digital transformation roadmap from improved data visibility, to operational insight, and eventually predictive maintenance.

Results

- **Improved visibility to remote assets**
- **Enhanced collaboration and people empowerment**
- **Increased trust in data validity, with futureproofing for further developments**
- **Better planning for all assets and facilities**
- **Reduced O&M costs, including reduction in insurance premiums**



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!