OPERATIONS & MAINTENANCE MANUAL

Rev 1.0

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Introduction

The Envision Energy Management System is a comprehensive, real-time monitoring and reporting platform developed to help industrial facilities optimize energy usage, monitor system performance, and identify cost-saving opportunities. Built on a proven, secure, web-based data visualization platform, this application delivers responsive, mobile-friendly dashboards and intuitive tools for monitoring and analyzing real-time data.

Envision serves as a centralized interface that enables engineering teams, operators, and sustainability personnel to make informed, data-driven decisions regarding energy consumption, equipment health, and process efficiency.

Purpose of the Application

The Envision system was developed with the primary objective of optimizing energy usage and operational performance across key plant utilities including chillers, boilers, air handling units (AHUs), compressed air systems, refrigeration, and more. By providing actionable insights through real-time dashboards, historical trends, and energy baselines, the system empowers users to:

- Visualize utility performance
- Track energy intensity metrics normalized to production (APU)
- Compare actual vs. optimal energy demand
- Evaluate equipment efficiency and load distribution
- Identify opportunities for improvement
- Understand utility costs over time

Key Features

- Interactive Dashboards: Modular, scalable screens for each plant utility and system component.
- Data Normalization: Metrics presented per APU (Adjusted Production Unit) for accurate benchmarking.
- Cost Tracking: Integration of real-time or manually configured utility rates for cost metrics.
- All Trend Viewer: A custom module discussed in Section 11 that allows users to select and view trends for any available data tag.
- User Management: Admins and supervisors can add/edit/remove users, manage roles, and update user permissions.
- Automated & Manual Data Modes: Flexibility for rate inputs, performance targets, and control setpoints.
- Trend Analysis: Custom tag-based trend viewer for troubleshooting and system optimization.

- Opportunity Management: Dedicated dashboard to log, analyze, and track energy-saving projects.
- Alarm Notifications: Built-in user defined alarm notifications delivered via email, SMS, or voice call with escalation capabilities.
- Report Generation: Automatically compiled summaries with charts, benchmarks, scorecards, and event lists such as alarms for comprehensive system insight.

This Operations & Maintenance Manual serves as a guide for navigating each module of the system, interpreting the displayed data, and understanding how to leverage its features to drive operational excellence and sustainability. While Envision modules are consistent project to project, not all are included for all projects and systems monitored will vary. Therefore, screenshots and sections of this Operations & Maintenance Manual will vary from specific project deployments and this document shall serve only as a guide. For project specific questions, contact Veregy account manager or technical support if provided under the terms of the project agreement.

https://support.veregy.com/

1. Home Screen

Purpose:

This screen acts as the primary navigation and overview interface for monitoring multiple facilities within the Envision platform. It provides users with an interactive map and intuitive controls to drill down into detailed operational data for energy optimization efforts.

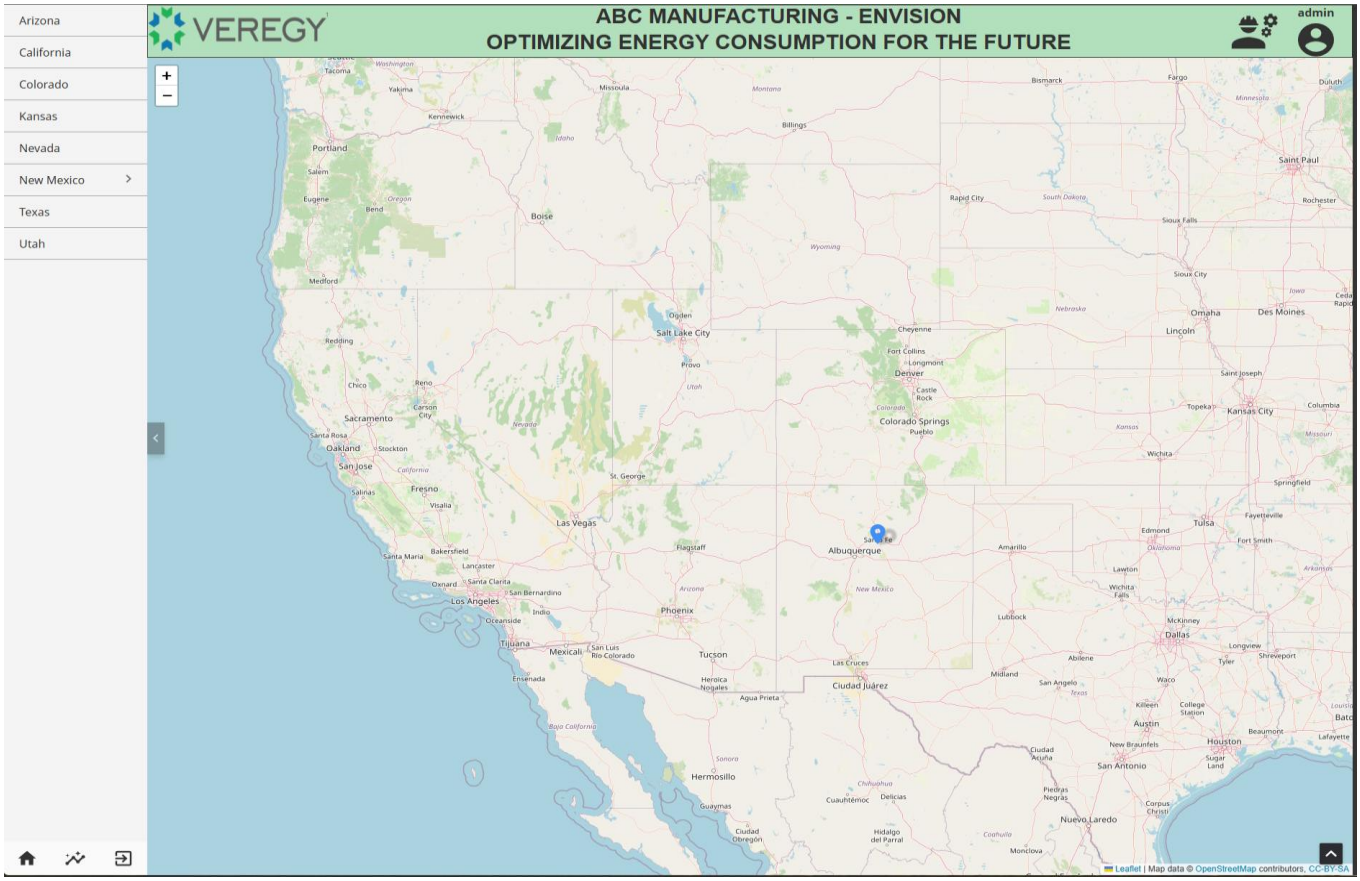

FIGURE 1: HOME SCREEN

System Functionality:

1.1 Map Interface

- Interactive Markers: Facilities are represented by markers that users can click to view additional facility-specific dashboards, performance metrics, or historical trends.
- Zoom Controls: Users can zoom in/out using + and – buttons or scroll functions.

1.2 Navigation Sidebar (State-Based Filter)

- Expanded and Collapsible Panel: The left-hand sidebar lists the states where facilities are located.
- Filter Function: Clicking a state name dynamically shows available plant city locations to allow navigation to site specific information.
- Bottom Navigation Buttons

- Home (Leftmost Button): Returns the user to the default map view.
- All Trends (Middle Button): Open system-wide trend dashboards for data analysis.
- Sign Out (Rightmost Button): Logs the user out of the application securely.

1.3 Top Banner / Header:

- Client Name and Objective Statement
- User Profile Access**:**
  - Logged-in user ("admin") is displayed on the right. Selecting this button allows the user to log out.
  - User administration dashboard is accessed via the button to the left of username for users with administrative permissions.

User Interaction Flow:

Step	Action	Result
1	Login to the system	Loads the default overview map screen
2	Select a state (e.g., Texas)	Map zooms into the selected region, highlighting relevant facilities
3	Click a facility marker	Opens detailed dashboard for that facility
4	Zoom/pan map	Navigate across the United States to explore additional sites
5	Access user menu (top right)	Modify system preferences or log out

TABLE 1: HOME SCREEN USER INTERACTION FLOW

2. Overall Plant Dashboard

Purpose:

This screen serves as a centralized dashboard for tracking the overall energy performance and utility consumption of the plant. It provides key indicators such as energy usage, gas and water consumption, and comparison of facility performance against comparable metrics, enabling stakeholders to make informed decisions about operational efficiency and sustainability initiatives.

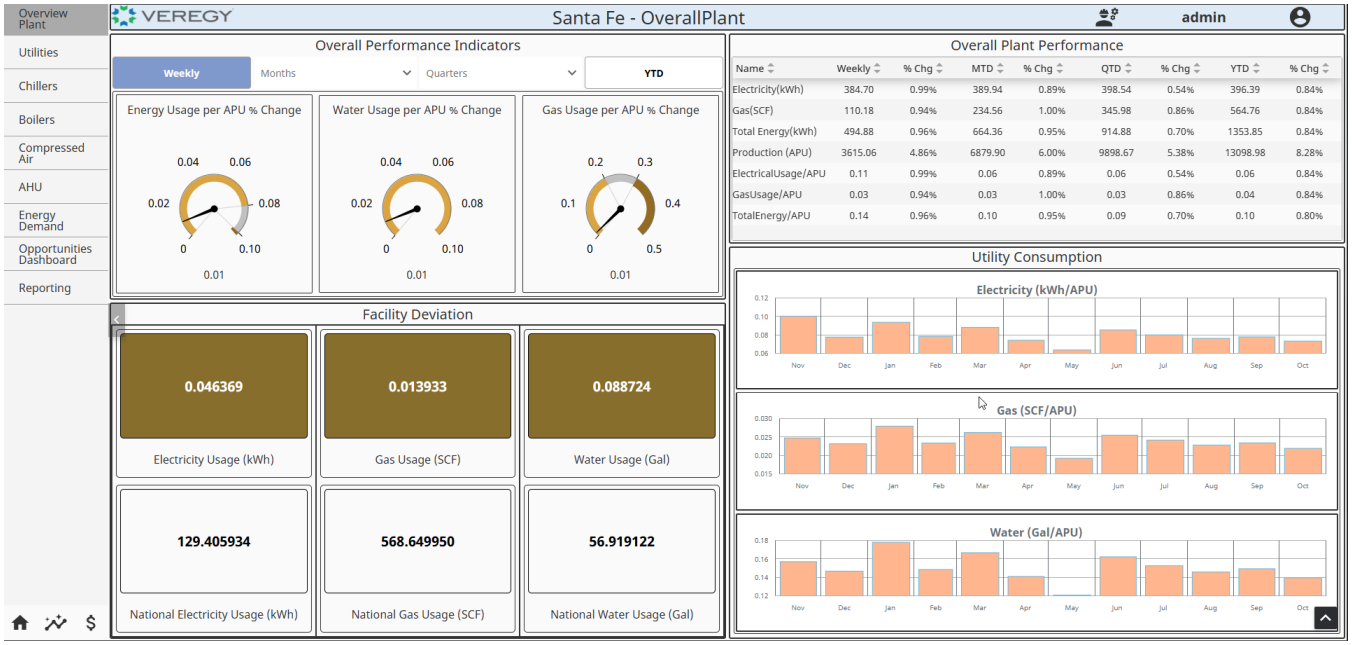

FIGURE 2: OVERALL PLANT DASHBOARD

System Functionality & Key Sections:

2.1 Overall Performance Indicators

- Consumption vs. Production Metrics:
  - Energy Usage per APU % Change
  - Water Usage per APU % Change
  - Gas Usage per APU % Change
- Time Range Filter:
  Toggle between Weekly, Monthly, Quarterly, or YTD (Year to Date) for contextual performance insights.
- Visualization**:**
  Gauges provide intuitive feedback on percentage change, helping identify trends quickly.

2.2 Overall Plant Performance Table

- Displays electricity, gas, and production data for given time ranges:
  - Weekly

    - MTD (Month-to-Date)
    - QTD (Quarter-to-Date)
    - YTD (Year-to-Date)

      Each entry includes both raw values and percentage changes.
- Key Columns:
    - Name: Metric being tracked (e.g., Electricity (kWh), Gas (SCF), Total Energy)
    - Usage Values: Raw numbers for each timeframe
    - % Change: Trend percentage from previous periods

2.3 Facility Deviation Section

- Purpose: Quantifies how the plant facility is performing relative to comparable metrics such as national average.
- Metrics Displayed:
    - Electricity Usage (kWh)
    - Gas Usage (SCF)
    - Water Usage (Gal)
- National Benchmarks:

  Values below show the average national usage for comparison:
    - National Electricity Usage (kWh)
    - National Gas Usage (SCF)
    - National Water Usage (Gal)
- Deviation:

  Values like 0.040277 represent the deviation or efficiency gap, to highlight better or worse performance over time.

2.4 Utility Consumption Trends (Bar Charts)

- Visual Performance Analysis by Resource:
    - Electricity (kWh/APU)
    - Gas (SCF/APU)
    - Water (Gal/APU)
- Monthly Distribution:

  Each bar graph displays monthly usage normalized by APU (Adjusted Production Units), enabling direct performance comparisons month-over-month.
- Usage Insights:
    - Helps spot seasonal patterns or anomalies.
    - Enables facility managers to correlate spikes with operational events or external conditions.

User Interaction Flow:

Step	Action	Result

1	Select desired time filter (Weekly, YTD, etc.)	Updates gauges and tables accordingly
2	Analyze gauges for high-level trend visibility	Quickly assess if performance is improving or declining
3	Review performance table for detailed data	View exact usage and trends per timeframe
4	Examine facility deviation against national averages	Identify under- or over-performing areas
5	Review bar charts for historical patterns	Understand monthly consumption behavior per utility

TABLE 2: OVERALL PLANT DASHBOARD USER INTERACTION FLOW

2.5 Utility Rate Configuration Panel

Purpose:

This module enables users to input or adjust the utility rates used for cost calculation across all dashboards and performance metrics. It allows manual control (for fixed-rate contracts) ensuring accurate financial projections and cost-based KPIs like Cost/APU, Cost/kWh, etc. Selecting Automated utility rate method prevents entry as rates are polled automatically from utility provider so that they may adjust over time.

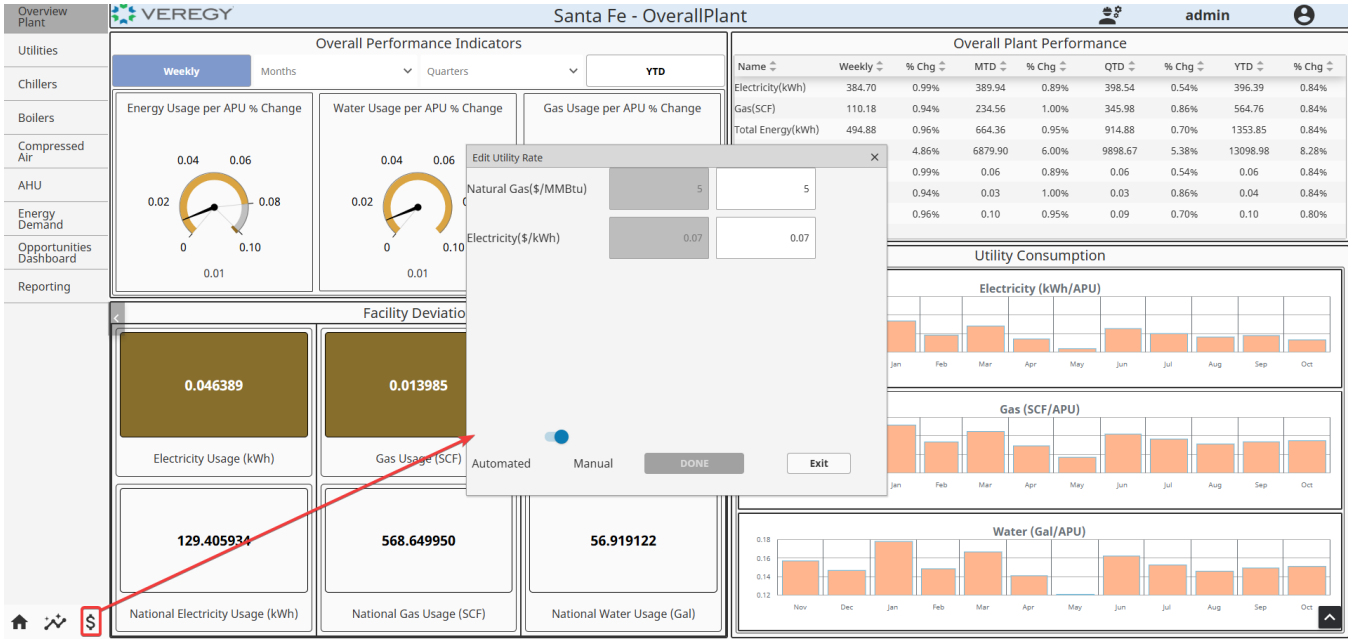

FIGURE 3: UTILITY RATE CONFIGURATION PANEL

System Functionality & Key Sections:

2.6 Access Panel

- Click the dollar sign icon ($) on the bottom-left of the navigation pane (see red arrow).
- This opens the Edit Utility Rate configuration pop-up.

2.7 Rate Configuration Popup

Field	Description
Natural Gas ($/MMBtu)	Enter the cost per MMBtu of natural gas
Electricity ($/kWh)	Enter the electricity cost per kWh
Automated vs Manual	Toggle switch to control how rates are updated

TABLE 3: RATE CONFIGURATION POPUP LEGEND

- Manual: Values are entered by the user and remain fixed until changed.
- Automated: Values are derived from utility provider and are updated automatically.

12.3 Buttons

- SET: Saves the current utility rate configuration.

- EXIT: Closes the panel without saving.

User Interaction Flow:

Step	Action	Result
1	Click the $ icon	Opens the rate editor
2	Select mode (Manual or Automated)	Enables or disables rate fields
3	Input updated utility costs	New values reflect across all dashboards
4	Click **SET** to confirm	System updates live metrics (e.g., Cost/APU)
5	Click **EXIT** to discard	Closes the dialog without saving

TABLE 4: RATE CONFIGURATION POPUP USER INTERACTION FLOW

3. Utilities Dashboard

Purpose:

This screen provides a detailed view of utility consumption across key systems within the plant. It breaks down total energy use by category (e.g., chiller, HVAC, compressed air, boilers) and tracks electricity, gas, and water usage over time. This enables operations teams to pinpoint high-consumption areas and identify efficiency opportunities.

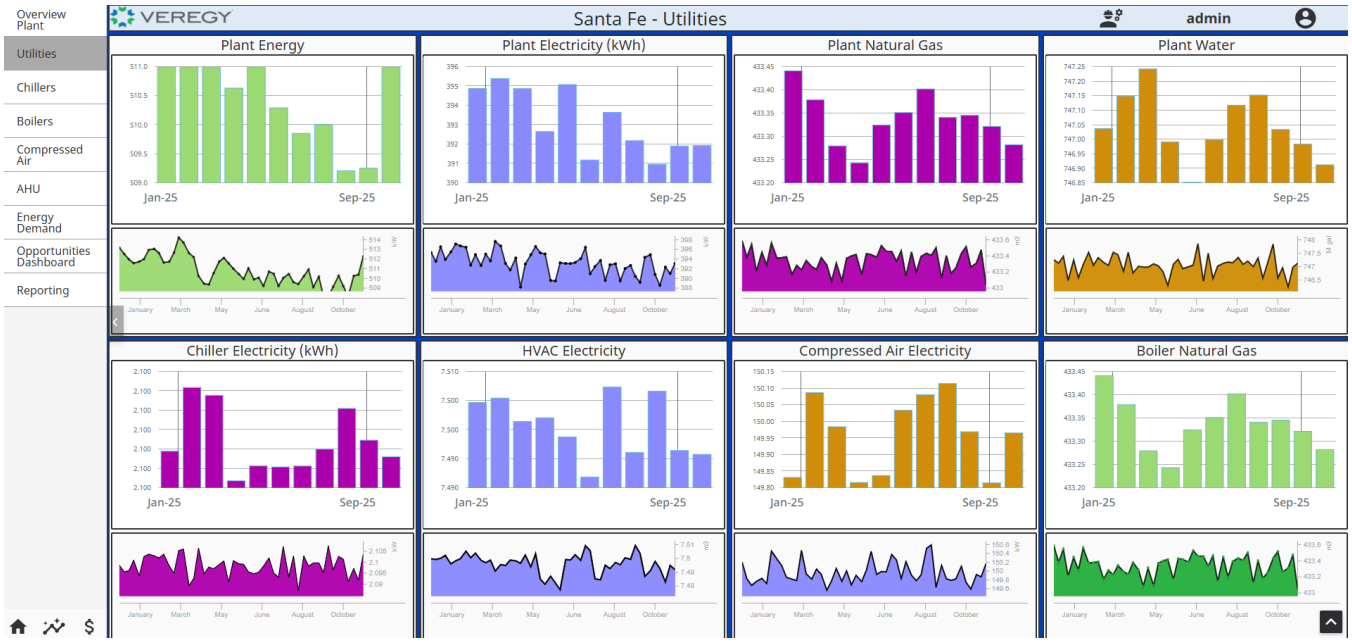

FIGURE 4: UTILITIES DASHBOARD

System Functionality & Key Sections:

3.1 Plant-Level Summary (Top Row)

- Plant Energy:
  Aggregated energy use from all subsystems (kWh) across time range displayed.
- Plant Electricity (kWh):
  Bar graph showing monthly electricity use trends.
- Plant Natural Gas:
  Tracks total SCF (Standard Cubic Feet) of gas consumed per month.
- Plant Water:
  Displays monthly gallons of water used at the facility level.

3.2 Time Series Trends (Second Row)

- Each metric has a time-series chart underneath the bar graph view for granular day-by-day tracking:
  - Energy, Electricity, Gas, and Water usage over the last 12 months.
  - Provides real-time responsiveness to operational changes.

- These charts help detect spikes or inconsistencies in real time, such as:
    - Sudden surges due to equipment malfunction.
    - Efficiency drops due to poor scheduling or control strategies.

3.3 Subsystem Utility Breakdown (Third Row)

Subsystem	Metric Tracked	Unit	Notes
Chiller	Electricity Usage	kWh	High usage may indicate poor cooling load distribution or over cycling.
HVAC	Electricity Usage	kWh	Seasonal trends expected; useful for climate control optimization.
Compressed Air	Electricity Usage	kWh	Energy-intensive; typically, one of the top consumers of electricity in industrial sites.
Boiler	Natural Gas Consumption	SCF	Key for monitoring thermal load and combustion efficiency.

TABLE 5: SUBSYSTEM UTILITY BREAKDOWN TABLE

3.4 Subsystem Efficiency Monitoring (Bottom Row)

- Compressor Efficiency:
  Aggregated energy use chart tracking compressor performance. Variations may indicate issues with air leaks, pressure settings, or duty cycles.
- HVAC and Compressed Air Efficiency:
  Real-time load responsiveness graphs showing energy stability and usage patterns.
- Boiler Efficiency:
  Trends in natural gas use per BTU generated or runtime efficiency (depending on setup).

User Interaction Flow:

Step	Action	Result
1	Select a utility chart (e.g., HVAC Electricity)	Highlights data and enables drill-down into that subsystem
2	Hover over charts	Displays exact values for each bar or point
3	Correlate bar and line charts	Identify how operational timing impacts total consumption
4	Compare month-over-month data	Evaluate utility trends and seasonality impacts

TABLE 6: UTILITIES DASHBOARD USER INTERACTION FLOW

4. Chillers Dashboard

Purpose:

This screen provides real-time and historical insights into the performance of chiller units and the chilled water system. It tracks energy consumption, system efficiency (COP), cost metrics, and peak demand offering both individual chiller and system-level views. This dashboard is vital for

identifying operational inefficiencies, monitoring equipment health, and ensuring optimal chiller operation.

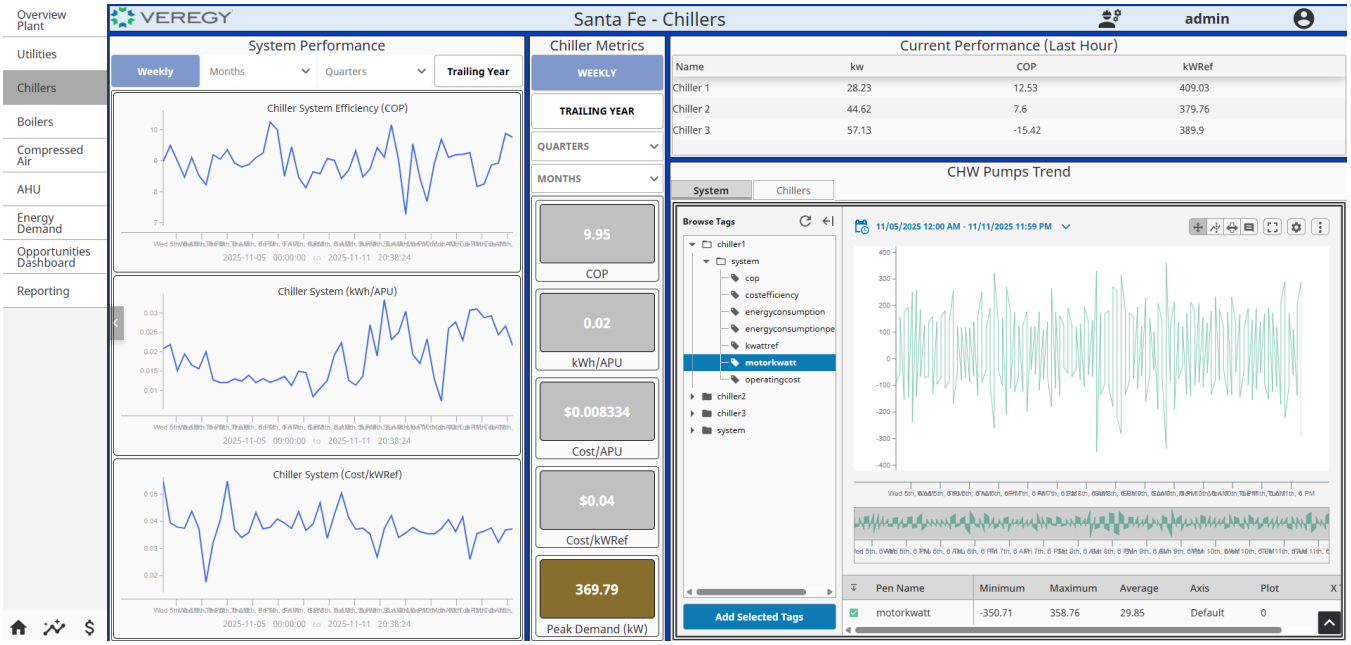

FIGURE 5: CHILLERS DASHBOARD W/ TRENDS

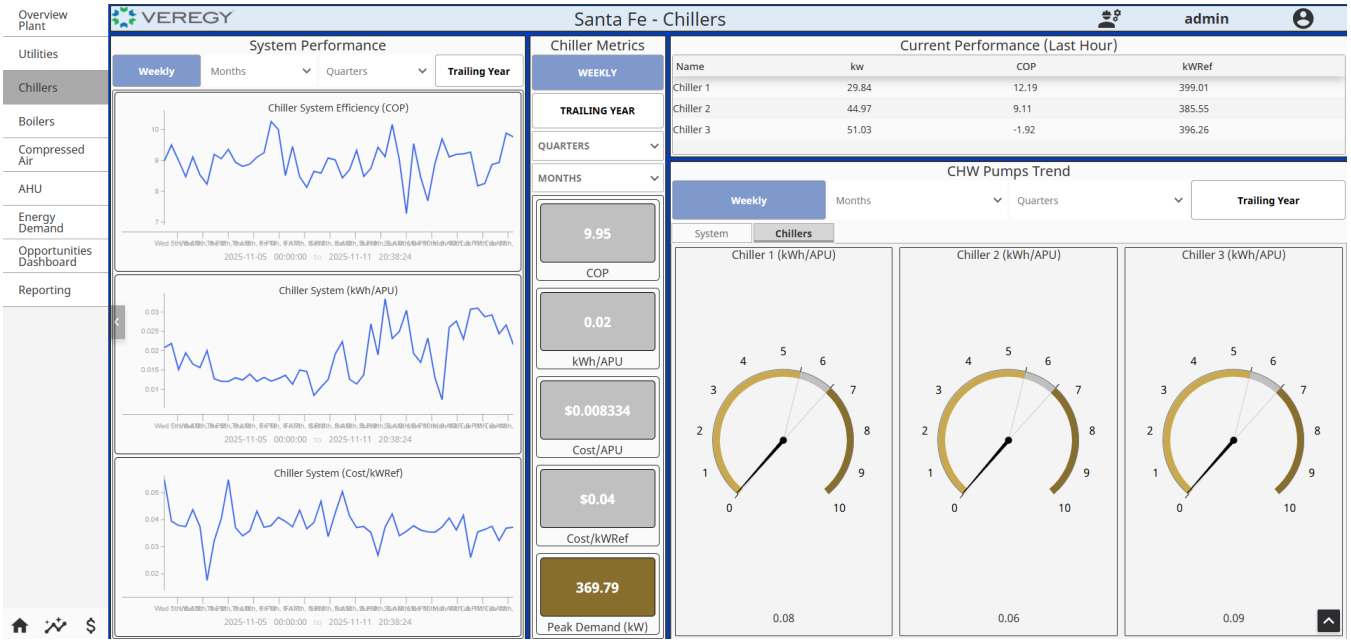

FIGURE 6: CHILLER DASHBOARD W/ GAUGES

System Functionality & Key Sections:

4.1 System Performance (Left Panel)

Shows system-wide historical performance trends across the selected time period. Users can toggle between:

- Weekly
- Monthly
- Quarterly
- Trailing Year

Graphs:

1. Chiller System Efficiency (COP):
   Coefficient of Performance indicating chiller efficiency (higher = better). COP fluctuations may point to load mismatches or mechanical issues.
2. Chiller System (kWh/APU):
   Energy intensity normalized per Adjusted Production Unit (APU), showing how energy usage scales with production.
3. Chiller System (Cost/kWRef):
   Cost per unit of refrigeration energy consumed. Useful for identifying cost-effective periods of operation or tracking demand charges.

4.2 Chiller Metrics Panel (Middle Panel)

Metrics Summary Cards:

- COP: Average Coefficient of Performance.
- kWh/APU: Energy per production unit.
- Cost/APU: Dollar cost per unit produced.
- Cost/kWRef: Cost per refrigeration energy unit.
- Peak Demand (kW): Displays maximum recorded system demand over the selected period.
- Each metric tile uses color bands represent performance efficiency:
  - Gold – Indicates most efficient performance.
  - Silver – Indicates improved performance.
  - Bronze – Indicates acceptable performance.

These data provide quick visual reference for operational KPIs and are updated based on the selected timeframe (e.g., Weekly, Monthly).

4.3 Current Performance (Top-Right Panel)

Table showing **real-time (last hour)** performance of each chiller:

Chiller	kW	COP	kWRef
Chiller 1	38.41–43.81	9.64–9.85	388.76–389.99
Chiller 2	44.98–43.88	8.92–9.05	377.05–378.12
Chiller 3	45.34–50.47	10.86–23.67	424.11–410.64

TABLE 7: CHILLER CURRENT PERFORMANCE TABLE

- kW: Real-time power consumption.
- COP: Real-time efficiency.

- kWRef: Chiller kW load.

4.4 CHW System Trend (Bottom-Right Panel)

This section provides customizable trend visualization. Refer to Figure 5:

- Toggle between System and Individual Chillers
- Apply filters by Weekly, Monthly, Quarterly, and Trailing Year
- Displays dynamic performance over time for chilled water (CHW) pumps
- System Trend Viewer: Graphical display of selected tags over the trailing year, including:
  - cop, costefficiency, energyconsumtion, kwattref, operatingcost, and more.
- Tag Browser:
  Users can drill into individual chillers or view system-level metrics.
- Pen Stats Summary:
  Shows Min, Max, and Avg values for each trend line plotted.

Useful for correlation analysis and diagnostic tracking of air system behavior.

4.4 CHW Pumps Gauge (Bottom-Right Panel)

Quick-view efficiency of each chiller represented in gauge-style format. Refer to Figure 6:

- Chiller 1: ~6.0
- Chiller 2: ~5.5
- Chiller 3: ~6.5
  Values indicate how energy-intensive each chiller is based on current normalized data.
- Each gauges uses color bands represent performance efficiency:
  - Gold – Indicates most efficient performance.
  - Silver – Indicates improved performance.
  - Bronze – Indicates acceptable performance.

User Interaction Flow:

Step	Action	Result
1	Select a time range (Weekly, Monthly, etc.)	Updates system performance graphs and KPI cards
2	Review COP & energy metrics in graphs	Identify trends or spikes in chiller operation
3	View current performance table	Get real-time status of each chiller
4	Navigate CHW Pump Trend tab	Compare individual chiller performance across time
5	Use gauges to evaluate chiller efficiency at-a-glance	Identify underperforming chillers for further inspection

TABLE 8: CHILLER USER INTERACTION FLOW

5. Boilers Dashboard

Purpose:

This screen provides detailed, real-time and historical analytics on the boiler system at the plant. It allows monitoring of boiler efficiency, steam pressure, steam flow rates, and fuel energy usage, supporting energy management, equipment maintenance, and production planning.

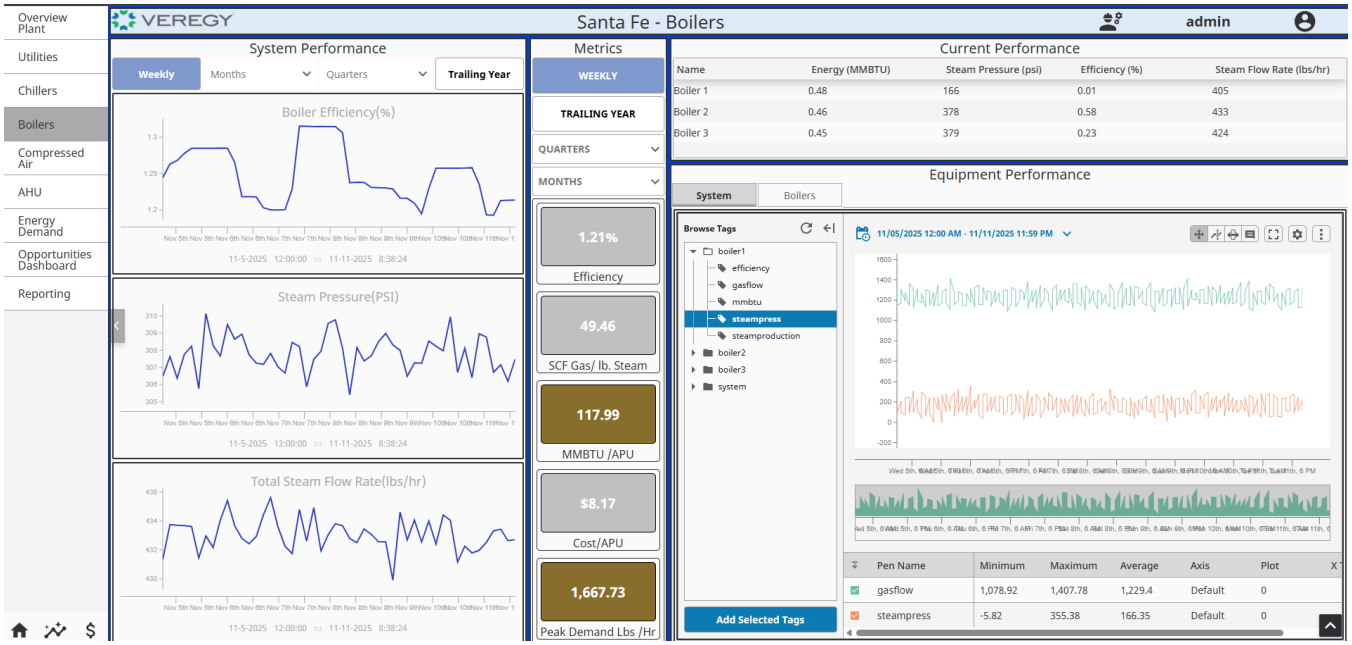

FIGURE 7: BOILER DASHBOARD W/ TRENDS

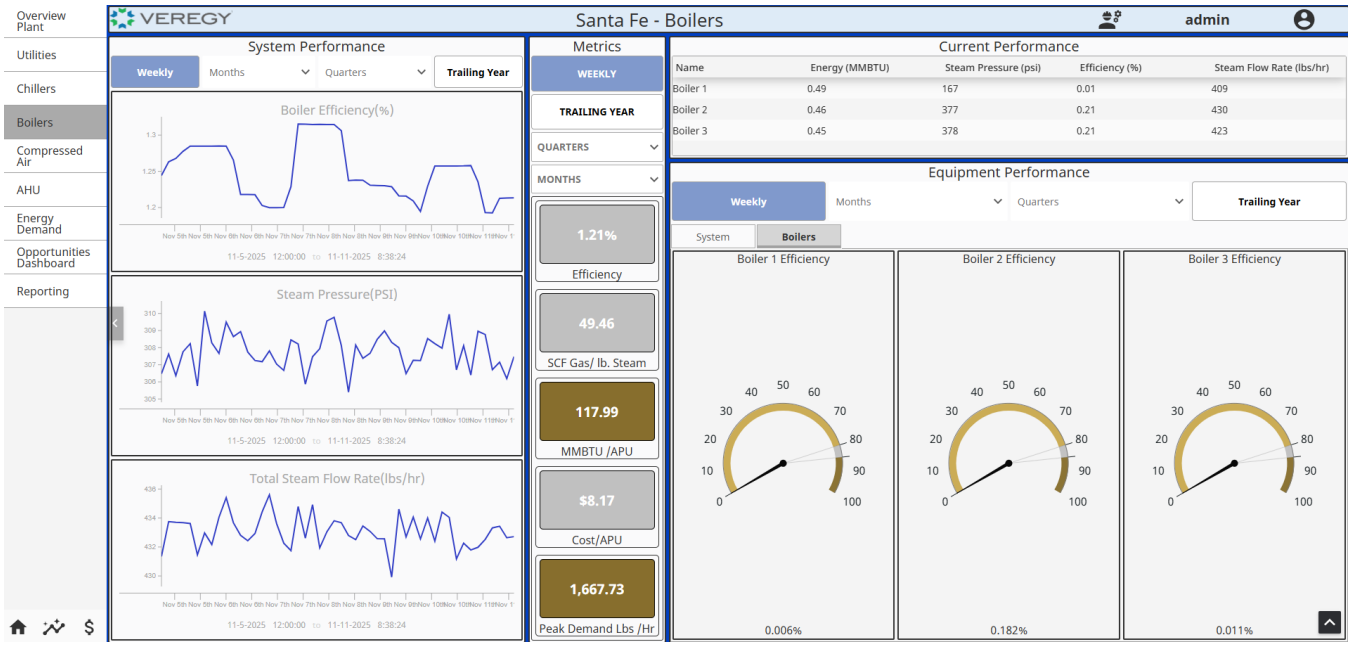

FIGURE 8: BOILER DASHBOARD W/ GAUGES

System Functionality & Key Sections:

5.1 System Performance (Left Panel)

Time-series line graphs visualize the trailing year's performance of boiler operations. Users can toggle between:

- Weekly
- Monthly
- Quarterly
- Trailing Year

Graphs:

1. Boiler Efficiency (%):
   Represents the heat transfer effectiveness of the boiler. Efficiency variations highlight combustion tuning needs or insulation losses.
2. Steam Pressure (PSI):
   Displays system pressure over time. Fluctuations may suggest valve cycling, load changes, or inconsistent control.
3. Total Steam Flow Rate (lbs/hr):
   Indicates how much steam the system is generating. Correlates with production demand and gas input.

5.2 Metrics Summary (Middle Panel)

Metric	Description
Efficiency (%)	Averaged across all boilers for selected period
SCF Gas / lb. Steam	Standard cubic feet of gas required to produce 1 lb of steam
MMBTU / APU	Heat input per Adjusted Production Unit
Cost / APU	Boiler energy cost per APU
Peak Demand (lbs/hr)	Maximum observed steam generation rate

TABLE 9: BOILER METRIC SUMMARY TABLE (MIDDLE PANEL)

KPI update based on selected time range and provide instant performance context.

- Each metric tile uses color bands represent performance efficiency:
  - Gold – Indicates most efficient performance.
  - Silver – Indicates improved performance.
  - Bronze – Indicates acceptable performance.

5.3 Current Performance Table (Top Right Panel)

Shows boiler metrics for the last hour, helping assess the real-time state of each boiler unit:

Boiler	Energy (MMBTU)	Steam Pressure (psi)	Efficiency (%)	Steam Flow Rate (lbs/hr)
1	0.46–0.49	164–169	0.01	409–410
2	0.46	377	0.22–0.279	412–420
3	0.47–0.5	389–390	0.20–0.209	430–437

TABLE 10: BOILER PERFORMANCE TABLE (TOP RIGHT)

Useful for detecting boiler load imbalances or detecting inactive burners.

5.4 Equipment Performance (Bottom Right Panel)

Two visualization modes:

- System Tab - Line Graph (Figure 7):
  Displays real-time tag trends such as efficiency, gasflow, and steamproduction, and more.

- Boilers Tab - Gauge View (Figure 8):
  Represents current boiler efficiency using analog-style dials:
  - Boiler 1: ~0.007%
  - Boiler 2: ~0.279%
  - Boiler 3: ~0.209%
- Each gauges uses color bands represent performance efficiency:
  - Gold – Indicates most efficient performance.
  - Silver – Indicates improved performance.
  - Bronze – Indicates acceptable performance.

Ideal for quick visual recognition of underperforming units or those exceeding thresholds.

User Interaction Flow:

Step	Action	Result
1	Select a time range (Weekly, etc.)	Graphs and metrics update accordingly
2	Review system graphs	Identify abnormal behavior in efficiency, pressure, or flow
3	Inspect boiler metrics table	View last-hour performance and fuel use
4	Browse tags and trend equipment data	Pinpoint inefficiencies or performance issues
5	Use gauge view for fast health check	Instantly spot boilers out of range

TABLE 11: BOILER DASHBOARD USER INTERACTION FLOW

6. Air Compressors Dashboard

Purpose:

This screen tracks the energy efficiency, airflow output, and cost performance of compressed air systems at the plant. It offers both system-level analytics and individual compressor data, providing engineers with tools to optimize air system operations, reduce energy usage, and ensure air pressure stability.

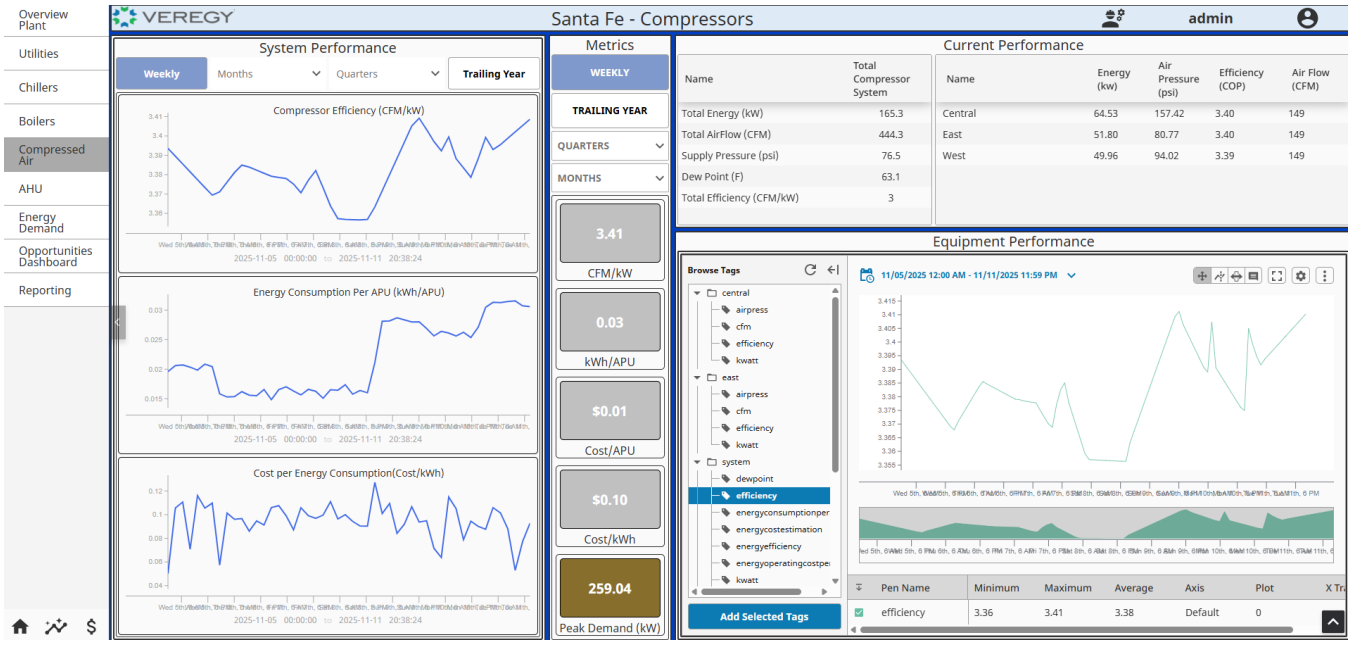

FIGURE 9: COMPRESSOR DASHBOARD

System Functionality & Key Sections:

6.1 System Performance (Left Panel)

Historical data visualizations over the selected timeframe (Weekly, Monthly, Quarterly, Trailing Year). Key line charts include:

1. Compressor Efficiency (CFM/kW):
   Indicates how efficiently air is produced per kilowatt consumed. A higher value represents better performance. Drops may signal leaks or improper staging.
2. Energy Consumption per APU (kWh/APU):
   Tracks air system energy usage per unit of production.
3. Cost per Energy Consumption (Cost/kWh):
   Reflects variability in the cost of electricity consumed by compressors. Spikes may correspond to peak demand charges.

6.2 Metrics Summary (Middle Panel)

Metric	Description
CFM/kW	System-wide efficiency value over time

kWh/APU	Energy usage per production unit
Cost/APU	Cost of air system energy per APU
Cost/kWh	Average cost per unit of energy consumed
Peak Demand (kW)	Highest compressor demand recorded

TABLE 12: COMPRESSOR METRIC SUMMARY TABLE

These data give an at-a-glance view of compressed air performance.

- Each metric tile uses color bands represent performance efficiency:
  - Gold – Indicates most efficient performance.
  - Silver – Indicates improved performance.
  - Bronze – Indicates acceptable performance.

6.3 Current Performance (Top Right Panel)

This live table shows compressor-specific data for the Central, East, and West compressors:

Unit	Energy (kW)	Air Pressure (psi)	Efficiency (COP)	Air Flow (CFM)
Central	49.13	218.47	3.42	217
East	72.16	55.50	3.40	217
West	52.54	103.15	3.41	217

TABLE 13: CURRENT PERFORMANCE TABLE (RIGHT PANEL)

- Variations in air pressure and COP help detect potential staging or performance issues.
- Air Flow (CFM) is consistent, indicating balanced demand.

6.4 Equipment Performance (Bottom Right Panel)

- Trend Viewer:
  Graphical display of selected tags over the trailing year, including:
  - cfm, efficiency, airpress, kwatt, dewpoint, and more.
- Tag Browser:
  Users can drill into individual compressors or view system-level metrics.
- Pen Stats Summary:
  Shows Min, Max, and Avg values for each trend line plotted.

Useful for correlation analysis and diagnostic tracking of air system behavior.

User Interaction Flow:

Step	Action	Result
1	Select a date range (Weekly, etc.)	Updates charts and metrics accordingly
2	Monitor performance cards	Understand system-wide energy and cost impacts
3	Analyze compressor table	View real-time behavior and health of each unit
4	Use tag browser and trend viewer	Plot trends for diagnostics or deeper insights

5	Investigate peaks or efficiency drops	Take corrective actions (e.g., leak repair, staging logic review)

TABLE 14: COMPRESSOR USER INTERACTION FLOW

7. AHU Dashboard

Purpose:

This dashboard provides in-depth monitoring of the air handling systems at the plant. It tracks AHU efficiency, airflow output (CFM), air changes per hour (ACH), and energy consumption relative to production. The system helps facilities teams ensure proper ventilation, thermal comfort, and indoor air quality while optimizing energy use.

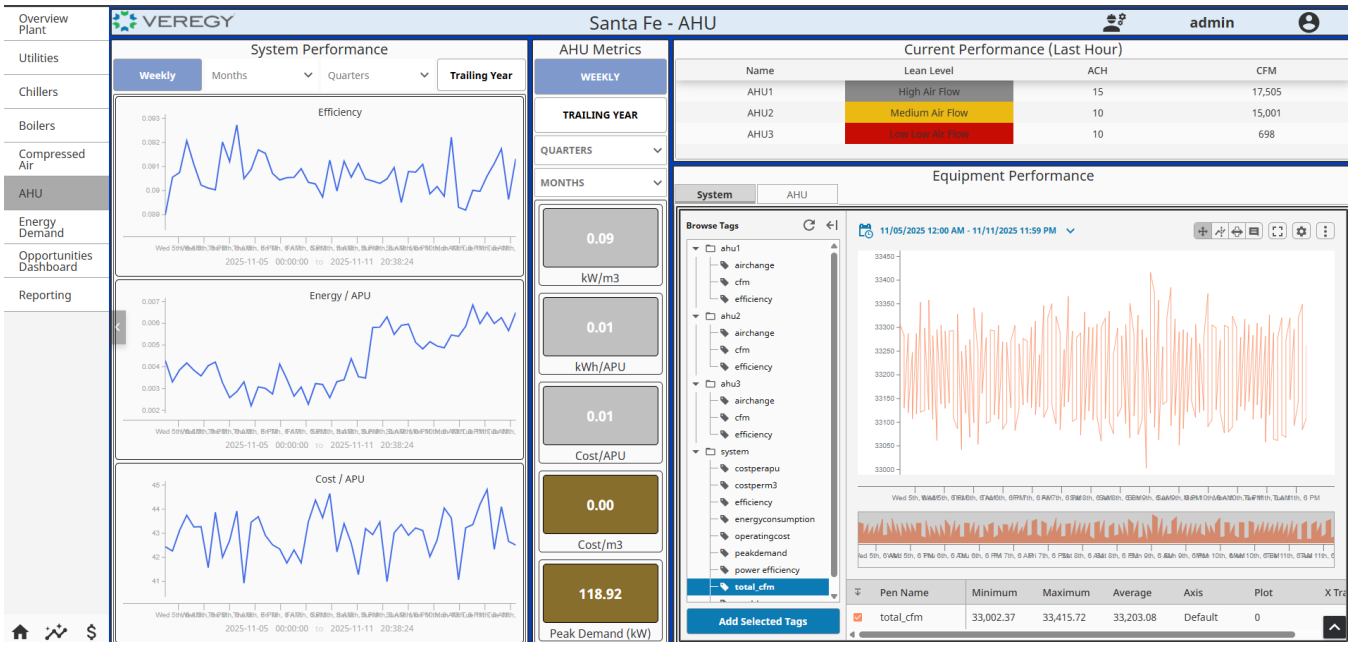

FIGURE 10: AHU DASHBOARD W/ TRENDS

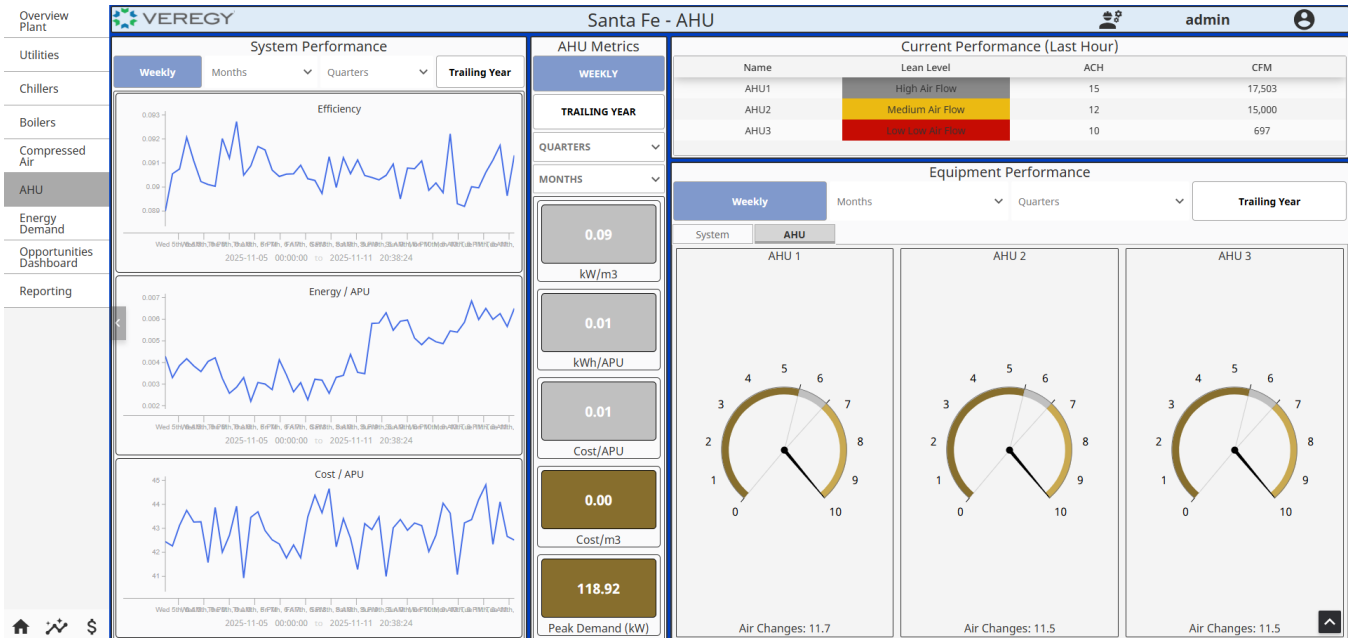

FIGURE 11: AHU DASHBOARD W/ GAUGES

System Functionality & Key Sections:

7.1 System Performance (Left Panel)

Visualizes historical performance over the selected time period, such as Weekly, Monthly, Quarterly, or Trailing Year.

Trend Graphs:

1. Efficiency:
   Typically measured in kW/m^3, showing how much energy is needed to move air. Lower values indicate more efficient air circulation.
2. Energy / APU:
   Displays energy consumed by AHUs normalized by production output.
3. Cost / APU:
   Reflects the cost to operate the AHUs per unit of production. Helps budget for operational costs or identify savings opportunities.

7.2 AHU Metrics (Middle Panel)

Key performance indicators for the AHU system:

Metric	Description
kW/m^3	Energy efficiency for air movement
kWh/APU	Electricity used per production unit
Cost/APU	Dollar cost of AHU operation per APU
$Cost/m^3$	Cost per cubic meter of air moved
Peak Demand	Highest power draw (kW) during period

TABLE 15: AHU METRICS

All values auto-update based on the selected time filter (weekly, etc.).

- Each metric tile uses color bands represent performance efficiency:
  - Gold – Indicates most efficient performance.
  - Silver – Indicates improved performance.
  - Bronze – Indicates acceptable performance.

7.3 Current Performance (Top Right Panel)

Provides the last hour's real-time status for each AHU:

AHU	Lean Level	ACH (Air Changes/hr)	CFM (Cubic Feet per Minute)
AHU1	High Air Flow (gray)	6	17,500
AHU2	Medium Air Flow (orange)	9	15,020
AHU3	Low Low Air Flow (red)	10	704

TABLE 16: CURRENT PERFORMANCE TABLE

- Color Coding:
  - Gold – Indicates least efficient.
  - Silver – Indicates optimal performance metrics.
  - Bronze – Indicates acceptable but improve performance.

Airflow and lean levels are used for zone balancing and ventilation control.

7.4 Equipment Performance (Bottom Right Panel)

Two Views:

- System Tab - Trend Viewer (Figure 10):
  Tag browser on the left allows users to select and plot historical trends for:
  - airchange, cfm, efficiency, cost, etc.
  - Compare all AHUs or system-wide metrics.
- AHU Tab - Gauge View (Figure 11):
  Real-time air change rates visualized via radial gauges:
  - AHU 1: 11.7
  - AHU 2: 11.5
  - AHU 3: 11.5
- Each gauges uses color bands represent performance efficiency:
  - Gold – Indicates most efficient performance.
  - Silver – Indicates improved performance.
  - Bronze – Indicates acceptable performance.

Helps quickly identify if AHUs are meeting ventilation targets.

User Interaction Flow:

Step	Action	Result
1	Select desired time period	Metrics and charts refresh accordingly
2	Review KPIs for system health	Ensure all metrics are within acceptable bounds
3	Inspect real-time airflow alerts	Identify and respond to airflow deficiencies
4	Plot tag trends	Analyze historical performance or correlate issues
5	Use gauges for fast AHU checks	Quickly validate system performance visually

TABLE 17: AHU USER INTERACTION FLOW

8. Energy Performance Dashboard

Purpose:

This dashboard tracks and compares actual plant energy demand against optimal and baseline values to identify energy savings potential. It focuses on key process setpoints (e.g., AHU zone temp, chilled water delta, condenser pressure) and evaluates how deviations from these optimal settings affect overall plant performance and cost.

FIGURE 12: ENERGY PERFORMANCE DASHBOARD

System Functionality & Key Sections:

8.1 Total Plant Energy Demand Graph (Top Panel)

- Visualization:
  Intended to display a line chart comparing:
  - Actual energy usage (Red line)
  - Optimal energy usage (Blue line)
- Time Range: Shows the trailing year.

8.2 Savings – Optimal vs Actual (Bottom Left Panel)

- Trends Graph:
  Shows the cumulative savings gap between optimal and actual energy demand over the selected time period.
- X-Axis:
  Time/date range across March and April.
- Legend:
  - Red = Actual energy usage

- Blue = Optimal target based on setpoint logic and modeling

The higher optimal usage is relative to the actual, the better the energy performance.

8.3 Deviation from Savings Potential (Middle Panel)

Metric	Description
Facility Deviation	Shows the % deviation from achievable optimal savings (23.90%)
National Average	Reference value (11.50%) for benchmarking against similar facilities

TABLE 18: DEVIATION FROM SAVINGS POTENTIAL TABLE

This section quantifies how well the plant is performing in comparison to its modeled savings potential and national averages.

- Each metric tile uses color bands represent performance efficiency:
  - Gold – Indicates most efficient performance.
  - Silver – Indicates improved performance.
  - Bronze – Indicates acceptable performance.

8.4 System Set Points (Right Panel)

Displays optimal, current setpoints, and actual process values for critical systems impacting energy efficiency. Active values are highlighted.

System	Optimal Setpoint	Current Setpoint	Current Process Value
AHU (Zone Temp)	66.00°F	66.00°F	80.00°F
Chilled Water ΔT	11.00°F	10.01°F	10.00°F
Condenser Fan Pressure	9.00 psi	7.50 psi	10.00 psi
Steam Pressure	5.02 psi	3.02 psi	306.84 psi

This section highlights where operational parameters differ from the optimal configuration, which contributes to energy deviation.

User Interaction Flow:

Step	Action	Result
1	Select a time filter (Weekly/Trailing Year)	Updates graphs and deviation metrics
2	Review setpoint vs. actual values	Identify where inefficiencies are originating
3	Compare facility vs. national average	Gauge plant performance against industry benchmarks
4	Monitor deviation bar	Quantify unrealized energy savings in percentage terms
5	Adjust process parameters	Bring values closer to optimal to reduce energy waste

TABLE 19: ENERGY PERFORMANCE USER INTERACTION FLOW

9. Saving Opportunities Dashboard

Purpose:

This dashboard helps identify, evaluate, and track potential Energy Efficiency Measures (EEMs) across the facility.

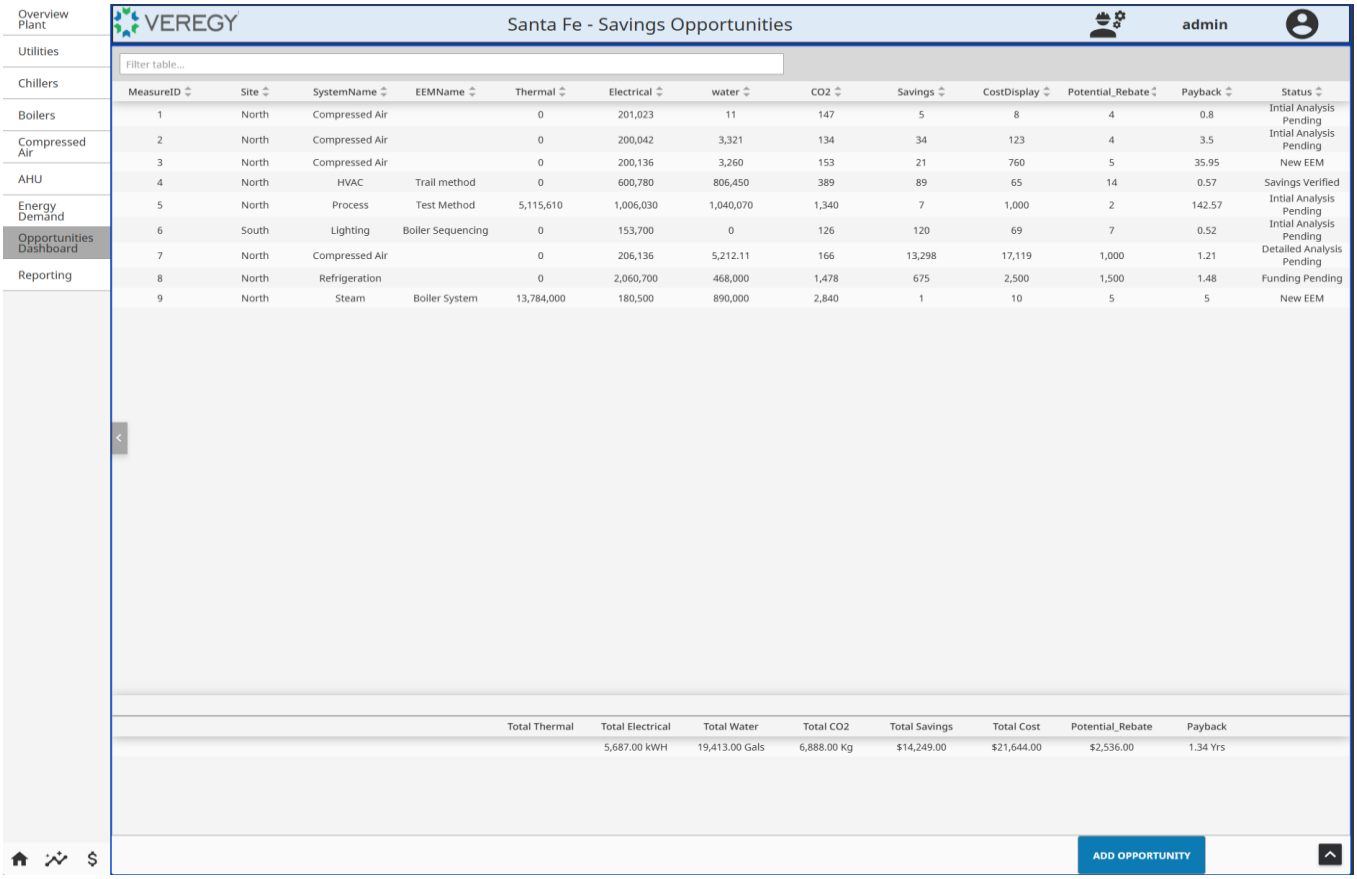

FIGURE 13: SAVING OPPORTUNITIES DASHBOARD

System Functionality & Key Sections:

9.1 Main Opportunities Table (Top Panel)

Column	Description
MeasureID	Unique identifier for each EEM
Site/SystemName	Area and system type (e.g., HVAC, Lighting, Compressed Air)
EEM Name	Custom method or title of the opportunity
Thermal / Electrical / Water / CO2	Estimated annual savings across energy types and emissions
Savings / CostDisplay	Financial benefit and implementation cost
Potential Rebate	Expected rebate value from utility or incentives
Payback	Estimated payback period in years

Status	Current development or approval stage (e.g., New EEM, Analysis Pending)

TABLE 20: MAIN OPPORTUNITIES TABLE

Use the search bar above the table to filter opportunities by system, site, or keyword.

9.2 Summary Footer (Bottom Panel)

Displays totalized values from all opportunities listed:

- Total Thermal: e.g., 0 Therms
- Total Electrical: e.g., 5,687.00 kWh
- Total Water: e.g., 19,413.00 Gals
- Total CO2: e.g., 6,888.00 Kg
- Total Savings: e.g., $14,249.00
- Total Cost / Potential Rebate: Combined project funding and rebate values
- Payback: Average weighted payback across all opportunities

10. Reporting Module

Purpose:

This module consolidates and visualizes energy data into structured reports for facility-wide, systems. It allows energy teams to extract PDF-ready documentation, track progress vs. targets, and benchmark system efficiency across departments.

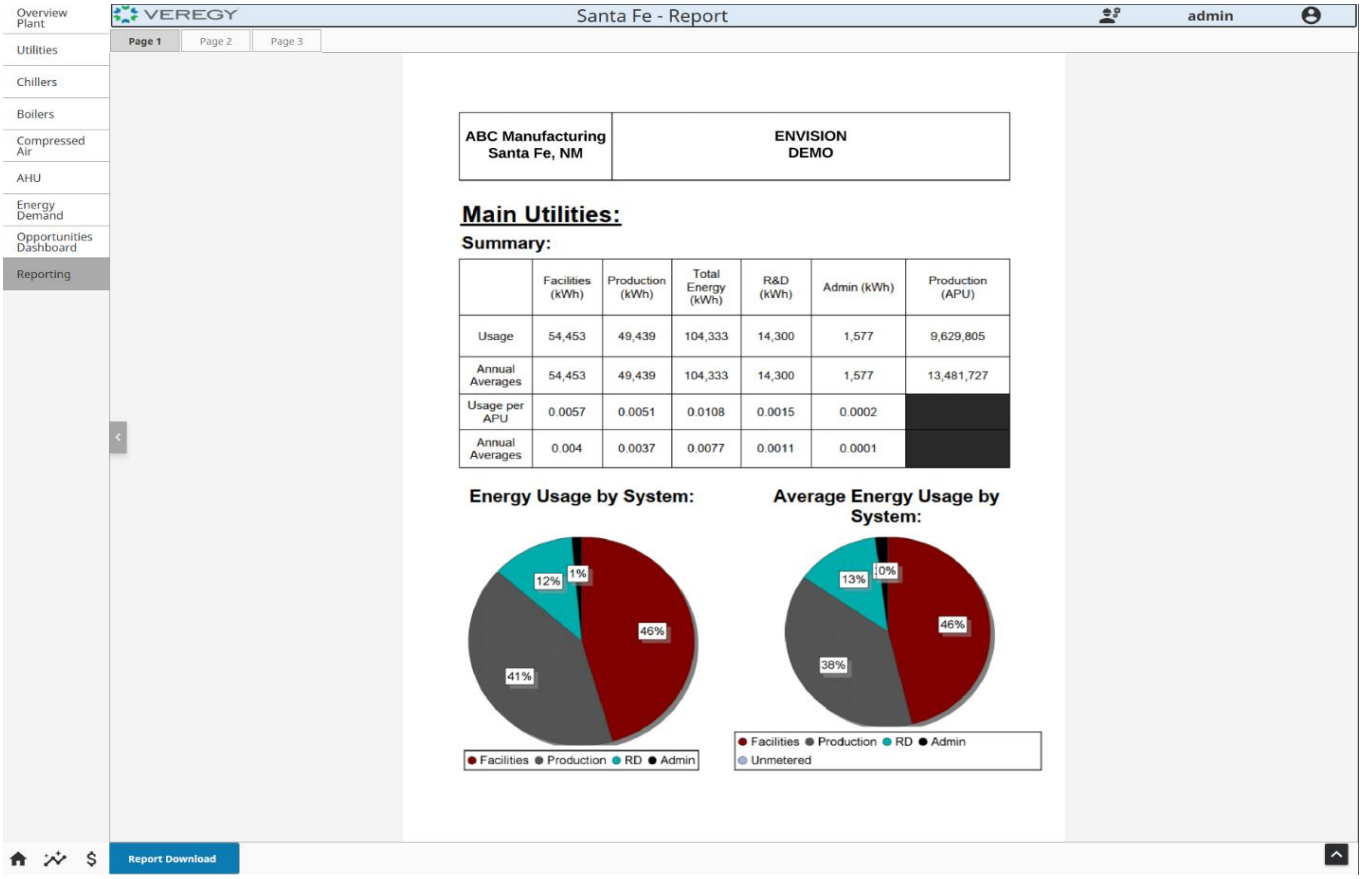

FIGURE 14: MAIN UTILITIES REPORT

System Functionality & Key Sections:

10.1 Page 1: Main Utilities Overview

Summary Table

Metric	Description
Facilities, Production, R&D, Admin (kWh)	Energy usage by department
Production (APU)	Adjusted Production Units used as a normalization baseline
Usage per APU	Energy intensity by department normalized to production

Useful for identifying which department or process area consumes the most energy per unit output.

Pie Charts

1. Energy Usage by System
    - Breaks down energy consumption into Facilities (46%), Production (41%), R&D (12%), Admin (1%)
2. Average Energy Usage by System
    - Adds an "Unmetered" category and shows average trends: Facilities (46%), Production (38%), R&D (13%), Admin (1%), Unmetered (2%)

Helps compare moment-in-time usage with rolling averages.

10.2 Page 2: Chiller System Report

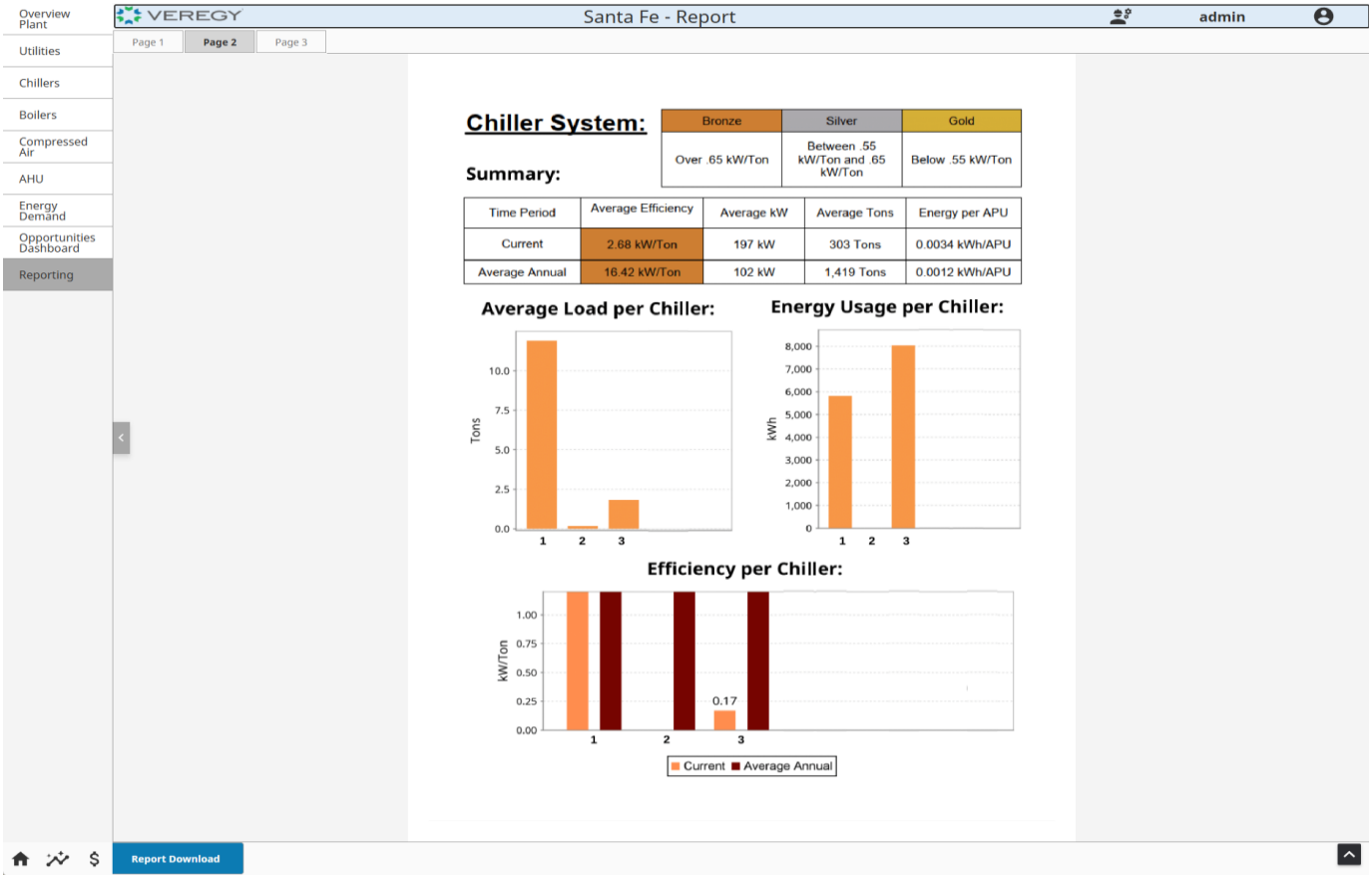

FIGURE 15: CHILLER SYSTEM REPORT

Efficiency Bands (Gold/Silver/Bronze)

Defined by kW/Ton:

- Gold: Below 0.55 kW/Ton
- Silver: 0.55–0.65 kW/Ton
- Bronze: Over 0.65 kW/Ton

Chiller Summary Table

Metric	Current	Average Annual
Avg Efficiency	2.68 kW/Ton	16.42 kW/Ton
Avg kW	197	102
Avg Tons	303	1,419
Energy/APU	0.0034	0.0012

TABLE 21: CHILLER SUMMARY TABLE

Indicates current chiller usage is less efficient than annual average, suggesting load issues or equipment degradation.

Bar Charts

1. Average Load per Chiller – Shows Chiller 1 with highest load

2. Energy Usage per Chiller – Chiller 3 is using the most energy
3. Efficiency per Chiller – Visualizes current vs average annual efficiency

10.3 Page 3: Compressor System Report

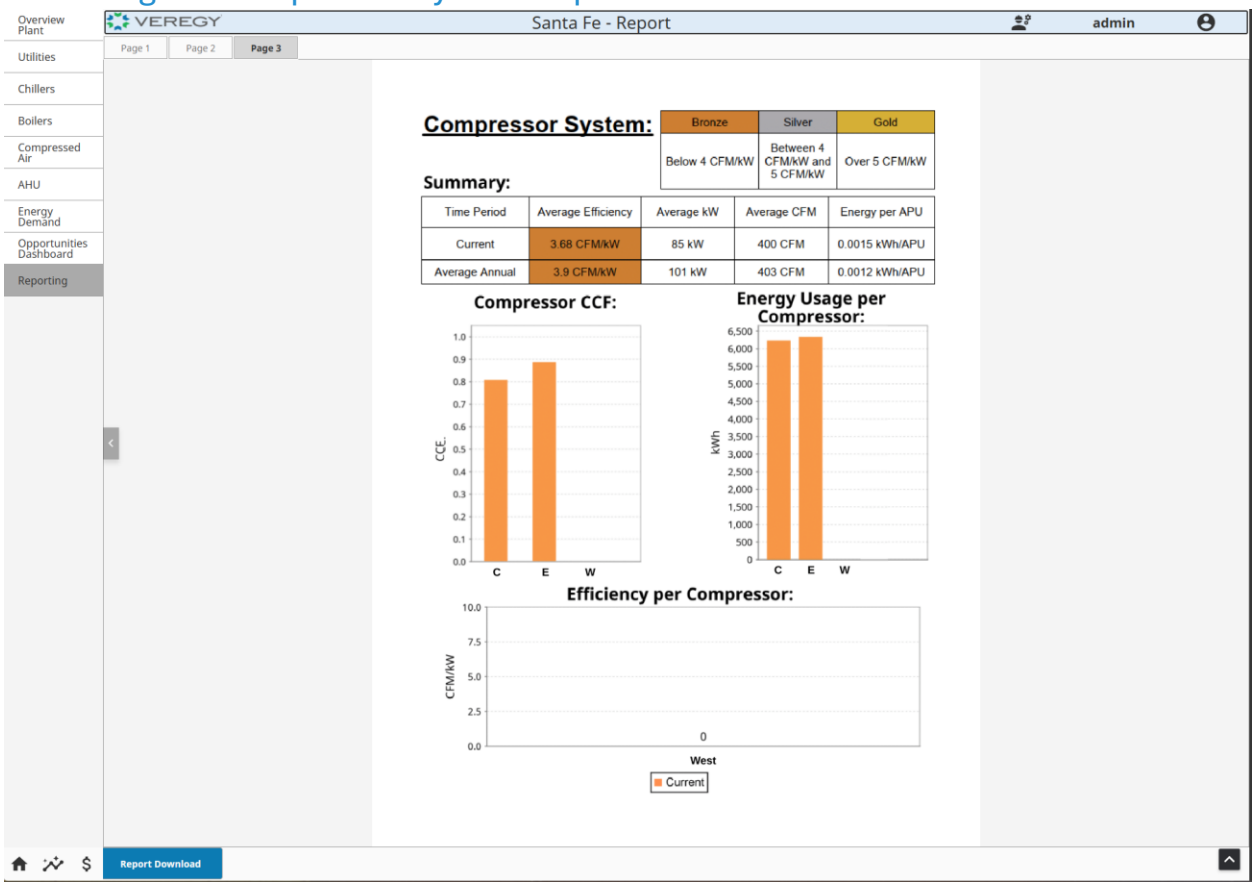

FIGURE 16: COMPRESSOR SYSTEM REPORT

Efficiency Bands (Gold/Silver/Bronze)

Defined by CFM/kW:

- Gold: Over 5 CFM/kW
- Silver: 4–5 CFM/kW
- Bronze: Below 4 CFM/kW

Compressor Summary Table

Metric	Current	Average Annual
Avg Efficiency	3.68 CFM/kW	3.90 CFM/kW
Avg kW	85 kW	101 kW
Avg CFM	400	403
Energy/APU	0.0015	0.0012

TABLE 22: COMPRESSOR SUMMARY TABLE

Efficiency is slightly lower than optimal; west compressor may require maintenance.

Bar Charts

1. Compressor CCF – Central, East, West CCFs
2. Energy Usage per Compressor – Consistent across all three units

3. Efficiency per Compressor – Graph shows West compressor with missing/zero efficiency, indicating a data gap or fault

11. All Trend Viewer

Purpose:

The All Trends Viewer is a flexible data visualization tool used to monitor and analyze live or historical trends from any system at the plant. This module provides a unified environment where users can build custom graphs using selected tags from various equipment (AHUs, boilers, chillers, compressors, etc.).

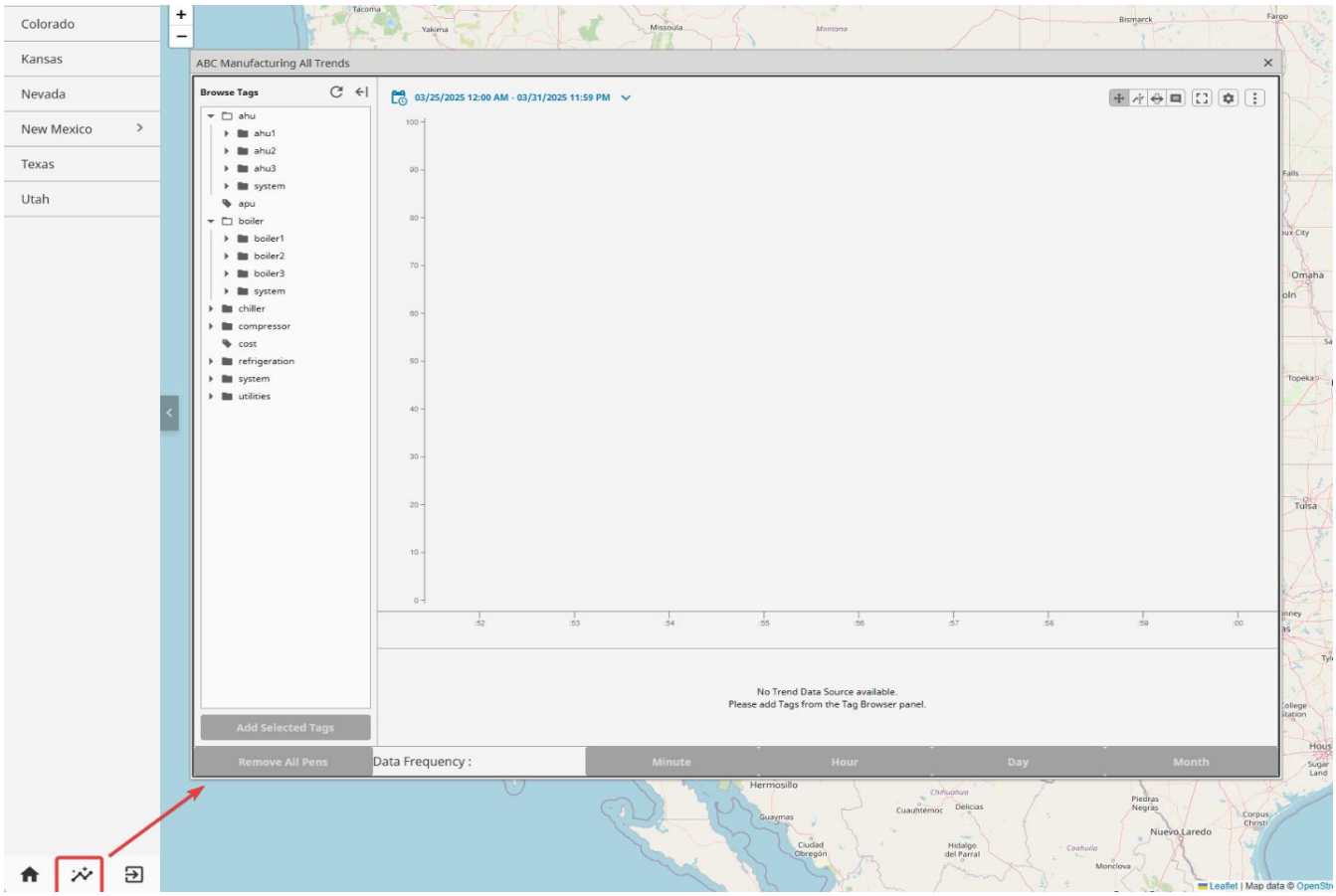

FIGURE 17: ALL TREND VIEWER

System *Functionality* **& Key Sections:**

11.1 Tag Browser (Left Panel)

Hierarchically organized by system type and subsystem:

Tag Group	Description
ahu	Air Handling Units (ahu1, ahu2, ahu3, system)
boiler	Boiler 1, 2, 3, and boiler system data
chiller	All chiller system tags
compressor	Compressor tags (central, east, west)
cost	Financial-related tags (cost/APU, savings, etc.)

refrigeration	Process cooling and refrigeration tags
system	Aggregated or calculated plant metrics
utilities	Sitewide energy-related KPIs

TABLE 23: TAG BROWSER

Select one or more tags, then click **Add Selected Tags** to plot them. To add multiple tags at once, hold the **ctrl** key while selecting.

11.2 Chart Area (Main Panel)

Displays trend lines for selected tags over the defined time range.

- No Trend Data Message:
  Displayed if no tags are selected or if data source is unavailable.
- Toolbar Controls (Top Right):
  - Pan & Zoom Tool:
    - Allows the user to pan across the timeline or zoom into a specific data range on the trend graph.
    - Click and drag to move the view or scroll to zoom in/out.
  - X Trace Tool:
    - Activate a vertical cursor that snaps to data points across all pens (tags).
    - Useful for identifying exact values at a specific timestamp.
    - Supports multiple X Traces if enabled under “More”.
  - Range Brush Tool:
    - Enables users to select a range on the trend graph.
    - Helps zoom into a specific time period by dragging a highlighted window over the chart.
  - Annotation Tool:
    - Used to mark notes or comments on the chart.
    - Ideal for tagging important events, anomalies, or manual entries.
  - Full Screen Toggle:
    - Expands the trend viewer to fill the entire screen for easier viewing during analysis or presentations.
  - More Options: Opens a dropdown menu with additional actions.
    - Clear X Traces: Removes all existing X trace markers from the chart.
    - Settings: Opens chart configuration settings such as time range, axis preferences, and data display formats.
    - Export: Exports in csv format the visible datapoints on the various plots.
- Time Range Selector (Top):
  Example: 03/25/2025 12:00 AM - 03/31/2025 11:59 PM

11.3 Pen Controls (Bottom Left)

- Add Selected Tags: Adds chosen tags to the trend graph.
- Remove All Pens: Clears the chart of all current data lines.

11.4 Data Frequency Selector (Bottom Center)

Customize resolution of trend data:

- Minute
- Hour
- Day
- Month

Adjust frequency to reduce noise or view broader trends.

User Interaction Flow:

Step	Action	Result
1	Click the trend icon from the homepage (see red arrow in screenshot)	Opens the All Trends module
2	Expand tag folders and check desired metrics	Tags are staged for graphing
3	Click **Add Selected Tags**	Graph populates with historical data
4	Use time selector and frequency options	Tailor view for your analysis needs
5	Export data (optional) or annotate findings	Supports documentation and reporting

TABLE 24: ALL TREND USER INTERACTION FLOW